# Emergency Reporting Using Smartphone

**Dissertation**

Submitted in partial fulfillment of the requirements for the degree of

**Master of Technology, Computer Engineering**

by

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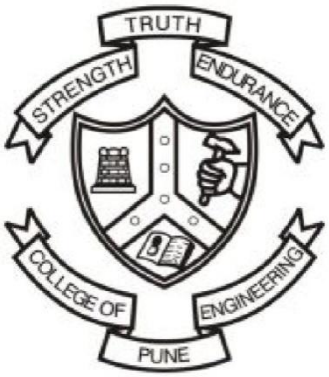
**MIS No: 121122013**

under the guidance of

**Prof. S. K. Gaikwad**

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## CERTIFICATE

This is to certify that the dissertation titled

# Emergency Reporting Using Smartphone

has been successfully completed

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Dedicated to

Silicon Brain, **Mr. S. P. Dixit**

For his kindliness, eternal guidance and encouraging us towards world of electronics and embedded systems.

From R&D Manager, Programme Coordinator, Senior Scientist to Director of C-DAC Pune, he spend almost two decades of his life in C-DAC, Government of India. We, student of College Of Engineering Pune know him in his second half. In his seventies, he voluntarily deliver lectures in various reputed colleges, not to earn but to learn and make others learn along with him about new technologies.

We glad to have such technology lover teacher, who guides us on cutting edge technology and thanks to him for sharing his various experiences of silicon changes. On personal front, we learnt lot of things from him as human being.

I sincerely dedicate my small piece of work to this silicon brain, as his knowledge and experience inspired me to work on electronic gadgets.

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I would also like to thank **Mr. S. P. Dixit** for encouragement and detail knowledge sharing on microcontrollers and other aspects of electronics in human life. Also two of my Electronics Engineering friends **Amit Deshmukh** and **Rushikesh Shinde** who helped me lot to understand and play with microcontroller.

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## ABSTRACT

Emergency never comes with prior intimation. In real world scenarios detecting such emergencies and reporting them is a real challenge. This project contains the detail survey of existing systems and proposed system to overcome common problem of having manual intervention while reporting emergency. We are proposing the new idea to automate this process of emergency detection and reporting, this system will record and report emergency in real time. It works in three steps as Detection of emergency, data collection & processing and reporting it to outside world. Electronic sensor with Bluetooth module will trigger emergency and transmit the data over Bluetooth communication (short range protocol), where as the Smart phone which is paired & in range of sensor (10 to 100 meters depends upon Bluetooth class) will work as receiver of this information and responsible for recording and processing it further. Smart phone will upload that emergency along with other information like current location tracked by GPS on phone, mobile number (person's identity) and incident time over internet (long range protocol) to concern website.



***Keywords: Emergency Reporting, GPS, Wireless sensor networks, Bluetooth sensors, Android***.

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# 1. INTRODUCTION:

To start with introduction section, this section talks about overview on emergency reporting, recent trends, problem statement and major objective of this project.

## 1.1 Overview:

*Emergency never comes with prior intimation and in real world scenarios, detecting such emergencies & reporting them is real challenge.* Disaster management organizations, may its government or private one, have their own agenda in place to work-out on the plan and rescue the person who is in emergency. But many of such rescue teams/organizations complaints as they won't get 'right information in right time'. That is disaster management teams will not able to get the right information of the emergency in right time, so more the delay in reaching information of emergency to rescue team leads less chances of rescue.

Countries like US, where most of the old age citizens stay alone; separate from their children. Medical emergency is most important factor for such citizens. Even considering other personal emergencies like fire at home due to some unfortunate conditions and being alone, sleeping at home leads to major injuries; sometimes death. As per Indian governments ministry of road transport and highways departments report during the calendar year 2010, there were close to 5 lakh road accidents in India, which resulted in more than 1.3 lakh deaths and inflicted injuries on 5.2 lakh persons. These numbers translate into one road accident every minute, and one road accident death every 4 minutes. Unfortunately more than half the victims are in the economically active age group of 25-65 years. The loss of main bread winner can be catastrophic. (Source: Government of India, Ministry of road transport and highways, transport research wing, New Delhi)

In all such situations person who is in emergency will not be in position to inform disaster management team, and that is the worst situation where needy needs help but not able to seek it. So by any means if emergency is detected and reported automatically to disaster management team, then these teams will be in position to rescue person in emergency, even

before he/she knows about such emergency. To do so we would take help of all emerging technologies and available hardware sensors.

## 1.2 Recent Trends:

Wireless Sensor Networks (WSN) is an emerging era in Embedded Systems. WSN majorly works on the short distance/range protocol. Whereas another wireless communication system which is backbone of our mobile communication uses the long range protocol to communicated between the devices. We developing the hybrid system in wireless technology which can make best use of short-range protocol as well as long range protocol to design the world class application.

Now a day's Mobile device (cell phones) are integral and inseparable parts of common man for contacting each other via call or text. Moreover Personal Digital Assistants (PDA's) facilitated with other good options like send or receive files, checking emails and it's become gaming device now to play joyful games. Smartphones are used in many different sectors such as business, healthcare, social networks, environmental monitoring, safety and transport. For enabling related application to consider different domains, a set of embedded sensors such as accelerometer, compass, gyroscope, GPS, microphone and camera are directly included to Smartphones[1]. Smartphones are also capable to record useful data like location & other environment details and continuously upload it to particular server. Based on such location traces and also tagging the activities, (such as walking, biking, driving, etc.) one can have complete information about user [2]. Although mobile phones are in market as a platform for its sensing capability and such research has been carried out for a number of years now, in both industrial [3] and research communities [4], there has been little or no advancement in the field until recently. Numbers of technologies are introduced in recent year which have major changes of embedded systems. Along with sensing industry Data Exchange is also one of the key factors of today's advanced smart phones. One such widely accepted and mostly used open wireless technology to exchange data is Bluetooth.

To replace cables used to connected devices new technology used worldwide is Bluetooth. Robustness, low power, and low cost are the main key features of Bluetooth technology. It

works in the ISM band from 2400-2480 MHz on short wavelength radio transmission link, with creation of personal area networks (PANs). Bluetooth has Special Interest Group (SIG), which consists of different companies working in these electronic and software related services as working member and contributor for this future research and releases. Currently latest version of bluetooth 4.0 is available in market and widely used by electronic industry. This latest version has features like low cost, multi-vendor interoperability and ability to run for years on standard coin-cell batteries [5]. Proposed system will be using this data transfer technology for its short distance data communication.

We are proposing the Emergency reporting system which will record and report emergency in real time. Deployed electronic sensors with microcontroller will triggers in emergency and transmits the data over Bluetooth communication(short range protocol), where as the smartphone which is in range of sensor (10 to 100 meters depends upon Bluetooth class) will work as receiver of this data and responsible to record it, this software on smart phone is also responsible for uploading that data along with other information like current location tracked via GPS , mobile number, and incident time over internet( long range protocol) to concern department website.

## 1.3 Problem Statement:

Person in emergency will not be in position to inform rescue team on fly and wait for their help; perhaps he/she try to escape if they are conscious and know about emergency. More dangerous situations occur when person is unconscious or not able to take action against emergency for example physically handicapped person or old age citizen who can’t step down immediately from emergency place. Considering other situation like person is not aware about emergency at all and he/she continues their work in hand; in such situation, detecting any emergency with help of sensors and reporting them to outside world, so that concern disaster team takes appropriate action to rescue the needy.

‘Right information at right time’ will lead to rescue lives.

### 1.4 Objectives:

1. Developing such a system which will work in Emergency, and will record & report emergency in real time.
2. System should work automatically and not require any human interference or manual setup during Emergency to report it.
3. System should convey the crucial information like Person in emergency, emergency type and emergency location.
4. Make use of both communication channels; short range wireless channel like Bluetooth and long range wireless channel like GPRS.

## 2. LITERATURE SURVEY:

Considering worldwide systems for emergency reporting regardless of their communication method where it's wired or wireless, majorly we studied some unique parameters of the systems which will help us to define the strong objectives about our proposed systems. Below listed generation wise systems gives us the fair idea about the survey we had done.

### 2.1 Closed-Circuit Television (CCTV):

Closed-circuit television (CCTV) is the use of cameras and its wired or wireless network to transmit a signal to its monitoring box. It's not the same which we have as Television sets. It can be deployed as point to point or point to multipoint links between camera and monitoring set. These are mainly used in surveillance areas such as banks, airports, military installations, casinos and convenience stores.

In mechanical and production plants, these video cameras are used to monitor and take decisions accordingly while sitting in control room only. Some places like heavy heat generated while molding metal or other area where worker can't sustain with that

environment that time such CCTV are more useful and most suited one. Depends upon the requirement these CCTV operate continuously or time being to monitor a particular application [6]. Now a day we have advanced Digital Video Recorders (DVRs), it provides flexibility to record 24 by 7 recording for couple of years. Continuously running and record it in some storage like disk or tape. Also some has great features like face detection and motion monitoring and many related to image processing. Also these CCTV supports IP based monitoring and centralized network based storage. Some of them equipped with high range mega pixel sensors and internal storage to work as standalone recorder.

**Summary:**

1. CCTV is used for monitoring and not for emergency reporting.
2. It's moreover investigation system for any cause later.
3. Recorded videos or images needs to be governed by administrator to know any kind of abnormal behavior.

## 2.2 Smoke Detection Systems:

Smoke detector systems are Emergency detection system in case of fire. Such detectors are widely used in mechanical and production factories. Also it has personal and public use like mall, conference halls and similar public gathering areas. These systems either report such fire emergency to central fire alarm systems or issue some kind of audible alarm to alert public around it.

These devices are available in many shapes depends on requirement, mainly available in around shaped which is applicable in public gathering places. Older smoke detectors where using physical process of ionization whereas latest technology enable us to use the photoelectric diode sense the smoke in air. Some of the applications mainly of production houses use both these systems of detecting smoke to figure out the emergency in effective manner. To operate such detectors it's possible to run them on either battery backup typically cells of 3v. Or in large areas like factories it runs on main power supply.

**Summary:**

1. Emergency alarm is only addressable for public in limited areas say room or hall.
2. Repetition or exact occurrences are not being recorded.
3. Unconscious or physical handicapped person will not able to respond, even this system alerts by audio signals.

### 2.3 ELERTS app:

This is widely used mobile application in all over America. This system is centralized and available in both application and web format. Using this application the person on emergency site can take photo of it, which automatically uploaded to website and other application user gets the alert regarding such emergency along with location and photo. So being one 1st hand responder of any emergency, one can help other via this application [7].

ELERTS Features Include:

Two-way communication: once user get alert message on his/her phone, they can also reply with any other detail information regarding that emergency. Here rescue teams or any other helper and suggest the directions to get out of such situation.

Reports: every smartphone user who has this application installed on their cell phone can send 1st hand report to others. Report may include text and pictures. This is actually triggering point of this application where user witness about emergency and send across.

Photos: sharing the live images with security personal or any other nearby user is great feature supported by this application.

GPS & Mapping: using latest technologies like Google Maps and geo location parameters, application locates the emergency place and advice others on the issue with location details.

**Summary:**

1. Emergency should be seen and reported by 1st responder, it not automatic.
2. Needy suppose to respond and ask for help.

### 2.4 HelpMe:

Another interesting mobile app which deals with disaster environment called HelpMe [8]. It introduces new approach of building the ad-hoc network using Wi-Fi to enable smart phones to communicate during disaster time. it works without help of any telephone providers network, and smartly forwards the message on hop-to-hop basis. It also make decides to forward the message by using routing algorithms.

It has centralized HelpMe server to record the all happening about emergency, once service is restored. This information from cell phone intended to know the missing person.

**Summary:**

1. Heavily depends on ad-hoc network created nearby.
2. It's may not be appropriate for personal emergency where needy stay alone or in situation like old age citizen or person with unconscious minds.

### 2.5 GreatCall:

GreatCall [9] gives you reliable and easy-to-use wireless services. This is wireless system very similar to normal cell phone but with one button device. 5star is most used service in which person in emergency can talk with service representation directly upon pressing that help button. Quick response with trained agent on call is main feature of such services. This is mostly used as personal advisable device in US, as most of citizen are staying alone in home and getting noticed by someone in emergency is important during emergency.

**Summary:**

1. Emergency is not detected automatically.
2. Emergency should be reported by person who is in emergency.

# 3. PROPOSED IDEA:

We are proposing the **real time** system which reports emergency **automatically** and also records the sufficient data **like person in emergency, location, time and type of emergency** and communicate this message to outside world with help of **wireless channels**.

## 3.1 System Architecture:

As shown in Figure 1, proposed system works in 3 layers -

a) Electronic sensor equipped with Bluetooth
b) Smartphone with designed software
c) Centralized website as Data storage system.

Electronic Sensors will be placed in observation areas which consist of sensor and microcontroller that transmits the signals/data parameter immediately after the detection of emergency. These signals are Bluetooth signals. Bluetooth communication is precise one at low cost, easily available with smart phones and have good coverage of 10 to 100 meter range depends on the Bluetooth class underlined with smart phone and deployed sensors. Smart phones in range are installed with special designed software (EmePort) suppose to collect that data transmitted by sensors and record for further use. EmePort is also responsible for transmitting the same data along with other information like person in emergency, location, time and type of emergency to respective centralized website over GPRS. The concept of central website is nothing but the Government or private agencies or any public rescue teams who voluntarily responsible for handling such type of emergencies in state.

It's likely to consider that if GPRS is not active or due to some abnormal behavior GPRS is not working on that Smartphone at that moment of emergency, then what will happen? Quick answer to this is - This system will have robust support to report the emergency. Second level reporting is available in system that will send text messages to help line number, this is considerably good option. Message sending is done with use of existing telephone service provider's network. Associated cost will be normal as per normal text message package, no additional cost involved. Immediate next question may raise like what if at all telephone network is not available; say user is in some remote area like hill station where neither any service provider provides you network nor any chances of having GPRS then making satellite Emergency call (all handset provides this) with automated or recorded voice

to appeal for help will be also suitable and possible way to report emergency. While this emergency call, we will convert all the information like location, emergency type etc. to speech with help of available text to speech built-in converter in smartphone and read out the emergency during that call. Hence this application will never fail to report emergency once it's detected and being sent to Smartphone.

As to exchange data, we are making best use of short range wireless communication channel such as Bluetooth and spreading the emergency indication to other world with another long-range communication channel with GPRS.

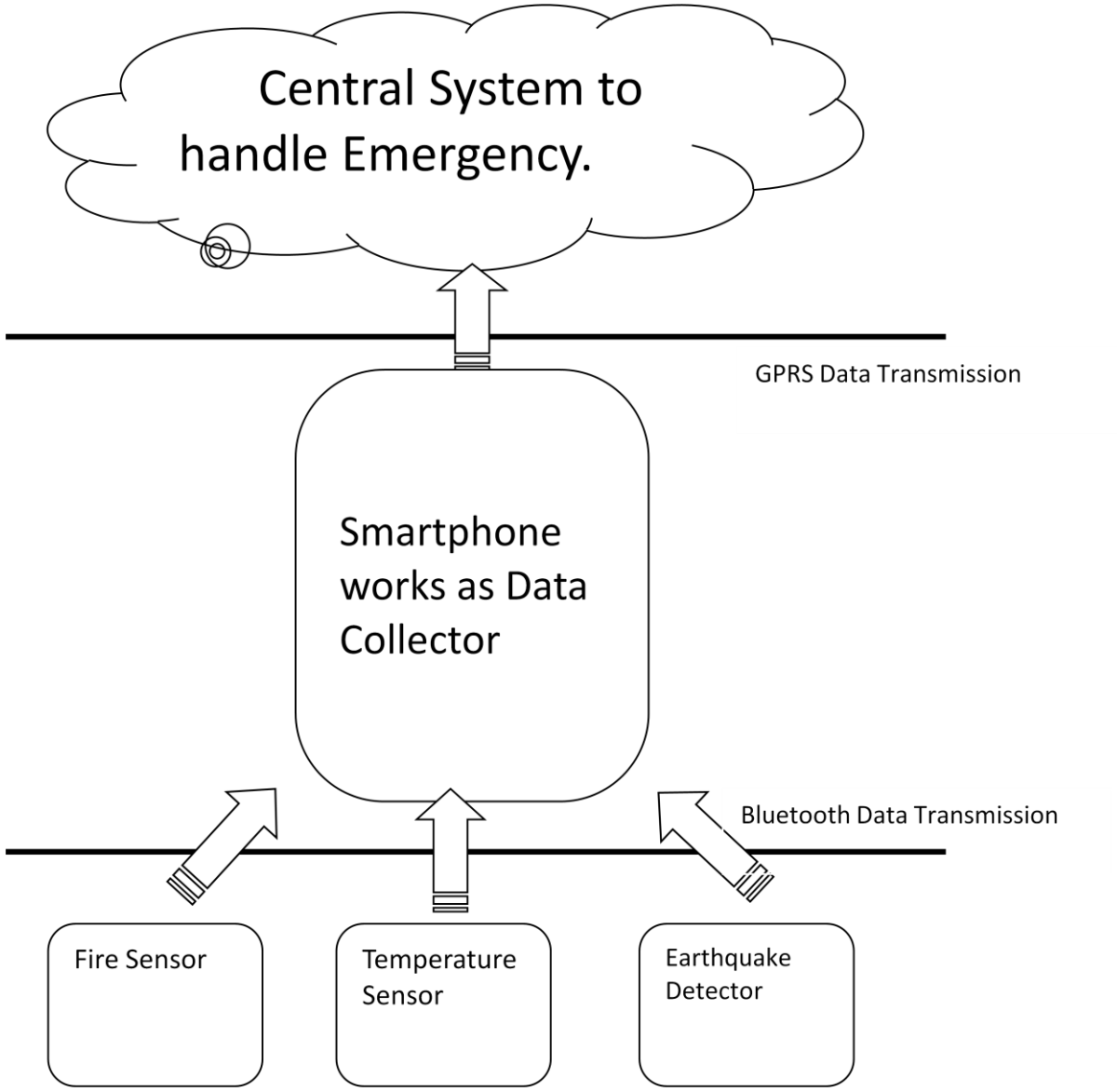



Figure 1: System Architecture of Proposed Project

### 3.2 Application Flowchart:

Figure 2 explains about the data flow in application. As shown, initialization and pairing between the sensor device and Smartphone is done at first level. Both devices are in standby mode and listening to their particular signal to catch and report emergency.

Sensor device suppose to detect emergency first and then transfer the bluetooth signals to Smartphone. These signals are noting but the emergency type codes. System will have some

set of predefined emergency type code, like – 1 for fire, 2 for gas leak, etc. Once Smartphone get emergency code via bluetooth, it fetches the location details with help of GPS on handset. As collective information is has, try to send this emergency in three different way –

IF GPRS is available and active on set

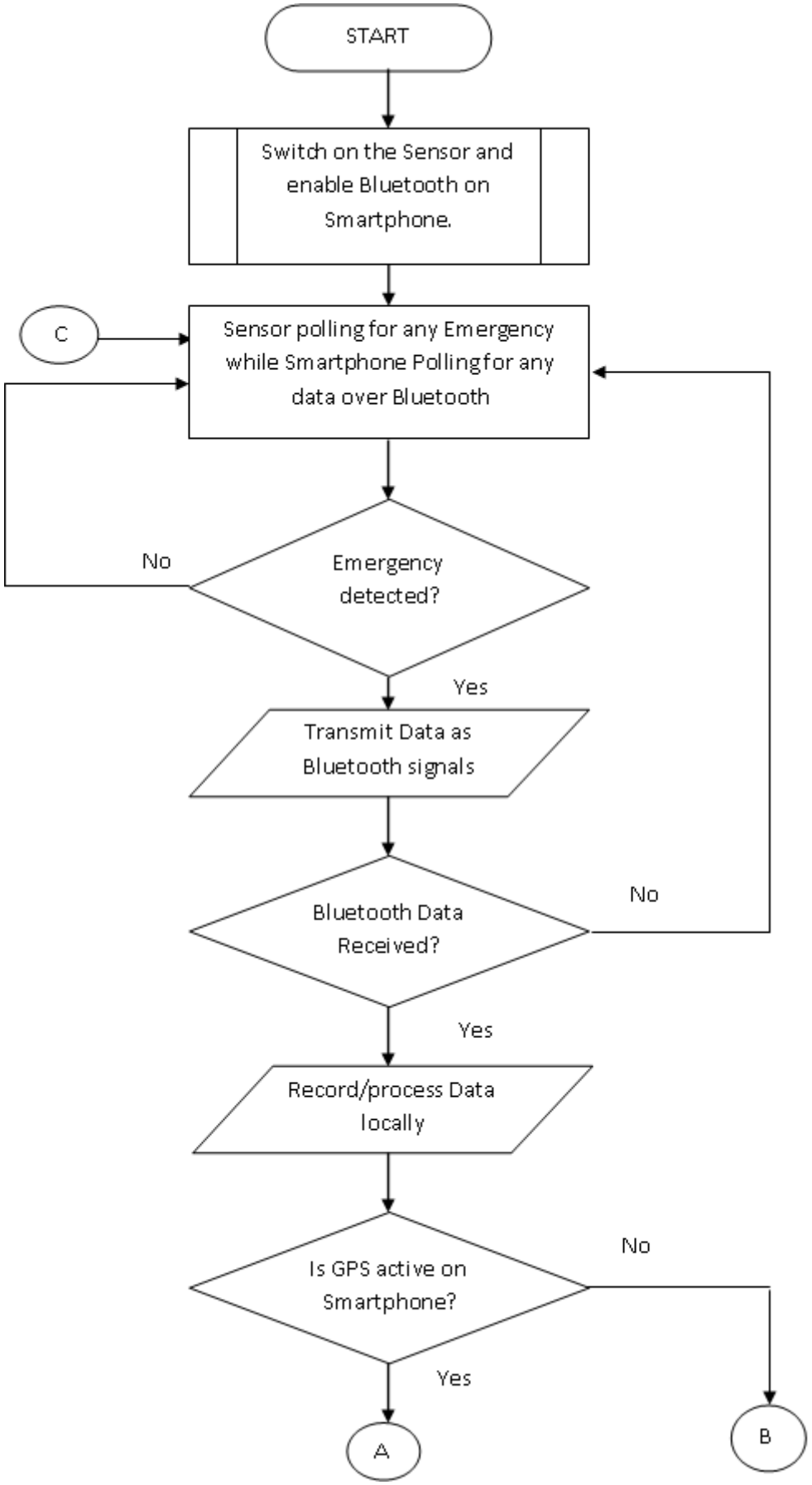
THEN post the emergency on central website

IF telephone network is available

THEN send text message to emergency help line

IF neither GPRS nor telephone network available for use

THEN make satellite emergency call.


START
Switch on the Sensor and enable Bluetooth on Smartphone.
C
Sensor polling for any Emergency while Smartphone Polling for any data over Bluetooth
No
Emergency detected?
Yes
Transmit Data as Bluetooth signals
Bluetooth Data Received?
No
Yes
Record/process Data locally
Is GPS active on Smartphone?
No
Yes
A
B

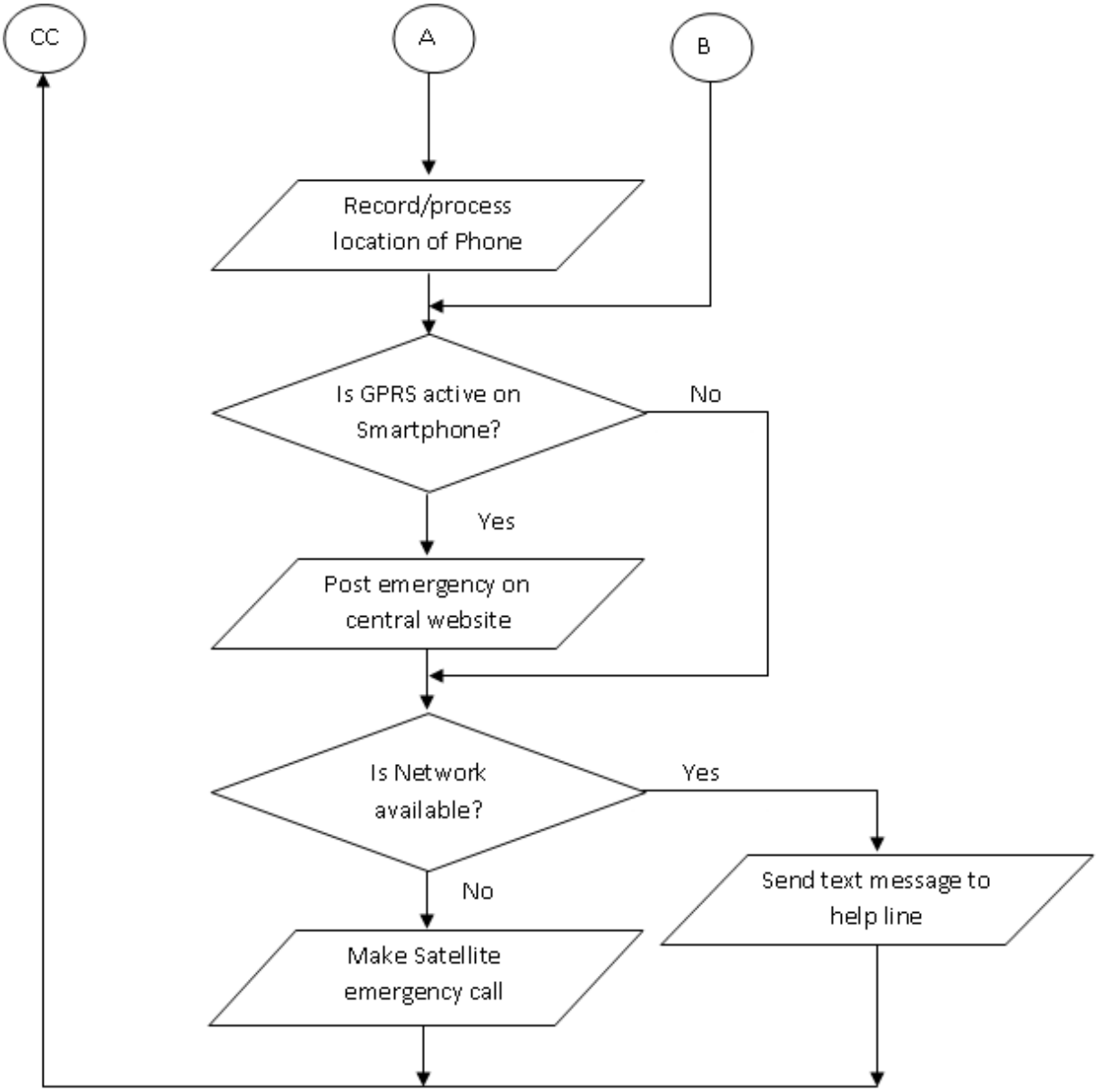



Figure 2: Flowchart of EmePort Application

# 4. SYSTEM IMPLEMENTATION:

As per design given in section 3.1, implementation will be carried out in three separate layers and they will be connected with communication path between them. This section describes in-depth details of components designed with their specifications.

## 4.1 Electronic sensor equipped with Bluetooth:

To implement and demonstrate the emergency reporting system, we are using electronic circuit assembled with LM35 - Precision Centigrade Temperature Sensor and Serial Bluetooth Module V5 connected via serial port to board. Microcontroller is main heart of any circuit to manage all activities, we are using AT89S51 Microcontroller. It's placed on board and programmed with instruction sets to monitor the incoming temperature value from LM35 temperature sensor. We can set the threshold value via program; crossing threshold limit – it's time to trigger Emergency. We set 35 Celsius degrees as threshold for our demonstration. As sensor continuously read the environmental temperature, we monitor it through our assembly program, set to read that temperature continuously. LM35 plays with voltage hence we used LM358 amplifier to amplify incoming voltage. AT89S51 microcontroller is supported with NE555 timer to oscillate and generate correct time intervals. We used normal power supply of 240v and converted to 15v using transformer. Throughout the circuit power supply used is 12v, so that it's also possible to run this circuit on battery cell which will generate 12v of power. We used KA7805 and KA7812 voltage regulators to maintain the voltage at 5v and 12v respectively on board. As sensor gives analog output, we used ADC HM546AF to convert sensor output from analog to digital.

For monitoring purpose we placed one 16 character x 2 line dot matrix LCD module which set to continuous display the current temperature read by sensor. It also triggers a message on LCD when given threshold limit reaches. Once threshold value reached i.e. sensor is able to sense temperature more than 35 Celsius then microcontroller sends signals on serial port in specified format. On serial port Bluetooth module is connected; it reads the incoming data stream and post it to outgoing data stream which is paired device, noting but smartphone. Designed device snippet is shown in Figure 3.

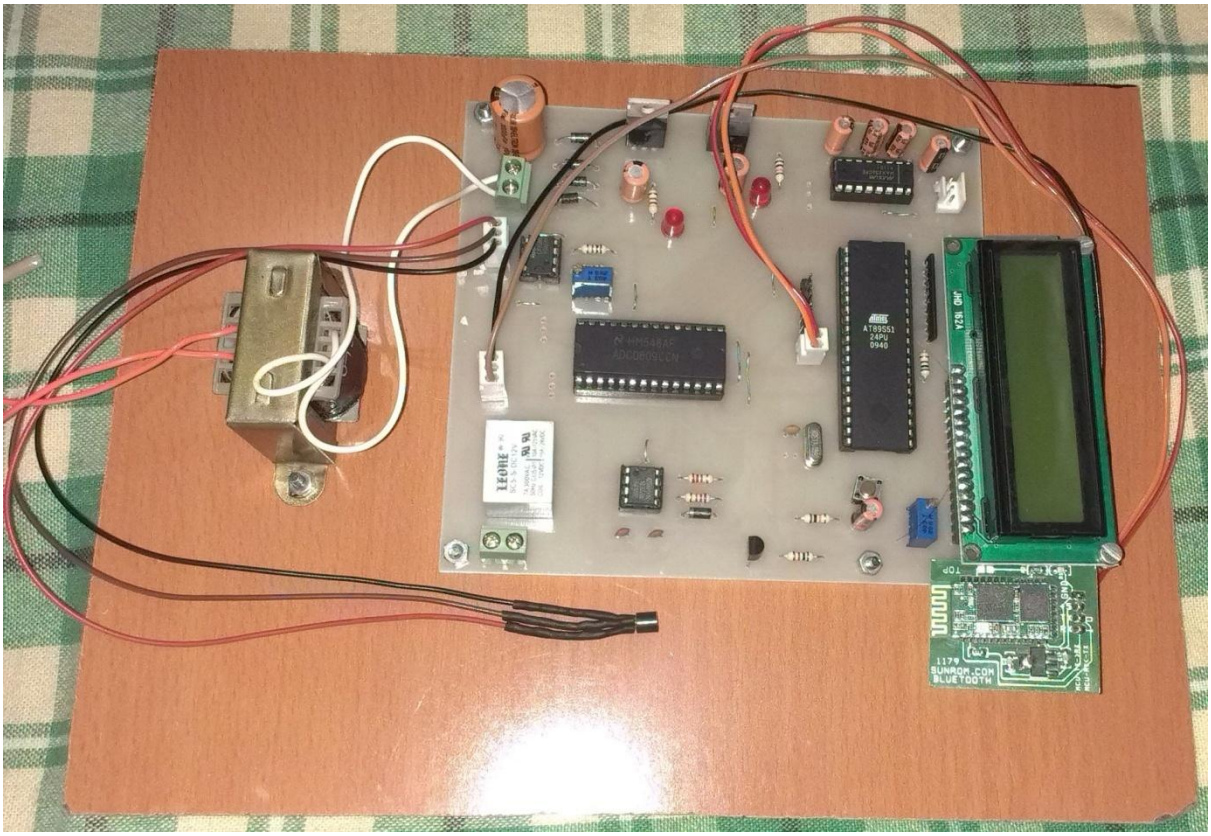


Figure 3 : Circuit board assembled with sensor and Bluetooth module

### 4.2 Smartphone with designed software – 'EmePort':

*EmePort* – ***Eme***rgency re***port*** is specially developed software in Android and deployed on Smartphone. As Microcontroller is heart of electronic device, EmePort is heart of our project. It plays vital role in this emergency reporting system. EmePort is responsible for reading the data (emergency type code) transmitted by sensor over bluetooth and record it for further use. Depends upon available resources and applicable environment it decides the appropriate channel to send this emergency signals along with other information like person in emergency, location, time and type of emergency to respective centralized website over GPRS or text message to emergency help line number or satellite call, respectively.

#### 4.2.1 Software and Hardware Requirements:

We developed this application considering the open source android platform. Below given list briefs about the minimum requirements of hardware and software for this application.

Android version 4.0.3 or later

In-built Bluetooth support required

GPS supported handset

400MB or more RAM

GPRS activated

High speed is experienced with EDGE support (its optional)

### 4.2.2 Data Flow and Code Snippets:

As EmePort is Android application, it follows standard framework of android application development and its conventions. EmePort has main Activity and respective layouts where it follows the order of standard callback methods for Activity.

Getting started, EmePort's main activity consists of onStart callback where reference of local bluetooth adapter of smartphone is used for handling further communication with electronic device. As shown in Figure 4 code snippet of onStart callback, it checks for bluetooth availability; if it's available and currently not active then it prompts user to start it. Same is case with GPS location service. If it's available and not active then prompts user to activate it. Both Bluetooth and GPS location service are vital part of this project.

```
@Override
protected void onStart() {
    super.onStart();
    getRequestedOrientation();
    setRequestedOrientation(ActivityInfo.SCREEN_ORIENTATION_NOSENSOR);
    // If BT is not on, request that it be enabled.
    // setupConnectivity() will then be called during onActivityResult
    if (!mBTAdapter.isEnabled()) {
        Intent enableIntent = new Intent(
                BluetoothAdapter.ACTION_REQUEST_ENABLE);
        startActivityForResult(enableIntent, REQUEST_ENABLE_BT);
    } else {
        if (mBTService == null)
            setupConnectivity();
    }
    /* Check if the GPS setting is currently enabled on the device.
     */
    LocationManager locationManager = (LocationManager) getSystemService(Context.LOCATION_SERVICE);
    final boolean gpsEnabled = locationManager
            .isProviderEnabled(LocationManager.GPS_PROVIDER);
    if (!gpsEnabled) {
        /* an alert dialog that requests user to enable the location services
         */
        new EnableGpsDialogFragment().show(getSupportFragmentManager(),
                "enableGpsDialog");
    }
}
```

Figure 4: Checking availability of Bluetooth and GPS services

Bluetooth service running on smartphone needs to be paired first with required device. This pairing can be done on either secure or insecure RFCOMM. Similar as TCP socket programming, bluetooth comes with BluetoothSocket and BluetoothServerSocket. With help of this we can simulate the client-server relationship between smartphone and electronic sensor. Once paired, it's running in separate thread to listen for any incoming data. Even same connection can be used to write/send data.

As per standards of bluetooth technology, EmePort application uses polling method to get data from paired electronic sensor device. At any instance, if application receives data from electronic device then it follows the flowchart described in section 3.2. Data that sensor suppose to send is in xml format –

<Emeport>01</Emeport>

Emergency type code sent by device is predefined in application. Current set defined as –

FIRE_EMERGENCY = 1;

GAS_LEAK = 2;

EARTHQUAKE = 3;

EXTREME_HEAT = 4;

EXTREME_COLD = 5;

EXPLOSION = 6;

ACCIDENT = 7;

PERSONAL = 0;

By default emergency type code is set to 0, i.e. Personal. In case sensor not sends any of these predefined code or emergency is trigger manually from EmePort application then emergency type code will be always 0. This data sent from electronic device are in hex code, it needs to be converted first and then used to decide on emergency in application.

Once received, application starts to locate the position of smartphone on earth. GPS is main source to know the longitude and latitude. With newer version of android (2.3 and above) it facilitate with network providers location also, hence we used both the location and calculate the more accurate position of smartphone depending on the timestamp attached with position parameters. Android support with good set of location manager API's where we just need to register our request with one listener, so that system periodically update that listener for any position change. The notification internal can be set in application, we set it to 10 minutes and 10 meters; that means if smartphone moved 10 meter away from its earlier position or location is not calculated from last 10 minutes then location manager API update the listener for current values of its longitude and latitude. Same setting is done for network provider's location value, hence in application we compared both the outputs and try to fetch which is latest one and used that to notify further. Google offers free service of Geocoding; we used it in our application. As we get longitude and latitude from location manager API, same it forwarded to reverse geo coding API provided by Google. It returns the postal address of that area. It enables us by one further step to know the emergency area clearly. We send this as address of emergency from EmePort application.

As personal contact number of person using that mobile and emergency help line is preserved at application, same is provided by user when he/she first time open this application on his/her mobile. We check for this numbers and along with other information – Person mobile number, emergency type code, longitude & latitude, date-time of emergency occurred (its current timestamp); with this all data handy, application set to report this emergency to outside world with three different means.

First we try to post on central website about this emergency if GPRS is enabled on device. To do so we bundled all handy information in JSON format and with help of simple HTTP URL connection, made REST web services call with POST method. Since this is separate HTTP request, we executed it in separate thread (asynchronous task) rather than doing it in UI thread which may unnecessarily block current UI thread. Figure 5 illustrates the same.

```
class PostOnWebsite extends AsyncTask<Void,Void,Void> {
    protected Void doInBackground(Void... arg0) {
        try {
            URL url = new URL("http://eme-port.appspot.com/eme/emePort");
            HttpURLConnection conn = (HttpURLConnection) url
                    .openConnection();
            conn.setDoOutput(true);
            conn.setRequestMethod("POST");
            conn.setRequestProperty("Content-Type", "application/json");
            JSONObject inputObj = new JSONObject();
            inputObj.put("mobileNo", mSelfPhNo).put("longitude", mLongitude);
            inputObj.put("latitude", mLatitude).put("emergencyType", mEmergecyType);
            inputObj.put("address", mGeoAddress).put("date", getEmergecyDate());
            OutputStream os = conn.getOutputStream();
            os.write((inputObj.toString()).getBytes());
            os.flush();

            if (conn.getResponseCode() != HttpURLConnection.HTTP_CREATED) {
                throw new RuntimeException("Failed : HTTP error code : "
                        + conn.getResponseCode());}
        } catch (Exception e) {e.printStackTrace();}
        return null;
    }
}
```

Figure 5: Posting Emergency on Central Website

Second way of reporting emergency is sending text message along with required information. We check for telephone network availability; if present then form the message of handy information about emergency and send it to emergency help line number given by user at starting of this application. Message sending is done with use of existing telephone service provider's network. Associated cost will be normal as per text message package subscribed by user; no additional cost is involved. Figure 6, shown the text message received on emergency help line administrator's handset, sent by EmePort Application.

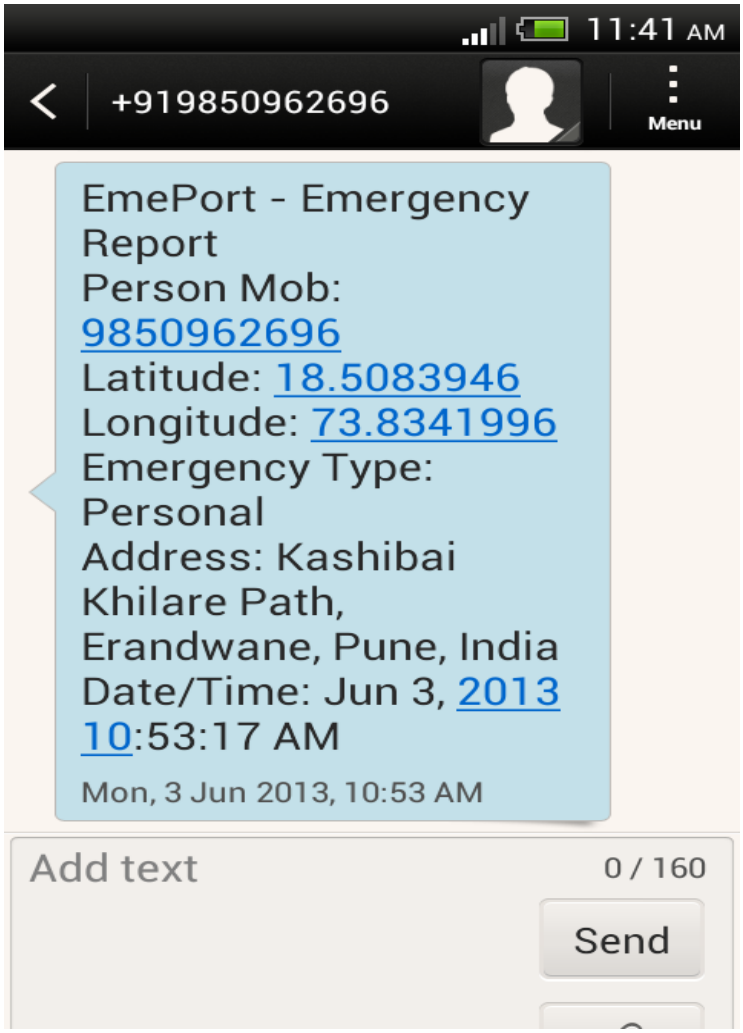



Figure 6: Text Message received on Administrator's handset

Third way to report emergency is calling Emergency numbers. This option will be triggered only if both of above ways are not working. That means if we don't have GPRS active (not able to post on website) and even we are not in telephone providers converge area (not able to send text message) then we are going to use the facility of calling emergency number via satellite. This facility is supported by almost all handset. We trigger automatic call to emergency number to report the emergency.

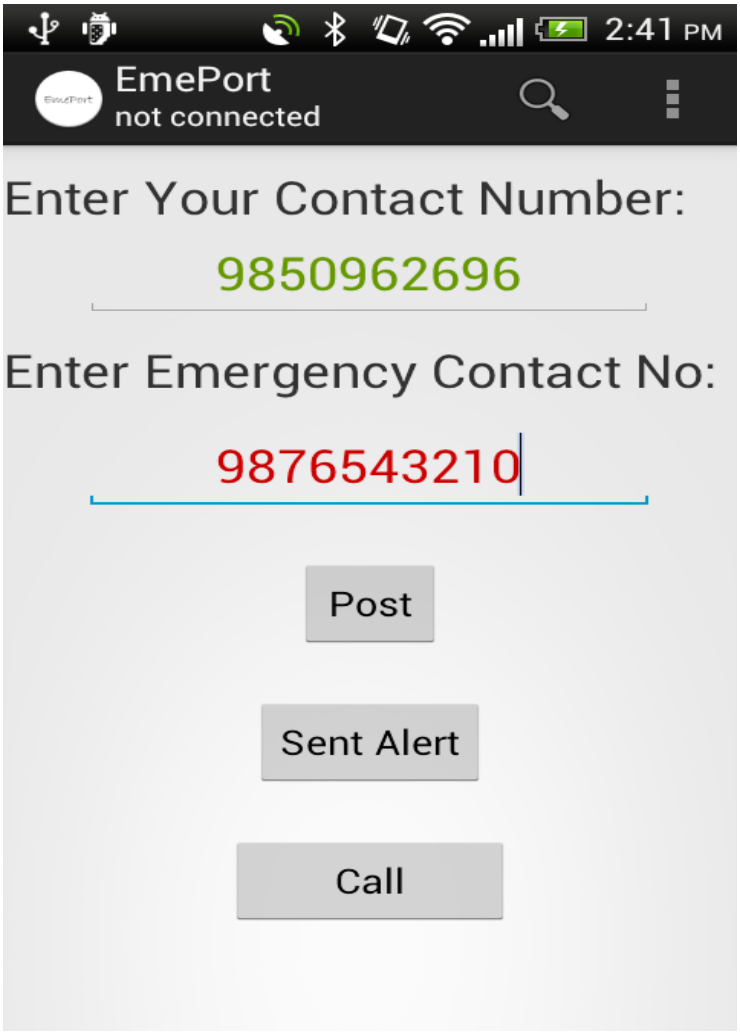



Figure 7: EmePort Application layout on Smartphone

Figure 7, layout of EmePort Application showed appears on smartphone when user runs this application. As this is automated process of reporting emergency when it sensed by electronic sensor, however we provided UI (user interface) too, in case if someone silently wants to convey the message like – they are under unsuspicious attack or its medical emergency where they are not in position to talk and in need of serious help. All three ways we used to report emergency in our automated system are provided here in form of clickable buttons. 'Post', 'Sent Alert' and 'Call' are doing the same functionality what we seen earlier in our automated process respectively. Initially this was not part of proposed system; we added this feature to our application soon later the worst and brutal gang-rape case reported on 16 December 2012 in Munirka , New Delhi.

### 4.3 Centralized website as Data storage system:

While proposing this system, we mainly considered this part as already existing systems which are up and running as government agencies, private organizations or any voluntarily formed rescue teams, which takes care of such event in given scope. We can target any website of such teams to update about emergency on their portal.

To demonstrate this concept of website and posting emergency from our EmePort application, we designed – http://eme-port.appspot.com/emeportwebapp website hosted on Google App Engine (GAE). GAE is free space web hosting service which is mainly targeted to students and technology lovers to use and practice about their ideas. It provides up to 5GB free space. We build one simple REST web service with help of Jersey framework. This web service accepts the POST calls in JSON format. From each POST sent from smartphone, it exacts the data and stores it in In-Memory storage list. We set its limit to 10 (limit can be changed in program), so that last 10 such emergency reports are shown on website.

Along with details of emergency we also added the Google Map feature to website. One can easily visualize the emergency place on Map. This gives better idea about the emergency address so that rescue team can plan their action steps accordingly. Figure 8, shows the two column section web page where on first section the emergency report rows are shown and in second section Google Map with marker for selected location of emergency is shown.

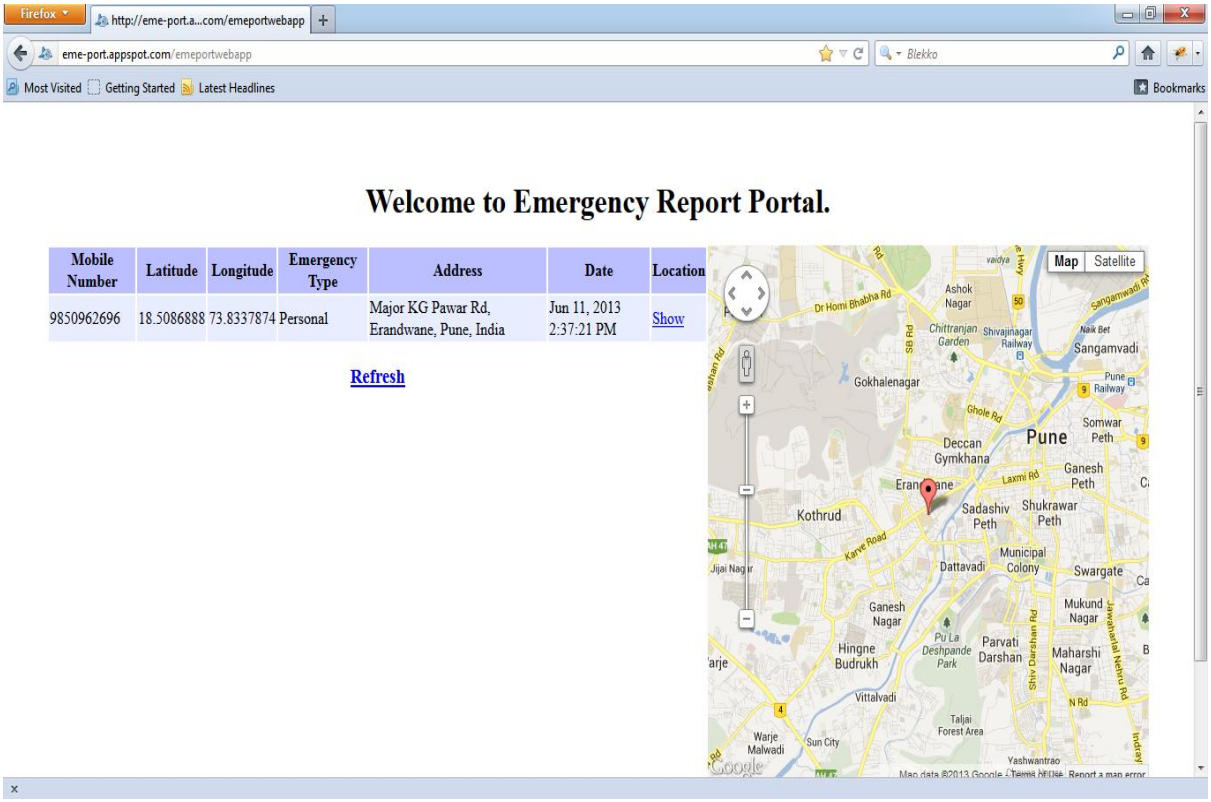



Figure 8: EmePort Web Portal on GAE

# 5. EXPERIMENTS AND APPLICATION:

This section briefs about the different test cases and conditions we tested on EmePort application and what are the different type of applications can be build using this concept of emergency reporting system. Prior to this we just listed all the installation steps for EmePort Application on smartphone and getting connected with sensor device. These steps are required and assumed to be performed before doing any experiments and test cases.

## 5.1 Installation guide of EmePort Application:

Below is the list of steps to demonstrate working prototype of EmePort Application of HTC desire X handset. This Android application follows framework of Android Development and code is open for further modification under open source project development, however this EmePort application is not signed by Google Play license; hence not allowed to distribute and only to demonstrate in debug mode. We connect our HTC desire X mobile to PC where this EmePort application is developed.

1. When application installed first time, it asks to enable the bluetooth as well as GPS services on mobile, provided these services are not ON, else this step will be skipped. First fragment on screen ask user to enable bluetooth; if user denies then application will be terminated as bluetooth is communication channel between electronic device and smartphone, its mandatory to enable it.

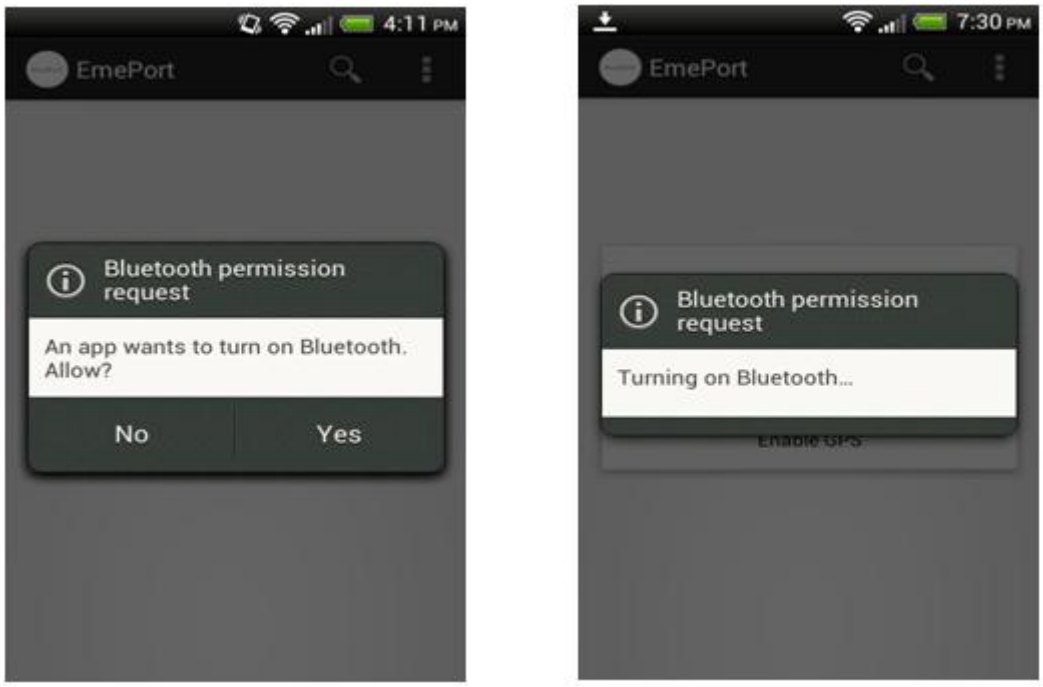



Figure 9: Enabling Bluetooth while installing EmePort Application

2. Once bluetooth is turned ON, application asks user to enable the GPS location services

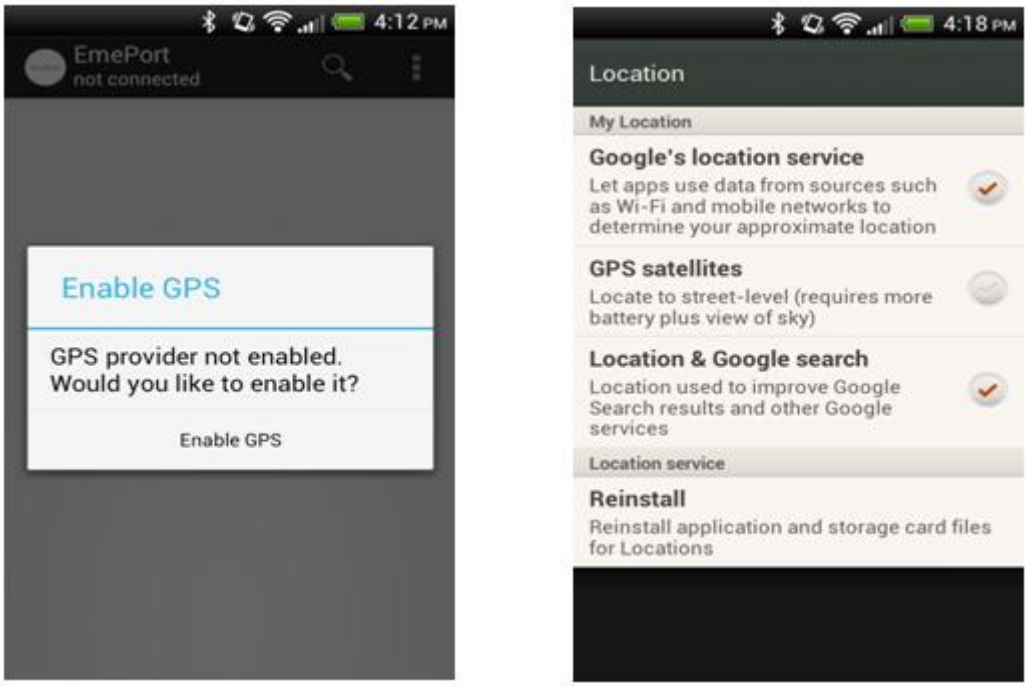



Figure 10: Enabling GPS service while installing EmePort Application

3. Now user is suppose to connect with electronic sensor device. On application screens title bar after the EmePort title, search icon is provided as action menu, which is used to search the available bluetooth devices present in its range. By clicking on search icon it will give the list of paired devices with user's smartphone and also provide one clickable name 'Scan for devices'. If user already used and paired smartphone with sensor device then that device name will appear in paired list. For first time connection, user has to scan for devices (click on scan for device button).

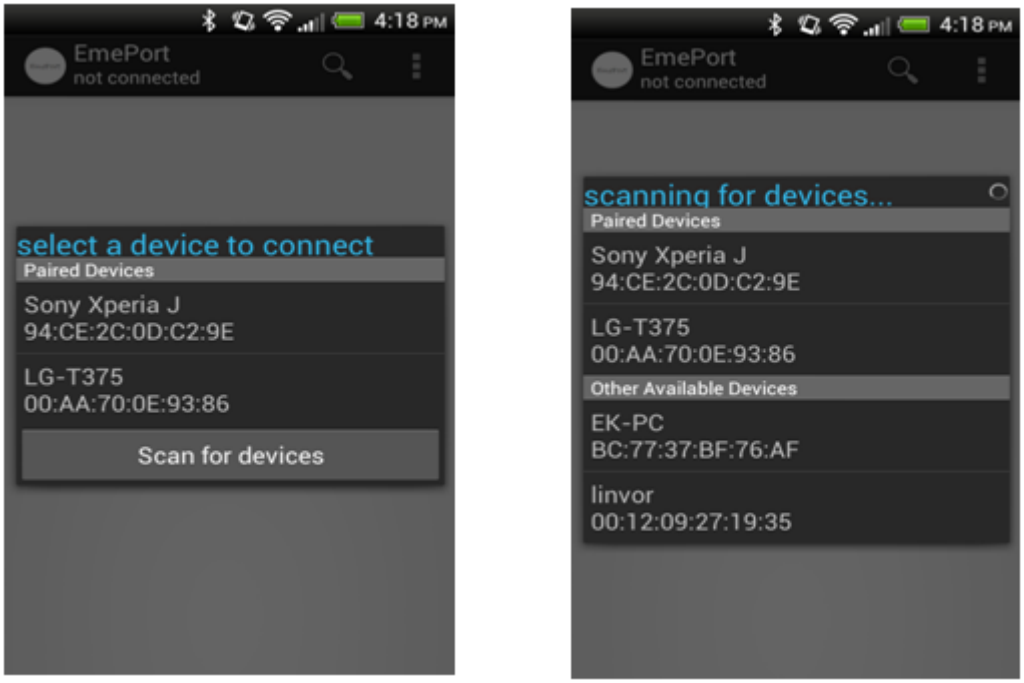



Figure 11: Scan for sensor device to get connected

4. It will list all in-range devices, among that user suppose to select sensor device for pairing, first time it will ask for pairing code. By default device come with default pass code as 1234 (this may vary from device to device). Please provide the same at space provided on screen. Once done, you can see ‘Connected’ message right below the EmePort project title on screen.

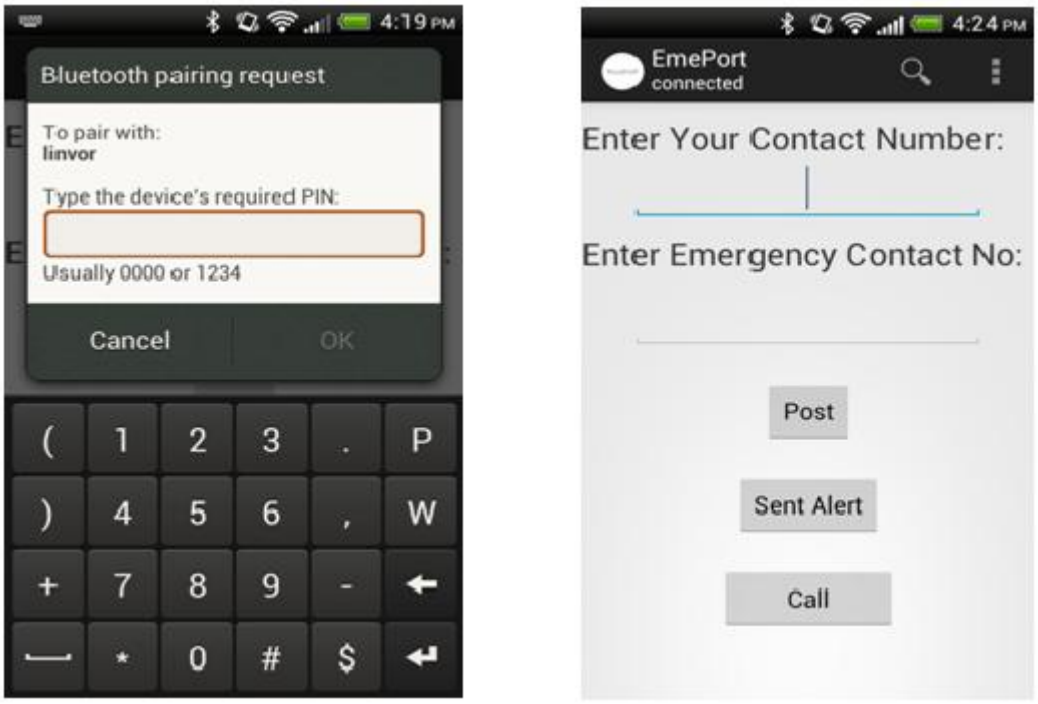



Figure 12: Pairing and getting connected with sensor device

5. Once connected, user needs to enter his/her mobile number and emergency help line number. This both numbers are used while emergency is triggered by electronic sensor device. After providing these, user can do other work by going on home screen. User is all set with EmePort Application, so far smartphone is connected to device, it's listening to any emergency and if any it will report automatically without user intervention.

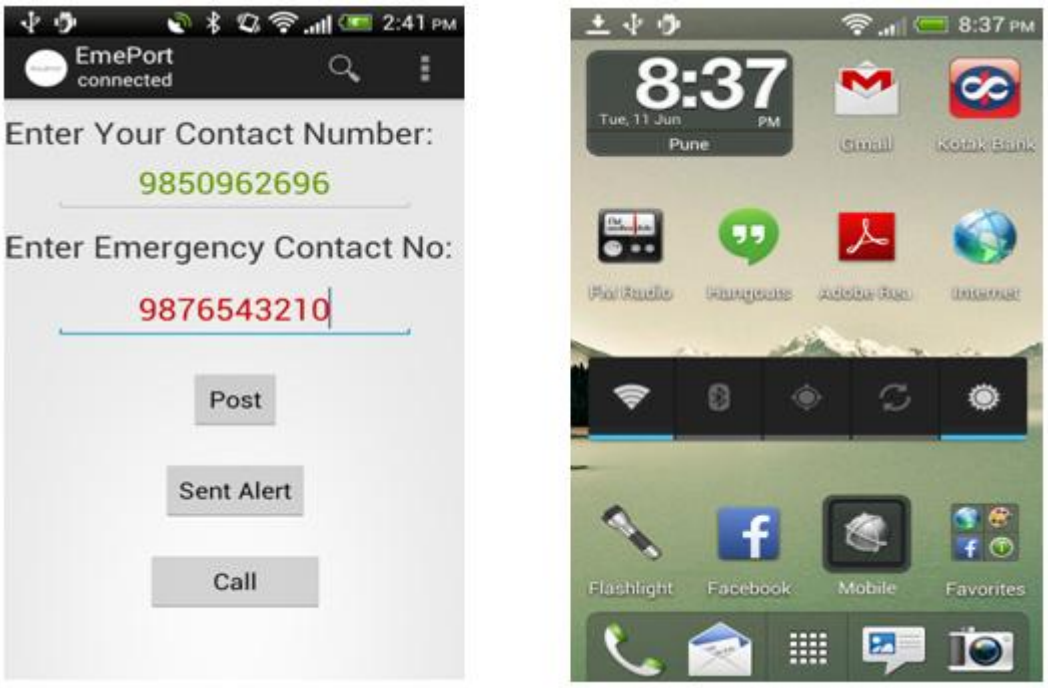



Figure 13: EmePort Application Installation done

6. Above steps are needs to be performed if device got disconnected or smartphone rebooted with any reason. The device and smartphone must be in particular distance specified by bluetooth device specification (10 meter in case of Bluetooth 2.0).

## 5.2 Experiments and Test Cases:

As our proposed system involves the short range wireless communication (bluetooth) as well as long range wireless communication channel (GPRS), there could be more dependencies on radio frequency ranges and its quality at the time of communication. In this section we are listing all the positive and negative test cases and their results –

Scenario 1: considering all normal steps of installation, emergency is triggered by electronic device.

Results: Success case. Emergency has been recorded at smartphone and emergency along with other information is posted on central website and also text message has been sent to emergency help line given while installation.

Scenario 2: neither smartphone is subscribed for data connections (GPRS) nor it's using any Wi-Fi service provided by nearby other data service providers.

Results: Success case. Emergency has been recorded at smartphone and emergency along with other information in text message has been sent to emergency help line given while installation.

Scenario 3: neither smartphone is enabled for any data services (GPRS) nor it has telephone network to send message or make call.

Results: partial success case. This is special case and we handled it by making satellite Emergency call. As we can't call 100 or 101 for testing, we provided provision in application to do so.

Scenario 4: smartphone is connected with sensor device via bluetooth and its rooming in circle of 10 meters from sensor device location.

Results: Success case. Emergency has been recorded at smartphone and emergency along with other information is posted on central website and also text message has been sent to emergency help line given while installation.

Scenario 5: smartphone is connected, now user is answering some call on smartphone or listening to music or doing any other stuff on smartphone.

Results: Success case. Emergency has been recorded at smartphone and emergency along with other information is posted on central website and also text message has been sent to emergency help line given while installation. EmePort application runs in separate thread (as separate process) so it's not required to stay on same screen of EmePort application. User is free to use his smartphone for other stuff.

Scenario 6: smartphone is connected with sensor device via bluetooth, but smartphone is now placed far away (more than 10 meters in case of Bluetooth 2.0)

Results: Failure case. As soon as smartphone goes way form sensor device, bluetooth connection between device and smartphone have been terminated, hence even thought sensor senses the emergency it's not transferred to smartphone and eventually to the rest of world.

Scenario 7: while installation GPS is working fine, but somehow when emergency triggered by sensor, GPS on smartphone not responded in proper manner.

Results: Success case. Even though GPS is not responded, we used telephone service provider's updates in application. Hence with help of that EmePort Application reports emergency as expected.

Scenario 8: Personal number on EmePort application is not provided, it left empty.

Results: Success case. Emergency has been posted on Website and text message has been sent with person mobile number as 'Unknown'. If required rescue teams can back track the text message sender, as we used the smartphones SIM cards service provider to send text message, so it will be that same number of the owner who is in emergency.

Scenario 9: Emergency contact number on EmePort application is not provided, it left empty.

Results: Success case. Emergency has been posted on Website however text message is not trigger as destination for that text message is been left blank by user.

Scenario 10: Both personal contact number and Emergency contact number on EmePort application are not provided, they left blank.

Results: Partial success case. Emergency has been posted on Website with personal mobile number as 'Unknown' and text message is not trigger as destination for that text message is been left blank by user. Update on website will let rescue team know about the emergency and location of it but not the person details who is in emergency.

Scenario 11: consider the Geo-code service provided by Google is out of order.

Results: Success case. Emergency has been posted on Website and also test message been sent, with address field as 'Unknown'. In application we are using geo-coding of Google for

obtaining the address from longitude and latitude. Its additional information we share with rescue team and not mandatory one. As long as we are sending longitude and latitude to rescue team, they can also retrieve address from this; same we achieved on website by showing Google map with marker.

Scenario 12: consider the website the down and emergency contact number is out of order for some reason.

Results: Failure case. In application update for website and text message for emergency number has been triggered, with no guaranty of its acceptance at other end. If both channels are denying accepting emergency note by any reason then emergency will not reach rescue team by any other means; Neither EmePort application checks for delivery of post or message to given destination, nor it repeats its work on periodical base.

## 5.3 Applications:

Presented implementation of proposed idea is generic in nature. We demonstrated with considering one emergency type. This idea of reporting emergency can be implementation in elsewhere applications –

Accident: In car or bike accident is detected by vibration sensors, this will be another great application supported by our proposed idea. Fixing accident detection sensor on bike or car and drivers smartphone is connected with sensor via bluetooth, EmePort ensures that even person is in some remote place then also emergency gets reported by satellite call. This application will be best in use and saves crucial time to treat person who met with accident. Figure 14, shows the bike rider who is equipped with such sensor and his smartphone.

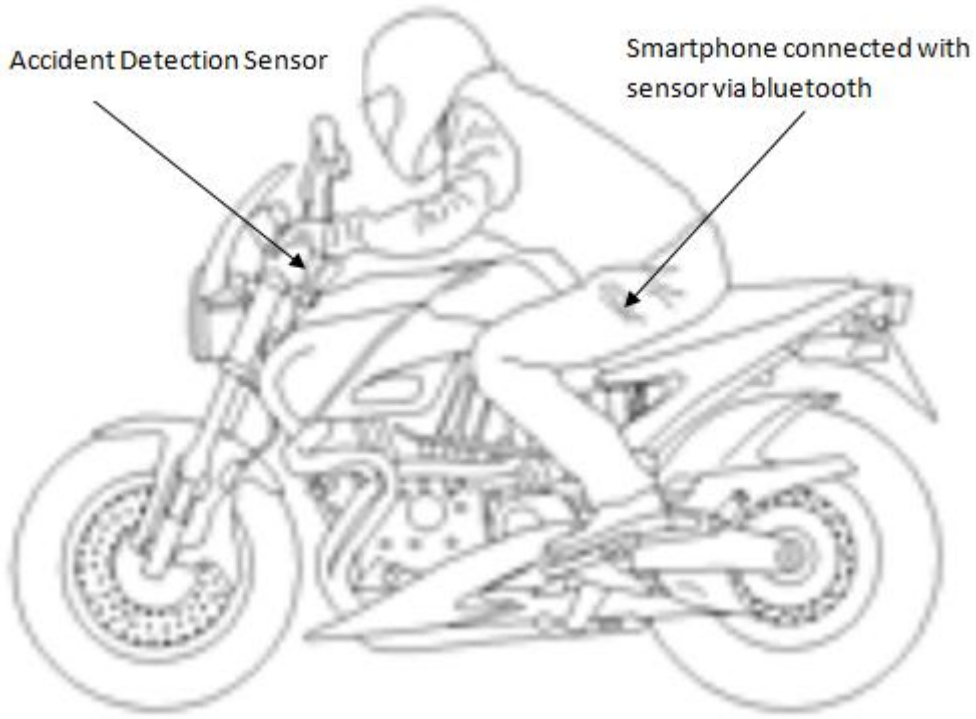



Figure 14: Bike rider equipped with EmePort Application

Gas leak: Most of the modern houses build with pipelined LPG facility. It's very dangerous if it has some leakage and not being noticed. Such gas detectors are available in market; it can help you to sense a gas leak even if you don't notice its smell. EmePort Application has this emergency as predefined value in it, hence no change in software only we need to get such detectors assembled with bluetooth module to communicate with smartphone.

Earthquake: Countries like Japan, China, Indonesia and Italy are most earthquake prone areas in world. Even its minor or major quake, it plays with human lives. We can use EmePort Application here for as personal emergency reporter in home. Electronic quake detectors are available in market; we suppose to integrate it with bluetooth module for data channeling. EmePort Application has this emergency as predefined value in it, hence no change in software.

Extreme heat or cold: applying Air Conditioner at home is most due to recent issues of global warming and unbalanced layers in atmosphere. Now a day's AC comes with dual functionality; it applies cold or heat depends upon requirement. Due to some malfunctioning it may decrease/ increase the degree below/above specified value which may dangerous to

living person, and that too he/she is old age citizen or in unconscious mode will lead to death penalty sometime. Such conditions can be handled by this EmePort application.

Explosion: malfunctioning of any household electronic goods or any chemical reactions used at home may cause minor or major explosion. Such events can be monitored with help of electronic sensor. We can deploy EmePort application here to report this emergency in no time.

# 6. CONCLUSION AND FUTURE WORK:

In this chapter we discuss the conclusion drawn from the project work and the future work that can be carried out.

## 6.1 Conclusion:

As per the problem statement defined in earlier section, we proposed robust system to report the emergency. System implementation with one emergency type and their respective experiments shows the positive feedback on systems working model. Including the partial success scenarios as well as fully succeeded scenarios listed in experiments section proves that - Implemented system is **real time** system which reports emergency **automatically** and also records the sufficient data like **person in emergency, location, time and type of emergency** and communicate this message to outside world with help of **wireless channels.**

Two ways (posting on website and sending text message) out of three ways to report emergency are tested and working as per expectations. Third way to report emergency is of Satellite Emergency calling is not been tested fully, however provision to do so is provided in EmePort Application.

Enlisted applications of this project will be run without any changes at EmePort application. One has to adjust the hardware part of sensor to make sure that it sends the correct emergency code via bluetooth.

## 6.2 Future Work:

As we concluded, the third way of emergency reporting is partially tested. In future more emphasis can be given on its detailed testing and enhancing it further, if required.

This system is developed on bluetooth as short range communication channel. Future work can be carried out on the other options like Wi-Fi Direct or Infrared technologies. Same way EmePort application can be implemented for other mobile OS like Windows, iOS or platforms like PhoneGap. Making most of it is always appreciated and suited for upcoming projects.

This system worked with two components - Electronic sensor and EmePort application on smartphone. Most excited work to study and implement the integration of these two separate

components. i.e. smartphone itself must have in-built sensors. This work will definitely breakthrough in embedded systems era.

Current system works in two tier architecture. Another solution to report emergency is standalone system which can satisfy the given proposal of emergency reporting system with 3 tier system. That means first tier will have all sensor devices in place and second tier will be one device which should responsible to collect data from connected multiple sensors and then it will transfer the data to third tier device, noting but smartphone.

## 7. PUBLICATIONS:

Our proposed system has been accepted for conference:

*"2nd International Conference on Current Trends and Challenges in Management, Engineering, Computer Applications and Technology."*

And published under the journal:

*"International Journal of Advances in Management, Technology & Engineering Sciences (IJAMTES) ISSN no: 2249-7455, Vol. II, Issue 6 (VII), page no. 66-69, March 2013."*

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