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Universally Designed Earthquake Management System in Pakistan

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Preface

The basic purpose of this research was to spread awareness in Pakistani people to follow safety precautions during an earthquake. The approach used to accomplish this was to make a universally designed earthquake management system. This approach was used to target the maximum amount of people including the elderly and people with impairments. This research attempts to save lives.

Finally, I wish to thank my supervisor Terje Gjøsæter who is extremely helping. I really relied on his expertise. I am also thankful to Oslo Met for providing me facilities and access to tools and databases.

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Abstract

The broad objective of this research is to analyze how the research field of Universal Design of Information and Communication Technology (ICT) can save lives from emergencies and disasters. The primary objective of this research is to analyze how universally designed earthquake management system can save lives for Pakistani people specifically elderly and people with disabilities by providing them awareness and necessary precautions that one should follow during an earthquake. A literature review on earthquake management system and Universal Design of ICT is conducted. A universally designed earthquake management system website prototype is made and tested by Pakistani people and questionnaire is conducted from them.

The ultimate goal of this effort is to answer the following questions:

1. How can Universal design of ICT reduce the impact of emergencies or support diverse people in emergencies., in particular for Earthquake situations in Pakistan?
2. What are the requirements for such a universally designed information system?
3. What is a suitable universal design for such a system that is optimised for the situation in Pakistan regarding availability of ICT equipment and network?

A set of gaps are identified from the literature and questionnaire, indicating that many Pakistani are not aware by safety precautions for earthquake. There is lack of Universally designed systems to provide such awareness. The survey serves future research to fill gap to promote emergency support information systems through universal design.

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Introduction

Many people died in emergencies due to not having proper information of safety and precautions specially the disabled and elderly people that do not have source of information due to lack of accessibility. (Onuma, Shin, & Managi, 2017). The knowledge of specific safety precautions is mandatory in specific emergencies. For example, in a situational disability, in which people also be considered as disabled for specific situation for example during an earthquake people cannot read safety precautions easily due to shaking of the earth. Similarly, with diverse population that is, including disabled and elderly people and also people from different countries who speak different languages; it's hard for them to read safety precautions. Hence, there is a need of universally designed system to deal with such difficulties. In Pakistan, there is lack of information of safety precautions due to which mostly Pakistani did not know what to do in emergency situations. That results in the loss of lives that could be saved. That's why the knowledge of emergency management precautions and safety is very important

Universal design has become very vital to advance the teaching skills or to provide any knowledge or safety precautions (Perez & Gonzalez, 2017). Participants from a research study are significantly in favour of Universal design for instructions (Hartsoe & Barclay, 2017). As, the purpose of this research study is to make a universally designed system, to save lives by providing necessary safety advice for all kind of people regardless of their age, gender, location and disability. These safety precautions will be used in emergency management specifically earthquake emergency management. The targeted audience of this research study is Pakistani people including the people having different impairments disabilities and elderly people. So, by this research a universally designed system for earthquake emergency management will be designed to save lives for all sort of people. This system should not only provide safety guidelines but also give advices for all sort of people including the impaired, elderly and situational impaired people.

Universal Design:

World is full of diverse people, so the technology should be rich enough to deal all kind of people. So, the concept of universal design came into being. As the name depicts universal design is design for all people, regardless of their age, sex, education level, language and impairments. The concept of Universal design was introduced by North Carolina University in 1990's (Connell et al., 1997), when the researchers of the University proposed to make such a flexible design that can be used by all the people of the world including the disabled one. Universal design has seven principles:

1. Equitable use
2. Flexibility in use
3. Simple and intuitive use
4. Perceptible information
5. Tolerance for Error
6. Low physical effort
7. Size and space for Approach and use (Connell et al., 1997)

We should follow these principles to make a universally designed system. Universal design is now being used in different systems e.g. athletes are using Universal design for learning in most effective way (Vargas, Beyer, & Flores, 2018). Universal design plays very vital role for diverse learners. Universal design for learner is a framework that provide guidelines. These guidelines help to make documents accessible for all readers regardless of their diversity and impairments (Scanlon, Schreffler, James, Vasquez, & Chini, 2018). Similarly, universal design can also be used in emergency management system.

Emergency

Emergency is sudden or unexpected situation that creates injury, loss of life, damage to the property, or environment. Most of the emergencies need urgent safety assistance and support to prevent more severe situation that might result to big loss.

Types of emergencies

Emergencies can be categorized in following types

1. Dangers to life
2. Dangers to health
3. Dangers to environment

Dangers to life

This type of emergency causes an instant risk to the life of living beings that become victim of it. Since this type of emergency is related to life so it ranges from a single human being to infinite humans. For single person this emergency can be a medical emergency like strokes, trauma or heart attack. For large amount of people this emergency can be in the form of a natural disaster such as flood or earthquake or it can a disease that affect multiple people like malaria or cholera.

Dangers to health

Some emergencies do not instantly lead to the risk of losing the life, but it might leave serious consequences for the future health of effected persons. In this type of emergency, the range of affected persons are way more than dangers to life emergency type. Broken limb is an example of danger to health emergency type because it does not usually take life, but an instant cure is mandatory for proper recovery. (Pascapurnama, et al., 2018)

Dangers to the environment

Some emergencies do not directly cause any damage or risk to the people life, health or property, but it affects the atmosphere or natural environment. With the passage of time it leaves a great impact on human life. Its examples could be pollution and marine oil leakage.

Emergency Management

There are many emergency management services protocols that can be applied in an emergency. These emergency protocols usually start with planning before an emergency occurs. One commonly used emergency management protocol consists upon four stages as shown in Figure 1.

1. Preparedness
2. Response
3. Recovery
4. Mitigation

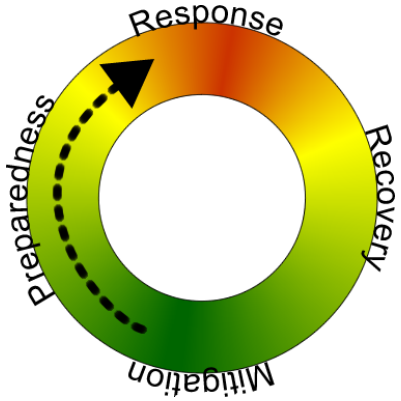

Figure 1:Emergency Management Cycle (http://www.odpem.org.jm/DisastersDoHappen/DisasterManagementinJamaica/TheDisasterManagementProcess/tabid/240/Default.aspx)

Preparedness is the first step in the of planning phase of the emergency management system. In this step the agencies prepare themselves and make a strategy to respond to some incident or set of emergency situations. Ideally it should include the command and control. It also divides the tasks for agencies and remove the possible conflicts that can occur for example four different agencies all start to provide emergency shelter for the persons who become victim of a disaster.

When a plan has decided that which agency will provide which services and what steps they should take to cater with the emergency. They execute that plan and may provide some response.

After the response phase, agencies then take steps for recovery according to the type of incident, where they can provide medical treatment or financial support, or help the people to overcome from that incident.

Mitigation is the fourth and last phase of the emergency management cycle. It involves such steps that can ensure that same incident cannot be possible again, otherwise in mitigation new plans are suggested to avoid from the maximum damage. Thus, it provides more precise and updated feedback to the preparedness, to deal with future emergencies more powerfully.

A natural disaster is an adverse event that occur due to change in natural by its own without any human influence for examples floods, earthquake and tsunamis. A natural disaster can take a lot of lives and properties damage that can vary from one person to entire region or cities or countries or maybe someday entire Earth might become prey of it. Regardless of loss of life and property damage its severity also depends upon the ability to recover and on the available infrastructure. (G, Bankoff et al., 2003)

Earthquake

As described earlier there are many types of natural disasters but mainly focus of this research is on earthquake. When the surface of the earth shakes due to some natural changings in the earth it is called an earthquake. The main reasons that cause earthquake is abruptly release of energy from the Earth's lithosphere. This energy emission generates seismic waves due to which surface of the earth shakes and results an earthquake. Earthquakes destructions can range from none to huge that could range not to kill a single person to destroy whole cities. Many developed countries have earthquake resistant houses and advanced technologies to know when the earthquake is going to be happen in near future, but rest of the countries don't have such facilities. This type of situation creates digital divide.

Digital divide

When assistive technologies are not provided or available to different regions or countries than digital divide occurs. The difference between IT development within different regions in a country or in different countries is known as digital divide.

Digital divide mostly occurs between rich and poor countries. It also exists in urban and rural cities. Since the poor countries have very few assistive technologies that can be used to remove disabilities of impaired persons. It is admitted fact that there is a big variation in disability prevalence rate between high and low-income country. The most prominent reason of this is high-income countries provide many facilities to disabled people due to which the disabled people can live their normal life; according to the social model of disability they cannot be called as disabled people. In high-income countries in which many impaired people cannot be called as disabled people, due to the following reasons

1. High-income countries like in Norway, the NAV provides electronic Wheelchairs to handicap people, there are proper pathways for them. Low-income countries cannot afford it. So, in this way Pakistan is a low-income country. Still now new buildings don't have proper pathways for handicapped people.

2. Rich countries like Norway the surface between the entrance of the transport is equal to the surface of the earth so a person on wheelchair can easily step into any bus, tram, train. So according to social model of disability the person on the wheelchair is not a disable person. But Pakistan don't have equal surface between the entrance of the transport vehicle to the earth. So, according to social model of disability a person on wheelchair is disabled in Pakistan.

3. High-income countries have special toilets for impaired people and they can use it without anyone's help, but Low-income countries do not have such facilities which increase the ratio of disabled people in low-income countries according to social mode.

4. High-income countries provide special gadgets to impaired people through which they can do work. I personally Visited NAV which is government institute of Norway and there I met David. He was blind, But NAV provided him assistive technology and special gadgets and he was doing a job there and he uses the MacBook. While Pakistan have lack of such assistive technologies. Only Rich people in Pakistan can afford such technologies as Government of Pakistan does not provide such facilities to its disabled persons.

5. High-income countries have elevator facility which mostly low-income countries do not have. In Pakistan elevator exist only in shopping malls or big highly developed offices.

6. High-income countries provide assistive technology for impaired people. Like in Norway I went NAV and I saw they are providing the computers that can be used by eye. There were also computers that can be used by moving the head. According to social model of disability the people that do not have hands but have such assistive facility they cannot be called as disabled persons as they are full filling their needs by using such assistive technologies. But on the other hand, such people will be considered as disabled if they do not have assistive technologies.

7. Another technology I saw at NAV is they made a special software for deaf and dumb in which a communicator speaks on their behalf, so this service removes the deaf and dumb disability. But this service is very costly. So low-income countries do not have such facilities that can overcome the gap between normal and disabled people and the society.

Digital divide can be measured by measuring the gap among the cities or countries that can and cannot use new technological tools, like WIFI, 3G or 4G. A study was conducted to calculate the existence of digital divide in rural and urban areas of different cities of Pakistan. A survey was conducted amongst 384 respondents from Muzaffrabad a City of Pakistan. Results of that survey confirmed that the websites using web 2.0 are more popular and attracting people to use internet. As it covers diverse users of different abilities moreover people feel easy to use such websites.(Shokat et al., 2018)

Pakistan is listed amongst the low-income countries. So, to implement Universally designed ICT system is quite challenging.

In Pakistan, many deaths happen during an emergency due to not having proper knowledge of what to do in such a situation. That’s why the knowledge of emergency management precautions and safety is very important. Pakistani people do not have an awareness that how much lives could be saved if they focus and pay attention to safety precautions for an emergency.

An example of unawareness took place on 25th of June 2017 at 9:25 am when an oil tanker was going from Karachi to Lahore and carrying 40,000 liters of fuel. When it was taking a sharp turn, it flipped on National Highway, Ahmedpur East. The fuel started leaking and many nearby people from the village rushed there to collect the fuel. There were many women kids and old men as well. Everyone was collecting fuel without having an awareness that fuel can catch fire. After a couple of minutes when many people gathered there to collect the fuel the tanker exploded and squeezed all the nearby men, women and children who were collecting the fuel. Approximately 123 people died in this incident and more than 120 got injuries. (Michael, 2017)

As the focus of this research is to implement a universally designed system to educate people about the safety precautions. So, in universal design, we cannot ignore disable, handicapped or impaired people. It is very rare in Pakistan that someone accepts disabled persons as a contributing member of society. Even disabled persons are considered as a burden on the family. But we cannot ignore disabled persons, as approximately10% of the population of the world is disabled according to United Nations. Like in many other countries, disabled people are living a miserable life. (Salahuddin & Jalbani, 2007)

Moreover, these people should know all the possible safety precautions in an emergency. Pakistan is a low-income country it is very expensive to provide safety precautions instructions to people specially to the disabled or impaired persons. So, the cheapest and easy way to provide safety precautions for emergency management is to make a Universally designed website.

From the above-mentioned example, it is clear that

1. ICT is not much used as an emergency management in Pakistan
2. Universal design of ICT Is not so much common in Pakistan
3. Slow internet speed or no internet availability, electricity load shading, virus threat and not having enough knowledge to use mobile features to surf internet are the main reasons due to which ICT is not very much used in Pakistan (Siddiquah & Salim, 2017).

Problem Statement

Many Pakistani die in emergencies due to unawareness of security precautions. Pakistan is not utilizing ICT to spread the awareness of necessary precautions that are required during emergency situations to avoid chaos and deaths. Pakistan does not have strong economy (Laila Akber Cassum, 2020)and it does not have much resources to spend money on advertisement and arranging safety classes for emergencies.

We can safely assume that if Pakistan used universally designed ICT in Emergency management to spread awareness of security precautions, many lives could be saved. Moreover, it is not costly and people with different impairment can also get safety precautions without having any additional and expensive safety classes.

Problem Descriptions

The description of the problem leads towards what's the major and important issue that will be discussed and critically analysed by conducting this research study. No doubt, there are few ways that are adopted by the governments of Pakistan for managing emergency cases such as an earthquake. But it requires new advanced ways that can be utilized as the precautions in the region of Pakistan in order to manage in the earthquake. This study is conducted in order to introduce and analyse the universal design of ICT in Pakistan particularly to benefit in the situation of the earthquake. This universal design of ICT will guide for the precautions by which the lives of a thousand people can be saved in effective manners. This design will be the universal design ICT that will be particularly utilized in order managing the case of emergency. The case of emergency is related to the earthquake.

Research question

1. How can Universal design of ICT reduce the impact of emergencies or support diverse people in emergencies., in particular for Earthquake situations in Pakistan.
2. What are the requirements for such a universally designed information system?
3. What is a suitable universal design for such a system that is optimised for the situation in Pakistan regarding availability of ICT equipment and network?

Methodology

In this study, a universally designed website is made by following Web Content Accessibility Guidelines 2.0. The safety precautions data for earthquake emergency is gathered from websites, articles and different research papers. Front-end development of the website is made in React which is modern JavaScript library for building user interfaces. The back-end development will be done in PHP. MySQL database will be used to store safety precautions data which will be collected through different research papers, websites and articles as mentioned before. Furthermore, with the additional guidance of partner company “EVRY”, the website backend implementation will be accomplished. To test the accessibility of the website “Automated Accessibility Testing Tool” (PayPal, 2016), “Web Accessibility Checker” (Web Accessibility Checker, 2011) , “Functional Accessibility evaluate” (Illinois, n.d.) and “Accessibility Viewer” (Group, n.d.) will be used to ensure the website is fully accessible. Once the website is finalized and passed all the accessibilities tests. A questionnaire is conducted related to the usage and accessibility of the website. This questionnaire is conducted in Pakistan to various people who used that website. The range of people vary with age, gender, language and impairments. The collected data from these questionnaires will be used to improve the website and to conclude the impacts of universally designed website.

As the focus of this thesis is to implement Universally designed ICT system. The purpose of this system is to provide guidance and safety precautions during an emergency especially during earthquake. Such kind of awareness is very important to save lives or to avoid unnecessary injuries. E.g. It often happened in Pakistan that an earthquake visited with an average range of magnitude of 5 to 6 but people didn’t have proper awareness that what should they do in earthquake situation. They got worried and everyone started running and they made chaos due to which many people died.

From the above-mentioned incident it is obvious that awareness to deal with emergency situations is very important. But as universal design is design for all, so it includes all kind of people regardless of their impairments and language. It also includes diverse people and people with situational disabilities. Read the safety instructions while running during an earthquake is an example of situational

disability. So, a universally designed earthquake management system can be utilized to save lives of all sort of people and situations.

The importance of safety precautions during earthquake can be judged by the destruction done by the earthquake in past.

How Universal Design of ICT reduce the impact of emergencies

The focus of the thesis is to implement a universally designed earthquake management system. The purpose of this system is to provide guidance and safety precautions during an emergency, especially during an earthquake as it was safely assumed that the universal design of ICT could save lives. It's been observed that ICT has a positive impact on emergencies, and if the ICT system is universally designed than it has even more impact on natural disasters like earthquakes (Gjøsæter T. R., 2018). These hazardous situations can be overcome by effective manners and guidance of it can be provided by spreading awareness through a universally designed ICT system.

ICT plays a vital role in plenty of areas to accelerate and secure human lives. Government sectors of many countries are already using ICT technologies to reduce risk vulnerabilities and improve disaster resilience. In the past, some applications were built that are very helpful in lifesaving. For example, Foresti made an emergency management advanced system that fuses social data and bottom-up communication with smart sensors in mobile phones (Foresti G, 2014). building damage assessment application was developed by (Fujiu M, 2012). In 2011 another application was developed for estimating risk for disaster areas (FEMA, 2011). By analyzing many studies, it can be seen that ICT support more effective disaster management in many ways (Aydin, Tarhan, Selcuk Ozgur, & Tecim, 2015)

The prevention from natural disasters such as earthquakes is necessary, and it is hard to reduce and overcome the problems aroused by an earthquake, but this situation can be handled to some extent by providing safety tools, awareness, and quick communication for all people including elderly and impaired as well. Therefore, the universal design of ICT can reduce emergencies, and it also has great capabilities to save human lives in the case of any emergency occurring during a natural disaster such as an earthquake in Pakistan. In the case of the crisis of communications and

emergency management, the universal design of ICT can save lives. Scientists and Practitioners agree with suitable, Universally designed ICT technologies that can improve the crisis of communication and disaster management related to the people's needs along with the disabilities (Gjøsæter, 2018).

To handle emergencies more abruptly and effectively, ICT is one of the important priorities among the public sector nowadays. Information communication technologies following universal design principles can be categorized as an important tool for emergencies because it is engaged in covering the most productive sectors to maintain continuous improvement. ICT also provides new inventions and new products for more efficient and effective handling of emergencies. Because the ICT sector is involved in providing services to the people in case of any emergency and with the use of advanced technologies, the handling of these emergencies will be more appropriate. In the future, many new technologies are expected to emerge that would be very helpful to control the effect of disasters or the affected people, so there is a huge need that all the ICT systems should be universally designed so that elderly and impaired people can also utilize these facilities.

The universal design of ICTs is about the provision of the trend, which is identifiable for the physical objects. It is done by connecting with the internet through proper communication networks (García, 2015). As the Universal design expands the ICTs domain application, which has the potential to avoid the stagnant multi-factor productivity (MFP) growth, that is, related to the ICT capital surplus to observe industrialized economics. It is the main point, where the impact of the ICT in the investment of the Earthquake situations by the MFP is characterized. The application of the ICTs is not interacting more with the physical world, and there is a variety of new use cases like allowing the integration of the Universal design of ICT, creating the liquid marketplaces (lMunib ur Rahman, 2016).

An emergency is considered a dangerous, unexpected, and difficult situation, particularly in accidents that happen suddenly, and it requires quick action to deal and handle these situations. The abrupt actions are necessary for emergencies to protect the lives of living organisms.

Generally, the adaptation of Technology and innovation shows bigger technical changes for inventions and different sizes of the market. Researchers develop a test directed for technical changes and the structure of wages. The model evaluated skilled workers, and complementary technology changes the adaptation and application of different communication technologies. Conceivable conclusion approved hypothesis that the rate of Technical changes is based upon the growth of industries and skills of employees. The higher the skills of the people, the more effectively they can respond to emergencies like in an earthquake. More skilled people can perform more appropriately and abruptly in emergencies, and due to this, the outcomes will be higher, and more development will be observed (Treball, 2012).

It has been observed that ICT is more effectively used and adopted in developed countries because of the more advancement of technology. Contrarily, ICT is less used in poor countries due to a lack of IT infrastructure as well as illiteracy. The language barriers are one of the most important issues for adopting it.

During many disasters, ICT has been very helpful to help the people and alter the emergencies occurring due to disasters, especially in Earthquake. The use of technologies that require an internet connection is suitable only in those areas where internet connection is available. Through the use of social media and text messages, it is easy to get notified about the disasters and acquire information related to disasters, particularly for Earthquake. There are numerous applications of the WSNs (Wireless Sensor Networks) and ICTs. The major disasters of the community can be tackled through proper communication technology. By using the WSNs (Wireless Sensor Networks), the design of the useful model can be proposed. This model will be very useful to sense the seismic waves of an earthquake and hence provide information for an upcoming earthquake. (A. Hassini, 2014).

A research was conducted to identify differences between CST “Computer-Supported Training” perceptions at the beginning of the program and the end of the program; the participation perception improved particularly in the case of Earthquake situations in Pakistan. At the beginning of the courses, the digital inequity was based on social organizations, government programs, pricing policies, content, and industry structure. The findings of the research include processes, inputs, outputs, and summaries model for the improvement of information technology in the organization.

The developed world has been more knowledgeable and equipped in terms of ICT and its basic knowledge and skills. But this is not the case with the impact of emergencies, who have been struggling to get their firm position through ICT by creating an impact of emergencies, which is based on income and information of emergencies.

How Universal Design of ICT can reduce the impact of the earthquake

There are the following methods to reduce the impact of earthquake hazards.

- Interpreting the recorded ground motions
- Constructing the seismic hazard maps
- Developing resistant structures
- With Seismic waves exploration the earth interior
- Long-period oscillations of the globe
- Seismic phenomena of Extra-terrestrial

Universal Design of ICTs can reduce the impact of emergency situations like earthquakes (Gjøsæter T. R., 2018). During earthquake shaking of the Tectonic plates bin, the Earth's crust causes lava to explode, and a volcanic eruption occurs as a result of heavy Earthquakes. The short-term impacts of these natural hazards are fatalities, and the long-term impacts of the Earthquake are the loss in business, loss of income and revenue generated, and the lack of tourism. Therefore, the ICT is used for predictions of the likelihood of an earthquake, which is occurring by detecting the plate movements and if there will be chances of After-shocks after the Earthquake. Moreover, it is observed that the person who already had evacuation experience from the previous disaster are more motivated for the preparation of item from basic preparedness and energy preparedness. It is also observed from the data analysis that the people are more prepared who suffered from the Great East Japan Earthquake of 2011. Contrarily the Great East Japan Earthquake does not have a prominent impact on preparedness (Onuma, Shin, & Managi, 2017).

The implementation of the Universal design of ICTs provides the ability to save lives of the people in the situation of the earthquake as it can provide information to elderly and impaired persons also about the area of the earthquake before happening an uncertainty. The appropriate technology of universally designed ICTs has been acknowledged by several scientists and Practitioners to improve crisis communication

and disaster management according to the needs and requirements of the people along with their disabilities (Iscram2018.rit.edu, 2018).

By using the WSNs (Wireless Sensor Networks), the unusual movement of animals can be determined even before happening natural disasters like earthquakes. For determining the possibility of an earthquake, the abnormal movement of animals such as; rats, rabbits, reptiles, etc. are really helpful, and it provides the information related to the earthquake. To determine the earthquake-prone areas, the sensors can be attached to the animals that partially act as GPS (Global Positioning System), which can be used to track their movements in a particular region. To determine the anxiety or fear of the animals, the sensors are also helpful by analyzing the body temperatures and several other features. By using this universal design of ICTs, the precautions can be provided or adapted in a particular area where the chances of the earthquake are predicted (K.R.Lakshmi, 2014). By using a universally designed ICT system, elderly or impaired people can also send their location or ask for aid or necessary precautions from the concerned emergency management system authorities.

By the environmental crises, whether the flooding, earthquake, or tsunamis short-sighted designed has occurred. Therefore the technology could also provide the planners, government, engineers by the basic feedback which is offering the feedback is the better methods, and it also predicted that behavior of the environment also constitutes advanced technology, and it provides essential methods which are proactive, and effectively make the communities disaster-resistant. The government must determine the different methods which reduced the earthquake damage. It also involves the infrastructure for the development along with the maintenance plus the preparedness in the event of disasters. In Japan, builds are earthquake-proof, but in Pakistan, builds are not earthquake resistant due to which a small scale of an earthquake can demolish buildings. So, the structure of builds should also be universally designed. Impaired or elderly people can also easily evacuate from the building during a disaster. Awareness of such things should be available on the universally designed ICT website. For example, during an emergency, people should use an emergency exit, and one should not use an elevator during an emergency.

Form Autodesk, the technology is available, which converges the engineering design, architectural designs, plus geospatial data. The capability is used to precise

the geospatial data and also applied across the infrastructure lifecycle, which also includes the maintenance and the operations. There are significant variations where the integration is enabled and made to address the management needs and town planning (Audio, 2013).

In the impact of the universal design of ICT to an earthquake, the broader implications are that; select the emerging economy that has the same characteristics of the developed countries. It should still receive the MFP (Multi-factor productivity) advantages for their investments in the universal design of ICT to deal with the impact of the earthquake. The improvement of the diminishing of the MFP returns connected by the ICT investments. The development of the universal design of ICT considered as business process, valuable economic development, and reduce digital inequality, streaming of national information infrastructure, language barriers, and constraints in the building of information technology capabilities in the development of the country. The developed world can play a big part in making sure that the changing impact of an earthquake can gain an equal level of access and skills related to ICT so that these societies can be capable of using ICT and its aspect for bringing earthquake change, which changes the lives of the majority of people. If only a short segment of society is changing their fate with the universal design of ICT, it means that the universal design of ICT reduced the impact of the earthquake in so many ways, which can play its part in income as well as informational inequality.

A study was held by researchers to the universal design of ICT and its relevant elements. The study kept three major things in perspective; the first thing was access to the universal design of ICT and its devices, the second thing was basic skills, and the third thing was complex capabilities. It is a fact that most of these studies have been keeping their focus on the developed world, but few researchers have also focused on the developing world as well. The role of this research has been instrumental in knowing how things have been changing in developing, transition, and emerging economies when ICTs made their influence in so many ways. It evaluated over the years that lots of investments have been made in ICT so that productivity and results achieved with better outcomes. (Mendonça, Crespo, & Simõesa, 2015)

How Universal Design of ICT can support disabled people in emergencies

With disabilities, the people are excessively affected in emergencies, along with the particular experiences with morality, which has high rates in different contexts. The emergencies are also increasing disabilities of people with a vulnerability like the people with disabilities, the less able to escape from the hazards. It also loss essential for the assistive or the medication of the devices like the hearing or the spectacles along with the mobility aids, which is also left behind the community that is forced to evacuate. The disabled peoples might also have very large problems accessing their basic needs, including the water shelter, food, latrines, along with health services. In 2011 in Japan, the Earthquake or tsunami has a statistic that presented the fatality for the rate of the people by the disabilities is twice for the non-disabled people. Elderly and impaired people can gain benefits with different ICT systems if they are universally designed.

The universal design of ICTs adoption has reached the point of Productivity. The productivity increase and the quantity of the production factor are helping in earthquake situations. Factor accumulation is causing short-term growth for the improvement of the productivity that has permanent effects. Then, the analyses of the factors, which is an effect on the productivity that has central earthquake situations. There is the opportunity used for the available tools involving ICT, and it is also building an inclusive society for the disabled person. Through the working sectors of all of the societies, it may be private, public as well as civil society which is finally ensuring the inclusion of the one billion persons by the disabilities of the digital age. The universal design of ICT permitted the removal of various barriers that face disabled persons. By the ICTs, which is increasingly and integrated with every aspect of the modern world of the ubiquitous technology, which is also the positive transformation of empowerment and the developments along with the institutional framework. Whereas the universal design of ICT also providing access to public services by the widespread applications for social progress and economic growth (Leblois, 2013).

The study came up with a new method to investigate what relationship lies between earthquake situations and the universal design of ICT by keeping a neoclassical growth accounting framework in context. This method proved a handful

to investigate the various research questions asked by the research study (Samoilenko & Osei-Bryson, 2011). It is important to keep in mind that such issues are very much evident in transition economies, where the universal design of ICT skills and capabilities not established, as those established in the developed impact of earthquakes (Rohan Samarajiva, 2012).

The major benefits of the universal design of ICT (Information and communication technologies) tools are timeliness, speed, user-friendly interface, and flexibility. In the classroom of translation, several ICT (Information and communication technologies) application has turn into unavoidable (Dash, 2013). There are several benefits of the universal design of ICTs, which involve supporting the helpless person in case of emergencies, integration of digital competence found to be compulsory for disabled people. No doubt, they have a great impact on worst conditions such as an earthquake. (Salahuddin & Jalbani, 2007)

Skills of universal design of ICT (Information and communication technologies) related to translators can also be helpful for the pedagogy development because of needs for the development of accurate environment learning, to utilize MT and CAT tools and target texts (MihokoSakuraia, 2019). The universal design of ICT is trying to remove the gap between elderly, impaired, and normal people.

By summing up the entire discussion of this question, it has been analyzed the various applications of universal design of ICTs as well as WSNs (wireless sensor networks) for disasters managements and earthquake alerts. The various ways analyzed in this study to generating an alarm for an upcoming disaster as well as determining earthquake precursors. It is observed in this discussion that the WSNs (wireless sensor network) offer the platform for designing earthquake detection mechanisms. The universal design of ICTs helps in broadcasting earthquake precautionary measures and safety information to all kinds of diverse humans. The earthquake early warning considered as the set up to helping the individuals minimize the harm brought by seismic tremors.

Requirements for such a universally designed information system?

Under this research question, the particular requirements will be explored that will be beneficial for the universally designed information systems. This information system will explore the ways for the people to protecting from certain disasters that are uncountable and cannot control easily. To maintain sustainable and peaceful environments, peoples are educated for securing themselves. The universally designed ICT system provides good knowledge for the people to protect their selves. Two particular requirements must be considered while designing the universal design of ICT, and these requirements are one of the most important sources for developing a good design of ICT. These requirements are;

Content

This section of the universal design of ICT will explore the ideas about content that are particularly used to spread awareness and information of preparedness and guidance for diverse people such as the elderly and impaired. This content will be used in a universally designed ICT website. This section also explains the information meaning s of the content; it means which type of information will be provided by this particular design of ICT. The details related to the various innovative techniques and precautions are also exploring under this section of the research study. The content of this ICT design will explore the adequate information related to the precautions from the earthquake. It will also explore the meanings of the Universal design. The design of the environments and products are concerned with the design and layout that may be used by people (Calacademy Org, 2018).

It provides the possible greatest extent for any need for adaption or a particular design. For the universal design, one of the most important prerequisites is accessibility. It has been indicated in W3C/WAI. In the case of Web, the accessibility is referred to like those people along with the disabilities that can understand, navigate, perceive and interact with tools and websites and all of these things can contribute easily (Gjøsæter T. R., Universal Design of ICT for Emergency Management. In International Conference on Universal Access in Human-Computer Interaction, 2018).

Such kinds of incidents, for example, earthquakes occur without any kind of warning, and these are one of the most painful and admirable incidents. The information about the happening of the earthquake cannot be explained by the feelings and perceptions of one person. To protect from these incidents, this universal design offers various techniques to protect from this. The content of this design will be contained on the particular accurate information that can be used for the safety of the people. Six particular ways are explained in this design to procure from the earthquake (Alex Greer, 2012). These all methods are;

Check for Hazard in the Home

- The shelves must be fastened securely with walls
- The lower shelves must use in order placing heavy or large objects (National Research Council., 2011).
- The cabinets must be closed with latches; the breakable items must be stored, for instance, glass and bottled food.
- The heavy items must be hanged away from the bed, such as mirrors and pictures.
- The overhead light fixture must be braced
- The water heater must be secured by bolting it on the floor and strapping it to the walls.
- In foundations and ceiling, the deep cracks must be repaired. If there would be signs of the structural defects, just go for the advice of the experts.

Identification of Outdoors, Safe Places and Indoors

- The bed must be against an inside wall

- Under sturdy furniture for instance; table or heavy desk

- Select the area for use away from the glass windows, where there would be a doubt for breaking glass, shattering the windows, pictures. Away from the places where the heavy furniture and bookcases can fall over (Ndma Gov Pk, 2019).

- Try to choose the open paces such as; away from the telephone, building, electrical lines, elevated expressways, trees, and overpasses.

- Try to select a safer place where you can stay.

Educate yourself and your siblings

- Teach your children about the emergency helplines, such as the fire department, when to call them. Teach your children about the radio stations to tuning for an emergency.

- To get more information about earthquakes to contact the American red cross chapter and local management office for providing more information on the earthquake.

- Get information about the protection of your property in the case of an earthquake.

- Teach your family members about turning off electricity, gas, and wait.

Have Disaster Supplies on Hand

- Try to arrange and use extra batteries and flashlights (Harrison, 2008).
- Try to use portable things it includes extra batteries and battery-operated radio
- Prepare your manual and first aid kit
- Pack your bag for water and emergency food
- Use an essential medicine
- Wear sturdy shoes
- Prepare your cash and credit card

Develop an Emergency Communication Plan

- After the disaster's make a plan of reuniting of your family members have been separated from one another during the earthquake.
- This possibility can occur when the adults are engaged in their working, and the children are in their schools
- Contact your friends and relatives for servings as a "family contact." It's often easier to call long distance after the disasters.
- Ensure every member of your family must know about the address, name, and the number of the contact person.

Help Your Community Get Ready

- The special section in the local newspaper must be published along with the particular information on the earthquakes.
- By printing, the phone numbers of the offices of the local emergencies localize the information. It includes the hospitals and various security center in Pakistan.
- In order to locate hazards in the home, conduct a series of a long week.
- In order to prepare the special reports to work with the services of the local emergencies and Red Cross services in Pakistan with the name of Halal-e-Ahamar (United Nations, 2005).
- In order to conduct earthquake drills in the home offers several tips.
- Contact with the water, electric and gas representative companies for shutting off various utilities.
- In the community, work together for building codes and apply your knowledge.
- It includes family emergency plans, retrofitting programs, neighborhood, and hazard hunts.
- This content of the website must contain the authentic and applicable information in order to provide the proper guidelines to the new generation for protecting from such incidents.

The requirement for the development of the website

This section of the research study explores the information about the requirements that are related to the developments of the websites. It leads towards the information that will be used for developing the universal design of ICT in order to procure disaster conditions such as; earthquakes. It includes the structure, color, and design, contrast, and language of the website by which various persons can avail beneficial information from this design. This design of the ICTs will lead to the Pakistani nation towards greater achievements by providing its unique qualities and information for the precautions of the earthquakes. In this case, it will introduce the website with the name of ABC that will be built by following the universal design of ICT principles.

The website can only be universally designed if it follows universal design principles.

Equitable Use:

The design of the ABC should be attractive to users, and it will be developed by considering the cases of special people. So, it provides the same mean of use for all diverse people. It means it would be referred to as the good product for the people who are suffering from the problems of the color blind, the design of this website should build by considering the viewing problems of diverse people. Particularly, this website will use the product for people who are suffering from diverse abilities (WOODWARD, 2017).

Flexibility in use

The design of the website or software ABC will be selected by considering the abilities and preferences of the individuals. It will offer a wide range of designs in order to accommodate its users, and ABC will be created according to the flexible use of the users, and it will provide the accurate information to its visitors.

Simple and Intuitive Use

The use of the design of the ABC will user-friendly; it will be easy to understand as compare to the level of the current concertation of its users, experiences of the user, language skills, and knowledge. The design of the ABC will be created by considering the ease of the user. This site will be eye attractive and user-friendly.

Perceptible Information

The necessary information will be communicating to the user of the ABC effectively as compare to the sensory abilities of the users as well as their ambient conditions. The use of authentic information will be preferred only while considering the design of ABC.

Tolerance for Error

The adverse consequences of the unintended or accidental actions and hazards will be minimizing by the design of the ABC. The ABC will select that particular design that can be beneficial for solving the issues of the various sever hazards.

Low Physical Effort

The physical efforts are one of the most important things while designing any site and software in order to provide the cure for any problem of society. The design of the ABC can be used comfortably and efficiently by applying the minimum amount of fatigue.

Size and Space for Approach and Use

In the design of the ABC, the particular and appropriate design, size, and space are offered for the approach. By applying this, the person can reach, manipulation, and use regardless of user's body size, posture, or mobility. The appropriate font size will be used to design the ABC.

Non-text Content

Any kind of the non-text content which is presented for the user should have alternative text to provide information regarding the non-text content (W3 Org, 2010). The website should be accessible to all users. It is nice if it follows all the WCAG 2.1 guidelines but, at least it should follow WCAG “A” and “AA” guidelines. Accessibility of the website could be tested by “Automated Accessibility Testing Tool” (PayPal, 2016), “Web Accessibility Checker” (Web Accessibility Checker, 2011) , “Functional Accessibility evaluate” (Illinois, n.d.) and “Accessibility Viewer” (Group, n.d.) tools to ensure the website is fully accessible.

Suitable Universally designed system for Pakistan

The majority of elderly people cannot read or understand the English language. The same case is for impaired people because no one supports them or bear their expenses to study, so the ratio of educated impaired or disabled people is too little. The most common physical disabilities in Pakistan are blindness, deafness, crimplenes, and dumbness (Ahmed, 1993). There is also a majority of poor people in Pakistan that cannot afford educations and hence cannot read or understand the English language. Almost all the Pakistani can understand Urdu So, universally designed ICT website should have instructions in both languages, i.e., English and Urdu. According to Pakistan Telecommunication Authorities, 90% population of Pakistan use mobile phones for daily communications. So, the universally designed website should be mobile phone compatible as well, and hence it should follow WCAG mobile accessibility guidelines as well.

Internet service is available almost all the areas of Pakistan, but it is expensive, and there are some area’s in Pakistan where internet speed is quite slow so, its suitable to use the least amount of images and instructions videos in universally designed system so that website can load easily in the least amount of time. Audio Instructions for blind people should available on demand. That is, user action should be required to download audio. Instead, the browser loads it automatically with the loading of the page and consume internet data and slows down the website to load. There is a huge amount of Pakistani people who has low eyesight so webpage should be responsive and supports zooming feature to make text content easily readable for low eyesight users.

Literature Review

Who the Literature Review is for?

The purpose of the Literature Review is to know the importance of universal design and how Universal design of ICT can be used to save lives during an earthquake emergency.

Universal Design of ICT

The emerging research field of universal design of ICT for emergency management is used to reduce the barriers for all, including people with situational disabilities and people with diverse abilities, situations and equipment, including the elderly and people with disabilities. (Gjøsæter, Radianti, & Chen, 2017)
Universal design covers all the people of the world. But the problem is how disabled people can use the system? Either they must get rid of from their impairment to use the technology or technology should be rich enough that even impaired persons can use the assistive technology. To sort out these issues different models of disabilities were proposed.

Medical model of disability

The medical model of disability narrates that people are disabled by their physical, sensory or mental impairments and differences. It focusses on what people cannot do. These impairments should be recovered by medical treatments. For example, a teacher who refuses to print the document in a larger font for a visually impaired student due to this the student cannot participate in class.

Social model of disability

The social model of disability narrates that person's difference or impairment is not the cause of disability. But the disability is created by the way society is organized. Social model says that it is society that disables people, by designing everything to facilitate people who are not disabled. Social model focusses the way of eliminating barriers that bounds the life choices for impaired persons. According to

social model society should take steps to reduce, and eventually eliminate, some disabling barriers. (Disability Nottinghamshire, 2017)

For instance, in Norway the people that cannot walk uses the facility of electronic wheelchair to go out, but in Pakistan such people cannot go out by their own as Pakistan don't have electronic wheelchairs and special roads. So According to Social model such people are disabled in Pakistan but not in Norway.

Gap Model of disability

This model is intermediate between medical model of disability and social model of disability as it states that the problem is not in society and in impaired person. According to the Gap Model of disability the problem is the gap and mismatch between society's demand and impaired person abilities. Figure 2 illustrates that the gap between individual abilities and requirements from the environment creates disability.

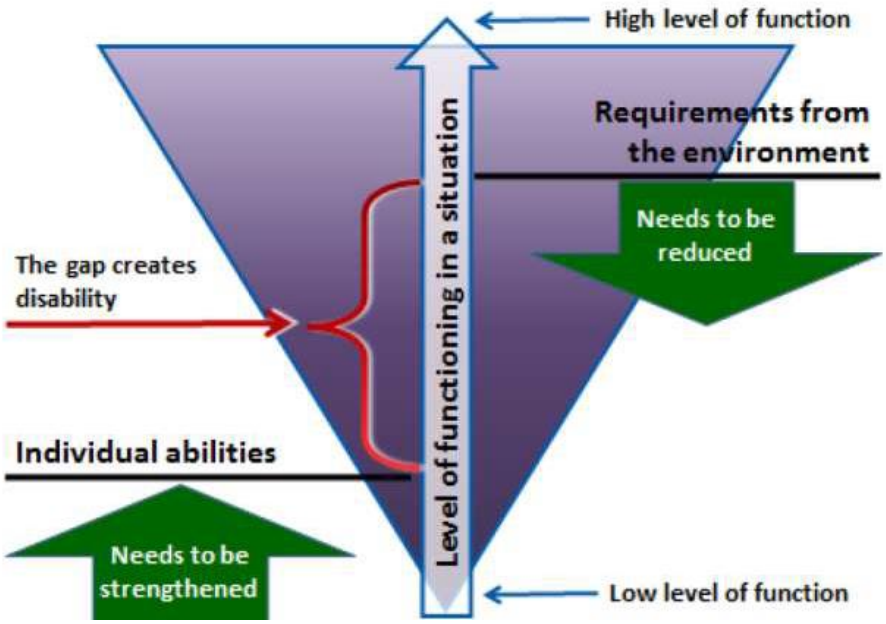

Figure 2:Gap Model of Disability (https://www.researchgate.net/figure/The-disability-gap-model-based-on-the-white-paper-on-Dismantling-of-Disabling-Barriers_fig3_270508482)

To cover the gap between gap model accessibility, assistive technology and usability should be used.

Accessibility

The extent to which environment, system, services, products and facilities can be used by the people that have widest range of capabilities (including impaired persons) and characteristics (age, sex, education, languages, culture) to achieve a specific target in a specified context of use is known as accessibility. (ISO 26800,2011)

Accessibility can be categorized into four levels in first level we have to consider all the people universally for our design than in second level we customize them into special groups e.g. impaired persons that need wheelchair are customized into one set of groups. In level three of accessibility pyramid we have to we have to customize individuals and in the fourth and last level of accessibility we provide personal assistance and assistive technologies to the individual person. Accessibility pyramid can be seen in Figure 3.

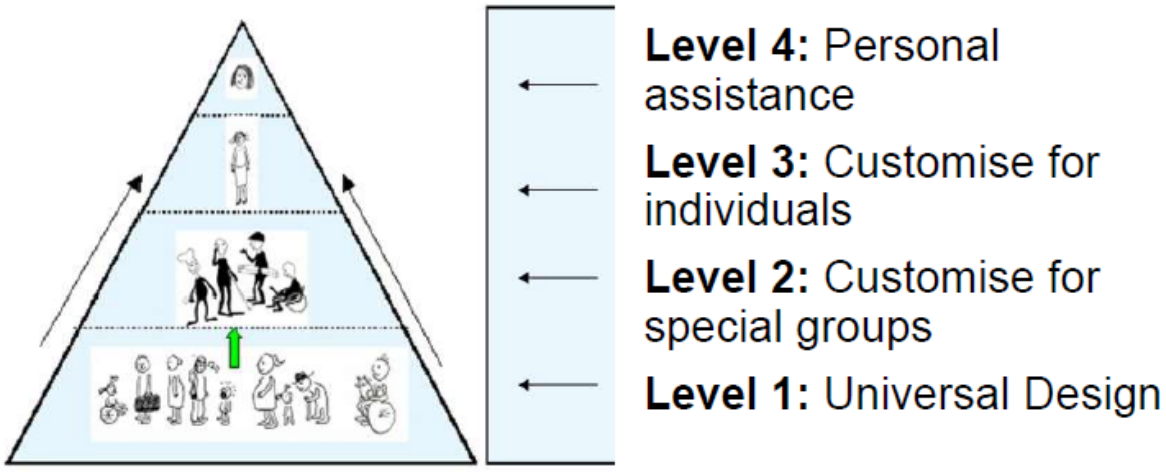

Figure 3:Accessibility Pyramid (http://www.vuu.no/gammelt-innhold/universell-utforming/brukbarhetspyramiden/)

To make an accessible website, researcher must take account following factors

1. There is never only one solution for a problem.
2. Solutions can be complicated and complex.
3. Sometimes combination of alternative solutions is required, and only a single solution will cannot work well.

4. Web accessibility field is not only for impaired people, but it is also for other people and for organizations as well
5. To build websites and applications that have features of flexibility, device independence and heterogeneity is challenging, difficult, and incredibly vital. (Simon Harper, Yeliz Yesilada)

To make accessible websites is one challenge but, after making website accessible to check, either it is fully accessible or not is another challenge. So, to help developers to make more accessible websites, the Web Accessibility Initiative (WAI) published accessibility guidelines. The first version of Web Content Accessibility Guidelines that is known as WCAG 1.0 was published in 1999 (Vanderheiden, G., Chisholm, W. and Jacobs, 2012). WCAG 1.0 is consists of 14 guidelines and every guideline has some checkpoints which are 65 in total. And these checkpoints have assigned a priority based on its importance. Due to massive increase in websites and users, second version of the WCAG was published in 2008 named as WCAG 2.0. It includes 12 guidelines and four principles which are as follows

1. Perceivable
2. Operable
3. Understandable
4. Robust.

Form these guidelines we can evaluate the accessibility of websites. Form the last few years, a lot of researchers used these guidelines to measure the accessibility of websites. The evaluation of the accessibility can be done manually by some accessibility expert. The evaluation can also be done by using automated tools which is most commonly used to check accessibility of website. But, it was observed that automated accessibility checking tools cannot perfectly check all accessibility issues. and hence manual accessibility checking is more preferred. For example, if an image has an alternative text then automated accessibility checking tool will approve it as accessible but it cannot judge that either the alternative text was describing the image, or it is some useless text.

From the literature it has been observed that most of the websites do not meet almost all the WCAG guidelines. The Digital Rights Commission (DRC) did an investigation of thousand websites. In investigation the results showed the statistics

that just 19% of the websites were following the WCAG 1.0 level A. Only 0.6% of the websites were following WCAG Level AA and not even a single website was following the AAA level.
Digital Rights Commission formal investigation of 1000 websites it was one of the first studies that raised this issue. The results of their investigation showed that only 19 % of the websites conformed to the WCAG 1.0 Level A, with the figures for AA and AAA be much lower. Only 0.6 % of the websites conformed to AA and none of the websites conformed to AAA.

Information sharing tools

There exist some information sharing tools related to earthquake that informs about the next upcoming earthquake with a couple of hours or days ago. These information sharing tools should be universally designed so that disabled, elderly or situational disabled people can use such kind of tool to save their lives. (Radianti, Gjøsæter, & Chen, 2017)

Assistive Technology and Usability

Assistive technology is a technology in which products, devices, instruments, equipment or software is used to reduce the gap in gap model of disability by preventing, compensating, relieving, monitoring, neutralizing impairments, activity limitations, and participation restrictions. (ISO 9999)

The extent to which a system, product or service can be used by specified users to accomplish a specified set of goals satisfaction, efficiency and effectiveness in a specified context of use is known as usability. (ISO 9241-11)

User diversity

As the name depicts, widest range of diverse users or diverse conditions in which the system can be used is known as user diversity. Diverse conditions can be like in darkness or in severe brightness, in hot or cold or in un steady place like travelling in vehicle. Diverse users can have different characteristics with respect to age, gender, education, nationality and impairments.

Health education in disaster

Natural disaster took a lot of lives, it also damages infrastructure and material. It entirely changes the life of affected survivals. It is observed that health is big issue for the survivors of a disaster. These survivors face different health related issues e.g. infectious diseases but, due to disaster there exist limited health related services and facilities. Due to lack of knowledge or limited information related to health risks and not having awareness to safety precautions lead to infectious diseases. Survivors can easily prevent from such diseases if they have safety awareness. A study was conducted in the investigation of 8 natural disasters in Indonesia. It was observed that the infected people did not take necessary safety precautions and suffered from infectious disease. Because of aftereffects, the most common diseases among the survivals of these eight natural disasters are water-borne and air-borne. To increase the safety awareness after natural disasters Pascapurnama narrates that “Health education and promotion can be integrated into curriculum-based or training-based DRR programs as modules, short courses, drills, and printed and visual media”. (Pascapurnama, et al., 2018)

Household preparedness for natural disasters

After the Great East Japan Earthquake of 2011, a survey being done in 2013 by the affected persons of the earthquake. The data collected from the survey cover more than twenty thousand households that include almost all the regions of Japan. It covers both type of regions that include low disaster risks and those who recently suffered from disaster experience. Collected data was categorized into following three types.

1. Basic Preparedness
2. Energy/Heat Preparedness
3. Evacuation Preparedness

Regression analyses was used to judge the consequence of disaster experience during preparation of the categories of emergency supplies. Results showed that the people that suffered from previous disaster they are more focused on preparedness. Moreover, it is observed that the person who already had evacuation experience from the previous disaster are more motivated for the preparation of item from basic

preparedness and energy preparedness. It is also observed from the data analysis that the people are more prepared who suffered from the Great East Japan Earthquake of 2011. Contrarily the Great East Japan Earthquake does not have a prominent impact on preparedness. (Onuma, Shin, & Managi, 2017)

Impacts of Education and Experience on Disaster Preparedness

A study was conducted to understand how disaster preparedness can be promoted by education. Loss and damage from natural disasters can be reduced by using family evacuation plan. Though in disaster-prone areas, disaster preparedness in level of household is quite low. By concentrating on disaster preparedness (Roman & Raya, 2017) investigated

1. The pathways according to them the education promotes preparedness
2. The combination of experience and education can be used to shap actions for the preparedness

(Roman & Raya, 2017) analyse the data by conducting face-to-face surveys from the people at least fifteen years old. This survey is done in Thailand and in Philippine. In Thailand the number person whom the surveys were conducted was 1310 while in Philippine the surveys were conducted from females only and the number of females were 889. After analysing the data (Roman & Raya, 2017) found that by providing formal education related to safety precautions increase the tendency of the people to prepare and tackle against any sort of disaster. (Roman & Raya, 2017) also found that the importance of disaster preparedness education was facilitated in Thailand through their social capital as well as through disaster risk perception while on the other hand they could not find any evidence in Philippine i.e. education related to disaster preparedness was not delivered to people through any social channel. When the authors compared the necessary disaster precautions education, with the real disaster experience, the authors observed that disaster related education promotes disaster preparedness for such families that do not have suffered from any disaster in the past. (Roman & Raya, 2017)

From Figure 4:Disaster preparedness measures by country. it is observed that Philippine has was more overall preparedness than Thailand i.e. in Philippine more than 76% of population already have knowledge of preparedness while in Thailand

only 32% people have awareness related to overall preparedness. Almost 52% of the respondents in the Philippines stated that eating stored food at home instead of using self-reliant in case a disaster strikes while, in Thailand 14.4% of the respondents claimed to eat stored food at home instead of using self-reliant in case a disaster strike. Similarly, disaster preparedness knowledge for structural upgrades is way more in Philippine than Thailand i.e. Thailand has only 16% preparedness knowledge related to structural upgrades.

In Figure 4 it is also observed that only a few people have knowledge of preparing emergency kit in an emergency. Only 19% of Philippines and only 10% of Thailand population has knowledge of preparing emergency kit in emergency. It Is also observed that Philippines have more preparedness education than Thailand in almost all the subcategories of preparedness education except for the family emergency plan. Only 8% of the Philippines population has knowledge of family emergency plan while on the other hand 18% of Thailand people has knowledge related to family emergency plan.

Quite a few people have disaster insurance, six-point three percent from the entire Philippines population have disaster insurance and approximately only one-point four percent population of Thailand have disaster insurance as shown in Figure 4.

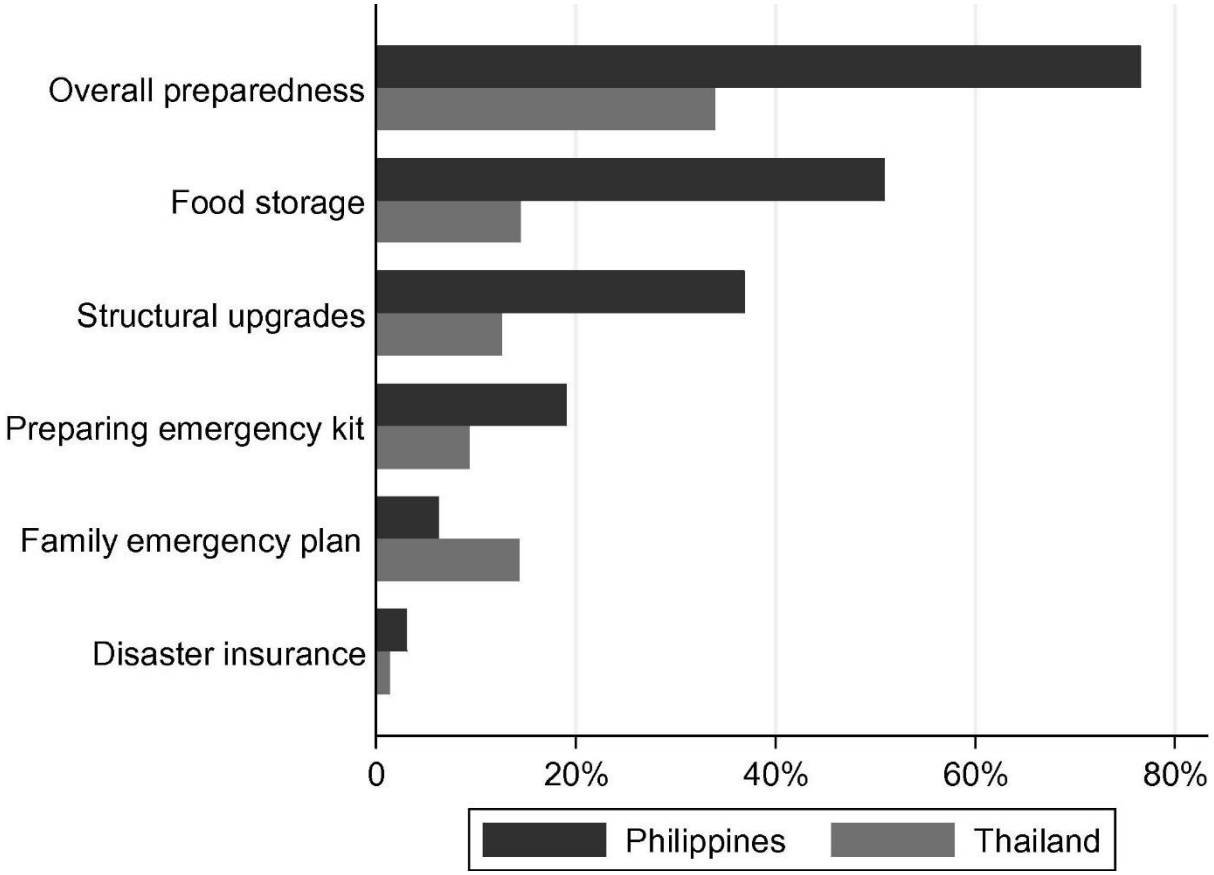

Figure 4:Disaster preparedness measures by country. (Roman & Raya, 2017)

In Figure 5 it is observed that the people that do not suffer from any disaster experience by their own, for those people education influence a strong disaster preparedness among them. Their preparedness level increases with the increase of years of education. Contrarily the people that suffered from a past disaster, education do not dray any effect on them at all. Same case is for Philippines and Thailand.

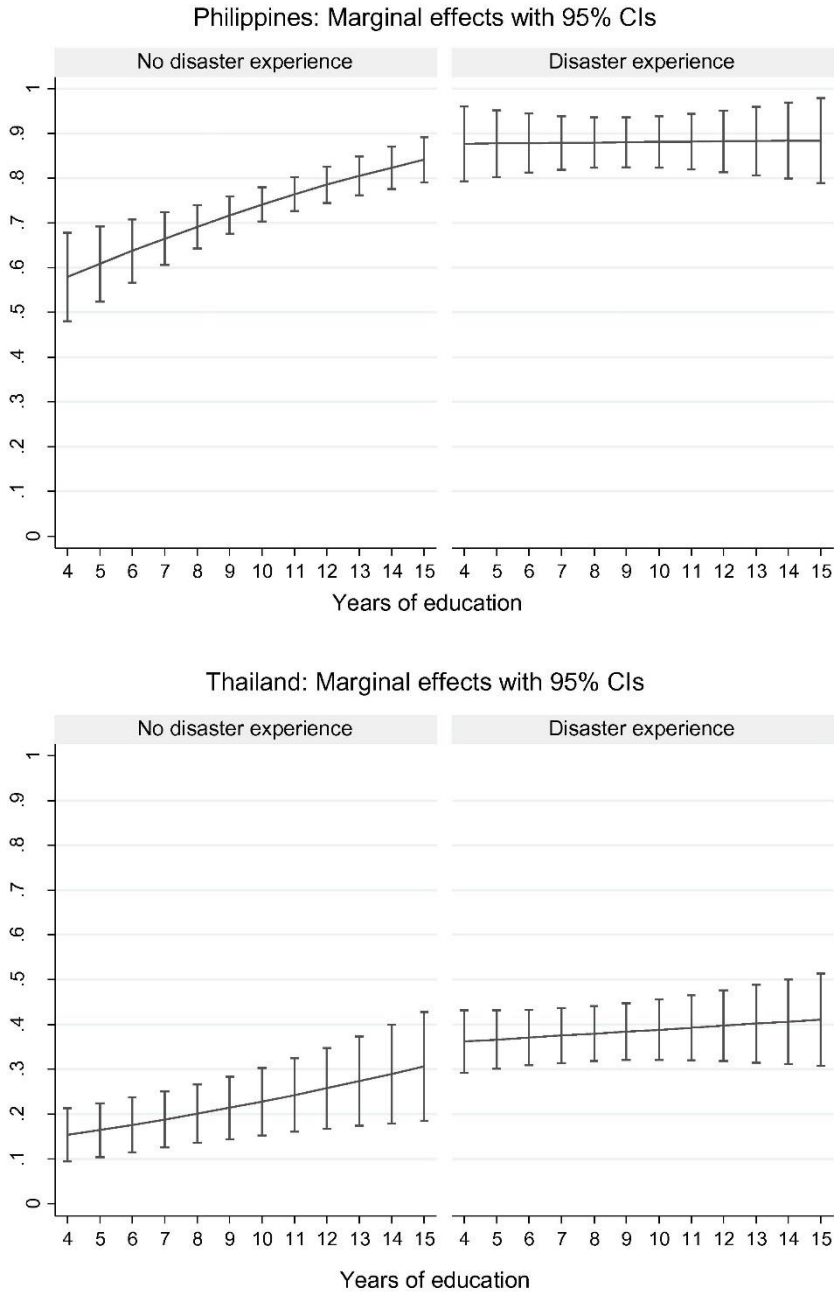

Figure 5:Plots of marginal effects from logit models displaying the probability of taking preparedness measure by years of education in the Philippines and Thailand. (Roman & Raya, 2017)

The authors concluded that necessary safety related education of emergency management strengthen our abstract reasoning and improves our anticipation skills to such extent that; without having any disaster experience an educated person can take preventive measures instead of 1st time taste the consequences from such disaster experience and then learn after it by its experience. Now a day many UN agencies are promoting education for maintainable development. (Roman & Raya,

2017) research provides a solid empirical evidence that promotes education in disaster risk reduction. (Roman & Raya, 2017)

To implement universally designed system to spread awareness in Pakistan. First, we should have knowledge that which sort of disabled persons exist in Pakistan. According to social modal of disability it is the system who made a person disable. So, we should know which facilities Pakistan provide to reduce disability and in which facilities Pakistan lack that other developed countries provide to their citizens.

Website Description

This section explains the website prototype design. This prototype contains four tabs on top named as “Home”, “Gallery”, “Earthquake Alerts” and “Contact Us”. Home page of the website can be seen in figure 6.

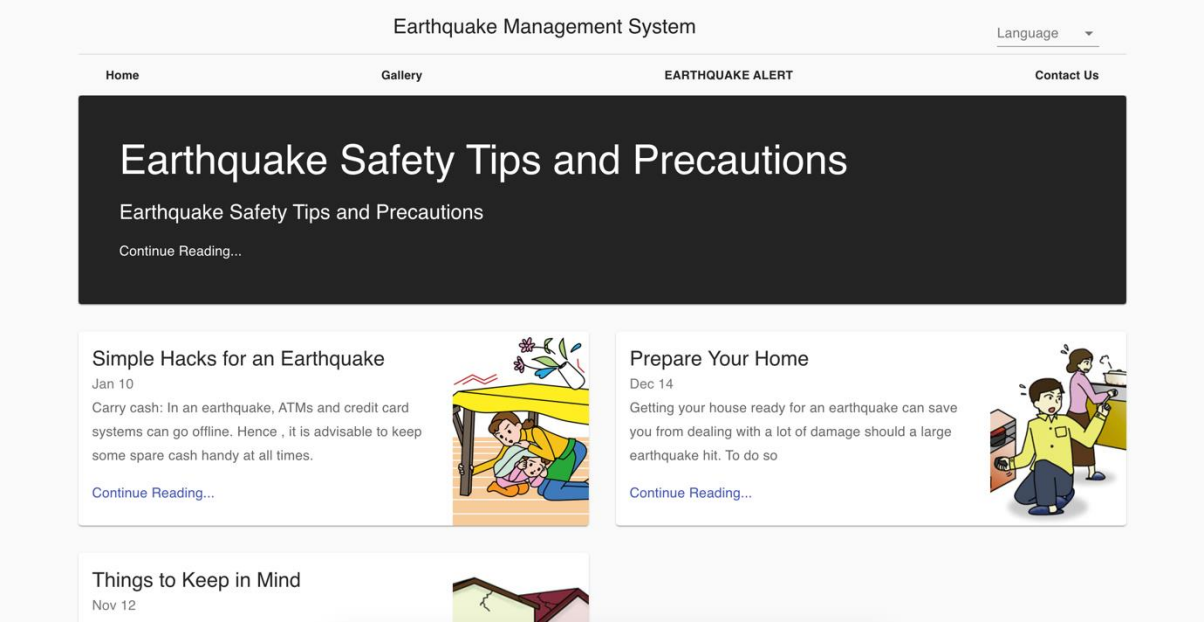

Figure 6: Earthquake Management System Home Screen

This prototype supports two languages English and Urdu. On top right of the webpage there is a dropdown menu where desired language can be selected. Urdu version of this website can be seen in figure 7.

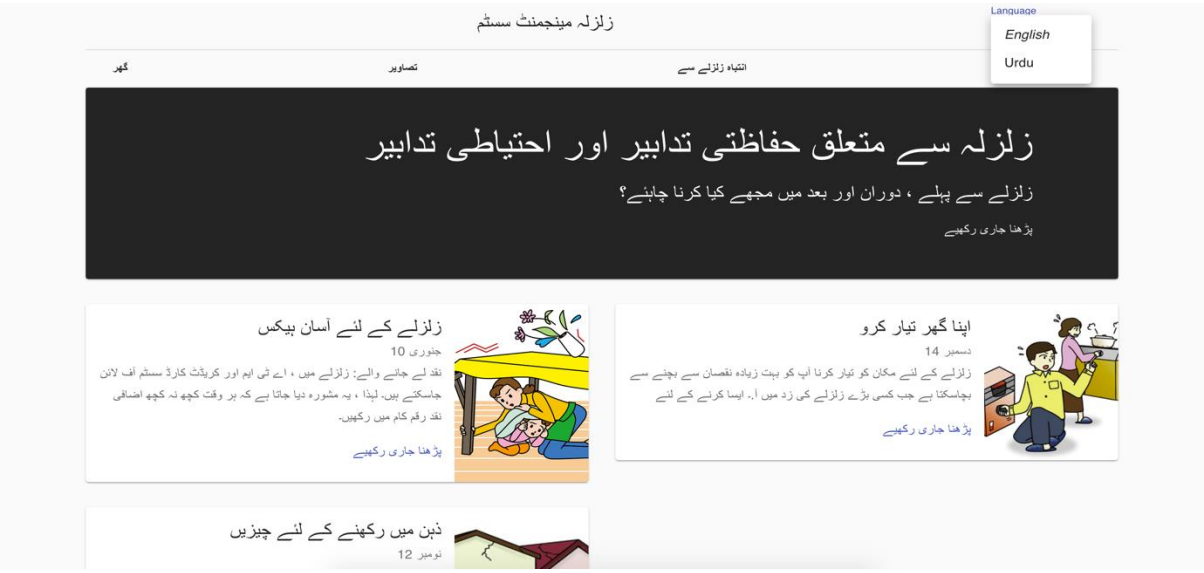

Figure 7: Earthquake Management System Home Screen Urdu Version

When a user clicks to a post the website navigates to that complete post as shown in figure 8.

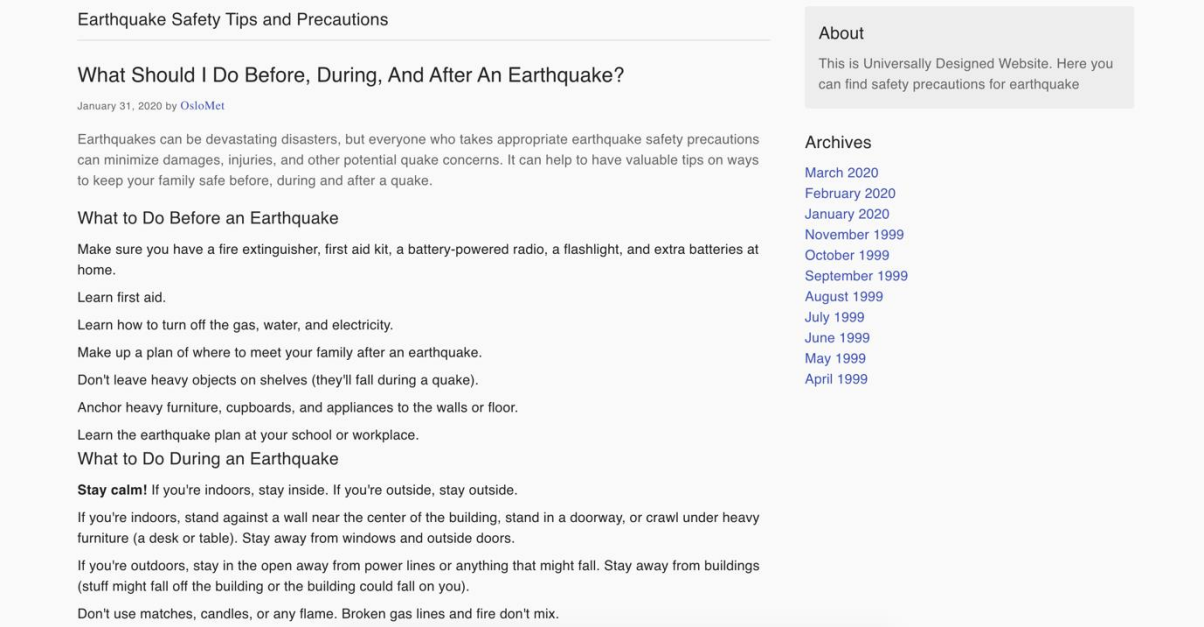

Figure 8: Article on website

In Gallery tab, images automatically navigate with a specific time interval. These images provide precautionary information for people in different situations during an earthquake. Interface of gallery tab can be seen in figure 9.

Figure 9: Gallery Page of EMS Website

Earthquake alert tab navigates to external link that monitor the most recent earthquake that occur on earth. Last tab, which is Contact us tab, is used to take user inputs. These inputs can be related to earthquake emergency or website bugs and improvements or about its usability. Contact us tab can be seen in figure 10.

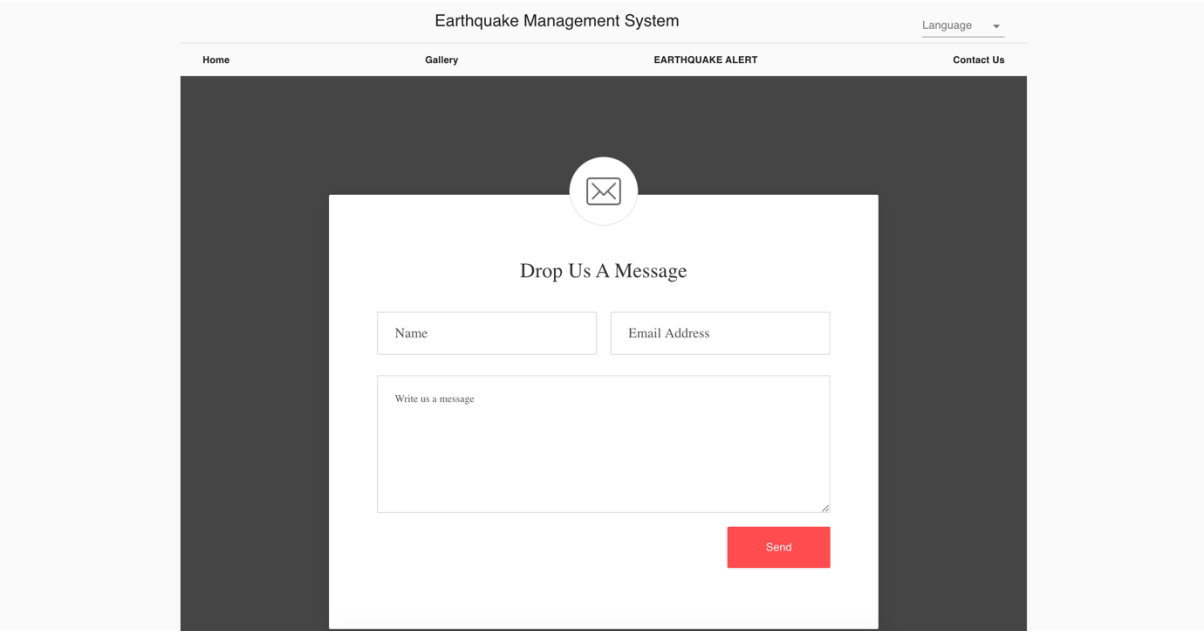

Figure 10: Contac Us Section of EMS Website

More features can be added to this prototype in future. Following is the link of the website.

http://ahmaddar009.0fees.us/

Accessibility check

The website accessibility is tested by Web accessibility evaluation tool. Initially it found some errors and contrast errors. After fixing those errors the final result of web accessibility evaluation tool can be seen in picture 11.

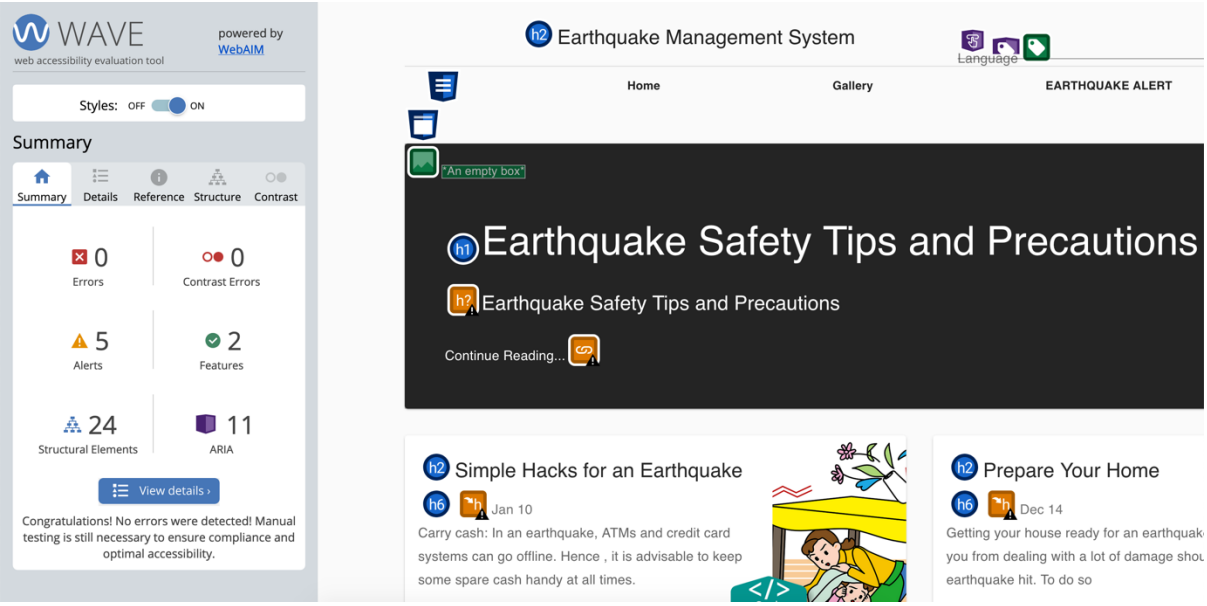

Figure 11:EMS website accessibility test

The accessibility of the website is also tested by Web accessibility checker tool. This tools check WCAG 2.0 guidelines with Level AA. It also does not find any accessibility issue except some potential problems but those were not accessibility issue. It was because of the React framework that is being used in the development of this prototype. So, those potential problems cannot be counted as problems. Web accessibility checker tool results can be seen in picture 12.

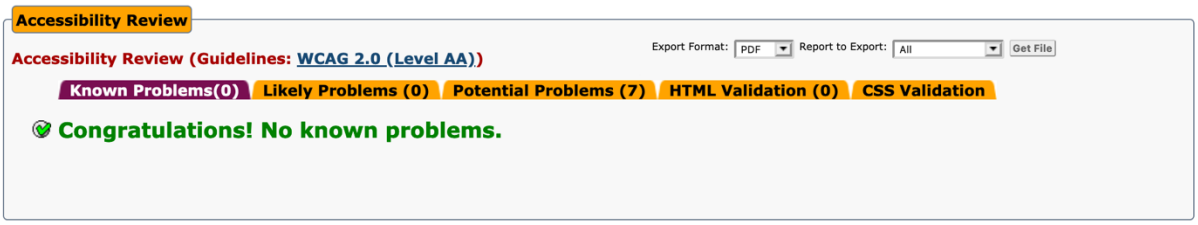

Figure 12: EMS accessibility check by Web accessibility checker tool

An online survey is conducted along with the website link. Targeted audience of this survey was Pakistani people with different gender, age, education level and impairments. Audience was advised to first use the website and then complete the survey. Findings of this survey is described in next section.

Results

A questionnaire was formulated and distributed to Pakistani people especially elderly and impaired people. Live website link was also provided to them. Respondents were advised to use website first and then fill the survey. The data was collected by using questionnaire technique and then SPSS software analysis was carried out to collect results on the basis of data collected by online questionnaire. For the graphical representation, SPSS inbuild graphical feature was used to demonstrate the results.

The frequencies of the respondents have been discussed along with their particular percentages. It also explains the participation of the respondents in order to fill the questionnaire as well as participates in the survey. This section explains the frequency distribution tables of the respondents along with the particular charts or graphs.

Gender		Frequency	Percent	Valid Percent	Cumulative Percent
	Male	71	18.3	28.4	28.4
	Female	179	46.0	71.6	100.0
Total		250	64.3	100.0	

Table 1: Representing total number of participants and their gender

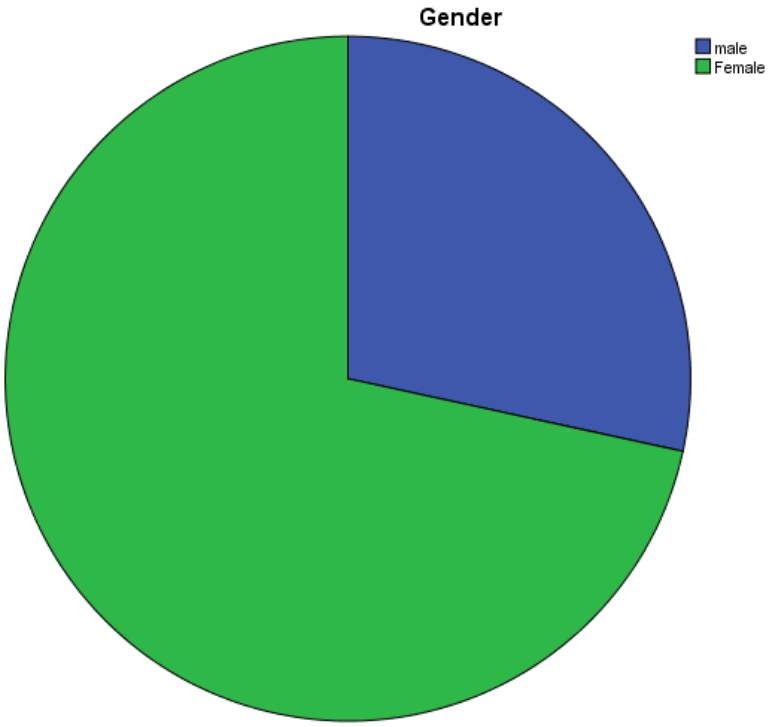

Figure 13: Pie chart explaining number of males and females who attended the survey

The above given table of the frequency distribution is illustrating the frequencies and percentages of the respondents who has participated in this study in effective manners. It has been represented in this table that 28.4% of the total respondents are males who have participated in this study and the frequencies of these respondents are 71 males. The remaining 71.6% of the total respondents are females that are 179 females who have participated in this study. Total this question has been answered by the 250 respondents including the frequencies of male and female. The attractive colours of the pie chart as shown in figure 13., is also illustrating the percentages of the respondents such as; green colour is representing the percentages of the female respondents and blue colour shows the male respondent's percentage. It is important to note that the website has been universally designed to ensure that maximum amount of diverse people can learn necessary earthquake related precautions. First of all, from the results, it can be analysed that both females and males have answered the questions and their responses have been recorded. Secondly, due to the implication of universal design, people having disabilities or impairments, or people who cannot read English can use the website. Actually, the website has been designed in such a manner to promote equality, equal

opportunity for all sort of people so that questionnaire could be conducted to diverse people. In some studies, responses are obtained from only some specific group of people which limits the reliability of results. In this case, it has been ensured that nothing like that happens by providing an equal chance to all people. It has resulted in a diversity of opinions, which indicates that the reliability of results is higher. This approach helps in accomplishing the objectives of this research better with such a potential that cannot be possessed by a research that does not make the use of diverse results.

	Age	Frequency	Percent	Valid Percent	Cumulative Percent
	14-19	41	10.5	16.4	16.4
	20-30	42	10.8	16.8	33.2
	31-40	33	8.5	13.2	46.4
	51-60	51	13.1	20.4	66.8
	51-60	31	8.0	12.4	79.2
	61-70	11	2.8	4.4	83.6
	71-80	15	3.9	6.0	89.6
	80 Plus	26	6.7	10.4	100.0
Total		250	64.3	100.0	

Table 2:Table showing age group of respondents

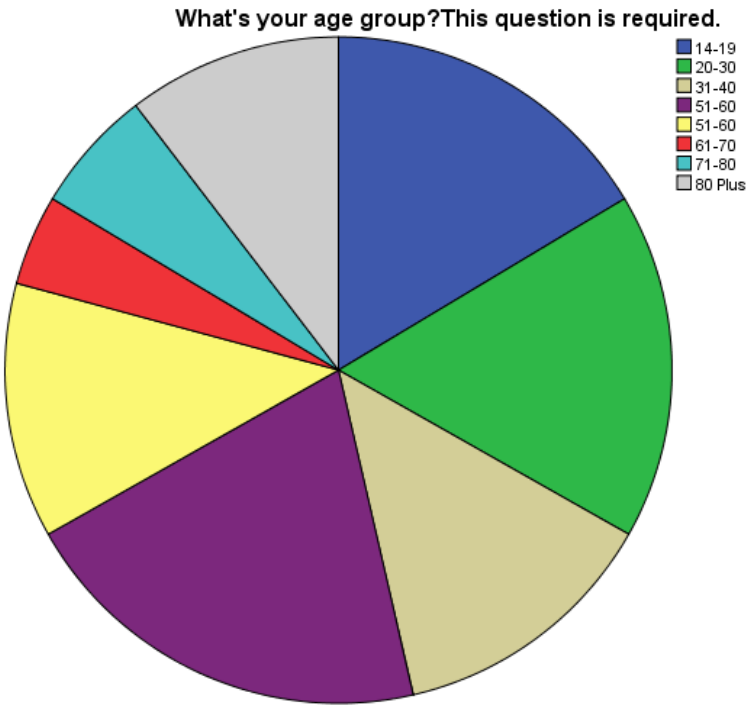

Figure 14: Pie chart explaining the age group of respondents

The question of the ages of the respondents has been answered by 250 respondents as well. All of these respondents belong to the various ages group. 16.4% of the total respondents i.e. 41respondents belong to the first age group that is the 14-19 years old. There are 42 respondents who are falling in the age group of 20-30. 33 respondents from the total respondents are belonging to the age group of 31-40. There are 51 respondents from the total respondents who are falling in the age group of the 41-50. Thirty-one respondents i.e. 12.4% of the total respondents are categorized in the age group of 51-60. Meanwhile, only 4.4% of respondents of the total respondents are lying in the age group of 61-70. Remaining 6% and 10% of the total respondents belong to the 71-80 and 80 plus age group and those are forty-one in total that can be seen in table 2.

Do you have any disability? This question is required.

Disability	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	80	20.6	32.0	32.0
No	170	43.7	68.0	100.0
Total	250	64.3	100.0	

Table 3:Table representing amount of disable and normal respondents

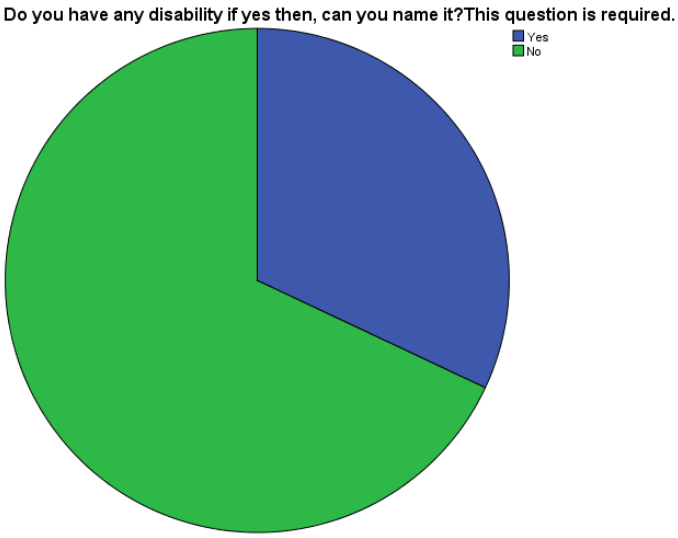

Figure 15: Pie-Chart representing amount of normal respondent's vs respondents with disabilities

One of the important questions that were asked in this survey is: Do you have a disability? This was a required question. As it had been described in the previous section, there were 250 respondents who completed the survey. Out of them, 80 people responded to have some sort of disability. Though people with disabilities also responded to the survey it means they are capable enough to use the website and they don't have that severe disability that they cannot even participate in the survey. Meanwhile, 170 people determined that they do not have any disability. The percentage of normal and the respondents having some disabilities can be seen in the pie chart diagram 15. The green portion of the pie chart is illustrating those people who did not have any disability. where's, the dark blue color is illustrating all those people who had a disability and they answered the question with a 'yes.'

Target people of this survey were people with impairments even though not many respondents had a disability, but still, some respondents having disabilities filled survey, it still indicates that disabled people were able to interact with the website. This question has been answered by the total 250 respondents and their frequencies are presented in the table 3. The above-given table of the frequency distribution is illustrating the frequencies and percentages of the respondents who have participated in this study in effective manners. It has been represented in this table that 32% of the total respondents are the disabled who have participated in this study and the frequencies of these respondents are 80. The remaining 68% of the total respondents do not have any disability those are 170 respondents of the total who have participated in this study.

How much knowledge do you have regarding during an earthquake, the precautions we should take?

		Frequency	Percent	Valid Percent	Cumulative Percent
	Not at all	85	21.9	34.0	34.0
	Good Information	107	27.5	42.8	76.8
	All information	58	14.9	23.2	100.0
Total		250	64.3	100.0	

Table 4:Table representing number of respondents having earthquake preparedness

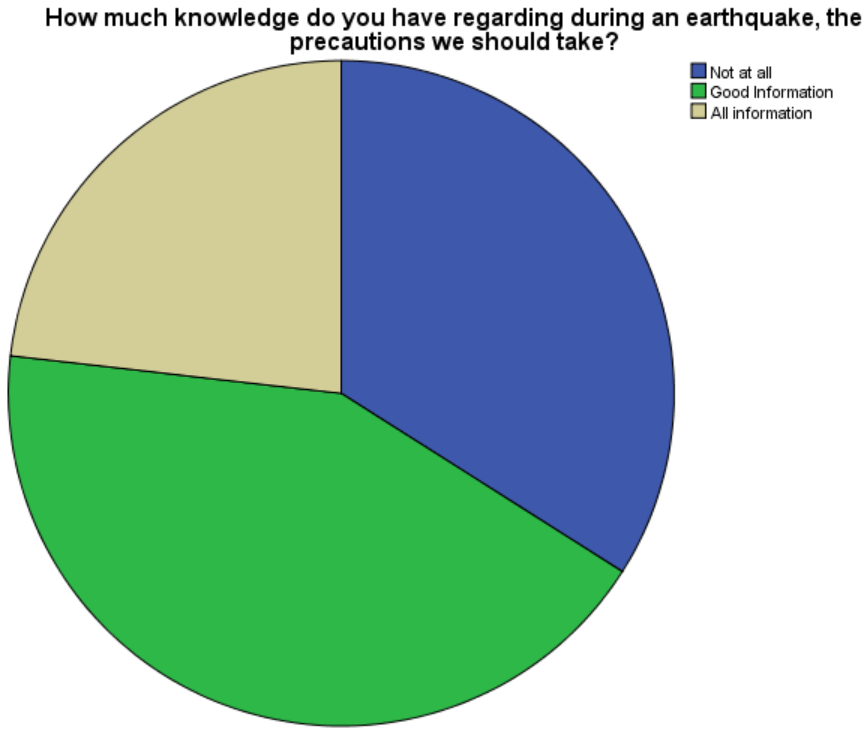

Figure 16:Pie chart representing percentage of respondents having earthquake preparedness

The next question of the survey is: How much knowledge do you have regarding during an earthquake, the precautions we should take? In case of this question, options of yes and no were not provided because it would have served to not provide any information on the level of awareness or knowledge possessed by the respondents in case of disaster management. Thus, in order to properly analyse the standard or level of knowledge, three options were provided including: not at all, good information, and all information. The answers of respondents are distributed or divided among these options. It has been explained in the previous section as well that 250 respondents underwent this survey and answered the questions.

Out of them, 85 respondents determined that they did not possess any information about precautions that should be taken in case of a disaster such as earthquake before reading the content of this universally designed website. Meanwhile, 107 respondents determined that they had sufficient or good information about the precautions that must be taken. Lastly, 58 respondents responded that they had all the necessary information about precautions that must be taken in a disaster like earthquake. From these results, it would not be wrong to say that the highest

percentage of respondents indicated that they had good information about precautions it can be seen in table 4.

In figure 16. pie chart graph represents the percentage of respondents. There are 34% of the total respondents who do not know about the earthquake precautions they are represented in blue color in pie chart. Meanwhile most of the respondents have good information about the precautions of the earthquake and these are 42.8% of the total respondents. Remaining 23% of the total respondents have all of the information about precautions of the earth quack. A green color on the pie chart that has occupied most of the section on the chart is representing the percentages of the respondents who have good information.

Main source of information for earthquake precautions

		Frequency	Percent	Valid Percent	Cumulative Percent
	People	52	13.4	20.8	20.8
	TV/ radio	52	13.4	20.8	41.6
	News paper	41	10.5	16.4	58.0
	Website	58	14.9	23.2	81.2
	Social Media	47	12.1	18.8	100.0
Total		250	64.3	100.0	

Table 5:Table representing respondents' sources of earthquake preparedness

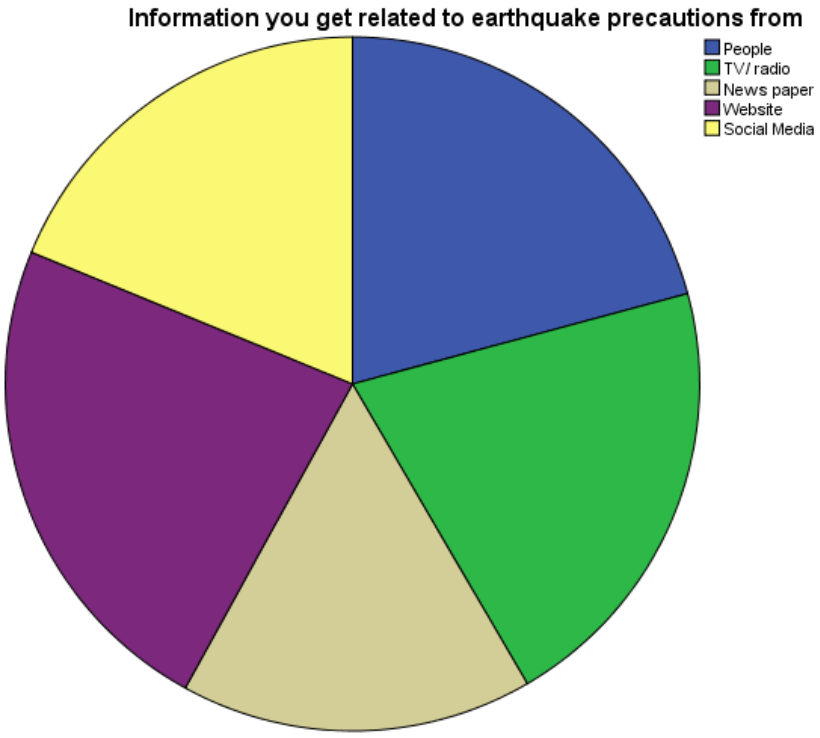

Figure 17:Pie Chart providing percentage of respondents' sources of earthquake preparedness

Another important question that is been asked in the survey is The source where you gained earthquake information. As it can be seen, this question seeks to determine how people get information about earthquake precautions. In order to obtain reliable information and responses, a number of options were again provided. These options included: television or radio, newspapers, websites, people, and social media.

Respondents had varying answers. Out of the 250 respondents, 52 responded that they got this information from television or radio. Meanwhile, 41 respondents indicated that they got information about earthquake precautions from newspapers. 58 people responded that they got information about earthquake precautions from websites. Lastly, 47 people answered that they got information about precautions that should be taken in case of an earthquake from social media. The visual representation of these responses can be seen in the Pie chart above in figure 17. Thus, it can be said that most of the people got information about earthquake precautions from different websites.

There are 20% of the total respondents who got knowledge about the earthquake and its precautions from the other people and these are the 52 participants.

Meanwhile, the number of respondents that have attained good information about the precautions of the earthquake from TV, Radio is 20 % of the total respondents. Remaining 23% of the total respondents are getting the information about precautions of the earthquake from the website. Meanwhile remaining 18.8 % of the total respondents are getting information about precautions of the earthquake from the Social media Channels. Purple color on the pie chart that has occupied most of the section on the chart is representing the percentages of the respondents who got information from the website.

How is the design of website

		Frequency	Percent	Valid Percent	Cumulative Percent
	Not Good	85	21.9	34.0	34.0
	Good	107	27.5	42.8	76.8
	very good	58	14.9	23.2	100.0
Total		250	64.3	100.0	

Table 6: Represents amount of respondent's response related to design of website

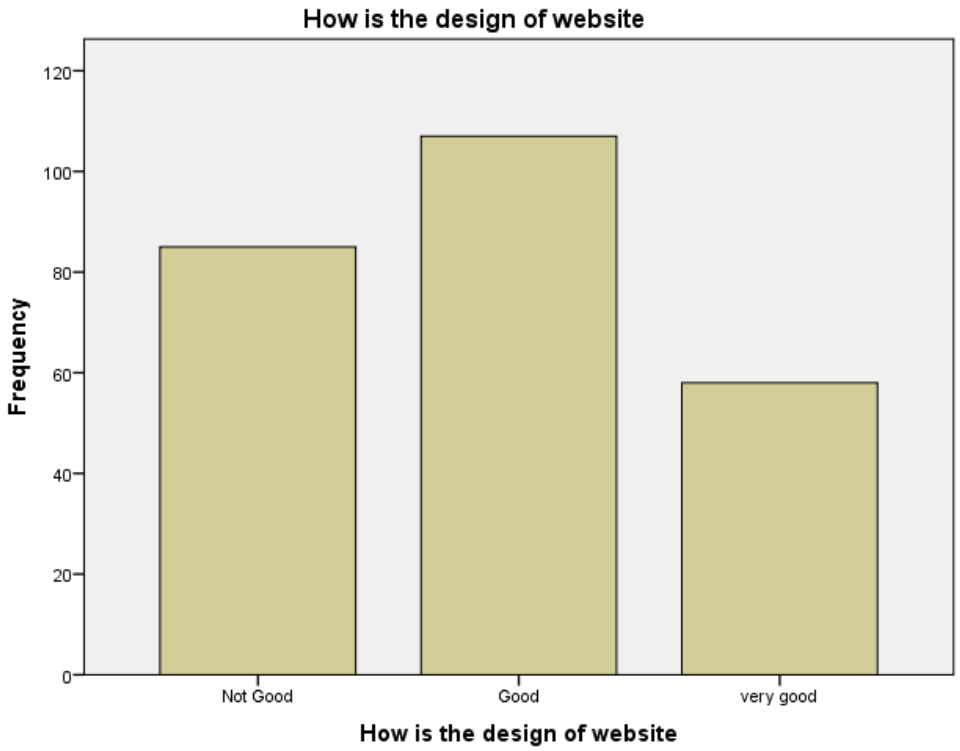

Figure 18:Represents amount of respondent's response related to design of website

Another question that was asked is: How is the design of the website? In order to answer this question as well, the options of yes and no were not provided according to the nature of the question. Obviously, just from these options, it would not be possible to obtain relevantly and required answers. Thus, to ensure that reliable answers would be provided, three options were provided including: not good, good, and very good. From these options, respondents chose their answers and it provided the required information. For instance, 85 people or respondents determined that the design of the website was not good. Other than these respondents, 107 respondents indicated that the design of the website is good. Lastly, 58 people responded that the design of the website is very good. It can be analyzed from this information that the largest portion of respondents determined that the website design was good. However, it also indicates that further work is needed to be done on the website design for ensuring that more visitors can be satisfied by the design and they can interact effectively with the website without experiencing any difficulty.

This question has been answered by a total of 250 respondents and their frequencies are presented in table 6. Figure 18 a bar chart diagram represents the percentages of the respondents related to the design of the website. It has been

represented that 34% of the total respondents who said that the design of the website is not good it depicts there is a need for improvement in design. There are 42% of the total respondents who said that the design of the website is too good because it is universally designed the frequencies of these respondents are 107. Meanwhile, it has been stated by the remaining 23% of respondents that the design of the website is very good because it is a universal design that works for disabled people as well. The yellow color of the above-given bar chart is illustrating the percentages of the respondents.

How is the colors of website

	Colors	Frequency	Percent	Valid Percent	Cumulative Percent
	Not Good	101	26.0	40.4	40.4
	Good	54	13.9	21.6	62.0
	very good	95	24.4	38.0	100.0
Total		250	64.3	100.0	

Table 7: Respondents responses related to color of the EMS website

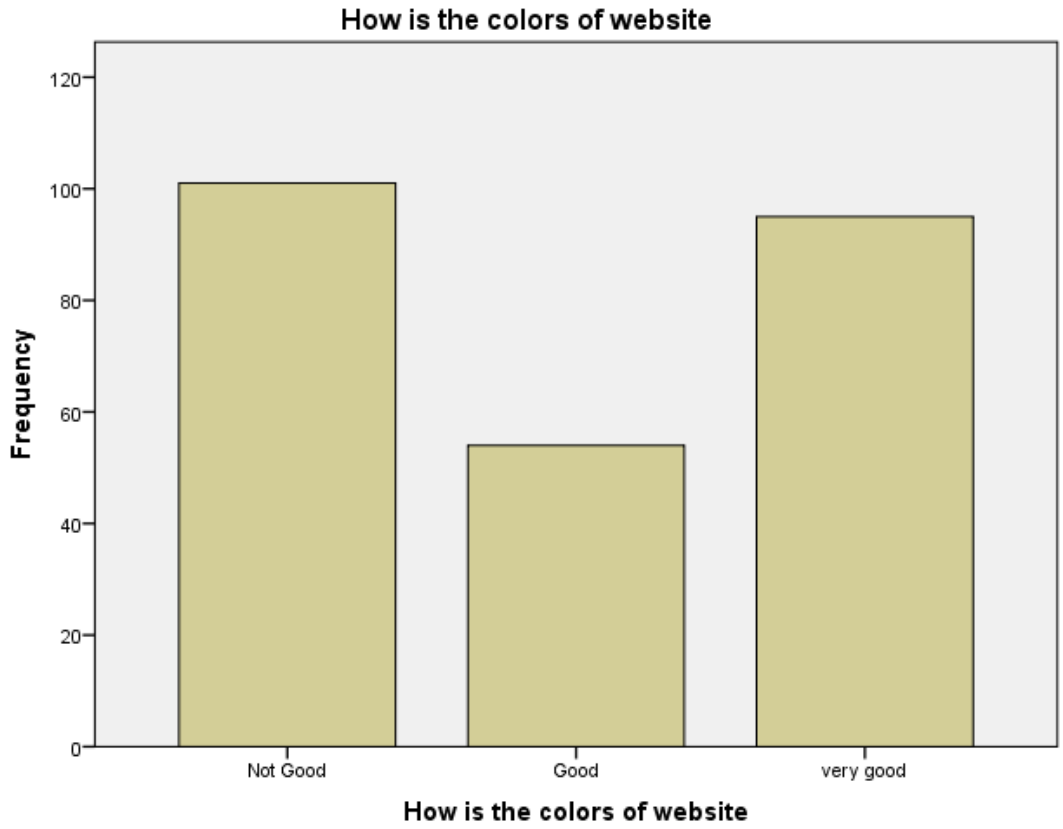

Figure 19:Bar chart representing frequency of respondents against colors quality of EMS website

The next question is: How are the colors of the website? The same can be said about this question as well because an answer in simple yes or no would not be sufficient enough to provide the necessary details. Therefore, rather than providing these two options, the same options as the previous question were provided in this question as well. The options to answer the question included: not good, good, and very good. Out of 250 respondents. 101 respondents determined that the colors used on the website are not good. Meanwhile, 95 respondents concluded that the colors used on the website are good. Lastly, 95 respondents gave a response that the color combination used on the website is very good with good contrast. It can be analyzed from these results that the largest portion of respondents did not like the colors that were used on the website. Although 95 respondents considered the colors are very good, it is important to note that the objective is to deliver a website that meets the requirements of every person. Thus, work is required to be done to improve the colors used on the website. In Figure 19 a bar chart visually represents the frequency of respondents for those three answers. The bar chart is also

illustrating the percentages of the respondents such as; high column at the bar chart is representing the percentages of the people who did not like the color of the website.

Table 7 represents the frequencies and percentages of the respondents who responded related to the color of the website. It has been represented in this table that 40% of the total respondents who said that the design of the website is not good because they believe it could use better colors. There are 21.6 % of the total respondents who said that the color of the website is too good maybe they believe it is developed in attractive color. Meanwhile it has been stated by the remaining 38% respondents that color of the website is very good because an attractive colors has been used by considering the consumer's perception. Moreover, people have different color choices.

How good and relevant the images are

	Frequency	Percent	Valid Percent	Cumulative Percent
Not Good	13	3.3	5.2	5.2
Good	147	37.8	58.8	64.0
very good	90	23.1	36.0	100.0
Total	250	64.3	100.0	

Table 8:Frequency of people responses on images feedback of EMS website

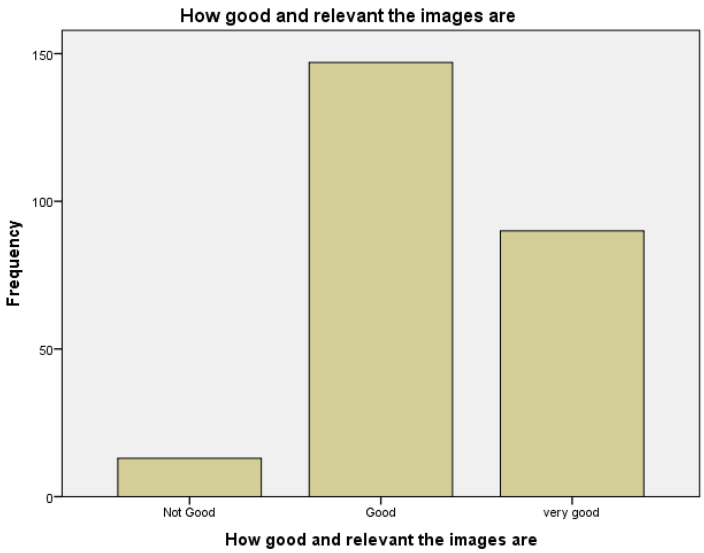

Figure 20: bar chart representing Frequency of people responses on images feedback of EMS website

This question has been answered by the total 250 respondents and their frequencies are presented in table 8. The above-given table of the frequency distribution is illustrating the frequencies and percentages of the respondents related to the images of the website. It has been represented in this table that 5.2% of the total respondents who said that the images of the website are not good because they feel that the images are a bit blur and do not provide much information. The frequencies of these respondents are 13. There are 58% of total respondents who said that the image of the website is too good because these are developed by following universal design principles and do have image descriptions when the mouse is hovered over on them. The frequencies of these respondents are 147. Meanwhile, it has been stated by the remaining 36% of respondents that images of the website are very good. The bar chart in figure 20 is also illustrating the frequencies of the respondents such as; high column at bar chart is representing the percentages of the people who said that the images of the website are too good and attractive.

How was the experience of website on your smartphone?

		Frequency	Percent	Valid Percent	Cumulative Percent
	Not Good	36	9.3	14.4	14.4
	Good	52	13.4	20.8	35.2
	very good	162	41.6	64.8	100.0
Total		250	64.3	100.0	

Table 9:Experience of EMS website on smartphone

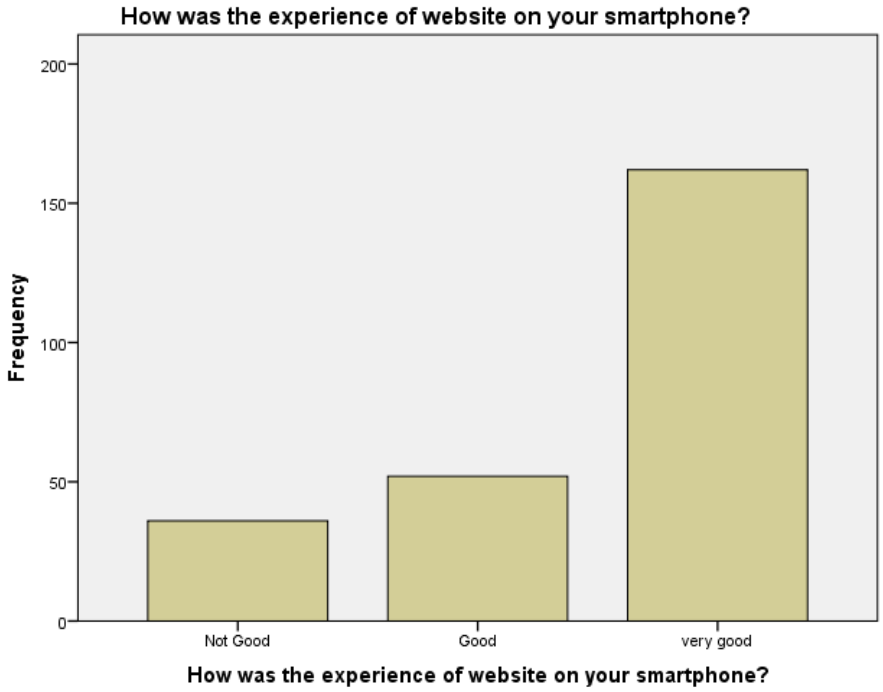

Figure 21: bar chart showing respondents experience of EMS website on their smartphones

Another question that was in the survey was: How is the experience of the website on your smartphone? In order to obtain relevant and useful answers from respondents, three options were given to them that included: not good, good, and every good. Table 9 illustrates that out of the 250 respondents, 36 respondents

responded that the experience was not good. Meanwhile, 52 respondents determined that their experience was good. Lastly, it was determined by 162 respondents that their experience was very good. From these results, it can be analyzed that most of the respondents are satisfied by using the EMS website on the mobile device. Although there some respondents considered that it is not good, but the larger portion of respondents has determined it to be very good. Though few respondents did not like the experience, it is quite important to ensure that website is universally designed and give good performance on all kind of devices and screen sizes. In this manner, most people can interact with it in a better manner.

The bar chart in figure 21 illustrating the percentages of the respondents such as; high column at bar chart is representing the percentages of the people who said that their experience of the EMS website on the smartphone was pretty good.

In which language do you prefer to read the content of this website?

		Frequency	Percent	Valid Percent	Cumulative Percent
	Urdu	109	28.0	43.6	43.6
	English	141	36.2	56.4	100.0
Total		250	64.3	100.0	

Table 10: Frequency of respondents to choose their preferred language

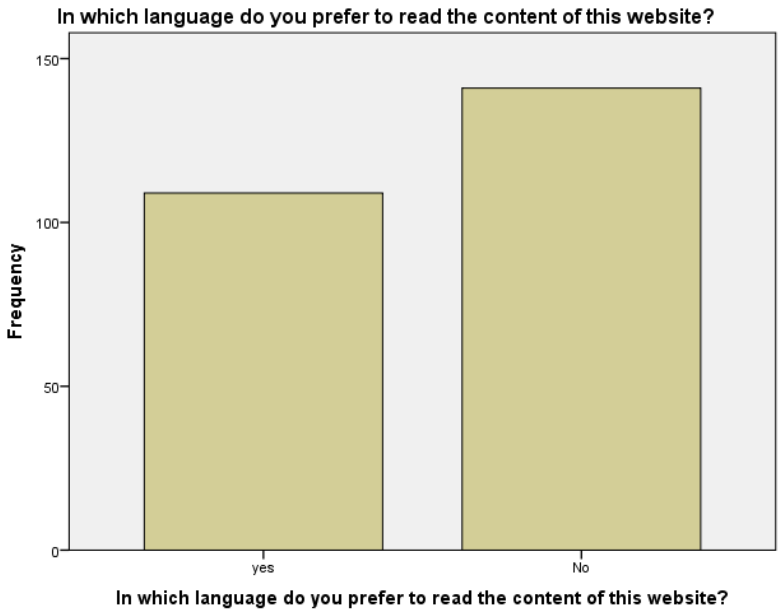

Figure 22:Bar chart illustrating frequency of people to choose their preferred language

Table 10 of the frequency distribution is illustrating the percentages and frequencies of the respondents for the selection of the language in order to read out and visit the website. The prototype of the website is developed by considering the respondents and the given choice for this question is related to English and Urdu. It has been observed in table 10 that there are 109 respondents who prefer the Urdu languages to read the website and they are 43.8% of the total respondents. Remaining 56.2% of the total respondents prefer English langue in order to read this website and they are 141 participants of the total respondents. The higher column on the bar chart in figure 22 is also illustrating the percentages of the respondents who prefer the English language for the respondents.

Is the content of this website is relevant and good?

	Content	Frequency	Percent	Valid Percent	Cumulative Percent
	Not Good	37	9.5	14.8	14.8
	Good	80	20.6	32.0	46.8
	very good	133	34.2	53.2	100.0
Total		250	64.3	100.0	

Table 11:Respondents feedback related to content of the EMS website

This question is related to the relevant content of the website. It has been observed by table 11 on this website that there are 37 respondents who stated that the content is not that good that it could be. This is 14.6% of the total respondents. They feel it because they do not clearly understand this content. There are 32% of the total respondents who said that the content of the website is good, and they are 80 respondents. Meanwhile, according to the remaining 53.1% of the total respondents, the content of the website is to the point and relevant and. These are the 133 respondents that can be seen in table 11.

Did you find this website meaningful?

		Frequency	Percent	Valid Percent	Cumulative Percent
	Yes	5	1.3	2.0	2.0
	No	143	36.8	57.2	59.2
	Don't Know	102	26.2	40.8	100.0
Total		250	64.3	100.0	

Table 12:Frequency of respondents narrating the EMS website is meaningful or not

The next question of the survey is the EMS website is meaningful. It has been observed in this table 12 that there are 143 respondents who stated that this website does not seem to be meaningful for them and this is 57.2 % of the total respondents. It might be because they do not clearly understand the content of the website. There are only 2% of the total respondents who said that the content of the website is good, and they are 5 respondents only. Meanwhile, according to the remaining 40.8 % of the total respondents, they don't know either this website is meaning full or not. These are the 102 respondents who are not sure about it.

Did this website help you?

		Frequency	Percent	Valid Percent	Cumulative Percent
	Yes	45	11.6	18.0	18.0
	No	99	25.4	39.6	57.6
	Don't Know	106	27.2	42.4	100.0
Total		250	64.3	100.0	

Table 13: Frequency of respondents providing inputs about the usefulness of the website

The next survey question was did this website helpful for you. It is clear from table 13 that 99 respondents who stated, this website is not helpful and this is 39 % of the total respondents. Out of 250 respondents, only 45 of them responded that this website was helpful for them it is 18% of total frequency. While according to the remaining 42.4 % of the total respondents they don't know either this website is helpful or not. These are the 106 respondents who even don't know how this website can be helpful.

Is the text of website easily readable?

	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	24	6.2	9.6	9.6
No	226	58.1	90.4	100.0
Total	250	64.3	100.0	

Table 14: Frequency of respondents answering, the text is readable or not

This question is related to the readability of the content of the website according to its content and design that has been used for the website. It has been observed that 9.6 % of the total respondents who said "Yes" the text of the website is easily readable for which they are searching and looking for and these are the 24 respondents. It has been observed that there 90.4 % of the total respondents who said "No" the text of the website is not easily readable, and these are the 226 respondents. The percentages of these respondents can be seen in table 14.

Were you aware about these precautions before?

	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	24	6.2	9.6	9.6
No	226	58.1	90.4	100.0
Total	250	64.3	100.0	

Table 15: Number of respondents having information of earthquake precautions

Figure 23:bar chart illustrating number of respondents having information of earthquake precautions

This survey question was related to the awareness that respondents have about the precautions of the earthquake. As well as the content of the website according to its content and design that has been used for the precautions of the earthquake. From table 15. it has been observed that 9.6 % of the total respondents responded "Yes" they have good information for the precautions of the earthquake before this website and those are the 24 respondents. It has been observed that 90.4 % of the total respondents who said “No” they have not any information about the precautions of

the earthquake and these are the 226 respondents. The percentages of those respondents can be seen in figure 23.

How much do you think this website can help diverse people from earthquake situations?

		Frequency	Percent	Valid Percent	Cumulative Percent
	Very less	13	3.3	5.2	5.2
	Normal	147	37.8	58.8	64.0
	Very much	90	23.1	36.0	100.0
Total		250	64.3	100.0	

Table 16:Responses of respondents related to diverse people support through EMS website.

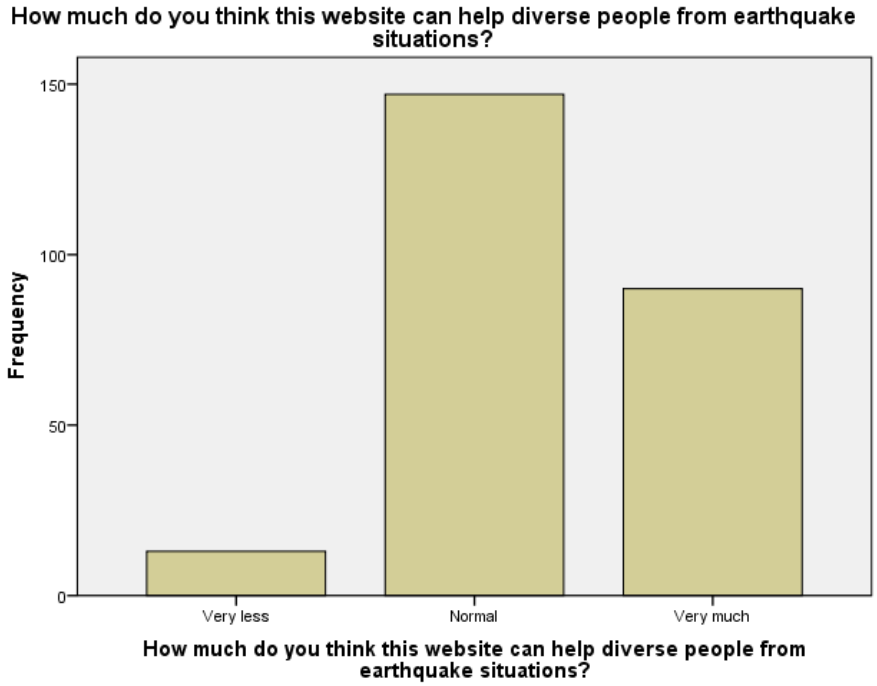

Figure 24:Frequency of respondent's responses that how much diverse people can gain knowledge from EMS website

The next question of the survey was: How much do you think this website can help diverse people from earthquake situations. In this question, the word diverse is mainly targeting the elderly or people having disabilities. This question also covers the quality of the content of the website i.e. it's content and design that has been used for helping the diverse people. From table 16 it has been observed that 5.2 % of the total respondents said that this website is less helpful for the diverse people. It has been observed that there are 58% of the total respondents who said this website is helping diverse people and respondents. There are 36% of the total respondents who said that the website is very helpful. From the bar chart in figure 24. it can be seen that the number of respondents who responded that for diverse people this website is from least helpful to most helpful are 13, 90, and 147 respectively.

Have you ever used any other similar website regarding earthquake precautions?

		Frequency	Percent	Valid Percent	Cumulative Percent
	Yes	24	6.2	9.6	9.6
	No	226	58.1	90.4	100.0
Total		250	64.3	100.0	

Table 17: Frequency of respondents that have already used similar kind of website

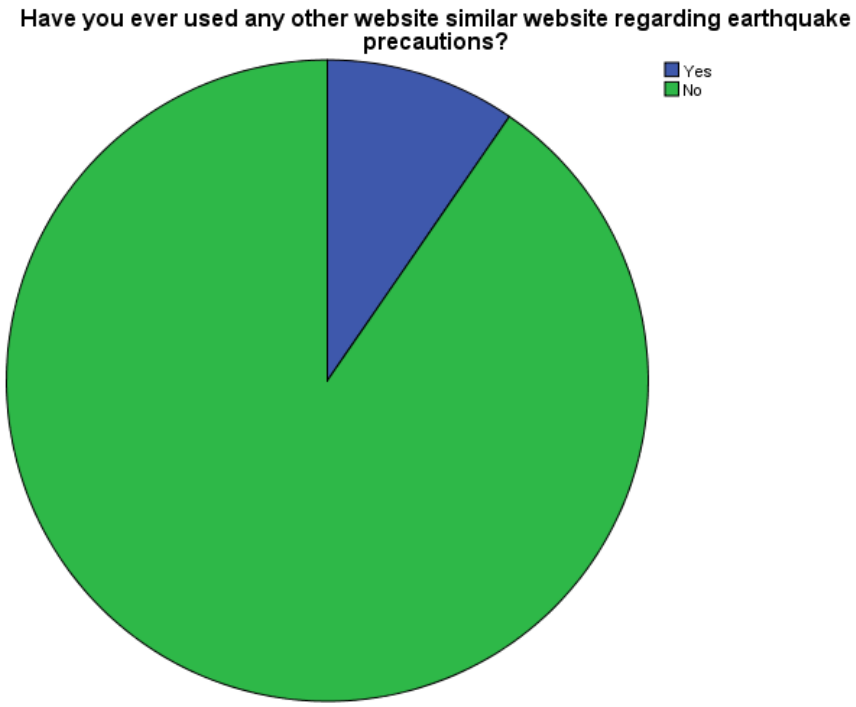

Figure 25: Percentage of respondents that have or have not used similar kind of website before.

The last question of the survey is: Have you ever used any other similar website regarding earthquake precautions? From table 17 it is clearly obvious that 9.6 % of the total respondents, responded "Yes" to this question. It means they were already aware of earthquake preparedness and safety precautions. The frequency of these respondents is 24. While on the other hand, 90.4 % of the total respondents responded “No” to this question it depicts that out of 250 respondents 226 respondents might not have the necessary information about the precautions of the earthquake and these are the 226 respondents. The attractive colors of the pie chart in figure 25. is also illustrating the percentages of the respondents. The green area on the pie chart is representing the percentages of the respondents who have not used such kind of website before. The blue section is representing the percentages of the respondents who used this information.

Discussions

After the careful analysis of the responses retrieved from the survey. It is observed that respondents from the age group of fifty and fifty plus, mostly they responded that the content of the website is not easily readable. There could be two possibilities of it either the aged people have weak eyesight, or they were reading the content of website in Urdu language as majority of Pakistani old people cannot read English (Laila Akber Cassum, 2020). It is clearly obvious that Urdu font that is used in website is not super good, but this is the only Urdu font that is available.

It is analyzed that no significant diversity is observed between responses on the basis of gender and the age group less then forty. Moreover, majority of the respondents answered that they were not aware of earthquake precautions and least number of respondents seen such kind of websites before.

The developed website and the concluded results do agree with the previous research and literature as this universally designed website increases diverse audience to use the system. This developed universally designed earthquake management system is important as it could save lives. This is the strongest aspect of this research. However, some elderly and people with disabilities still need someone’s assistance during earthquake this could be weak aspect of this research.

Conclusion

One of the research questions of this research study was:

How can the Universal design of ICT reduce the impact of emergencies or support diverse people in emergencies., in particular for Earthquake situations in Pakistan?

Since after making the website and conducting and analyzing the survey questions it is concluded that the majority of Pakistani people didn't use such kind of website before and the majority of them were not aware of earthquake precautions. Moreover, many Pakistani people cannot read English and a Universally designed website helped them to read it in their national language Urdu. Finally, some people with disabilities also managed to use the website to some extent all these factors somehow answered the above-mentioned research question.

The second research question of this research study was:

What are the requirements for such a universally designed information system?

This research question was answered well during the literature review and methodology section. It should follow Web content accessibility guidelines 2.0 with level AA. It should fulfill universal design principles and the content of the system should be readable and easily understandable.

Last research question of this research study was:

What is a suitable universal design for such a system that is optimized for the situation in Pakistan regarding the availability of ICT equipment and network?

This research question was also explained in the literature review and methodology section. The universally designed system should be lightweight due to slow internet speed in Pakistan. It should provide the instructions in audio as well for deaf and blind people. There is a huge amount of Pakistani people who has low eyesight so webpage should be responsive and supports zooming feature to make text content easily readable for low eyesight users.

The targeted audience of this study was quite generic. In the future, further research could be done on a specific audience, for example, people having a specific type of

disability and what kind of problems they face during using such kind of Universally designed emergency system.

During this research study, it is also observed that many Pakistani people do not aware of such kind of systems. Further research could be done to fill this gap that how universal design can promote such a universally designed information system amongst the people of Pakistan.

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