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SMS2FAX: A TOOL TO ENHANCE PUBLIC SERVICE IN EMERGENCY SITUATION

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Abstract- Fax machines are still extremely vital in confidential and important official communications. Today, even with more sophisticated forms of communication such as Email, Short Message Service, Instant Messaging, and video conferencing etc, fax machines are very essential information and telecommunications technology equipment in everyday official functions. This paper describes how a fax machine- an old Information and Communications Technology product could be used with a new communication method i.e. SMS that would enhance public service and especially during emergency.

Keywords- *Digital Governance, Crisis Response, SMS, FAX, Communication*

I. INTRODUCTION

This paper presents a conceptual framework for digital governance to provide better and smart public service during emergency situation by using the mass 'crowd' or by disseminating information among the common mass, along with a number of digital applications to facilitate urgent communication by using SMS and Fax machine. A recent trend of decreasing the use-rate of fax machines has been noticed, as there are several digital communication options easily available in the market. However, different government and business offices use fax machines, as it is really useful to attract someone's attention quickly, reliable, very fast, and trust worthy mean of communication. Through fax communication means, people cannot only transfer data but also can speed up the process. So, throwing away fax machines from offices seems to be a bit unrealistic and at the same time it is really difficult to implement, as other communication tools with such type of high level of efficiency has still yet to be replaced faxes for different level of official communication. There is no doubt that faxes are very fast and help to get attention quickly. However, from the perspective of general users there are some disadvantages of fax machines have been identified. It is not worthy for an individual to buy a fax machine just to send some faxes in a month. Secondly, fax machines are heavy and it is not possible to move easily as we want because normally it is connected with a fixed telephone line. So, from the perspective of general users, it is neither user-friendly nor really ideal to communicate with different government and business offices via a fax machine. Mobile communication has opened a new window of communication between common folks and governments; between different government officials; among citizens and so on. It has the potentiality in offering wider access to public information and basic services to all most all citizens as well. The main reason is the growing penetration rate of mobile phones, irrespective of geographical location far ahead that of fixed Internet connection. Let us have a look on some statistics. In 2011, estimated penetration rate of mobile phones is 86.7% in the world where as developing countries like Bangladesh and India have mobile phone penetration rate 62% and 75% respectively and active mobile broadband subscription was 17% where as active fixed line broadband subscription was only 8.5%; the overall Internet penetration rate was 37%; Bangladesh 3.5% and India 10.2% [1]. As of now, 40% of adults use their mobile phone to do on off the following: use the Internet, e-mail or instant message [2]. Based on the previous progress on mobile penetration rate, it could be estimated that by 2017, mobile penetration rate would be 100% [3]. So, after 2017 mobile phone would be the most effective tool for governments to connect 100% of their citizen.

On this background, an extensive research has been carried out to know whether it is possible to develop a communication system that would help common people to send fax directly from their mobile using their SMS bundle during any man-made crisis or any natural calamities. At the end of the desk research, it has been identified that it is possible to send a fax using mobile SMS bundle.

The tool is under construction and we will have the tool by the end of April 2013. The proposed digital framework and applications have been conceptualized to demonstrate the capabilities of an innovative software that is now in the initial stage of development. This software connects a traditional 'communication device' i.e. Fax with one of the latest 'communication methods'

i.e. SMS to avoid wasting of time for accurate communication of confidential and urgent information during any crisis or emergency.

II. DIFFERENT COMMUNICATION TOOLS AND METHODS: FAX, TELEPHONE, EMAIL AND SMS

The modern fax machine came into common use during the 1980s, however the patent for the fax machine was granted to Alexander Bain almost 140 years ago, 33 years before the invention of the telephone in 1843. It first became significant in 1906 when used for transmitting photographs to newspapers [4]. In March 1876, Scottish-born inventor, Alexander Graham Bell voiced the famous words into the telephone to his assistant sitting in the next room: "Mr. Watson, come here, I want to see you" [5]. A conventional fax connection was not possible without having a fixed land telephone connection. In the early 1971, Ray Tomlinson was working on a small team developing the TENEX operating system, with local email programs called SNDMSG and READMAIL. In late 1971, Tomlinson developed the first ARPANET email application1 when he updated SNDMSG by adding a program called CPYNET capable of copying files over the network, and informed his colleagues by sending them an electronic mail (e-mail) using the new program with instructions on how to use it [6,7]. Initially, a fixed telephone connection was needed to have an Internet connection. At present people can avail Internet connection even without having a fixed line telephone line. People can use mobile phones to access Internet. Mr. Neil Papworth, a 22-year-old test engineer for 'Sema Group' in the UK, used the SMS messaging for the first time on 3 December 1992 [8]. The present name of 'Sema Group' is 'Airwide Solutions2'. He used a personal computer to send the text message "Merry Christmas" via the Vodafone network to the phone of Mr. Richard Jarvis [9]. At present normally people are using their mobile phones to send SMS. However, people also can send SMS using different easily available web-based services if they have Internet connection. As this paper will discuss, how people can use SMS to send a Fax, this paper will introduce a system that connects two ICT products of different era.

With the extensive progress of ICT, people are now using more sophisticated, excited and easy to use communication tools for different types of communication. However, when people need to use fax for sending urgent and important messages, people are still using fax machines. In some cases, people can use email to send a fax as well. Though, to send a fax using email address, someone needs to have an email address and Internet connection as well. Moreover, the process is a bit complicated to someone who is not well experienced to handle some basic Information and Communications Technology (ICT) systems and tools. For example, people can send a fax by attaching PDF or JPEG documents along with an email to a particular email id and that email id forwards the received documents to a particular fax number.

In this research paper, a new approach to urgent and important communication will be discussed where common citizens, officials of different government offices- especially in remote regions, would be able to use their mobile phones to initiate a Fax dispatch using their free or low cost SMS bundle from their own mobile phones. So, people with very little knowledge about ICT tools and systems will be able to operate it very easily. The concentration will be given in this paper to the optimum use of a traditional communication tool with the help of one of the latest communication methods. It means that this paper is going to illustrate the development of a new software that transfers an increasingly becoming unpopular ICT tool i.e. Fax to becoming more important communication tool to report during crisis or emergency situations with the help of mobile SMS.

III. STATE OF THE ART

As this paper is intended to introduce a new software that would enable governments, business organizations, non-government organizations and citizens to communicate urgent information during emergency, let us highlight reasons behind the idea for developing of this software. There are several examples of m-participation to deal with different crisis situation. United Nations including some civil society organizations used m-participation in Haiti, Kenya3, Pakistan [10], Japan, and Libya. 'Ushahidi4' platform used mobile phones to report violence following the 2007 presidential election in Kenya [11]. After the severe earthquake in Haiti, victims and other people used mobile to send report, ask for food and shelter and rescue workers helped them after the confirmation of a report [12]. In Japan after the severe tsunami, Japanese new media activists developed a crisis map5 to report different incidents. In 2011, a joint initiative of the United Nations Office for the Coordination of Humanitarian affairs (UNOCHA) and the Standby Task Force, online volunteers worked to monitor social media sites and extract relevant information to manually create reports and developed the Libya Crisis Map6. There were some similarities in all the above-mentioned incidents. All these initiatives were developed to deal with man-made crisis or natural crisis. People were able to send SMS to a particular number to report incidents, send a tweet with a particular #hashtag, send an email or submit a report directly from the PC etc.

A software called FrontlineSMS7 that allows citizens to easily send, receive and manage text messages, which can be useful for a variety of activities in many different sectors. Activists also use this service during crisis to gather information directly from the common

mass and to provide further assistance. So far, no example has found of sending fax using mobile SMS or web SMS for information gathering during crisis. Not sure about the real reason but it seems using fax during those incidents was not technically well supported or not used in an innovative way. As the current crisis reporting system is not yet dependent on fax machines as well like other tools, so far, nowhere fax machine was in the scene. Despite the fact that fax is still an important tool to communicate or to report urgent information to the higher authority, there was no way to use it. The idea of developing a software (i.e. SMS to FAX) was based on this very simple background.

As I am introducing a new application to enhance public service during emergency situation, I would like to take the opportunity to introduce a framework for digital governance during any emergency situation as well. It is believed that without a proper 'Digital Governance Framework during Crisis (DGFC)' and a standard 'Crisis Response Communication Chain (CRCC)', no ICT application will be sustainable for disaster response service, and so it would also be appropriate to introduce them as well.

IV. DIGITAL GOVERNANCE FRAMEWORK DURING CRISIS-(DGFC)

It is not only a believe but also a proved phenomena that new technologies can play an important role in good governance and that can facilitate transparency and accountability [13]. An ideal framework for digital governance during any crisis should involve the common people to know the real situation on the ground and also to provide better and smart services. The proposed framework considers a chain of communication during any artificial or natural crisis. The main idea behind this framework is to develop a participatory digital framework where common people along with the different Crisis Response Unit (CRUs) of governments together can play a greater role to deal the situation properly and to resolve any crisis within very short period of time.

As it is the urge of the hour to have accurate information on right time, people expect exact information all time especially during emergency situations. Hence, this framework suggests operating it as a chain system starting from the very beginning i.e. reporting information about an incident to the end i.e. receiving feedback about the action taken by the Crisis Response Unit.

The diagram below (Figure 1) shows an ideal and accountable communication system during emergency that aims to provide information and update to the victims and other people starting from the very beginning to the end of the rescue operation.

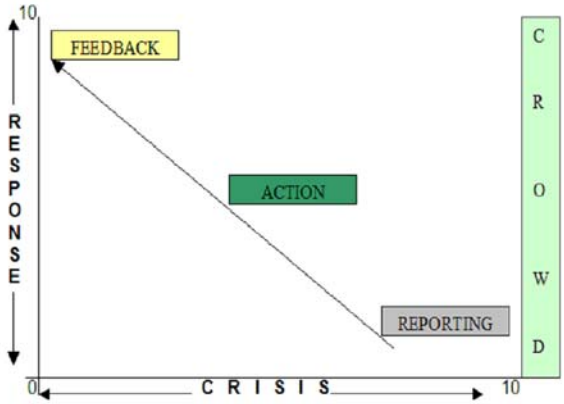

Figure 1. Crisis Response Communication Chain (CRCC)

Now, let me describe the scenario to explain how the 'Crisis Response Communication Chain (CRCC)' would be followed to complete the crisis response work successfully according to the proposed Digital Governance Framework during Crisis. To me, there should be some consistent steps that need to be taken to deal any crisis or emergency period.

A. Different Steps of a possible Scenario:

1. Citizens noticed an incident i.e. blazing a multi-stored building / bomb blast / terrorist attack / earthquake etc.
2. They inform the Crisis Response Unit (CRU) by sending SMS to a CRU short code or a given mobile number / making phone calls / sending a Fax / submitting reports on web portal / updating social networking spaces / sending an email etc.
3. Information reached to the Crisis Response Unit (CRU) and they verify the information.
4. After verification, the CRU takes instant decision about the coordination of the crisis intervention.
5. The CRU informs different Rapid Action Team(s) (RAT) i.e. Police, Hospital / Ambulance services / Bomb Disposal Unit by calling them / sending fax / email or SMS. In an ideal situation, the CRU also needs to inform the victims about their planned actions and / publicizes their proposed actions to deal with the crisis.
6. During the rescue operation, different CRU also continues communicating with the victims of the incidents to know the further needs of the victims and also sends regular information / report to other units that are working on the case.
7. End the rescue operation, the CRU informs the victims and other citizens about the operation.

There will be different technical requirements for different crisis response tools that are being proposed in this framework given in figure 2 in order to facilitate proper digital governance initiatives. The requirements are different hardware and software, in brief, communication systems, tools, methods and platforms- for example, faxes, mobile devices, servers, desktops, social networking sites, database, applications etc.

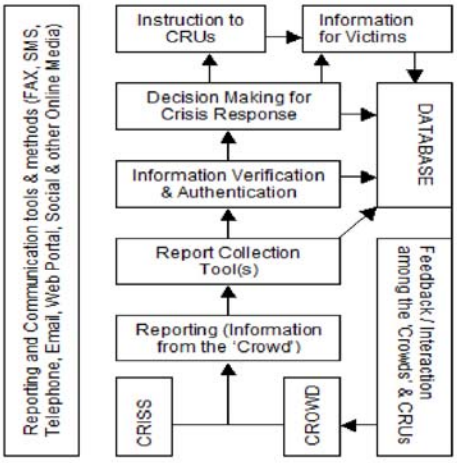

Figure 2. Digital Governance Framework during Crisis (DGFC)

V. THE INNOVATION

In this section, the innovative digital application that would help common people to send a fax directly from their mobile phones using the SMS facility will be discussed briefly. It intends to be really a low cost solution to send a fax at any point of time, even people when are on the move. People will not need to buy fax machine to send a fax using this digital application. This software demands to be one of the groundbreaking digital innovations and would be useful for different public service offices, for non-government organizations that do digital campaign very often, for research organizations, business organizations and also for common people.

A. The Software

The software will be developed to run on Windows, Mac and Linux. It will not need Internet connection to work. However, it is potentially possible to use FAX gateways or FAX servers, which may work out cheaper in the long run when sending thousands of faxes out. Sending Fax via mobile phones using SMS with the help this software makes very easy to send urgent information to anyone who use fax. It will be also possible to send Faxes to different destinations at one time. This software would be able to send SMS to make urgent important announcements for different regional offices, send instructions to disaster rescue workers to coordinate the rescue work properly. The software works in automatic mode. When SMS arrives, it looks for short code in the message and looks up the destination number from the pre-configured routines set by the admin user and sends out the Fax directly. Another functionality is automatically replying to incoming SMS. The back-end application helps to visualize incoming data, allowing the admin to quickly understand and export the results. It is possible to manage incoming and outgoing messages more easily with a flexible filing system, featuring folders and an archive capacity; inbox, outbox, and the ability to monitor pending Faxes, how many faxes are on the queue etc.

As a number of SMS will reach at a time, it is possible to take extra care while sending Faxes to important destinations and look and locate messages based on name, location, or date as well as by activity, group and folder.

1) Software Description: Functions and High-level components

The software will have the following high-level components as shown in the figure 3 to perform its full operation.

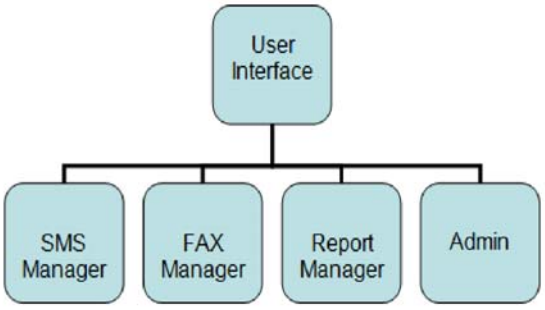

Figure 3. High-level components

2) User Interface

The software will present a standard User Interface (UI) based on Java supported technologies. By this component the user will be able to interact with the software. The detailed functions of the UI will have to be worked out at the final stage of the development phase.

3) Functions of SMS Manager

The component that reads SMS will be responsible for reading incoming SMS and put the SMS in queues according to pre-identified keywords. The SMS Manager will communicate with the connected GSM SIM capable device connected to the computer via serial port.

4) Functions of Fax Manager

This component will receive different pre-keyword identified texts that were on the queue and identifies pre-added Fax destination and push for the SMS. It will be responsible for communicating with the connected FAX machine to the computer via COM port and to send SMS-fax to the destination.

5) Admin Manager

Admin Manager will allow completing various admin activities including:

Creating different SMS folders based on keywords
Moderation of Text Messages
Collecting and analyzing reports or SMS received from people.

Adding destination Fax number(s)
Responding questions
Requesting for further information by sending SMS to activists.
Display all reports in a map (real-time reporting) etc.

6) Reporting Component:
This component is responsible for generating reports on FAX sending status.

B. Technical requirements
The following software and hardware components will be required to operate this service.

A GSM SIM capable device (mobile phone or a USB Dongle)
A Fax machine
A PC
An active telephone (landline)
The software installed in the PC

The application introduced by the researcher will be working through different high-level components that have been shown in figure 3. The figure 4 depicts how the interaction among human, ICT tools, software and hardware will happen starting from sending SMS. The following figure shows how different steps of interaction between men and machine and between machine and machine could guide a text message delivering to a fax machine.

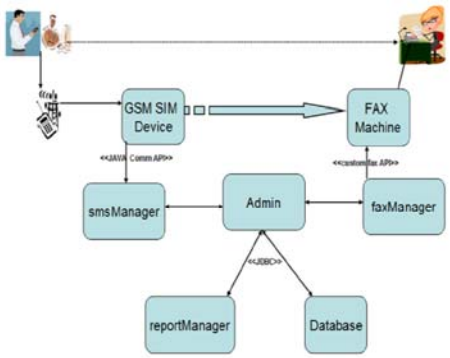

Figure 4. Interaction between different Software and Hardware Components

C. Interaction between human and technology

- A GSM SIM capable device such as a mobile phone or a USB dongle will be connected to a PC via serial port. The SIM should be active and work properly so that people can send SMS directly to the number and it could be short code or a long code.
- A Fax machine will be connected to the PC via communication (COM) port. The fax machine is also connected to the active landline phone provider.
- Desktop software will then communicate with the mobile phone for any incoming SMS.
- The software will read the message and decode the message.
- Based on the short-code provided in the message, the software will work out the destination Fax no from a list of predefined short-code to a particular Fax number provided to the software at the time of installation or later by the admin.
- The software will then FAX out the content of the received SMS to the destination FAX no.

D. Technical Architecture

To make the system work in as much as possible Open Source independent way, it is decided to use Java based technologies where possible.

Overall, this software will be developed using various available Java APIs such as Database operation, SIM device operation and also few custom FAX APIs will be developed to support the overall process.

VI. CONCLUSION AND FUTURE WORK

In this paper, I have introduced a new application to send faxes directly from a mobile phone by using SMS and also a Digital Governance Framework during any crisis period. This model and the software explore how a conventional tool ould be used to handle crisis situations actively; could be used promoting and disseminating important information widely though m-participation model. So, one of the main future work is to be taking initiative for advocacy to implement the 'Framework' and to use this software along with other crisis response digital tools. From the 'Framework', it has been identified that to achieve the ultimate goal of digital governance in the era of Information Technology, together we have to solve some issues [14] as well.

A. Legal issues
There are several important issues that have to be solved. Government needs to identify whether the legal issues have to be solved within the existing laws and /or policies on Information Technology or have to create different rules and regulations to deal with different legal issues that could arise when operating this communication tool.

B. User Generated Contents (UGC)
Governments also need to identify the copyright issues and responsibilities issues of user-generated contents (UGCs) and also to identify the possible legal issues related to user-generated contents (UGCs) and solve those issues.

C. Identification
Governments have to develop a policy relating to disclosure of identity of people who will be taking part in the reporting process and would indirectly help to save victims and governments during the emergency by sending information to the authority. Governments have to take proper measurement for these activists. So there will be a real need put in place some policies to deal the issue of identity. However, at the same time also it has to be kept in mind that the General Packet Radio Service (GPRS) enabled mobile phone would be easily discoverable.

D. Security

At present, in most mobile handsets, privacy and security standards are not up to the mark, which can involve the collection and exchange of very sensitive information. Also as the numbers of mobile users are increasing everyday, m-government services could be the target of attack more often. So there is a need for stronger privacy and security standard to avoid such type of trouble.

E. Cultural resistance

As mobile governance is a huge shift from conventional governance, still a big number of people do not believe in sending crisis report that could help saving the common mass. However, it is the government that can convince common people to participate in such type of active participation initiatives to enhance public service during any crisis or emergency period. Thus, governments would be able to overcome this challenge as well.

To conclude, I must say that the developing world should take necessary steps to ensure m-governance system to enhance public service at every level of the day-to-day life of their citizen without any delay. This would enable governments and citizens to be well connected with each other at all time.

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