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A Personal Emergency Disaster Communication Service for Smart Phones using RF Transmitter

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***Abstract*: Communication network such as mobile phone networks are quietly damaged during large-scale disaster, making SOS message dissemination and sharing location to rescue authorities for extreme difficult situation. In this paper, we proposed a RF based emergency communication system for long transmission using smart phones. Our main aim is to broadcast emergency messages to nearby people to provide more instant help. The emergency communication service in order to improve communication range, victim localization and evacuation route planning. Here, communication establishment done by using APP along with micro controller and zigbee transceiver in order to send message to rescue team. We can communicate in bi-directional also. Our experiment result based on smart-phones shows the communication service is cost effective and energy efficient with relatively large communication range.**

***Keywords*: Emergency messages, sharing location, bi-directional communication**

1. Introduction

Communication is very important in daily life. During the catastrophic disaster, a large number of people were trapped under collapsed buildings and flooded areas. Victims have more chance to survive if they rescued within 72 hours of disaster attack. However, reaching the trapped victims within 72 hours is a challenging task because communication is terminated during disaster. We proposed a system of delivering emergency messages efficiently and sharing the location using zigbee transceiver through smart phones. The existing system is deeply studied where the communication serviced using FM radio transmitter using smart phones. It uses morse code for safety transmitting the messages. The combination of FM radio signal and morse code is completely compatible and increase the possibility of successfully receiving and recognizing SOS messages. The main disadvantages are that there is only one-way communication so that victims can send the information but cannot receive any acknowledgment. During FM transmission electromagnetic interface is introduced. To overcome these limitations, we introduce RF transmitter for long range communication and reduce noise interference. It can be used for bi-directional communication also. It uses microcontroller and zigbee transceiver for transmitting and receiving emergency messages. Additionally, we are creating an application for getting location automatically using smart phones and sending information in absence of cellular network.

2. Objective

Our main objective is to broadcasting emergency messages to nearby people is considered to provide more instant help than distant rescue units. This emergency communication service is used to improve communication range, victim localization and evacuation route planning. We can easily find location using rescue application and sharing location to nearby rescue teams. It is cost effective and energy efficient with relatively large communication range.

3. Literature survey

Stephen M. George, Wei Zhou "A Wireless Ad-Hoc and Sensor Network Architecture for Situation Management in Disaster Response" (2010) designed a simple wireless audio sensors are deployed around damaged buildings to cover areas inaccessible to rescuers. It can deliver the message with less congestion in multichannel protocols. In this method time to process the message and number of iteration during transmission will be increased.

Xian Wu, Maciej Mazurowski, Zhen Chen, Nirvana Meratnia "Emergency Message Dissemination System for Smart Phones During Natural Disasters" (2011) designed an emergency communication system through smart-phones. But it is used for one-way communication. It can transmit messages through bluetooth for short distance purposes.

Noriyuki Suzuki, Jane Louie Fresco Zamora, Shigeru Kashihara, Suguru Yamaguchi "Location Estimation of Immobilized Persons through SOS Message Propagation" (2012) designed a propagating immobilized persons SOS message via bluetooth. The immobilized person transmits name, current condition and GPS information to propagator and they will rescue them. It supports bluetooth communication only.

Yao-Nan Lien, Hung-Chin Jang, and Tzu-Chieh Tsai "A MANET Based Emergency Communication and Information System for Catastrophic Natural Disasters" (2009) designed a system of communicating large number of rescue volunteer using peer to peer communication This support walkie-talkie, VoIP. There is less possibility of all volunteers having their own

personal PC network during disaster.

u-Jia Chen, Chia-Yu Lin, Li-Chun Wang "Sensors-Assisted Rescue Service Architecture in Mobile Cloud Computing" (2013) designed a system of multiple sensed mobile devices to provide a personalized situational awareness using bluetooth using voice module. We integrate proximity, orientation, accelerometer sensors and GPS module to detect users motion. It uses rescue team for conveying SOS messages so time delay is high.

Sheng Zhoug, John k. pollard "Position Measurement using Bluetooth" (2006) designed a system of bluetooth receiver signal strength indicator values has been used for position measurements, within a single cell using line of sight (LOS) radio propagation model. This was done by disabling the bluetooth transmission power control. The maximum communication range is 10 meter.

4. Block diagram

A. Hardware modules

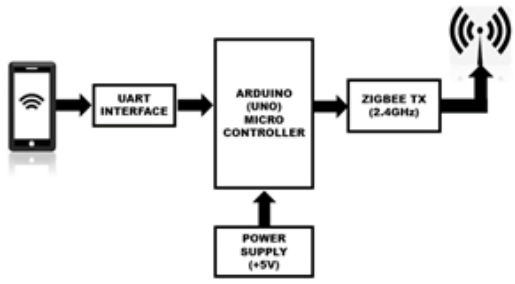

Fig. 1. Node-1: transmitter (victim side)

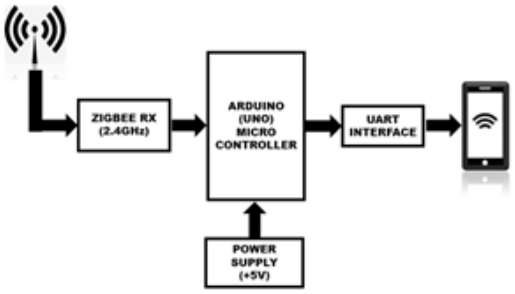

Fig. 2. Zigbee

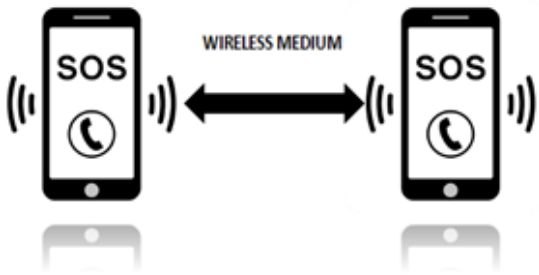

Fig. 3. Node-2: receiver (rescue side)

5. Methodology

In this system, we propose a personal emergency communication service by integrating microcontroller with zigbee transceivers in order to send emergency messages to nearby possible nodes. We developed a rescue application in which we get a victim location (GPS) and emergency messages. We sent the information through smart-phones using USB to RS232 converter (UART interface) fed into microcontroller. Zigbee transceiver is used to transmit and receive the emergency messages to nearby possible nodes. Here we will implement two nodes, victim node and rescue node. Two nodes are communicated each other using zigbee transceiver for bidirectional purposes.

6. Components

Microcontroller: ArduinoUNO microcontroller is used for this system. It is a Atmega 328 based board. Arduino is an open source platform. It has 14 Input/Output pins. It is the latest version in the series of USB arduino boards. It is low cost compared to other arduino boards. The Embedded -c language is used in this micro-controller using some software's like Arduino IDE 1.8.6 and Proteus 8 professional. microprocessor based systems, programs were developed using assemblers and fused into the EPROMs. there used to be no mechanism to find what the program was doing. LED's, switches, etc. were used to check for correct execution of the program. But they were too costly and were not quite reliable as well. As time progressed, use of microprocessor-specific assembly-only as the programming language reduced and embedded systems moved onto C as the embedded programming language of choice. C is the most widely used programming language for embedded processors/controllers. Embedded C uses most of the syntax and semantics of standard C, e.g., main() function, variable definition, data type declaration, conditional statements(if, switch, case),loops(while, for),functions, arrays and strings, structures and union, bit operations, macros, etc.

Fig. 4. Arduino UNO Microcontroller

Zigbee transceiver: It is a bidirectional device. Zigbee is a wireless communication medium. It contains low data rate and easy to implement. It supports upto 65,000 nodes connected in a network. Zigbee can automatically establish its network. It is a low cost device. It can transmit the data upto 100 meters.

Fig. 5. Zigbee transceiver

Driver: Relays are simple switches which are operated both electrically and mechanically. Relays consist of an electromagnet and also a set of contacts. The switching mechanism is carried out with the help of the electromagnet. The main operation of a relay comes in places where only a low-power signal can be used to control a circuit. It is also used in places where only one signal can be used to control a lot of circuits. They were used to switch the signal coming from one source to another destination. The high end applications of relays require high power to be driven by electric motors and so on. Such relays are called contactors.

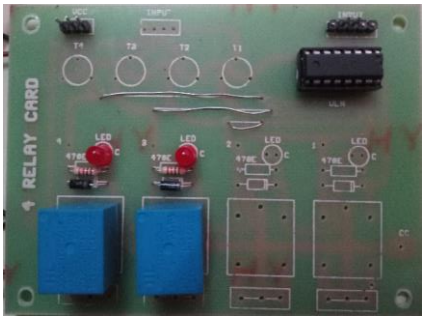

Fig. 6. Two Relay Card

RS 232 converter cable: It is used for UART interface protocols. Our converter cables provide two way RS232 serial communication signal conversion between the TTL output (such as a microcontroller board, like the Arduino) to and from a personal computer RS232 Serial COM port. This converter can be used on any microcontroller which has TTL serial communications that needs to be converted to RS232. We have also expanded our cables to include USB to TTL. Our standard cables are equipped with female DB9 connectors but male variants are available. The female cables will plug directly into common RS232 ports. The cable converts the 0V and 5V TTL signal to the -12V and 12V RS232 serial signal. The circuitry is all inside the cable itself.

USB Cable: U052-06N-OTG-AM is a USB OTG (On-the-Go) cable that features a unique USB Micro-B / USB combo connector with a retractable USB Micro-B built into the standard USB A-Male connector. It acts as an OTG cable with the retractable Micro-B connector pulled out, connecting a USB device such as a keyboard, mouse, or flash drive to an OTG compliant Micro-B device. Push the retractable USB Micro-B connector back in to use the cable as a standard USB 2.0 A/A extension cable. It is used to connect the smart-phones and microcontroller through RS32 Cable for sending and receiving the data from microcontroller and smart-phones.

Fig. 7. RS 232 Cable

Fig. 8. OTG Cable

Rescue Application in smart-phones: We have to develop our own rescue app using Android studio software. We use java language which is created in Java – netbeans IDE. Once the apk file of application is created then it is installed in smart-phones. The main use of this application is getting the GPS location and sharing to rescue team without using the network. Once app will develop then we have to interface app and micro controller and to send GPS location and message to nearby receiver node. It is more compatible compare to other communication devices.

Fig. 9. Mobile APP

A. *Advantages*

- Our system increases the possibilities of successful receiving and recognizing SOS messages.
- Cost effective and energy efficient with relatively large communication range.
- During disaster we can able communicate one to one.
- We can easily find location using rescue app.

B. *Future scope*

This system uses zigbee transceiver for communication range of 40 meters. It can improved by a component LORA for

long range communication upto 1.2 Km.

7. Conclusion

There are many ways of communicating affected peoples in disaster area but this system is more efficient and easily compatible devices. The main advantage of this system is that sharing the live GPS location to rescue teams for instant help.

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