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**Role of mobile application for participation of
youths in urban development in context of
Universal Design**

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Abstract

Urbanization and increase in population of urban areas due to migration is a global trend. Migration into the urban areas from rural areas is the main reason behind it. To make the urban society cope up with this increase in number of populations, sustainable urban plans and policies are required. Also, to make urban development sustainable, fulfill the needs of the people living in urban areas, development should be carried out in collaboration with the public and the governing bodies. This paper focuses on the youth participation using the mobile application which is developed following on the principles of Universal Design. For making urban development more effective with a fact that youths are the future of our society, and combination of the participation process with fusion of technology is performed. Applying qualitative methodology by interviewing the participants and user testing mobile app developed for this research, the results are analyzed. The results shows that mobile apps can act as a bridge between youth participation and urban development, however existing tools are not sufficient. The results also shows that involvement of youths via mobile apps is high possibility in a community level. The major entities for it are considering privacy of the users since it involves a community and public as well, features that motivate the youths; following the modern trend and features that are easily adaptable. Lastly, the simplicity of the tool; considering the universal design concept to target larger audience as well as to make the features universally designed as well. To achieve this, this research concludes that the best approach will be taking feedbacks from youths and addressing it, to bind the youths and the concerned authorities together and repeating the steps considering Universal Design during the process.

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Abbreviation List

API:	Application Programming Interface
CBA:	Color Blind Awareness
CUD:	Center of Universal Design
EU:	European Union
ETSA:	European Telecommunication Services Association
GIS:	Geographic Information System
ICT:	Information and Communication Technology
ISO:	International Standard Organization
MOO:	Multi Objective Optimization
NEI:	National Eye Institute
PME:	Personnel Management Evaluation
UD:	Universal Design
UN:	United Nations
UNCED:	United Nations Conference on Environment and Development
UNCRPD:	United Nations Convention on the Rights of People with Disabilities
UNDESA:	United Nations Department of Economic and Social Affairs
UNICEF:	United Nations International Children's Emergency Fund
UNDP:	United Nations Development Programme

1. Introduction

As per the report from United Nations Department of Economic and Social Affairs UNDESA (2018a), about 55% of the world's population are residing in urban region. From the same report it is also predicted to increase to 68% by the year 2050. The report also explains that there is a projection showing a gradual shift from rural to urban areas. Moreover, it also predicts that the population of the world is also going to increase by 2.5 billion in urban areas by the year 2050. This shows that the urban population is likely to be affected in almost all the parts of the world. This affects the various parts of the urban areas and there is a need for the proper urban development process. This pattern is to be studied via research and the need for sustainable planning for the urban development is felt. The challenges in the future of implementation of 2030 Agenda of Sustainable development can be uncovered by understanding the pattern in urbanization (UNDESA, 2018a). This will also help to create a new framework for urban development. While mentioning the development, it comes to the participation of the public and youths, which plays a vital role in development process.

Reports from (UNDESA, 2018b) provides us with the fact that the total population of the youths in the world is around 1.2 billion with the age group of 15 to 24 years. This accounts for 16% of the global population. Sustainable development is only possible by the youth participation in the development works. This can help to make the stable and inclusive society that is sustainable. The participation not only helps to achieve sustainable development but also to minimize the risks and challenges that are currently emerging such as climate change, conflicts, migration, poverty, inequality, etc. (UNDESA, 2018b). The current problem is youths are not taken as the part of participation process while almost half of the population of the world is below the age of 30 (UNDP, 2013).

Today the world is driven by the technology and the public are more into the fashion of using digital technology in their daily basis. Information and Communication Technology has touched almost all the sectors in the present scenario. Hence, ICT enabled innovation can boost the participation of the public in development process too. We cannot deny the fact that ICT has changed the innovation process by the user of broadband internet facility e.g. user driven application which are more into the social and 3G/4G services provided by the

telecom companies (Khan, Ludlow, Loibl, & Soomro, 2014). Also, there are examples in European countries where people are using ICT tool to interact with the city governments; resulting in better e-inclusion, e-democracy, e-participation and e-governance (Misuraca, Reid, & Deakin, 2011). ICT is transforming a relation between the public and the government by the ICT enabled management all over the urban areas. This can also help in the urban development process and increase the participation via technology.

Participation can be more effective if the diversity of the people can participate in the process of urban development. This is possible by the idea of Universal Design which suggests to design the product or environment which can be used by all people without the need of extra adaptation or specialization in a large extent as possible (CUD, 1997). Using universally design ICT tool can help or assist the urban development participation including the youths as youths often called as the future of the world.

This paper investigates the possibility of mobile apps for the participation of youths in the urban areas, which focuses on the Universal Design. In addition to that diverse user including people with disabilities can take part in the development process.

There are number of campaigns and events considering the participation of the youths in various sectors of development from the community level to the national and international level(Habitat, 2010; UN, 1992; UNCRPD, 2006). These events for motivating youth and their active participation are beneficial in some way. Nevertheless, there is still a gap between the actual desire and vision of youth which can be taken as a major contribution for the enhancement of the community (Omar, Omar, Othman, & Yusoff, 2016). The tools, communication channels, infrastructures, etc. are still behind for full potential of the youth participation. To reduce the gap between the tools and technologies and youths in urban development, mobile apps have the potential to be extremely beneficial in the development of the society. It can act as a bridge to the different areas where the development process is lagging. At some level, mobile apps are used to make processes run smoothly yet it is not effective in context of accessibility. The people with disabilities (UNCRPD, 2006) is still left behind and their participation in the community development programs are low. In this research, the main problem that is to be studied is very low participation of the youths and the problem with addressing the issues that are crucial for them. This paper studies to

resolve this problem by using the mobile app as a means of communication in bringing youths and urban development together.

This research studies the participation of youths in urban development based on the question, “How can mobile app promote or support participation of youths in urban development?”

This paper presents a brief overview of related literatures that explains the idea about the youth participation, urban development, accessibility, and Universal Design. Followed by the literature, methodology used for the research is described including research methods, target group of the research, overall plan, and process for the data collection. Afterwards, ethical considerations including confidentiality, vulnerability, privacy, and inclusiveness of the research are explained. Later, findings of the research are presented with detailed discussion based on the result. In the final section, the conclusion drawn from this research is explained in brief with the work carried out and the outcomes of the research drawn from this research.

2. Literature Review

To understand the current scenario and the previous efforts in the areas of research, various relevant papers are used. The important attributes and findings of previous related research, that are helpful for the current research is explored. The purpose of it is to have a clear idea about the major topics for this research. This chapter also helps to outline the broad picture of the urban development for smart cities, application that are used in smart cities, youth participation and the value of their contribution. In addition to these, the concepts related to accessibility and universal design are explained, which will be used in the mobile app that is going to be used for this research.

2.1 Urban Development

The technical and political process of using the areas in urban zone and overall design of the environment is called urban planning (Dodman, McGranahan, & Dalal-Clayton, 2013).

Sustainable development can only be achieved as the result of future urban development and configuration of urban policies by formulating or making the city's environment strong (Coello, Lamont, & Van Veldhuizen, 2007). The areas to be considered are economic, social and cultural level and for this Multi Objective Optimization - MOO technique can act as an alternative solution (Coello et al., 2007). Using MOO, the requirements of the urban planning are defined as the quantitative way. The requirements considered as the objective function which can be used as the concurrent functions through which the solutions can be determined to be used by the decision makers. Moreover, MOO can be used in the field of land use for sustainable urban development (Lubida, Veysipanah, Pilesjo, & Mansourian, 2019).

In order to modernize the city, urbanization plays a vital role which also needs to modernize the political and economic structures with a view to increase the level of productivity of the populations that are growing inside of it (Currie, 1966). The research in Romania found that the requirements for the urban development does not have an agreement and what are the things to be included are not clear (Tulbure & Prunariu, 2017). The author also argues that there is an agreement that reflects the requirements that fulfills the requirements of the present without affecting the needs future generations. However, this approach is unclear

because this causes the variation with how cities should carry out the process to become sustainable. The same paper also explained that in the present context, the goal is promoting sustainable urban development. For the development, the aspects to be considered are related to technical, economic, social, and environmental aspects. This means that there is a need of heterogenous work amongst the various experts along with the people that are residing in that urban area.

For urban development, planning should play a strong role via series of assessment and reinventing the planning itself (Habitat, 2010). The article explained that this can be done by the deep analysis on the new areas of urban planning and responses from it by taking the knowledge from success stories and innovative ways. Furthermore, these analysis would be helpful for healthy and better planning for sustainable urban development (Habitat, 2010). The article also added that the urban planning should be viable for all the citizens living inside it. This means that addressing all the rich as well as poor by taking their concerns at high level of decision for development in which the risk factors are effectively considered for all people.

Moreover, the ongoing process of innovation explains there are major changes in the planning process (Habitat, 2010). The changes are migration of planning from command and control model to strategic and selective oriented, reformation of institutional and legislative frameworks related to planning are revised, and participatory process are becoming more embedded (Habitat, 2010). The benefit of the first one is it is environmentally conscious and focuses on whole community addressing the priority issues of engaging stakeholders. This includes private sector which focuses on providing better outcomes and maximizing the resource effectiveness. E.g., are the projects of Kenya, Indonesia and Vietnam using the strategic planning. The second one facilitates the intersection of coordination and position of urban planning with public sectors and resource allocation which are discussed and implemented. The examples are the project of Sri-Lanka and Kenya supporting the reform of institutional and legislative frameworks related to planning. The last one which focuses on public participation is helping the meaningful involvement and engagement of public in all phases. The phases involve decision making, implementation and planning which has changed the urban planning to be a tool for democracy, the examples are the projects on Kosovo and Afghanistan. The UN Habitat also says that the participatory planning empowers

the communities and result in better design outcomes that are more effective to fulfill the diverse need of the urban groups.

From all the research mentioned above it gives us a clear idea about the urban development and its processes. The process involves the coordination among different bodies in the urban areas. Following this process, ideas can be gathered for making plans for the urban development. The papers also signify about the participation of the public in the urban development helps to make the development sustainable. This is well depicted through examples of different projects that were successfully implemented in different countries.

2.2 Smart Cities

The concept of smart cities has gained a popularity over the last decade among the businessmen, government, public media (Kitchin, 2014b). The author mentioned this theory has two sides. One side using the information and communication technology to boost the development. On the other side, the excessive trend of using technologies into the wires of cities to fulfill the urban management. Kourtit, Nijkamp, and Arribas (2012) defined smart city as the city which is technically inspired innovation, creativity and entrepreneurship and practiced by the smart people. The smart city, from other perspective is one that can be run, regulated, and managed in real-time using Information and Communication Technology tools with universal computing (Townsend, 2013). Kitchin (2014a) briefs that the smart city planner thinks themselves as crafting new technologies, new ways and plans that are scientific, objective, commonsensical and apolitical. However, the deep thinking towards it is very little. This has the wider implications of technologically rooted entrepreneurial urban development for city administrators and citizens (Kitchin, 2014a).

In many smart cities concepts the computation technology are taken as the source to inter connect the process and infrastructure to amplify the resource, service and participation of public in urban areas (Gabrys, 2014). The author adds that the for the smart city to be sustainable it requires more efficient process and engagement of the citizens in the participation with computation and monitoring practices.

Use of ICT tools and application has grown tremendously in several sectors (Boyd & Chan, 2002; Liberatore & Funtowicz, 2003). This sector includes experiments done in public for

planning cell, public assessment exercises and discuss various things related along with the experiment with policy and impact assessment. Boyd and Chan (2002) mentioned that there are number of planning and analysis tools which are ICT based to make the public understand the decisions that are made. Also, its impacts are presented by providing the numerical as well as visual representation for development related works. The same tools also helps the citizen by providing the access to explore the behavior to boost the urban development (Boyd & Chan, 2002). Moreover, there are many mobile applications developed for participation of the public in urban planning. The examples are mobile phone 3D augmented Reality Application for Vienna (Boyd & Chan, 2002), Turku Soft GIS for Helsinki (Kahila & Kyttä, 2009; Kyttä, 2011) and PME using mobile phone data for Vienna (Loibl & Peters-Anders, 2012). Many countries have studied about role of mobile apps and other ICT tools and began to publish data to increase accountability and control, as well as engagement of citizens, new innovation and efficient governing (Parycek & Sachs, 2010).

Khan et al. (2014) stated in their theory that the requirements for the development of the urban area differs in the cities depending upon the local bodies and policy and priorities of it that exists currently. This creates a challenge in ICT to adapt with the situation of the policy and priorities and develop the software so as to implement and integrate the features (Khan et al., 2014). The authors suggested that the future work to develop the model driven approach using the existing ICT systems. This also implies to develop new application on top of it along with the planning which involves the participation via social networking.

Hence, we understand about importance of ICT for making the smart cities. ICT is the major tool for making the cities smart by connecting everyone living in that area. When smart cities are mentioned, urban development is the key factor for making smart cities. Therefore, idea of smart cities is only possible when there is urban development. This contains the clear concepts about ensuring the ideas, inputs from the people residing in that area.

2.3 Smart application for smart cities

Various user focused approaches for innovation are proposed by different researchers for better development of smart cities. The paper by Sauer (2012) suggests that smart cities are providing the opportunities to engage in the innovation process in which the users are

included in their daily life process. The paper by Calderoni, Maio, and Palmieri (2012) suggests that the implementation of the location aware mobile applications for smart city by retrieving the relevant information from the user's surrounding.

The case study by Videira Lopes and Lundstrom suggest the virtual city in planning for the urban development which includes the powerful tools for promoting change in the cities (Schaffers, Ratti, & Komninos, 2012). The authors mentioned that it can be done via the idea of conceptualization and visualization in which the incremental approach is taken by observing the existing infrastructures in the city. Winkler, Zerkow and Weinberg explored the benefit of participatory process and using the urban sensing by involving citizens in the public affairs via theme of mobile government (Schaffers et al., 2012).

Smart application process mentioned above gives us a clear idea that for making smart cities the focus should be on the innovative ideas. This involves the ICT as well as public participation using the modern tools and technologies. Using the application developed using modern technologies helps to identify the requirements that can be used for planning of the city by the governing authorities.

2.4 Youth participation

The chapter 25 in Agenda 21 on Convention (UN, 1992) directs the nations to include the participation of children and youths in sustainable development. Also, UN (1992) states that the program areas of this chapter promote the advancement of youth and their participation in protection of environment along with social and economic development. And this is only possible by active participation of youth in decision making process as it impacts their daily life along with their future. Moreover, the other program focuses on involvement of children and youths in sustainable development. The basis for action is defined by the number of population of children and youths which is nearly half in the developing countries. These population are most likely the vulnerable to the consequence of the environmental degradation. Therefore, it signifies the vital role of children and youths for the securing the future with sustainable development. The Convention of the Rights of the Child briefs the child rights including youth's involvement in process of decision making which affect their future according to their capabilities.

The journal published by the UNICEF states that there are myths and reality when it comes to child participation which can be also taken for youth participation as well (UNICEF, 2003). The journal states that myth is considering the participation of only a single child, giving power to them by their superior level who are not capable of it, they should not be given more responsibilities, etc. Whereas the reality is, child needs a group to represent their identity and their priorities. Participation doesn't mean to hand over power rather to include them. Participation means giving responsibilities by their evolving capabilities in their development process and removing the barrier which causes them to feel like they are neglected and give freedom being for what they are.

In relation to planning, youth participation has been promoted for three decades however it still remains behind when it comes to adult participation (Checkoway, Pothukuchi, & Finn, 1995). Authors mentioned there are a variety of barriers in operation. According to Knowles-Yáñez (2002) the major barriers are taking the ideas from youths into consideration which is dominated by the process of economic interest. This barrier is resulting in the marginalization youth concerns. This is due to the inability to understand importance of youth in combination with economic, social, and political areas. In addition, there is also a resistance towards the youth's effort because of the doubt that either the participation of youth is advantageous or not (Frank, 2006).

The participation of youths in community development research is scarce, as can be considered as uneven because of number of factors. Checkoway and Richards-Schuster (2003) argues that the factors can be the interest of youth to participate, having no idea about what to do after participation. Authors added that, some youths even try to get involved resulting in no support from elders or must tackle with social problems that exists in the society. Regarding these factors, it is a very complex to find out the actual issue in participation and the quality of it. This is because the study still shows that development and participation is still undeveloped (Checkoway & Richards-Schuster, 2003). This research also points out the major reasons for less participation of youths in community. These are the perfect points to provide knowledge about social action, help youth involve in political as well as social rights, allowing to share the knowledge, active participation in democratic society, develop and strengthen the skills at individual and organizational level and to be capable to create change in the society (Checkoway et al., 1995).

The participation of youths has also been seen in various community events. Figueroa, Infante, and Serna (2000) mentioned in via example, in which the youths document the effects of pollution near school areas and submit finding to the health officials. Later they organize a program in different level about the racism awareness and create anti-racism events (Figueroa et al., 2000). The author also mentioned that the youth participation is also helping to evaluate the various sectors in the community and counsels the directors. This also helped to act in allocation of funding in the community, document the involvement of youths in the crime in the newspaper and submit the finding to editors.

The research conducted on focus group discussion shows that the youth participation in community level is very low still not much effective (Omar et al., 2016). The reasons behind this lagging in the participation are related to understanding of youth and community. Youths believe that they are left out by the community while community often neglect the youth participation. Hence, from this we can see that the community should play a vital role in including youths for the participation in community level. The author clarifies that this can be done by sharing the information to all the individuals of community which is a significant approach. Being largest group in community youths are more likely to get encouraged for the community development programs. Author added that, this is because they are major contributors for shaping the society and influence the upcoming generations too. To improve the quality of the participation, there should be some effect on the process, impact on a decision or create a positive result by the people (Checkoway, 1998).

Therefore, we come to know that youths can play a vital role in the process any projects. When it comes to public participation, youths are also the part of it, and their participation helps to make the development process more innovative. This can be effective via their ideas and desire for shaping the community. Moreover, planning in development works can also help using their feedbacks. The papers also explained that youth are the key to the future, and they can help making the urban development process more effective. This is through participating and providing their ideas based on their academic knowledge and their keen interest in related topics.

2.5 Universal Design, accessibility, and guidelines

This section focuses on universal design, accessibility, guidelines for accessibility in android application and explains the importance of it in relation to this research.

2.5.1 Universal Design

The Center for Universal Design at North Carolina State University defined universal design as *“the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design”* (CUD, 1997).

Universal Design (UD) is also defined by the United Nations which is slightly different than the definition by Center for UD and it includes the term assistive devices within it. The actual definition of UD by UNCRPD (2006) states that *“Universal Design means the design of products, environments, programs and services to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design. Universal design shall not exclude assistive devices for particular groups of persons with disabilities where this is needed.”*

CUD (1997) has defined seven principles of Universal Design which are equitable use, flexibility in use, simple and intuitive use, perceptible information, tolerance for error, low physical effort, and size and space for approach and use. Each of these principles evidently defines that how the designer should consider this while designing something that is targeted to the wide range of users.

When it comes to Universal Design, the question comes in one’s mind that why should this be considered or is it part of legislation. There are various international and national level legislations which recognizes the Universal Design. The international legislations are International Human Right Treaties, UNCRPD and European Union. The national legislations are Anti-Discrimination Laws, US rehabilitation Act Section 508, procurement laws and regulations.

Considering universal design has been a major topic since its introduction in 1990s, the actual implication of it on the field of ICT is not sufficient. This statement is backed by the article that focuses on the human rights and universal design focusing on the role of ICT in

the participator process (Giannoumis & Stein, 2019). The article depicts that Universal Design as one of the main components in human rights in relation to equality and non-discrimination in society. Authors added that use of ICT ensures accessibility along with the idea of participation of the people to ensure their human rights. Moreover, this paper concludes that ICT can play a vital role to enhance the participation. This can be done via taking marginalized groups of people in the society into consideration. The goals for it are to eradicate the hurdles or barriers caused by accessibility. This involves promoting the importance of participation of such groups in the process of design and development of ICT based products.

After all the statements from Universal Design Center and UNCRPD, concepts of Universal Design are clear that it helps to make designs that are inclusive for everyone via participatory methodology. This implies making the daily life of the users easier and hassle free. The role of the ICT in universal design can also ensure the human rights and the importance of participation can help in achieving this in the design process is also well explained. Moreover, the importance of this concept is well addressed by different legislations throughout the world. This also depicts the vitality of concepts and progressive effects in the society.

2.5.2 Accessibility

ISO defines accessibility as, *“extent to which products, systems, services, environments and facilities can be used by people from a population with the widest range of characteristics and capabilities, to achieve a specified goal in a specified context of use”*. In other words, accessibility means something that can be used by large number of people without any difficulties to achieve the desired result (ISO, 2011).

Various people have different kind of disabilities. They use different technologies for using ICT tools, some even use the specially designed technologies also known as Assistive Technologies. For example: people with visual impairment uses braille, people with dyslexia uses text to speech technology. Since, we have three terminologies Universal design, assistive technology, and accessibility; people often get confused about accessibility and Universal design concepts in relation to assistive technology.

ISO (2011) describes accessibility as the part of Universal Design. Accessibility mainly focuses on making the product that can be easily used by the people with disabilities and elderly people (ISO, 2011). Whereas Universal Design is mostly leaning towards making the design that can be used by everyone in any context without any assistance or use of assistive technologies.

In addition to the concept of accessibility, different governing bodies national and international recognizes the accessibility. The article 9 of United Nations Convention on the Rights of the Persons with Disabilities mentioned about the accessibility (UNCRPD, 2006). This explains that people with disabilities should be able to involve in all aspects of life independently and the responsible parties should also follow the measures to include the need of persons with disabilities as equal to others (UNCRPD, 2006).

For the most part, accessibility focuses on making the product accessible for everyone. Since, it's also recognized by many national and international legislations, the importance of it cannot be denied. Considering this, accessibility is considered as important factor in the prototype application used in this research.

2.5.3 Color blindness and types

Color blindness is defined as the inability to visualize or differentiate between certain colors (NEI, 2019). National Eye Institute (NEI) mentioned that this has no cure though people having color blindness can adapt using different type of contact lens. These different lenses are specially designed spectacles to perform their daily activities without any difficulties. As per the statistics by CBA (Color Blind Awareness) website in 2016, color blindness has the global impact where 1 in 12 men and 1 in 200 women are color blind with 300 million people with color blindness across the world (CBA, 2016).

As per National Eye Institute NEI (2019) that defines the color blindness, color blindness is categorized into three types. They are red-green, blue-yellow, and full color blindness. Person with red-green color blindness have difficulty in differentiating red and green color. Person with blue-yellow color blindness has the same with blue and yellow color. If the person has complete color blindness, then then person cannot distinguish any color at all.

Red-green color blindness has 4 subtypes: deuteranomaly, protanomaly, deuteranopia and protanopia. The most common color blindness is deuteranomaly in which person visualize green color as red. Protanomaly is another type on which it's just opposite to deuteranomaly where person visualize red color as green and less bright. Deuteranopia and protanopia both are similar where person cannot differentiate between red and green color.

Blue-yellow color blindness has 2 subtypes: tritanomaly and tritanopia. Tritanomaly is the condition where the person finds it hard to differentiate between green and blue, and red and yellow. Tritanopia is another type where person cannot differentiate between three sets of colors which are blue and green, red, and purple, and pink and yellow.

Complete color blindness is the condition where person cannot see any colors at all which is also called monochromacy. It is the least common color blindness and person with it have difficulty in clear sight as well as sensitive to light.

After the knowledge about different type of color blindness, we can also imagine how it can have impact on the person with color blindness. In addition, it is one of the major accessibility issues that can have a serious impact to a person. The first impression of a person goes towards the colorful elements and presentation of an app. Hence, color blindness is one of the vital considerations for this research. This will be assured in the prototype application development as a part of this research.

2.5.4 Accessibility on android and guidelines

Android has an accessibility layer which helps to users with visual impairments to navigate through the device easily via different services like text-to-speech, haptic feedback, etc. (Google, 2021). To ensure the accessibility on android, three major principles are mainly focused: clear, robust and specific (MaterialDesign, 2021). The first principle: clear can be described as making the layouts that are clear and distinct to perform action. The second principle robust can be achieved by designing the app to include diverse users. And the last principle specific means to endorse assistive technologies to existing platform (e.g., multiple input methods touch, keyboard, mouse).

The article also explains about the Screen Reader software provided by android as assistive technology which uses braille display also known as Google Talkback. This helps people with visual impairment read the texts easily using the screen reader. While using screen reader, navigation is made easy using the explore by touch method. During the process user moves their finger at different parts of the screen and get to know what's underneath it, and user can select the item using double tap. To perform smooth navigation, user can jump back and forth the screen using the back and forward swipes in a linear fashion and read the pages easily.

In addition to the accessibility layer and service provided by android, some guidelines are explained in the article to make the apps accessible. Visual hierarchy, focus order, grouping, transition, color and contrast, visual clues, touch targets, fonts, captions, alternative texts, embedded texts, label for UI elements, control states, control interactions, hint speech, use of images (decorative and informative), logos, sound and motion, etc. are the major topics for guidelines to be considered while designing and developing the android application (MaterialDesign, 2021).

Altogether, the guidelines mentioned above will be considered during the prototype android app development for this research. In addition to this, the WCAG 2.0 (WCAG2.0, 2008) guidelines are also considered to make the prototype accessible.

2.5.5 Summary

To sum up, idea of universal design and accessibility explains the need to address these in every context of the society. This cannot be denied in the field of ICT as well. Moreover, considering the goal to achieve sustainable urban Development for creating the smart cities, the concept of universal design and accessibility plays a significant role. This helps to target larger number of people in society including people with disabilities, youths, and elderly citizens. The concepts of universal design and accessibility helps to make the planning more effective and universally designed for everyone in the city. For incorporating the concept of Universal Design and Accessibility the law bodies are also available and has mentioned why it is required take it into consideration. In addition to address these on the product, the guidelines are followed in the prototype mobile application for this research.

2.6 Existing tools used for the project

Since, our co-researchers are using different apps for this research, the one that is currently being used is called “Experience Fellow”. It is a mobile app that is available both on Android as well as iOS platform. The features of this app allow the researchers to use their smartphone to take the photos or capture videos, post comments, and give review about various locations. It also allows the analysis of the data both in quantitative as well as in qualitative way. Ratings are taken as the quantitative data whereas tagged content are taken as the qualitative data. It also provides the feature for visualizing the content or finding on a map and export the data as per requirement.

“Experience Fellow” was used in two Norwegian projects which are called *Ungdomstråkk* (AFI, 2016) and *Seniortråkk* (DOGA, 2019). Our co-researchers are using this app for the purpose of collecting the data individually as well as in groups. *Ungdomstråkk* covers or focuses on the youth. *Seniortråkk* focuses on the elderly. The main purpose of these two projects is same that is to help identifying the location around their community that are find and that needs to be improved. For the case of youths residing in the urban area, we see that the place that has the offer for food items at lower price are important. When it comes to senior parks, meeting places, and workout places are important.

The app being used currently performs well yet lacks several features to collect the data and analyze it. However, there are also several improvements in context of the app which can be done to make the research process easier and better. So, we thought of creating a new app that focuses on the existing app as well as new features that help in research purposes.

In short, we understand that existing tools that’s being used already has some features available, however on the other hand limitations as well. Hence, the aim is to develop a new app that can perform what the existing app does with some additional features.

2.7 Summary

To summarize, the exploration of the existing research that are related to urban development, smart cities, participation of youths in urban development and what role can ICT play in the process of it mentioned. The literatures have looked at urban development,

concepts of the smart cities and status participation of youths in community. It also explained about the status of ICT in the urban development process. The examples also provide clear idea about the tools and technologies that are used for improving the participation of people in the urban development related activities. The literatures also reflected the status of participation and what are the benefits of it. Moreover, how the ICT is being used for the participation process and the role of ICT in the urban development participation. Along with ICT, the concepts of universal design and accessibility, are also explained with a set of guidelines and tools that are used for this research. From this we conclude there is a need for the use of new tools and technologies along with integrating the existing systems in and innovate way to increase the participation.

3. Methodology

The methodology that is used for this research is explained in this section. It explains about process for collecting data, tools used for this research, etc. in brief.

3.1 Qualitative research case studies

According to (Noblit & Hare, 1988) qualitative approach in the research mainly focuses on the subjective world. The author also explained that the qualitative approach also offers a clear idea into social pattern. This helps to find out why the participant performs the thing that way and what are the reasons behind to through their experience. Akir (2006) adds that qualitative approaches can also help in formulating questions when the process is complex to express using numeric data. Also, qualitative analysis can assist in the understanding of the mixed results. Thus, it can also help to find out the entities that prevents or give the clear idea about the implementation of the research (Akir, 2006). The subject that is to be taken under research is generally studies in the natural way (Fuglerud, 2014). The author also says that the researcher always tries to reflect or explain the process in a way that importance of it brought by the people.

Qualitative research is based upon the understanding of the pattern of the society. This includes the observation and action of the people as the major source that creates what we think about the community (Speziale, Streubert, & Carpenter, 2011). According to Layder (2005) qualitative approach commonly is a humanist approach which gives the preference to action over the structure. Hence, from this pattern also we can say that the researcher tries to observe things from several perspectives of participants involved. The objectified society that rules, forms on how people perceive and take action is less accepted in the qualitative research (Roberts & Wilson, 2002). Due to this argument, it decreases the priority in understanding of the society which is not going to be fulfilled by the grouping and analysis of the pattern observed. Hence, social understanding can be only deduced by taking the meaning of its existence for the participants (Holloway & Galvin, 2016; Morse, 1990; Parkin, 1982).

There are other approaches for qualitative research that focuses on the double analysis of the data that are taken from qualitative approach itself (Heaton, 2008; Weed, 2002). Weed (2005) argues that this kind of approach is complex and cause problems because in this type the data available are not complete. Author added that secondary analysis of the data cannot be done, and this should be conducted by the original researcher itself. Meanwhile for an example author gathered the data from his own research and from the help of the partners who are involved in the various research to generate an idea about the participation of the sports tourism.

All things considered; we can conclude that qualitative method best suits this research because we are going to investigate the social behavior of the youth. Qualitative method also helps to formulate interview questions easily. This also helps to solve complex data that are in numbers. Being a humanist approach, qualitative method counts and observes the action and sometimes reanalysis of the research can be also possible. All the cases mentioned above match our research goal. This be because we are focusing on Universal Design and the participants for this research may have several impairments, their own way of understanding the topic, this we need to deal with each participant individually.

3.2 User Groups

This research targets to develop an ICT based solution that is universally designed. This implies it can be used wide range of users including people with disabilities. Youth involves the participants with various kind of disabilities, the goal is address all of them possible. The number of participants for this research is planned for 10 people with the target age group between 20-30. In addition, the goal is to include 3 participants with various kinds of disabilities such as visually impaired, hearing impaired and motor impairments on a voluntary approach. Also, the user groups focus on the diversity of people with various characteristics like academic level, experience, level of impairment, gender, background, etc.

3.3 Data Collection

For the data collection in this research, we will be using universally designed mobile application that is targeted to the youths to get involved in the urban development participation process. We will be also conducting the interview after testing the mobile app

that is used as an ICT tool for this research. Meanwhile, while testing the android application with the participants we will be observing how the participant are performing. The observation will be done for the task given, level of difficulty and all other factors that can have impact on the findings of this research.

Interview and observation are the part of qualitative method. Comparing the investigations in different cases increases reliability (Lazar, Feng, & Hochheiser, 2017). Therefore, a combination of interview and observation will be held with all the participants for this research. In general, this process contains the following:

1. Information about the project and user consent
2. Background of the participant
3. Task solving using the ICT based tool
4. Open interview
5. Feedback

In addition to interview and observation, thinking aloud method is also used which is a common for testing the usability to observe the experience of user and it is called “thinking aloud” (Baecker, 2014; Constantine & Lockwood, 1999; Nielsen, 1993). The participants will be directed to speak aloud while they are performing, feeling and their thoughts while testing or performing the given task. The researcher will be with the participant and observe how the participant is performing the task and assisting him/her. The main idea of this method is to make participant feel comfortable and easy while given to perform the task on the prototype of the project.

As mentioned in the literature review, we will be using an ICT tool (prototype android app) that is developed for this research. We will be performing the ICT based data collection via using the app as a tool to understand about the concepts of youth participation. This is done to understand the implications of it via the feature review. In addition, we will also understand the importance of accessibility and universal design concepts that will be considered while developing the app.

The name of the new app to be developed is called “*MinBy*” which translates as My City in English. The features that are to be integrated into this new app focuses on accessibility and

the feature is to locate the findings in indoor as well as outdoor space in the community. Hence, this newly created app prototype will be used as an ICT tool for user testing and learn about the feedbacks and improvements that can be done on it in relation to the project.

In addition to all the features mentioned above, app will be developed following the set of accessibility guidelines from both WCAG 2.0 and android accessibility guidelines. This is intended to focus on the users who are disabled and needs the assistive technology to use the app. This will make the app accessible for all the users and we can understand the importance of this topic based on our research questions as well.

3.4 Interviews and user testing

In this section, overall process of data collection and testing the prototype app with the participant selected was done. The steps involved in this process starting with creating questionnaires, participant information sheet, interview method, tools used, participant selection process are described in this section. At the end of this section, process involved in the data analysis is also explained in brief.

3.4.1 Participant information sheet

Participant information sheet was created to give the participant the brief idea about what the research is about and why the participant is selected. This information sheet covered all the important aspect of the consent form. The points cover the theme of the research, voluntary participation, method of interview, right to withdraw from interview process, user confidentiality, further implication of the research and contact information of the researcher and research supervisor. The detailed participant information sheet is available on Appendix 1.

3.4.2 Interview questionnaires

As described in the methodology section of this research, we used the ICT tool (android app) and interview as method of data collection. Our prototype app development was completed on mid-September 2020, so after this we self-tested the prototype to find out the hidden issues if any. Meanwhile, the setup procedure for the data collection was also carried out in parallel. For the data collection procedure, the questionnaire consisting in

total of 17 questions was prepared. The questionnaires were divided into 3 sections which are general section with 6 questions, technical section with 8 questions and accessibility section with 3 questions. The list of questionnaires used for data collection is available on Appendix 2.

In contrast of 3 sections of questionnaires, general section contained the questions related to youth participation, community development, issues community and their tendency to react on it. Technical section contained the questions related to the app prototype and feedbacks related to it, covering a small part of the accessibility in general as well. And the final accessibility section was created focusing people with disabilities who use accessibility services for using the app. The question related to accessibility barrier and improvements were included in the accessibility section.

3.4.3 Data collection setup

After the participants accepted the invitation for being involved in this research, they were provided with the prototype app to install on their phone. The prototype installation file was sent using google drive because sending APK file is not supported using email attachment. This APK file can be easily installed on android phone device. Most of the participant used their own android phone for testing the prototype. P1 used the device provided by us, because of unavailability of android device. The device used by the participant during the process is listed on Table 3.2. In addition to this, all the participants interview was recorded using the audio recorder. This step was optional and only done with participants consent. The intention of this step was to avoid the possible interruption during the interview process where researcher must stop the participant to note down data collected. P1 decided not to record the interview session for general section, then again later agreed to record the interview with technical section questions. Participants were pre informed about not to disclose their personal information after the recording started.

3.4.4 Participants

Most of the participants were chosen based on their interest in information technology, involvement in youth related activities in past and present, and the academic background. Since our main target group of the research are youth, so we conducted user testing and

interview with 7 participants in total (P1 to P7) with age group between 20-30. Moreover, the data collection was anonymous, any sort of personal information of the participant was not recorded. The demographic information of the participant with age range, gender and academic background are listed in Table 3.1.

Table 3.1. *Participants demographic information*

Participant Number	Age Group	Gender	Background
P1	20-30	Male	Computer Science
P2	20-30	Male	Computer Science
P3	20-30	Female	Social Science
P4	20-30	Male	Entrepreneurship
P5	20-30	Male	Computer Science
P6	20-30	Male	Environmental Science
P7	20-30	Female	Statistics

The demographic information listed on the Table 3.1. above were collected at the start of data collection interview. Since, we are not recording any personal information that can identify the participants, all the participants were marked with participant number starting from P1 to P7. All the participants were between 20-30 age group. Two of the participants P3 and P7 were female and other five of them were male. 3 out of 7 participants P1, P2 and P5 were from the computer science background whereas, others were from different background: P3 from social science, P4 from entrepreneurship, P6 from environmental science and P7 statistics.

3.4.5 Procedure for interview and user testing

For the interview and user testing, meeting time with each participant was scheduled beforehand considering the availability of the time for interview session. The interview process was estimated to be 20-30 minutes. The process began with the demographic data

collection, followed by the questionnaire from general section. After the general section was complete, the participant was asked to have some time for a break if required.

After the break session, the participants were given the prototype application to install on their android phone. The brief introduction of the app was given to the participant so that they can get the actual context and motive of the app. Most of the participants were comfortable using the app, and did not have any difficulties accessing the app. Some questions were asked by the participant, regarding the purpose of the feature which were answered by the interviewer. Participants used various testing device and the interview was also conducted with both face to face and video call. The detail of the interview type and testing device used by the participant is listed on Table 3.2.

Table 3.2. Method for interview and device used for user testing by the participants

Participant number	Interview type	Testing device used
P1	Face-to-face	Samsung Galaxy s10
P2	Video Call	Samsung Galaxy s9
P3	Face-to-face	Samsung Galaxy s10 plus
P4	Video Call	Huawei P20 Lite
P5	Video Call	One Plus 7T
P6	Face-to-face	Samsung Galaxy J7
P7	Face-to-face	One Plus 5

Table 3.2 listed out the testing device used by participants and type of interview conducted. Participants P1, P3, P6 and P7 went through the face-to-face interview, whereas participants P2, P4 and P5 went through the video call interview. Various participants used different devices for app prototype testing.

After the user testing for the app was done, the technical section questionnaires were asked to the participants with 8 questions. All the participants answered the questions based on

their experience while testing the prototype and provided lot of excellent feedbacks consisting of both good and bad sides of it. In addition to this, most of the questions were open ended, which made the interview session fruitful and excited the participant to provide the answers based on the critical thinking as well. To make the interview session more interactive, there was a lot of two-way conversation between interviewer and the participant. This also helped to make it more like a normal conversation rather than an interview.

3.4.6 Data analysis

For analyzing data collected from the interview process and user testing, open coding method (Crang & Cook, 2007) was used for coding the answers from the participant in the interview. The choice for open coding was selected because it is widely used for qualitative data analysis and good step towards it based on “grounded theory” (Birks & Mills, 2015).

Data collected from the interview was the recording of the interview in audio file. Firstly, audio recording was documented into the written form manually. For the coding process, to save time and effort of coding the interview manually, NVIVO tool was chosen to rapidly code the interview. The data analysis process took almost two weeks. As the qualitative data collected from the interview has a in depth meaning based on the experience from each participant, it took some time to analyze it. The data collected from the 7 participants were coded and gradually categorized into categories. The process was very effective as the data was being analyzed and the result of the data can also be seen as the process moved forward. In addition to this, all the demographic information related to the participant was also coded on NVIVO as the cases. We created the participant demographic information with participant number, background, gender, age group, interview type and testing device used.

Later, when the coding process was completed, we already have the preliminary result of the research. Content analysis (Lazar et al., 2017) helped to analyze the data in deep level and also helped to create the abstract theme based on the codes generated. This was done to further polish the result based on the research question and generate a theme of the result.

4. Ethical Considerations

Maximizing the benefits, minimizing the harm and respecting the human dignity are the basic ethical duty in research (Fuglerud, 2014). Understanding the effects of the research and to maintain the privacy, think about human rights are the duty and responsibilities of the researcher no matter what the research is based on. Therefore, to address these ethics following ethical considerations will applied to this research.

4.1 Human Dignity

The participants will be fully briefed about the intent of the research and the primary objectives. The course of action without any hassles from the participant to perform the certain task without the need of justifying it, is called respect of the autonomy (Fuglerud, 2014). The participants will be informed about the consent through email or letter and the consent will be explained in person to clarify any confusions regarding it. Appointment will be taken for each user and follow ups will be done to make participant free to withdraw from the participation and postpone or cancel the appointment. Also, the participant will be voluntary, they will not be forced to participate into this.

4.2 Vulnerability Sensitivity

To protect the persons who are sensitive or vulnerable to avoid the exploitation, abuse or discrimination is one of the ethical process. For this research we will be including the participant with impairment as well as the healthy. So, we need to also focus for those participants who don't feel like sharing their identity or any personal things and will be noted earlier in order not to collect such personal data as the part of this research with the consent from the participant.

4.3 Privacy and confidentiality

In order to assure that no personal data of the participant that can identify the person or risk the vulnerabilities of that person to be in the public, the Norwegian Personal Data Act (Act., 2000) will be followed. To ensure the personal data of the participant, the interview recording is only stored in the computer that belongs to researcher and not in any sort of

cloud storage on internet. In addition to it, the recordings are stored in an encrypted folder to prevent it from potential theft or access from someone outside.

Also, the General Data Protection Regulations from (EU, 2018) will be used for the proper and efficient use of the data collected. As per the GDPR Section 3, Article 17 right to erasure, the participants were given freedom to request for removing the collected data. Also, it is also ensured that data collected will be deleted on request.

Moreover, the data related to disability of the person and health is a private data hence they must be handled properly (Act., 2000). The aim of this research is also to include the participant with disabilities however, not necessarily to include the type of disabilities the participant has. Only the demographic information is collected which includes age, gender, and background. Hence, not any sort of information related to the disabilities are recorded in any means.

4.4 Risk of harm

It is important to be attentive to the participants wellbeing and to tailor the testing methodologies to their needs while working with individuals with limited physical or cognitive ability (Culén & Van Der Velden, 2013). While testing the app with the participant we will be giving a message to a participant that it was just the testing of the app not evaluation of the performance by them. The level of easiness that a participant feels depends on several factors. Fuglerud (2014) mentioned that the level of strain depends upon the ability of the researcher to make the participant comfortable. In addition to this, machines or tools that are used, external environment or place where the test is being done, impairment of the participant are factors that impacts the level of strain. Moreover, the capability to solve the problem by participant as well as their nature also plays an important role. Hence, for this research also we need to be very sensitive with each participant.

4.5 Inclusiveness and Justice

The transparency and equity while selecting the participant for the research is related to inclusiveness and justice (Dittrich, Kenneally, & Bailey, 2013). The small things like providing the access to the participant access to the research areas, knowledge about the research

and giving freedom to gain information about research materials. Since, this is a research of Universal Design, we might not be able to cover participant with all types of impairments, so we are aware that many aspects might not be covered in this research.

5. Results

This chapter presents process involved in the application prototype development followed by the final prototype mobile application. Later, the results obtained via data collection including both interview and user testing of the prototype is described. The result is based on theme generated from raw data during the interview and user testing of the prototype. These themes are categorized based on their similarities and actual topic of this research are explained in detailed in this chapter.

5.1 App design and development

In this section, the overall process of application prototype development starting from sketch design, wireframes, mockup design and final prototype development is explained in detail. In the final prototype development section, the guidelines considered for ensuring accessibility and how universal design principle are included for prototype development are explained.

5.1.1 Initial concept of the app

The initial concepts aimed for the new app are listed below with short description. The description includes the features that need to be improved from the one that existed in the “Experience Fellow” and the new features. The top features that are must are listed in the top four section. Other features are extra features which are more advanced and might not be realistic at current point of time to implement.

Categories:

Experience Fellow was based on the touchpoints and the geolocation of the touchpoint are the places where the researcher posts the photos, videos, comment, or ratings. This terminology is not clear for our project, hence we wanted to introduce as new category for data entry purpose. The main data entry section that is available on the home page of the app are:

- A. Send us an idea**
- B. Send us a report**

C. Send us a review

These above mentioned 3 section for data entry purpose includes the basic and strong points that covers the general intention of user while using the app. These 3 sections can be different for different project. These sections will be followed by 6 categories along with 1 additional category (other), which user can select if none of the categories match the context user wants to send the interview, idea, or report.

Geolocation:

We have a geolocation feature that comes after selecting the section and one of the categories in the app. For the geolocation purpose, we are using google maps, where user can zoom into the exact location of the place to review and drop a pin on the map. The latitude and longitude of the point where pin is dropped is taken as the location information while sending the idea, report, or interview.

Multiple input methods:

To provide user with multiple input mechanism, the app has the multiple inputs which is text, speech-to-text input, image selection directly from camera as well as gallery. Further scope for input will be supporting video input, audio input, etc.

Language:

Experience Fellow was only available in English language. This was creating a language barrier for the participant who are elderly for the project "*Seniortråkk*". For our new project we will be providing multilanguage feature so that it can be even used at wide range at international level in various countries. For the current prototype testing, we are supporting at least English and Norwegian language.

Mobile and tablet:

Experience Fellow was developed only for the smartphones with low density screens and was missing the tablet experience for using this app. Since, the app contains complex features that is complicated to use in the small screen, we would like to make it available in large density screens supporting the tablets and iPad. Large screen display helps the elderly to easily use the app along with the features like cropping, adding comments, drawing sketches, etc. Whereas youths are still more into using private mobile phones.

Integration with municipal planning offices:

The main aim of the project is to provide data that can be used by the city planners. We want to make the app compatible with the format of the data to be delivered to the planners. This can either be done by creating a global format of the data using various API to make it available internationally or integrating with the system used by the city planners.

Image recognition and other AI features:

One of the possible features for the app is to recognize the objects using the images and add additional question based on the type of the image or object whose image is captured. It would be great for us to be able to ask additional question after detecting the type of object whether it is a building or a park or a crossing, etc.

Indoor and outdoor use:

We also have the project that requires the researchers to map positive and negative locations and objects in indoor space such as youth clubs. We are thinking about integrating the indoor GPS system that is currently developed by Oslo Metropolitan University. It could be useful to track the precise positioning in the indoor spaces rather than regular GPS.

Gamification:

The app will have a feature that are more like game, problem solving, quiz, individual performance points, etc. so that it makes the user excited while using the app. For the first phase, we have included the reward point system, user will earn the points for each review/idea/interview they send. This is only available is the user is authentic and verified.

5.1.2 Initial brainstorming for implementing actual concept into app

Initially, we setup a meeting with the members working on this project “MinBy” to brainstorm about the features and ideas to be included in the app. The major goal of this meeting was to outline the layout of the product that we are going to build. We listed out the basic features that are required for the app. We decided to have a User authentication page with login and signup screen. In addition to it, we also decided to have a social login/signup support with Facebook and Google. For the home page, we decided to have categories section where user can choose any of the 6 categories, which are to be named later. To have a pictorial representation of the issues reported or reviewed by user, we

agreed to have a map page which contains the cluster of marker pins. Since, we added login and signup process, we also decided to have a basic profile page for the user, where user can view and edit their personal information.

HVA SKAL TIL FOR AT DERE VIL BRUKE APPEN?

- At den er enkel å bruke
- Poengsystemet: Hvis forslaget er bra for man poeng.
- Premier for mange poen
- Kategorier for ting man anmelder.
- at den er anonym, så man kan si hva man vil/mener
- at endringer faktisk skjer, innspill blir lyttet til

Figure 5.1. Initial concept and high-level overview of MinBy application.

Figure 5.1 shows the initial concept brainstormed and high-level overview of basic features and goals for the MinBy application. Figure 5.1 contains the information in Norwegian language hence it is translated into the English. The major points that were listed out on the figure are as follows:

- Must be simple to use
- Point system: Get points if the suggestion is good
- Reward for multiple points
- Categories for things you comment/review
- Anonymous so you can state opinion
- Necessary that changes happen, reviews are listened to

For the main feature of the app, there were number of ideas how to achieve it, and what should be the input methods to be used for sending the report or reviews. After selecting

any of the category from the home page, user should be directed to select the exact location of the page and drop a pin on map. We decided to have this step mandatory, otherwise it would defeat the purpose of pinpointing exact location of issue and displaying it on cluster. Followed by it, we added a page where user can enter the information about the issue that is to be reported. For general setup, we agreed on to have support for adding image and text only. And, after this step is completed, user will submit the issue and earn a reward with some points. The main idea of having a reward is to attract the youths to use the app in regular basis. Future work of this reward system is to integrate with the cafeteria in university or within the city where it is possible to cash out the points and buy the fast foods or beverages.

5.1.3 App Wireframe design

About one month after the initial meeting, where we decided to have a brainstorm session for creating layout of features, we had another meeting where we discussed about the actual representation of the features that should be used in the app. In this meeting session, we discussed how the app look like should, what are the shapes of buttons or images should be. We discussed about the headings, description and need of icons to represent some main sections of the app.

After having a long fruitful conversation among the team members, we concluded to use the buttons with rounded corners, text on title of the screen and in all possible screen where needed. We also agreed on to follow the accessibility guidelines for the mobile application. After agreeing upon the wireframe design, this was sent out to the designer who will create the mockup design for it and will have something that will show us the actual representation of the features in app.

5.1.4 Mockup design

We got the mockup design ready 2 months after we had the meeting for wireframe design. Since all the team members in this project were working part time only, it took quite a while to get the things done. Mockup was designed by one of the team members who had the responsibility for designing the overall content of the application. Figure 5.2, Figure 5.3, and Figure 5.4 shows the final mockup design.

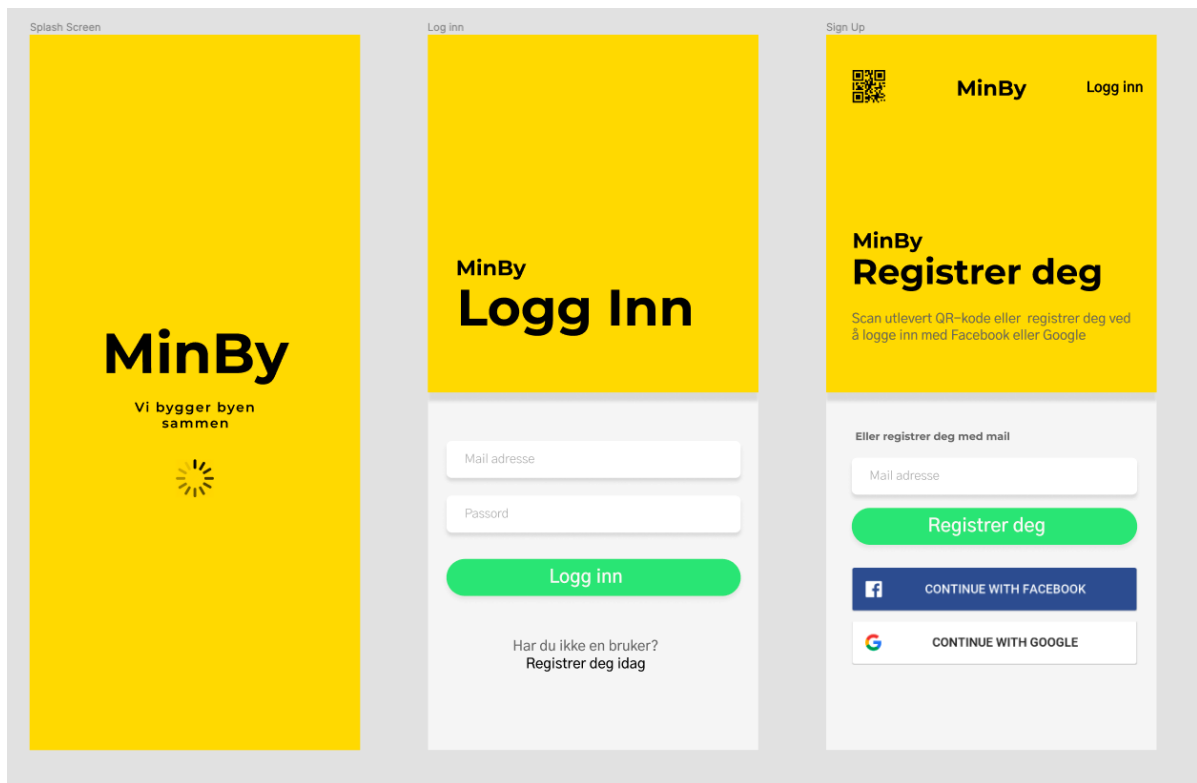


Figure 5.2. Splash page, login, and signup page mockup design.

Figure 5.2 shows mockup design of three screens: splash page, login page and signup page. Splash page is the initial page which is opened while opening the app which contains the title of the app in the center with the theme of the app which translates as “we build city together”.

Login page contains the two forms for entering email address and password with a button to login. Figure 5.2 shows that there is also an option for user to register as new user, which opens register page displayed in third mockup design.

Register page has the option to go back to login page, with option to register using email address along with the support to register using Facebook and Google as well. The initial mockup design also contains the QR code (idea to signup/login) using the web browsers. This concept was later dropped and removed.

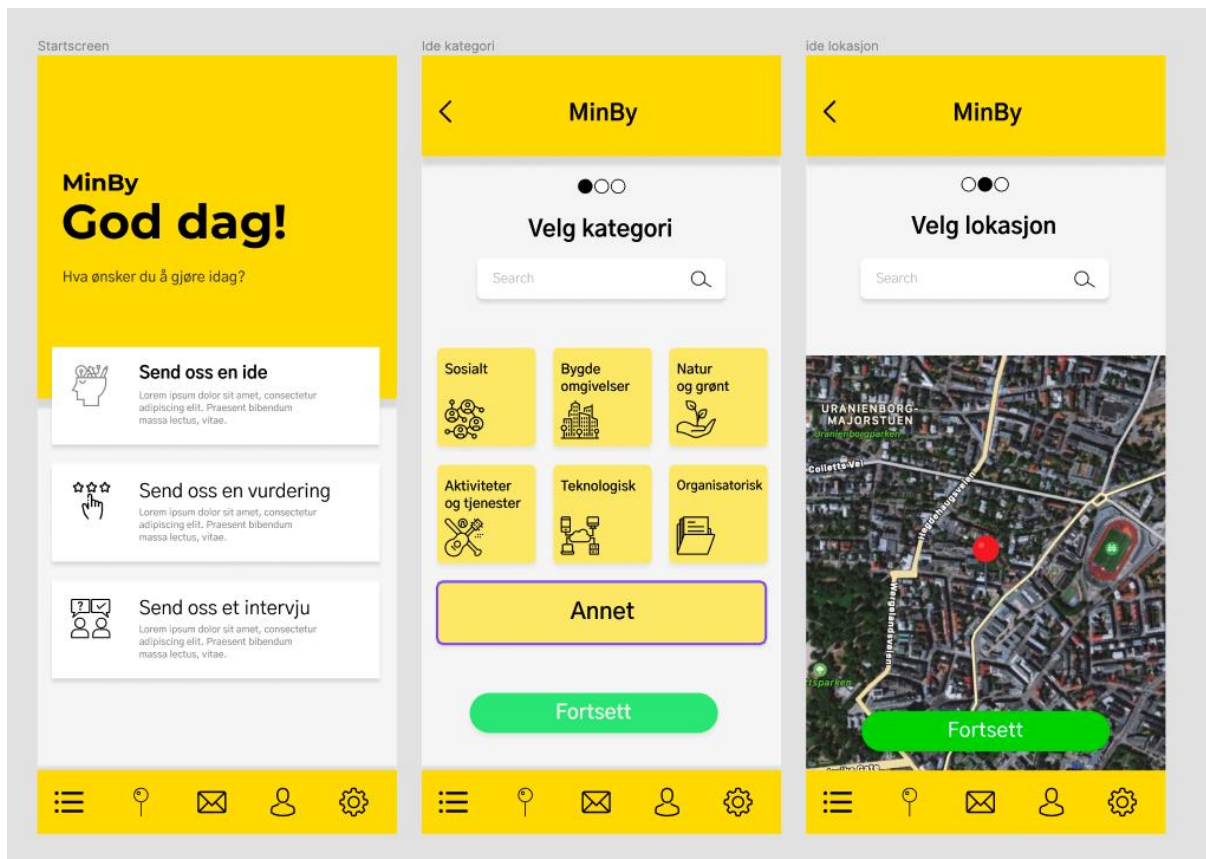


Figure 5.3. Home, categories, and location page mockup design.

Figure 5.3 shows the mockup design of three pages: home page, categories page and location (map) page. Home page contains the greeting text on the top of the screen based on the time of use of app with 3 options to either send idea, report, or review. Home page also contains the navigation bar at the bottom of the page for navigating between different home pages.

Categories page mockup design contains the search bar with six different categories selection button. In addition to specific categories there is also a button for another category which doesn't belong to specified categories. At last, the button to move forward to next step to open a location page is present at the bottom.

The final mockup design location (map) page is shown at end of Figure 5.3. This contains the option to select the location that the user wants to report or review. This page also contains the button to navigate to next step which is entering details.

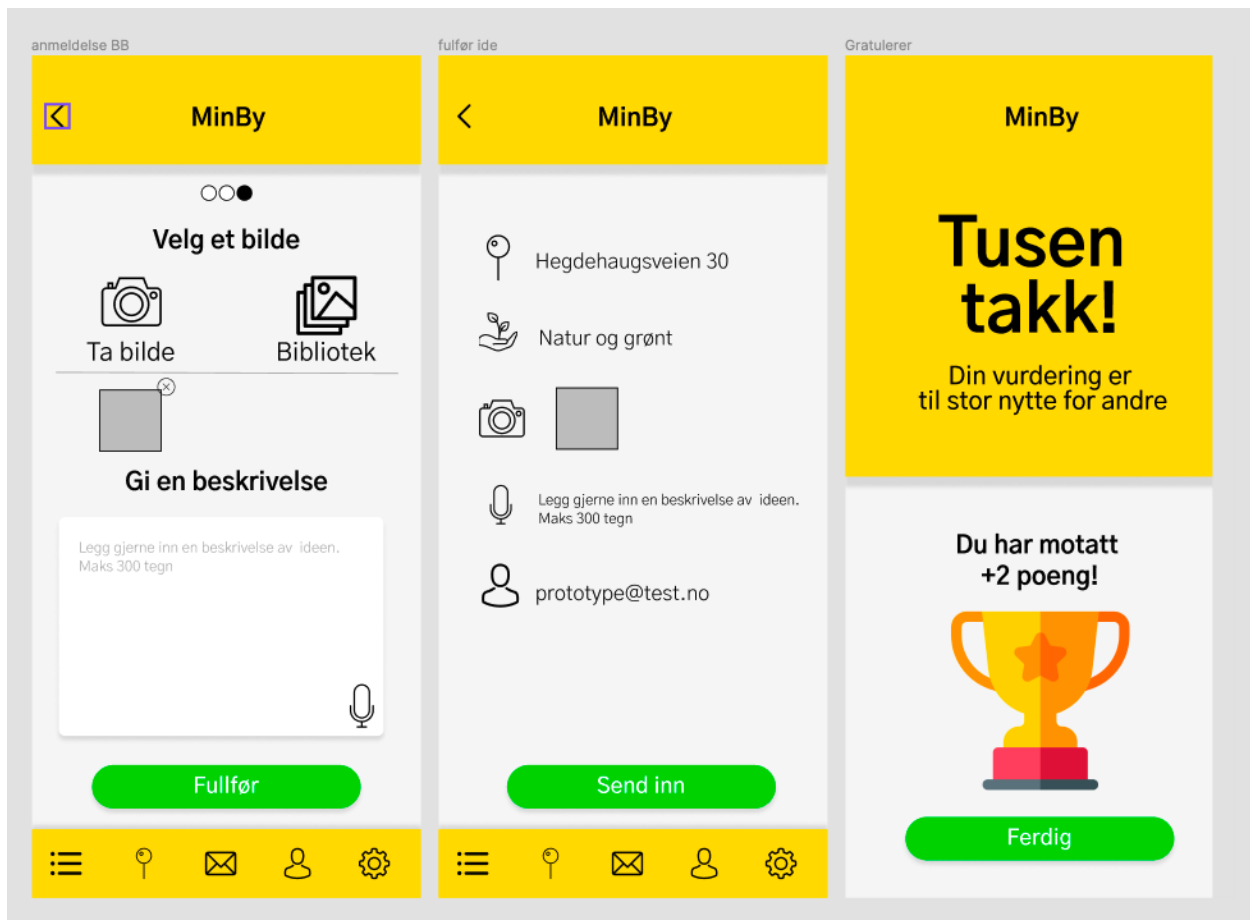


Figure 5.4. Input method, summary, and reward page mockup design.

Figure 5.4 shows the mockup design for three pages: input method, summary, and reward page. Input method page contains the option to select the image from either camera or gallery of the mobile device by clicking the button. There is also a space to show the selected image to upload, and at the end of the page there is a form where the user can enter the description of the report or review or idea to send. To support multiple input method, there is also an option to use speech-to-text. Speech-to-text translates the speech into text and fills the description area. At the bottom of the page, the button to navigate to summary page is provided.

Summary page shows the summary details of the contents selected in previous pages. This includes selected location, category, image uploaded, text description, and email of user. At this screen, the user can send the feedback to the server by clicking into send button and after this user will be navigated to reward page.

Reward page contains the thankful message for the user with decorative image and point the user earned for submitting the input. Use can complete this page using the complete button at bottom of the page.

The mockup design in the above figures was approved by the project stakeholder and they sent it for the review to get the feedbacks from the young students studying at university. That took around 3 weeks, and we got the number of feedbacks for the app mockup design.

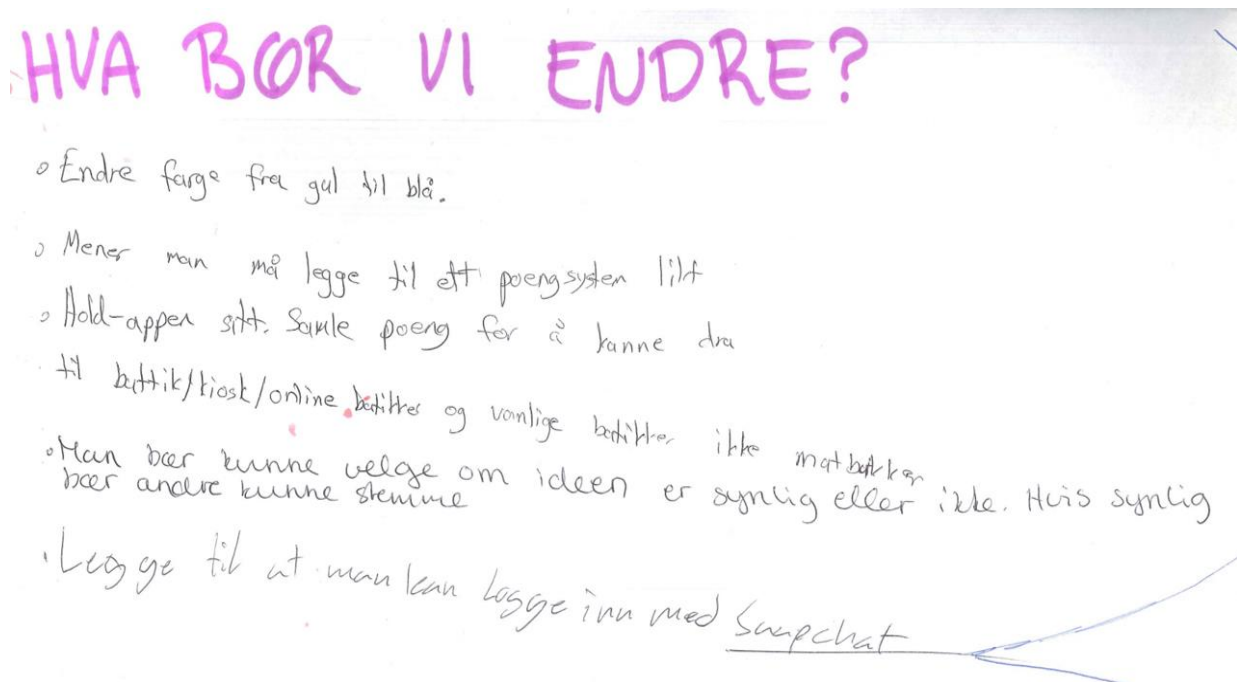


Figure 5.5. Initial feedbacks on design from survey.

Figure 5.5 shows the initial feedbacks collected on design from survey conducted. Figure 5.5 contains the information in Norwegian language hence it is translated into the English. The major points that were listed out on the Figure 5.5 are as follows:

- Changing the theme color from yellow to blue
- Point system: Like HOLD app
- Collect points to shop in stores, etc.
- Choice whether idea is anonymous or not. If visible let others vote.
- Login via snapchat

The feedbacks from the survey were more like an extension to the existing feature with integration of new features. We considered to address the visual feedbacks only because

adding more features in the prototype introduces complexity. Since all the ideas were excellent on the other hand we wanted to make the initial app simple, other feedbacks related to features were recorded for next phase. From the design perspective most of them were about changing the accent color of the app to blue, have a colorful icons and text that are more readable. There were also several comments about moving the layout contents like form and title to some suitable areas which helps to make it look more attractive.

After considering the initial feedbacks from the survey conducted by the stakeholders, those points were documented and sent to the designer for creating the final mockup design. This initial feedback for the mockup motivated us to redesign everything from the scratch. Keeping all the components in current mockup design with small tweaks in the contents, we redesigned the mockup in such a way that they look more simple, clear, and attractive. After a long hard and frequent communication with designer, we finally got the final mockup design for the application, which is shown on Figure 5.6, Figure 5.7, and Figure 5.8.

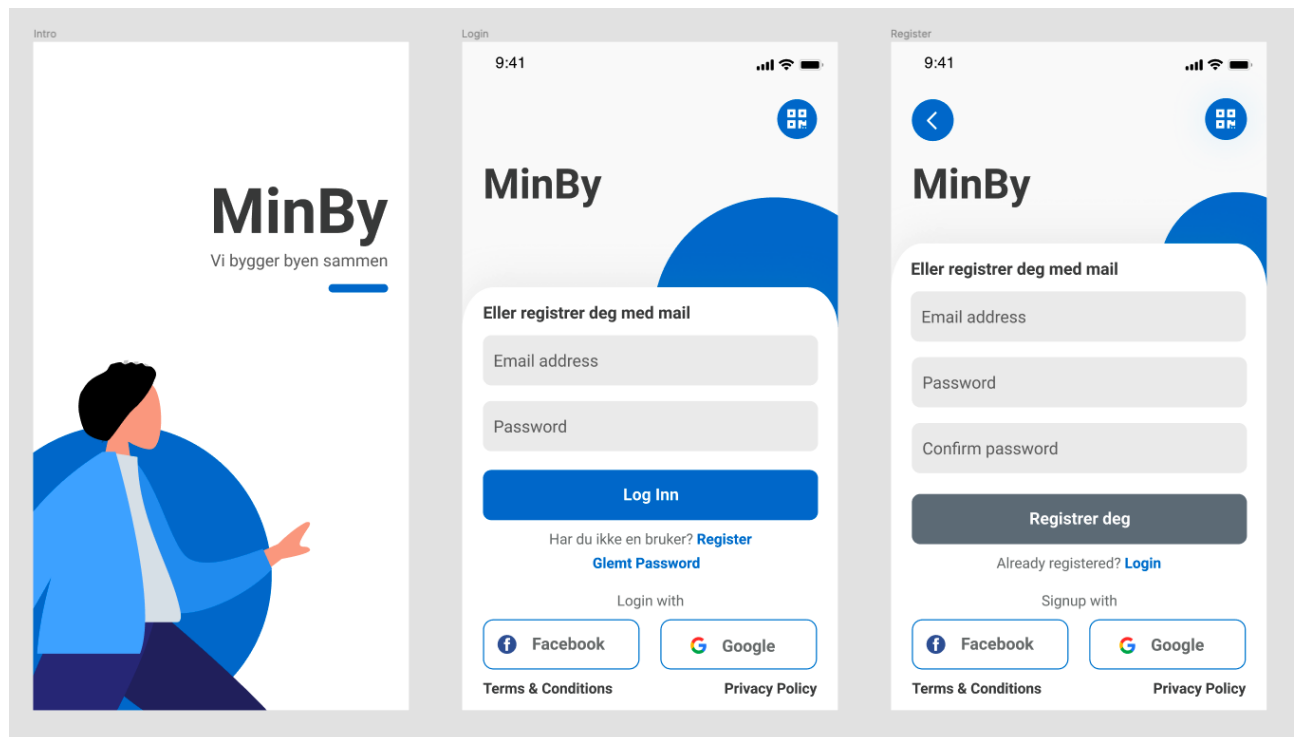


Figure 5.6. Final mockup design for splash, login, and signup page.

Figure 5.6 shows that the new mockup design for splash page and user authentication page. Splash page contains the image as well as title of the app with a blue color theme making it more appealing. The login and signup page were also bit modified so that both login and

signup are integrated within the same page, so that user won't have hassle to move between the pages for basic authentication.

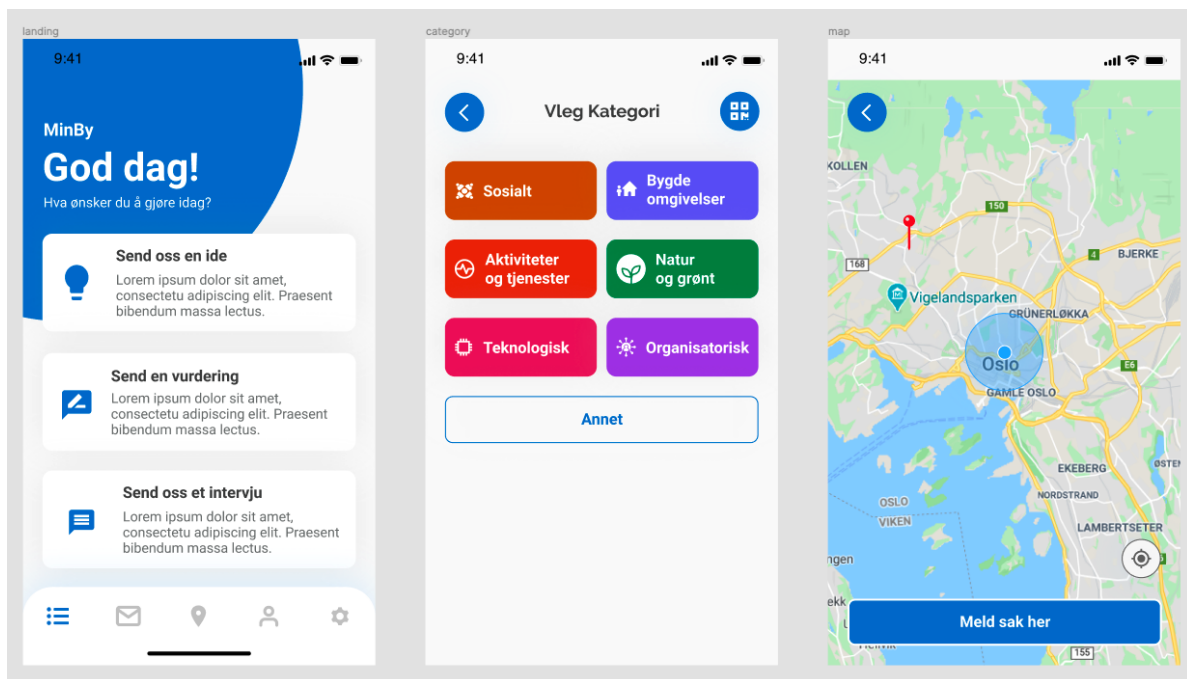


Figure 5.7. Final mockup design for home, categories, and location page.

Figure 5.7 shows that the final mockup design change made on home page, categories page and location page with change in icons and layout representation which looks more readable and clearer.

In addition to 3 sections on homepage, we also added description to each section which gives user clear idea about what these 3 sections are meant for. Also, the navigation bar at the bottom of page were also changed, with modern trending design and icons were also replaced to match the color theme of the app. Categories page was modified to use colored background grid with new icons, which represents the category name itself. The colors were chosen in such a way that they reflect the category as well as it follows the color palette to make it look more attractive.

Map page for selecting the location was also bit modified as well, with the use of actual snapshot of google maps, making it look more realistic to how it will be in the app.

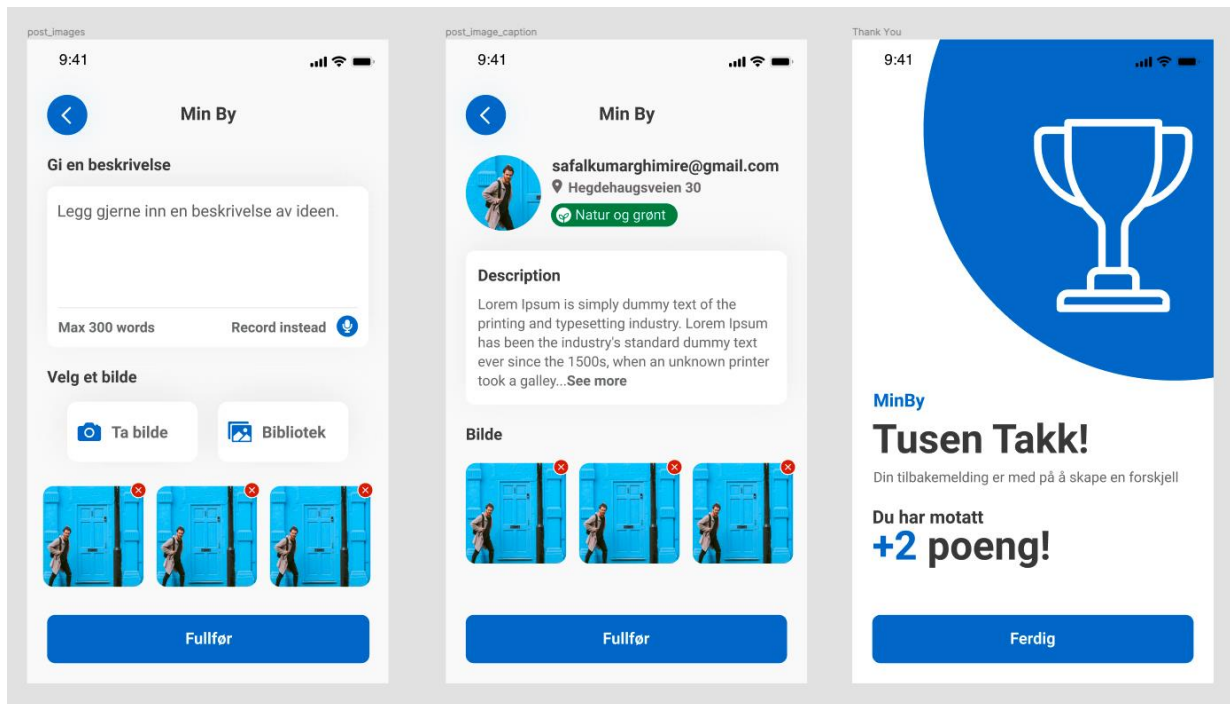


Figure 5.8. Final mockup design for input method, summary, and reward page.

Figure 5.8 shows the changes made for input page, summary page and reward page. The changes made on this page were just alignment of the elements in the page, to match the color theme and every major section has the title text to give the info about the element. Also, the images uploaded are displayed on the bottom of the screen with ability to remove the image if user wishes to. Reward page which was previously colorful is now replaced by simple and concise page with the trophy icon and readable text which give info about reward point gained.

5.1.5 Final App Prototype

After the final mockup design is ready, the application development task was carried out. The duration for app development took around 7 months. App was developed on android using Android Studio with Kotlin and Java programming language. While developing the android app the following things were taken into consideration which helped to ensure the accessibility guidelines for mobile application.

5.1.5.1 Support multiple display density

For implementing the mockup design, default android XML was used. Android devices has a wide range of varieties and has multiple device display density and screen size. We implemented design in such a way that it supports most of the android devices available in

the market. This approach for implementing the mockup design on app while designing helped to support the tablets as well by default. To ensure that all the design implemented are displayed correctly, the inbuilt layout attribute tool was used to observe the output of the design on several devices. The preview of the design on different device can be seen on the following Figure 5.9.

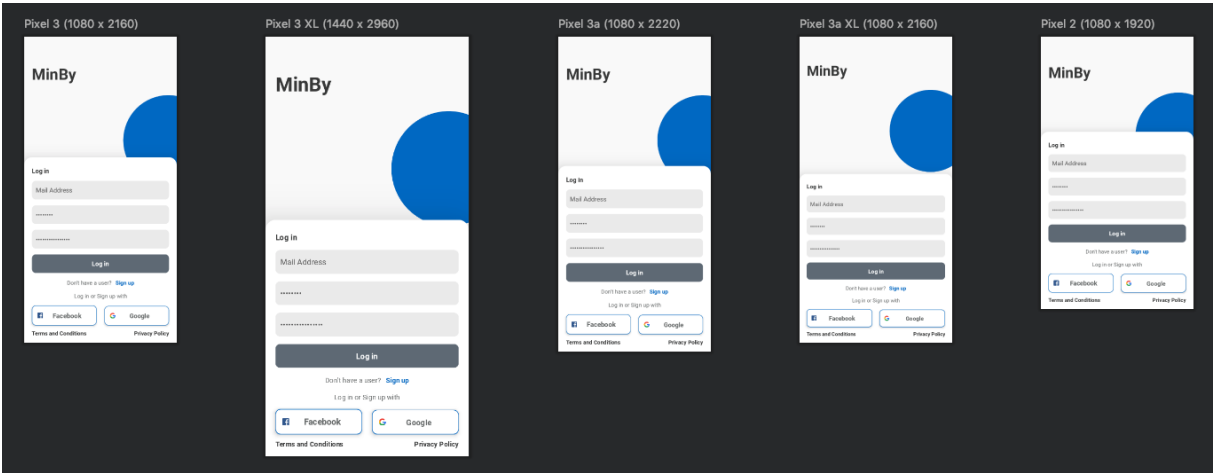


Figure 5.9. Preview of the prototype design on devices with different densities.

Figure 5.9 shows the preview of the design mockup on different device with various dimension. The preview for the pixel device were used as standard device, because it covers almost all the devices with wide range of dimension. Figure 5.9 contains 5 previews of the devices with different display densities which are Pixel 3 (1080 * 2160), Pixel 3XL (1440. * 2980), Pixel 3a (1080 * 2220), Pixel 3a XL (1080 * 2180) and Pixel 2 (1080 * 1920). All the preview is based on the login page, to make sure that the components are as per design in all devices regardless of display densities. This preview helped us to know if there are some broken designs on different device. Similar previews are checked for each page on the app to ensure that the design is similar as per the mockup designs without any missing or broken element.

5.1.5.2 Support various font sizes

While implementing the designs on android, the font size that will be displayed on the device was also taken into consideration. This is one of the major elements, that breaks most of the design if user wishes to override the default font system on android. This feature is provided on default android settings, which user might change anytime. As per the WCAG 2.0 guideline 1.4.4 to give ability to resize the text without losing any displayed content or

breaking the feature (WCAG2.0, 2008), we assured it during implementation of the layouts. This feature is used by users with different visual disabilities to enlarge the text or zoom out. Also, as per android accessibility guidelines, different devices can adjust the font sizes throughout the system. To support different devices, we defined the text size in sp (scalable pixels) (MaterialDesign, 2021). Also, to make sure that the major components of the app are not broken, even when the font size are changed, we used font size preview tool on layout validation provided on android studio. The validation done for different font size are shown on the Figure 5.10 and Figure 5.11.

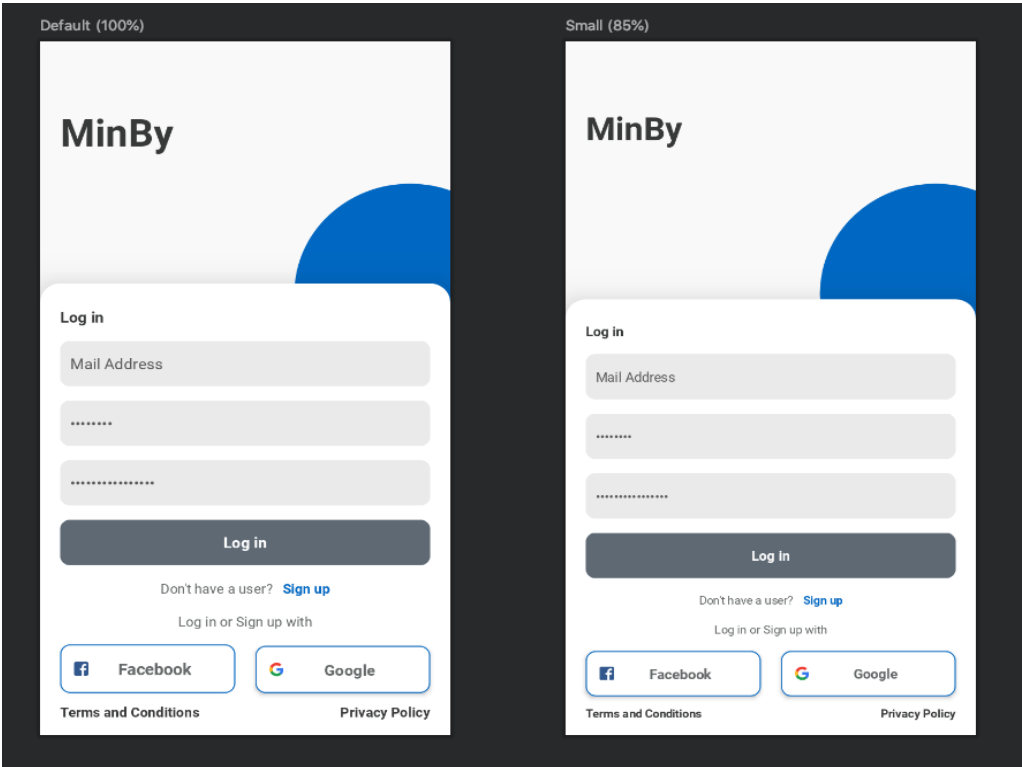


Figure 5.10. Preview of the prototype design on devices with font size and small.

Figure 5.10 shows the two previews of the design on device with the default font size which is 100% and small font size which is reduced to 85%.

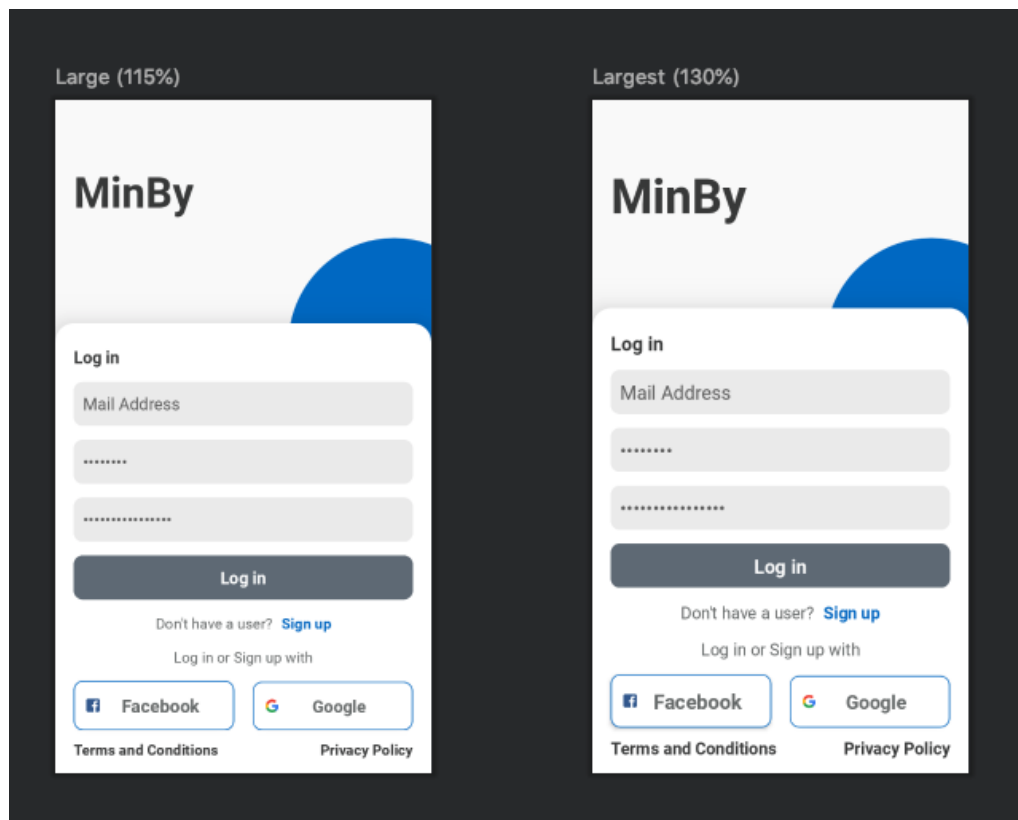


Figure 5.11. Preview of the prototype design on devices with font large and largest.

Figure 5.11 shows the two previews of the design on device with the large font size which is 115% larger than default font size and largest font size which is 130% larger than the default font size.

From the above Figure 5.10 and Figure 5.11 we can see that the design looks intact and adjusts with the different font sizes. None of the major elements on the layout are changed and user can use the app easily. In addition to this, as per guidelines provided by Google’s material design for minimum text size to be used, we also made sure that none of the text used in the prototype are below 12pixels (MaterialDesign, 2021).

5.1.5.3 Support for color blind users

Following the WCAG 2.0 guideline 1.4.1 to make use of color that are distinguishable (WCAG2.0, 2008), and android accessibility guidelines for use of accessible colors (MaterialDesign, 2021) was followed. This was done to provide enough contrast between

foreground and background we used the different color for different states that are enabled and disabled.

Also, to target the users with color blindness as well, we also ensured the color blindness check, which helps to make the color-blind users use the app without any difficulties. This point was initially considered while the mockup design was created. Then again due to lack of inbuilt tool to check color validation while designing, we could not manage to do it. Later, while implementing the design on android, this point was also verified due to the availability of the tool. Figure 5.12 and Figure 5.13 shows the validation done for various color blindness.

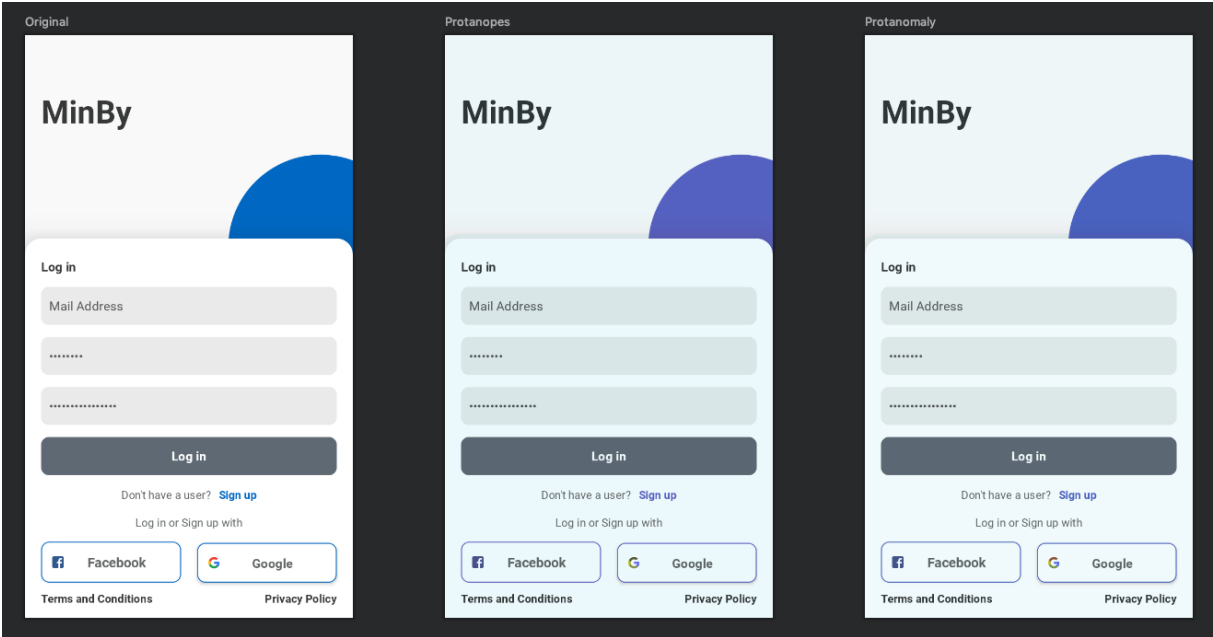


Figure 5.12. Preview of the prototype design to differentiate between original, protanopes, protanomally color blindness.

Figure 5.12 shows the color blindness preview for protanopes (complete red-green color blindness) and protanomally (red-green color blindness - visualizing red color as green) along with normal preview.

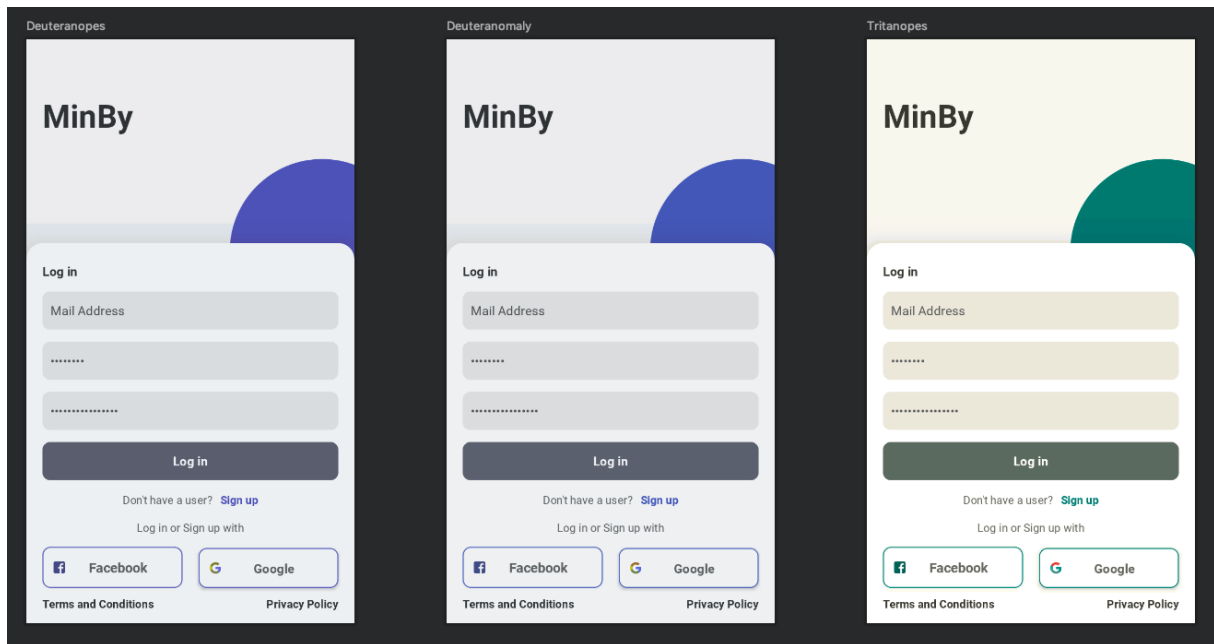


Figure 5.13. Preview of the prototype design to differentiate between deuteranopes, deuteranomaly, tritanopes color blindness.

Figure 5.13 shows the preview of 3 color blindness which are deuteranopes (complete red-green color blindness), deuteranomaly (red-green color blindness - visualizing green color as red) and tritanopes (unable to differentiate blue and green, red, and purple, and pink and yellow).

The detailed description about the color blindness is explained in the literature review section of this research. This validation of color blindness ensured that there is no major effect on theme color used on the app on any kind of color blindness. We can observe it on the button state. On all 5 different previews for color blindness, we can see that user can easily differentiate that the button is disabled. In other words, the color of button on disabled state, doesn't conflict with the enabled state color i.e., default blue. And the state of the button follows the color contrast as per the guidelines from WCAG 2.0 and Material Design for android.

5.1.5.4 Text Contrast ratio

Following the WCAG 2.0 guideline 1.4.3 which focuses on minimum contrast of texts (WCAG2.0, 2008) and contrast ratios from android accessibility guidelines (MaterialDesign, 2021), we also checked color contrast ratio of for text and background. We made sure that the minimum requirement for text to background color contrast ratio 4:5:1 is maintained.

This is considered for all type of forms, button (enabled and disabled state), and overall background and foreground of the app, where color and text play a vital role for readability of the text.

5.1.5.5 Labeling and alternative text

To make the app accessible for the visually impaired users as well, we followed the WCAG 2.0 guideline 1.1 to support alternative texts (WCAG2.0, 2008). In addition, android accessibility guidelines was followed to provide the alternative texts to any visual elements to translate to text-based element (MaterialDesign, 2021). To support the accessibility features on android (e.g., screen reader) labels were added for form and text for all the contents in the app where required. For all the elements on the app that user can click, we used the button for such elements. For the case where button is not feasible to use, we used the text and added attribute as clickable which helps the accessibility service to recognize it as clickable.

For the images and icon used in the app, we also added alternative texts. For the navigation icon (back icon, map icon, settings icon) we provided alternative text. For image that are vital in the app, we also added alternative texts. For graphical content that are added for decorative use are ignored for accessibility.

5.1.5.6 Multi language support

App was developed to support two languages English and Norwegian, with English as default language. All the texts used in the app are translated into Norwegian language as well. This also applies for the text used for forms, labeling and alternative text for icon and images as well. This can be helpful if user is using the app with Norwegian language as default, the user will get the feedback on Talkback on Norwegian as well. For testing this accessibility feature, we used Google talkback feature manually on each screen while app was under development.

5.2 Community development, Youth Participation and Communication

This section of the result focuses on findings from interview conducted for this research. This main topics for this part of the result is based on community development, participation of youths and role of communication.

Table 5.1. Themes on participation, app for communication and community development

Name	Description	References
Community Development	View towards community development	13
Participation	User engagement results, Benefits of participation, Level of participation, recommended users for app prototype	51
App for communication and bridging youth and authorities	Role of app as communication tool for bridging youths and authorities for community development	28

Table 5.1 listed out the result themes generated from the data analysis focusing on participation, app for communication and bridging youths and authorities, and community development. These elements of the Table 5.1 are further explained in detail in upcoming sections of this chapter.

5.2.1 Community Development

All the participants talked about the community development as a part of urban development. Most of them were concerned about the infrastructures in the community, about management systems in urban areas, public properties, social issues etc.

Participants raised various concerns in community development. P7 mentioned that, *“I am interested in community development...kids are enjoying the environment most as they grow up to become youths.”* The reason behind it is children grow to become youths and youths know much better about the issues they faced while growing up. P1 also mentioned about infrastructure and said, *“I used to play sports, that’s something big for community, it’s good to focus on its infrastructures.”* From his experience he was involved in contributing towards development and promoting the sport venues and team building activities. This shows that the participants were leaned towards the infrastructures of the community as a part of development.

Other participants also shared their experience being the part of community and being responsible for resolving the issues within their neighborhood in collaboration among each other. This implies that the participants were somehow involved in the community directly or indirectly to resolve the issues via collaboration within the community.

Participants were also asked about the issues that they have faced in community and most of them pointed out the issues that they have experienced openly. P4 and P6 have described the issues related to waste management. Regarding waste management P4 said, *“I faced defector of the garbage manage waste management”* and P6 added that, *“I feel waste management issues in public areas...industrial waste is mixed in water.”* P4 and P7 explained the issue related to public parks, cultural heritage, and social issues in the community for e.g., P7 said, *“things in public parks were broken.”* Other issues faced by participants are drugs issue, homeless people on the streets and public transportation. This shows that most of the issues that participants undergo are directly related to public issues. These issues are also related to management of the urban entities which are mostly connected to problems persists in urban areas.

This depicts that participants are always actively or inactively connected in the community development. The involvement is more direct towards specific areas and partially involved to resolve the issues among each other. Moreover, they do care about the issues with the public areas and management systems that are visible in their community.

5.2.2 Participation

This section gives the overview of the frequency of participation in urban development. In addition, participants view towards the level of participation required and recommended areas and target user groups for the app prototype along with the positive effects of it.

When it comes to the result related to user engagement, participants were highly active for reporting, more active for getting the information, less active for reviewing the places. P6 mentioned, *“it’s not easy to report... tools are not available... more effective tools are needed.”* P6 added that he is not that active for reporting the issues, whereas other participants are regularly involved in reporting the issues. For getting information, all the participants were always involved in some way to get information about the places, using

different tools and technologies. For reviewing part, participants tend to give both positive and negative review and are more comfortable with ratings rather than writing reviews.

Participants believed that the participation level can be a wide range. From the interview response, most of the participants believed that this app can be a great tool for participation on a community level. P2 and P7 added that the app can be used not only by youths but also by different age. For e.g., P2 said, *“for youths its perfect.”* Whereas P4 gave a broad opinion saying that it this kind of app can be effective on larger scale on which P4 said, *“On micro level youth are often participating on national and international level sharing ideas in places we live around.”*

Lot of positive sides of participation is suggested by the participants from their experience in participation as well as their positive attitude towards it. P4 believed that participation helps to solve various issues and digital platform is a gift for initiating participation for non-participatory communities. P4 states it as, *“digital platform doesn’t need me standing in person... sharing thoughts, idea, opinion digitally is like a gift.”* P5, P6 and P7 added that that youth can create new ideas via their thinking ability. P5 mentioned that, *“youths can generate new ideas and new thinking...new manners.”* This can make a huge difference by sharing the knowledge, because youths are energetic, productive, and inventive in nature.

Most of the participants openly said that they would recommend the app to use among their friends and youths in their community. They also shared their opinion that why can contribute by sharing the promoting the app on social platforms. Hence, we can say that the deploying app to a user group which includes youths can benefit a lot.

5.2.3 App for communication and bridging youth and authorities

Communication is the fundamental for bridging youth and authorities which is supported by the result of the data collected from the participants. Most of the participants described that app is very simple and concise for communication. Participants mentioned the number of benefits of communication which helps to resolve the issues via it. The results are separated into two parts focusing on role of communication and bringing youth and authorities together.

Regarding role of communication, P1, P2, P4 and P6 expressed that due to lack of idea, unaware of place to report and how to report. For e.g., P1 stated, *"its normal to talk...don't know how or where to report or begin"* and P4 also added, *"social media ... not sure it reaches authorities... hotline numbers are what I use."* They also added that they are not used to with tool to participate in community they are not participating. This strongly points that the communication gap exists.

Other participants mentioned the strengths of communication on the concept of our prototype app which are bringing youths and authorities together. P4 said that, *"if there are some app that doesn't need me in person... share my thoughts, idea, opinion... it would be a gift."* Overall, the app creates the communication platform, which is easy use and is a good tool with idea, report, and review as the strong themes of the app. Participants also added that, communication is only not enough for participation. To make it more effective two-way communication between authorities and youth is needed.

Different opinions came from participants on the topic bringing together youths and authorities. Looking at the overview of the result, we can categorize it into three elements which are authorities' action, user behavior, strengths of it.

P5 mentioned, *"if this app is taken seriously by concerned authorities"* which means bringing together youths and authorities only via authorities acting and being responsible. P4 builds on this idea by stating that, *"it should be same way around"*. This will help to make authorities responsible as well. P7 also gave similar opinion stating that, *"it gives so many ideas to policy makers for what and where to build."* This means policy makers can plan and build based on feedback from youths. All the participants generally believed that the app could provide the platform where lot of problems can be solved. This can be done using two-way communication and interest between youths and authorities.

Some participants also mentioned to bring youth and authorities together, behavior of the user is also an important factor. P1 believed that, *"it's hard to say but it's a right step towards bringing youth and authorities closer and there is nothing wrong with this app"*. P4 stated, *"it depends on how people perceive ideas, views, or information so it depends on people itself."* This shows that it totally up to the people itself to take it for good or not.

Regardless of significant factors mentioned above, we got the number of results which reflects the positive side of the app for connecting youths and authorities. P6 mentioned that digital tool can be the best way to review about the development works being carried out in community. P3 said, *“they don’t have to conduct surveys, gather data continuously.”* This explains it helps to reduce the hassle for conducting survey and data can be retrieved all the time using the app as a digital platform. According to P4, *“the digital platform can create a positive junction for youth and authorities.”* From all the positive feedbacks from the participants, it shows that digital platform can have a heavy impact on minimizing the process and help in communication digitally.

5.3 Existing methods, tools used and experience of the participants

Participants were asked about the tools they use for getting info, reporting, and reviewing in their day-to-day life and share their experience on it. Table 5.2 shows the various ways that participants used for retrieving information, reporting, and reviewing.

Table 5.2. Existing methods used by participants in their daily life.

Method type	Tools used	Experience and extra information
Getting information	Google, Google Maps, Social Network (Facebook pages and groups), Authority websites	P1, P2, P5 and P7 used google as well as google maps P3, P4, P7 used websites and mobile apps along with social network
Reporting the issues	Mobile app, social medias, websites, phone call, email, in person, chatting with customer support, anonymous reporting	P3 said, <i>“I don’t report until its personal”</i> P7 said, <i>“going in person is impractical”</i>

Reviewing the places	Google places review, ratings on app and websites, Facebook reviews and reviews in person	P5, P6 and P7 said they only give positive reviews P2 gives both positive and negative reviews on Facebook
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Table 5.2 reflects the result of the data collection for tools participants use in their daily life for retrieving information, reporting the issues, and reviewing the places they like to. The table contains three sections: method (getting info, reporting, and reviewing), ICT tools used for the method, and their day-to-day experience on information they seek, report and review.

For the method to get the information, the most common tools used by the participants are google search engine, google maps to find the places, hotels, parks, etc., The second most common methods are social networks like Facebook pages, social media groups (e.g., Facebook groups, reddit groups, etc.) and the authorized websites for specific information. Participants P1, P2, P5 and P7 stated that they mostly use google and google maps to find information, for e.g., P5 said, *"I generally user google maps to search for..."* and P7 also said, *"... most of the time I use google maps."* However, P2 stated that google map for community is an ideal solution rather it's a general solution, hence it is not an optimal tool. P3, P4 and P7 added that they use mobile apps for similar purpose and use social network for it. This shows us that ICT tools are highly used to gather the information in daily life.

For the method used for reporting the issues in their daily life, participants responded that most of them use mobile apps, social medias, websites, email. Some mentioned about chatting with customer support, anonymous reporting if available. Few participants replied that they use phone call or go in person for reporting the important and serious issues. They also added they use ICT tools as well for reporting. Regarding the experience shared by the participants, P3 said, *"I don't report until its personal"* and P7 said, *"going in person is impractical"*. P4 and P7 also raised the issues that social media has disadvantages for discussing and reporting the urban development. For instance, P7 openly said, *"social media don't feel right place or its not serious enough..."* This reason behind this is authorities are not aware of the discussion and social media is not a serious place to talk about it. In

addition to that, P2 talked about language barriers in some apps. He mentioned, *“apps in Norway are mostly in Norwegian language but not available in English”* hence this describes the accessibility and usability issues. From the above-mentioned statements about tools used for reporting and experience shared by the participants, it shows that there is a high tendency to use the ICT based tools for reporting the issues. One of the participants even mentioned that its very uncommon to report by going in person. It shows that ICT tool is commonly used for reporting.

For the method used for reviewing the places, participants shared the platform they used. Most of the participants used google places review, ratings on app and websites, Facebook reviews and review in person. This also shows that most general method for reviewing is via ICT tools on different platforms. Review in person is also common then participants said they were more comfortable using ICT tools because it gives freedom to criticize as well as give positive review indirectly. Participants also shared their experience to give reviews. P5, P6 and P7 said they only give positive reviews. P6 said, *“I give more good reviews”* and P7 also added, *“I tend to give positive reviews only.”* Then, P2 mentioned to give both positive and negative reviews. This shows that for review as well, participants are using ICT tools frequently. From their experience, participants are more comfortable to give both positive and negative reviews with ICT tools.

In summary, the information listed in Table 5.2 presented that ICT tool is very common for fetching information, reporting issues, and reviewing the places using different services. Most used services are various social network and information providing platforms. This was explained from the experience they shared.

5.4 Features review, User experience with privacy concerns

The major findings from the user testing of the app prototype are explained in this section of the result. Table 5.3 below listed out the three themes feature reviews, privacy concerns and user experience.

Table 5.3. Themes on feature review, privacy concerns and user experience

Name	Description	References
Feature reviews	Review of features in app, categories, methods, and improvements	88
Privacy Concerns	Privacy concerns for using the app as tool for participation	18
User Experience	Overall user experience with strength and improvements	31

Elements listed out in the Table 5.3 begins with features review of the app including methods, categories, and improvements on features. Followed by it, privacy concern is mentioned which contains the opinion about the user confidentiality and privacy that participants felt should be considered. The final point is user experience, and it focuses on the issues with the tools, strengths, and improvements based on the prototype testing. The detailed result on all these points is covered in upcoming section of this chapter.

5.4.1 Feature reviews

This section will present the results based on the features that are implemented in the prototype app. The results are more focused towards 2 essential features of this app for providing the input. This section begins with information that shows what the participants use in their daily life for getting information, reporting, and reviewing. Main feature review results are explained on further part of this section. And later section contains the feature suggestions provided by the participants for the overall feature of the app prototype. Table 5.4 below shows the feature reviews with strengths and improvements on separate features in the prototype app.

Table 5.4. *Feature review of the prototype application*

Features	Strengths	Improvements
Categories	<p>Covers everything in larger scope of urban area</p> <p>Pretty good presentation</p> <p>Inclusive</p>	<p>Description for categories</p> <p>Sub-categories would be great</p> <p>User validation for some categories</p> <p>Additional categories like health, politics, and transportation</p>
Methods (text, photo, geolocation)	<p>Sufficient and fits into right amount</p> <p>Geolocation is handy</p> <p>Location and photo uploading are best</p>	<p>Time of occurrence of the issue (for report)</p> <p>Video input</p> <p>Tagging user or organization</p> <p>Search feature in map page</p>
Reward points	<p>Amazing feature, everyone loves rewards</p>	<p>Clear info about rewards and should be highlighted in home page to attract users</p>

Table 5.4 shows the feature review results based on major features of the app which are categories, methods (text, photo, and geolocation), and reward points. For each of these three features participants also gave the strong points and suggested improvements as well. Each of the feature reviews are explained below.

5.4.1.1 *Categories*

For the categories feature implemented on the prototype app, user can select the categories based on the nature of the report, review, or idea. User can select, any one of the six categories (social, building and construction, activities and training, nature and green,

technology, organization) with one extra category other if none of the six categories matches the context of topic.

The strengths of using these categories as per the participants are it covers all the major topics of urban area. Each category also had a different color which are chosen to ensure the accessible color and maintaining the text to background contrast ratios. Participants found it attractive. In addition to that participants also pointed that the categories are very inclusive and covers almost all entities in the urban context.

For the improvements, participants felt the need to description for categories and suggested to add some subcategory that are applicable. Few participants mentioned that user validation would be a good option to have for category that can have a nature to report a critical issue. Also, category that participants felt missing are health, politics, and transportation.

Hence, we can understand that the categories included in the app are enough. In addition, it requires attention and can be further improved though wide range of areas are covered by categories.

5.4.1.2 Methods

Moving towards the feature to provide the input for sending idea, report or review, prototype app consisted of three input methods (text, photo, geolocation). In addition to support the multiple input, app also implemented the speech-to-text input for entering the description using the voice which translates into the speech and fills up the description box.

Participants responded that the methods used in the apps are enough and fits right into the amount. Most of the participants said that the attaching the geolocation during the input is one of the best ways to express about the actual place where they want to be focus. Hence, geolocation feature is very handy. In addition to the location, participants also felt that uploading photo with geolocation makes is much effective.

Though the features included in the app are strong enough for the input method, participants suggested few improvements that can make it better. The feature requested by the participants are time of occurrence of the issue, so that user can have the exact time

along with the location to report issues. The prototype app did not have searching for location in the prototype app hence one participant felt the need for searching location in map page. Few participants also mentioned that video input would be great addition to the existing input methods. On the larger scope when this prototype app is launched, the advanced features that can be integrated like tagging the user or organization responsible for addressing the topic were also suggested by the participants.

To summarize, strengths and improvements for the input method explained that these methods in app are sufficient, however, there are lot of improvements that can help to shaping it much better in the future.

5.4.1.3 Rewards points

After submission of idea, report or review, the prototype app provides a reward to the user in the form of points. The idea of this reward is to collect the points and cash it out on fast food stores and buy drinks or snacks. Participants gave positive feedback for this feature and were very pleased to know about this feature.

Most of the participants said that it is an amazing feature that can motivate the user to use the app for reporting, sending idea and reviewing as everyone loves rewards.

Though the feature is liked by the participants, the feature was only visible to the participant after the successful completion of submission of the topic. This made the feature hidden though its present and exciting feature. The improvements suggested by the participants were to mention info about rewards somewhere in the app prior to installing. In addition, few suggested it should be highlighted in home page to attract users and to encourage to use the app for report, review or send idea.

Therefore, we come to know that reward feature included in the app is one of the best. The only downside of it was not being highlighted and hidden feature.

5.4.1.4 Feature suggestions on the prototype from participants

Despite of getting lot of positive reaction to the features and feedbacks for improvements, participants expectation was much higher. Lot of better features are suggested by the

participants which can help to make the prototype application much better. The list of suggested features suggested by the participants are listed below.

- Change language within the app
- Communication feature between user and authorities via chat
- Community based discussion platform to discuss ideas and review the ideas by other users
- Feed page to have overview of the trending ideas or reports with possibility to upvote (time saving way to provide support for similar posts by others)
- Event platform for youth and activities related to youths
- Sharing post among users and on other social platforms
- Tracking the issues and getting updates on it

Apart from the above requested features, participants shown their positive gratitude towards the app. P4 mentioned that app can grow as it matures and reaches larger audience. In addition to larger audience, P5 said that, *“user feedbacks should be the key point for improvement as it reaches larger audience”*.

5.4.2 Privacy Concerns

Most of the participants raised a concern about privacy with advantages and disadvantages of it. The major concern was revealing user information while using the app prototype for sending review, idea, and report. Most of the participants said that the option to be anonymous should be allowed for reporting the issues. P2 said that, *“if there were some issues in neighborhood, I would like to be anonymous”*. P4 added that, *“there should be option to give a secret review to the authorities”*. P2 also added that being anonymous for some categories in the app, option to be anonymous should be provided. Hence, from this we know what participants were more comfortable being anonymous depending on the context and nature of the report or review.

Regardless of most participants being comfortable being anonymous while reporting or reviewing, P1 gave a different opinion about privacy. P1 stated that, *“considering how genuine report... should be anonymous.... otherwise, youths or teenagers might create troll*

posts, hence monitoring is needed." This shows the negative aspect of having option to be anonymous to prevent the potential misuse of the app.

When it comes to the privacy related to location tracking for reporting, P2, P4 and P7 gave a positive opinion that location for reporting is not a big issue. P2 clearly said about location stating, *"your privacy about location doesn't matter.... you are just reporting issue in specific place."* P2 added, rather it would help authorities to have exact location of the issue which in turns help in solving the issue. This shows that location tracking while reporting is very affirmative from the participants response.

Consequently, participants were concerned about the privacy in general. The mixed feedback shows the positive aspects as well as possible negative aspects of privacy. However, regarding the location tracking, users were positive towards sharing the location for reporting issues.

5.4.3 User Experience

After going through the prototype testing, participants provided number of positive feedbacks and indicated the room for improvement related to the usability of the app.

Regarding the usability of the app, lot of positive feedbacks are provided for our app prototype. P1, P3 and P6 praised openly about the readability of the contents in the app, as the language used in app is simple, easily to understand and readable. For instance, P1 said, *"everything looks clean and smooth... seamless experience with no glitches"* and P6 stated, *"easy to use, not difficult."* P2 mentioned that multi-language support of app solves the issue with language barrier that he faced a lot. Hence, multi-language support in the app turned out to be useful for the participants. P1, P3, P4 and P5 said that the user interface is simple with nice formatting of layouts in the screen. P4 is really impressed by the color used in app where he mentioned that *"frankly color confrontation is more user friendly...text and background colors."* P2 praised the speech-to-text feature stating that, *"you can record your speech and it will be translated to text."* In general, all the participants gave their positive feedback on app prototype based on how they felt regarding readability, multi-language support, colors used, presentation and alternative input feature.

Regardless of following the accessibility guidelines and considering lot of minor elements for making app prototype accessible and user friendly, there were some improvements suggested by the participants. P4 added that the area of implementation of app is required which was missing. P2 and P5 added that a better description and some onboarding for the user would be great improvement at homepage of the app. P2, P3 and P7 said that the reward feature should be highlighted beforehand as it is hidden currently. P2 said, *"I only knew about reward later after submitting report"* and P7 also mentioned, *"rewards info should be at starting page of the app or home page."* Users are unaware of it until they submit the issue. Though the app is available on two languages English and Norwegian, P6 added, *"...should be multilingual..."* This also shows that more language should be supported to make it more usable.

Therefore, need for improvement is felt based on the suggestions received. There is still more focus required for improving the readability, presentation of basic features, and adding for language support.

6. Discussion

This section interprets the findings and explain them how the obtained results answer the research question. Results are explained in detail via discussion of findings with relevant literatures mentioned in literature review. The main aim of this research was to study about the role of ICT and how it can promote or support the participation of youths in urban development. From the results obtained from interviews and user testing of the ICT tool, the research question state in this study, the analysis of the data supports that ICT is very crucial for the youth participation in community development. In addition, the findings also suggests that there are lot of improvements that can be done on the ICT tool used relating to the topic of features, privacy concerns and usability. This answers the research question and agreeably supports the role of ICT and its impacts on youths and urban development. All the highlights of the results based on the theme defined in the results will be used for the interpretation of the results and map it to the literatures wherever possible.

6.1 Community Development

All the participants mentioned about the importance of community development focusing on the urban infrastructures, public properties, and social aspects of the urban areas. Participants also mentioned various issues faced in the community on which they were pretty much open. Most of the participants mentioned the issues related to the management systems, preservation of the public properties, cultural aspects, transportation issues and addressing social issues, etc. One of the participants focused more on infrastructure on children taking ideas from the youths. Whereas other participant mentioned the focus on sport infrastructures. This shows us that the area of focus varies with people as different people has different opinion towards building the infrastructure in the process urbanization. The results were focused on public areas, infrastructures and social aspects which makes this a larger topic of implementation with different subtopics. Thus it distinctly supports the findings presented by Tulbure and Prunariu (2017) where it mentioned that the requirements of the urban development doesn't have an agreement and the area of topic to include are not clear. This result also supports the claim that there is a need for heterogeneous work among the various responsible entities within the urban area.

From the experience shared by the participants, they are involved within the community to resolve the issues that are present via participation and collaboration among each other within the neighborhood. This supports the report published by Habitat (2010) which depicted that the participatory process has the positive effect and embedding this can have greater impact on urban planning. The result also supports the concept mentioned by UN Habitat, participatory process empowers the community and better results to fulfill the various needs of urban groups.

Specific issues that are related to with drugs, homeless people in the streets, etc. were also mentioned by the participants which seems to be very legitimate in the context of urban areas. This actual cause for these issues were not found from the result in this study. This topic falls under socio-economic field of study, also closely in relation relating to the psychological behavior of the people. Hence further research is required to find the actual cause relating to these social and psychological issues which cannot be interpreted in this research.

6.2 Participation

The results gave us different topics related to participation which includes user engagement, level of participation and its advantages along with recommended age groups for youth participations from the participants.

User engagement level was high for reporting the issues and for getting the information and relatively low at some levels for reviewing. However, participants were somehow concerned towards the issues in the community either via getting information, reporting the issues, and reviewing the places. Well this result does proves the research on focus group for youth participation by (Omar et al., 2016) which states participation is very low still not much effective. This trend seen on the result partially supports Agenda 21: Programme of action for sustainable development (UN, 1992) where its mentioned that sustainable development is possible via active participation of the youths as it impacts their day-to-day life and future. The participation method has already been applied in various community events (pollution around school, racism awareness, anti-racism events) as per the journal published by Figueroa et al. (2000). The journal consisted of that youths documented various information

about the topics within a community and submit the findings to the respective authorities showing a good participation. Though the user engagement level is for getting info, reporting issues, and reviewing places, we may take this result as the basis for path into the participation at a ground level. This in return is contributing to the development of the society directly via formal programs and indirectly via other programs.

While going back to results of participation level, it depicts that users that can participate may vary from community level including different age groups among youths. P2 and P7 mentioned it can be extended for use in adults and other citizens as well within neighborhood. This shows a positive direction towards involvement of youths. This positive direction also supports the journal by UNICEF (2003), where the reality of participation is explained as to provide youths opportunity by giving them responsibility with their evolving abilities and giving freedom for what they are.

Results also depicted the responses from P5, P6 and P7 which described youths do have creative thinking ability and knowledge sharing can be the huge add to the development. This undoubtedly supports the research by Checkoway and Richards-Schuster (2003) which points out the reasons for youth participation in community is to have perfect way to provide and share knowledge. It involves youths in social and political rights and be capable to create change in society.

In relation to using the ICT tool for this research, participants recommended the user groups and how they can promote the participation of the youths in the community. The major recommendation was to focus on youths who are within youth circle and via sharing the ICT tools via social platforms. This can help to overcome the issue of low participation mentioned on paper by Omar et al. (2016) by taking the recommended user groups from the youth itself. This also proves the claim on same paper which mentioned that sharing the information to individuals in community will increase in shaping the society and make a greater influence. Moreover, this results may also help to improve to create a positive impact on result by the participation of people and have a good effect on process and decisions as mentioned in the paper by Checkoway (1998).

6.3 ICT tool for bringing together youth and authorities

When it comes to participation and bringing together youth and authorities, communication plays a vital role. From the result, participants P1, P2 and P6 expressed that they were unaware of platform or tool, place to report, etc. This result shows us that there is a lack of communication. Hence, this can support the statement by Omar et al. (2016) that participation is still low and not much effective, and the reason for it may be lack of communication.

The strength of communication is well described by participant P4, that emergence of virtual way of participation without person being in present is introduced by using ICT tool. This can support the concept of computation technology (Gabrys, 2014) to communicate and amplify the resource, service and participation of people in urban areas.

Moreover, the results also showed that there is a need for two-way communication between authorities and youths helps us to know the importance of ICT tool for communication. The importance for communication is shown via the research by (Parycek & Sachs, 2010) which described us the importance of tool and effects of publishing the data for transparency and participation to create new innovation and efficiency in governing.

The importance ICT tools is also supported by the result on which participant P4 and P5 stated, authorities should be equally responsible for acting on issues and youths should be equally responsible via participating. The use of ICT application and tools helped to fulfil the gap between public and authorities have also been proven to explore and boost the urban development as described on paper by (Boyd & Chan, 2002). This result also supports usage of tools and application used in several sectors to access and discuss information from public and its effectiveness to formulate policy and impact assessment (Boyd & Chan, 2002) (Liberatore & Funtowicz, 2003).

As mentioned by some participants that bringing youths and authorities together via ICT tool also depends on user behavior that how they perceive it, and totally depends on the user. This may be due to the trust issues in the use of ICT tool or may be perception of the user after using the application and how the authorities handle the information by user. The user behavior and perception towards the effectiveness of ICT tools requires further study to

know in depth about the impacts of bringing youths and authorities together. For now, from the positive responses from the participants. P1 mentioned that, if the app focuses on positive direction, it is a right step in bridging youth and authorities. P4 also added that it is very inclusive platform which benefits both extroverts and introverts considering the human nature as well. From these statements we can say that the use of ICT tool is going forward in a positive direction to connect youths and authorities together in present context.

6.4 Usage of existing ICT tools, methods, and user experience

Referring to the results mentioned in section 5.3 showed us that most common way to use ICT tool is to retrieve information using various social platforms, digital maps, and websites. Same pattern for reporting and reviewing was seen as well. This suggests us that people are depending on ICT tools for most of the tasks they perform. This also supports the perspective of the smart city which is controlled, operated and managed using ICT tools as mentioned in paper by Townsend (2013) from the user's perspective. This implies that user is heavily dependent on ICT tools in present context. Responses from participants also showed that there is a very low scenario of going in person. Also, less in the traditional methods for communication like phone calls, meeting in person unless necessary, etc. This trend also shows that there are wider application of technology rooted in urban development for city administrators and citizens (Kitchin, 2014a). In other words, people are already on the path to new ways of using ICT tools and explore much more in different areas within the city.

From the perspective of reviewing the places, the results in this study showed us that participants were more likely to give reviews using ICT tools. ICT tools are more comfortable for providing both praise and criticize by reviewing. This on a broader scope supports the research by (Gabrys, 2014) to make smart cities sustainable by having more efficient process and engagement of people in participation and monitoring.

6.5 Feature review of ICT tools used in this research

The ICT tools used in this research was a prototype android app which was reviewed by the participants. Detailed interpretation of the results for three main features: categories, methods and rewards are explained below.

6.5.1 Category

Category feature was introduced in the prototype to have a clear overview of the context from the user who is using the app to submit the information. The use of categories made it clear to the user covering all the urban areas via 6 different categories. This feature may have solved the issue with the experience fellow app which was based on touchpoints and geolocation without any context of the actual issue making it unclear.

Although the category gave a context, participants felt that there is still a need for better descriptions to have the detail overview what each category covers. This may be due to the broad scope of the category title and categories intersecting with each other. For example, the category “Building and construction” often intersects with the category “Nature and green”. Participants also mentioned the need for subcategories and additional categories: health, politics and transportation which are common for urban area. The need for subcategory is justifiable as the category can be broad sometimes. In addition to this, the need for additional categories mentioned in result is also non deniable as they are essential part of the urban society.

6.5.2 Methods of input

Different methods of input were implemented in the prototype including distinct method to send idea, report and review, category for it, geolocation on a map, text and images uploading support. Geolocation is the most mentioned and liked feature by the participants. The support for geolocation has proven to be beneficial in smart cities by retrieving relevant information from users surrounding (Sauer, 2012) is also proven by this finding. The use of images with geolocation and categories seems to provide for clarity.

The results showed us that the input methods are sufficient in general. However, participants asked for additional improvements on it like adding search feature on map page to search for places, video input in addition to images, etc. The improvements suggested by the participants were very basic and elementary features. Also, the ICT tool we used was very infant prototype; the suggestions can be taken into consideration for future improvements.

In addition to the basic improvements, some advanced features were also recommended such as tagging user or organization related to the type of information to be submitted. This can also be basis for new features in the future, however it was too complex for prototype. This need for advanced features also showed us that it is a challenge task. The need for it may differ in various cities for adapting the situation and develop software to integrate features as mentioned in the paper by Khan et al. (2014).

6.5.3 Reward points

The idea of having a reward points in the app after each submission of idea, report or review is well supported by most of the participants. The results showed us that participants found it motivating factor to use the app. Regarding the use of rewards in the app, none of the downsides was mentioned by the participants. However, the research by Thiel (2016) on reward based vs. social gamification showed that reward based has high risk for raising questions about genuineness of the participation process. This may be because our ICT tool is only used for this research as a prototype, and yet still lacks the actual feedback from users in the urban areas. The same research also showed us that reward-based feature doesn't have any negative impact on the level of participation. Hence, reward feature in our prototype app is right thing at right place.

Also, the results showed us that this feature is hidden in the app, and participants were unaware of it. This may also be one of the reasons for not having more feedback about reward points feature. Further study can be done to know more about the improvements and have not only reward based but also social gamification to increase the participation of users. Moreover, there were number of suggestions to highlight this feature on main pages of the app and somehow notify the users may encourage users to submit the response using the app. This can be taken as a limitation of the app, considering it being hidden.

6.5.4 Feature suggestions

Lot of feature suggestions were provided by the participants on which they mentioned to integrate more features which are modern and well adapted in ICT platforms. The most requested feature was related to communication among the users along with the authorities as well. Tracking of issues and getting updates on information they submitted was also

mentioned by the participants. Participants were seeking community platform of some kind within the ICT tool and live chat with authorities which was not available on our prototype. This feature would make users feel the seriousness of the ICT tool making it more genuine and two-way communication makes it for comfortable when there is always feedback from the responsible authorities.

In addition, discussion platform was also mentioned by several participants, which creates a portal to discuss about ideas, upvote the issues and to explore more information and minimize the redundant information. Along with discussion platform, participants mentioned to have it like a usual feed page. This would help users can see what's happening around their area and trending topics more like a news portal, share it, create events, etc. This may be due to the usage of lot of social platforms which follow these kind of user experience and youths are more attracted to it. This also shows that the feature does need a universal design itself, as the users are more leaned towards use of features that are similar in different mobile application.

For the further improvements in the app, P4 said that, the maturity of the app depends as it reaches larger audience and P5 also added user feedbacks can be an essential entity for growth. This can be one good strategy to make app much better considering the feedbacks from users itself. This will make the app go in a direction that the users are looking forward to and encourage the stakeholders to move forward in a positive direction.

6.6 Privacy concerns

From the results we know that some privacy concerns were raised for the features in the app. One of the major concerns was to be anonymous while submitting the information via the app. P2 mentioned being anonymous is more comfortable for neighborhood issues which shows us that the users are a bit uncomfortable to report social issue to avoid personal conflict among the neighbors. In addition to that, P4 was more comfortable in providing report or review without disclosing personal information in form of secret review. This also depicts that participants don't want to reveal their identity for some issues. This shows us that the users are a bit cautious while sharing their personal information while using the app. Meanwhile, P1 gave a different opinion that ICT tool can be easily misused for

making trolls, providing false information, etc. and hence requires monitoring. From these responses we can see that privacy is equally important to be anonymous, nevertheless also very important for monitoring the misuse. This may be avoided by having some sort of security mechanism which secures the user's information as well as monitor the potential havoc that may arise. Developing this kind of technology which ensures both privacy as well as the security of user information; and equally monitor the data to avoid potential frauds and scams will be a bigger challenge in the field of technology.

Regarding sharing the location in the app for submitting the information, participants provided a positive response. This may be because the purpose of location tracking was not for tracking the user. The purpose of tracking was only for locating the exact place about the information the user is reporting. This result shows that user is totally aware of the services that are activated in their mobile devices. As per the book published on privacy and confidentiality by (Van den Hoven, 2020) where it was assumed that users are well aware when the sensors like camera, GPS are activated, our results also supported it. This is well presented from the awareness of user for sharing the location and the purpose for it.

Hence, privacy concern was not the big factor for our prototype app. When it comes to location sharing, it was equally important to give user a control to be anonymous. Moreover, the technology these days are user centered, where user is in full control to configure their device with various permissions to enable or disable. Hence, this topic of sharing the information via different mobile services totally depends on "reconfigurable technology" and the extent of knowledge of the user for configuration (Dechesne, Van den Hoven, & Warnier, 2011).

6.7 User experience

Though the prototype app is developed considering the android accessibility guidelines and WCAG 2.0 guidelines for mobile, the results from the user testing helped us to know the efficiency of it.

Participants mentioned that they felt language barrier on various apps, but the multi-language feature has solved this issue. Nevertheless, our prototype only supported two language, this may have resolved the language barrier issue. Regardless the participants

were mentioned about the language supported, they mentioned they would like to have it available on different language.

In addition to the language support, readability of the texts on the prototype was also mentioned by participants. They mentioned that the text color, text position and textual contents were easy to understand and readable without any issues. This result also supports the guideline 3.1 in WCAG 2.0 making the text readable and understandable (WCAG2.0, 2008).

Regarding the user interface, most of the participants responded that the layouts and elements in the screen is well formatted and eye catching. The color confrontation used in the app also got a good review. These responses suggests that the accessibility guidelines (MaterialDesign, 2021; WCAG2.0, 2008) for the use of color contrast ratio on foreground and background has a very positive impact on users.

Although, some barriers were faced by the participants on which they mentioned that still the content descriptions in app were minimum. A better description on home page, highlighting the rewards, etc. would make it much clear. This may be due to the reason that the area of implementation of the app is pretty much new to the participant, and user from different background find it difficult to the actual context of the app. Moreover, the designs were focused to make use of icon along with texts to make it simple, but the results showed us the importance of use of descriptions.

7. Limitations of the study

Although the research was conducted in many steps starting from creating a prototype, applying the suitable methodology, selecting the participants, etc. that are well suited for this research, there were some limitations on it. One of the major limitations of this study was unable to test the accessibility features with the people with disabilities. Regardless the prototype app was developed following the guidelines from both WCAG 2.0 and Android accessibility guidelines, without the proper user testing it will remain unclear on its efficiency. Hence, it requires a further study to get the clear overview of accessibility to the disabled users.

Another limitation of this study was the participants not being aware of the research topic itself. Participants were chosen randomly from various background to have different opinions on it, but most of the participants were confused about the actual purpose of the study. Hence, conducting this study with the participants with sufficient background knowledge about the urban development and youth participation might give a different result than what we found on this study.

8. Conclusion

Urban development is a challenge in the present context from facts that the people are migrating from rural to urban areas. As innovation in mobile technology is evolving and the number of users depending upon it are also increasing. Thus, it can play an important role in the process of urban development. Youths are the ones that are more familiar with mobile technology and aware of needs and changes required for the society. Hence, youth participation in urban development can have a huge impact for shaping the urban society in the future. From the results it can be inferred that mobile application could help to connect youths and urban development and the process should consider the Universal Design. The importance of Universal design is reflected both on participation process as well as the features development process in mobile application. This is because sustainable urban development is not possible by excluding the certain groups from the society. In addition, everybody wants to use the technology that are similar and inclusive. Therefore, from this study we concluded that involvement of large number of people living within society and making it accessible for everyone, using the concept of Universal Design helps to make world a better place.

9. Future works

Despite the role of ICT and importance of it in community development and youths has been carried out in different perspectives, there is still a need for further research on this topic. Accessibility is a significant topic that needs to be further explored because this research did not include participants with disabilities. Thus, further research can start with testing the prototype used in this app with youths with disabilities and explore more about the ICT barriers. In addition, this may also help to explore the urban area and community from different perspective. Also, it will help to find potential contribution areas via participation in the community. If the policy makers were to implement the concepts or tool used in this research, we to focus on features that are more contextual based provisional on area of implementation in city or community. At a greater level, policy makers should consider universal design in youth participation, formulate plans, implement it into practice in technological level and conduct more research on it. For technical developers, this research suggests exploring more features that are not integrated on the prototype app via exploring more about the ICT barriers and integrate additional accessibility features.

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Appendix 1: Participant information sheet

Participation of youth in urban development in the context of ICT: Universal Design

This is an invitation for you to take part in research with the title above. The main purpose is to give you the information about what is being studied and why your contribution matters. Feel free to take as much time as possible to go through this and read all the information mentioned below carefully. If you have any sort of confusion, and you would like to have some more details, you can ask questions anytime you want. Take your time and decide either to take part or not.

Who Am I? What is the purpose of this study?

My name is Safal Kumar Ghimire, student at Oslo Metropolitan University (Oslo Met) studying Masters in Universal Design of Information and Communication Technology (ICT).

As a part of my masters, I am doing a research on participation of youths in urban development, how they can contribute to development of modern community or city. For this I am using the modern technology using android app which is developed considering the principles of universal design. This app will be used as a tool to encourage youth's participation, which is designed not only for the general people but also everyone including people with disabilities. The purpose of this research is study about the quality of the application and the contents that are included in it.

Things included while you take part

While you are participating in this study, research will be talking about the topics like participation of youths in the community related events, your experience about it, and your view towards using modern technology in such events. In addition to that, you will be asked to go through the application prototype developed and you will be asked some questions based on how you feel using it. This process will take around 20-30 minutes and you are free to do it either online or have a face-to-face interview. Your answers/feedbacks to the questions will be noted during the process.

Why have you been invited?

You have been chosen as the potential participant on this research based on your interest in youth empowerment, daily active user of modern technology as a tool for all sort of activities in daily life.

Do you have to be part of it?

It is totally up to the participant either to involve or opt out of this study as a participant. In other words, the participation in this research is entirely voluntary. Even if you decide to

take part in this study, you have a right to refuse answering some questions or withdraw anytime during the process.

Confidentiality

The interview process is totally confidential. Any sort of personal information of participant that can identify the participant is not recorded. You will be completely anonymous, and your input will be not shared with your personal information in any ways. Meanwhile, if you are allowing the audio recording of the answers during the interview, the audio recording will be destroyed after the research is complete.

Procedure of data collection

Interview will be conducted either face to face or via online video call. Your answers/feedbacks will be noted down by the interviewer as you answer. Interviewer might ask for your consent for recording the interview session to avoid the interruption of the interview (optional). As mentioned on above section, the recording will be destroyed as soon as the research is complete.

Result of the study

After successful completion of this research, it might be published in journal as well as there is possibility of publishing it on conference.

Contact information

If you have any questions or would like to learn more about this study please contact the following individuals using the contact information mentioned below:

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Appendix 2: Questionnaires for interview

General questions:

1. What are your thoughts for participation in community events related to the environment, community development and youth empowerment?
2. Share your experience about the issues in your community that you have faced. It can be about the environment, public areas, noise, or similar.
3. How do you usually report the issues that you face?
4. In what ways do you feel comfortable reporting the issues? In person or using social media like Facebook groups, WhatsApp, hotline numbers, etc. or any other ways?
5. Do you use smart technologies like mobile apps, or similar technology to get information about the places in a community, if yes what? If not, what do you use?
6. What kind of review do you tend to give while reviewing the places that you have been?

Technical questions related to prototype:

1. How do you feel about the categories included in the app (prototype), to address the issues in the community? Suggest more that best suits here if you feel something is missing.
2. What are your thoughts on the methods (text, photo, geolocation, category) used for reporting the issues via the app? Anything to add here?
3. What sort of privacy do you think should be addressed while reporting? For e.g.: Location should be optional, be anonymous, etc.
4. Are these features enough to attract youth to actively participate in community events? If not any improvements?
5. Who would you recommend this app to use?
6. What are your thoughts on this app being a bridge between youth and the authorities?
7. Improvements that need to be done. Mention them if any. Any other comments?
8. Share your experience while using this app. Any sort of difficulties or barriers? Anything that excites you?

Accessibility Questions (applicable only for people with disabilities)

1. How do you feel while using this app with accessibility services (Voice over or talkback)?
2. What are the difficulties that you face while going through the features? What needs attention?
3. Do you feel that some accessibility features should be added or removed here? What kind of features?