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DETECTION AND MONITORING OF VICTIMS TRAPPED UNDER COLLAPSED BUILDINGS USING WIRELESS COMMUNICATION

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Abstract

The occurrence of building disaster happens with varying frequency across the world. In such a case, survived human beings are often trapped in the cavities created by collapsed building material; thousands of people are killed as a cause of building collapse. It is very important to maximize the chances of detecting trapped persons in collapsed buildings. Our designed system with the meteoric embedded systems along with microcontroller is preventing deaths and providing safely guided measures. A new sensitive piezoelectric plate system which is used to locate and obtain valuable information regarding human subjects which are trapped under collapsed building has been developed. The proposed system can remotely detect the vibration of human beings trapped survivors of collapsed buildings. By proper processing of these data, the status of the person under the trap can easily judge that they are alive or not. Our aim is to save the human by disaster management system (DMS) from the disaster. In the present proposed method we use a piezoelectric plate to sense the vibration created by trapped person in disaster area so the microcontroller connected is to collect the data and sent the data to the data collecting unit (DCU) by using Wireless transmission. Then the data collecting unit gives an alert signal to the rescue team. It helps the rescue teams to identify the alive people.

Keywords: Piezoelectric plate, PIC Microcontroller, RFM Transmission, GPS, .Net Monitoring.

I. Introduction

Disasters are highly disruptive events that cause suffering, deprivation, hardship, injury and even death, as a result of direct injury, disease, and the partial or total destruction of critical infrastructure such as homes, hospitals, and other buildings, roads, bridges, power lines, etc. Disasters can be caused by naturally occurring events such as earthquakes,

hurricanes, flooding, or they can be due to man-made events, either accidental or deliberately caused. Collapse of man-made structures, such as buildings and bridges, occur with varying frequency across the world. Common cause of such collapses is overload due to faulty construction, faulty design, fire, gas explosions, terrorist acts, but the single most common and devastating cause of collapse of man-made structures is earthquake. Certain types of natural disasters are more likely to occur in particular parts of the world. However, most every place you could live is prone to one type of natural disaster or another. No place is absolutely safe from natural disaster. And, of course it goes without saying, that no place is safe from the threat of terrorism and other man-made disaster events [3, 13].

The problem of rescuing people trapped in collapsed buildings does not have an ultimate technical solution that would guarantee efficient detection and localization of victims. The main techniques in use are: Feeding a camera on the end of a flexible pole into the collapsed building - this shows where people are and how much of the building's structure is left, (the usability of such devices and their efficiency depend on the structure of collapsed building and besides, when the victim is detected it is difficult in the most cases to determine its actual position). Sledge hammers are used to give a signal to potential victims, and rescuers also use sound location devices connected to a microphone system; the device bangs on the rubble three times and if people tap back or call out for help, they can be tracked and assisted (the main limitation of this method is that unconscious people cannot be detected.

Localization of victims is a problem as well) [1].Trained sniffer dogs are deployed in the disaster area. They detect presence of victims efficiently by smell, but information about their actual positions or quantity cannot be indicated. Moreover, dog is likely to indicate the presence of dead person which distracts rescuers from locations where alive people can still be found [7].

A new revolutionary piezoelectric plate system, which is used to locate human beings trapped survivors under collapsed buildings, has been designed. The proposed system can remotely detect the vibration of human beings trapped survivors under collapsed buildings.

The vibration data from the person's body is properly distinguished, so the person alive can be detected. By proper processing of these data, the status of the person under trap can be easily judged. Thus a person under debris can be identified. The location of the person under the rubble can be detected by using GPS.The proposed method is an efficient method for identification of people in a given area.

II. Related Works

Ashutosh Gupta et al. have suggested that an infrared ray is used to detect the human body, it emits the ray to human and reflected temperature from the human can be deducted by the IR. No accurate detection results with transparent or bright colored materials.

IR distance detection sensor for solid-state and gas are two different units. Detection accuracy loss with increasing the reflection distance. Due to the differences in weather conditions the detection results may change [1]. Chen. K. M et al. proposed that when a microwave beam of appropriate frequency is aimed at a pile of earthquake rubble covering a human subject or illuminated through a barrier obstructing a human subject, the microwave beam can penetrate the rubble or the barrier to reach the human subject is the concept [2].

David W Paglieroni et al. described that the GPR is used to find the Object, the GPR is placed in the moving vehicle and it deducts the object and the captured object can be converted into 3D image by digital image processing. In this system they are finding only the objects, if we use this system in collapsed buildings means, it denotes the objects and gives intimation to us. So this is difficult to save the human's life [4]. Vijayaragavan S P et al. developed the human deducting robot for earthquake rescue operation, by using Wireless Camera, sensing the affected area, and give information to Zigbee (Transceiver) which is used to deduct the human and pass the signal to control room. In this system they are focusing only the surface and do not deduct the persons in depth. Here they are using camera for deduction purpose by Battery, it will not support for long time [12].

III. Materials and Methods

The prime objective of the proposed system is to enable rescue teams to perform a quick survey of the disaster site, detecting people trapped in the ruins so as to plan the subsequent rescue operations in the quickest and most effective way. This section includes detail description of block diagram of detection of human beings under building rubble.

The detecting unit consists of a piezoelectric plate which senses the minute vibrations from the subject pulse, the signal conditioning unit, microcontroller, MAX 232, RFM Transmitter and GPS [14].

3.1 Signal conditioning unit:

The signal conditioning unit accepts input signals from the piezoelectric plate and gives a conditioned output of 05V DC corresponding to the entire range of each parameter. Operations performed in signal conducting unit are filtering,

amplifying and isolation.

It is primarily utilized for data acquisition, in which sensor signals must be normalized and filtered to levels suitable for analog-to-digital conversion so they can be read by computerized devices. Signal amplification performs two important functions: increases the resolution of the imputed signal, and increases its signal-to-noise ratio. Signal isolation must be used in order to pass the signal from the source to the measurement device without a physical connection: it is often used to isolate possible sources of signal perturbations [9, 14].
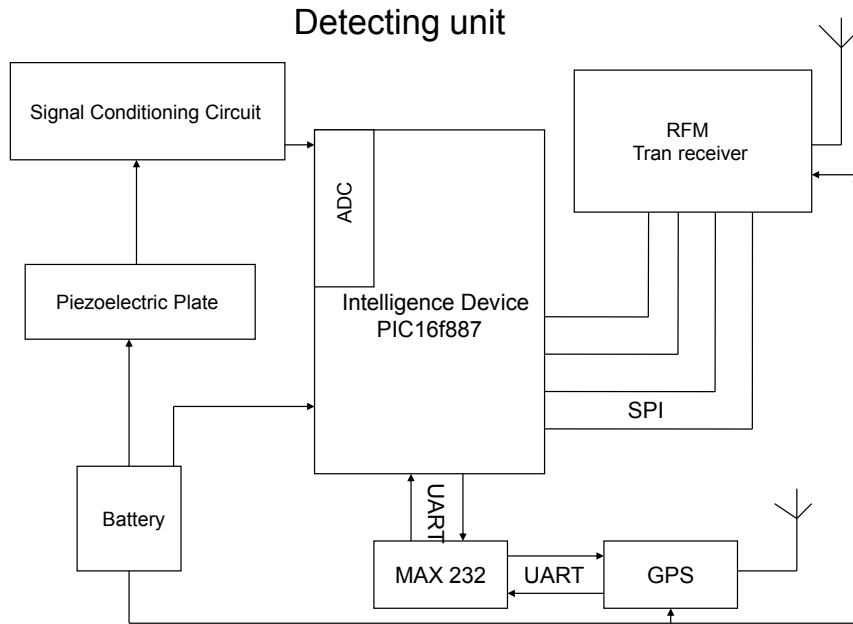
Fig. 1: Detecting Unit.
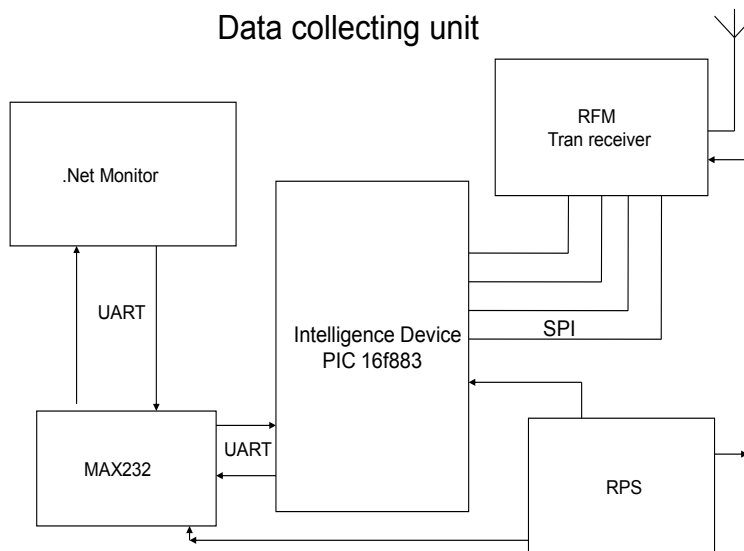
Fig. 2: Data Collecting Unit.

3.2 Piezo Electric Plate:

The basic principle used in this setup is piezoelectricity. It is a phenomenon of internal accumulation of charge in crystals in response to external mechanical force applied on it. The material used in piezoelectric element is lead zirconate crystal. These crystals generate measurable piezoelectricity when they are deformed, about 0.1% of their original dimensions. These crystals readily release the current when the orientation of crystal is disturbed by mechanical vibrations. The piezo element can detect slightest vibrations to make it useful to detect Seismic waves Useful, cheap and can be used for many applications.

3.3 Microcontroller:

The microcontroller is the heart of the power saving unit, which get the data from signal conditioning unit, sensor and drive the control circuit. It is an integrated chip that is often part of an embedded system. The microcontroller includes a CPU RAM, ROM, I/O ports and timers like a standard computer but they are designed to execute only a single specific task to control a single system they are much smaller and simplified so that they can include all the functions required on a single chip. FLASH memory is the most recently developed. Methodology that is used in PIC16F877 is flash technology, so that data is maintained even when the power is switched off. Easy Programming and removing are other features of PIC 16F877 [14].

3.4 MAX232:

The MAX232 is an IC that converts signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits. The MAX232 is a dual driver/receiver and typically converts the RX, TX, CTS and RTS signals. The drivers provide RS-232 voltage level outputs (approx. ± 7.5 V) from a single + 5 V supply via on-chip charge pumps and external capacitors.

This makes it useful for implementing RS-232 in devices that otherwise do not need any voltages outside the 0 V to + 5 V range, as power supply design does not need to be made more complicated just for driving the RS-232 in this case. The receivers reduce RS-232 inputs (which may be as high as ± 25 V), to standard 5 V TTL levels. These receivers have a typical threshold of 1.3 V, and a typical hysteresis of 0.5 V [11].

3.5 RFM Trans Receiver (Radio frequency module):

RFM73 is a low-power, high-speed FSK/GFSK transceiver module specifically operating in the world wide ISM

frequency band at 2400 - 2483.5 MHz It can be widely applied in various wireless connections in daily life or activities, and it is very easy to use and interface with Microcontrollers via SPI bus. RFM73 operates in either as a transmitter or as a receiver.

A transmitter and a receiver must be programmed with the same RF channel frequency to be able to communicate with each other. The output power of RFM73 is set by the RF_PWR bits in the RF_SETUP register. The RF channel frequency determines the center of the channel used by RFM73 [10].

3.6 Global Positioning System (GPS):

The Global Positioning System (GPS) is a satellite based navigation system that can be used to locate positions anywhere on earth; it consists of satellites, control and monitor stations, and receivers. GPS receivers take information transmitted from the satellites and uses triangulation to calculate a user's exact location. 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 [5].

3.7 Regulated Power Supply (RPS):

Almost all electronic devices used in electronic circuits need a dc source of power to operate. The source of dc power is used to establish the dc operating points (Q-points) for the passive and active electronic devices incorporated in the system. The dc power supply is typically connected to each and every stage in an electronic system. It means that the single requirement common to all phases of electronics is the need for a supply of dc power. The combination of a transformer, a rectifier and a filter constitutes an ordinary dc power supply, also called an unregulated power supply [6].

3.8 Simulation Tool:

NET MONITOR is used for window application. Proteus 7.0 is a Virtual System Modeling (VSM) that combines circuit simulation, animated components and microprocessor models to co-simulate the complete microcontroller based designs. This is the perfect tool for engineers to test their microcontroller designs before constructing a physical prototype in real time [8].

IV. Results and Discussion

The detecting unit consists of a piezoelectric plate which senses the minute vibrations from the subject pulse and detect the data and by processing through microcontroller the data is send to the data collecting unit. The detecting unit and the

data collecting unit are displayed in figure 3 and figure 4.This data collecting unit collects the data through RFM73 which is a wireless communication and the accurate location of the subject is seen on the screen.

The processing of inputs and output generation is in accordance with the programming of the microcontroller to take input and generate outputs. The microcontroller is programmed in arduino compiler using C logic. The output data such as the person status whether dead or alive and also the longitude and latitude values are displayed on the .Net monitor using the .Net software. The status and the location of the person is shown in Figure 5.
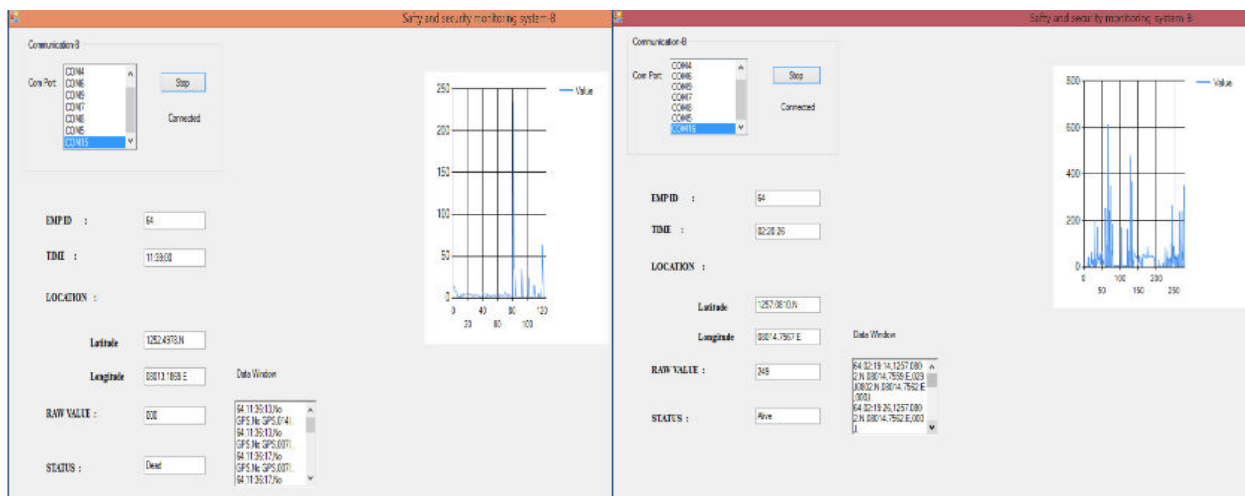
Hardware Prototype:
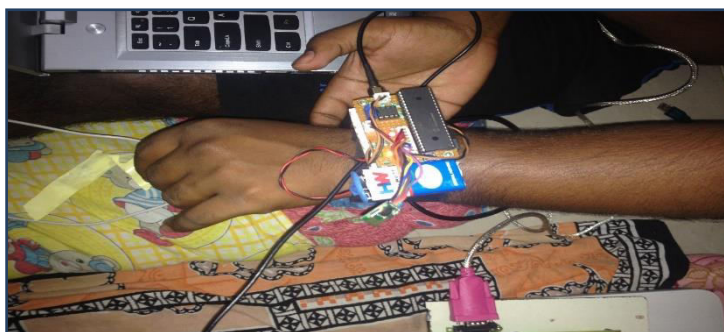
Fig. 3: Detecting Unit.

Fig. 4: Data Collecting Unit.

Fig. 5: Output screen showing the status and location.

V. Conclusion

In this paper a new approach is proposed to assess the casualty situation in urban areas shortly after building collapse. It is a new sensitive life detection system using piezoelectric plate for locating human beings under collapsed buildings. The vibration data from the person's body is properly distinguished by the piezoelectric plate, so that the person is alive or dead can be easily detected. By proper processing of these vibration data, the status of the person under trap can be easily identified and the location of the person under the rubble can be detected by using GPS.This proposed method proves to be an efficient solution and can be implemented with an ease of build and doesn't require any skilled labour for its usage. By the advent of this system the world death rate as a cause of natural disaster may decrease to a great extent.

VI. Acknowledgement

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