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"Mobile Cloud Computing: Data Management in a private mobile cloud during natural disasters".

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***Abstract*—While the mobile computing has took an advantage in wireless communication & adhoc networks has been in use during natural disasters, this paper proposes a new approach for data management during natural disasters which relies on the mobile cloud computing architecture. Since mobile phones have proved to be basic need & now coming as smart device it can be used in natural disasters for information collection & transfer in order to take management into effect to a positive direction . Rescue teams using mobile phones can collect data about victims through these smart devices & this data can be managed in a cloud server so by creating a mobile cloud.**

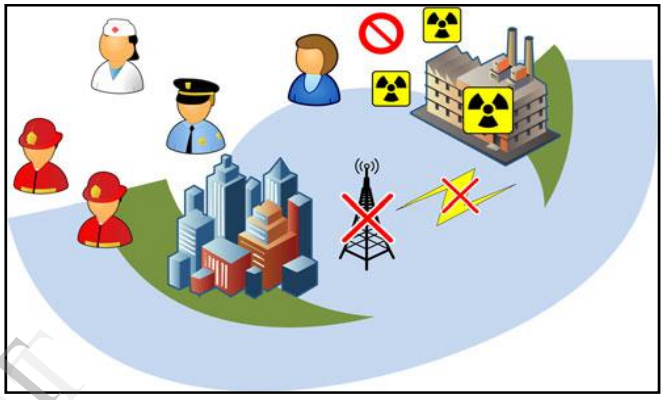
***Index Terms*—Cloud Computing, Mobile Computing ,Mobile cloud computing, Data Management, Disaster Management, Smartphone.**

1. INTRODUCTION

The continuous rise in use of Mobile computing and cloud computing technologies have enabled complicated persistent applications. Nevertheless, the applications built for the latest generation of mobile devices today, e.g. smart phones and tablets, are still constrained by power consumption, speed of computation, size of memory, bandwidth of wireless network, etc. This create a problem for executing useful programs that could run only run on systems with high configuration & have those applications required. Since the Internet became popular, a mobile device might overcome the constraints by offloading portions of application workload onto a server machine[2] via the net work to save execution time and conserve energy. Again during disasters availability of internet is not possible sometimes & again this poses a problem to use webservices [7].

Recently, cloud computing has changed software infrastructures and business models of Internet services with technologies to provide and manage abundant resources of computation and data storage over the network at relatively low amortized operation costs[1,4] .Today, the popularity of smart devices and mobile networks has substantially changed the way people access computers and network services. With the combination of cloud computing and mobile computing, termed mobile cloud computing has started to show its effects with many seemingly innovative smartphone applications[2].

An important and potential application area of wireless communication and mobile networking is Disaster Management[3]. Globally, all the countries are now taking initiatives to develop technologies for early warning before disaster and post-disaster management. So, researchers are now taking active interest to address the challenges posed in a post-disaster scenario when the communication infrastructure gets disrupted partially or completely.



A typical disaster scenario
Fig 1.1

In those situations information technology is playing a crucial role in these relief works to take effect in right direction. While mobile handsets are heavily used in the data communication mostly though message services (SMS, MMS) In our scheme we are going to provide management of data which is collected at the disaster site by the rescue team aided by smartphones. As the infrastructure gets disrupted publically available infrastructure could not be used so an adhoc network is required to be created at the disaster site which will help in the direction of connectivity for information transfer. A mobile ad-hoc wireless network can be formed [5] in this situation with the wireless interface such as Bluetooth or Wifi ready to use in cell phones carried by relief workers. These kinds of networks are formed exploiting the mobility of the cell phone users as the opportunity for communication. This rapidly deployable wireless network can provide the most effective data collection technology that gives authorities better visibility of available resources and need. Today smart phones had become an integral part of an individual's life as smart-phone based applications like, mobile banking, location based services, and online games etc. are gaining lots of popularity. Industries are now looking for trained man-power with exposure in smart-phone based application development preferably on android platform.

In this paper we endavour to implement mobile cloud computing will contain a data server & mobile devices connected through wifi. These mobile devices held by the rescue team volunteers will collect data about the site & the

victims & this information will prove to be very useful for taking actions in favor of victims relief planning such as medical aid, shelters, & information about victims whatever possible.

2. Scenario & Use Case considerations

Post disaster management may vary according to the situations like place & type of disasters. Because of this different approaches are needed to deal with such kind of problems. Information like type of disaster, intensity of disaster, number of victims & facilities available like medical facilities & volunteers for taking relief steps. By accumulating this type of information rescue steps could be taken in the right direction.

Disaster management systems are already deployed for both pre & post disaster scenario. Early monitoring & warning systems already deployed but it is seen that in natural disasters like flood, landslides & even earth quakes these systems may become unusable as the infrastructure gets destroyed completely. Therefore already deployed networks are not applicable for post disaster situations. There are several stakeholders in a typical disaster scenario communicating with each other including rescue teams (e.g., fire department, police forces, technical relief) , management teams and third party volunteers. It is important to consider volunteers and victims as well.

It is seen that in providing relief work to the victims data collected about victims is helpful in providing aid required at the moment and also in tracking the right status of victim. Again this data will also help different teams in taking right decisions like shelter & hospital management.

Technical Background

1) DNS: The main purpose of DNS is to map domain names to network addresses. DNS specifies the roles of the service provider (server) and the service user (client). The client sends the request for a given domain name to the server and receives the corresponding network address. A LAN wide DNS server will be used in our implementation.

2) CDMI: The Cloud Data Management Interface--better known as CDMI—is a SNIA standard that specifies a protocol for self-provisioning, administering and accessing cloud storage .CDMI[8,9] defines RESTful HTTP operations for assessing the capabilities of the cloud storage system, allocating and accessing containers and objects, managing users and groups, implementing access control, attaching metadata, making arbitrary queries, using persistent queues, specifying retention intervals and holds for compliance purposes, using a logging facility, billing, moving data between cloud systems, and exporting data via other protocols such as iSCSI and NFS. Transport security is obtained via TLS.

3) Wifi. Wireless Internet Protocols are the suite of wireless protocols after Wireless Application Protocol 2.0 (WAP). It includes XHTML Basic, Nokia's XHTML Mobile Profile, and future developments of WAP by the Open Mobile Alliance.Wireless Internet Protocols are able to deliver XHTML pages to appropriate wireless devices without the need for HTTP to WAP proxies.Using Wireless Internet Protocols, web pages can be rendered differently in web browsers and on handhelds without the need for two different versions of the same page.

3. Related Work

In [3] *Klauck, Kirche et. al,* have proposed widely applicable monitoring system for post disaster management. They have created a system that uses XMPP i.e. Extensible Messaging and Presence Protocol as a communications protocol for transferring the sensor data in the form of messages. In his approach they had connected hand-held devices as well as autonomous sensors through a single protocol (i.e., XMPP). XMPP is for us the glue that holds different devices and networks together to enable a cross-border communication and collaboration to support post-disaster management stakeholders. Two approaches are used to deliver data between these devices.

Approach 1: In this approach hand-held devices and sensor devices are connected directly to the Internet.

Approach 2: In this approach where there is unavailability of internet devices could share data using XMPP protocol connecting directly the communicating devices with each other delivering a real-time data stream with a high resolution directly to the cloud service. The system consists of sensor-equipped portable devices, autonomous sensors with short range communication, stakeholders with different (sensor-equipped) devices and cloud services Each device runs an XMPP software client through which it can access the XMPP network and publish sensed data. The cloud service manages a storage pool for the measured sensor data as well as several XMPP domains which facilitate an interconnection and data exchange between different organizations (e.g., rescue team, government, NGO).

In the above approaches portable sensor devices like smartphones can be equipped with any compatible detector to enable data collecting, depending on the requirements of the current incident. It follows the principle of a construction or building block kit where all necessary components can be exchanged or upgraded. Default and pre-configured modules are GPS, an acceleration sensor, and a WWAN modem.This allows us to localize the sensor device over the Internet and to get the latest acceleration and sensor values on demand via the publish/subscribe paradigm of XMPP. *XEP-0174 Serverless Messaging* can be used as an alternative to read sensor data directly in the vicinity of a sensor device through an ad hoc network connection.

4. System design

This section presents a flexible, reliable, cost-efficient, and widely applicable data collection system for post disaster management. The system consists of mobile entities with cloud services to store data about the victims and the interaction of observers with the cloud to retrieve the current status of victims for further steps to be taken in favor of relief program.

4.1 Architecture of system

The system consists of WLAN 802.11 equipped portable devices, for short range communication, with different stakeholders. Each device runs a browser through which device can access the web application published by the

cloud server. The cloud service manages a storage pool for the data collected by the different rescue workers as well as facilitate an interconnection and data exchange between different organizations (e.g., rescue team, government, hospital & NGO). Data access for third parties/volunteers can be enabled by giving access to the disaster site data storage.

4.2 System criteria

Standard protocols Wifi and DNS are established standards for detecting entities in ad hoc networks and for collaborative communication. In contrast to XMPP , XMPP can be used for resource constrained devices running contiki our approach which is browser centric which enables devices of different platforms containing wireless LAN that is Wifi can exploit facilities provided by the cloud server providing data storage.

Transient usage Emergency situations occur rarely and over a limited period of time. The proposed system is designed to be deployed at the disaster site for a short period of time from days to a week. The system is advantageous because the permanent communication network gets disrupted and it cannot be used so an adhoc wireless network proposed by us is beneficial in those situations to track the information about the victims.

Movable entities The data collecting devices should be compact and transportable. The devices should be equipped with browsers coming preinstalled with these devices free of cost as well as the data storage that is facilitated by the cloud server and the application server is also implemented using LINUX and XAMPP server which are freeware instead of proprietary operating systems to reduce maintenance and development costs. In the broader sense it offers us the possibility to run standards like PHP and basic HTML pages on such devices.

Cost efficiency Using embedded browsers and commodity hardware like PCs, laptops, or smartphones to collect the information about the victims will reduce the costs significantly, because no special hardware must be developed. Autonomous smart phones will be integrated through 802.11 WLAN standard protocol which comes ready to use with these devices & thus costs and test periods can be reduced, because designing,implementing, and intensively testing new underlying network protocols can be skipped.

Automatic configuration User-driven configuration of the system is not required . Automatic configuration shall be an integral part of the system, so that the mobile entities of the system automatically detect the network & neighbor entities in the ad hoc network.

Network access The system access the cloud services using internet technologies like HTTP running on the top of 802.11 wireless LAN technologies.

4.3 Functioning of system

Our system will comprise of the following entities:

1. The data collection server(cloud server).
2. The volunteers holding the smart phones.
3. The application server providing web application for data uploading.
4. The wifi hotspot.

At the disaster site the rescue team with the mobile van will reach. Since the internet connectivity can not be assured at the disaster site cloud service can not be used. So a local cloud has to be established & data storage facility is to be provided locally at the site.For this a local wireless LAN has to be established.So for establishing local LAN the wifi hotspot mounted on the mobile van will be activated the data server & application server will be booted up. DNS on the application server is configured so that the web applcation could be accessed by the name of the web site. Now each volunteer will run towards victims for help as well as they will collect data about the victims throun the web application which will be accessed through the local wireless LAN using HTTP protocol.The web application consists of web pages cosisting different fields as well as the auto generated reference id for the victim. The fields displayed in the form in the web page will be filled as well as the photo of the victim taken through the phone will be uploaded through HTTP post which will contain the information about the current status of victim.

At the server side the administrator collects the data through the web application running on the server and after regular intervals the data is uploaded on the global cloud throuh internet facility when & where it is found at near by places of the disaster site.

4.4 Data Accessibilty

Data collected about the victims can be accessed in two ways globally through the URL of the wesite if internet facility is available & locally at the disaster site through wireless local LAN. Data accessibility is restricted for every type of user.

Three categories of users are identified :

Rescue Worker: The rescue worker can enter and access the data about the victims but the facility of data modification in any field is not provided .

Medical team : In this category the medical aid teams can modify the data about the victims such as the life status as well as the hospital in which the victim is referred to.

Administrator: The administrator has all the rights to modify update & delete the data about the victims. He can also create the user ids & delete the users & manage the teams. The administrator can analyze the data & based on that he can publish the information about the disaster and victims as well as photos & videos of disaster site.

*Guest :*Guest users can be considered into two categories

*a)*Those who came for additional help .

b) This category include those citizens whose relatives are affected by the disaster & they want to know the current status about them.

The guest users coming in category ‘a’ can post the information but the this information has to be checked by the administrator then only it will be accepted other wise rejected. Category b of guest users can only view the data about the victims but they can not modify the data.

4.5 Communication Flow

Figure 2 depicts an exemplary communication flow:

I: Volunteers holding devices start connecting to the local server via non-disrupted infrastructure or via portable access points (in case of destroyed infrastructure).

II: They access the DMS website using URL through browsers in their respective smart phones.

III: Volunteers start collecting data and start sending it to the local server , where it is stored in the cloud-based data storage.
IV: Administrator at the server site will move the collected data in the global cloud server for global access at regular intervals.
V: Hospital management teams access this data through website globally available through the internet to modify the current status of the victims .
VI: Victim's relatives and known persons can check the status of the victim.

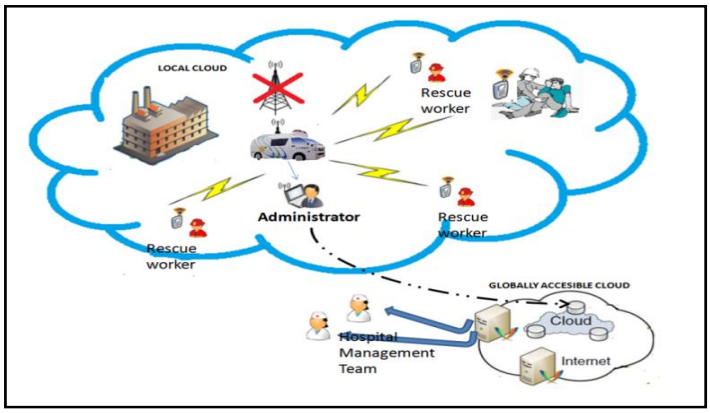


Fig 4.1

5.EXPERIMENTAL SETUP

Our experimental setup consists of following elements

1. An UBUNTU 12.04 server that is a linux based server running a XAMPP web server on it. XAMPP is a free and open source cross-platform web server solution stack package, consisting mainly of the Apache HTTP Server, MySQL database, and interpreters for scripts written in the PHP and Perl programming languages.

1.1. Apache HTTP server. It is an open source HTTP server for modern operating systems. Apache supports a variety of features, many implemented as compiled modules which extend the core functionality. These can range from server-side programming language support to authentication schemes. Some common language interfaces support Perl, Python, Tcl, and PHP.

1.2. MySQL. It is an open source relational database management system (RDBMS) that runs as a server providing multi-user access to a number of databases.

1.3. PHP. PHP is a general-purpose scripting language that is especially suited to server-side web development where PHP generally runs on a web server. Any PHP code in a requested file is executed by the PHP runtime, usually to create dynamic web page content or dynamic images used on websites or elsewhere. It can also be used for command-line scripting and client-side graphical user interface (GUI) applications. PHP can be deployed on most web servers, many operating systems and platforms, and can be used with many relational database management systems (RDBMS). Most web hosting providers support PHP for use by their clients. It is available free of charge, and the PHP Group provides the complete source code for users to build, customize and extend for their own use.

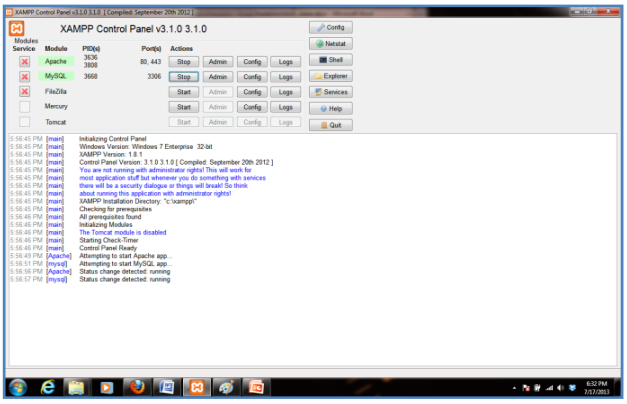


Fig 5.1

2. A DMS (Disaster management system) web application running on the XAMPP server which is accessed by the mobile clients through WLAN formed between the different mobile phones joining the network & the server .

Fig 5.2

3. Mobile Clients: after configuring DNS ,mobile clients accesses the application through the mobile phones using the browsers running http & uploads the information to the data server which will be accessible by the other clients also.

Fig 5.3

Fig 5.4

4. Medical Agents : After certain period of time information collected will be uploaded from local server to a server that could be accessed globally through world wide web(www) through the registered website. This information could be utilized by the citizens & specially by medical agents who will update the current status of every victim referred to the hospital as a patient.

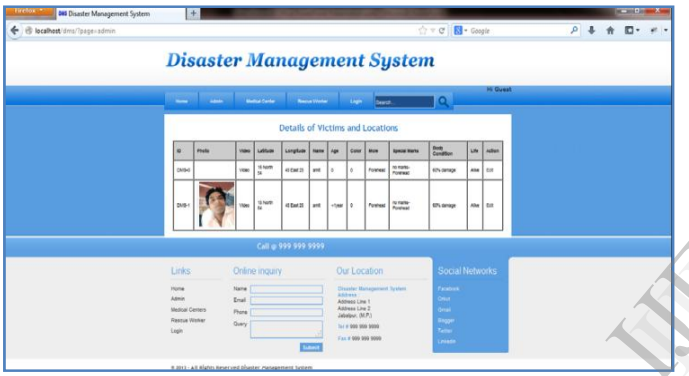


Fig 5.5

6. Conclusion & Future Work

Mobile cloud computing gains advantage in providing rich execution environments, rich resource pool for applications & greater data storage facility to mobile devices there by making mobile devices less specific & independence to platform dependent applications. Mobile cloud computing is today proving as one of the more rich research field for the coming researchers. As discussed in this paper mobile cloud computing has proved to be helpful during natural disasters as suggested for collecting data about the victims. This data is helpful for post disaster actions like medical aid, shelter management, current status of victim & the victims current geographical position of the victim.

This work can be enhanced by applying data mining & image processing on the data accumulated during disasters by mobile devices information could be retrieved that could prove to be useful in post disaster management strategies. Like if relatives of victim wants to know his current status instead of searching the data in the database through the information provided by the relative & identification is done by manually , if we apply image processing on the image provided by the relative, the extracted features could be used to identify the particular person in the database.

7. References

[1] Niroshinie Fernando, Seng W. Loke, Wenny Rahayu , "Mobile cloud computing: A survey" , Future Generation Computer Systems 29 (2013) 84–106

[2] Chandra, P. Bahl, Maui, Making smartphones last longer with code offload, in: Proceedings of the 8th International Conference on Mobile Systems, Applications, and Services, MobiSys'10, ACM, New York, NY, USA, 2010, pp. 49–62.

[3] Ronny Klauck , Michael Kirsche : Combining mobile XMPP Entities and Cloud Services for collaborative Post-Disaster Management in Hybrid Network Environments , Springer Science+Business Media, Mobile Netw Appl (2013) 18:253–270.

[4] Xinwen Zhang ,Anugeetha Kunjithapatham, Towards an Elastic Application Model for Augmenting the Computing Capabilities of Mobile Devices with cloud Computing in Mobile Netw Appl (2011), Springer Science+Business Media, 16:270–284.

[5] Satish Narayana ,Srirama,Carlos ,Paniagua,Huber Flores: Social group formation with mobile cloud services SOCA (2012) , Springer-Verlag London Limited 2012 , 6:351–362

[6] M. Somasundaram , S.Gitanjali T.C.Govardhani , G. Lakshmi Priya , R.Sivakumar: Medical Image Data Management System in Mobile Cloud Computing Environment, International Conference on Signal, Image Processing and Applications , IPCSIT vol.21 , 2011, Singapore.

[7] Shomoyita Jamal, Ralph Deters, Using a Cloud-Hosted Proxy to support Mobile Consumers of RESTful Services in: proceedings of 8th International Conference on Mobile Web Information Systems (MobiWIS) Procedia Computer Science-5(2011),625–632.

[8] http://www.snia.org/

[9] http://en.wikipedia.org/wiki/Cloud_Data_ Management_ Interface