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On Time Assist for Victims Trapped in Collapsed Building Enhanced with IOT Technology

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Abstract

Objectives: To increase the chances of saving the victims under debris especially those trapped under collapsed building. **Methods:** Technology used in this project is Internet of Things (IOT); through this technology the information about the victim trapped under debris is collected and stored in internet which is used for future use. A separate website is created to store the information about the workers in and out time and a GPS system is used to identify the victim location **Findings:** The simulation result explains about the latitude and longitude position of victim under rubble, Employer Id and the status of the victim under rubble. While comparing with the existing system the ARM processor is used where the analog to digital signal conversion is faster while comparing with PIC microcontroller, the information stored about the victim is useful for future purpose. **Applications:** Improvement is to reduce the size of the hardware and weight of the hardware. It is mainly applicable for saving the victims' life under collapsed building and under rubble.

Keywords: ARMLPC2148A, Collapsed Building, IOT Technology, Piezoelectric Plate and GPS, Victims

1. Introduction

The victims trapped under debris building are detected and rescued by the rescue team. In the existing system the piezoelectric plate will sense the vibration from the trapped person and then the data signal is sent to the microcontroller where the signal is converted into digital signal by ADC pin in the processor. The system consists

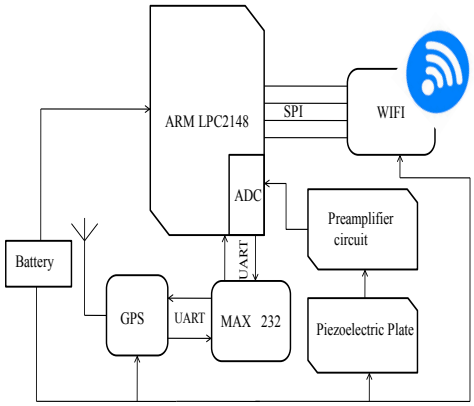

Figure 1. Block diagram of Data detecting unit.

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of detecting unit and data collecting unit. The signal is given to the wireless transmission (RFM) through Serial Peripheral Interface (SPI). The RFID reader will give the information about worker whether they are IN or OUT. The problem in the existing method is if the victim is beyond the range of communication then the rescue team cannot save the person. The information can be send within the range.RFM transmitter and receiver will increase the size of the hardware and cost of implementation is also increased[1-3].

2. Proposed Method

In the proposed method the victims trapped in the collapsed building are detected and the data is collected by the other unit. The rescue team can detect the trapped person under rubble easily by processing of the data.

2.1 Block Diagram

The detecting unit and the data collecting unit are involved in the system. The detecting unit consist of piezoelectric plate, a vibration sensing device, which is tied up in the victim hand. If the signal is sensed by the plate then the victim is alive. The preamplifier circuit is used because output produced will be in milli volts so that it should be amplified. The signal from the amplifier is analog signal which is to be converted into digital form so that the signal is sent to the ADC pin of the ARMLPC2148A Processor. Location of the trapped victim is detected by the GPS System. This is the operation performed in data detecting unit (Figure 1)[4-6].

Data from the detecting unit is transmitted to the collecting unit via WI-FI. The data received from the detecting unit is updated continuously in the database of the system Figure 2[7].

The advantage of the proposed method over the existing method is, a separate RFID reader is not required to identify whether the person is IN or OUT because the data about the workers will be uploaded in the system with a unique ID number of the device which is tied up in the workers hand. The simulation tool used in the project is PROTEUS 7.0 which is a perfect tool to test the design before developing a real system. The data collecting unit is shown below.

Advantage of Proposed System

1. The size of the device is minimized while comparing existing system.
2. The cost also reduced.
3. The inventory details are updated in the database for future use.

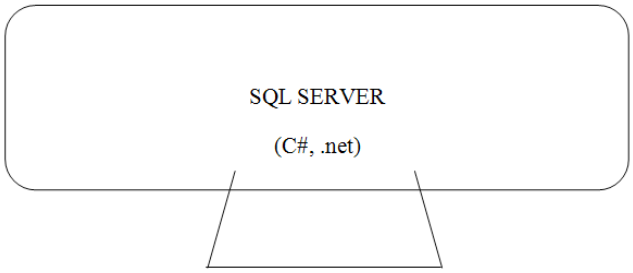

Figure 2. Block Diagram of Data Collecting Unit.

2.2 ARMLPC2148A

The widely used IC in ARM family is LPC2148, manufacturing company is Philips. More number of peripherals are preloaded which are in-built in the IC and also in high end application, this type of ICs are more efficient and reliable. The features of ARMLPC2148A are as follows: The size of On-chip Static RAM is 8 to 40KB and Flash program memory size are 32 to 512KB respectively. ARMLPC2148 provides high speed operation with the range of 60MHz Figure 3&4.

It has single 10-bit digital to analog converter which provides variable analog outputs. Number input output pins in LPC2148 are 45 pins. The speed of Single flash sector is 400ms and the programming speed of 256 bytes in 1ms. Two 32-bit timers and two 32-bit external event counters, Pulse Width Modulation unit and special timer called Watchdog timer. In most embedded system application microcontroller family is widely used. Main advantage of ARMLPC2148 is low power consumption with high performance. The system memory will be operated continuously because Reduced Instruction Set Computer (RISC) and (CISC) Complex Instruction Set Computer are simple while comparing with Pipeline technique. Power saving mode of ARMLPC2148 are Power- down and Idle. Seven modes of operation are performed in ARMLPC2148 they are User Mode (all kinds of normal application will be run in this mode), FIQ (Fast Interrupt Request), IRQ (Interrupt Request will cleared based on priority), Supervision mode, System mode, Abort mode and Undefined mode (undefined instruction will be executed)[8]

2.3 Piezoelectric Plate

A piezoelectric plate measures charges in pressure, temperature, acceleration and it is will convert them as an

Figure 3. ARM.

Figure 4. Collapsed Building.

electric charge. It is found in useful application, such as the production and detection of sound, generation of high voltages, electronic frequency generation. In piezoelectric plate the crystal charges are balanced even though it is not arranged symmetrically. In the piezoelectric effect there will be no free charges because charges be cancelled each other, the effects of the charges are no longer which will cancel one another out so the net positive and negative charges will appear on opposite faces of crystal. Voltage will be produced in opposite faces hence it is said to be piezoelectricity. Lead Zinconate is a materials used in piezoelectric crystal. The operation performed in this plate is transverse, longitudinal, shear Figure 5[9,10].

2.4 Global Positioning System

The Global Positioning System (GPS) consists of satellites, control and monitor stations, and receivers. Receivers receive the information which is transmitted from the satellite the method used to locate the position is triangulation method. GPS is used on incidents in a variety of ways, such as to determine position locations and also determine distance between two points or how far you are from another location[11].

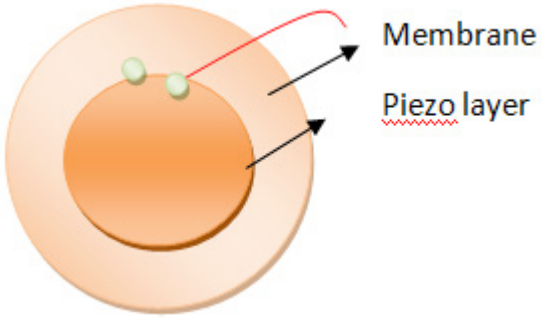

Figure 5. Piezoelectric Plate.

3. Software Profile

3.1 Simulation Tool

Proteus is a simulation tool the 7.0 version is used. It also referred as Virtual System Modeling (VSM). This kind of simulation tool is mainly used in microcontroller design with the combination of animated components, simulation of circuits and microprocessor models to design/co-simulate the complete microcontroller based designs. Before developing a physical prototype model to implement in real time usage we can check the system process with this tool and it is the perfect tool to test the microcontroller designs before developing.

3.2 CCS Compiler

CCS compiler is used to transform a Source code into another computer language. It is a computer program or set of program (the language will be in the form of binary form which is known as object code).Debug files are used to find the debugs and to prevent the software of the system and convert the binary data into ASCII format standard HEX files are used and also ensure compatibility with all programmers. The data displayed either in decimal or HEX format. C functions are used to access the hardware's such as Electrically Erasable Programmable Read-only Memory, timers, Universal Serial Bus, analog to digital converter.

Stack space will be saved by automatic linking of inline function and multiple code pages. Linker is used to determine the architecture either automatically or manually.

In each and every I/O the tri-state register will be refreshed and determined by the compiler directives. Custom Computer Service compiler will work with serial bus such as RS232, I2C bus.

MPLAB IDE integrators are another simulator which is used by editors for debugging in source level.

3.3 Embedded C Programming Language

It is the extension of C language; to write a program for embedded system application it is used. In most of the embedded system application embedded c language is used for programming in such application. In embedded system commonly used languages are C and assembly language.

Many factors should be considered to select a languages they are Efficiency (memory should be used efficiently), Speed (program should run faster), easy maintain, read and implementation. C compiler for embedded system will provide Interrupt Service Routines (ISR), Reading from and writing to internal and external memories, Bit manipulation, Implementation of timers/ counters, Examination of internal registers.

Template of Embedded C program

```
#include <reg88x. h>
Void main (void)
{
//body of the program
}
```

The following Key characteristics of an embedded C development are In-line assembly language, device knowledge and mechanical knowledge. The feature / advantage of embedded C programming are Code speed and code size. Code speed and code size are depending on the power for processing the code, Time consumption, Memory space for programming and Programming language.

High level optimization can be done in embedded C. Only pre-defined Program can be run, embedded C application will be used in both Microcontroller and Microprocessor. Programming is easy to understand, cost is less and dedicated task is performed by embedded programming. Extra memory and space for storing is not required in embedded c programming. By comparing Assembly language and C the assembly language, it is not depends on processor and it won't specify any particular microprocessor/ microcontroller or any system.

The embedded c program is mainly used in mobile phones, easily portable across systems and also used in browsing applications.

To develop a Java Program, Java Virtual Machine (JVM)is required, lot of resources are consumed. Hence it could not be used in small embedded devices. In embedded system applications languages such as c and C++ are being used.

4. Simulation Flow and Result

The simulation flow diagram is shown Figure 6&7; after initiating the simulation it checks both piezoelectric plate signal and GPS signal. If the vibration from the victim body is sensed then the person is alive otherwise person is dead. The signal from the GPS is checked whether the victim is in out of range or within the range.

If the signal is within the range then the victim is present else the victim is absent. The data received will update in the database through Wi-Fi. The process will be stopped at the end.

This is the output generated about the victims trapped under collapsed building Figure 8.

The following information is as follows.

Employee/victim ID and the location are trapped by the GPS system.

Figure 6. Rescusing the trapped person.

Presence and Absence of the employee in the working area information is also known from output.

Information about the employee whether the victim is alive or not stable.

The position of the victim under debris will be identified with the latitude and longitudinal position.

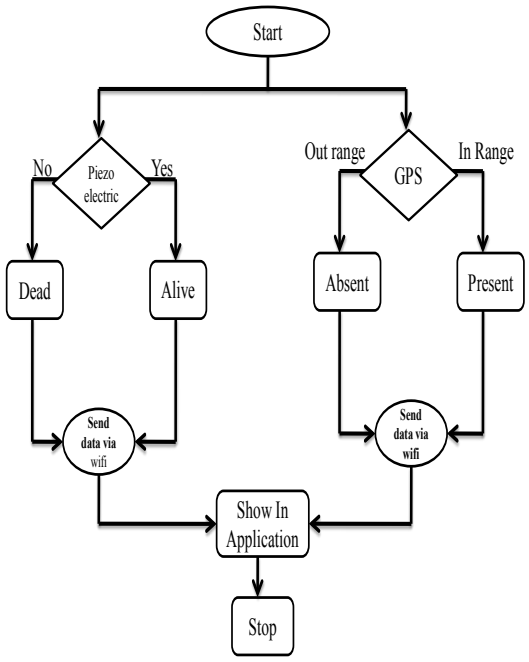

Figure 7. Simulation flow diagram.

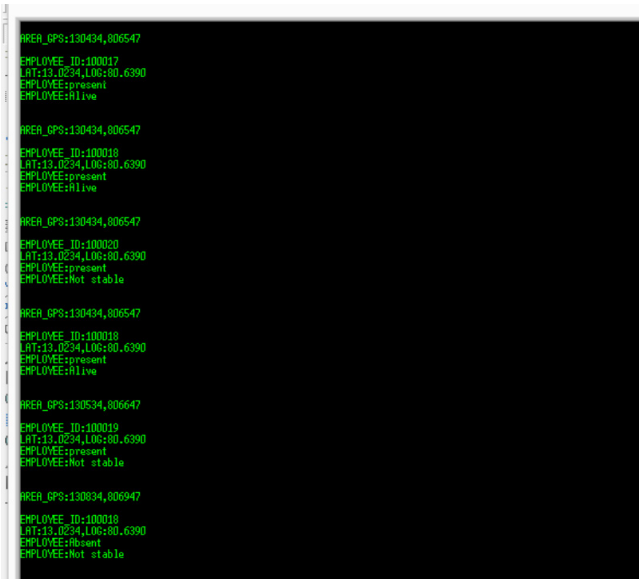

Figure 8. Simulation output.

5. Conclusion

The proposed system assesses the casualty occurred location in urban areas shortly after a building collapse. Under collapsed building the trapped person will be identify by this life detection system using piezoelectric plate. Vibration data from the alive and dead persons will be easily detected or distinguished by using the piezoelectric plate properly.

Vibration created from the plate from the victims under debris can be detected. The longitude and latitude position of the victim under rubble is also identified by GPS. This proposed method proves to be an efficient solution and can be implemented with an easy built and doesn't require any skilled labour for its usage. The rescue operation of the workers in the construction field can be improved to a greater extent by using this proposed system.

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