

**A THOROUGH STUDY ON THE BENEFITS AND CHALLENGES OF VIDEO  
CALLING FOR EMERGENCY SITUATIONS IN CONTEXT OF  
BANGLADESH**

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Degree of Bachelor of Science in Computer Science and Engineering.

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## **APPROVAL**

This Thesis titled “**A Thorough Study on the Benefits and Challenges of Video Calling for Emergency Situations in Context of Bangladesh**”, submitted by **Md. Rokonuzzaman, Enayet Morshed Haque** and **Md. Imrul Hasan** to the Department of Computer Science and Engineering, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering (BSc) and approved as to its style and contents. The presentation has been held on the 11<sup>th</sup> December 2018.

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## DECLARATION

We hereby declare that, this project has been done by us under the supervision of **Mohshi Masnad, Lecturer**, Department of Computer Science and Engineering, Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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## **ABSTRACT**

Nowadays, in Bangladesh Emergency Service Helpline is widely used for reporting different kinds of emergencies. The advancement of technology has created the opportunity to think about the betterment of this service for the future by incorporating new modality like video-based calling for emergency helpline. The concept of combining video-based calling brings the challenge that how video-based calling system can be designed and how it can be beneficial or challenging. We observed the system in Bangladesh to understand what the opportunities and limitations are there currently. Along with observation, we conducted contextual interviews within emergency response call center to investigate those issues. Our observation was focused on the work practices of the call center as well as emergency dispatchers of the emergency helpline in Bangladesh. We found that video calling can pull out important contextual information about a situation helping emergency call attendants to overcome challenges like inexact information, location, and awfulness of the incident or communication issues. Challenges like control, privacy or information overload are also there if the systems are not designed well enough. The outcome of this study clears the opportunity, possibility, limitation and challenges of merging video-based calling apart from voice call only. In the meantime, it figures out requirements and roadmap towards a well-designed video-based calling system.

## TABLE OF CONTENT

<b>CONTENTS</b>	<b>PAGE</b>
Board of examiners	i
Declaration	ii
Acknowledgement	iii
Abstract	iv
List of Figures	viii
<b>CHAPTER 1: INTRODUCTION</b>	<b>1-5</b>
1.1 Introduction	01
1.2 Motivation	02
1.3 Rationale of the Study	03
1.4 Research Questions	04
1.5 Expected Outcome	04
1.6 Report Layout	04
<b>CHAPTER 2: BACKGROUND STUDY</b>	<b>6-10</b>
2.1 Introduction	06
2.2 How Emergency Service Helpline in Bangladesh Works	06
2.3 Related Works	07
2.4 Challenges	10
<b>CHAPTER 3: STUDY METHODOLOGY</b>	<b>11-13</b>
3.1 Introduction	11
3.2 Participants Demographics	11

3.3 Data Collection Procedure	11
3.4. Data Analysis	13
<b>CHAPTER 4: DATA COLLECTION AND ANALYSIS</b>	<b>14-23</b>
4.1 Current Practice of 9-9-9 Call Center	14
4.2 9-9-9 With Video Calling	21
<b>CHAPTER 5: DISCUSSION AND CONCLUSION</b>	<b>24-28</b>
5.1 Summary of the Study	24
5.2 Recommendation	25
5.3 Future Implementation	26
5.4 Other Opportunities We Found	26
5.5 Conclusion	27
<b>REFERENCES</b>	<b>29</b>
<b>PLAGIARISM</b>	<b>33</b>

## **LIST OF FIGURES**

<b>FIGURES</b>	<b>PAGE NO</b>
Figure 4.1: Location of Calls for Emergency Service	16
Figure 4.2: Service Request at 9-9-9	17
Figure 4.3: Incoming Calls During Our Observation at 9-9-9	18
Figure 4.4: Call Taker's Feedback on Incoming Calls	18
Figure 5.1: Caller Locations	27



# CHAPTER 1

## INTRODUCTION

### 1.1 INTRODUCTION

In the year of 1935 the first ever emergency service helpline (999) was launched at London, UK following a fire at a London doctor's surgery on November 1935, which was initially providing five facilities [1]. The concept received a huge public attention instantly, which inspires other countries to adopt the concept for their own. Following that the government of Bangladesh decided to introduce a national emergency service helpline.

The service offers people to place phone calls requesting for emergency assistance in situations like requiring an ambulance service, fire fighters, or the police. For the time being, only voice-based phone calls can be made using telephone or mobile phones which are taken by an attendant known as “call taker” who assesses the circumstance and send off to the appropriate responders for proper initiative.

Since technology has been passing through an evolution starting from the very beginning of this century, it's high time to think of an emergency help desk with advanced communication support where people can use text messaging, photograph or video sharing, or video streaming along with voice calls. We are currently focusing on the concept after exploring the idea of video-based calling for 9-9-9 calls, like a Skype or WhatsApp call between the attendant and people who are experiencing emergencies.

Now a lot of questions arise with the idea of showing a call attendant an emergency situation through video calling including what changes will there be on the work of emergency call attendants? How the additional calling system can better the services of 9-9-9? How should the system be designed so that it meets the needs of the callers and call attendants to assure emergency video calls are effective and efficient, and many more.

We investigated those research questions by observing the 9-9-9 call taking practices at the national emergency helpline call center in Dhaka. Our aim was to understand the key factors that are important for designing such video calling systems if 9-9-9 services are

going to be expanded to include them. We observed ambulance, police, and fire service call attendants and dispatchers during their regular work as well as conducted contextual interviews with them about their experiences and work practice. In some cases, we assumed a possible future of 9-9-9 emergency services with video calling technologies incorporated for a real time observation.

Our investigation outcome shows that video calling, and the sharing of photographs or video clips supported calling system holds the potential for benefits, including the capability of dealing with inaccurate or ambiguous information, including additional contextual information of scenes.

Besides, the addition of video calling brings many new challenges and facts to be concerned about, like handling information overloading, privacy challenges, or proper training for employees to adapt to the changes. Comparing with available voice and video chat software (e.g., Viber, Skype), calling for 9-9-9 might be considered as a continuum where the control of sharing media (e.g., photo, video) and video call is there while the primary communication medium is voice call. So, the system should combine this with the feature of supporting complicated camera work and decision making about how and when to show the emergency situation along with transition between different modal qualities within the call.

## **1.2 MOTIVATION**

Digital Bangladesh [2,3] is one of the nation's dreams and the government of Bangladesh implemented a large number of projects relating to digital technologies. As a part of the movement towards “Digital Bangladesh”, the government launched a national emergency helpline desk for helping people real quick.

Many other countries are engaging for the betterment of their own emergency service to reach out every citizen and present the system as a place of reliance as well. As Bangladesh is moving towards a developed country, we definitely can explore ideas for a reliable “Next Generation Emergency Service Helpline” where the communication medium won’t be limited to voice calls only, rather people can use voice message, text message, video

streaming, sharing of images or video clips. We focus on this topic by exploring the idea of video calling for 9-9-9 calls.

With the evolution of smartphones and smart communication technologies, video calling among family, relatives and friends has become widespread. With video calls it's much easier to sense activity that is occurring which let people share an environment, place, object, and activities that are happening around. These facts influence to think of the potential of video calling where people are intimately able to share views of an event with emergency helpline call attendants. Using advanced video calling technologies, like, video views from multiple cameras, 360-degree video technology etc. 9-9-9 services can be taken forward to the next level to overcome limitations and face future challenges.

### **1.3 RATIONALE OF THE STUDY**

Since the country is developing and heading towards urbanization, and with the propensity of people to resettle in big cities, more crimes, accidents, and unwanted incidents are happening.

In the future these circumstances will be more challenging, at least in Dhaka. To keep pace with the current and upcoming challenges, we thought of -

- Developing an idea that will help to make the existing emergency helpline service better and even more efficient.
- Enforcing the modern technologies of communication to ensure the maximum benefits of the service.
- Taking the initiative to the next level for proper service for what this has come into existence and prevent spam of misuse of it.
- Finally make this important service more people friendly in emergency cases so that people can seek help in a manner of more informative communication and better understanding for the responders.

## **1.4 RESEARCH QUESTIONS**

As of the research project focuses on the benefits, scope, and challenges of video calling for emergency helpline (9-9-9), the followings questions are the things we tried to accomplish throughout this project.

- How video calling can be beneficial for the callers who are seeking help from the emergency helpline?
- How beneficial is the video calling for the emergency responders?
- What are the challenges of video calling for emergency helpline?
- What are the risks and requirements for designing a system that offers video-based communication between people and emergency helpline (9-9-9)?

## **1.5 EXPECTED OUTPUT**

Throughout this research, we planned to perform a qualitative analysis according to the research questions and expected to find our-

- Strength and weakness of current system.
- Challenges for call takers and dispatchers in regular work practice.
- Difficulties for the callers in sharing various information with call takers.
- How video calling for 9-9-9 eliminates or minimizes the difficulties for callers and call takers.
- Opportunities and challenges for incorporating video calling.

## **1.6 REPORT LAYOUT**

In chapter 1 of this report we tried to evaluate our research topic and motivation behind the research. Following these, research goal and other relativities has been discussed.

In the second chapter we explicitly discussed our background study, including current circumstance overview and other studies that has been conducted on relative issues.

Then in the third chapter we revealed our study methodology in details, which includes planning and our working procedure.

Following that, chapter 4 is all about our findings and manipulation. Details analysis and other opportunities have also been covered here.

In the fifth and last chapter, research summary, future scope and our recommendation has been discussed.

## **CHAPTER 2**

### **BACKGROUND STUDY**

#### **2.1 INTRODUCTION**

The 9-9-9 emergency helpline received a huge attention from people around the country immediately after being launched as an experimental project on the 1<sup>st</sup> October 2016. The service has received around 3.3 million calls during its experimental phase [4]. People across the country found the tool handy in the moment of witnessing an emergency situation.

The national emergency service offers people to call -

- When someone witnesses a crime.
- When someone fears for their life.
- When someone is hurt or injured.
- When someone is in danger.
- When a fire breaks out.
- When someone is in urgent need of an ambulance [4].

#### **2.2 HOW EMERGENCY SERVICE HELPLINE IN BANGLADESH WORKS**

In the emergency helpline call center, call takers gather detailed information from the caller who are facing an emergency, about the situation or incident to classify as well as prioritize that emergency. They record textual information in Computer-Aid Dispatch (CAD) system. Then the call taker establishes a connection with appropriate response team that is required like police, ambulance or fire fighters. In the meantime, he creates an event in their system on this occasion for the dispatchers. One of the dispatchers receive and follow up the event

created and passed by the call taker. He communicates with the respective response team as well as the caller who reported the emergency situation to ensure that the service is properly delivered.

In some cases, it's difficult to gain enough information about an emergency situation or point the caller's exact location because the description of a location and situation given by the caller is inaccurate, ambiguous or insufficient. Sometimes voice of the caller is unclear due to extra noise or regional accent. Besides, during an emergency situation some callers are frantic, desperate, or hysterical so it is really difficult getting details and accurate information.

In such cases the call takers as well as the emergency response team face a huge challenge on helping people in trouble. In some cases, they gave maximum effort but failed to reach people who are badly in need of emergency service.

Spam calls are another obstruction for the national emergency service in Bangladesh. The call takers receive a huge number of blank calls, Irrelevant calls and offensive calls each day which are literally wasting the potential of this important service. The authority is still searching for a solution to get rid of those unwanted calls [More details about 9-9-9 calls has been discussed in the Data Collection and Analysis part].

At this moment there is only hundred working station in the emergency helpline call center which is inadequate compared to the whole population. Expansion process of the call center is on-going. The authority also has a plan to link the call center with the social media platforms so that people can get the service from it immediately [5].

### **2.3 RELATED WORKS**

A large number of studies have been conducted related to emergency service helpline, emergency calling and dispatch, video communications, and the benefits of video calling.

### **2.3.1 Emergency Helpline, Emergency Calling and Dispatch**

In emergency call centers, call takers receive calls from a citizen facing emergency situation and collect details information about the circumstance to classify and prioritize it [6,7,8]. Then textual information is recorded in a Computer-Aided Dispatch (CAD) system [9]. Dispatchers review the event or recorded information and send an immediate response team (police, fire or ambulance) that is needed [6, 7]. Sometimes, it is difficult to figure out the caller's exact location because the incoming description of location given by the caller is inaccurate or ambiguous [6, 8]. Call centers can become chaotic if call volume is too high [7]. Some callers are frantic, desperate or hysterical so it can be difficult to gain accurate or enough information [10,11]. Call takers are trained to take control of the call so they can ask specific questions, however, hostile callers may not want to give up control [12].

Situation awareness is critical in emergency service call centers [13]. Situation awareness for a call taker is a real time understanding of what's happening during an inverted situation and how the incoming information is treated [14,15]. This can be gained by listening to another people, by looking around purposefully, or by observing information in someone's visual perception [13,17,19]. Call takers use situation awareness to manage a perception of incoming calls to make sure that multiple calls about the same event is known [7,8,10]. Besides they can maintain awareness by scanning call list in their CAD system as well [7,8]. Call takers can face anxieties from working with traumatic incidents and have to rely on counseling [20] or peer support [21,22]. Complex nature of calls, confusing information from callers, multiple emergency services need, and communication problems (e.g., poor English or regional accent) cause stress [21,23]. Life and death calls and calls involving child are particularly stressful [23,24].

For deaf people or hard of hearing, emergency situations are more challenging and they have to depend on friends, family or others to call emergency service helpline [25]. Text to emergency services are available in most of the areas within North America [16,26]. Some researchers have designed special app for deaf people [25].

Visual information of an incident is more valuable for medical team and hospitals to understand the awfulness of the situation in order to better prepare for the arriving



ambulance [21]. Video can also be used to show injury, body details, and medical equipment's display screen [27]. Researches have shown better result while providing medical staff with video of patients who are on the way to the hospital [27,28]. In response to emergency situations due to natural disaster, inaccurate or lack of information hinder the response team to perform better [29,31].

Our study extends the related work by inspecting the likely advantages and challenges of using video calling for emergency services.

### **2.3.2 Video Communication and The Advantages of Video Communication**

Our study extends the related work by inspecting the likely advantages and challenges of using video calling for emergency services. Video calling among family, relatives and friends within homes has become widespread with the expansion of internet and in the outdoor with mobile [31,32,33]. Using video calls (e.g., WhatsApp, Skype), people communicate and share views of activities or scenes [34,35,36]. This lets people show what an object or environment looks like and activities what people can perform [32,34,37]. These perceptions propound the potential of video calls where people might similarly have the ability to share views of an incident, scene or location with emergency helpline call takers.

Yet video calling has its own challenges in domestic settings. Sometimes video calls among relatives/friends are difficult to maintain due to connectivity issues or trouble in operating the user interface [31,35]. Everyone is not comfortable being on camera because of how they might look [38,39,40], which sometimes raise the fact whether both parties need to share their video view [38]. Privacy concern exists for bystanders who got captured in a video stream unwantedly [41,42,43]. This associates with autonomy of one's will to participate in a video stream according to their own terms [38].

## **2.4 CHALLENGES**

From the very beginning of our study we tried to collect data about the emergency service helpline in Bangladesh from different online and print media. We hardly found articles and information on this. Even the official website doesn't hold much information. So, the challenge was there in gathering required information for our analysis.

We visited the call center of 9-9-9 and tried to collect data of different categories. It was difficult to observe their events as per our expectation because of the higher rate of spam calls.

We managed to overcome those adversities with the hospitality and cordiality of the employees and officers in charge of the 9- 9-9 call center. We really appreciate their hospitality and generosity.

## **CHAPTER 3**

### **STUDY METHODOLOGY**

#### **3.1 INTRODUCTION**

As mentioned earlier that in Bangladesh the only call center for emergency service helpline 9-9-9 is managed by the police force, we requested for the approval of our research study to the authority. We conducted a research to realize the work practices of call taking, dispatching and the Computer Aided Dispatch (CAD) system. We also focused on the opportunities and challenges that 9-9-9 video calling might bring.

#### **3.2 PARTICIPANTS DEMOGRAPHICS**

We spent two days and around four hours each day during the process, where we observed the call center and conducted interviews with some of the employees. Each day is divided into three sessions. Different group of employees are on at different session. All of the employees have come from the police force. The call takers were working as Constable in different police station before getting appointed in the call center while the dispatchers belong to the rank Sub-inspector. Our participants were fourteen people from the call center: nine call takers, three dispatchers, one supervisor, and the officer in charge of the call center. The participants had at least one year of working experience in the call center and were familiar with video calling technology. The call takers and the dispatchers had training periods focused on course work, call taking, Computer-Aid Dispatch (CAD) system understanding, event creation, dispatching, ability to handle stress, and cyber-crime. Course work includes set of questions to ask during a call, conversational skill to show empathy and control the call. The duration of training period varied for different participant depending on their previous knowledge and how training had evolved.

#### **3.3 DATA COLLECTION PROCEDURE**

In the 9-9-9 call center we followed the steps mentioned below for data collection.

### **3.3.1 Observation**

We observed the environment, work practices of emergency call takers, dispatchers, supervisors and the way they gather, record and classify incoming data from caller in their system. This allowed us to see and understand what practices might be easy or difficult to communicate over video calls during emergency situations. We watched and listen to their work, what software and hardware systems they were using, how they organized their work and work area, how they maintained situation awareness and what they asked callers during calls. We only collected observational data about those people who consented to participate. We recorded our conversation with them for further analysis.

### **3.3.2 Interview with Emergency Call Takers and Dispatchers**

We conducted one-on-one interviews with emergency call takers and dispatchers. We asked them questions about their work practices, needs and how they were trained to talk with callers. We recorded the entire conversation for data analysis.

### **3.3.3 Interview with Emergency Responders**

We conducted one-on-one interviews with emergency responders (fire-fighters, medical team) and instructors where we asked them questions about their work practices, challenges and needs.

### **3.3.4 Interview with People Who Have Called 9-9-9**

We conducted one-on-one interviews with some people who had called 9-9-9 in the past to understand the situation around their call and how they interacted with call takers. We asked them for feedback about the use of future technologies as a part of 9-9-9 calls. After gathering all these data and information about the 9-9-9 emergency call center, emergency call takers, first responders as well as callers, we examined on them.

### **3.4 DATA ANALYSIS**

During data collection procedure we received a huge amount of random data and information. Then we transcribed and classified them according to different topics. Open and selective coding were used to analyze the data in order to draw out main theme. Details of our data analysis has been discussed in the following part of this report.

## **CHAPTER 4**

### **DATA COLLECTION AND ANALYSIS**

In this section we will be discussing the manipulation and classification of our collected data. After transcribing the audio-recorded conversations we categorize and subcategorize them under various topics like current situations, in which cases people asking for help, challenges for call takers etc. We now describe all of these along with some participant quotes without revealing their identities.

#### **4.1 CURRENT PRACTICE OF 9-9-9 CALL CENTER**

We subcategorized the data about current situations into the following topics:

##### **4.1.1 Work Practice in 9-9-9 Call Center**

999 Emergency Service Helpline provides 24 hours service with a hundred working station in the call center. Call takers, dispatchers and supervisors are working in three sessions per day, which are morning session (8am-2pm), evening session (2pm-10pm) and night session (10pm-8am).

After taking a call the conversation begins with asking what service the caller needs. Then they ask for the caller's name, location and other stuffs from the predefined question set. For a valid call, call takers go ahead and store the information in the CAD system. According to the caller's need he establishes a telephone connection with the service provider (e.g., police, fire service) of the respective area for a quick assistance. In cases where multiple emergency service is required, for example, in an accident spot police and ambulance service might be needed. In such occasion call takers contact different service providers one by one. At the service provider's end CAD system is not available till now. So, details information on an incident, location or about the caller is passed over telephone. After getting all these things done, the call takers categorize the call into ten categories,

create a new event in the CAD system with the stored information gained from the caller as well as the information about the service provider/providers he contacted. Then the event is forwarded to the dispatchers for further follow up in order to ensure that the event successfully done. The dispatchers contact the particular service provider/providers as well as the caller as parts of the follow up.

The ten categories used to categorize incoming calls are -

- i) CFS (Call for Service): Calls to 9-9-9 for valid services.
- ii) BLK (Blank Call): Calls in which the caller does not speak.
- iii) ENQ (Enquiry Call): Calls where the caller asks for information about the Emergency Service Helpline or something else.
- iv) ENQ Transferred: Enquiry calls that are transferred to the dispatchers.
- v) TEST (Test Call): Calls which are made only to say “hello” and then terminated.
- vi) CRK (Crank Call): Calls where people speak out of context, incoherent and even abusive words.
- vii) DEP (Departmental Call): Calls where people asks for information about a government or non-government organization/department.
- viii) Child Call: Calls made by children, in most of the cases for no reason.
- ix) Women Call: Calls where women requests for services.
- x) Repeat Call: Calls to report an incident that has already been reported by another witness.

#### **4.1.2 Findings About Call for 9-9-9**

From the starting of 9-9-9 Emergency Service Helpline, people across the country are calling for various assistances. The calls are mostly about road accident, fireplace, domestic violence, theft, robbery, sound pollution, information inquiry, traffic jam, online fraud,

cyber-crime. Not all of the cases are relevant to emergency service. In irrelevant and non-emergency cases they are helping people with proper information that how and where to complain. Most of the call they receive are from inside Dhaka and at the evening or night. Through social media we tried to know from people who have called for emergency service and we got positive feedback.

**Average Caller Location According to District**

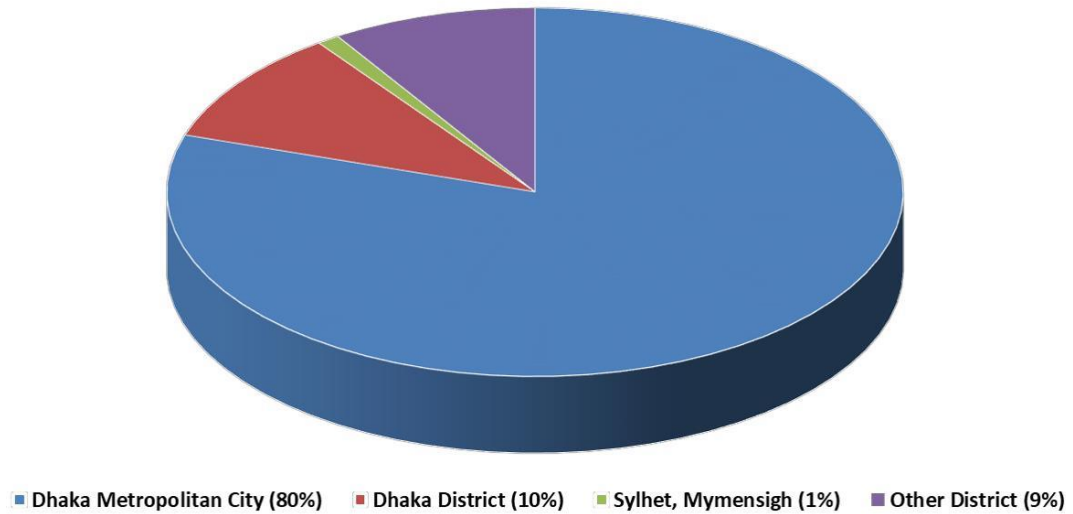


Figure 4.1: Location of Calls for Emergency Service

Till now callers mostly request for police service at 9-9-9. Few callers request for ambulance and fire fighter.



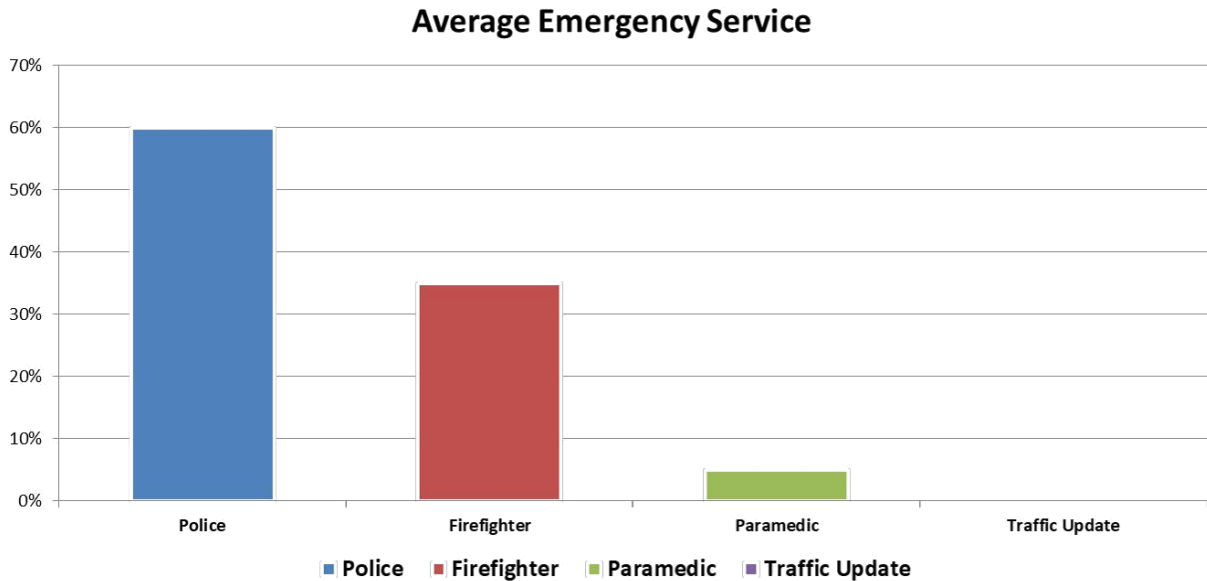


Figure 4.2: Service Request at 9-9-9

But most of the people in Bangladesh do not know what is 9-9-9, and what are the services it provides. Each day the call takers in 9-9-9 call center receive lots of irrelevant call where people ask for helps which 9-9-9 does not provide. Many callers think 9-9-9 is similar to the customer cares of telecommunication company and they call for SIM card related problems. Besides, the rate of blank call, test call and crank call is unbelievably too high. The call takers think many people calls for no reason because 9-9-9 calls are free of charge. Even some parents call 9-9-9 and let their child talk to the call takers without reason.

*“Many of the caller do not know when to call 9-9-9. Their irrelevant calls are wasting our time and energy which interrupt our regular activities.”* - said one of the call takers.

During our observation we saw less than 30% of the incoming calls are valid, others are irrelevant or spam call and multiple spam calls from one phone number is not rare.

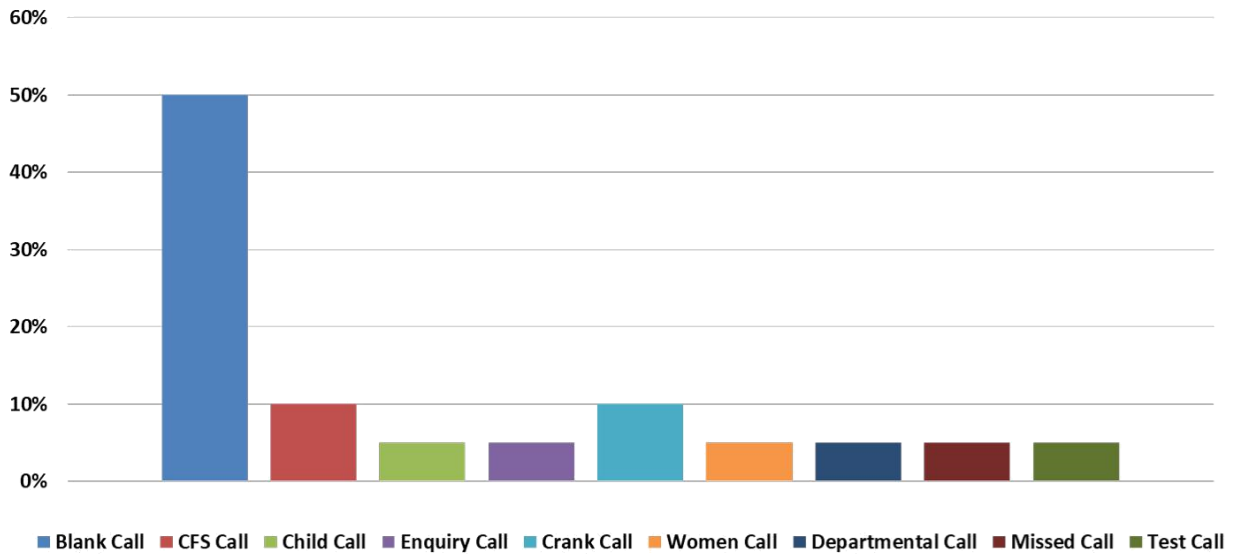


Figure 4.3: Incoming calls during our observation at 9-9-9

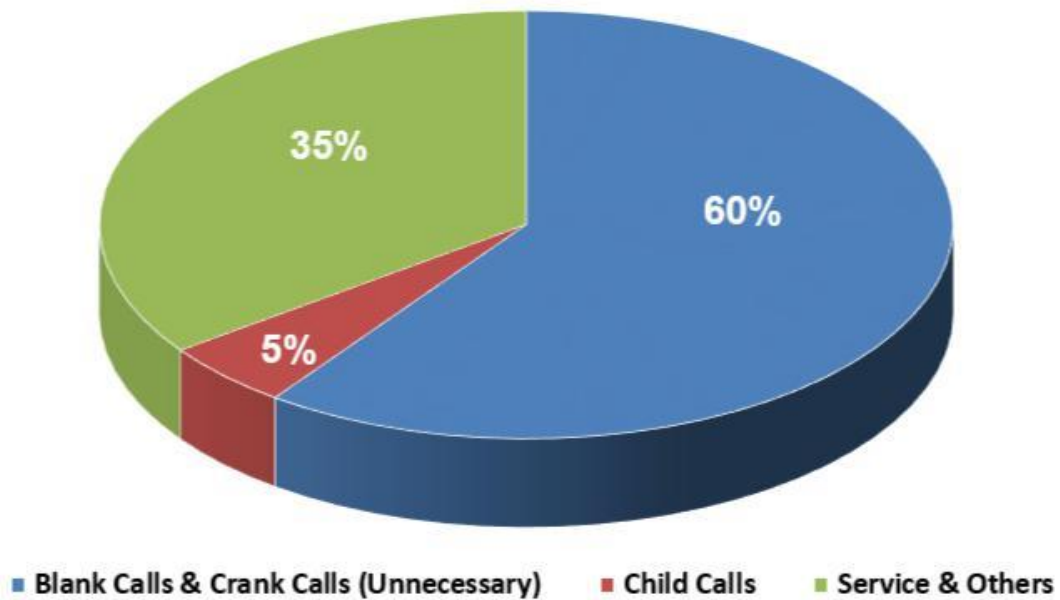


Figure 4.3: Call Taker's Feedback on Incoming Calls

Some people scold the call takers in call, some even abuse them.

*“Some callers talk offensive to abuse us. For such kind of people’s stupidity, sometime we cannot pay full attention to a valid call which comes right after an abusive call.”* - said one of the call takers.

In a populated country like Bangladesh only a hundred working station in Emergency Service Helpline is not enough. Besides, the higher rate of unexpected, invalid or spam call is a matter to be concerned for.

Till now no of use step has been taken to prevent or minimize spam calls. If multiple spam calls are received from the same number, the call takers just warn the caller through a SMS and forward that matter to the supervisor. Considering the caller’s approach some phone numbers are block listed in their system for few days. But it’s not a proper solution. We think the authority should find an effective way to control the spam calls. In addition to that, using media and social media a movement to aware people of the necessity and usefulness of National Emergency Service, so that people don’t misuse such an important service.

#### **4.1.2 Limitations in Current System**

In a populated country like Bangladesh only a hundred working station in Emergency Service Helpline is not enough. Till now the only way of communication with 9-9-9 is phone call. There are no options for sending message-based information or documents (e.g., photos) about an incident, location or crime. Besides, deaf and people who are hardly able to hear, cannot take advantages of the Emergency Service Helpline by their own self at all.

Call takers and dispatchers cannot track caller's location because GPS tracking or mobile location data access is not available at their end. They depend upon caller’s information in this case.

### **4.1.3 When Call Takers Struggle to Provide Help**

In a populated country like Bangladesh only a hundred working station in Emergency Service Helpline is not enough. In an emergency situation to send response, clear and complete information on the location or the incident is very important factor. To gain that information the call takers give their best efforts, but still in some cases their effort doesn't bring success. From our observation we found some circumstances like that.

#### **Callers Uncertainty or Inability to Describe a Situation**

Oftentimes callers are in a state of panic when they call in. Many of our participants talked about such calls and during our observation we experienced them as well. In some cases, the call was travelling and didn't know much about the location.

*“Few months ago, I received a call from a lady. She was trapped inside a bus and in need of immediate help, but she didn't know where she was. I tried my best to get at least a hint about the location, but before getting something the call was terminated. I found the number switched off when called her back. It is the most tragic experience for me as a call taker”* – said one of the call takers.

Our participants also experienced that callers were not always fluent at describing situations. For example, someone might not be good at describing the area of a fireplace. Besides come callers had difficulties in describing specific shapes or color of something. Participants described difficulties in getting accurate information from caller. Some people describe a situation as more terrific than what it actually is.

#### **Situations Where People Cannot Speak**

Our participants also experienced that callers were not always fluent at describing situations. In some cases, callers were not able communicate effectively. For example, callers might be children, deaf, or incompetent to speak clearly for some other reasons like accents.

*“I got a call from Sylhet. The caller was speaking in regional accent. It was too difficult for me to understand his problem. I told him to find someone around him who can speak clear.”* -said one of the call takers.

In some situations, the caller cannot speak because of security risk while a suspicious individual is near. In such case voice call is not an option to seek help.

## **4.2 9-9-9 WITH VIDEO CALLING**

In many cases where our participants faced difficulties to gather proper information, video calling could make it much simple for them. With the help of participants, we found out the benefits of video calling as well as the challenges to incorporate it in 9-9-9.

### **4.2.1 Benefits of Video Calling for 9-9-9**

Video calling in emergency situation creates the potential for sharing location information and situation intensity within a moment. Location information is more valuable within buildings where background of a video may help call takers or emergency responders to know caller's exact location. In cases where describing a situation was difficult for a person due to stress, injury, or emotional distress, participants sensed that getting themselves able to see the situation on a video call would be highly beneficial.

Participants thought that, with their training and experience they might notice something important in a video which the caller would not. For example, in an accidental case if the caller could show the injured people with video calling, small changes to a person's facial expression could imply symptoms of a stroke, but caller may be focusing on other injuries while describing the person.

For deaf, people dealing with hearing loss or cannot talk for other reason, video calling can be highly beneficial. In other cases, for example, someone is witnessing a crime and it's not safe for him to speak at that moment. They can still inform and share details information 9-9-9 with video calling.

Video calling can solve some common problem for the call takers like inaccurate information, ambiguous or unclear description etc. Some of our participants thought video

calls could be considered as recorded evidence. In some cases, it could be important for police as well as court cases after an incident has occurred.

We asked our participants for their opinion on video calling for 9-9-9 and all of them said it will much more efficient way of communication between them and the callers.

#### **4.2.2 Challenges of Incorporating Video Calling**

In spite of the likely benefits of 9-9-9 video calling, we found challenges that may come with the implementation.

Our participants talked about designing a new CAD system which can handle video calling, messages with media and queue of incoming calls. The existing system is good only for voice calls. Besides, handling and storing call data or footages could be a new issue to keep an eye on. Currently 9-9-9 keeps audio recording of the calls for 45 days, but when we are talking about messages, video clips and footages, data management and storage can be a little complex process as well.

Many of our participants were concerned about handling video calls along with their knowledge and training. Their job will no longer bound to information gathering with some set of questions, rather they will have to access different scene as well as make inferences depending on what is being showed by the callers. Misperception about an injury, location, or an incident can negatively affect the emergency response received by the callers. With this consideration new protocols need to be designed which will determine how and when the call takers will respond to what they see in a footage or video call. Moreover, new training structure needs to be implemented for the call takers and the dispatchers to cope with the new system.

Call takers have two computer displays at their working station. One is used to take calls, create event and interact with CAD system, another one is used to find information to assist a caller who called for an enquiry. Some participants were concerned of where a video call will be appeared. To use a third computer display can be a bit complex to work with, while they don't want to switch what was visible on the two screens.

Lastly, most of the people around the country don't use mobile internet connection for video calling even the people who have smartphones because of the cost is too high. We think many people won't be interested to take the advantage to video calling for 9-9-9 in this circumstance. Since technology is being evaluated taking cost into consideration, people of developing country like Bangladesh should get the facilities of internet as well as digitalization at minimum cost.

## **CHAPTER 5**

### **DISCUSSION AND CONCLUSION**

#### **5.1 SUMMARY OF THE STUDY**

In modern time Emergency Service Helpline is one of the smartest initiatives to ensure people's need in adverse situation. Developed countries are working on the betterment of this important service to achieve more reliability. Here in this study we tried to explore the usability of video calling for National Emergency Service Helpline (999) in Bangladesh.

Throughout the study we focused on some topics, like useful is the service for people in Bangladesh, how 9-9-9 is providing their service now, how other countries taking their emergency service up to the mark, strength, limitations and challenges of emergency service in Bangladesh, how video calling might help in communication between 9-9-9 and the citizen etc. To understand the system, we visited the 9-9-9 call center in Bangladesh, where we observed their work practices, difficulties and opportunities. We collected information based on our research questions to perform a qualitative analysis to find out different aspects. Our goal was to determine whether video calling is more productive for 9-9-9 calling or more challenging.

Since the beginning of National Emergency Service Helpline's (999) journey, it's doing a great job for people in need of immediate services. 999 is successful enough to create a positive impact on people across the country. The service has its limitations and challenges. Communication or information sharing is one of them. Our purpose was to eliminate or minimize the difficulty with the potential of video calling.

Video calling has the potential to develop the communication and information sharing between the calls and the call takers. While call takers and emergency first responders struggle in some cases, video calling can be mollifying for them. People with hearing or speaking difficulties can find a way of communication with 9-9-9 in emergency situation.



With a bunch of benefits video calling for 9-9-9 may bring some new challenges. System development, data handling, data overloading, background knowledge and training of the call takers, privacy concern are some of them.

There is much more work needs to be done on exploring the design of video calling solutions and testing out the ideas that may be gained from our research.

## **5.2 RECOMMENDATION**

Considering our study and observation, we strongly suggest that the implementation of Video Calling System in 9-9-9 emergency helpline service is a must and need to implement as soon as possible. It will help them to overcome the following issues:

**5.2.1. The Emergency Situation is True:** In a day the call takers receive eighteen thousand to twenty-two thousand phone calls. Among them, 60% of calls are crank calls or fake calls. As a result, the call takers are always in an ambivalence situation to assume if the callers' erudition is true or not. In such situations, they depend on their instinct. In this case, the video calling system will be a big plus point for the call takers as well as for the dispatchers.

**5.2.2. The severity of an emergency:** Getting a clear idea or the severity of a situation over the phone call is quite impossible for the call takers. In this case, if they could see the situation in their screen, they will be able to take proper actions immediately.

**5.2.3. An Appropriate Idea About the Location:** During our observation, we witnessed that a fire incident took place in a village. The fire responders needed one hour to reach the spot because they did not have the proper idea about the location. Video calling might help them to overcome this location issues.

Since the implementation of video calling system needs time, the call takers need the GPS tracking or mobile location data access in their CAD system immediately to know the callers' location. Because every day the call takers receive eighteen thousand to twenty-two thousand phone calls. Among them, 60% of the calls are crank calls, fake calls or missed calls.

As a result, the call takers cannot take any proper steps against them. On the other hand, the actual help seekers face problems in getting help as the lines stay busy.

Currently the call takers of the 9-9-9 emergency helpline service helping eighteen thousand to twenty-two thousand people per day. In a heavily densely country like Bangladesh, serving people with only phone calls is very tough. Moreover, sometimes there are situations where people cannot speak or listen. If there's an SMS or MMS service in the 9-9-9 emergency helpline service, then the dumb and deaf people would be able to seek help from them easily.

### **5.3 FUTURE IMPLEMENTATION**

In this modern era of communication data is the most precious thing. But the 9-9-9 emergency helpline service erases all its voice call records after 45 days without keeping any records for a future investigation. But these data needs to be saved in a structured way.

Here, structured way means, at first we will convert the whole audio file into strings. Then, we will use the tokenization method in the strings for separating the main keywords like road accident, mugging, Meghna River etc. and save these keywords in a matrix with an initial value of zero or one. After that, if the call takers get any calls related to the keywords that have been indexed in the matrix an algorithm will automatically increase the value of the keyword. That's how they will be able to keep records of their received calls for a long time.

### **5.4 OTHER OPPORTUNITIES WE FOUND**

From the data collection and analysis, we've seen that thousands of calls from different region of the country are being made in different issues. 9-9-9 call center keeps calls data for 45 days only. There's a great chance to manipulate and analysis those data to build up a perception on development, problems, lack of opportunities, and criminal offences of a region. Some of the call data is even more valuable, because many people share an issue with 9-9-9 but they don't want to reveal their identity. Which means they are comfortable

in sharing information only over phone calls or messages. We think well designed data storage system and storing data in a structured manner can be beneficial for the government in terms of development.

*“Every day we get lots of call from the Meghna Bridge due to unbearable traffic jam.”* - said one of the call takers.

This is just an example which highlights a communication problem of a location.

## 5.5 CONCLUSION

Our research shows that every day the call takers and the dispatchers from the hundred working station of 9-9-9 emergency helpline service are answering and serving eighteen thousand to twenty-two thousand calls. Peoples from all over the country call every day.

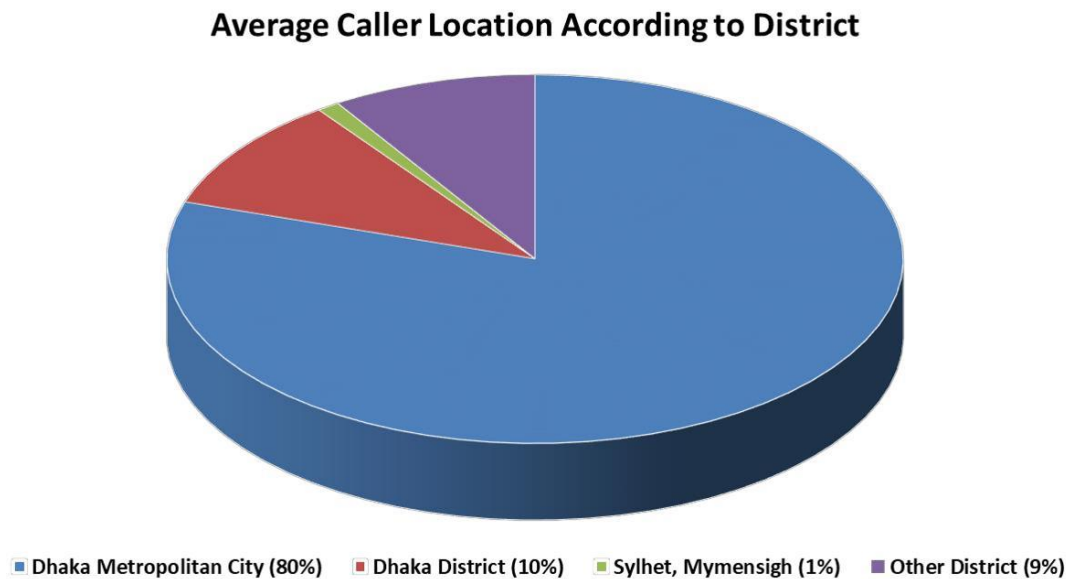


Figure 5.1: Callers Location

In our research, we focused on the experiences of call takers and dispatchers to understand the depth of this perspective. Of course, this research has its limitations. We do not have data from actual callers to know about their specific needs and privacy concerns for video calling. Still, we believe from the depth of our hearth is that this work sets the scene for a rich research motivation.

According to the opinions of the call takers and the dispatchers, we found out the key benefit of work is the opening of the design space around future emergency calls and call handling. There are huge possibilities for such technologies, as the organizations are planning to continue to move to a variety of next-generation 9-9-9 solutions for emergency calls in our country and others.

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CHAPTER 1 INTRODUCTION 1.1 INTRODUCTION In the year of 1935 the first ever emergency service helpline (999) was launched at London, UK following a fire at a London doctor's surgery on November 1935, which was initially providing five facilities [1]. The concept received a huge public attention instantly, which inspires other countries to adopt the concept for their own. Following that the government of Bangladesh decided to introduce a national emergency service helpline. The service offers people to place phone calls requesting for emergency assistance in situations like requiring an

ambulance service, fire fighters, or the police. For the time being, only voice-based phone calls can be made using telephone or mobile phones which are taken by an attendant known as "call taker" who assesses the circumstance and send off to the appropriate responders for proper initiative. Since technology has been passing through an evolution starting from the very beginning of this century, it's high time to think of an emergency help desk with advanced communication support where people can use text messaging, photograph or video sharing, or video streaming along with voice calls. We are currently focusing on the concept after exploring the idea of video- based calling for 9- 9-9 calls, like a Skype or WhatsApp call between the attendant and people who are experiencing emergencies. Now a lot of questions arise with the idea of showing a call attendant an emergency situation through video calling including what changes will there be on the work of emergency call attendants? How the additional calling system can better the services of

9- 9-9? How should the system be designed so that it meets the needs of the callers and call attendants to assure emergency video calls are effective and efficient, and many more. We investigated those research questions by observing the 9- 9-9 call taking practices at the national emergency helpline call center in Dhaka. Our aim was to understand the key factors that are important for designing such video calling systems if 9- 9-9 services are going to be expanded to include them. We observed ambulance, police, and fire service call attendants and dispatchers during their regular work as well as conducted contextual interviews with them about their experiences and work practice. In some cases, we assumed a possible future of 9-9-9 emergency services with video calling technologies incorporated for a real time observation. Our investigation outcome shows that video calling, and the sharing of photographs or video clips supported calling system holds the potential for benefits, including the capability of dealing with inaccurate or ambiguous information, including additional contextual information of scenes. Besides, the addition of video calling brings many new challenges and facts to be concerned about, like handling information overloading, privacy challenges, or proper training for employees to adapt to the changes. Comparing with available voice and video chat software (e.g., Viber, Skype), calling for 9-9-9 might be considered as a continuum where the control of sharing media (e.g., photo, video) and video call is there while the primary communication medium is voice call. So, the system should combine this with the feature of supporting complicated camera work and decision making about how and when to show the emergency situation along with transition between different modal qualities within the call. 1.2 MOTIVATION Digital Bangladesh [2,3] is one of the nation's dreams and the government of Bangladesh implemented a large number of projects relating to digital technologies. As a part of the movement towards "Digital Bangladesh", the government launched a national emergency helpline desk for helping people real quick. Many other countries are engaging for the betterment of their own emergency service to reach out every citizen and present the system as a place of reliance as well. As Bangladesh is moving towards a developed country, we definitely can explore ideas for a reliable "Next Generation Emergency Service Helpline" where the communication medium won't be limited to voice calls only, rather people can use voice message, text message, video streaming, sharing of images or video clips. We focus on this topic by exploring the idea of video calling for 9- 9-9 calls. With the evolution of smartphones and smart communication technologies, video calling among family, relatives and friends has become widespread. With video calls it's much easier to sense activity that is occurring which let people share an environment, place, object, and activities that are happening around. These facts influence to think of the potential of video calling where people are intimately able to share views of an event with emergency helpline call

attendants. Using advanced video calling technologies, like, video views from multiple cameras, 360-degree video technology etc. 9-9-9 services can be taken forward to the next level to overcome limitations and face future challenges.

### 1.3 RATIONALE OF THE STUDY

Since the country is developing and heading towards urbanization, and with the propensity of people to resettle in big cities, more crimes, accidents, and unwanted incidents are happening. In the future these circumstances will be more challenging, at least in Dhaka. To keep pace with the current and upcoming challenges, we thought of -

- Developing an idea that will help to make the existing emergency helpline service better and even more efficient.
- Enforcing the modern technologies of communication to ensure the maximum benefits of the service.
- Taking the initiative to the next level for proper service for what this has come into existence and prevent spam of misuse of it.
- Finally make this important service more people friendly in emergency cases so that people can seek help in a manner of more informative communication and better understanding for the responders.

### 1.4 RESEARCH QUESTIONS

As of the research project focuses on the benefits, scope, and challenges of video calling for emergency helpline (9-9-9), the followings questions are the things we tried to accomplish throughout this project.

- How video calling can be beneficial for the callers who are seeking help from the emergency helpline?
- How beneficial is the video calling for the emergency responders?
- What are the challenges of video calling for emergency helpline?
- What are the risks and requirements for designing a system that offers video-based communication between people and emergency helpline (9-9-9)?

### 1.5 EXPECTED OUTPUT

Throughout this research, we planned to perform a qualitative analysis according to the research questions and expected to find our-

- Strength and weakness of current system.
- Challenges for call takers and dispatchers in regular work practice.
- Difficulties for the callers in sharing various information with call takers.
- How video calling for 9-9-9 eliminates or minimizes the difficulties for callers and call takers.
- Opportunities and challenges for incorporating video calling.

### 1.6 REPORT LAYOUT

In chapter 1 of this report we tried to evaluate our research topic and motivation behind the research. Following these, research goal and other relativities has been discussed. In the second chapter we explicitly discussed our background study, including current circumstance overview and other studies that has been conducted on relative issues. ©Daffodil International University Then in the third chapter we revealed our study methodology in details, which includes planning and our working procedure. Following that, chapter 4 is all about our findings and manipulation. Details analysis and other opportunities have also been covered here. In the fifth and last chapter, research summary, future scope and our recommendation has been discussed.

## CHAPTER 2 BACKGROUND STUDY

### 2.1 INTRODUCTION

The 9-9-9 emergency helpline received a huge attention from people around the country immediately after being launched as an experimental project on the 1st October 2016. The service has received around 3.3 million calls during its experimental phase [4]. People across the country found the tool handy in the moment of witnessing an emergency situation. The national emergency service offers people to call -

- When someone witnesses a crime.
- When someone fears for their life.
- When someone is hurt or injured.
- When someone is in danger.
- When a fire breaks out.
- When someone is in urgent need of an ambulance [4].

### 2.2 HOW EMERGENCY SERVICE HELPLINE IN BANGLADESH WORKS

In the emergency helpline call center, call takers gather detailed information from the caller who are facing an emergency, about the situation or incident to classify as well as prioritize that emergency. They record textual information in Computer-Aid Dispatch (CAD) system. Then the call taker establishes a connection with appropriate response team that is required like police, ambulance or fire fighters. In the meantime, he

creates an event in their system on this occasion for the dispatchers. One of the dispatchers receive and follow up the event created and passed by the call taker. He communicates with the respective response team as well as the caller who reported the emergency situation to ensure that the service is properly delivered. In some cases, it's difficult to gain enough information about an emergency situation or point the caller's exact location because the description of a location and situation given by the caller is inaccurate, ambiguous or insufficient. Sometimes voice of the caller is unclear due to extra noise or regional accent. Besides, during an emergency situation some callers are frantic, desperate, or hysterical so it is really difficult getting details and accurate information. In such cases the call takers as well as the emergency response team face a huge challenge on helping people in trouble. In some cases, they gave maximum effort but failed to reach people who are badly in need of emergency service. Spam calls are another obstruction for the national emergency service in Bangladesh. The call takers receive a huge number of blank calls, Irrelevant calls and offensive calls each day which are literally wasting the potential of this important service. The authority is still searching for a solution to get rid of those unwanted calls [More details about 9-9-9 calls has been discussed in the Data Collection and Analysis part]. At this moment there is only hundred working station in the emergency helpline call center which is inadequate compared to the whole population. Expansion process of the call center is on-going. The authority also has a plan to link the call center with the social media platforms so that people can get the service from it immediately [5].

### 2.3 RELATED WORKS

A large number of studies have been conducted related to emergency service helpline, emergency calling and dispatch, video communications, and the benefits of video calling.

#### 2.3.1 Emergency Helpline, Emergency Calling and Dispatch In emergency call centers, call takers receive calls from a citizen facing emergency situation and collect details information about the circumstance to classify and prioritize it [6,7,8]. Then textual information is recorded in a Computer-Aided Dispatch (CAD) system [9]. Dispatchers review the event or recorded information and send an immediate response team (police, fire or ambulance) that is needed [6,7]. Sometimes, it is difficult to figure out the caller's exact location because the incoming description of location given by the caller is inaccurate or ambiguous [6,8]. Call centers can become chaotic if call volume is too high [7]. Some callers are frantic, desperate or hysterical so it can be difficult to gain accurate or enough information [10,11]. Call takers are trained to take control of the call so they can ask specific questions, however, hostile callers may not want to give up control [12]. Situation awareness is critical in emergency service call centers [13]. Situation awareness for a call taker is a real time understanding of what's happening during an inverted situation and how the incoming information is treated [14,15]. This can be gained by listening to another people, by looking around purposefully, or by observing information in someone's visual perception [13,17,19]. Call takers use situation awareness to manage a perception of incoming calls to make sure that multiple calls about the same event is known [7,8,10]. Besides they can maintain awareness by scanning call list in their CAD system as well [7,8]. Call takers can face anxieties from working with traumatic incidents and have to rely on counseling [20] or peer support [21,22]. Complex nature of calls, confusing information from callers, multiple emergency services need, and communication problems (e.g., poor English or regional accent) cause stress [21,23]. Life and death calls and calls involving child are particularly stressful [23,24]. For deaf people or hard of hearing, emergency situations are more challenging and they have to depend on friends, family or others to call emergency service helpline [25]. Text to emergency services are available in most of the areas within North America [16,26]. Some researchers have designed special app for deaf people [25].

Visual information of an incident is more valuable for medical team and hospitals to understand the awfulness of the situation in order to better prepare for the arriving ambulance [21]. Video can also be used to show injury, body details, and medical equipment's display screen [27]. Researches have shown better result while providing medical staff with video of patients who are on the way to the hospital [27,28]. In response to emergency situations due to natural disaster, inaccurate or lack of information hinder the response team to perform better [29,31]. Our study extends the related work by inspecting the likely advantages and challenges of using video calling for emergency services. 2.3.2 Video Communication and The Advantages of Video Communication Our study extends the related work by inspecting the likely advantages and challenges of using video calling for emergency services. Video calling among family, relatives and friends within homes has become widespread with the expansion of internet and in the outdoor with mobile [31,32,33]. Using video calls (e.g., WhatsApp, Skype), people communicate and share views of activities or scenes [34,35,36]. This lets people show what an object or environment looks like and activities what people can perform [32,34,37]. These perceptions propound the potential of video calls where people might similarly have the ability to share views of an incident, scene or location with emergency helpline call takers. Yet video calling has its own challenges in domestic settings. Sometimes video calls among relatives/friends are difficult to maintain due to connectivity issues or trouble in operating the user interface [31,35]. Everyone is not comfortable being on camera because of how they might look [38,39,40], which sometimes raise the fact whether both parties need to share their video view

[38]. Privacy concern exists for bystanders who got captured in a video stream unwantedly [41,42,43]. This associates with autonomy of one's will to participate in a video stream according to their own terms [38]. 2.4 CHALLENGES From the very beginning of our study we tried to collect data about the emergency service helpline in Bangladesh from different online and print media. We hardly found articles and information on this. Even the official website doesn't hold much information. So, the challenge was there in gathering required information for our analysis. We visited the call center of 9-9-9 and tried to collect data of different categories. It was difficult to observe their events as per our expectation because of the higher rate of spam calls. We managed to overcome those adversities with the hospitality and cordiality of the employees and officers in charge of the 9- 9-9 call center. We really appreciate their hospitality and generosity. CHAPTER 3 STUDY METHODOLOGY 3.1 INTRODUCTION As mentioned earlier that in Bangladesh the only call center for emergency service helpline 9-9-9 is managed by the police force, we requested for the approval of our research study to the authority. We conducted a research to realize the work practices of call taking, dispatching and the Computer Aided Dispatch (CAD) system. We also focused on the opportunities and challenges that 9-9-9 video calling might bring. 3.2 PARTICIPANTS DEMOGRAPHICS We spent two days and around four hours each day during the process, where we observed the call center and conducted interviews with some of the employees. Each day is divided into three sessions. Different group of employees are on at different session. All of the employees have come from the police force. The call takers were working as Constable in different police station before getting appointed in the call center while the dispatchers belong to the rank Sub-inspector. Our participants were fourteen people from the call center: nine call takers, three dispatchers, one supervisor, and the officer in charge of the call center. The participants had at least one year of working experience in the call center and were familiar with video calling technology. The call takers and the dispatchers had training periods focused on course work, call taking, Computer-Aid Dispatch (CAD) system understanding, event creation,

dispatching, ability to handle stress, and cyber- crime. Course work includes set of questions to ask during a call, conversational skill to show empathy and control the call. The duration of training period varied for different participant depending on their previous knowledge and how training had evolved.

### 3.3 DATA COLLECTION PROCEDURE

In the 9-9-9 call center we followed the steps mentioned below for data collection.

#### 3.3.1 Observation

We observed the environment, work practices of emergency call takers, dispatchers, supervisors and the way they gather, record and classify incoming data from caller in their system. This allowed us to see and understand what practices might be easy or difficult to communicate over video calls during emergency situations. We watched and listen to their work, what software and hardware systems they were using, how they organized their work and work area, how they maintained situation awareness and what they asked callers during calls. We only collected observational data about those people who consented to participate. We recorded our conversation with them for further analysis.

#### 3.3.2 Interview with Emergency Call Takers and Dispatchers

We conducted one -on- one interviews with emergency call takers and dispatchers. We asked them questions about their work practices, needs and how they were trained to talk with callers. We recorded the entire conversation for data analysis.

#### 3.3.3 Interview with Emergency Responders

We conducted one-on-one interviews with emergency responders (fire-fighters, medical team) and instructors where we asked them questions about their work practices, challenges and needs.

#### 3.3.4 Interview with People Who Have Called 9-9-9

We conducted one-on-one interviews with some people who had called 9- 9-9 in the past to understand the situation around their call and how they interacted with call takers. We asked them for feedback about the use of future technologies as a part of 9-9-9 calls. After gathering all these data and information about the 9-9-9 emergency call center, emergency call takers, first responders as well as callers, we examined on them.

### 3.3 DATA ANALYSIS

During data collection procedure we received a huge amount of random data and information. Then we transcribed and classified them according to different topics. Open and selective coding were used to analyze the data in order to draw out main theme. Details of our data analysis has been discussed in the following part of this report.

## CHAPTER 4 DATA COLLECTION AND ANALYSIS

In this section we will be discussing the manipulation and classification of our collected data. After transcribing the audio-recorded conversations we categorize and subcategorize them under various topics like current situations, in which cases people asking for help, challenges for call takers etc. We now describe all of these along with some participant quotes without revealing their identities.

### 4.1 CURRENT PRACTICE OF 9-9-9 CALL CENTER

We subcategorized the data about current situations into the following topics:

#### 4.1.1 Work Practice in 9-9-9 Call Center

999 Emergency Service Helpline provides 24 hours service with a hundred working station in the call center. Call takers, dispatchers and supervisors are working in three sessions per day, which are morning session (8am-2pm), evening session (2pm-10pm) and night session (10pm-8am). After taking a call the conversation begins with asking what service the caller needs. Then they ask for the caller's name, location and other stuffs from the predefined question set. For a valid call, call takers go ahead and store the information in the CAD system. According to the caller's need he establishes a telephone connection with the service provider (e.g., police, fire service) of the respective area for a quick assistance. In cases where multiple emergency service is required, for example, in an accident spot police and ambulance service might be needed. In such occasion call takers contact different service providers one by one. At the service provider's end CAD system is not available till now. So, details information on an incident, location or about the caller is passed over telephone. After getting all these things done, the call

takers categorize the call into ten categories, create a new event in the CAD system with the stored information gained from the caller as well as the information about the service provider/providers he contacted. Then the event is forwarded to the dispatchers for further follow up in order to ensure that the event successfully done. The dispatchers contact the particular service provider/providers as well as the caller as parts of the follow up. The ten categories used to categorize incoming calls are - i) CFS (Call for Service): Calls to 9-9-9 for valid services. ii) BLK (Blank Call): Calls in which the caller does not speak. iii) ENQ (Enquiry Call): Calls where the caller asks for information about the Emergency Service Helpline or something else. iv) ENQ Transferred: Enquiry calls that are transferred to the dispatchers. v) TEST (Test Call): Calls which are made only to say "hello" and then terminated. vi) CRK (Crank Call): Calls where people speak out of context, incoherent and even abusive words. vii) DEP (Departmental Call): Calls where people asks for information about a government or non-government organization/department. viii) Child Call: Calls made by children, in most of the cases for no reason. ix) Women Call: Calls where women requests for services. x) Repeat Call: Calls to report an incident that has already been reported by another witness.

4.1.2 Findings About Call for 9-9-9 From the starting of 9-9-9 Emergency Service Helpline, people across the country are calling for various assistances. The calls are mostly about road accident, fireplace, domestic violence, theft, robbery, sound pollution, information inquiry, traffic jam, online fraud, cyber-crime. Not all of the cases are relevant to emergency service. In irrelevant and non-emergency cases they are helping people with proper information that how and where to complain. Most of the call they receive are from inside Dhaka and at the evening or night. Through social media we tried to know from people who have called for emergency service and we got positive feedback. Figure 4.1: Location of Calls for Emergency Service Till now callers mostly request for police service at 9-9-9. Few callers request for ambulance and fire fighter. Figure 4.2: Service Request at 9-9-9 But most of the people in Bangladesh do not know what is

9-9-9, and what are the services it provides. Each day the call takers in 9-9-9 call center receive lots of irrelevant call where people ask for helps which 9-9-9 does not provide. Many callers think 9-9-9 is similar to the customer cares of telecommunication company and they call for SIM card related problems. Besides, the rate of blank call, test call and crank call is unbelievably too high. The call takers think many people calls for no reason because 9-9-9 calls are free of charge. Even some parents call 9-9-9 and let their child talk to the call takers without reason. "Many of the caller do not know when to call 9-9-9. Their irrelevant calls are wasting our time and energy which interrupt our regular activities." - said one of the call takers. During our observation we saw less than 30% of the incoming calls are valid, others are irrelevant or spam call and multiple spam calls from one phone number is not rare. Figure 4.2: Incoming calls during our observation at 9-9-9 Figure 4.3: Call Taker's Feedback on Incoming Calls Some people scold the call takers in call, some even abuse them. "Some callers talk offensive to abuse us. For such kind of people's stupidity, sometime we cannot pay full attention to a valid call which comes right after an abusive call." - said one of the call takers. In a populated country like Bangladesh only a hundred working station in Emergency Service Helpline is not enough. Besides, the higher rate of unexpected, invalid or spam call is a matter to be concerned for. Till now no of use step has been taken to prevent or minimize spam calls. If multiple spam calls are received from the same number, the call takers just warn the caller through a SMS and forward that matter to the supervisor. Considering the caller's approach some phone numbers are block listed in their system for few days. But it's not a proper solution. We think the authority should find an effective way to control the spam calls. In addition to that, using media and social media a movement

to aware people of the necessity and usefulness of National Emergency Service, so that people don't misuse such an important service.

#### 4.1.2 Limitations in Current System

In a populated country like Bangladesh only a hundred working station in Emergency Service Helpline is not enough. Till now the only way of communication with 9-9-9 is phone call. There are no options for sending message-based information or documents (e.g., photos) about an incident, location or crime. Besides, deaf and people who are hardly able to hear, cannot take advantages of the Emergency Service Helpline by their own self at all. Call takers and dispatchers cannot track caller's location because GPS tracking or mobile location data access is not available at their end. They depend upon caller's information in this case.

#### 4.1.3 When Call Takers Struggle to Provide Help

In a populated country like Bangladesh only a hundred working station in Emergency Service Helpline is not enough. In an emergency situation to send response, clear and complete information on the location or the incident is very important factor. To gain that information the call takers give their best efforts, but still in some cases their effort doesn't bring success. From our observation we found some circumstances like that. Callers Uncertainty or Inability to Describe a Situation Oftentimes callers are in a state of panic when they call in. Many of our participants talked about such calls and during our observation we experienced them as well. In some cases, the call was travelling and didn't know much about the location. "Few months ago, I received a call from a lady. She was trapped inside a bus and in need of immediate help, but she didn't know where she was. I tried my best to get at least a hint about the location, but before getting something the call was terminated. I found the number switched off when called her back. It is the most tragic experience for me as a call taker" – said one of the call takers. Our participants also experienced that callers were not always fluent at describing situations. For example, someone might not be good at describing the area of a fireplace. Besides come callers had difficulties in describing specific shapes or color of something. Participants described difficulties in getting accurate information from caller. Some people describe a situation as more terrific than what it actually is. Situations Where People Cannot Speak Our participants also experienced that callers were not always fluent at describing situations. In some cases, callers were not able communicate effectively. For example, callers might be children, deaf, or incompetent to speak clearly for some other reasons like accents. "I got a call from Sylhet. The caller was speaking in regional accent. It was too difficult for me to understand his problem. I told him to find someone around him who can speak clear." -said one of the call takers. In some situations. the caller cannot speak because of security risk while a suspicious individual is near. In such case voice call is not an option to seek help.

#### 4.2 9-9-9 WITH VIDEO CALLING

In many cases where our participants faced difficulties to gather proper information, video calling could make it much simple for them. With the help of participants, we found out the benefits of video calling as well as the challenges to incorporate it in 9-9-9.

#### 4.2.1 Benefits of Video Calling for 9-9-9

Video calling in emergency situation creates the potential for sharing location information and situation intensity within a moment. Location information is more valuable within buildings where background of a video may help call takers or emergency responders to know caller's exact location. In cases where describing a situation was difficult for a person due to stress, injury, or emotional distress, participants sensed that getting themselves able to see the situation on a video call would be highly beneficial. Participants thought that, with their training and experience they might notice something important in a video which the caller would not. For example, in an accidental case if the caller could show the injured people with video calling, small changes to a person's facial expression could imply symptoms of a stroke, but caller may be focusing on other injuries while describing the



person. For deaf, people dealing with hearing loss or cannot talk for other reason, video calling can be highly beneficial. In other cases, for example, someone is witnessing a crime and it's not safe for him to speak at then moment. They can still inform and share details information 9-9-9 with video calling. Video calling can solve some common problem for the call takers like inaccurate information, ambiguous or unclear description etc. Some of our participants thought video calls could be considered as recorded evidence. In some cases, it could be important for police as well as court cases after an incident has occurred. 4.2.2 Challenges of Incorporating Video Calling In spite of the likely benefits of 9-9-9 video calling, we found challenges that may come with the implementation. Our participants talked about designing a new CAD system which can handle video calling, messages with media and que of incoming calls. The existing system is good only for voice calls. Besides, handling and storing call data or footages could be a new issue to keep an eye on. Currently 9-9-9 keeps audio recording of the calls for 45 days, but when we are talking about messages, video clips and footages, data management and storage can be a little complex process as well. Many of our participants were concerned about handling video calls along with their knowledge and training. Their job will no longer bound to information gathering with some set of questions, rather they will have to access different scene as well as make inferences depending on what is being showed by the callers. Misperception about an injury, location, or an incident can negatively affect the emergency response received by the callers. With this consideration new protocols need to be designed which will determine how and when the call takers will respond to what they see in a footage or video call. Moreover, new training structure needs to be implemented for the call takers and the dispatchers to cope with the new system. Call takers have two computer displays at their working station. One is used to take calls, create event and interact with CAD system, another one is used to find information to assist a caller who called for an enquiry. Some participants were concerned of where a video call will be appeared. To use a third computer display can be a bit complex to work with, while they don't want to switch what was visible on the two screens. Lastly, most of the people around the country don't use mobile internet connection for video calling even the people who have smartphones because of the cost is too high. We think many people won't be interested to take the advantage to video calling for 9-9-9 in this circumstance. Since technology is being evaluated taking cost into consideration, people of developing country like Bangladesh should get the facilities of internet as well as digitalization at minimum cost. CHAPTER 5 DISCUSSION AND CONCLUSION 5.1 SUMMARY OF THE STUDY In modern time Emergency Service Helpline is one of the smartest initiatives to ensure people's need in adverse situation. Developed countries are working on the betterment of this important service to achieve more reliability. Here in this study we tried to explore the usability of video calling for National Emergency Service Helpline

(999) in Bangladesh. Throughout the study we focused on some topics, like useful is the service for people in Bangladesh, how 9-9-9 is providing their service now, how other countries taking their emergency service up to the mark, strength, limitations and challenges of emergency service in Bangladesh, how video calling might help in communication between 9-9-9 and the citizen etc. To understand the system, we visited the 9-9-9 call center in Bangladesh, where we observed their work practices, difficulties and opportunities. We collected information based on our research questions to perform a qualitative analysis to find out different aspects. Our goal was to determine whether video calling is more productive for 9-9-9 calling or more challenging. Since the beginning of National Emergency Service Helpline's

(999) journey, it's doing a great job for people in need of immediate services. 999 is successful enough to create a positive impact on people across the

country. The service has its limitations and challenges. Communication or information sharing is one of them. Our purpose was to eliminate or minimize the difficulty with the potential of video calling. Video calling has the potential to develop the communication and information sharing between the calls and the call takers. While call takers and emergency first responders struggle in some cases, video calling can be mollifying for them. People with hearing or speaking difficulties can find a way of communication with 9-9-9 in emergency situation. With a bunch of benefits video calling for 9-9-9 may bring some new challenges. System development, data handling, data overloading, background knowledge and training of the call takers, privacy concern are some of them. There is much more work needs to be done on exploring the design of video calling solutions and testing out the ideas that may be gained from our research.

## 5.2 RECOMMENDATION

Considering our study and observation, we strongly suggest that the implementation of Video Calling System in 9-9-9 emergency helpline service is a must and need to implement as soon as possible. It will help them to overcome the following issues:

5.2.1. The Emergency Situation is True: In a day the call takers receive eighteen thousand to twenty-two thousand phone calls. Among them, 60% of calls are crank calls or fake calls. As a result, the call takers are always in an ambivalence situation to assume if the callers' erudition is true or not. In such situations, they depend on their instinct. In this case, the video calling system will be a big plus point for the call takers as well as for the dispatchers.

5.2.2. The severity of an emergency: Getting a clear idea or the severity of a situation over the phone call is quite impossible for the call takers. In this case, if they could see the situation in their screen, they will be able to take proper actions immediately.

5.2.3. An Appropriate Idea About the Location: During our observation, we witnessed that a fire incident took place in a village. The fire responders needed one hour to reach the spot because they did not have the proper idea about the location. Video calling might help them to overcome this location issues. Since the implementation of video calling system needs time, the call takers need the GPS tracking or mobile location data access in their CAD system immediately to know the callers' location. Because every day the call takers receive eighteen thousand to twenty- two thousand phone calls. Among them, 60% of the calls are crank calls, fake calls or missed calls. As a result, the call takers cannot take any proper steps against them. On the other hand, the actual help seekers face problems in getting help as the lines stay busy. Currently the call takers of the 9-9-9 emergency helpline service helping eighteen thousand to twenty-two thousand people per day. In a heavily densely country like Bangladesh, serving people with only phone calls is very tough. Moreover, sometimes there are situations where people cannot speak or listen. If there's an SMS or MMS service in the 9- 9-9 emergency helpline service, then the dumb and deaf people would be able to seek help from them easily.

5.3 FUTURE IMPLEMENTATION In this modern era of communication data is the most precious thing. But the 9-9-9 emergency helpline service erases all its voice call records after 45 days without keeping any records for a future investigation. But these data needs to be saved in a structured way. Here, structured way means, at first we will convert the whole audio file into strings. Then, we will use the tokenization method in the strings for separating the main keywords like road accident, mugging, Meghna River etc. and save these keywords in a matrix with an initial value of zero or one. After that, if the call takers get any calls related to the keywords that have been indexed in the matrix an algorithm will automatically increase the value of the keyword. That's how they will be able to keep records of their received calls for a long time.

5.4 OTHER OPPORTUNITIES WE FOUND From the data collection and analysis, we've seen that thousands of calls from different region of the country are being made in different issues. 9-9-9 call center

keeps calls data for 45 days only. There's a great chance to manipulate and analysis those data to build up a perception on development, problems, lack of opportunities, and criminal offences of a region. Some of the call data is even more valuable, because many people share an issue with 9-9-9 but they don't want to reveal their identity. Which means they are comfortable in sharing information only over phone calls or messages. We think well designed data storage system and storing data in a structured manner can be beneficial for the government in terms of development. "Every day we get lots of call from the Meghna Bridge due to unbearable traffic jam." - said one of the call takers. This is just an example which highlights a communication problem of a location.

5.5 CONCLUSION Our research says that every day the call takers and the dispatchers from the hundred working station of 9-9-9 emergency helpline service are answering and serving eighteen thousand to twenty-two thousand calls. Peoples from all over the country call every day. In our research, we focused on the experiences of call takers and dispatchers to understand the depth of this perspective. Of course, this research has its limitations. We do not have data from actual callers to know about their specific needs and privacy concerns for video calling. Still, we believe from the depth of our hearth is that this work sets the scene for a rich research motivation. According to the opinions of the call takers and the dispatchers, we found out the key benefit of work is the opening of the design space around future emergency calls and call handling. There are huge possibilities for such technologies, as the organizations are planning to continue to move to a variety of next-generation 9-9-9 solutions for emergency calls in our country and others.

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