Czech University of Life Sciences Prague

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Bachelor Thesis

Post-Earthquake Safety Assessment on Mobile Devices

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CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Faculty of Economics and Management

BACHELOR THESIS ASSIGNMENT

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Thesis title

Post-Earthquake Safety Assessment on Mobile Devices

Objectives of thesis

The main objective of this thesis is to examine the designing and prototyping process of a mobile application that provides rapid safety assessment after an earthquake.

Partial objectives:
- To review the available literature on communication in crises, and data crowdsourcing.
- To analyze the requirements and propose new solutions for the app.
- To design a mock-up interface of the app and conduct a user test
- To evaluate the proposed app, formulate recommendations and a natural conclusion.

Methodology

The theoretical part will consist of a comprehensive literature review of relevant academic articles, professional books, and earthquake-related organizations to examine the current state of the art of using mobile platforms for rapid safety assessment during crises. This thesis will employ fundamental scientific, software engineering, and user interface design methods.

The practical part of the thesis will include designing a mobile application that provides rapid safety assessment after an earthquake. Based on the synthesis of the theoretical findings and the results of the practical part, the recommendations will be formulated, and conclusions will be drawn.

The proposed extent of the thesis

50 pages

Keywords

Mobile application, earthquake, safety assessment, rapid reporting, user interface.

Recommended information sources

AMIRESMAILI, Mohammadreza, et al. Role of social media in earthquake: A systematic review. Iranian Red Crescent Medical Journal, 2021, 23.5.

MARTÍNEZ-ROJAS, María; DEL CARMEN PARDO-FERREIRA, Maria; RUBIO-ROMERO, Juan Carlos. Twitter as a tool for the management and analysis of emergency situations: A systematic literature review. International Journal of Information Management, 2018, 43: 196-208

MORA, Kate, et al. Public perceptions of building seismic safety following the Canterbury earthquakes: A qualitative analysis using Twitter and focus groups. International journal of disaster risk reduction, 2015, 13: 1-9.

SIKDER, Md Fahim, et al. Smart disaster notification system. In: 2017 4th International Conference on Advances in Electrical Engineering (ICAEE). IEEE, 2017. p. 658-663.

SONWANE, Varsha S. Disaster management system on mobile phones using google map. Proceedings of International Journal of Computer Science and Information Technologies (IJCSIT), 2014, 5.

SUWAL, Dipesh, et al. Geofencing post-disaster scenario using android app. In: International Workshop on Strengthening Opportunity for Professional Development and Spatial Data Infrastructure Development, Kathmandu-Nepal. 2015.

WALD, David, et al. ShakeCast: Automating and improving the use of ShakeMap for post-earthquake decision-making and response. Earthquake Spectra, 2008, 24.2: 533-553.

WANG, Yanxin, et al. Using mobile phone data for emergency management: a systematic literature review. Information Systems Frontiers, 2020, 22: 1539-1559.

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Prague on 12. 02. 2024

Declaration

I declare that I have worked on my bachelor thesis titled "Post-Earthquake Safety Assessment on Mobile Devices" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the bachelor thesis, I declare that the thesis does not break any copyrights.

In Prague on 15.03.2024 _____

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Post-Earthquake Safety Assessment on Mobile Devices

Abstract

After the natural disasters that occur in many countries today, there are still deficiencies in time management and correct coordination. Among these natural disasters that affect people's lives and create a race against time after they occur, one of the most important is the earthquake. Nowadays, different technological methods need to be used to manage the time after an earthquake. Governments of countries and their citizens need to act with technology during this critical crisis management process. The fact that information and communication technologies (ICT), social media, and e-government are all effective in different ways for a single purpose. It can be considered as proof that mobile technology can be disseminated and used in the easiest way after the earthquake. This study aims to investigate the most effective ways of using today's post-earthquake information sources, how a difficult period such as post-earthquake should be managed with coordination by government institutions, and how people become a part of it with social media and mobile devices.

In conclusion, this study provides a different vision of how mobile technology can help people report their situation in the shortest possible way after an earthquake, how to minimize information pollution for a government institution, and how mobile devices can help people achieve results in post-disaster time management.

Keywords: Mobile application, earthquake, safety assessment, rapid reporting, user interface.

Posouzení bezpečnosti po zemětřesení na mobilních zařízeních

Abstrakt

Po přírodních katastrofách, ke kterým dnes v mnoha zemích dochází, stále existují nedostatky v řízení času a správné koordinaci. Mezi těmito přírodními katastrofami, které ovlivňují životy lidí a vyvolávají závod s časem poté, co k nim dojde, je jednou z nejdůležitějších zemětřesení. V dnešní době je pro řízení času po zemětřesení potřeba používat různé technologické metody. Vlády zemí a jejich občané musí během tohoto kritického procesu krizového řízení jednat s technologií. Skutečnost, že informační a komunikační technologie (ICT), sociální média a e-government jsou účinné různými způsoby za jediným účelem. Lze to považovat za důkaz toho, že mobilní technologii lze po zemětřesení nejsnáze šířit a využívat. Tato studie si klade za cíl prozkoumat nejúčinnější způsoby využití dnešních zdrojů informací po zemětřesení, jak by se obtížné období, jako je po zemětřesení, mělo zvládnout s koordinací vládních institucí a jak se lidé stávají jeho součástí pomocí sociálních médií a mobilních zařízení.

Závěrem lze říci, že tato studie poskytuje jinou vizi toho, jak mohou mobilní technologie pomoci lidem nahlásit jejich situaci co nejkratším způsobem po zemětřesení, jak minimalizovat znečištění informací pro vládní instituce a jak mohou mobilní zařízení pomoci lidem dosáhnout výsledků po zemětřesení. řízení času katastrof.

Klíčová slova: Mobilní aplikace, zemětřesení, hodnocení bezpečnosti, rychlé hlášení, uživatelské rozhraní.

Table of content

1 Introduction

Natural disasters have always caused loss of life and property throughout history. One of the most critical disasters that cannot be resisted today is the earthquake. Each country reacts differently to an earthquake. The loss of life, material damage and the impact on trust between society and the government can be seen at different rates in each country. Certain preparations must be made against an earthquake that will eventually occur through scientific means. A community must first be made aware of earthquakes by its own state, and then put this awareness into practice. A state that raises awareness among its society is obliged to be closely interested in the concept of e-government and to resort to technological means for the best management.

The third chapter explains how a state can raise awareness about earthquakes among its people and in what ways it can make its people think about it. After providing adequate education about the earthquake to the people, it is explained how the community will benefit from the current combination of e-government and technology. In the period that needs to be managed after the disaster, the public as well as the state institutions have been an important part of this process. Findings are presented on how the public helps its own people through social media. It has been researched for what purposes mobile devices, which are the most widely owned technology by the public today, can be used after the earthquake and how they can contribute to the process.

In the fourth chapter, as a result of the findings in the literature review, the idea of developing a mobile application on how users can interact with e-government to meet their needs after the earthquake on mobile devices is presented. Accessing live earthquake data and user experience of an application that will be used by citizens to help themselves and their surroundings constitute the main parts of the practical part.

2 Objectives and Methodology

2.1 Objectives

The main objective of this thesis is to examine the designing and prototyping process of a mobile application that provides rapid safety assessment after an earthquake.

Partial objectives:

- To review the available literature on communication in crises, and data crowdsourcing.
- To analyze the requirements and propose new solutions for the app.
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2.2 Methodology

The theoretical part will consist of a comprehensive literature review of relevant academic articles, professional books, and earthquake-related organizations to examine the current state of the art of using mobile platforms for rapid safety assessment during crises. This thesis will employ fundamental scientific, software engineering, and user interface design methods.

The practical part of the thesis will include designing a mobile application that provides rapid safety assessment after an earthquake. Based on the synthesis of the theoretical findings and the results of the practical part, the recommendations will be formulated, and conclusions will be drawn.

3 Literature Review

3.1 Earthquake Preparedness

Earthquakes are natural disasters that are difficult to predict and cause serious damage to a society in terms of loss. In order to reduce the losses that may be experienced, certain earthquake preparations should be applied. The current literature shows that as the earthquake knowledge in people increases, the preparation to be made will increase in a positive way. People who have self-governing information about earthquakes are more likely to be prepared, according to a study conducted in a rural area of China. Another part that tends to be more prepared is people living in areas with higher earthquake risk. Being informed about the earthquake and being aware of the earthquake by the people creates a positive effect on the people living in the places where the earthquake risk is high. These people are more conscious about being prepared for a possible earthquake and they are more inclined to prepare. An important factor in raising the awareness of local residents about earthquakes is government agencies.

Government agencies can reduce losses in future earthquakes by improving public earthquake education. It is also important how much knowledge one has about natural disasters. According to the level of knowledge possessed, the level of preparedness of individuals also varies. Education is a crucial factor in raising awareness of earthquake information among individuals and families attending school in a community. With the education given in terms of earthquake preparedness, a community can be prepared for itself against earthquakes. And as a result, it can be seen that disaster awareness acquired through education has a positive impact on the public.

How accessible the resources are also playing an important role in people's preparedness for a natural disaster. Besides the level of accessibility of resources, an individual's ability to learn on their own is also important. Motivating the community to take precautions against disasters is another factor that will reduce the loss and damage that occurs after an earthquake. [10]

3.1.1 Promoting Earthquake Awareness and Education

Earthquakes are natural disasters with important consequences for humanity. Earthquakes are events that occur without human control. It is an underground disaster and causes tremors on the ground surface. Earthquakes, in addition to being one of the most important natural disasters, cause physical, economic, and social losses for humans. Apart from loss of life and property, psychological and sociological problems can also be seen in survivors. Raising awareness of the public about earthquakes gives positive results in the preparedness of the public against earthquakes. Public awareness and education efforts initiated after the 1971 Sylmar earthquake in the USA confirmed that people's rate of earthquake preparedness has increased. Earthquake Preparedness rates were measured and seen in the same region in 1987 and 1989. The importance of education, the positive change in the statistics measured after the earthquake, has been proven based on a certain factor. This factor is that people who are educated about earthquake awareness are better prepared for earthquakes and know better what to do in the event of an earthquake. For the purpose of having information about a disaster, getting its education directly instead of the information learned from the environment provides a more scientific approach. [1]

3.1.2 Empowering Society for Effective Disaster Response

Emergency management reminded that it is the most important issue with the global COVID-19 outbreak in 2020. In an emergency management, a successful process cannot be implemented without collaboration. Collaboration is an important factor for accurate information flow and instant information identification. [4] As the experience of disaster events increases, the knowledge of the measures to be taken increases in direct proportion. [2] After an earthquake disaster, society's awareness of the situation plays an important role in the reactions given. In addition to having sufficient awareness of society, the effort given is also a key factor to reduce the damage after the disaster. [3] In the last two to three decades, the number of people affected by natural disasters has grown disproportionately with population growth. It is necessary for a society to have the ability to respond to these natural disaster threats, which they feel deeply both economically and as loss of life. In order for a society to feel responsible and cope effectively with disasters without being left alone, government must first and foremost play an important role. As a result of the responsibility that the government does not fulfil in the event of a disaster, the people in that community are the ones who suffer

the most. This situation does not depend on the level of economic situation of the country. The table below (Table 1) shows the loss of life among the severe earthquakes, which is a critical natural disaster, in recent years.

Year	Country	Death	Magnitude
2023	Türkiye and Syria	53,537	7.8
2023	Morocco	2122	6.8
2022	Indonesia	321	5.6
2022	China	40	6.8
2022	Afghanistan and Pakistan	1100	6.1
2021	Haiti	2200	7.2
2021	Indonesia	81	6.2
2020	Greece and Türkiye	120	6.9
2018	Indonesia	4340	7.5
2018	Indonesia	460	6.9

Table 1 - Some devastating earthquakes in the last 5 years

Even if the most basic needs of people are tried to be met and different measures are taken after a natural disaster, dissatisfaction can be seen in the results. The reason for this may occur as a result of the society not including itself in this solution process. The idea of Community Based Disaster Management (CBDM) has gained importance as the people at the community level are the first and most affected in the event of a disaster. CBDM aims to make people more free in the use of resources after the disaster, to have more control in this difficult process and to keep simple social services in a way that society can use more easily. With these goals, it is aimed to give the society the ability to know what to do after the disaster, to evaluate and comprehend the situation in an emergency, and most importantly, to make the right decision and implement it. [5]

With the aim of keeping the buildings standing after the earthquake, it can be aimed to increase the investments made by the government in seismic improvements. It has been proven as a result of some research that the strength and indestructibility of the buildings in the event of an earthquake is related to the safe and fast exits of the people, rather than the height of the building and the material used in its construction. While questioning the earthquake resistance of the building in which a citizen lives, of course, he can see the design of that building and the

materials used as a key element. However, making a professional decision about the earthquake vulnerability of a building requires knowing more than these factors. From the perspective of a citizen, the age of a building may be perceived as the most important factor. People may also consider an old but reinforced building to be more robust than a newly constructed building. Building owners are also reluctant to participate in strengthening activities, partly because of their belief in their effectiveness, but also because of their perception of earthquake risk in general and the financial expense that would require communication in the event of a crisis. [22]

3.1.3 Earthquake and Evacuation Drills

After years of hardships in terms of natural disasters, it is seen by international organizations that societies are prepared for emergencies at this time of disaster. Drills are held to educate communities on what to do in the event of or after a disaster. For example, to train key actions such as the first steps to take when an earthquake occurs, and the process people should go through when evacuating are important goals in the drills. [6] When the steps to be followed during the earthquake and during the evacuation after the earthquake are applied correctly, the number of deaths will be reduced (non-structural deaths). [7]

A government must be active as a pre- and post-disaster response to ensure security for its community. When a disaster occurs, the public's trust in the government agency that should take action related to that natural disaster may not be so clear. [9]

A nationwide earthquake drill is being held in New Zealand. This exercise is called ShakeOut and is organized by the Ministry of Civil Defense & Emergency Management. The main purpose of the exercise is to inform and educate the people of New Zealand on what to do during and after the earthquake. Apart from the main purpose, activities related to pre-earthquake preparation and emergency planning are also taught to the people of New Zealand. The first of this exercise, in which New Zealand citizens must register themselves, was held on 26 September 2012 at 9.26am. The second exercise was held on 15 October 2015 at 9.15am. 1.3 million people participated in both. An observer survey was developed to evaluate the participation rate in the drills and the results of whether these drills were effective. Certain conclusions have been reached to evaluate whether ShakeOut Drill really works on humans before and after this drill. As the results show, ShakeOut Drill helped the community talk more

about natural disasters. It has been discovered that certain measures are more likely to be taken before a disaster than to make a move afterwards. The rate of getting survival items increased, and people began to make more serious plans in case of a disaster. [8]

3.2 E-Government and ICT

The highest authority in charge of major aspects of the lives of citizens living in a country is the government itself. [11] Mostly, the governments of developing countries have used computer-based information and communication technologies (ICTs) to provide basic services to their citizens and to manage the human development situation. The quality of the benefit that ICT will show to its citizens, which governments are trying to provide services to, passes through e-government. E-government is an essential part of digital government trying to stay engaged with its people. With the use of information and communication technologies, the provision of certain public services for citizens is achieved through the use of e-government. In order for the government to serve properly, there are certain services that can be considered as the application of ICT. The government's interaction with its citizens, the technological support of any government operation, and the participation of its citizens in these operations can all be achieved with the use of e-government. Besides the provision of quality public services, it is also counted as an application of ICT to ensure a higher level of accountability of a government. One of the main purposes of e-government is to make various services provided in the public sector and any government operation more efficient and transparent. While ensuring this transparency, it is also aimed to reduce the waste of public resources.

The success of an e-government is directly proportional to the capacity of the government and the performance of the e-government used. The capacity of the government is also related to how well that government develops and implements its own public policies. The level of independence of the government against political pressures, its emphasis on the quality of the public services it provides to its people, and its reaction depending on the potential of these services directly affect the capacity of that government. In addition to all the factors that show the capacity of the government, the level of credibility of that government that can be presented as evidence also plays an important role. Because e-government transparently presents all the operations followed by the government to its people. The effectiveness of the use of e-government in a country has to do with the social, economic, and technological infrastructure for e-government. The performance of e-government is determined by basic issues such as systemic and technological problems, political events, security problems, the interaction of the

administration with its citizens and cooperation between departments. The partnerships between the public and private sectors, and the integration between departments that play important roles in these sectors, also directly affect the performance of e-government. [12]

3.2.1 E-Government Usage for Disaster Management

E-government plays an important role in managing the situation after a disaster. It is also a fact that e-government is important for the dissemination of general instant information and at the same time for establishing communication correctly. It becomes even more important for the community to receive the necessary information and services, especially after a disaster. At this very moment, e-government can take over the center of this crisis management. The service to be provided to the public through e-government has a critical role in reducing the damage caused by natural disasters and significantly reducing their negative effects. E-government uses information and communication technology as a term. It is used to facilitate interaction of both public authorities and citizens as individuals with other citizens. It helps make certain government information available to the nationwide public. Among its offerings to the public, the availability of certain government services is also a key factor. There is certain national or local information that may be made available to the public. These particular information or services that the government is willing to offer to its people after a disaster are available over the internet. It is generally available through web browsers and mobile apps. With the exception of a disaster, certain information generally available to the public includes public events, announcements, news and current events as examples.

Among the services that a citizen can use with the help of e-government in daily life, renewing driver's licenses, paying taxes and getting information about various permit processes can be given as examples. The critical factor that makes e-government a necessary tool is the interaction it provides to its citizens. The attitude of citizens in a country towards the e-government system in that country is directly proportional to their trust in the government. In general, it is about the feeling of trust that state officials and the government formed by these officials give to their own citizens. The collection of transparent information that authorized people give to their people plays a role in gaining the trust of people. Thus, the more accurate the information and transparency of a government, the more attention it will receive in return for the service it will render to its people. The possibility of a citizen to provide convenience by using e-government services is directly proportional to all these trust factors. The more the citizen trusts the state

authorities, the more likely they are to use the e-government service they have the right to, and the probability of benefiting for themselves increases or decreases at the same rate. [13]

It is known that the frequency of people's use of e-government is related to how satisfied they are with the government's basic policies. The aspect referred to as government transparency can be considered as a bridge between people's use of e-government and their satisfaction with the services they receive. Any political distrust in the public can change the perspective of those people towards the service they will receive from the same government. Among the factors that depend on people's use of e-government and their trust in the service they will receive, analysis of social psychology and behavioral economics can be included. The e-government movement, which has been heard a lot in the last 30 years in European countries and the United States, encourages the participation of the public by taking certain steps for each country's own citizens. E-government is a definition that also seeks to motivating and supporting government operations. For people who advocate e-government, the way e-government is used should enable people to gain knowledge based on the government's performance. The accuracy of this information can encourage more diligent transparency by a government. [14]

3.2.2 E-Government Development Index (EGDI)

Within the reports published regularly by United Nations Department of Economic and Social Affairs (UN DESA) for 20 years, it has been published that a factor called E-Government Development Index (EGDI) determines how developed or undeveloped an e-government is. Government agencies use internet technologies to strengthen the connection and communication between citizens as individuals and also between the same citizens and firms. Many countries seek to establish such a transformative relationship with their citizens by regularly launching new e-government initiatives. Countries regularly engage in different e-government initiatives. With these initiatives, it is aimed to establish a transformative relationship with the public. In addition to making different e-government initiatives, the development process of a country in terms of e-government should also be followed. To be a part of the development as a follower, the United Nations prepares a worldwide report. This report is about measuring how much a given country has developed in terms of e-government using the EGDI value.

EGDI Sections

There are three different sections defined that make up the EGDI index. These three terms are Online Services Index (OSI), Telecommunications Infrastructure Index (TII), and Human Capital Index (HCI). There are three different sections defined that make up the EGDI index. The first term is Online Services Index (OSI). OSI evaluates nationally important websites covering education, social services, economic factors and the environment in a country. The second term is Telecommunications Infrastructure Index (TII). The main purpose of the term is to evaluate and categorize the infrastructure of telecommunications in a country. The third term is the Human Capital Index (HCI). The United Nations has created another index called e-participation index (EPI) and this index is evaluated by focusing on elements such as e-information, e-consulting, and e-decision giving. [15]

The global average of the EGDI value has increased in recent years. A difference of 0.05 was seen between 2018 and 2020. [16]

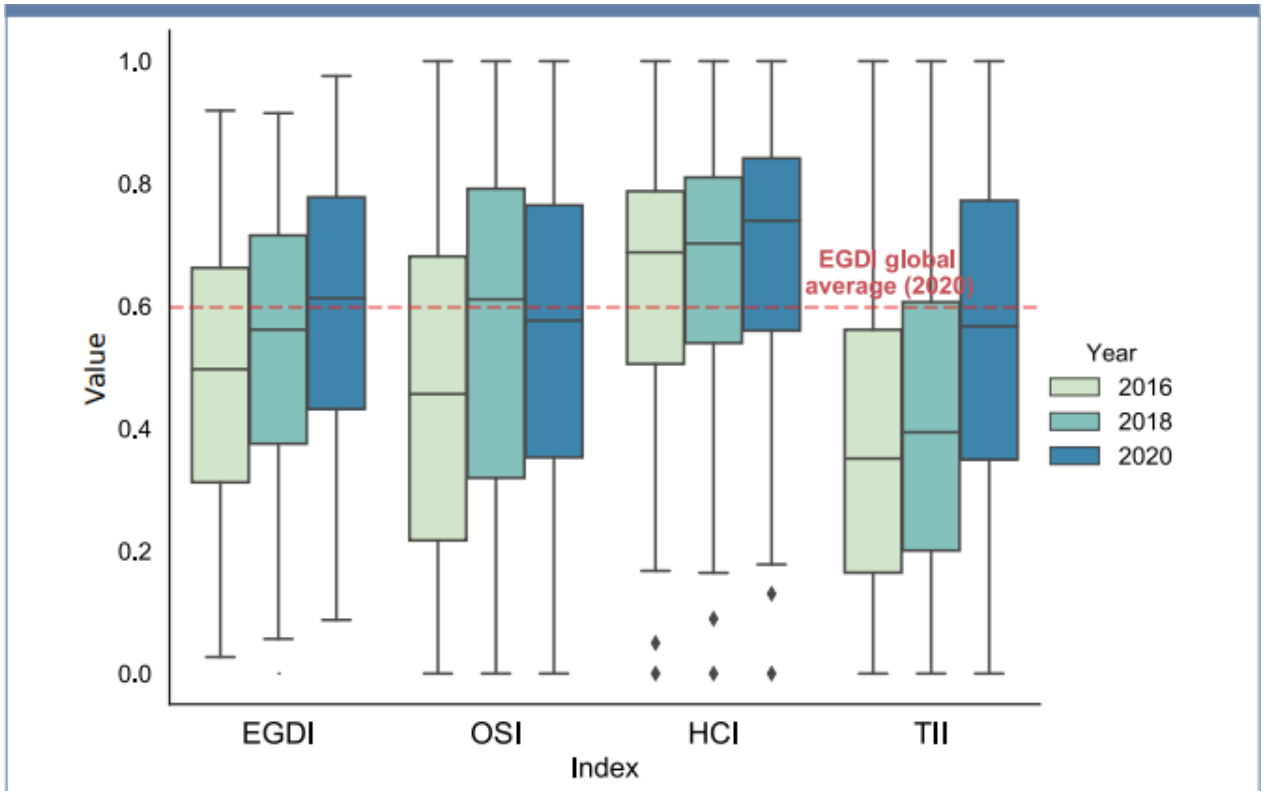


Figure 1 - The average values for the EGDI and its component indices for 2016, 2018 and 2020. [16]

3.2.3 Coordination between Government Agencies through E-Government

In order to increase the effective use of e-government, strong coordination and cooperation is required. The duties of the personnel who will work in cooperation across government institutions and departments should be clearly defined. It is aimed that the tasks to be assigned per person are in harmony with coordination. In line with these goals, the results are also expected to be completed in harmony. [18]

Collaboration is seen as a difficult and complex task to be pursued from the point of view of organizations. In order for a collaboration to be successful, it has its own indispensable factors. In organizations that want to achieve certain goals set during the collaboration, the people who will carry out the actions in the same collaboration must work in the same line. At the same time, the attitude of behavior adopted during a collaboration, the relational direction to be displayed and communication are directly related to success.

One of the biggest challenges in the implementation of e-government is related to the coordination and cooperation between government agencies, which must be seen at a good level. [18] The importance of cooperation in an e-government environment is related to the adaptability of the people who will be responsible when it comes to implementation and plays an important role. Employees who will contribute to the development of e-government within government institutions need the ability to coordinate. In addition to being able to coordinate the employees, the skills that will coordinate those employees are also needed.

Regardless of the level of authority of an employee in government, if they are to take on a role in e-government development, they must demonstrate the ability to coordinate with other employees, businesses, and citizens alike. [17] In the development process of e-government, coordination is also required in order to ensure the delivery of services with focal objectives, which are combined in line with an integrated purpose. In addition to the provision of these government services to the community, the development of the same services is also important and there is always a need for coordination. For the development of e-government, regardless of the physical or virtual environment, actors must be able to exert effort in harmony towards a goal. There are some aspects that can be described as positive and negative that actors may encounter in coordination. The efforts of people in an organization for a real teamwork and the cooperation between individuals and units can be considered as positive aspects. In an environment where there are services that are trying to be improved and effort must be made

with teamwork, another benefit of cooperation is that it eliminates the waste of resources since the actors will be in contact with each other. With the coordination between the actors, the objectives of e-Government projects will be revealed more clearly. The desired results are more comfortable and revealing for collaborating people. The fact that the actors can be in a practical harmony facilitates cooperation. Also in the same environment, inconsistencies between people and conflicts that may arise after these inconsistencies can also be evaluated as negative aspects. An institution should have formal authority that it can rely on should the cooperation environment to be established fail. [18]

The new public administration introduces a new idea of efficiency value focused on improving the performance of administrative systems and the efficiency of public service delivery. Public sectors force certain automation tools to be implemented so that the services provided can reach the community more easily. After reaching the service to be given to the community, it is also important how much the same service is available. The service to be offered to a citizen must be useful. For this, it is aimed to facilitate the use with automation tools.

When the development of e-government is considered in stages, it enters a stage where cooperation is the key component. At this stage, processes and services that can be considered different and new are included. The development of e-government is supported within the scope of new technological tools. The application of web-network governance technologies transforms the administrative processes of the public sectors and enables online participation, collaboration and consultation in various governance processes. Web network governance technologies play a role and are applied throughout the administrative processes of the public sectors. Among the core values provided by this phase are the consultation of actors with each other and the aim of online cooperation. A citizen who wishes to benefit from a service through e-government finds the right to participate in online governance processes. [19]

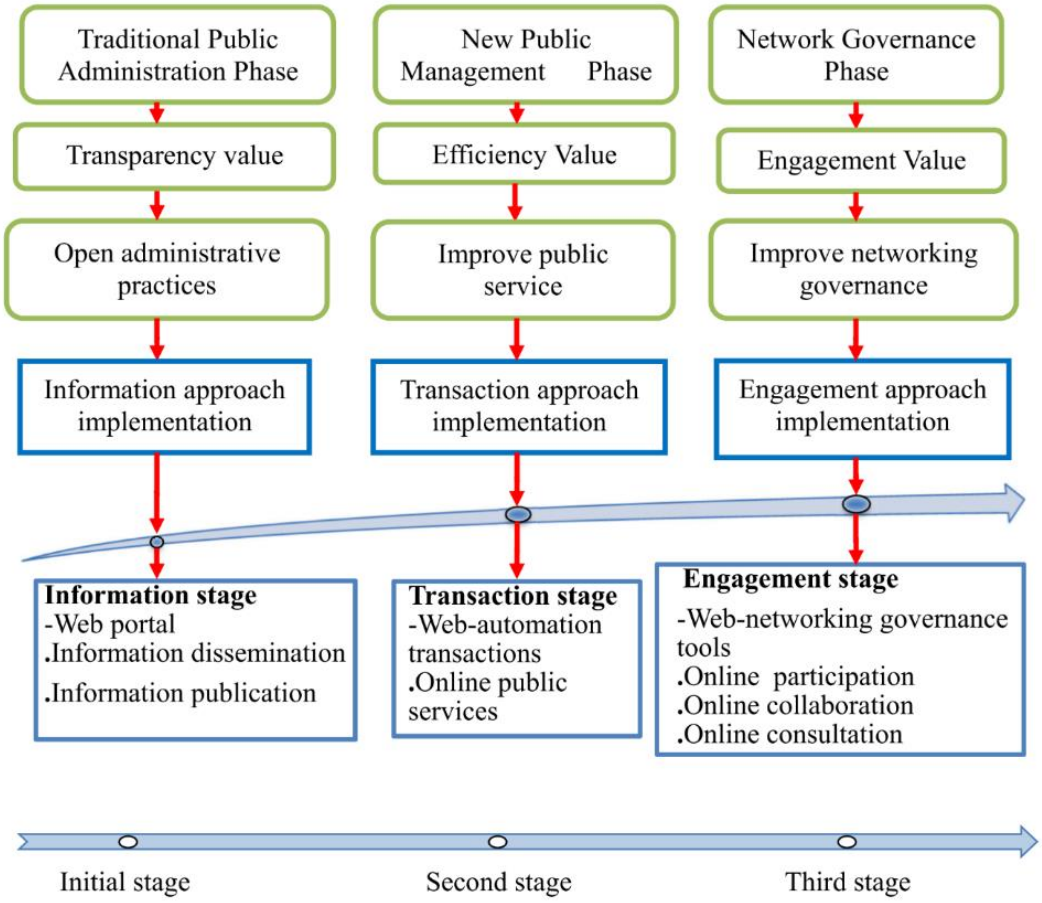


Figure 2 - Three kinds of public value and the stages of e-government development [19]

3.3 Effect of Social Media After Earthquakes

It is possible to witness an emergency situation when there is an obstacle for a normal living standard. The social media platform X, formerly Twitter, has been the most used social media platform when there is a new disaster occurred. Social media is used by the affected population when a disaster results in deaths [20].

The use of social media as a tool for disseminating information after a disaster has the effect of reducing the bad results of the disaster. Apart from that, it can also be used to communicate with people who are in a difficult situation or by citizens who want to help the community. Social media, used simultaneously for communication and information dissemination, helps reduce damage in the post-disaster period when loss of life and property must be carefully controlled. [21]

The main motivation for turning to social media is for having live information and announcing the situation of people who are having life risks at that moment. Most of the users may further spread information on the same social media platform, and even if the issue with this specific information is resolved, that information may still be circulating. The basic elements of the mainstream media are those who disseminate information to the public under normal circumstances. Instant news from television, radio and newspapers makes calls to people consciously urging them to help citizens in distress. A country's main media aims to help people with the least amount of information pollution. As technology advances and it becomes easier to create a connection between at least two people within the community, the purpose of using communication devices in the event of a disaster becomes even more important. [20]

In order for social media to have a positive impact after a disaster, the segment of the community that will use social media must show solidarity. Social solidarity is vital for citizens in distress and pushes people to support each other. Information spread on social media pushes people to act. When citizens who will act on social media feel like they are under the same roof, they begin to coordinate. Removing people from individuality while using social media means coordinating the community, ensuring solidarity, and mobilizing it at the same time. The efforts made by citizens who will take action to help via social media give morale to disaster victims. At the same time, any surviving citizen can involuntarily receive the emotional support he needs from social media. [26] Organizations can also see what the basic needs of people in the region affected by an earthquake are, thanks to social media. In the first hours after an earthquake, the areas where social media is used can be determined. Detailed information about the earthquake, the extent of damage and the number of casualties is the most visited information by people. [21]

3.3.1 Advantages and Disadvantages of Social Media in Earthquake Response

The main advantage that social media provides is that it provides material or moral assistance to the part of the community affected by a natural disaster. In terms of financial support, social media stands out because people from all over the world can donate. Another advantage is that any donation made reaches the necessary authorities quickly, in the important process that needs to be managed after the disaster. The fact that social media provides the highest speed of access to financial support is given to different segments of the society and authorized teams who are racing against time and trying to save the lives of people who are in a difficult situation.

[26] The importance of social media speed is most evident in the first 72 hours. It is seen that information about the earthquake spread faster in the first 72 hours and then slowed down. A communication system is established within the first 72 hours and information is quickly provided to the relevant institutions. [21]

After a disaster, there is always a need for new aid materials to meet basic needs. It is possible to find out how much help is needed in which region via social media. Both financial donations and donations of items that will help people maintain their basic standards after the disaster can be coordinated by social media and coordinate the order. [26]

Even though social media is used to spread information against disasters, it is not immediately known whether the information spread is correct or not. Spreading information after an earthquake does not call into question the identity of the user. Since users generally do not additionally share the source of the information they are trying to disseminate, depending on the information, it may require questioning whether the information is correct or not. As time passes, individuals who want to have an instant idea about the impact of the disaster can access the mainstream media. Reliable information can be obtained from mainstream media sources such as television and radio, but communities' trust in social media has also increased significantly. [21]

3.4 Mobile Technology in Disaster Response

The amount of money that needs to be spent on reconstruction after a natural disaster is enormous. The main reason is the high number of dead, seriously injured and homeless people, depending on the magnitude of the natural disaster. The biggest threats that cause such great loss of life and property are seen as hurricanes, earthquakes, tsunamis, and volcanic eruptions. As time passes and natural disasters occur, a great deal of research has been done to modify the great losses suffered with minimal damage. The mobile phone can be considered to have changed the way of communication with the help of technology. In the past years, as the communication format of the mobile phone changed, it was aimed that people have a warning system in crisis management by using the short message system (SMS). Since the warning and information system to be used with any SMS method will not have a disaster-oriented database, it will not be possible to have an idea about the instantaneous size and degree of the disaster. A warning system that is intended to be used with mobile phones should be presented to people in an easier way to use and access. It has been seen as more prone to use Android technology,

meaning that the system is easier to present. Notifying people and giving early warning before a disaster is part of the disaster management system. This disaster management system is more common in disaster-prone regions (for example, earthquake zones). Because with an early warning, an evacuation approach can be implemented. In disaster management systems, the benevolent way mobile phones have become important due to the major roles they play. Among the benefits of mobile phones after a disaster are monitoring, communication, warning, evacuation, and rescuing people in distress. After a disaster, if the number of SMS transmitted from a server exceeds the limit, it will damage the communication system on that network and risk causing it to crash. Certain mobile device solutions have also been provided to alert people some time before disaster strikes, and to create a route for them to go to the nearest shelter. Among the proposed solutions, the case of storing the information of the database to be used by converting it into JSON (JavaScript Object Notation) format can also be seen among the solution suggestions. Among the related studies, the plan of the solution proposal that creates a route in which JSON format is also used is as in Figure 3. [23]

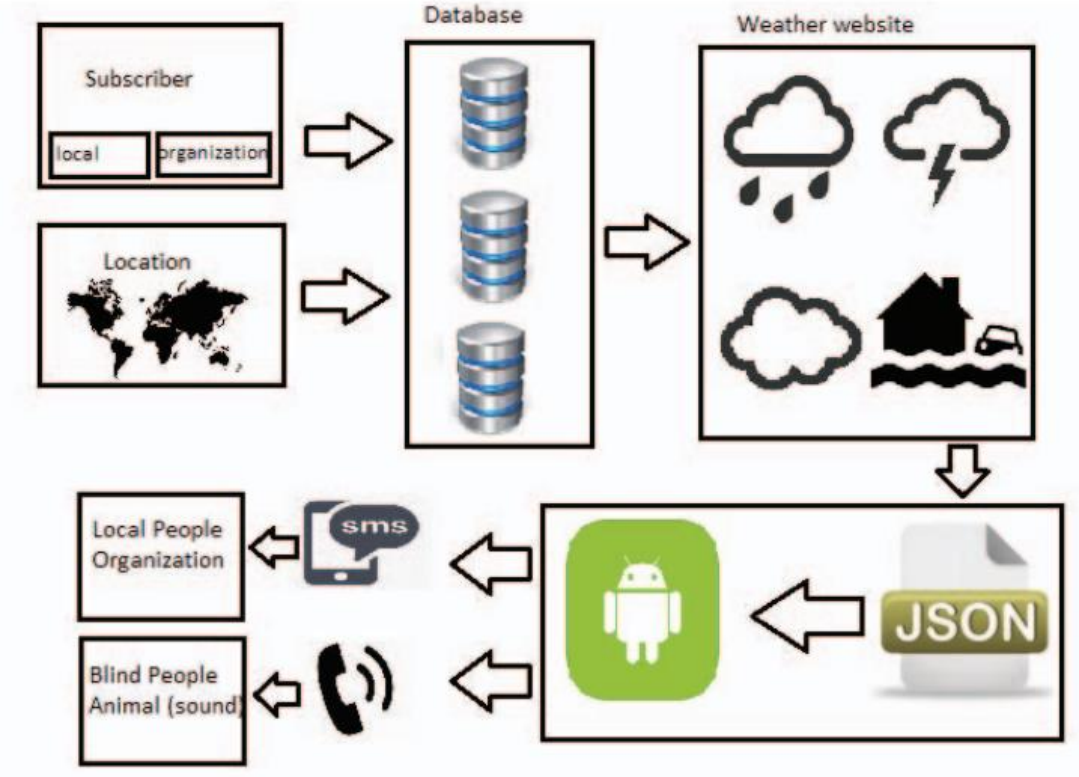


Figure 3 - An architecture of a proposed technique using JSON [23]

3.4.1 Emergency Mobile Communication in Earthquake Response

The damage caused by an earthquake are not limited to loss of life and property. One of the biggest challenges in response to efforts to rescue people is that communication networks will be severely damaged, subject to constant outages and making communication difficult. The communication network to be used after a disaster must be suitable for stable use without regular disruptions. Since most communication networks will be damaged after an earthquake, having a communication network that will be used only in emergencies is an effective precaution to take. Its main feature is that this communication network, which will be used after a disaster, is easy to structure. The main factor that announces the need for ease of structuring of the communication network is the first 3 days after the earthquake. [27] The first 72 hours after people are in a difficult situation are the most important hours when they wait to be rescued. During this important period, people are often trapped under damaged, partially collapsed buildings and debris. In addition to making it difficult to communicate with people due to temporary or permanent damage to power lines and networks, it also becomes not possible to determine the locations of people waiting for help in difficult situations. State-appointed teams must determine the exact location of a person trapped under debris before taking action to save them.

It is necessary to determine the exact location of its citizens and intervene on the spot. While determining the location of the victims, it is essential that the first responders intervene in a coordinated manner. The basis for the coordination of rescue teams depends on the communication established while managing the current emergency. The communication quality of the teams responsible for locating and rescuing people should be high-level and instantaneous. In this way, the number of citizens to be rescued will also increase. The most important problem that the teams may encounter against the communication they will establish among themselves is the damage to the existing network infrastructure after the natural disaster. [24]

Communication and location determination are the necessary actions for the teams that will go for rescue purposes in the first 72 hours, regarding the people affected by the earthquake in the region to be reached. Before starting a rescue action, it is also essential to have information about the current conditions in the area where the action will be taken. In addition to the information that rescue teams need to obtain, there is also information that needs to be delivered

to people affected by the earthquake. Civilians who need immediate alerts should follow rescue instructions determined by professionals. Citizens affected by the earthquake need these instant instructions to save their own lives as well as to enable rescue teams to be more effective. Damage to communication tools such as television and radio to the point of certain interruptions, and destruction of base stations make communication methods such as sending SMS or making calls very difficult. The intensity and traffic experienced in calls after a disaster can minimize communication resources throughout the city. For this reason, after an earthquake, phones should not be occupied with unnecessary calls urgently needed. [28]

3.4.2 Involving Communities with Secure Disaster Apps

Due to the lack of knowledge of communities in developing countries, they may not know how to act in a disaster that will affect all segments of society in that region. [29] Using today's mobile technology, disaster management methods can be achieved by alerting the public via SMS. For example, the United Kingdom can send SMS to inform the public in case of any disaster. Apart from raising public awareness, it is also possible to request financial support from the public and support certain disaster-related institutions of the government with donations. The Czech Republic can be cited as an example among countries where donations are made to institutions via mobile. [31] As the methods used to manage a disaster increase in countries, it is likely that new ideas will increase and managing the moment after a disaster with mobile technology will become a time period that everyone can handle for themselves from their phone. New mobile applications that will be used by citizens who are in a difficult situation or who will seek help from outside after the disaster should be developed today and made available to the public. Besides just developing an app, public awareness also plays a key role. Pre-disaster actions, the knowledge of keeping an individual ready for disaster at any time, needs to be reinforced in the public mind. Rather than allowing chaos to occur, it is necessary to be informed about the technological steps that need to be followed.

Those who will use the application must see the application to be developed and feel safe in advance. It can even provide a solution to the financial need for the development of the application. Applications that contain a certain part related to a citizen's personal security can be considered as a solution to make the application paid. Someone who truly trusts the practice for both their own safety and financial security will not hesitate to contribute to the financial need that will be important in the development of the practice. To make any mobile disaster

management system appear more attractive to the user, reassuring steps should be taken to require payment for the service to be provided. Incoming financial support can be stored in government institutions to be used in case of an emergency. Reducing costs during development requires convincing about security even when the project is in draft form. Over the years, changes have been observed in the number of countries' studies to use mobile technology. [30]

3.5 Summary of main findings

This study analyzes the impulse to act, loss of life and property caused by disasters, especially earthquakes, on societies from past to present, from an individual and social perspective. It is necessary to raise earthquake awareness educationally for citizens residing in a country with earthquake risk. Being ready at any time against an earthquake and keeping people conscious of the traumatic impact on society requires the government of that country to step in. Adequate information about the earthquake, the preparations to be made before the earthquake, the immediate reaction required during the earthquake, and the steps to be followed after the earthquake should be known by at least the majority of the public.

Government agencies established for post-disaster management must protect the public by educating the public and managing the critical initial period after a disaster. Using technology is an effective and important solution to raise public awareness and reduce loss of life by contributing to the time after the disaster. The concept of e-government emerges when there is a need for daily and urgent services to the public. The service to be offered to the public can reach the entire community by combining with information and communication systems. Mobile technology is the main and easiest way to reach the public technologically. The opportunity that mobile technology provides for social media access, the communication it provides during emergency times and the simple user experience make this technology one of the most effective solutions.

3.6 Research question

- What should be the design of a user-friendly mobile application providing rapid safety assessment for the users in danger after earthquake and government agencies?

4 Practical Part

In the practical part of the thesis, the live data retrieval method and design of a mobile application that every citizen can use, regardless of whether they are in a difficult or good situation after a disaster, have been developed.

For the mobile application, the idea of which is about to be developed, to receive live earthquake data at regular intervals, its connection with the USGS (United States Geological Survey) is first explained. Since the data of all small earthquakes in the world cannot be taken into consideration, an explanation has been made in some part about filtering the earthquakes that the application will use as a basis when receiving earthquake data.

User scenarios and personas have been created considering for what purpose and in what situations the users will use this mobile application.

After creating specific user scenarios, wireframes and prototypes were designed based on what kind of application design a user would have a better experience with. After the application design was prepared, how some users reacted during the application was evaluated through user testing.

Sample earthquake data was tested starting from December 2023. User testing of the designed user interface was carried out in February 2024.

Sample earthquake data obtained using USGS's API looks like the following if printed:
Magnitude: 6.9
Place: 35 km ENE of Aras-asan, Philippines
Time: 2023-12-03 19:49:37 UTC
Longitude: 126.6277
Latitude: 8.9571

4.1 Earthquake Data Examination

The mobile application will check earthquakes around the world with a certain frequency and collect data for itself. It will receive earthquake information from the USGS (United States Geological Survey). When it detects earthquakes greater than 6.0 magnitude, it will offer users who are within a certain proximity to the area where the earthquake occurred to choose the "Safe" or "Not Safe" options.

In order for the mobile app to capture earthquakes, it will need to access the USGS Earthquake API. Requests will be sent to the USGS Earthquake Catalog API with the 'requests' library of the Python programming language. Certain parameters will be determined when sending the request. These parameters will be **format**, **starttime**, **endtime** and **minmagnitude**. They will be used in the URL as filters.

```
import requests
from datetime import datetime, timedelta

current_time = datetime.utcnow()
start_time = current_time - timedelta(hours=6)

start_time_str = start_time.strftime('%Y-%m-%dT%H:%M:00')
end_time_str = current_time.strftime('%Y-%m-%dT%H:%M:00')
mag_str = '6.0'

url =
f"https://earthquake.usgs.gov/fdsnws/event/1/query?format=geojson&starttime={start_ti
me_str}&endtime={end_time_str}&minmagnitude={mag_str}"

response = requests.get(url)
```

The following features represented by the first part of the script written in the Python programming language:

- Imports the library requests for making HTTP requests. And the **datetime** and **timedelta** classes from the **datetime** module for date and time manipulation.

- Determines start and end times and sets them to Coordinated Universal Time (UTC).
- Formats the times to a string in the ISO 8601 format for the URL, as requested by the USGS API.
- Sets the minimum magnitude to **6.0**
- Creates the API Request URL. It includes the query parameters **geojson**, **starttime**, **endtime**, and **minmagnitude**.
- Makes the REST API Call by using the **requests.get** method to make an HTTP GET request to the USGS API with the constructed URL.
- Saves the server's response in response variable.

```
if response.status_code == 200:
    earthquake_data = response.json()

    for feature in earthquake_data['features']:
        properties = feature['properties']
        geometry = feature['geometry']
        coordinates = geometry['coordinates']

        print(f"Magnitude: {properties['mag']}")
        print(f"Place: {properties['place']}")
        print(f"Time: {datetime.utcfromtimestamp(properties['time'] /
1000).strftime('%Y-%m-%d %H:%M:%S')} UTC")
        print(f"Longitude: {coordinates[0]}")
        print(f"Latitude: {coordinates[1]}")
        print("-----")
else:
    print(f"Error: {response.status_code}")
```

The contents of the second part of the Python script are as follows:

- Checks whether the HTTP request is successful (200 status code).
- When the request succeeds, it converts the returned JSON content into a Python dictionary with **response.json()**.

- Extracts earthquake properties and geometry, where **properties** represent the magnitude, location, and time, and **geometry** shows gives information related to coordinates.
- Prints earthquakes' magnitude, location, and time information. The time is presented in UTC format.
- If the HTTP request is not successful, it prints an error message containing a status code.

4.1.1 Filtering and Determining Earthquakes

It is possible for a citizen to feel a 4.0 magnitude earthquake. The mobile application will work at earthquake magnitudes that may put people in a dangerous situation, rather than any earthquake that people will feel. Earthquakes of 6.0 and above can be considered a serious danger. Buildings may be damaged, and people may be frightened and leave their homes after the shaking. In order for the mobile application to ask people whether they are safe or not, certain filtering is required when receiving earthquake data from the USGS.

- mag_str = '6.0'

4.2 User needs analysis

Citizens who have access to their mobile phones from the moment the earthquake started and will apply to the mobile application for help from their phones have certain needs that must be provided to them.

A user will have certain needs when using the application after an earthquake. First, the reason a user uses the mobile app is to report if they are in danger. If a user is safe, their next need will be to reach people in their contact list. Citizens who are not in danger themselves need to receive news from their relatives. In the mobile application, before an earthquake disaster, the user must edit his/her Contact List.

A citizen who wants to indicate that they are in danger and expects help will need an government institution to be aware of the citizen's situation. When a user presses the button indicating that they are not safe, they must be informed for that their location is reported to the relevant government institution and action will be taken for them. For the mobile application

to serve the right purpose in partnership with the government institution, there are certain effective ways that e-government must offer to its citizens.

The important factors that the government should urgently offer in partnership with e-government for citizens waiting for help can be summarized as follows:

- Allowing citizens to report on their situation to the e-government platform.
- Access to government alerts and warnings.
- Real-time coordination.
- Emergency services.

To test the usability of the application, remote user testing will be carried out with some selected participants. In remote user testing, an online call will be made with the participant, the participant will share their screen and test the design of the application according to the given use cases.

4.2.1 Use Cases

Based on the basic needs of users who are about to use the mobile application after an earthquake, specific use cases and their successful scenarios have been created. The use cases and their scenarios for the interface of this application, which is designed to follow a simple usage path and be used by a panicked user, are as follows:

Selecting the City and Country

Scenario: The user opens the application, navigates to the settings, and selects their current city and country from a predefined list.

Editing Contact List and SMS Content

Scenario: The user opens the application, goes to the Contact List screen, and enters the phone numbers to which an automatic SMS will be sent when the user reports the post-earthquake situation. The user then enters the content of his message into a separate section. The user saves the changes made.

Reporting as Safe

Scenario: After an earthquake, the user opens the application and selects the option “Safe” to report themselves as safe, which then notifies their contacts via SMS including the message user prepared before.

Reporting as Not Safe

Scenario: The user selects the option “Not Safe” to report that they are not safe. The application notifies the emergency services with the user’s current location and status, and if possible, user’s emergency contacts with an automatic SMS.

4.2.2 User Location

Any citizen who is in danger after an earthquake needs to report their location to the e-government institution, which will set out to assist them. During the time it takes to manage the post-disaster process, it is possible for too many people to need help at the same time. A situation may occur where too many users indicate that they are not safe at nearly the same time. The help needed by people who are in certain danger or struggling to survive increases as time goes by. This situation creates a period that needs to be managed against time and where relevant government institutions need to act quickly. Depending on the desired quick action, obtaining the location information of all users who mark themselves as endangered in the fastest way and at the same time is the first moment that the relevant institutions interact with this mobile application.

When a user runs the app on their phone for the first time, the app will ask for permission to access the user's location information. Like a regular application, the user can disable this setting from the phone's own settings. However, when location information is not allowed, the effectiveness of the application is lost for people in danger.

4.3 Wireframe of the Mobile Application

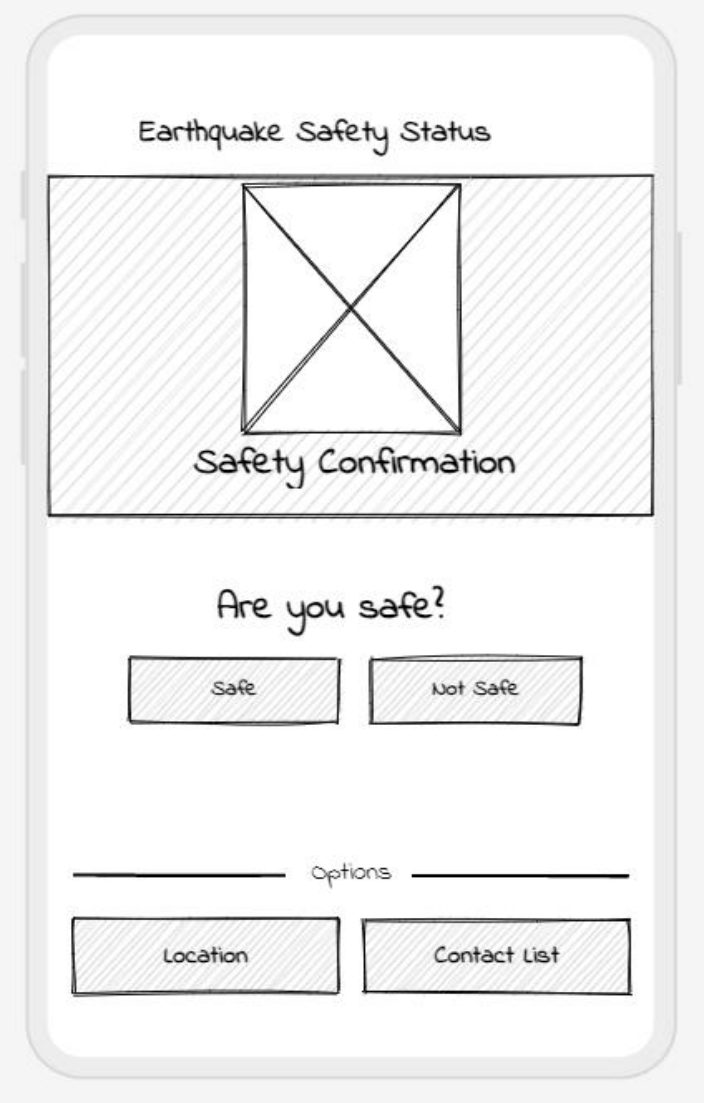


Figure 4 - Wireframe of the home page with the buttons

The home page is the first screen a user encounters when opening the application and has 4 buttons (Figure 4). Contact List and Location buttons direct the user to pages that need to be interacted with and visited before an earthquake.

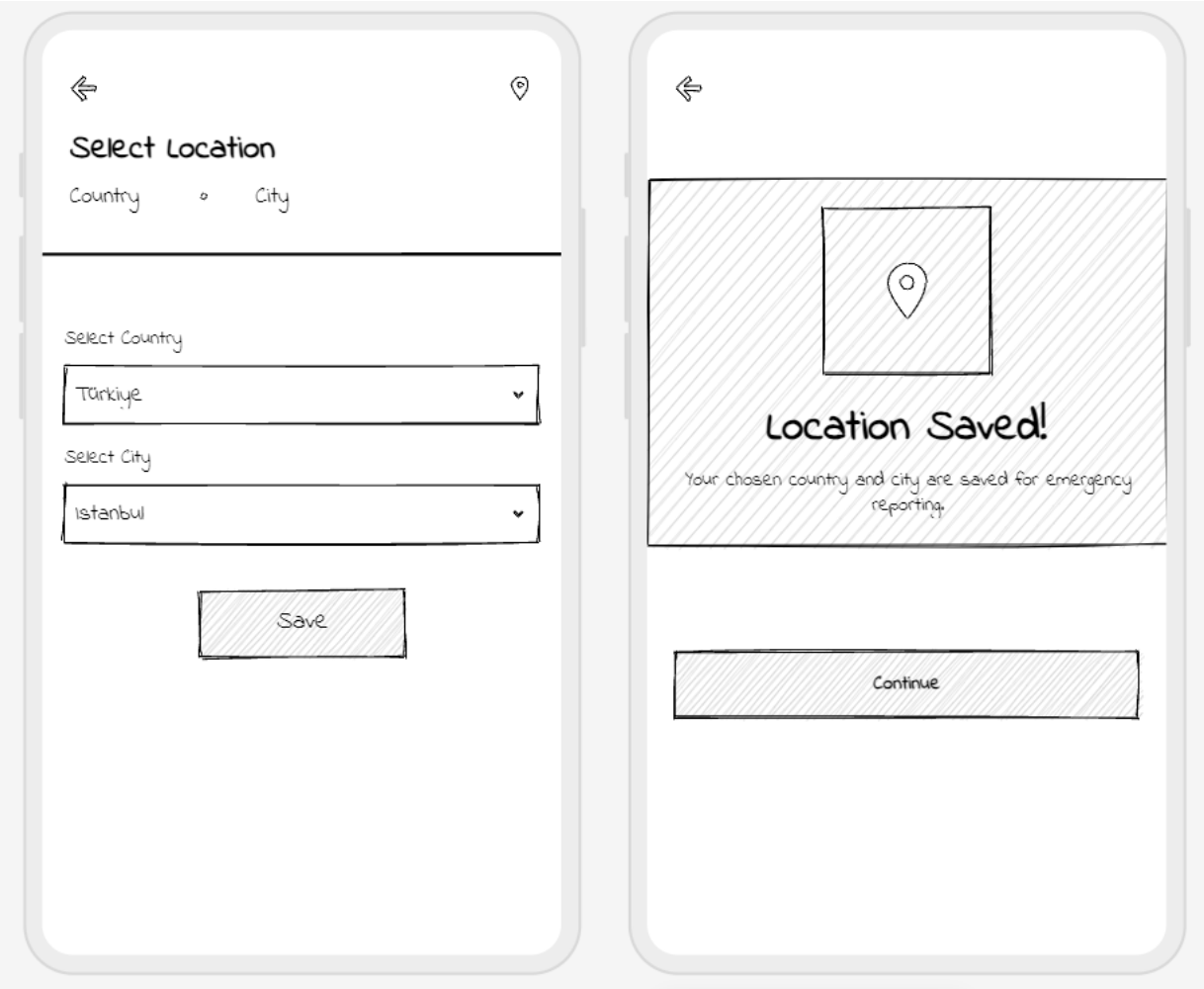


Figure 5 – Select Location and feedback pages

The first page the user should go to is preferably the Select Location page (Figure 5). On this page, the User determines the location of where he/she lives from the Select Country and Select City sections and saves his/her location using the Save button. The user also sees the feedback screen after successfully saving their location.

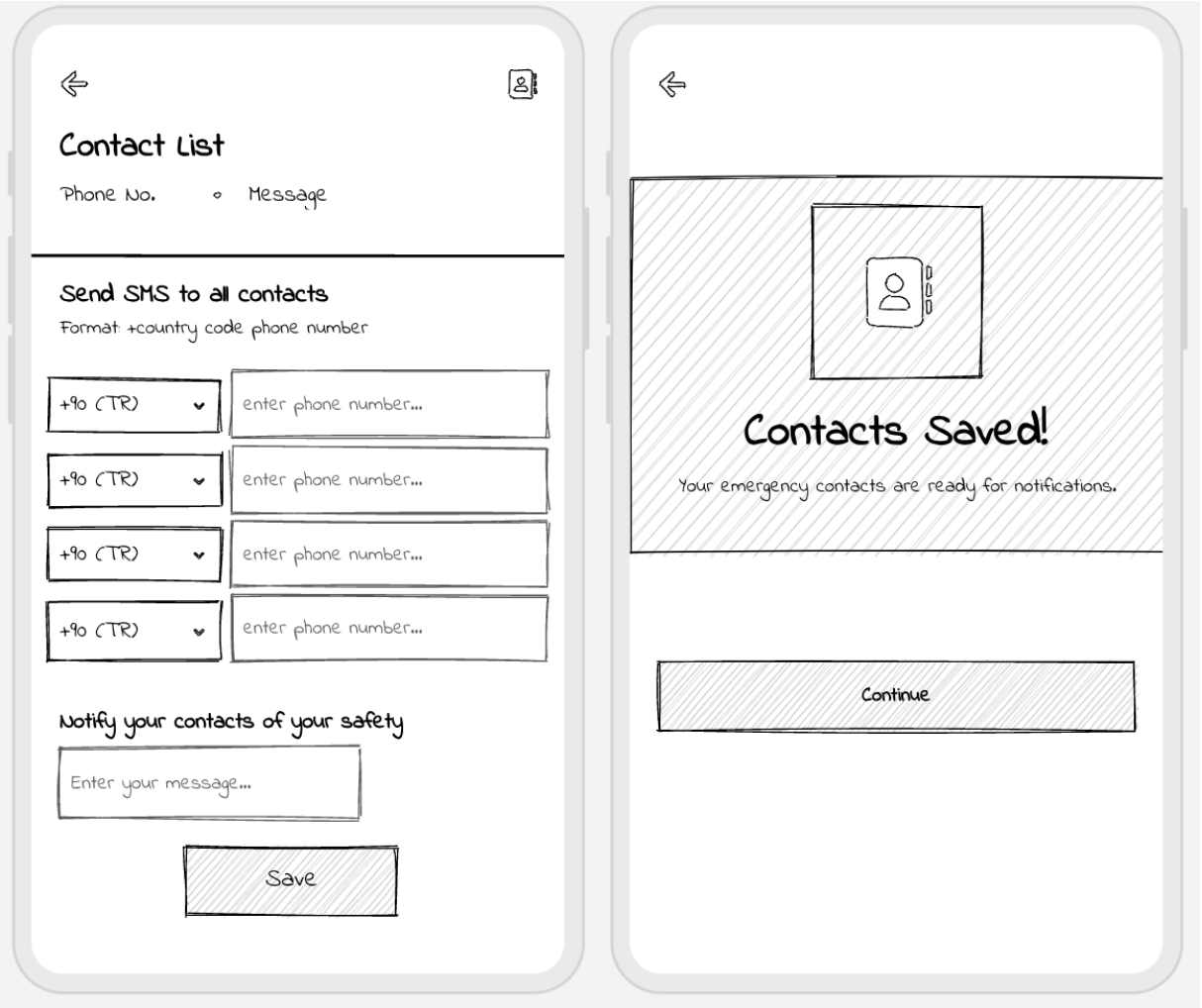


Figure 6 - Contact List and feedback pages

The screen that a user should interact with before the earthquake disaster is the Contact List, preferably second (Figure 6). When users report their situation on this screen, they enter the phone numbers of the people who will be automatically notified via SMS. In the second field, the user determines the content of the SMS to be sent. And finally, users save the information they entered by using the save button. When users complete these steps successfully, they reach the feedback screen.

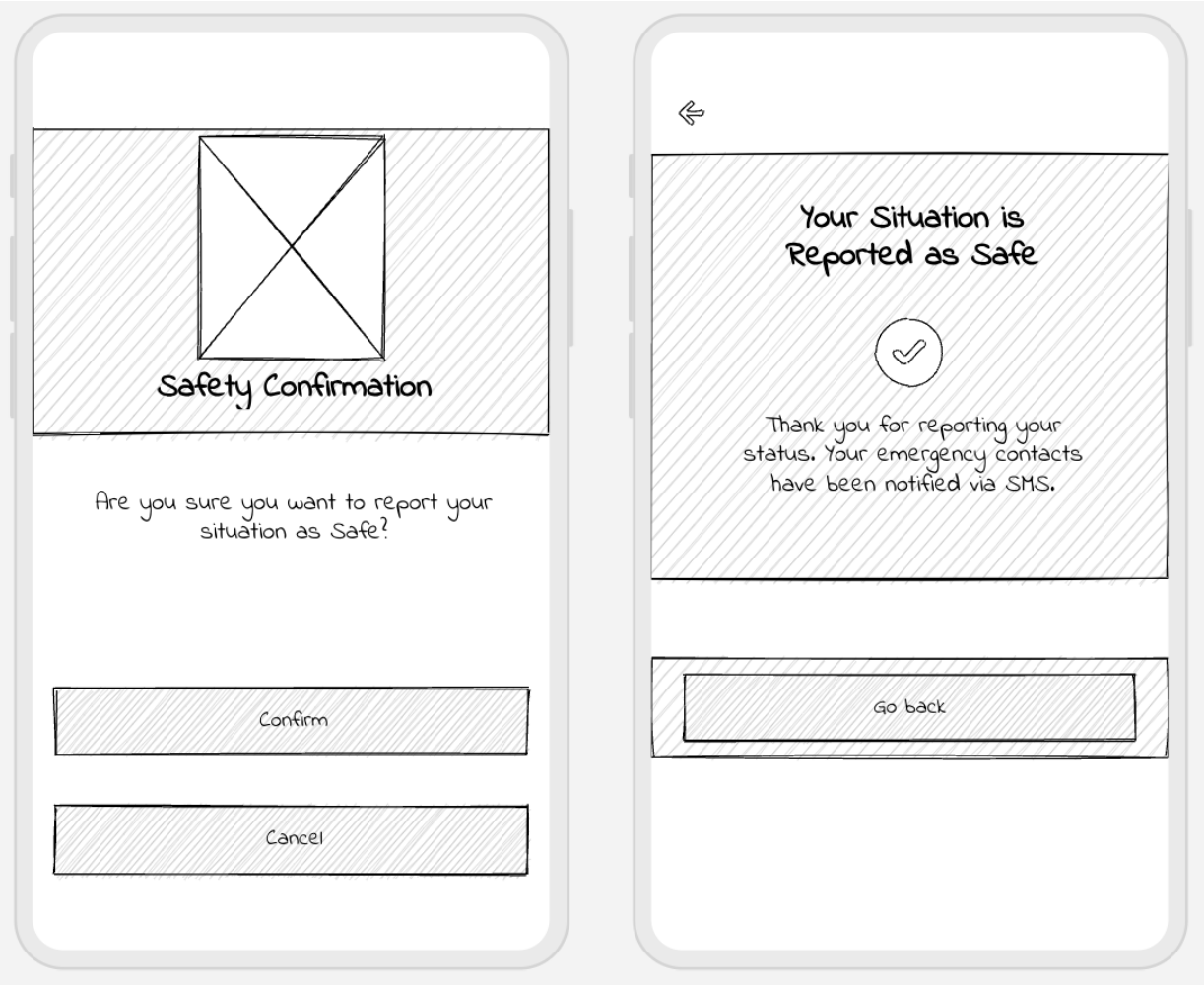


Figure 7 - Safety Confirmation and feedback pages

When users use the Safe button on the home page, they are navigated to the confirmation screen to confirm their status (Figure 7). When they press the Confirm button, they see the feedback screen. By pressing the Cancel button, they return to the home page.

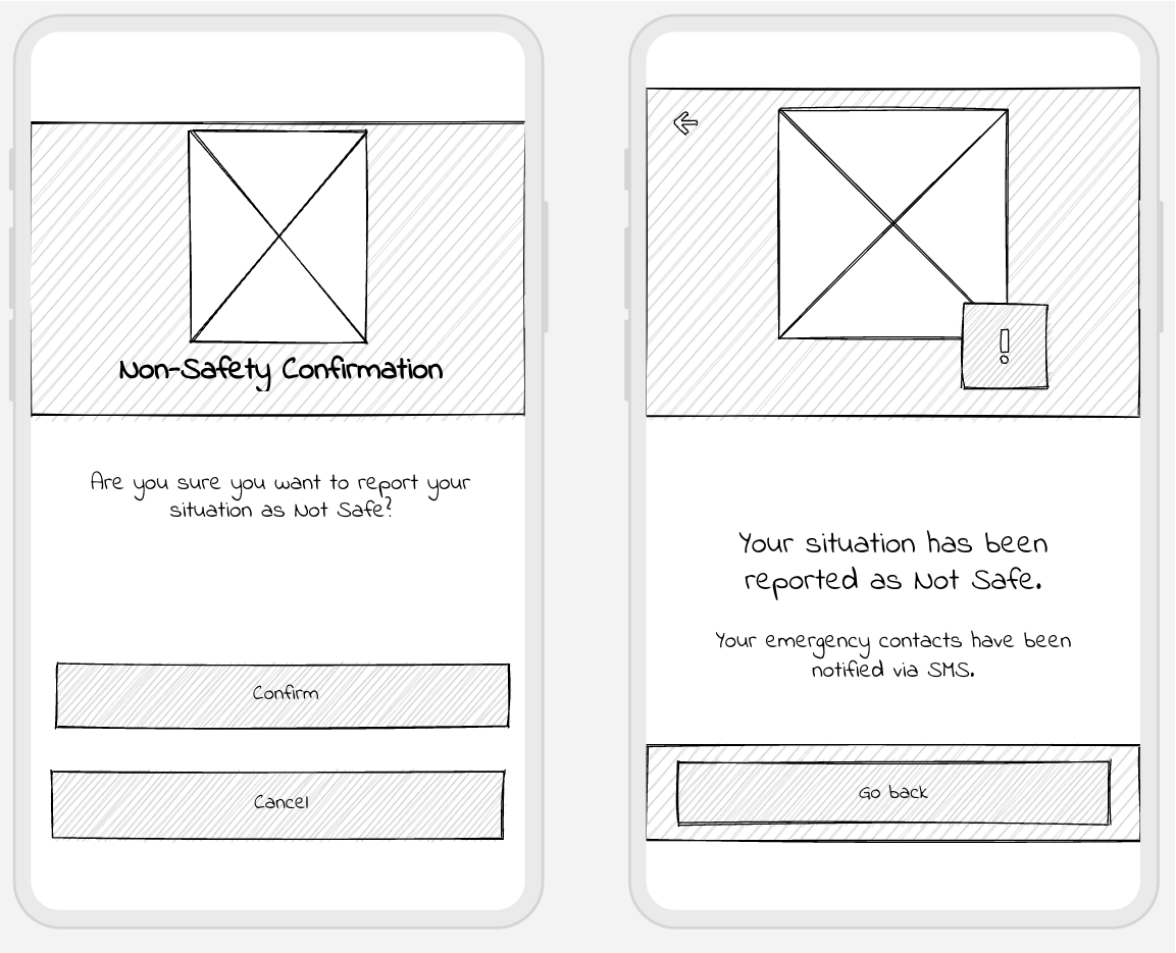


Figure 8 - Non-Safety Confirmation and feedback pages

When users use the Not Safe button, they are asked to confirm their status, just like the Safe button (Figure 8). Once the user confirms that their status is compromised, the application reports the user's location to the relevant agency and navigates the user to the feedback screen. The Cancel button brings the user back to the Home Page.

4.4 Prototype of the mobile application

The prototype of the simple interface, which is designed to be used by users of all ages, as well as users whose condition is at risk, is as follows:

Prototype of the first screen, Home Page (Figure 9):

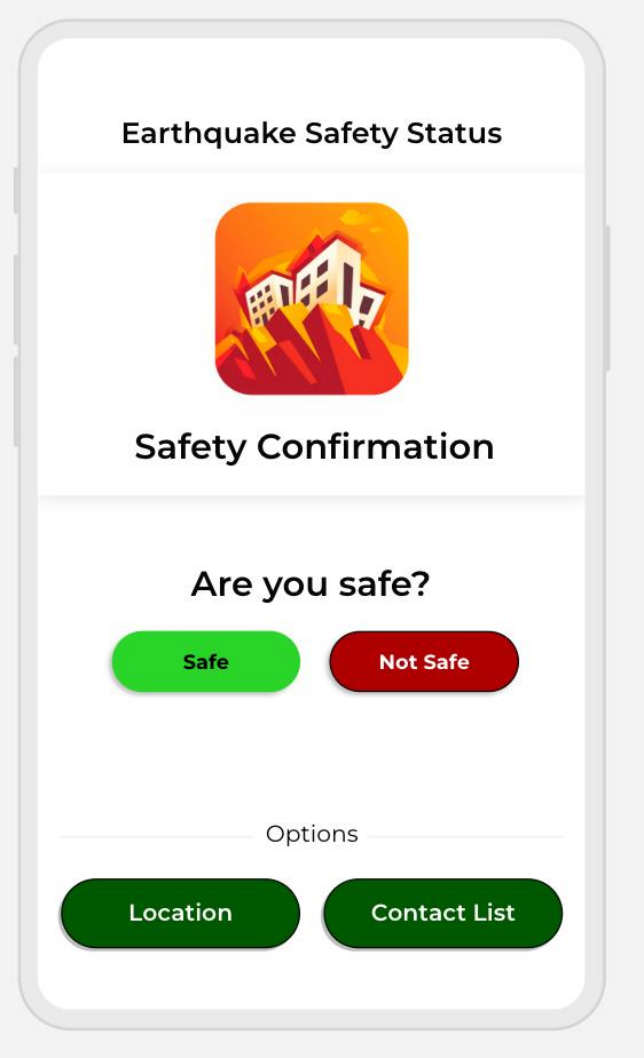


Figure 9 - Prototype of the Home Page

The prototype of the Select Location screen, which is the first screen to be visited from the Home Page in the application (Figure 10):

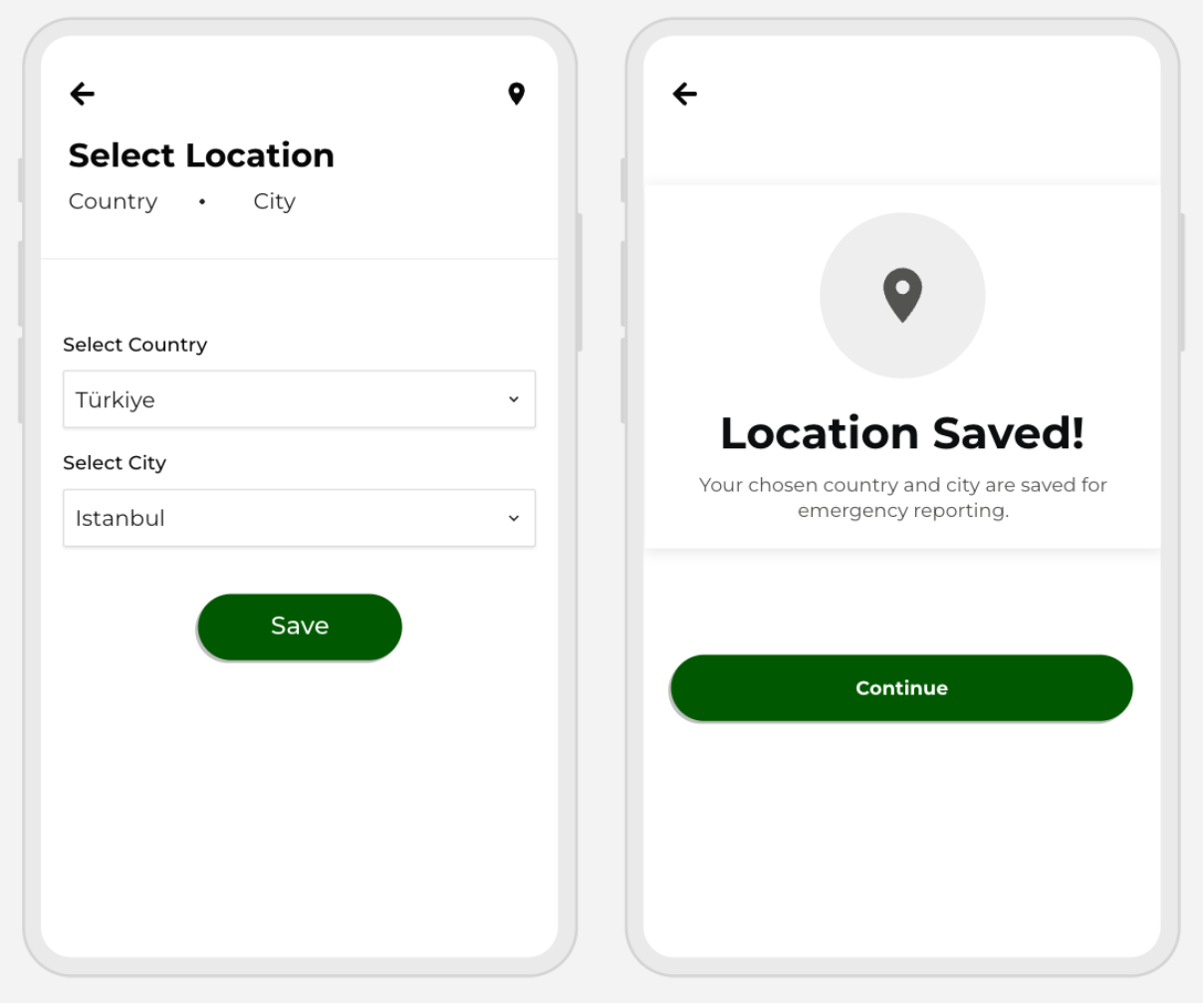


Figure 10 - Prototype of the Select Location Pages

The prototype of the Contact List screen, which is the screen that should preferably be visited after Select Location (Figure 11):

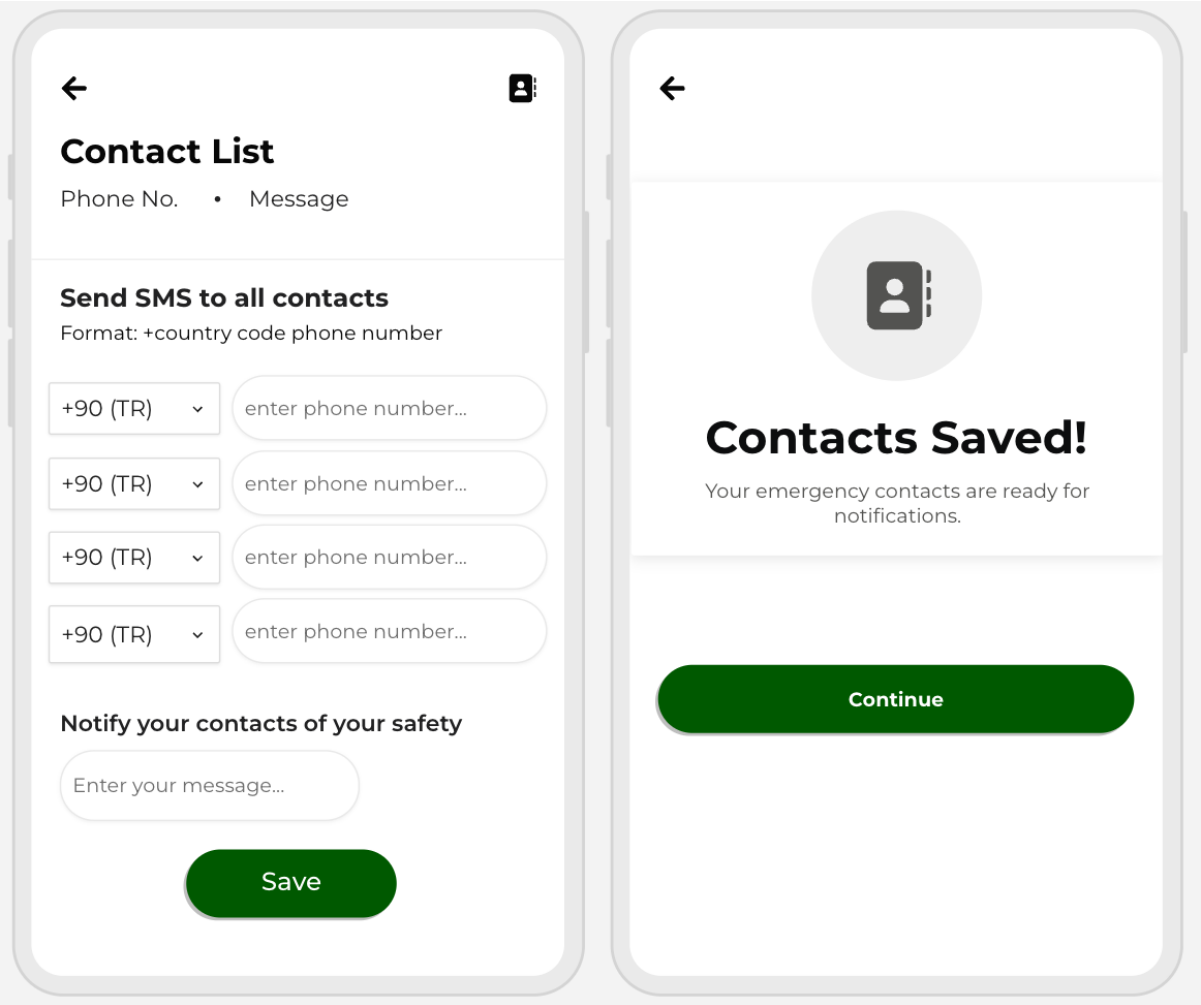


Figure 11 - Prototype of the Contact List Pages

Prototype of the screens where users first select that they are safe, then confirm their selection and receive feedback as a result (Figure 12):

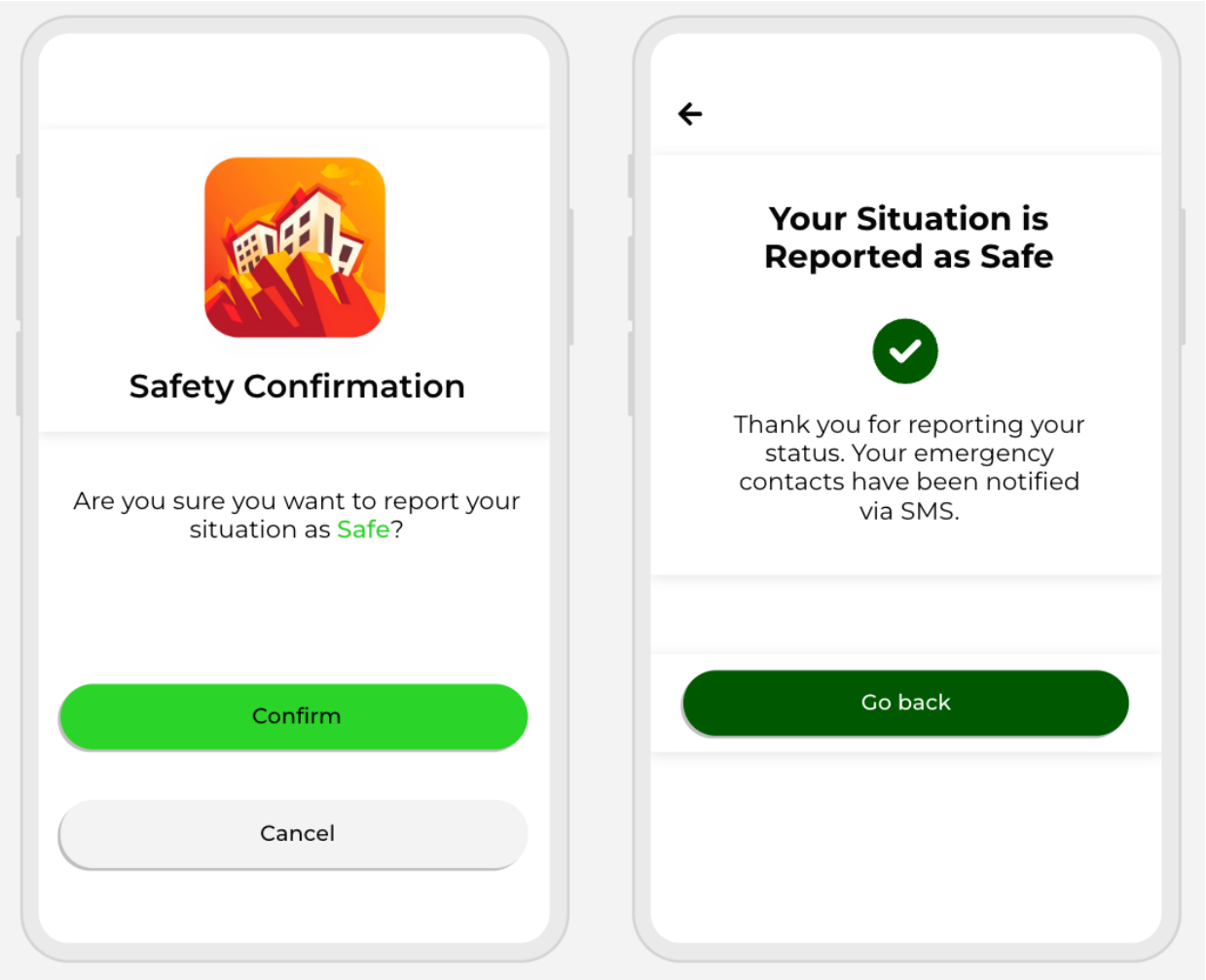


Figure 12 - Prototype of the Safety Confirmation Pages

Prototype of the confirmation screen that citizens who report that they are in danger and waiting for help navigate after using the Not Safe button and the feedback screen they see after confirming that they are in danger (Figure 13):

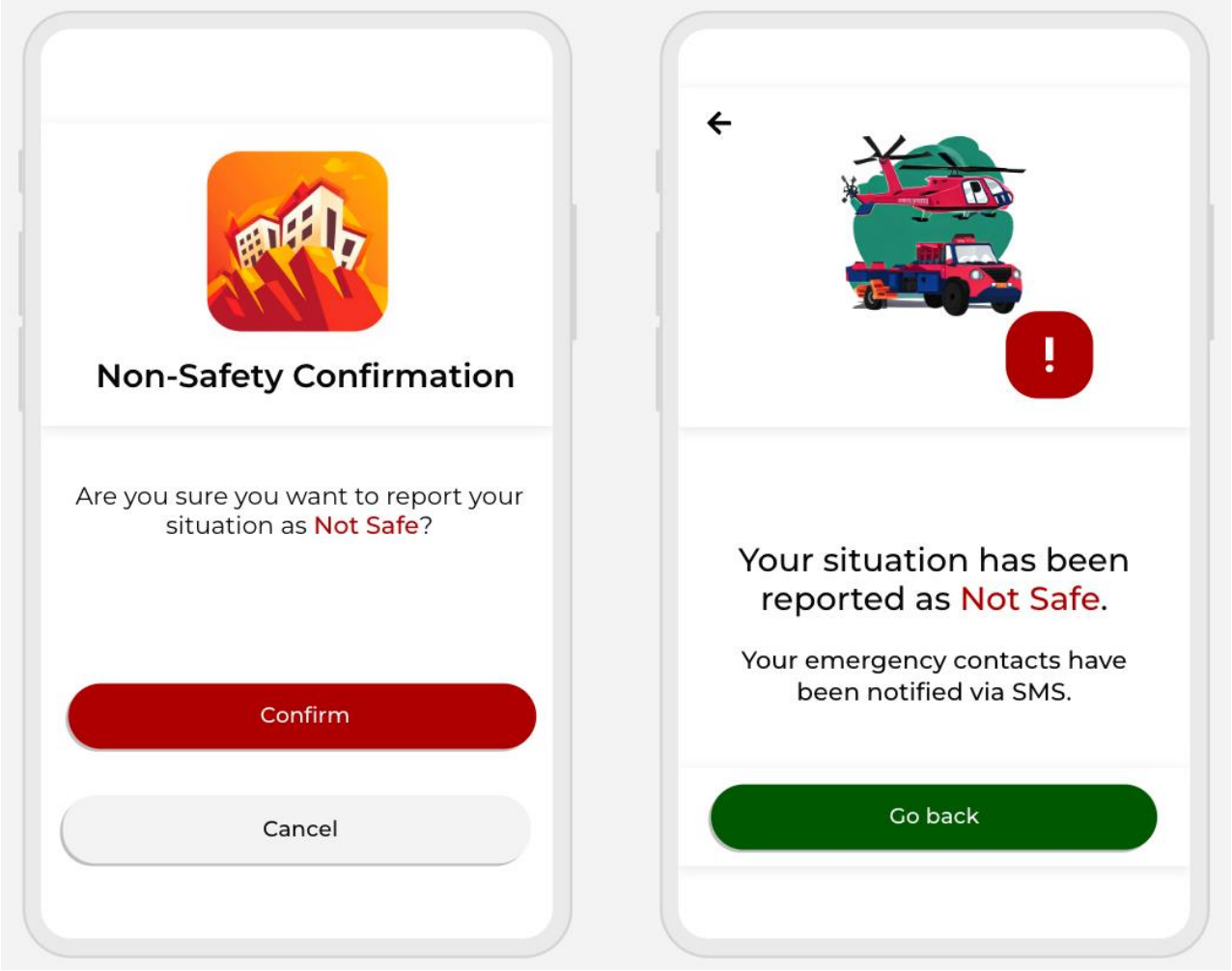


Figure 13 - Prototype of the Non-Safety Confirmation Pages

4.5 User Testing

A remote usability test was conducted to measure the experience of a user who will use the mobile application. Aiming to get feedback from users at the right scale, 5 participants were selected (Table 2), considering the suggestion of Jakob Nielsen, co-founder of Nielsen Norman Group.

Participant ID	Age Group	Gender	Occupation
P1	25-34	Female	Sourcing Expert
P2	35-44	Male	Software Developer
P3	25-34	Female	Student
P4	18-24	Male	Student
P5	55-64	Male	Retired

Table 2 - User Testing Participation Information

Participants in remote usability testing were asked one by one, the purposes of the previously determined use cases, and how they would proceed if they were using the application. The paths that the participants should follow were noted beforehand as expectations and compared with the path followed by them.

- Selecting the City and Country
  Expected path to select city and country: **Home** > **Location** > **Save.**

- Editing Contact List and SMS Content
  Expected Path to Edit Contact List and SMS Content: **Home** > **Contact List** > **Save.**

- Reporting as Safe
  Expected Path to Report as Safe: **Home** > **Safe** > **Confirm.**

- Reporting as Not Safe
  Expected Path to Report as Not Safe: **Home** > **Not Safe** > **Confirm.**

The use case names were given to the participants one by one, the reactions given by them were inspected, 5 statements were expressed to them for each use case. Each participant was asked

to give points to each statement by following the Likert scale (Figure 14). The expressions of the numbers on the Likert scale are as follows:

Figure 14 - Likert Scale

The 5 statements that participants are asked to give feedback (Table 3) using the Likert scale after completing each task are as follows:

1. The app was clear to understand.
2. Navigating through the app to complete the tasks was straightforward.
3. The app's user interface made it easy to complete the tasks.
4. The app tasks' completion was clearly acknowledged by feedback.
5. The time taken to complete the tasks in the app felt appropriate.

Participant ID	Statement 1	Statement 2	Statement 3	Statement 4	Statement 5
P1	5	5	4	5	4
P2	4	4	3	5	4
P3	4	5	4	5	5
P4	5	4	4	5	5
P5	3	4	4	5	3

Table 3 - Participant Likert Responses

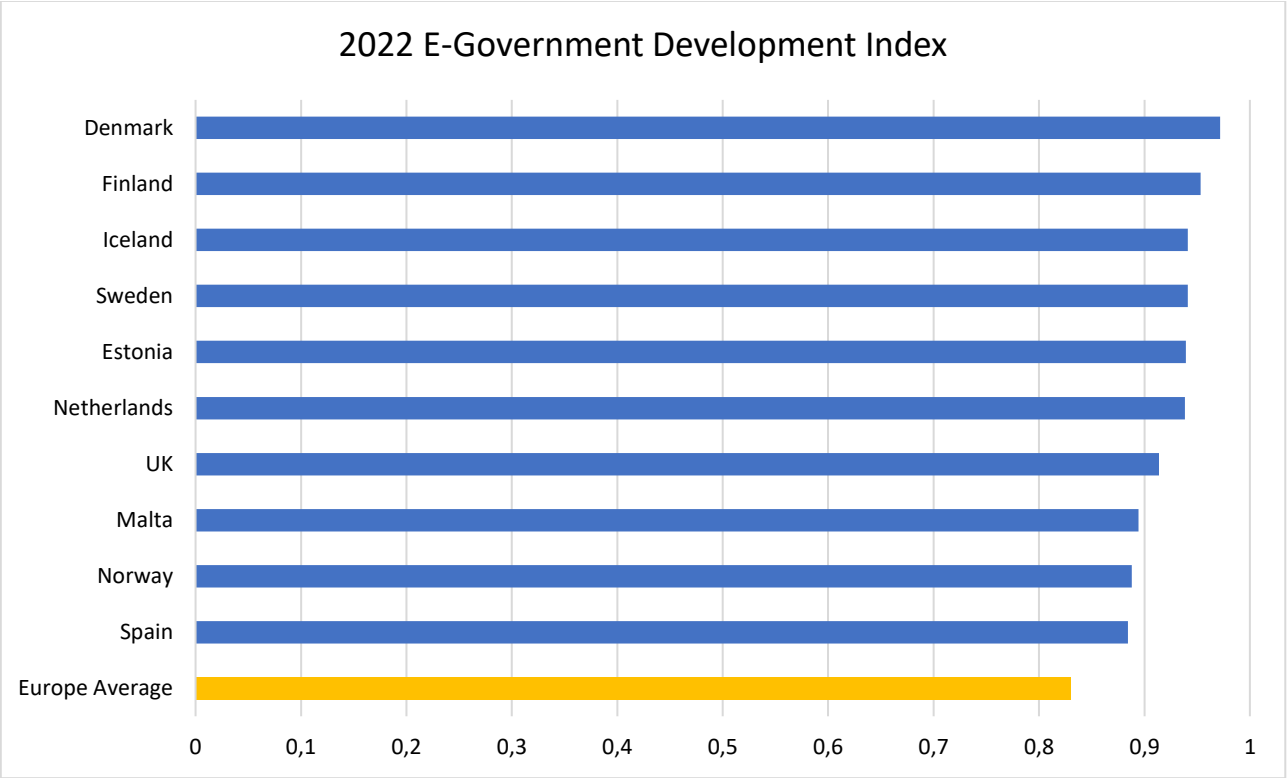
5 Results and Discussion

5.1 Results

This chapter describes the results of this thesis, which aims to investigate the communication between the government and citizens in a country about post-earthquake time management.
In line with the results of the comprehensive literature review of this study, it has been seen that the government's preparations against an earthquake should first begin by educating its own people about the earthquake. A public who is informed during the earthquake and the post-earthquake period can play a role in managing these processes.

A community made aware of the post-earthquake period becomes important in the period when the government will develop the concept of e-government with existing technology. A government should choose the path that will provide the most convenience to its people after an earthquake. Today, the technological way that will provide the best control after an earthquake is e-government. The development of e-government, combined with information and communication technologies today, makes progress in the technological path of any service to be provided. and the development of the concept of e-government. In addition, this technological assistance plays an important role in the part of e-government that involves any interaction with the citizen.

Governments that make the necessary investments in e-government and ensure mutual trust with their people are able to unite with their people in the post-disaster period. The development of the EGDI level in some countries in Europe can be seen in how well certain countries present this concept to their people. The graph below lists the 10 European countries with the best EGDI in 2022 (Graph 1).



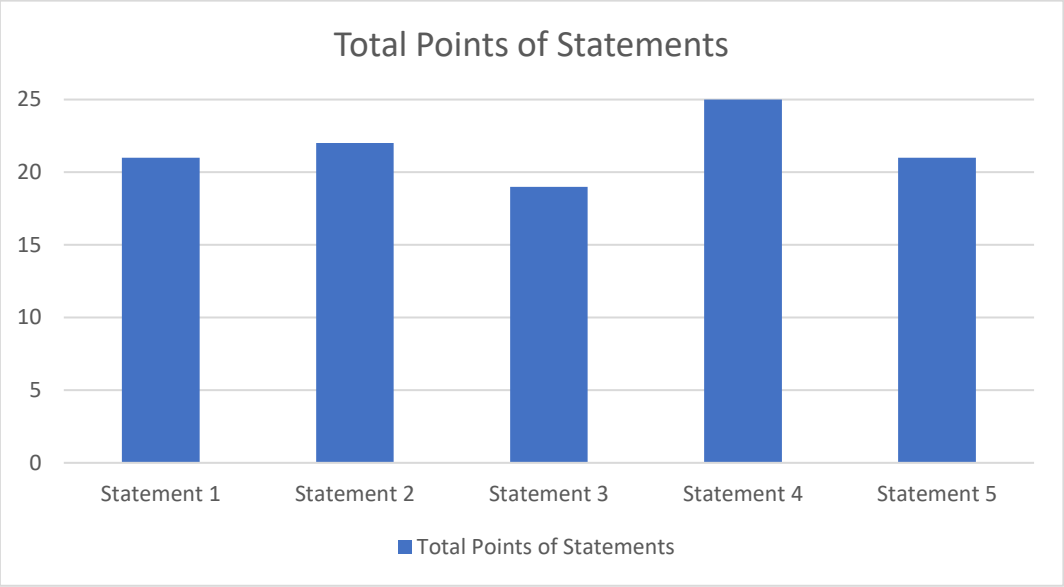
Graph 1 - Top 10 Europe countries with e-government development index

In the practical part of thesis, users participating in remote user testing were asked to do certain use cases beforehand. After these use cases, 5 statements were given to the users. They were asked to rate how much they agreed or disagreed with these statements in the application via Likert Scale. Scores were 1-5.

The user testing participants were first given the purposes of the following use cases and were asked what path they should follow without being told to the user:

- Selecting the City and Country
- Editing Contact List and SMS Content
- Reporting as Safe
- Reporting as Not Safe

The total points that the statements received from each user are as follows (Graph 2):



Graph 2 - Total points of statements given by user testing participants

As a result of user testing, within the total points given to the questions about how much users agreed, the statements are listed in order from the most to the least points as follows:

1) Statement 4: The app tasks' completion was clearly acknowledged by feedback. (25 points)
2) Statement 2: Navigating through the app to complete the tasks was straightforward. (22 points)
3) Statement 1: The app was clear to understand. (21 points)
   Statement 5: The time taken to complete the tasks in the app felt appropriate. (21 points)
4) Statement 3: The app's user interface made it easy to complete the tasks. (19 points)

After user testing, the most positive part of the application was that the user received correct feedback after each interaction. All users gave the maximum score of 5. The statement about the user interface of the application, explaining that its design makes it easier to complete tasks because people are accustomed to today's mobile applications, received the least score.

5.2 Discussion

To better understand the features that make the mobile application stand out, it can be compared with another mobile application idea mentioned in the literature review, which aims to warn people before a disaster. The main difference between the two applications is that this other idea, which aims to be used on Android phones, interacts with the user before the disaster, while the idea developed in this study is suitable for use after the disaster. The similarity of the two apps is that they ultimately use SMS to deliver information. The application, which sends advance warning to the location, saves the SMS data in JSON format in case of any mishap that may occur after any natural disaster. SMS data backup can be seen as a difference. One of the main differences is that the application that performs JSON backup only interacts with users, while the other one comes into play with the concept of e-government. With the introduction of the e-government concept, the location of people in difficult situations is reported to relevant government institutions. In addition, SMS with informative content is sent not to the interacting user, but to different phone numbers that the user has previously added to his or her contact list.

5.3 Limitations

The factors that do not allow to fully explain this study in the Practical Part and determine the limits of the study can be listed as follows:

- The mobile application for which the wireframe and prototype were designed was not actually tested by a user who was in a difficult situation after an earthquake. Users tested the application on a typical day.
- The number of users participating in user testing was 5 for this study. More in-depth statistics can be achieved with more users.
- The functions of the mobile application have not been tested, except for accessing live earthquake data. The only aspects tested are whether access to earthquake data works or not, and the interface of the application, which is tested by certain selected users and the author.

6 Conclusion

The main purpose of Bachelor Thesis is to examine the designing and prototyping process of a mobile application that provides rapid safety assessment after an earthquake, and to develop a mobile application idea that allows people to report their situation to the relevant e-government institution in earthquake countries. For a country to provide such interaction that will be active on mobile devices, it must be familiar with the concept of e-government and be able to use e-government effectively in crisis management.

It is necessary to raise public awareness and teach that citizens themselves are a part of it through social media and communication in the post-earthquake period. Only an informed community can aim to help itself and those around them with the mobile devices that everyone has. The fact that mobile devices are the most easily accessible technology for everyone today is one of the factors that makes this idea most important. A government that wants to develop e-government in the right way and serve its people must choose the fastest way in the post-earthquake period.

The mobile application was developed in terms of earthquake data and design, considering the conditions under which it will be used. Remote user testing was conducted based on specific users to obtain sufficient feedback.

Today, the governments of earthquake countries need to work in coordination with the help of technology and offer a solution that will help their people in the post-earthquake period. The mobile application, developed in terms of data and design, can be used by state institutions to save many lives in the post-disaster period.

References

[1] ADEM, Öcal. The relationship between earthquake knowledge and earthquake attitudes of disaster relief staffs. *Disaster Advances*, 2011, 4.1: 19-24.

[2] HASHEMIPOUR, Mehdi; STUBAN, Steven MF; DEVER, Jason R. A community-based disaster coordination framework for effective disaster preparedness and response. *Australian Journal of Emergency Management, The*, 2017, 32.2: 41-46.

[3] WALD, David, et al. ShakeCast: Automating and improving the use of ShakeMap for post-earthquake decision-making and response. *Earthquake Spectra*, 2008, 24.2: 533-553.

[4] WANG, Yanxin, et al. Using mobile phone data for emergency management: a systematic literature review. *Information Systems Frontiers*, 2020, 22: 1539-1559.

[5] PANDEY, B. H.; OKAZAKI, Kenji. Community-based disaster management: empowering communities to cope with disaster risks. *Regional Development Dialogue*, 2005, 26.2: 52.

[6] SANTOS-REYES, Jaime. Using logistic regression to identify leading factors to prepare for an earthquake emergency during daytime and nighttime: the case of mass earthquake drills. *Sustainability*, 2020, 12.23: 10009.

[7] FENG, Zhenan, et al. How people make decisions during earthquakes and post-earthquake evacuation: Using verbal protocol analysis in immersive virtual reality. *Safety science*, 2020, 129: 104837.

[8] BECKER, J. S., et al. Evaluating New Zealand's "ShakeOut" national earthquake drills: A comparative analysis of the 2012 and 2015 events. In: *Proceedings of the 2016 NZSEE Conference, Christchurch, New Zealand*. 2016. p. 1-3.

[9] MURPHY, H.; GREER, A.; WU, H. C. Trusting Government to Mitigate a New Hazard: The Case of Oklahoma Earthquakes: Trusting Government to Mitigate, Risk Hazards Crisis Public Policy. 9 (2018) 357–380.

[10] AO, Yibin, et al. Impacts of earthquake knowledge and risk perception on earthquake preparedness of rural residents. *Natural Hazards*, 2021, 107: 1287-1310.

[11] KHAERANI, Thalita Rifda. THE ROLE OF LOCAL GOVERNMENT IN DISASTER MANAGEMENT (Study on the Regional Disaster Management Agency in Flood Disaster Mitigation in Samarinda City). *CosmoGov: Jurnal Ilmu Pemerintahan*, 2022, 8.1: 76-87.

[12] MENSAH, Isaac Kofi. Impact of government capacity and E-government performance on the adoption of E-Government services. *International Journal of Public Administration*, 2019.

[13] ROZTOCKI, Narcyz; STRZELCZYK, Wojciech; WEISTROFFER, Heinz Roland. The role of e government in disaster management: A review of the literature. *Journal of Economics and Management*, 2023, 45: 1-25.

[14] GU, Edward, et al. E-Government Use, Perceived Transparency, Public Knowledge of Government Performance, and Satisfaction with Government: An Analysis of Mediating, Moderating, and Framing Mechanisms Based on the COVID-19 Outbreak Control Survey Data from China. *Social Indicators Research*, 2023, 1-46.

[15] KABBAR, Eltahir F. A comparative analysis of the e-government development index (EGDI). In: *14th International Conference on ICT, Society, and Human Beings, ICT*. 2021. p. 23-29.

[16] DESA, U. N. *E-Government Survey 2020: Digital Government in the Decade of Action for Sustainable Development*. Technical Report. Department of Economic and Social Affairs, United Nations, 2020.

[17] NURDIN, Nurdin; STOCKDALE, Rosemary; SCHEEPERS, Helana. Coordination and cooperation in e-government: An Indonesian local e-government case. *The Electronic Journal of Information Systems in Developing Countries*, 2014, 61.1: 1-21.

[18] CHILEMBO, Zondi; TEMBO, Simon. Opportunities and Challenges of Coordinating the Implementation of e-Government Programmes in Zambia. International Journal of Information Science, 2020, 10.1: 29-43.

[19] ZHANG, Yi; KIMATHI, Flora A. Exploring the stages of E-government development from public value perspective. *Technology in Society*, 2022, 69: 101942.

[20] MARTÍNEZ-ROJAS, María; DEL CARMEN PARDO-FERREIRA, Maria; RUBIO-ROMERO, Juan Carlos. Twitter as a tool for the management and analysis of emergency situations: A systematic literature review. International Journal of Information Management, 2018, 43: 196-208

[21] AMIRESMAILI, Mohammadreza, et al. Role of social media in earthquake: A systematic review. Iranian Red Crescent Medical Journal, 2021, 23.5.

[22] MORA, Kate, et al. Public perceptions of building seismic safety following the Canterbury earthquakes: A qualitative analysis using Twitter and focus groups. *International journal of disaster risk reduction*, 2015, 13: 1-9.

[23] SIKDER, Md Fahim, et al. Smart disaster notification system. In: 2017 4th International Conference on Advances in Electrical Engineering (ICAEE). IEEE, 2017. p. 658-663.

[24] HOSSAIN, Md Akbar; RAY, Sayan Kumar; LOTA, Jaswinder. SmartDR: A device-to-device communication for post-disaster recovery. *Journal of Network and Computer Applications*, 2020, 171: 102813.

[25] WONG-VILLACRES, Marisol; VELASQUEZ, Cristina M.; KUMAR, Neha. Social media for earthquake response: Unpacking its limitations with care. *Proceedings of the ACM on Human-Computer Interaction*, 2017, 1.CSCW: 1-22.

[26] OGIE, R. I., et al. Social media use in disaster recovery: A systematic literature review. *International Journal of Disaster Risk Reduction*, 2022, 70: 102783.

[27] ZHOU, Jianguo, et al. Integrated satellite-ground post-disaster emergency communication networking technology. *Natural Hazards Research*, 2021, 1.1: 4-10.

[28] KAISAR, Shahriar. Emergency Response and Post-Disaster Recovery Using Smartphone-Based Applications. In: *Digital Services in Crisis, Disaster, and Emergency Situations*. IGI Global, 2021. p. 31-49.

[29] GONIEWICZ, Krzysztof; BURKLE, Frederick M. Disaster early warning systems: the potential role and limitations of emerging text and data messaging mitigation capabilities. *Disaster medicine and public health preparedness*, 2019, 13.4: 709-712.

[30] ALIPERTI, Giuseppe; CRUZ, Ana Maria. Promoting built-for-disaster-purpose mobile applications: An interdisciplinary literature review to increase their penetration rate among tourists. *Journal of Hospitality and Tourism Management*, 2020, 44: 193-210.

[31] SOUZA, Flávio; KUSHCHU, Ibrahim. Mobile disaster management system applications–current overview and future potential. *Proceedings EURO mGOV*, 2005, 455-466.

7 List of pictures, tables, graphs and abbreviations

7.1 List of pictures

7.2 List of tables

7.3 List of graphs

7.4 List of abbreviations

CBDM - Community Based Disaster Management

ICT - Information and Communication Technologies

EGDI - E-Government Development Index

UN DESA - United Nations Department of Economic and Social Affairs

TII - Telecommunications Infrastructure Index

OSI - Online Service Index

HCI - Human Capital Index

EPI - E-participation Index

SMS - Short Message System

JSON - JavaScript Object Notation

USGS - United States Geological Survey

API - Application Programming Interface

Appendix

Online design tool that was used to create the wireframes and prototypes:

https://uizard.io/