Megacity Challenges
Public Safety and Possible ICT Solutions-
A Citizen Centered Approach

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Abstract

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This thesis was designed to study the challenges faced by the megacities of the world today and to take a deep dive into one of the challenges, to better understand the role of ICT in improving the quality of life of people in a megacity. Even though several challenges exist in the megacities, safety and security are utmost necessary to have a better quality of life. Hence "Public Safety" becomes a social challenge, which places burdens on the quality of life of people living in megacities and also with a huge scope for ICT opportunities was chosen to study this problem further. Particularly, importance was given to a futuristic approach of how citizens benefiting from ICT tools can influence the overall safety of their cities.

The background research on the megacity challenges finally led to addressing the megacity Mumbai, a fast developing city in India, a megacity with lower ICT infrastructure as a subject of this study of the future of ICT solutions in the Public safety domain. During this process user surveys with Mumbai citizens and the ideas gathered through discussions with UX experts in Ericsson led to the generation of a number of concept ideas surrounding public safety.

The concepts were created mainly focusing on women safety and empowerment, civic engagement and transparency of the law enforcement process and how ICT can be beneficial in solving these issues in the future. As a result, personas and scenario visualizations were created to further study the use of ICT solutions.

It was clear that information and communication technology solutions could empower citizens with similar interests to organize and engage themselves to be smarter citizens of their cities contributing to an effective, safe and livable city. Furthermore citizen-to-citizen interactions and citizen and government interactions can result in a productive network to take a city forward in terms of fulfilling the basic needs of citizens.
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Yours Sincerely,

Dhanfia Habeeb Rahman

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1 Introduction

In this chapter we will introduce the topic megacities and brief about the UX approaches in Ericsson.

1.1 Megacities

Today, 50 percent of the world’s population lives in cities, a figure expected to reach about 70 percent by 2050. Almost all the demographic growth over the next 30 years will be urban, and there is a constant stream of people moving from rural areas to cities in search of better opportunities and quality of life. (Anneroth et al. 2012). The definition of a megacity by UN says that a “metropolis is a megacity when it has a population of 10 million or more”. The increase in population in the megacities is a challenge in itself, which gives rise to many other risks like water shortage, security issues and unemployment. This population explosion is more common especially in the developing world (Asia and Africa) where the cities have a growth rate of 6% annually.

A high birthrate combined with increased migration from the rural areas to the cities in search of opportunities adds to massive issues in the megacities. For example in the developing megacities like Delhi, Mumbai, Dhaka etc. the standard of living of the citizens is affected, as there are low standards of infrastructure and housing, lack of educational facilities, poor security and negligence from the city governance.

The challenges faced by the megacities are diverse and can be described and categorized in different ways by different actors affected by them. Some include well-known governance areas like transportation, utility, food, water, public safety, unemployment and urban divides. Others include challenges seen from the inhabitants’ perspective, the perceived quality of life, job opportunities, entertainment and individual drivers (Anneroth et al., 2012).

In the developing world the constant increase in the population also has serious effects like increase in crime rate, health risks and increase in poverty when they are accompanied by a weak economical growth. World bank predicts that the cities in 2035 would become home to the majority of the worlds poor (G. Lofthouse, E. Unit, P. Munich et al. 2006). The uncontrolled migrations adds to the constant increase in the number of people living in slums in the developing megacities. The cities become home to different socio economic groups as a result of the migrations, who live in close proximity which gives rise to polarization and inequalities (Anneroth et al. 2012) among the citizens. In addition to this corruption and negligence from the governance add to the rise in safety and security issues in the megacities with lower socio economic status.
1.2 Thesis objective

The overall objective of this thesis is to gain knowledge about the people, businessmen and governance perspectives of a targeted challenge, public safety in this case, that affects large cities and realize what would be the opportunities that would be created in the long run. With the help of the existing data research within megacities and their challenges, a deeper analysis of some existing ICT solutions will be made and further concepts for future ICT solutions towards the megacity challenges will be developed. The major parts of the project includes

- Investigation, background research and documentation of research addressing the challenges identified for low ICT maturity city as those categories are the major focus of the thesis.
- Deeper analysis of one challenge area including existing ICT solutions in order to identify opportunities.
- Definition of a number of novel ICT concepts for future solutions (based on the conclusions from the research investigation)
- Visualizations of one or two of the defined concepts (story boarding).
- If applicable user feedback (i.e. focus groups, interviews etc) of the concepts using the developed visualizations.

1.3 Limitations

This thesis does not aim to provide any quantitative results on the user experience of the proposed ICT solutions as the visualizations are created to understand the concept rather than being functional. Instead it focuses on showing the various possibilities of ICT intervention in the safety of the future megacities, Mumbai in this case. As far as the challenge addressed in this thesis “Public safety”, being a complex area, it was not possible to look at all the problems associated with public safety in Mumbai. Hence the study was narrowed down and primary importance was given to women safety and their mobility, to come up with concepts surrounding it. Other ideas were also discussed around issues like migration and crimes like thefts and pickpocketing but the concepts were not visualized as such in this thesis.

Another important factor which has to be taken into account is that the user studies that were carried out was more of a remote study with focus on existing material as the studies were carried out in Sweden and the focussed user groups were located in Mumbai. The questionnaire that was designed and sent to Mumbai was only an attempt to get an inspiration on the conditions in Mumbai rather than to quantify the results as such. Hence the respondents did not belong to diverse groups but were the most relevant group like students and professionals who moved around in the city during different hours of day and night.
1.4 Ericsson User Experience Approach Overview

This thesis was carried out in the Ericsson User Experience lab. User experience is defined by ISO 9241-210 as “a persons perceptions and responses that result from the use or anticipated use of a product, system or service”. User experience includes all the users emotions, preferences, perceptions, physical and psychological responses, behaviors and accomplishments that occur before, during and after use.

The user experience approach of Ericsson is integrated into the beginning of the design process by having a focus on the users. This makes the entire approach more human centered. In addition to that it helps to get a deeper understanding of people, business and technology and look at opportunities and limitations resulting from the design ideas.

**Figure 1: UX inspired Approach, Ericsson UX lab Illustration**

*(Norlin, 2012)*

**Exploration Phase**

The user experience research process in Ericsson kicks off with the exploration phase, in which inspiration, knowledge and insights about the project are gathered and understood through various methods. Some of these methods are user studies which includes ethnographic studies, observations, desktop research and studying similar existing solutions. This is followed by ideation which includes brainstorming and discussion sessions.

**User Research**

The research phase mainly involves the use of qualitative methods like field studies and observations, user interviews, focus groups and desktop research to gather information about the users, the context of usage and the motivations behind the usage. The exploration phase looks into various details of the solutions like technology aspects, business aspects and also the people who are going to use them.
Ideation

Furthermore this phase includes sharing and generating new ideas through ideation. Ideation can be defined as an active, fast moving collaborative group process for forming ideas for design. It can be used as tool for design thinking. It is a process where new ideas can be brainstormed to solve design problems(Hartson and Pyla, 2012, p.274). Ideation process includes brainstorming and discussions with experts in user experience research.

Conceptualization Phase

The ideation is then followed with the actual sketching of the ideas gathered during brainstorming sessions. The sketching of the ideas is based on the concept itself rather than looking into the details of the design. These sketches serve as an important medium for communicating the ideas, (Nilsson and Ottsersten,1998). The sketches in the UX process are then used for exploring the possibilities of refining the concepts and the ideas and concretize them into potential solutions.

Personas

The concrete sketches are then followed by the creation of personas or user archetypes. Personas can be an imaginary person that would represent a target group for whom the concept or solution has been proposed. The characteristics of a persona can be studied during the exploration phase; these personas are mainly used as inspiration for discussion.

Scenarios

The personas created are used as actors to tell the stories, which are presented in user scenarios. User scenarios are used to visualize and narrate the concept along with the actors who will accomplish their tasks with the proposed solution. These scenario visualizations will focus on the users needs rather than the technological aspects of design. The scenarios can be presented in many different ways some of which includes sketches, pictures or movies. For example a user scenario showing a person using a smartphone to check traffic details can include details like the person sitting in his car and checking his phone for updates of traffic in his city. Such details can explain the concept being used in the context taking into many more aspects like cultural backgrounds, barriers and circumstances that lead the user to use the product (Quesenbery and Brooks, 2010).

In this thesis, the exploration and conceptualization phases of the UX research process are focused and discussed and the methodology of these phases are sought for addressing the megacity challenges and for coming up with ICT solutions for the same. The shape and build phase of the UX inspired development process is not under consideration in this thesis but can be used as an extension of studies in future.
2 Methodology

In this chapter we will explain the diverse methodologies and then summarize the results from them.

2.1 Work Flow

The research work started with the process of selecting a suitable challenge and megacity for this study as there are a number of megacities, with their respective challenges. After the selection of the city and the challenge, I have used a number of methods in combination as follows to explore the current issues and come up with possible ICT solutions surrounding them. These methods would be discussed in detail in this section.

![Flowchart](image)

Figure 2: The work Flow

2.2 Research Questions

The research questions that would be addressed in this project are as follows:

1. How can the present situation in low ICT mature (lower socio economic maturity) cities be addressed, What kind of ICT solutions be created in order to address the megacity challenges and improve the quality of life of people living in those cities (E.g. Mumbai, Delhi, Lagos etc.)?

2. How is crime in the city of Mumbai affecting the safe mobility of citizens (women) and whether ICT can open doors for the improved public safety conditions in this low mature megacity?

2.3 Selection of Challenge and City

This work includes research on the various megacity challenges existing in the megacities of today inorder to narrow down the research from a wider perspective and to cast out one major challenge and also to highlight one megacity, which is affected by that challenge. “Public safety” was chosen as
the challenge to be addressed, as it is considered as one of the major challenges that the megacities of the world are facing today. This challenge is also of prime importance from Ericsson’s perspective as Ericsson have carried out research and concept definition on ICT solutions in the public safety domain.

The research started of with a deep dive into the challenge “Public safety” and later determined to narrow it down to view it from the perspective of the low ICT maturity megacity Mumbai. The main aim of choosing Mumbai was to have this research done on a low mature city being the focus of the thesis work and also to get an insight on the citizen’s perspective of usage of the ICT solutions which is done by focusing on user studies, and existing ICT solutions within Public safety. The increase in crime rate in Mumbai from 2007-2012 was another important factor to get a Mumbai perspective in this study.

2.4 Desktop Research

This process included an extensive review on the existing literature on megacities. Ericsson reports on megacities, UN reports on safety and security to focus on Public safety issues, Government websites on crime in Mumbai were studied to get an insight into the major public safety issues in the metropolis. This research helped to further narrow down the focus from the complex public safety issues to daily life mobility issues faced by the citizens in Mumbai. A bottom up approach to address this challenge was decided to leave behind the traditional method (top down perspective) of solving safety issues by the law enforcement and the government. Existing ICT solutions surrounding the safe mobility in the city was also studied during the desktop research.

2.5 Questionnaire

In order to identify the major issues regarding Public safety in Mumbai and to complement the desktop research, the questionnaire method was chosen. This questionnaire was not aimed to make a quantitative study about the people in Mumbai, but to connect with Mumbai citizens and bring out the common views of the citizens of Mumbai on safety when they move about in the city. The main aim was to bring out the possibilities of grasping ideas around safety in the city from the citizen perspective, to be used as an inspiration for ideation and concepts.

The questionnaire was sent over the web through Google survey (Google, 2012) to participants in Mumbai, who were mainly students and professionals. It consisted of 31 questions in total, which were aimed at answering specific research questions. Most of the questions were multiple choices in order to make it easier for the participants to fill out the questionnaire without having to spend much time. Out of these, 3 questions were strongly open-ended questions to get participants opinion in their own words, which can be used as qualitative data during the research process even though other questions were also given options to add comments. As far as the closed questions were considered, there is very little scope for the researcher to misinterpret the results, which increases the reliability of the answers. In addition to that, the questionnaire prove to be an effective method because it is aimed at addressing the safety issues in Mumbai, which can be a critical area to
provide views on. Hence in the absence of the researcher, the participants can
give their views more truthfully which adds to the validity of the answers. The
following research questions were addressed to stimulate ideas and
inspiration around the same.

- How are Mumbai citizens affected by the social unrest or crime in the
city?
- How safe do the citizens feel when they move around the city?
- When, where and what kind of behavior or activity makes them feel
unsafe in the city?
- What kind of measures do they take to tackle crime or disturbances
caused when they are moving in the city?
- Who will play an important role in maintaining the safety conditions, the
people, law enforcement agencies or the government?

2.6 Ideation

Ideation can be defined as an active and a fast collaborative group process for
forming ideas for design. It can be understood as a tool to be used in the early
stages of design thinking. Brainstorming sessions were chosen as a main
method because of the creative ideas that would result after such sessions.
The ideas collected at the end can be used to carry out the task at hand.
These sessions were based on the motivations and ideas collected during the
research and the questionnaire process (Hartson and Pyla, 2012).

During this phase of the research, brainstorming sessions were conducted
with the UX experts team in Ericsson, which was an extensive and productive
2 hour session and also informal discussions with the team of 4 for the
megacity program in several occasions to generate concrete areas to focus on
in terms of the safety issues from Mumbai context and also to identify possible
ICT solutions surrounding the same. Major focus was given to certain issues,
which was inspired from the questionnaire surrounding Public safety, and
were discussed in detail during these sessions. Those major issues discussed
were around women safety, road safety, and pickpocketing. They were
discussed from a bottom up perspective, to have strong citizen centered ideas
revolving citizens, their communities, law enforcement of Mumbai, and the
government. The underlying reasons of these issues for example uncontrolled
migration from other states, poor security was also discussed during the
ideation phase.

2.7 Storyboarding

User personas were created with inspirations from the questionnaire, user
study, ideation and the research. Defining concepts around safe mobility of
women followed this, as it was under focus after the ideation phase. Sketches
were created to represent the possible use of ICT solutions and in what kind of
contexts women and the community would use them. These sketches were
then used as a base for visualizing the concepts, which was done with tools
like Keynote and Photoshop. The personas were then used in scenarios to
explain the story in a more intuitive way regarding the usage of the ICT
solutions for safely moving in the city through community driven initiatives (Quesenbery and Brooks, 2010).

### 2.8 User Feedback

The visuals created with the personas and scenarios, which exemplify ICT contributions for women to move safely in a megacity context was then used to get feedback from users. The interviews had to be conducted online over Skype because the participants were located in Mumbai. There were 5 interviews, which comprised of 2 male participants, one female participant, one women Police Inspector and one Ericsson employee from Chennai; two of the interviews were conducted in Stockholm itself. The feedback was noted down and recorded for analysis.

### 2.9 Methodology Review

When it comes to the questionnaire method, there were only 19 responses and hence it cannot be considered accurate information in regards to the citizens’ view. Most of the participants who responded were students or IT professionals and there is less possibility of them belonging to lower socio economic status because of their profession as such. There was no means to get responses from the lower socio economic maturity group, which could have been an interesting stimuli material to get a deeper knowledge on the issues faced by that user group. Mumbai being a city with 19 million would require a sampling method to send out questionnaire, which was not possible because of a remote study on this city. An ethnographic research on the city and face to face interview sessions with citizens belonging to different socio economic statuses and age groups, the Mumbai police, would have given an opportunity to better understand and experience the daily issues in Mumbai. This is a potential limitation in using the online questionnaire method to gain insights on safety of Mumbai.

On the other hand, whereas the user feedback sessions are taken into account, there were 5 sessions totally. It was done over Skype with the exception of one participant who was a visiting Ericsson employee from Chennai. The online sessions, because of the possible interruptions may have had an effect on the reviews on the concepts. A face-to-face feedback session would have added to the credibility of the concept reviews. People from Chennai, including the Ericsson employee and the police inspector was interviewed mainly because of it being another low mature megacity, and because of my nativity belonging to that part of the world.
3 Research

In this chapter we will discuss the background research carried out at the beginning of the thesis and also look at existing solutions.

3.1 Literature Review

Literature review for this thesis work started off by studying various external and internal Ericsson reports on Megacities and the networked society. This was carried out as an extensive desktop research. Also various articles, government documents, UN reports were studied to get hands on statistics and also to get a deeper understanding of the diverse challenges, the demographics and quality of life of the people living in the Megacities.

**Megacity Archetypes**

The megacities are diverse in nature, they can be categorized based on their socio economic status or ICT maturity levels; this can help to get a better understanding of their nature and the challenges that they face.

**LOW MATURITY (Example cities : Delhi, Dhaka , Karachi)**
- Transport, Water, Energy - lack of infrastructure or inadequate capacity
- Housing & Jobs - informal settlements and informal jobs
- Urban divides and segregation
- Corruption - a barrier to competitiveness
- Health - only provide rudimentary health services
- Education - high proportion of poorly educated

**MEDIUM MATURITY(Example cities : Beijing, Shanghai )**
- Transport, Water, Energy - lack of infrastructure or inadequate capacity, but better planning and resources (financial and organizational)
- Jobs - unemployment and underemployment
- Environment - economic growth is prioritized
- Higher demands from increased wealth

**HIGH MATURITY(Example cities : Tokyo, New York)**
- Transport, Water, Energy - old or obsolete system and infrastructure
- Health - healthcare inflation, aging population, health insurances etc.
- Changes of service expectations
- Incentives for a changed behavior

*Figure 3: Megacity Archetypes and Challenges*
The focus of this study is a low mature megacity and its challenges. These low mature cities are characterized by growth rates driven by migration and natural growth, much of which occurs in informal settlements (e.g., slums). For these cities, annual growth rates are typically 3-6 percent and they are often located in countries with urban populations of less than 50 percent. Examples of emerging cities are Delhi, Mumbai, Karachi, Dhaka, and Lagos. Their populations tend to be younger and more male dominated, with a high proportion of poorly educated rural migrants. Gaps between social groups are seen more often than in the other types of cities and certain types of infrastructure may not be accessible to everyone. Corruption is an important issue faced by the low mature megacities, which becomes a barrier to the overall development and affects the quality of life of the people.

There are a number of questions that arise when it comes to what could be the motivation behind people moving to these cities. Even though these cities are large and crowded, it does not stop people from moving into these megacities. Some of the reasons which are usually seen as motivations from the citizens is to improve the quality of life and grab opportunities that these cities offer. The economic opportunities are often much larger in cities (especially in developing regions eg. Mumbai, Lagos), and better schools and hospitals, better quality of life are very important factors when deciding to move to the city. The expectation of better health care and longer life also seems to be met to some extent since city dwellers today live longer than those in the countryside (Anneroth et al., 2012).

### 3.2 Public Safety- A Social Challenge

The megacities of the world have numerous challenges like transport, energy, infrastructure etc. Urban specialists claim that safety and security is a crucial infrastructure element for a city to be livable. Urbanization can be a driving factor for the increase in crime in the megacities of the world today especially in the developing or emerging cities. Safety of the city dwellers can be threatened both by man-made hazards and natural hazards. But the question is how can the city protect itself against these threats? As a result of a survey conducted with over 500 stakeholders, which includes elected officials, employees, NGOs, media and other influential people in academics. Security stakeholders answers in the survey had raised important concerns about safety especially in the emerging or low mature cities. Safety and security was ranked second only to transportation. Some of the issues that would cater to the increase in crime according to this survey were the crime itself (ranked first 24%), followed by corrupt or incompetent government (15%), poor planning/city management (10%), terrorism (9%) and natural disasters (9%). Also other social factors that were put forward were unemployment, and poverty, which was more prominent in the emerging cities (Lofthouse et al., 2006).

In addressing these issues the survey sensed the need for additional officers followed by planning and preparedness. The survey also indicated that in solving the safety issues, community involvement could make a huge difference by educating the community and increasing awareness and making each individual responsible for the public good. When technology was taken into account, the response was it can be seen as a crucial aid for officers in solving crime (Lofthouse et al., 2006).
3.2.1 ICT and Opportunities

In the past we have seen a lot of changes in the behavior and lifestyle of people with the advent of many interesting technologies that provide us connectivity along with different cloud services that govern our lives today. We are beginning to get a glimpse of the significance of the communication technologies, which can achieve more in the long run and unleash its true potential. Communication services are very essential nowadays to meet citizens' everyday requirements. When we speak about ICT from a megacities context, leveraging these technologies can be a turning point to govern the massive cities of the world today, where opportunities are numerous. Citizens of these megacities have an important role to play, by contributing data anonymously and also planning the measures to come out of issues, which can includes issues like the city infrastructure, crime prevention and transport .

The principal benefit of such ICT systems is the various uses that the data gathered from the citizens can be used, which can in turn be used to inform the citizens about benefits of ICT solutions. In the megacities context, low mature cities such as Manila, Johannesburg, Dhaka, Karachi and Lagos can instead make progress by addressing the digital gap. This can be done through digital access initiatives, ICT literacy training for the underprivileged, and ensuring the integration of ICT into public administration to improve efficiency (Ericsson, 2012c). In the case of ICT for low-scoring cities, way of reasoning about development refers to leapfrogging. The application of modern technology can be done by allowing the low mature cities cities to leapfrog traditional processes of urban development and management. This means that they will have the potential to quickly improve in ICT aspects without necessarily taking all the steps that ICT mature cities have taken. ICT can help in improving transparency of plans and decisions made by city leaders in the low mature cities (Anneroth et al., 2012).

3.2.2 ICT and Public Safety

ICT in the case of public safety has a high potential especially in response and recovery during emergency situations, situational awareness and monitoring and analysis. Some of the potential ICT solutions in the field of public safety are discussed in this section.

**Emergency Telecommunication**

Emergency telecommunication is essential when it comes to managing disasters and emergencies. During emergency situations there is a need for communication between the authorities and the affected citizens. Authorities can be the emergency services which may include the police officials, ambulance services etc (Morandini, 2008). The immediate response and recovery of the situation depends hugely on the efficiency of the communication networks. ICT infrastructures and communication networks of the different agencies involved must be interoperable to support coordination during emergency situations.
Emergency call services, communication among citizens, and dissemination of information to the public can be through mass notification systems like alarms, radio, and television, alerts to personal devices like smartphones, laptops, desktops and mobile phones. Web services, email, short messaging service (SMS) and instant messaging are some of the data services which are valuable during emergency situations (Suraci et al., 2010).

**Surveillance And Wireless Video Streaming**

Cameras have become an important tool in crime investigation, prevention and monitoring. Surveillance cameras are broadly used in the urban regions to investigate accidents that occur, with the help of video feeds captured by the surveillance cameras in the respective places. Today in the United States over 90% of the cameras are wireless, bandwidth is an important factor when it comes to wireless streaming of videos (PERF, 2012).

The London Metropolitan Chief Detective Jim Stokely was quoted saying that the first priority in using the surveillance cameras is to retrieve video feeds, and after examining the video feeds, they track down the criminals with images or videos captured near the crime scene (PERF, 2012). In the background these surveillance systems use multiple cameras, transmitting the video signals to a central control room, where security personal can access the feeds. Surveillance systems use image analysis techniques to extract information from the surveillance data. These systems use many algorithms like object tracking, object detection, and object classification. Some of the factors for classification can be based on size shape and colour of the objects tracked (Addpriv, 2011).

**Predictive Analytics To Prevent Crime**

Predictive policing with the help of ICT is an emerging concept, where past crime patterns are analysed and patrol is directed to the area where crime is expected to occur. This is considered to be a smart policing technique to fight crime, by predicting before it happens. This is made possible by analysis of crime data to take proactive measures to pre-empt crime. The predictive analysis of crime is identified with the Los Angeles Police Department.

The chief of Detective Charlie Beck of Los Angeles police department defines predictive policing as “Advanced analytics includes the systematic review and analysis of data and information using automated methods. Through the use of exploratory graphics in combination with advanced statistics, machine learning tools, and artificial intelligence, critical pieces of information can be identified and extracted from large repositories of data. By probing data in this manner, it is possible to prove or disprove hypotheses while discovering new or previously unknown information. In particular, unique or valuable relationships, trends, patterns, sequences, and affinities in the data can be identified and used proactively to categorize or anticipate additional actions or information. Simply stated, advanced analytics includes the use and exploitation of mathematical techniques and processes that can be used to confirm things that we already know or think that we know, as well as discover new or previously unknown patterns, trends, and relationships in the data”. Furthermore the accuracy of the predictive policing technique depends on the accuracy of the information (Bailey, n.d).
The crime data like crime type, date, time and location are stored in a web based system. The predictive analysis algorithm requires the date, time and location of crime and combines it with historical crime data to make predictions. These predictions are mapped as hotspots of crime and patrol is directed towards those areas where there is high possibility of occurrence (Friend, 2013).

### Social Media

Social Media growth have become popular among police departments to communicate with the public. Most of the police departments communicate to the citizens through websites, blogs, twitter and facebook accounts. They use this method to have a two way communication to involve the citizens as a stronger force to solve crime or to alert about events. For example, Sacramento Chief Rick Braziel was quoted saying that they use Facebook and twitter and also youtube to interact with public. They post all their press releases, crime prevention videos on their facebook accounts which attracts people to look into the information. They have also partnered with Women escaping a violent environment (WEAVE) and started a campaign to post educational messages about consequences of rape through social media (PERF, 2012).

A police agency in the UK stated that applications to track crime are being made available to victims who report crime, with which they can go online to see the progress the police are making on the crime they have reported (PERF, 2012). With its increasing popularity social media have become the latest means of communication that police officers use. The main goal of social media is not only to provide information but also to improve overall crime prevention abilities says Elizabeth Township, PA Chief Robert McNeilly (PERF, 2012).

#### 3.2.3 Deep Dive into Mumbai Context

In order to get a better understanding of the Public safety challenge in the context of a low mature city, Mumbai, which is a rapidly developing megacity was chosen. The Mumbai Metropolitan Region is the largest urban agglomeration in India (Risbud, 2003). The population of Mumbai (July 2012) is 18.414 million and a 25% increase in population is expected in 2025. The literacy late in Mumbai is claimed to be 88.5% (Patel, 2013).

Mumbai's contribution to the growth of the Indian economy has been significant as nearly 40 per cent of state domestic production originates in Mumbai. It is therefore called the 'commercial capital of India'. With its port, manufacturing industry, (traditional and modern), government and financial institutions, trade and services, Mumbai represents one of the most diversified and vibrant economies in the country (Risbud,2003) and this is one of the major reasons why Mumbai attracts people migrating here from all over the country. As it sounds it offers numerous opportunities, so people from different parts of the country get attracted towards Mumbai. Uncontrolled migration has resulted in a major growth in the overall population in the recent years. Migration has also resulted many informal settlements known as slums in the city. Over 48.88% of the population of Mumbai lives in slums (Patel, 2013). When it comes to opportunities in this megacity men and women are equally
competent in the job market, which becomes another important reason for the uncontrolled urbanization of this metropolis (Phadke et al., 2011).

### 3.2.3.1 ICT Maturity Of Mumbai

ICT maturity of a city plays a huge role in influencing the citizen behavior in a city to influence positive results like making the city more livable. Earlier in 2011 Ericsson in cooperation with Arthur D little, presented a networked society-city index that mapped the ICT maturity of 25 largest cities in the world. When we look at how far has Mumbai ranked in terms of ICT maturity, it has a ranking of 18 out of the 25 cities, which gives a hint that there is a huge scope for improvement when it comes to the use of communication technology in this metropolis (Ericsson, 2012c).

But there is a positive aspect of communication technologies when it comes to India as a country, as mobile phones are becoming more common and being used widely from rural areas to urban areas. In India, there are 20 million mobile subscribers each month. When it comes to India's smartphone user population which is growing exponentially according to a new survey by Nielsen Informate Mobile Insights. Only 9% of the entire mobile user base are smartphone users in urban India. With 900 million mobile phone users (according to Trai) India is considered to be one of the fastest growing cellular markets and every handset maker is trying to offer the full suite of products ranging from basic phones to the high end feature loaded smartphones. The major reason for this rapid adoption of new technology by Indian consumers; is the need of consumers to stay connected 24X7 and to do more while on the move are some factors that are driving consumer preference for mobiles and mobility (Rustagi, 2012).

### 3.2.3.2 Present Safety Conditions in Mumbai

As Mumbai has grown exponentially in the last several years, so has the rate of crime. Mumbai’s crime level is not high for a city with more than 20 million people. Based on Mumbai Police statistics, the crime rate continues to be an ongoing problem for the tremendously short-staffed city police. Mumbai law enforcement is noted to have 33,000 officers (165 officers for every 100,000 citizens) to police its rapidly growing city, which is 20% less than what they are authorized. 222 officers per 100,000 persons is the international standard of police strength. Reports of burglary, stolen bags, and valuables being fairly common; however, most of these crimes occur in a non-confrontational manner, usually through stealth or forgetfulness of the victim. While street crime such as pick-pocketing and robbery/assault is a common occurrence, Violent crimes do occur in Mumbai, but for the most part, the seem to be isolated in more high density areas such as slums and crowded apartments blocks (OSAC, 2012).

Crime against women have been on the media reports more than before in Mumbai. There is an increase in reports of street harassments, sexual assaults within the Indian community however this increase is attributed with increased sense of reporting crimes to authorities. Street harassments meted out to women are known as eve teasing here. According to the latest figures by Indian authorities, rape is the fastest growing crime in India (OSAC, 2013).
3.2.3.3 Women Safety – A rising Issue

A deep dive into the public safety challenge resulted in choosing a rising issue to focus on which was women safety in the emerging cities. The UN women report points out that with more than 50% of the world’s population living in cities, 1 billion live in slums, and often lack access to safe housing, essential services, land tenure, quality education, and basic rights, including freedom from fear and violence and the right to participate in an economic life. Fear is common for many women as violence have become a common occurrence in both developing and developed countries of the world. The victims of this violence are especially women, youth and children (especially girls). Sexual violence and harassment of women and girls in particular, poses a greater challenge, and women face experience such threats on their way to school, work, on streets, and in other public spaces (UN WOMEN, 2011).

The UN women organization while studying about the progress of women in the world have come up with many shocking realities about womens rights in world today. As per their findings, the progress of the world’s women starts with a paradox: the past century is seeing a transformation in women’s legal rights, with countries in every region expanding the scope of women’s rights. Still for most of the world’s women the laws do not offer equality and justice. In many contexts, in rich and poor countries alike, the infrastructure of justice – the police, the courts and the judiciary – is failing women, which results in poor services and hostile attitudes from the very people whose duty it is to fulfill women’s rights. As a result, although equality between women and men is guaranteed in the constitutions of 139 countries and territories, inadequate law, poor enforcement and implementation gaps make these guarantees only in paper, this has little impact on the day-to-day lives of women (Braun et al., 2012).

It also points out that a well-functioning legal and justice systems can prove to be a vital mechanism for women to exercise their rights equally in the society today. Laws and justice systems can shape society, by providing accountability, by stopping the abuse of power and by creating new norms about what is acceptable. Infrastructure of the justice systems are suffereing because of their discriminatory and missing laws, this makes access to justice near to imposiible for women. UN women mention in their findings that progress of the world’s women underscores that laws and justice systems are biased against women’s interests and reinforce unequal power relations between women and men, must be transformed in order to fulfill the potential they hold for accelerating progress towards gender equality (Braun et al., 2012).

Services of the justice systems do not seem to take into account the barriers that women face, due to social norms. Poverty or lack of awareness in the justice system is a major problem in all regions especially in the poorer regions of the world. In some communities, women are still unable to approach justice systems without the assistance of a male relative and social norms hinder their ability to exercise autonomy outside the household. The UN report quotes an example from Timor leste, by a study that 58 % of Timorese women are disapproved of speaking on their own behalf in any issues (Braun et al., 2012).
In cases of sexual and domestic violence, social sanction for women who approach the formal justice system is especially acute. Sexual violence is the only crime for which the victim is sometimes more stigmatized than the perpetrator in most of the countries of the world today, with women who report such crimes are not usually appreciated by their own families and communities (Braun et al. 2012).

3.2.3.4 Women Safety - Mumbai

Over the last decade, socio economic changes in Mumbai has resulted in a larger presence of women in the workforce, which includes, white and blue collar, as well as informal economy workers, who move around the city at different times of the day and night (Phadke et al., 2011).

The city of Mumbai was well known for its safe and friendly surrounding for women in the past. Recently when it comes to safety of women, there are a spring of issues rising in this metropolis and is not considered very safe. A survey conducted by Akshara, a women's Non Governmental Organization (NGO) that works towards gender sensitization, has now documented that Mumbai women are increasingly feeling unsafe in all its public spaces like railway platforms, subways, skyscrapers, buses, at bus stops, in the marketplace, and even on the beach.

In December 2011-January 2012, the NGO Akshara had undertaken a Safety Walk Project along with National Social Service (NSS) students from five colleges. They have selected 19 disparate locations to understand the physical and social factors that make a public space unsafe for women. "It is not just social but also physical factors that lead to violence against women," was quoted by Nandita Gandhi co-director of the NGO Akshara.

Students carried out the survey in each area during the day as well as dark hours, as the place’s character seemed to change at different times of the day. Three country liquor bars along the Kurla station road in Mumbai meant drunken men were found loitering in the area. In the evening, women quoted that their numbers increased. It was also found that non regulation in parking and movement of autorickshaws worsened the current situation.

The study found that most of the women faced lewd comments passed by construction workers and boys who hang around. The crowds made it easier for a girl to get harassed and there were also cases reported on theft and chain snatching.

At Churchgate and CST subways of Mumbai, lighting was found to be inadequate and women found the overenthusiastic vendors threatening. Women were also teased by clicking photos by men and vendors loitering in the subways. Most of the men were drunk and they added to the fear of women passing by. "Many men were seen crowding around the wine shop and in the evening heard passing comments at young women wearing skirts and shorts. Police presence through the day was inadequate and absence of CCTV made it difficult to detect crime," stated the report.

At the Chembur skywalk in Mumbai, widespread harassment of girls was reported both during the day as well night. Cases of whistling, singing songs, passing lewd comments, stalking and following women and girls on the
skywalk were reported as rampant occurrences. On all skywalks in Mumbai, couples were found to be hanging around. This attracted single men who would wander around the area and stare. In the evening or the dark hours, the number of couples increased. Poor lighting was reported in many parks like Shivaji Park and Aitond Gardens which paved the way for theft and robbery apart from harassments.

The author also states that in many areas, like Azad Maidan, women were comparatively less and never alone as it was frequented and used by men. The experience of violence by women at all times in all kinds of places across the city reflects the gender insensitivity of not only the general public but also that of the institutions that govern society, said Gandhi. "In spite of the increasing rates of crime against women in the city, no police personnel was found in any of the places audited. The security guards were either absent or, if present, hardly effective. Other people, both men and women, seemed barely concerned when they witnessed men eve-teasing or harassing women. Absence of measures to ensure women's safety speaks of a deeply entrenched discrimination against women and a normalization of values that disrespect and violate women," she said (Lewis, 2012).

**Some statistics on women safety Issues**

Some statistics of crimes against women stated by the author, Yadav (2012) are as follows (Yadav, 2012).

- In 2011 till November, the Mumbai city police had registered 663 cases under section 354 (outraging the modesty of a woman) and 509 (intentional insult to modesty of a woman), the figures have gone up to 698 for the corresponding period in 2012
- The figures are provided by the Praja Foundation, which relies on Right to Information from the government authorities
- As per the statistics provided, rape cases registered in the city during 2010-11 were 180, which went up to 207 (a rise of 15%) in 2011-12
- Similarly, in 2010-11, there were 483 molestation cases registered, which have increased by 14% to go up to 552 in 2011-12

To be noted these are statistics are of only the reported cases, cases which are not reported or registered, can add to the vulnerability of women safety issues in Mumbai.

**3.2.3.5 Law Enforcement Mumbai, India**

When it comes to Public safety, major responsibility lies in the hands of the law enforcement agencies to ensure security to the citizens. Hence a research has been made on the law enforcement policies in Mumbai context to get an overview of how they ensure safety to their citizens. Mumbai Police ensures the Rule of Law, enforce the law of the land impartially and they are supposed to maintain public order, preventing and detecting crime, maintaining and promoting communal harmony, ensuring a smooth flow of traffic, and taking strong action against terrorism, organized crime, anti-social/illicit activities/elements. They are also meant to serve and protect all; particularly the downtrodden, the weak, women, minorities, senior citizen's, slums dwellers,
the poor & other marginalized sections of society. Prompt & compassionate response to every call of citizen's in distress to make Mumbai a safer and better place to live is their mission and to work for this in partnership with the community (Mumbai Police, 2012).

3.2.3.6 Policing and ICT

When it comes to policing, India just not lack in terms of technology but also in terms of transparency, reforms, standardised police to people ratio and most importantly citizen centric governance. Even though the service delivery in the country is undergoing a complete transformation through e-Government implementation, to date one finds it a big hassle to lodge an FIR, especially the uneducated and deprived sections of our society. Intelligence gathering and sharing are areas where ICT could be leveraged in a big manner says Ravi gupta (Gupta, 2010).

Dr. Kiran Bedi, former director general Bureau of police research and development, India in an interview Regarding Public safety and ICT was quoted saying “In terms of the infrastructure Indian system has become stronger, but in terms of the assurance and the trust building from the citizens is still missing which makes the whole system weak”. She also was seen quting “ ICT has tremendous role to play in the modernisation of the Police as technology has no boundaries and cuts across all the barriers. Seamless technology is what is needed for integrated and transparent policing. Although the process has begun still it is a long way to go. e-Complaint has still not been networked, the process has till not begun at an all India basis. It is important that the whole crime mapping comes online as it will be easy to locate what is happening in a particular area. The strategy of the Police will change accordingly when most of the things will be visible online and subsequently things will be transparent. It will also help in the speedy decision making. For the online registration of the complaints, there needs to be one repository to manage the common complaints and the software should be such which should direct the complaints to the concerned Police stations and the departments. The software should be linked to the local/area Police stations so that the immediate crime could be reported. The online registration of the case will also help in the authentication of the records, which at the moment is not possible as the results are tampered with. The Police officer will have no choice to suppress the crime. ICT can also help in engaging the entire Police force of the country with the help of Video Conferencing. It will make the thing faster. People of the country have to be hungry for the reforms, then only the change in the system can take place” She feels that the police should have the zest to reach out to the common man in the remotest part of the country, then only a change can be bought about in the law enforcement system of India (Gupta, 2010).

3.2.3.7 Mumbai Police Initiatives

When it comes to Mumbai police they have taken some initiatives recently and took the aspect of crime fighting to schools and colleges to create awareness among the students and parents against crime, and traffic issues by conducting workshops. In Delhi, another low mature city in India,where the infamous rape incident occurred gained worldwide media attention. Even after much spur the women safety issues have not come to a halt and there has
been a spate of cases reported in Delhi and Mumbai following the incident.
Mumbai police also have taken their awareness venture to 350 schools asking
the students to report if they witness any crime against women on the streets
(Express news service, 2012).

The police in Mumbai maintain their web site which provides services to the
public to access information about crime statistics in the city and also about
the emergency helpline services and police station locations with contact
information (Mumbai police, 2012).

Following the ghastly gang rape in Delhi, higher officials of Law enforcement,
Mumbai Crime Branch Chief Joint Commissioner of Police Himanshu Roy
spoke out in support of a stringent law for crimes against women. At the same
time, the Mumbai Commissioner of Police Satyapal Singh also assured that
the police force would aim to increase policewomen in the police force. He
also stressed the force would need public support to ensure that Mumbai
remains a safe city for women. Taking forward this objective, top cops of the
Mumbai police had come together to launch ‘Operation Mrityunjay’, involving
the youth in the city. The aim is to familiarize them with rules and methods to
prevent crime (Gupta, 2013).

The Commissioner of Police, Mumbai also announced a phone app that could
help women in distress. The ICE (In Case of Emergency) application for
android phones is available on the Mumbai police website. Through this
software women can feed the mobile number of the concerned people that
they want to contact in case of emergency, and can even feed the number of
police. In case of emergency the woman have to press just one button of
telephone. The Mumbai Police hopes that the 'Mrityunjay' project will improve
its interface soon and make it a more people-friendly and approachable force.
The police are also banking on alert citizens to help them fight crime on the
streets, especially crimes against women as stated by the author the article
(Gupta, 2013).

3.2.3.8 Indian Government Initiatives

The infamous Delhi rape incident resulted in ensuring reforms for women all
over the India. Nirbhaya fund was solely created after this incident to ensure
safety of women in the Indian cities. The government of India announced it
during fiscal year of 2013.

While presenting the government's budget for this fiscal year of 2013, Mr
Chidambaram, Minister of finance, India was quoted saying, "We have a
collective responsibility to ensure the dignity and safety of women. Recent
incidents have cast a long, dark shadow on our liberal and progressive
credentials. As more women enter public spaces - for education or work or
access to services or leisure - there are more reports of violence against
them." He has also stated that, the fund will be used to empower and protect
women. The Government of India has also made many reforms across the
country for safety of women across the different states in India (Biswa,
2013).

In the state of Maharashtra, India, the government has proposed setting up a
special women's cell in all police stations, counseling centers and an increase
in the presence of women in the police force. Cops who fail to register
complaints of crime against women will be facing action as stated by the author Biswas (2013). Home Minister of India, R R Patil has also mooted the setting up of 25 special fast-track courts to hear cases of serious crimes against women in a faster pace (Biswas, 2013). In Rajasthan, India a helpline called Garima has been launched. It allows enquiry and assistance by making calls, sending SMS, and e-mails. Tamil Nadu Chief Minister J Jayalalithaa announced a 13-point action plan that her government will implement to counter crimes against women. The reforms include the establishment of special Mahila (women) fast-track courts, installation of Closed Circuit Television (CCTV) in all public buildings, and deployment of police personnel in plainclothes at public places frequented. In Karnataka, The state government has said that soon all taxis, autorickshaws, and state transport buses will be equipped with surveillance cameras. Taxis and autorickshaws will also be GPS-enabled. The state government has also proposed booking rape offenders under the stringent Goonda Act, which allows for preventive detention without bail (Biswas, 2013).

Public Sexual Offenders Lists - A future possibility

Thousands of students and social groups have organized protests in Delhi and other cities and have demanded better safety for women, tougher punishment for those found guilty of sexual assault, and a faster and more effective legal system after the rape incident.

This led to the Government proposing ideas to take the issue seriously, one of such proposal includes creating a directory of sexual offenders as it was one of the suggestions made by a group of students to help prevent repeat offences. The project may be test-piloted in Delhi, with the details being uploaded on the Delhi Police website. The idea is for every State in India to make its details available via the police’s website for access by the public. Though this idea has not been strictly imposed there is a chance for it be available in the future (Mukherjee, 2012).

3.3 Existing solutions

Some Existing solutions involving a stronger citizen involvement were studied to get inspiration on the use of communication technologies to tackle safety issues from Mumbai Perspective. There were a number of applications available, which involves citizen reporting, social platforms to discuss corruption, apps to send SOS alerts to family and friends etc. A few of the solutions like web services and smartphone applications are discussed in this section to get an understanding of such solutions in the real life situations.

3.3.1 Safe City

After the Delhi rape incident, which created shockwaves around the world, the safety of women in cities has been under the scanner more than ever in India. Three enterprising women came up with the idea of Safecity, which is a web service that was recently launched in January 2013 in India; they also provide a hotline number along with the web service. It allows the citizens of India to report sexual abuse incidents ranging from verbal and physical abuses; these reports are in turn used for creating hotspots in the city, which can be viewed online through the map. This is an initiative to increase the spirit of reporting
abusive incidents amongst women and also to invite the designing of apt solutions by the city governance by analyzing the root cause of such incidents. This application does not have any collaboration with the law enforcement agencies and is strongly developed for citizens to come forward and report crime against women.

http://www.safecity.in/

3.3.2 Fightback

Fightback is a smartphone application available for Android, Nokia and Blackberry phones for Women in Delhi. By the use of this application, women can send SOS alerts through email or Facebook to their friends and family when they are in danger. This application was introduced by a leading IT company in India namely Tech Mahindra in 2011. After the Delhi incident, the company has also given free subscription for users.

http://www.fightbackmobile.com/

3.3.3 RETIO

Crime in Mexico occurs at a high rate and can often be violent. Street crime, ranging from pick pocketing to armed robbery, is a serious problem in most major cities. Retio is an iPhone application, available for the cities of Mexico. It allows citizens to report and have real time information about what is happening in their city. Users are allowed to warn fellow citizens and keep them informed by tweeting about shooting and risky situations happening in their city. It also includes traffic reports in real time.

http://ret.io/app

Figure 4: Fightback app screenshot

Figure 5: RETIO app screenshot
3.3.4 Circle of 6

Circle of 6 is an application available for both android and apple phones that allows users to choose six of their friends and keep them informed when they want immediate help or want to be interrupted when they are in an uncomfortable situation. It also gives the users information about emergency numbers and national hotlines to be used in critical situations based on their location.

http://www.circleof6app.com/

![Figure 6: Circle of 6 app screenshot](image)

3.3.5 Sentinel

Sentinel is a smartphone application, through which a user can send an alert to family and friends along with the location information during medical emergencies, accidents or in critical situations of being robbed or stalked. The application can also send alerts automatically when there is a fear of the phone being destroyed or when the phone is out of the network coverage area. This application makes use of the GPS technology in the Phone.

http://sentinel.mindhelix.com/

![Figure 7: Sentinel app screenshot](image)
3.3.6 Harassmap

Harassmap is a web service with a digital map available in Egypt to address the harassments and abuses against women and change attitudes towards such abuses. It is a social platform for women to report harassment incidents via text messages and social media to increase awareness about sexual harassments and the necessity to report such crime. The Cairo police themselves harass most women when they go forward to report and do not intervene to take the necessary steps. Hence Volunteers were also recruited to convince local shopkeepers and by standers to act when they see such crime.

http://harassmap.org/ar/

Figure 8: HarassMap web service screenshot
3.3.7 Ushahidi

Ushahidi is an open source platform for increasing transparency and for democratizing information. This application is available in iPhone and iPad and helps in creating incident reports and sharing on the go. The users can filter the reports, view additional information like the location, pictures of the incident if available and also share the same via email and twitter. This application can also function without a network connection by making use of the devices camera and GPS capabilities.

http://www.ushahidi.com/

Figure 9: Ushahidi app screenshot

3.3.8 Hollaback

Hollaback is an application designed to help women to share their stories on street harassments along with the location details around the world. It includes 50 cities and 20 countries. It is a movement started by local activists in different cities of the world to end street harassment. The main purpose is to work in groups to better understand street harassment, to initiate public conversations, and to develop innovative strategies to ensure equal access to public spaces.

Instead of being silent to the street harassments women can share their entire story, which would permit for necessary actions, as helplines are more active nowadays only for serious crimes due to which the harassments faced by women is left on the backseat without being given the needed attention and support.

http://www.ihollaback.org/

Figure 10: Hollaback app screenshot
3.3.9 Egypt Anti harassment Squads - A non ICT initiative

Sexual harassment is epidemic in the streets of Egypt and the situation was made worse further when law enforcement turned their back on the issue. Not surprisingly, citizens have taken law into their own hands and have formed anti harassment squads, to pin down the street harassers. These social activists groups are mostly men themselves with flouro jackets patrolling the streets of Cairo to pick and Street Harassers and shame them using spray paints (Fick, 2012).

![Egypt anti harassment squad](Fick, 2012)

3.3.10 Mumbai Complaint Boxes

After the Delhi incident in India, which took away the life of a 23-year medical student as a result of a brutal gang rape in a moving bus. The Mumbai police officials are on alert to ensure safety of women in the city, they have placed complaint boxes at several locations in the city as reviewed by the article in IBN7. The complaint boxes have been put up for victims of sexual harassment and other crimes against women. They have placed such complaint boxes at 1000 different places in Mumbai and also major importance is given to colleges and the schools along with crowded neighborhoods. They have also tried to state to the citizens that they would ensure immediate attention to the complaints and also take action against any lapses in the entire process states the article (IBN7, 2012).
3.4 ICT And Low Maturity

After looking at a number of existing ICT solutions especially applications related to women safety, it can be clearly seen that the aspects that should be taken care of while defining ICT concepts for Mumbai are many. According to an article in YouStory by Mohan (2013) who states some of the necessary steps for an ICT solution like a smartphone app to work in a low mature city like Delhi and Mumbai in India are as follows.

- **Accessible** – There are about 30 million smartphones in India, which is less than 10% of the 800 million mobile connection subscribers that India has. Smartphone have not penetrated even though mobile phones have a great reach. Hence the author states that the first criterion, is that such a solution should be accessible to most people and the app must work across most of the platforms, from a Nokia 1100 to the latest smartphone.

- **Networks** – Another criterion which he puts forward is that the application must work on all networks i.e., it should work even without the possibility to connect to the internet. With an application being used for safety, it is absolutely essential that the right people get notified when a person sends a distress call the distress call. This can be ensured by having an application that would work on mobile Internet as well as SMS.

- **Minimal time to access** - When faced with a real-life problem, it is extremely important that the access time to the solution is minimized by as much as possible. The function of the application should be executed with minimal time. A widget or a soft key function will cater for this need and it must have on any application trying to save a woman from a tight spot (Mohan, 2013).

- **Integrated features** – The author also feels that along with the function of making calls, mobile devices can also offer features such as recording, GPS tracking etc to make the application more useful with different functionalities. In the case of an emergency, any means of communication and evidence will be useful.

- **Cost** - This is an important factor that would determine the overall reach of the applications for safety. Features that justifies the cost would be accepted by people (Mohan, 2013).
4 Results & Analysis

In this chapter we will discuss and analyze the results of the methods used in this thesis.

4.1 Questionnaire

The Google web survey (Google, 2012) was mailed to potential participants in Mumbai. Nineteen respondents answered the survey, which mainly comprised of IT professionals and students. The main aim was not to get quantitative data but to get opinions and inspirations on the safety issues in Mumbai. Also wanted to have an insight on what kind of problems the citizens face while moving around the highly dense Mumbai city during different time of the day, in order to identify potential areas to focus on. The results of the web survey formed the basis for the Ideation process.

The questionnaire gave many interesting insights on how the citizens of Mumbai perceive safety, and also the issues and opportunities associated with safety in Mumbai. Some of the relevant results of the questionnaire are represented in the following graphs and charts.

Out of Nineteen respondents who answered the questionnaire, there were 13 male and 6 female respondents.

![Gender of respondents](image_url)
Most of the participants were professionals followed by students. This group represents the people who constantly go out of their homes to work or study and there would be more chances of them being exposed to the issues which happen when they move in the city.

**Figure 13: Background of respondents**

Majority of the participants who answered the questionnaire had been in Mumbai for a long time and this gives an opportunity to know how well they know about the safety issues in Mumbai and how it has changed over the years.

**Figure 14: Duration of stay in Mumbai**

Majority of the participants who answered the questionnaire had been in Mumbai for a long time and this gives an opportunity to know how well they know about the safety issues in Mumbai and how it has changed over the years.
The above graph shows the results of the neighborhood in which they live in Mumbai, also taking into the aspect of time which is during the day and night hours as timings seemed to have a major influence on the perception of safety. Most of the participants felt a huge difference in the issues faced during day and night hours. As shown in the graph 12 people feel that the city is safe during the day whereas only 4 feel that the city is safe during night.

When asked about how they usually move about in the city, there were mixed answers and there was no absolute answers. Because most of the participants chose to opt for “sometimes” when they were asked whether they travel alone or with friends.

**Figure 15: Safety of the neighborhood**

**Figure 16: Travelling pattern in the city**
When the participants were asked specifically whether they felt safe when they moved alone in the city, there were some concrete answers about feeling very safe during the day when compared to nighttime while travelling alone.

*Figure 17: Safety levels of the city*

When asked about the areas, which made them feel unsafe the views of the participants is shown in the above graph. The participants were more concerned about safety in the subways and abandoned/poorly lit streets where there are not so much people moving around. These answers gave a better understanding of the situations where the people felt unsafe while moving around in the city.

*Figure 18: Unsafe areas in the city*
When the participants were asked to rank the major safety issues in the city. Both male and female respondents felt that harassments, pickpocketing, thefts were some common occurrences in Mumbai. This gave an insight into the major issues of people going out of their homes for work and study.

\[\text{Figure 19: Safety issues in the city}\]

When they were asked about the crime rise in the city and their neighborhood. Most of the respondents did not give a clear view as they gave a ranking of 3 out of 5 for the overall rise in crime. But this also gave an idea that crime was on the rise and not the other way as responses between the ranking 3 to 5 were greater in number.

\[\text{Figure 20: crime patterns in the city}\]
When asked about the measures they would take when they face an emergency or become a victim maximum number of respondents chose calling up friends when they were in emergency, followed by calling up parents/family. None of the participants opted for going to a police station during troubled circumstances neither called any helpline numbers to call up the law enforcement agencies.

**Figure 21: Measures taken by the victims in the city when they are a victim or a witness to crime**

When asked about the measures they would take when they face an emergency or become a victim maximum number of respondents chose calling up friends when they were in emergency, followed by calling up parents/family. None of the participants opted for going to a police station during troubled circumstances neither called any helpline numbers to call up the law enforcement agencies.

**Figure 22: Causes of crime rise**

The causes for safety threats in Mumbai, which people chose in this closed question, was population, poverty, governance, corruption and lack of responsibility.
4.1.1 Analysis

This questionnaire method, even though was answered by 19 respondents because of the distance of the country, proved to give an initial insight into the citizen's problems. Most of the respondents had the same opinions on the safety issues in Mumbai, which can be seen from the results of the closed questions in the graphs above. As far as the open ended questions were considered, when they were asked what kind of precautions they would take when they travel out of home. One of the respondent mentioned “I always try to move out with friends and family and seldom alone” which gave an interesting thought that citizens especially women do feel insecure to travel out alone. This can be associated with many reasons for example, the daily news reports which provide information about harassments and sexual assaults meted out to women who travel alone and the feeling of being victimized can be another reason for this response. But we cannot give an exact explanation of the responses as it depends on individuals and differs from person to person or male to female.

In order to evaluate the exact needs of the citizen's to improve safety, they were asked about their notion on a safe future Mumbai. The responses were mixed. Even though they wanted a better security system in their city like installation of security cameras in more numbers and a better police patrolling they also came up with an interesting thought that the citizens of Mumbai must involve in ensuring the safety of their fellow citizens. This was to bring up a feeling of responsibility and an increased awareness on the part of the citizens themselves rather than expecting the law enforcement to take care of all security issues.

Another important aspect was, most of the citizens felt that going to the police officials to report crime or for any assistance was a waste of time because of the lack of transparency and corrupted officials in the entire process and also the issue of being reprimanded instead of getting real help. They felt that the city police was not helpful and they were harassed in many instances when they approached the police for help.

There was a small attempt to ask the citizens whether they would use location-sharing services i.e. whether they would compromise privacy for safety in difficult situations and 16 people responded positive to this, which gives a hint that safety is preferred when compared to privacy. These results were taken as a qualitative study of the users to further narrow down the safety area into potential themes as “Public safety” itself includes a number of aspects which may be difficult to cover during further research.

The important aspects that were picked up after this questionnaire, from a wider public safety perspective were some of the common issues, which people face more commonly than a serious issue like robbery or murder that, occur infrequently. Some of them are women safety issues, because of the harassment issue which was pointed out prominently in the responses, In addition to that, pickpocketing and street menaces which includes assaults and harassments were taken into account for further research and to look at ICT opportunities involving this, more from a citizen perspective to empower themselves which could further contribute to a safe city as a whole.
4.2 Ideation

The results from the questionnaire were analyzed to get a grasp on the current situation in Mumbai addressing Public safety. The discussion session was conducted for 60 minutes during which the public safety questionnaire results were analyzed to create important themes to discuss about ICT solutions targeting them. During this session, the root causes of the situation as a whole was given more importance. Corruption in the governance, lack of transparency from the law enforcement officials, lack of responsibility from the citizens was discussed in detail. Also for instance, respondents from the questionnaire pointed out that awareness and responsibility on the part of the citizens could help in elevating the safety feeling of a community or city. Responsibility and awareness was taken as a central theme and different methods to improve them was discussed more from a non-ICT solutions perspective. This discussion resulted in the possible actors, the context in which a possible solution can be used and also some positive adaptations from a citizen perspective.

![Figure 23: UX lab White board Discussion](image-url)
A simple representation of the results of the discussion session is shown above. The positive adaptations that resulted were some of the actors or stakeholders who could possibly take control of the situation of ensuring safety to the citizens of Mumbai. NGO’s, women organizations, trusted men groups, friendly communities, reporting with public interests in mind, forming groups with people having similar interests were some of the important focus points triggered from this session.

**Bottom Up approach for Mumbai**

In an attempt to take a citizen centric perspective of the challenges, to balance the view on cities from the governance perspective in terms of safety risks like creating more passive citizens without enough awareness and responsibility towards their city was seen as an important perspective after the discussion sessions. Empowering, activating, and engaging the people in the cities with ICT solutions can actively learn and find ways forward. The involvement of citizens in the solutions can help in creating long-term effectiveness rather than short-term efficiency (Norlin, 2013).

Hence in the context of lower maturity cities, the author Norlin (2013) points out that one of the challenges is therefore to design a system in which all actors (citizens, businesses, governments, etc.) are aware that they are part of a wider interdependent system. Positive end results are beneficial for both the system and the individuals. And it is not only about being efficient; it is about being safe, smooth, productive, delightful, engaged, supportive, compassionate, and so on (Norlin, 2013).
Civic Participation

According to a UN report on public safety and police delivery, community initiatives were stated as an potential solution to come up with a productive strategy for ensuring safety at the local level. It also further says that engaging and employing the community and community structures in a partnership approach can help in identifying, responding and solving issues of crime and disorder that affect the local neighborhood. It calls up for a structure which would be inclusive to both the safety of public and the police. As a strategy, community involvement is not a universal panacea, but helps to eliminate misunderstandings, suspicion and conflict between police officers and the communities in which they operate. It emphasizes cooperation over confrontation as stated by the report (UN, 2006).

The United Nation’s urges the promotion of community participation in all phases of crime prevention and policing. Similarly, the United Nations Code of Conduct for Law Enforcement Officials states that “every law enforcement agency should be representative of, and responsive and accountable to, the community as a whole”. These statements emphasize the extent to which a community influence on safety is considered important to improve safety of a community. A number of additional benefits have accrued as a result of community participation in many places as it increases awareness and responsibility and also helps in turn to fill the trust gap with the authorities. It also helps in increasing greater trust in law enforcement and also between the citizens leading to more public cooperation and participation. Similarly, local policing has become more effective through an improved understanding and knowledge of the community, its crime problems and the people who cause them (UN, 2006).

In the context of Mumbai and the Public safety challenge, the change in the system that ensures public safety for e.g. the law enforcement agencies policies towards welfare of citizens can be brought about by the involvement of the community as a whole in this process. This can be explained as an individual being supported by the nearest possible community. Trusted individuals willing to stand up against crime in the city compliment the community as a whole. The community should then in turn be supported by the law enforcement, which is at the top level along with the government who would together plan to ensure safety. This approach could increase the trust on the officials on the part of the citizens and also increase the transparency, which lacks in the current system.
4.2.1 Brainstorming

The ideas generated during the discussion session were used as starters for the brainstorming session with the bottom up approach in mind. The brainstorming session was conducted with UX experts in Ericsson research in a conference room for duration of about 2 hours. In which the researcher (me) started of the discussion by explaining the key points from the discussion sessions and also from the research and the questionnaire methods. My supervisor, at Ericsson acted as the moderator during the entire session and noted downs the ideas that resulted from the session. The issues of Women safety, pickpocketing as a result of corrupted law enforcement, uncontrolled migrations were put forward. The possible ICT solutions that could address the needs of the citizens of Mumbai and solutions for the government to mange their city effectively were also discussed. Existing ICT solutions in this area like augmented reality solutions for seeing through safe roads, smartphone applications for reporting crime, policing with technology aids like predictive policing were also put forward to stimulate ideas around ICT solutions.

Figure 25: The citizen-centric model- Bottom up approach
Ideas from Brainstorming - ICT oriented

Some of the ideas that popped up during the brainstorming sessions are discussed below

Around Women safety

- Augmented reality solutions, i.e. to highlight a safe route through neighborhoods while moving around different parts of the city.
- Connected devices to locate other women who are also looking to be safe.
- Emergency or panic buttons which activates a siren on the phone to alert people around when in troublesome situations.
- Calling friends to feel safe while walking in unknown areas.

Around uncontrolled migration

- Some of the government initiatives for immigrant checks were discussed like an digitalized identity check for immigrants to keep track of the people moving into the city and also use this information for controlling uncontrolled growth.
4.3 Personas

Following the ideation phase, in order to represent the users who would use the ICT concepts in a context, user personas were created based on the information from user surveys, the demographic studies and the desktop research. Personas aid the human centered design process and can be used to understand the scenarios in an intuitive way. Although personas are imaginary, they are built from contextual data about real users. In this context four personas were created based on the user studies to explain the scenarios focusing on women safety and empowerment, civic engagement and transparency in the law enforcement process. All the personas have different backgrounds and motivation while using the proposed ICT solutions for safety.

4.3.1 Riya Sharma

Riya Sharma is a resident of Mumbai. She lives with her parents in an apartment located in central Mumbai. She works as an assistant HR manager at Cognizant technology solutions which is located towards the north of Mumbai. Riya has the habit of checking the local news when she leaves home for work. In the leisure hours she like to take short strolls in her neighborhood. She travels to her office by using the public transport system. From the transport station she walks for 10 minutes to get to her office. She also trains in her local gym when she comes back from her work place and then returns home around 8 in the night. Often she works night shifts and usually travels alone after her work. She is worried about the increase in crime rate in her city in recent years and does not feel as safe as she used to feel before. She makes sure that she takes the safest routes in her city to avoid any kind of uncomfortable situations.

![Figure 27: Persona Riya Sharma](image-url)
4.3.2 Siddharth Mehra

Siddharth Mehra is a 28 year-old man training to become a lawyer in Mumbai. He moved to Mumbai with his family when he was 10 years old. Since then, he has been in the city for his education. He stays with his friends in an apartment. Siddharth is a sports lover; he spends most of his leisure hours hanging out with his friends. He has a large circle of friends and is well known in his neighborhood. He is not happy with the current situation in Mumbai when he sees everyday news filled with harassment and assault cases especially against women. He wishes to contribute to his city by taking part in social activities and is willing to promote responsibility and end the social acceptance of such atrocities against women.

Figure 28: Persona Siddharth
4.3.3 Sania Ahmed

Sania is a young girl recently graduated from Anna University in Chennai. She shifted to Mumbai recently because of her placement as a program analyst in an IT firm located in Mumbai. She is very happy about her new job and also managed to find a suitable place to live in a Women’s hostel located about 15 kilometers from her office. She takes the trains everyday to go back and forth from work. She deeply misses her family back in Chennai and is trying hard to get on with her new city. She has not made any friends in Mumbai, as it has been a very short time for her in the big city. Sania is not completely aware of the city and is finding it hard to travel alone at times when she has to go shopping after her office hours and feels quiet insecure when she walks home late hours from her train station through the subway. She feels that Mumbai lacks the security for women when compared to Chennai.

Figure 29: Persona Sania
4.3.4 Riyaz

Riyaz is a 35-year-old nurse in Mumbai. He is married and lives with his wife and two daughters in his house located in Bandra. He is a very keen follower of his community welfare organization. He is quiet upset about things are looking in his community because of the inadequate patrolling of police during the late hours, he feel that this has become an opening for small gangs which takes advantage of the situation to harass women who walks alone on the streets. Riyaz feels that he has to report the crime but is not comfortable to go to a police station to register his complaint. He fears that he would be facing trouble from the police if he goes in person to report the crime.

![Persona Riyaz](image)

**Figure 30: Persona Riyaz**
4.4 Concepts

The concepts were put forward as a result of the exploration phase by taking into the aspect of three important focus points, which are

- Women safety and empowerment,
- Civic engagement to promote responsibility and awareness,
- Transparency from the law enforcement perspective but still with the main focus on the citizens.

The scenarios with the personas and the ICT solutions in focus are illustrated below.

4.4.1 Concept 1- Safety Application And Connected Badges

The safety application concept was to introduce smartphone as a women's friend while moving alone in the city. In this concept the safety application helps the user to choose routes before travelling and to check whether the routes are safe or unsafe based on the timing when she is supposed to travel. The safety of the routes depends upon the reports people have registered in the areas surrounding the routes. The reports are nothing but details of a particular crime, which can be sexual harassments, presence of gangs, poorly lit streets, low patrolled streets, wine shop locations where people drink late night and move about etc. This information also includes the police reports. Users of the application can pin up unsafe and safe areas with the description of what made them feel that area was unsafe through this application, a user especially women would be able to check for unsafe routes and view the detailed reports on the areas. The safe and unsafe areas are populated as hotspots in an updated map of the city.

The application uses location based services through which it alerts the user before he/she is nearing an unsafe area, if she activates her alert when she travels alone at night or at other times of the day. It also learns the route search patterns of the user and suggests routes to take, locating the safe, unsafe routes nearby. Through this application women can also connect to fellow users, women groups, the trusted gentlemen (discussed below in detail), get details of police stations and helplines. With this application she can feel connected all the time eradicating the feeling of being unsafe in her own city.

Trusted Gentlemen

The trusted gentleman is another small concept in this bigger concept of Safety application. The trusted gentlemen can be any citizen of Mumbai (in this scenario), who can register to the application and act as a custodian for women during late hours. For example women can call up a gentleman when they sense trouble or feel unsafe to walk alone in the late hours, Women can view the list of active gentlemen through this application. The application allows Women to call them or send them messages. Regarding verification of a person who registers, he needs to get approved by the organization (the service provider in this case), and then accredited by his friend groups and also by the community in which he lives. This gives a source of trust on the
part of the women before trying to call up gentleman nearby when she senses trouble or feels unsafe. Women can see the entire profile of the gentleman who has signed up in her neighborhood, some of the details like name, profession and age would be mandatory for the gentleman to provide, whereas other personal details can be optional. The gentlemen are given thumbs up (ratings) by the women users based on his services for his community, through which he can get recognition in his own community and also motivate him further in this service. The gentleman also arrives on receiving alerts from nearby women, and uses his time efficiently to prevent crime in the community. They also strengthen their community by networking with women (individual), women groups at a lower level and also with the law enforcement at a higher level bridging the gaps between the communities and the higher authorities. This can also add to a healthy citizen engagement in the process of ensuring safety within communities making the entire process of law enforcement or crime solving transparent for the citizens.

The aim of this application is to bring out the safe and unsafe areas in the city, through which people can be aware of what is happening around them. This information can in turn be used by law enforcement to track the areas plagued by reports and give better security for their people. The application was also aimed at citizen-to-citizen communication, to increase the responsibility of a citizen towards fellow citizens and the city as a whole.

**Scenario I - Safety App**

In this scenario the persona of Riya Sharma is used to tell the story of how this application helps her in her daily life by suggesting safe routes, alerting her of unsafe areas nearby, to call up gentleman for walks, to report and view others reports with details and also to view the safe and unsafe areas in her city and community. The gentleman is played by the persona Siddharth, who has a very good reputation in his community for his contribution through this service.

![Fig: Riya checks her phone before leaving home.](image1.jpg)

![Fig: Safe app displays her usual routes.](image2.jpg)
Fig: Riya views unsafe zones near her area routes

Fig: The application suggests alternate walking area routes.

Fig: Alternative route suggested by the app.

Fig: Riya decides to take a walk.

Fig: She gets an alert on her phone.

Fig: Riya picks up her phone to look at the alert details.

Fig: Riya checks unsafe route alerts and decides another route.

Fig: Gentleman persona, Siddharth
Fig: The gentleman, Sidharth uses his app

Fig: Riya on the other hand tries to look at nearby gentlemen to walk when she is late

Fig: She checks the list of gentlemen

Fig: She choses Sidharth to walk

Fig: Meanwhile the gentleman also checks for women near hot spots.

Fig: Riya and Sid, meet up and walk together

**Scenario II - Safety Connected Badges**

The safety connected badges complement the safety application. The badge is connected to the safety application, and is wearable by the user. It is a GPS tracker with an inbuilt camera, which starts recording audio and video at the press of the badge. Women can wear these safety-connected badges when they travel alone in the city, badges sense the area (connected to the app) and alert the user about a possible unsafe area that she is nearing. The main aim of this badge is to alert other users, women groups, gentlemen and police men who are near (For e.g. within 5 km radius) when the woman are in deep trouble or in emergency situations because of unwanted gangs during late
hours or being harassed by strangers on the street when they are alone. The gentlemen play an important role in this scenario. Women when not being able to use their phone to call for help, can immediately alert nearby gentlemen, police and women groups by pressing on the badge, which in turn delivers the details of her location as messages in their phone. In the case of police, the alert message and video feeds of the incident is delivered to the control room that in turn sends patrol officers to the location immediately for help or investigation. The design of the concept in this scenario is through a badge but there can be alternatives like an accessory that women wear in order to avoid stigmatization for displaying badges on shirts. There are a number of alternatives but in this scenario a badge is used to explain the concept of alerting through the application.

In this scenario, the persona Sania is used as an actor to tell the story of the working of connected badges, which is a GPS tracker with an inbuilt camera, connected to her smartphone. One Friday night, Sania travels alone after shopping, she gets late because of the public transport delays. As Sania is new in the city and do not have much friends, she always keeps her phone and her badge with her when she travels alone. While Sania cross an abandoned street she senses trouble as drunken people try to harass her, she activates the safety badge, which starts recording video as a source of evidence against the harassers. The alert message is also delivered to the nearby gentlemen, women and control room. The main aim of sending these alerts to nearby women and gentlemen is to get immediate help at the situation. This alert location is in turn pinned up on the map of the phone application as unsafe area along with time of occurrence. Further information can be updated to this incident by the police, women or gentlemen who comes to rescue or the victim itself, this information will serve as useful information for other women and guide them to take safe walking routes and also for the police to increase patrol in those areas.

The safety badges in this case uses GPS and has inbuilt camera which sends the video feeds recorded on activation to the cloud, from the cloud the feeds are made available to the control rooms who can have access to the evidence available from the scene to solve the issue more faster.
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Fig: Sania goes home after shopping

Fig: Sania's badge alerts her of an unsafe area

Fig: Sania press the badge when she senses trouble

Fig: The badge starts recording the scene

Fig: Alerts sent to nearby women.

Fig: Nearby women views the alert details.

Fig: Alert is also sent to the nearby control room.

Fig: Location details are informed to patrol.
4.4.2 Concept 2- Interactive City Screens

The concept of interactive city screens is to engage citizens of every economic stature in the city to influence the public safety conditions by sharing information seamlessly when they are outside their homes. This concept aims to have interactive screens in different centers of the city connected to the cloud service, so people even without access to mobile devices can make use of it to leverage information about the safety conditions of the city and spread awareness. It can also help in making proper use of public spaces, as it resembles advertisements or billboards but along with the possibility of interaction.

The city screen will provide details about the safe and unsafe areas in the community and the city with reference to its location, giving the most relevant information. It displays all the details similar to the safety application concept, for e.g. the presence of gentlemen, women groups in the community,
emergency helpline information, police station locations but more of a public display of important information rather than a personalized application. These city screens act as community hubs or meeting hubs for gentlemen and women.

Citizens can interact with the screens through touch, other modes of interaction like speech, i.e. speech as input and audio as output along with visual feedback is also a possibility and hence citizens can experience their city and its working through interactive maps which forms the major interface. They can share and gain information about their city. The city screens may not be limited to visualizing real time safety conditions, reports, information from law enforcement and government but also can be expanded to act as a platform for the citizens and the city governance to interact to increase trust and transparency. Additional features like choosing language to further broaden the citizen engagement by keeping in mind the context of a low mature city can be an integrated feature.

**Scenario III – Interactive Screens**

A girl interacting with a city screen in a public center is visualized in this scenario without giving importance to a particular persona to explain the story. As this concept is to engage the public as such without creating any strong user group who would use this service. In this scenario, a female citizen interacts with the city screen service to look at the details of crime in her neighborhood. It displays information with more visuals than text for example shows the crime pattern in the city during time of the day in a graph.
4.4.3 Concept 3 - Community Reporting Centers

The concept of community reporting aims to complement the previously discussed concepts, where citizens of Mumbai can anonymously register reports to the law enforcement, as a result of which people can avoid the traditional way of registering reports and also fulfill their responsibility towards their community by bringing out the problems they face. The reporting in community service centers where people can go and share their experiences anonymously. The community hubs can be an ATM center or public booths were people could report crime along with the other uses like withdrawing money in the case of an ATM. After registering reports, the user gets a status number which he can use to check what actions has been taken to rectify the problem. This addresses the focus points of the thesis i.e. active citizen engagement and transparency in the process of solving crimes by the law enforcement.

Scenario IV - Anonymous Reporting

This scenario is explained by another persona Riyaz, who has a family in Mumbai, he wants to report some disturbances in the neighborhood but is not motivated to go the police directly and instead uses the anonymous citizen reporting as a tool to take his views forward without having the trouble of being reprimanded by the law enforcement or the criminals. He goes to the reporting center and registers his complaint anonymously along with the evidence he has. This information can provide useful information for the citizens who can get information about this report on the safety application and the city screens with the details provided.

Fig: Riyaz is worried about harassments in his neighborhood

Fig: Riyaz decides to report the crime.

Fig: He choses to report anonymously.

Fig: At the community center, Riyaz choses to view previous reports
Fig: Riyaz views the reported crimes.
Fig: He views reported crime on a map.

Fig: Then he chooses to file the report against problem makers in his area.
Fig: Riyaz adds all the details and evidence the and sends the report.

Fig: Riyaz collects his status number to check progress on the case
Fig: Riyaz feels safe because he has reported anonymously.

4.5 Cloud Service

The data and information, which is gained as a result of the concepts, is stored in a database in the cloud. All the services are interconnected as they share the information, which is from various sources like the women, women groups, gentlemen, Government, data from the police and organizations involved in the entire process. The access to these information can be made available to the general public in case of the city screen though a service provider, who can be a business organization, IT firm, local supermarket owners, who would want the streets in which they are located to be safe and increase the number of customer visiting their shops or the government itself. Users of the services can use these services like the safety application on their smartphones by connecting to the internet and also information is made available to the general public without access to mobile devices through other end devices in these concepts like the city screens and the anonymous reporting centers, as these devices are themselves in a network and connected to each other.
On the other hand the law enforcement agencies will play an important role for managing the data that should be made available to the public without violating privacy and security aspects, as public safety information is always associated with sensitive information. This cloud service may be cost efficient and give unlimited data storage space, which can be the main motivation behind using the cloud for leveraging the data but the security of the data can be a potential risk in this case. Another important aspect of the service should be monitoring and analysis of the data in the database.

By monitoring and analysis, the data must be checked for duplicate information, unauthenticated user data, and trusted entities like gentleman information. It is necessary to use a reputation model so that users would trust the information they get from the sources like the law enforcement and the gentleman. It can be based on a number of factors like the services and achievements of the law enforcement, their ability to interact and previous records of crime prevention. When the gentlemen are taken into account, crucial information like his personal profile and the credits received by the fellow community members would prove to be useful information to women who would use and trust these services. Another important aspect when the working of these concepts are taken into account is the interoperability between the actors and agencies that would be involved and sharing information. In this case it would be the government, the law enforcement agencies, Non governmental organizations, the gentleman groups and the women groups. Seamless wireless transmission of crucial information like voice, video during emergency situations mentioned in the concepts like the location, video and audio transfer to the cloud than to the control room would play an important role in the overall working of these concepts. Also the privacy and security of the data involved must be taken care for example the attributes that the community members, the gentlemen and women would like to disclose (location information, name, sex, age etc)must be respected and maintained throughout.

![Diagram of information exchange through the cloud service](image-url)
4.5.1 Possible Stakeholders

Women groups

Women who work and travel alone in the city can connect among themselves with this application. They can exchange information about their city by pinning up unsafe safe and unsafe areas, adding details to unsafe areas by making use of this service. The application and the badge aim at empowering women and giving them a tool to fight threats outside home.

Gentlemen

Men in the city are made equally responsible through this service. They contribute their free time and help women in trouble to reach home safe. They get recognition through their services to their community/city women.

Service provider

The service provider of this application, badge, urban screens and reporting can be a Woman’s NGO, or a Local shop owner in a neighborhood, or neighborhood communities who want their streets to be safe, Startup tech companies or business men/women or local organizations, who have the motivation to promote a safe city for women and a safe city as a whole, to bring more women into the workforce by promising a safe environment for them.

Law enforcement

The law enforcement of Mumbai should provide information about their locations, helplines to create trust in them and also communicate with the citizens to ensure their safety, which is actually missing in the current situation. In turn they get abundant information about the working of their city from the eyes of their own citizens, this helps the police to solve cases and convict the criminals faster with the help of the evidence.

Government

The government itself can provide all the services, even though a question of trust arises because of the corruption (in the case of India) but as this service share information entirely created by the citizens themselves it would have more transparency than a service totally run by the police or the higher authorities. Furthermore the Indian government has allocated funds called “Nirbhaya funds” after the Delhi rape incident to ensure women safety in the Indian Metropolises.
4.6 User Feedback Results

The one to one feedback session was conducted online through Skype with 2 participants in Mumbai, a women police officer from Chennai, a Mumbaikar staying in Sweden and an Ericsson employee from Chennai. It was a 2-hour session, which took place as follows.

- Pre-session arrangements (5 minutes)
  - Review and sign nondisclosures and permissions.
- Pre-session Questionnaire (5 minutes)
- Introduction to the session (10 minutes)
- Scenario 1 (30 minutes)
  - Introduction
  - Presentation and briefing
- Questions and feedback (15 minutes)
- Scenario 2 (30 minutes)
  - Introduction
  - Presentation and briefing
- Questions and feedback (15 minutes)

Thoughts from the session

Some of the thoughts from the one to one interview feedback session are as follows.

- When they were asked about the feeling of safety while moving around in Mumbai

  "Mumbai is safe as I have not experienced any crime till now"

  One of the male participant responded that he has always felt safe in Mumbai because he has lived there for Long. And he travels alone at any time without fear except for certain areas.

  "I usually come home early after work and try to go with friends when I go out"

  One of the female participants, who is currently residing in Mumbai but originally from Coimbatore said she does not like to travel alone most of the times especially during dark hours because of the news reports she reads daily about harassments, but as she has not come in
to such situations, she feels Mumbai as a quiet safe place even though not as safe as Coimbatore down south of India.

The other male participant from Mumbai also had similar answer that Mumbai was quiet safe with comparison to Delhi. He also mentioned that he had been victim to pick pocketing in public transport twice but still did not feel Mumbai was unsafe.

- When the participants were asked about any measures that they would take while moving in the city

  “I do not like to carry cash on my wallet as I was pickpocketed twice”

One male participant replied that men are more prone to getting pickpocketed in crowded buses, streets or public transport stations and hence he remains alert when he goes out of home.

“I avoid late night travelling other than that I have not taken any specific measures”

The female participant said she did not take up any specific measure to remain safe but mentioned clearly her timing preferences when she travels alone.

The other participants had not taken any measures especially for safety.

- When the participants were asked an opinion on the city police

  “Very poor patrolling on the streets of Mumbai”

One of the male participants has mentioned that he used to travel a lot at nights and he has never come across police patrols in abandoned streets or near hot spots in the city. He strongly felt that the law enforcement is not doing its best part in taking care of its citizens. And also added that the police booth houses located at different areas of the city was empty most of the time.

- When the participants were asked about the safety application and the connected badge concept

  “Gentlemen seems an interesting concept, I would like to be a gentleman”

One male participant said that he felt that the introduction of gentleman in the concept of women safety seemed an interesting thought which could build up trust within a community and also bring a feeling of responsibility from their part to address the current issues regarding women safety.

“Connected badges can give very good evidence to solve cases faster”

The female police officer felt that the Indian law enforcement did not use much technology in the crime solving process. But if they could get hands on evidences with the help of technology they would
support the use of ICT solutions but she also mentioned that these services can be used only by a educated person and it would be difficult for somebody who is illiterate. She felt that connected badges in this concept could help women who is not educated to some level, if it somehow works without the smartphone application. Overall she felt that most of the cases against women go unsolved because of lack of evidence and this badge concept can actually provide the required evidence.

“Gentlemen concept will motivate many young men to stand up for safety of their women”

One of the male participant said he would be motivated if he would see men in his community or city coming forward for this service which in turn would increase the spirit of helping. He felt he would be satisfied if he helps one woman on the street if he was called when using this service.

“Badges need not be visible”

One of the male participant felt the visibility of the badges could create issues like the women without badges being victims or the possibility of pulling out the badges and breaking them by the criminals in cases of assaults.

“We want people to report - anonymously or in person”

The women police also mentioned that the anonymous reporting in community centers can be useful to people because she feels that most of the cases especially against women go unreported because of lack of support from the family, or the fear of being reprimanded by the criminal or the police.

“Reporting can be included in city screens”

One of the male participant responded that he would like to have a single hub for the information and also for reporting. He mentioned that the city screens could themselves be used in reporting as he felt he would not feel any problem in reporting in public.

He also mentioned that he would like to know the progress of his report if he has to be motivated to report again which is only possible if the police takes steps to counter the reported issues.

But the women police and the female participant felt that reporting centers can be separate as it has chances of revealing identities of people, which in turn may cause trouble.

**Future ideas for concepts**

- “Inclusion of public mobility in the map in the case of safety application"
- “Public poles as alarm systems” within certain distances for alerting nearby citizens.
4.6.1 Analysis

The participants from the one to one interview sessions were satisfied with the concepts of safety application and the connected badges, and felt it would increase the community feeling in their city. They also felt that citizens had a lot of responsibility in addressing the safety issues against women but the law enforcement agencies should be responsible on their part to increase the trust on them, which is lacking. Even regarding the safety badges they had the question of visibility of the badges, but they received the concept well.

They also felt that even though they do not face harassments and assaults daily, it is a necessity to come in turns with reality and take care of these issues seriously. Almost all the five participants felt that when it came to safety they would not have a problem in sharing their location as per the concepts.

They were positive about reporting and pinning up unsafe areas through the application and anonymously through the reporting center as they felt it would also inform other citizens and also bridge the gap between the police and the citizens without having the fear of being reprimanded or harassed as that is more common when people go to police stations to report crime. They also felt the concepts could be used for reporting other types of crimes in the city.

A question was also raised on the issue of smartphone apps as Mumbai is a low mature city and the service may not reach people below the poverty line and those living in slums. But as this concept was more related to women trying to move in the city to study and work they felt such services could be advantageous for those particular user groups. They felt that as these services are focusing on a low mature city with low socio economic status, cost effectiveness of the solutions would play an important role in reaching people.

The feedback from the police official, gave an important insight on how the police officials and the control rooms in cities work when there is an emergency. She felt more positive about ICT solutions for women and the police as she felt that even though they have heat maps in the police stations it would be better to have it digitalized with input from the witnesses themselves. The feedback and the thoughts projected from the participants resonated with the desktop research and complimented the background research.
Discussion And Conclusion

In this chapter we will discuss the results and try to find a conclusion about the problems and solutions that have been dissected in this chapter.

5.1 Can ICT tools help in citizen engagement and safety?

The research questions regarding ICT in improving public safety has been looked in detail throughout the study with a low mature city context, Mumbai. According to the concepts, ICT solutions for empowering citizens discussed here took a stronger citizen perspective in addressing safety issues. When citizens start engaging in the overall process, it induces behavioral change and it reduces the need for the cities to be governed in a traditional way. Through this we can clearly see an evidence of a more healthy decision making to counter safety issues as every citizen can have their say to bring about a change in the community they live.

ICT tools and solutions can empower citizens and make them smarter in the longer run. Social applications have already made a positive impact where people meet, organize and act for the betterment of their society. Hence it can be strongly said that with the evolving smartphones and social media even in low mature cities there is a higher chance of spreading awareness and creating responsible citizens. Furthermore crowdsourcing platforms can help in collaboration of citizens among themselves and also make a mark for the higher officials to follow and develop their city.

5.2 ICT and low mature cities?

The concepts discussed for women safety and empowerment and civic engagement in the context of Mumbai is an attempt to depict how ICT solutions can engage citizens, motivate and drive them towards a better city in the future. Even though these solutions were created with the perspective of Mumbai, these concepts can also be applied to the cities having similar issues regarding women safety. For e.g. Cairo in Egypt, which do women harassers plague. Mumbai, being a city with low socio economic status, the safety app and connected badges is not an impractical solution but a more futuristic approach to be commonly used by people belonging to all socio economic groups.

An important aspect, which we should keep in mind, is the citizens in low mature cities do not have access to smartphones especially people belonging to the lower socio economic statuses. Hence the personalized solution of a smartphone app for safety may not be a practical solution immediately but a realizable solution in the future. It is true that smartphones have penetrated the urban areas in the developing countries, but the economic inequality among the people is a major reason, that brings about a difference in the reach of these ICT solutions in these cities.
But the use of city screens in one of the concept, which can be a realizable idea when it comes to accessibility to help in participation of all user groups in drawing up a local development strategy, towards safety in this case. It is important for low mature cities to use existing features like GPS tracking, cameras in mobile phones, mobile broadband to bring about a change, which is cost effective and would also reach various user groups.

5.3 Pros and cons of the proposed ICT concepts

Although this work was based on Mumbai, it can also resonate with safety issues for women in the megacities of the world especially those cities that are envisioning themselves as global cities of the future. Women safety is an issue which has become the point of discussion in most of the urbanizing regions, where women come out of their homes to join the workforce more than before especially in the developing megacities. The concepts surrounding women safety issues like the “safety application” and the “connected badges” which is a discussed as a tool for empowering women was well received by the participants of the feedback session. They could relate to the situation and felt this could bring about a change in the society they live and ensure better safety with the gentlemen and women groups inclusion in the concept. They also felt that the concepts were different from the traditional aspect of sending distress calls or alerts out to friends, family and law enforcement. Also the concepts only discussed the existing technologies, like smartphone apps, GPS tracking, and community reporting centers, which was accepted by the interviewed participants because of the practicability of the solution from Mumbai perspective.

With respect to the connected badges concept, participants also expressed their concern about the verification of the users who are going to register, anonymously report, or use the city screens and the gentlemen involved, which was not discussed in detail during this work as it can be a major factor in the legibility of the content or information shared through this services. The verification process has to be a major part of the business organization that would provide this service and has to be aided by the government and the law enforcement.

The user groups discussed during this work were limited to students and professionals in Mumbai. The users belonging to lower socio economic statuses were not discussed in the research process. These users may be able to use the solution like safety apps only if they have enough knowledge on smartphone usage and so it is important to look at other root causes like education and spreading awareness, changing behavior and educating the forthcoming generations about the benefits of ICT usage.

Cost effectiveness of the concepts discussed also plays a major role in the context of a developing megacity and the ICT usage for users under all economic groups. In addition to that when low mature cities and ICT solutions are discussed, it is necessary to keep in mind that the low mature cities are developing rapidly and the infrastructure needed is not in place. Hence instead of going through all the stages of development that higher mature cities have gone through they can make their cities smarter by leapfrogging to inexpensive technologies. In this case, instead of having a smartphone app, even though it may be realizable in the near future, we can include mobile
phone which has penetrated into the developing urban regions more than before by making use of aspects like messaging and alerting with hot keys. Also the research was based on the finding from desktop research from various sources and cannot draw concrete conclusions, as there was no direct engagement with the user groups represented in this thesis work.

5.4 Future Work

ICT tools for other issues related to Public safety, for example issues surrounding corruption, uncontrolled migration, education discussed during this thesis can also be major focus areas and hence concept development around these areas can be an interesting alternative in future. Law enforcement perspective and the technology aids for them in solving crimes faster has been focus points when it comes to Public safety and ICT solutions. This is also an important perspective of managing a city and the tools from governance perspective to improve the quality of life of people living in the developing cities is an area on which further research on city governance can be done.

Public safety is a complex megacity challenge and there are number of issues that can be identified to improve the quality of life of people living in these megacities facing this challenge. The concepts can be reused to fit the issues but at the same time it is not possible to come up with a single solution addressing all the issues. There is a huge scope for research targeting this area, as it is one of the common challenges faced by low, medium and mature megacities of the world. A more human centered approach to address these challenges, by visiting the city of interest and gaining experiences and understanding what tools users would like to use could be an potential approach that can be carried out in future.

5.5 Final Words

Technology has been at the forefront of economic resurgence of the cities in India and it is strongly believed that in technology lies the answer to many of the challenges. It is necessary to create tools and processes that improve transparency, reduce bureaucracy, control corruption and empower citizens by engaging them in the process of addressing the challenges.

The basis of having connected citizens and engaging them to take better decisions as discussed in the concepts is to having a better internet infrastructure which is much needed in the context of a low mature cities. A strong internet network is crucial when it comes to a city being competitive with its peers. This can further improve the connectivity between the citizens and the governance. All this is highly relevant for Ericsson when looking at systems for city management and the increased connectivity between citizens and the other stakeholders, data analytics, and data mining. Engagement of citizens further results in creativity. This is required in order to design systems that allows governments, citizens, and business to address the true causes of problems together rather than the symptoms. Ericsson can offer these concepts to organizations involved with public safety and help with the required infrastructure which would in turn increase the network traffic and also promote Ericsson’s image.
GLOSSARY

MEGACITIES

A megacity is a metropolitan area with a total population of 10 million or greater.

UX

User Experience.

ICT

Information and communication Technology, which includes all the communication devices such as the computer, cellular phones, satellite systems and so on.

URBANIZATION

Urbanization is a process by which people in large numbers move towards cities making the cities more concentrated.

GPS TRACKER

A Global-positioning tracker is used to give location details about the person, a vehicle or a phone to which it is associated with. They are mainly used to track vehicles and objects when they are lost. Nowadays they are associated with smartphones and their applications.

MUMBAIKAR

A person living in Mumbai.


BRAUN, NANETTE, CHAKRABARTI, OISIKA, FORBES, JEAN , FREY, BÉATRICE GÓMEZ, EDUARDO, JIWATRAM, JAYA, JOSEPH, YVANS, LUCHSINGER, GRETCHEN WOLF, ADINAOUNNIR, ABDELLAH,GOLDSTEIN, ANNE, NASSALI, MARIA(UN WOMEN) 2012 Progress of the Worlds Women In pursuit of Justice. Available at http://progress.unwomen.org/pdfs/EN-Report-Progress.pdf [Accessed 1 November 2012]


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