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HGD: A RESCUE SYSTEM FOR AN ALIVE HUMAN GESTURE DETECTION IN DISASTERS MANAGEMENT-AN EXPERIMENTAL STUDY

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ABSTRACT

With the technology comes the threats and the natural disasters like bomb blasts, landslides, forest fires, floods, earth quakes and children falling into the pit holes/bowels, It is our responsibility to help rescuing people in this type of scenarios at the same time it is difficult to figure out whether the risks taken to rescue people are worth or not. In other words do they turn out to be positive results? To help this, we are proposing an algorithmic idea to avoid this ambiguity so that they can go ahead and rescue people in much better way. In our algorithm we are making use of wireless technology concepts specific to sensor networks. Here we are using specialized sensors to conclude a particular body is human body and is it dead or alive based on which we can assist rescue team to act accordingly at appropriate location with the help of GPS. The sensor networks are deployed at the disaster area and sensors are operated to figure out the required responses.

Keywords: rescue system, PIR sensors, XBee communication, wireless sensor networks, Arduino board.

INTRODUCTION

Background

Wireless sensor networks is a type of adhoc network with large number of sensor deployed in a particular region which are self-organized and self-configured. They form the clustering among themselves work individually and together to pass the sensed information to the base station. They have limited battery supply and also sensors are built to regenerate power themselves and charge themselves on their own periodically. They can be programmed to suit the user requirements.

Problem statement

These days, the quantity of calamities happened and the individuals influenced have been expanding. Consistently, daily papers report new fiascos around the globe. Instantly after the event of a fiasco, the people on call go to the influenced district to protect individuals and tackle possible issues. These territories offer numerous perils to the salvage group. Besides, the correspondence system base has ordinarily been devastated. Thus, it is imperative to make a structure to sense natural information to recognize perils. This structure needs to be free, simple conveyed and adjusted to diverse circumstances. This paper introduces a vitality proficient instrument for handling spatial inquiries on wireless sensor systems to identify perils in catastrophe circumstances. This paper lets you know how wireless sensor technology can be utilized as a part of calamity administration when an infant or a creature is stuck in a passage or a shallow range.

Importance

Importance of our project is to minimize the death rate in disasters. In one way we are challenging the life of a person or a baby. This project is real time and helps rescue team take appropriate decisions based on the findings that are found by our project. It just simplifies the job of the rescue team and also helps them accelerate their job to rescue the victims.

Rest of the paper is categorized as follows with section 2 discussing the few of the related works followed by discussing the proposed architecture in section 3. Section 4 discusses results and analysis. Final conclusion and future enhancements are discussed in section 5 and 6 respectively.

LITERATURE SURVEY

When we hear the word disaster we know that it's something huge and worst. The form of disasters is many it could be through land, water and air as well. The disasters thorough land include earthquakes, landslides, forest fires, road accidents, train accidents, babies falling into empty long pits/bore wells. Disasters through water include tsunamis and flooding. The plane crash falls in disasters through air. It's always the nature when we think of disaster and the control or the operation is not in human hands. What we could do is reduce the worsen effect. With the aim of that came many techniques, proposals, methodologies, tools in the literature. Let us see few such techniques from the past that try and prevent the disasters if not manage the rescues better whenever the disaster is at place and see to it that the effect does not go from bad to worse.

Landslide detection using WSN - wireless sensor networks

Landslides are one of the major concerns of the people who live in hill stations. Landslide can be described as the fall of rocks, stones all of sudden from top of the hill rolling downwards. It occurs due to changes in the tropical layer of soil. We have landslide detection techniques which work on monitoring the changes in the

soil with the help of sensors or camera and detect them whenever they occur.

Let us see a landslide detection technique proposed by [1, 10 and 11] where wireless sensor technology is being used in monitoring and detecting the landslides. They focus on non-geodetic techniques and instrumentation monitoring to detect the landslide. Here they are performing lab trial with the help of wireless sensor networks in integration with several other sensors. The key factor they use to detect landslide here is to monitor the slope instability that occur due to pore pressure or dielectric movements and also due occurrence of slight movements in soil with the use of sensor networks. The lab trail has 2 layer approach where lower layer collect data from sensors and these packets of data are sent to the upper layer, now upper layer groups this data and transfer it to gateway i.e. sink node. The nodes use ZigBee component for wireless communication. Now gateway sends an SMS to area that is prone to landslides and the people get evacuated from that place and reduce the disaster by a better margin.

Microcontroller (MC) based Earthquake detection using sensor element

With the technology, the nature gets disturbed and things get worsen. We can see the increase of global warming day by day which is burning the filter layers of atmosphere. This is allowing excess heat from sun in the earth. Now when this gets more and more give rise to earthquake which ends up with a massive disaster. We can see Earthquakes are very frequent these days. It's a surprise to few geographical locations but there are places of Japan which are frequently prone to earthquakes they know that they will receive an earthquake very soon. We cannot prevent the earthquakes as it is a natural phenomenon and as researches we can at least think of detecting it before it reaches the people or hits so that we can save some lives and minimize the worsening effect.

Let us see an earthquake detection technique proposed by [2, 13, 14] where they use piezoelectric effect which can be described as an effect which occurs whenever the stress is applied mechanically on some particular materials. For this they use 8 Mega Atmel microcontroller having AVR RISCC architecture. Along with this they use piezoelectric transducer as a sensing element which transforms physical quantity into electrical quantity and works on piezoelectric effect. Few piezoelectric elements include barium Titanate, Rochelle salts, Quartz crystals. As piezoelectric crystals are used because they are very sensitive to vibration and they can convert the physical quantity i.e. earths vibrations in to electrical quantity. Now these crystals are placed in earthquake prone areas and whenever there is a vibration in the seismic layer of earth, the crystal captures it and converts it to electric quantity and compares it with the threshold values, if it is greater, then signal is sent to amplifier for amplification after which the signal is sent to microcontroller. Now microcontroller immediately fires an emergency SMS to base station to try and survive lives.

Robotic system to detect alive human body and rescue

We might have seen the disaster locations you just can't believe if it was the same place before. The things are totally messed up. It is very difficult to locate things in such a messed up thing and it does take quite a few time to rearrange things or get the place to normal state. Now think of scenario where the disaster is hit and we have rescue team in place. The things are mixed up and it's difficult to identify what is what. Now how should the rescue team operate, they know that there are people who are still alive and screaming for help. Now we as a research should device methods to detect such bodies immediately and shift them to first-aid.

Let us see an alive human body detection technique proposed by [3, 8, 9] where they use sensor technology in specific they utilize the functions of PIR sensor and Image processing. Here the RF transmitters are used to transmit the information received from the sensors to the base station. Cameras are used to locate person with image processing techniques for face recongnization. So the working is like they start the PIR sensors at the disaster place, whenever there is any movement in the disaster place the PIR sensor senses it and the same is transferred to receiver i.e. rescue team using RF transmitter. Now they start the next level of operation that is by starting the camera and looking for human faces at the places where sensor has sensed some motion. If the system succeeds in finding a face that is in motion then they conclude as an alive human or else as dead.

Detection of forest fires

Forests provide wildlife to the animals and shelter too few people. It does ads to the beauty of nature making it look attractive, keeps the environment calm. Its human kind responsibility to preserve the forest. We know that there are strict laws being adopted for misusing the forest resources or destroying the forest. The truth is however the man protects the forest, there are environmental calamities which are out of our reach and that can rise to destruction of forest. Forest fires include to this category. Now with the technology we can at least save some wildlife by detecting these fires as early as possible and take the necessary actions.

Let us see a an Forest Fires detection technique proposed by [4, 12, 15] where they use wireless sensor technologies including few temperature sensors, GPS module, antennas and small scale satellites in detecting these fires and acting accordingly. They make use of temperature sensors to monitor for fires on loop to detect the temperature rise that happens whenever the forest fires occur. Now this information has to be transferred to nearest rescue teams. We know that the forests are remote areas and it is difficult to communicate. So these researches use antennas, there are 2 antennas one is main antenna that receives data (temperature rise information) from primary sensors. Now it has GPS module enabled to let the rescue team know where it has occurred and also it is useful to search for a nearest rescue team and send the information to it using the small satellites and then rescue operation is in place to take necessary actions.

Detection of Tsunamis - Wireless sensor networks

Sea is one of the resources of energy, which is produced with the help of tides or waves. The energy being called tidal energy and is made use in lot of domestic application or generating electricity and all. The strong waves will obviously accelerate the energy production but when these waves get wilder, it causes an enormous disaster and damage to the mankind. This happens due to underground earthquakes in the middle of the ocean and this is termed Tsunami. The earthquakes that hit underground starts generating strong waves which accelerate towards sea shore hitting the surrounding radius of 30 to 40 km at the speed of 800kmph which takes lakhs of people with it. It is very difficult to survive even though you know that you are going to be hit by it as the waves are very strong and wild. Researchers have thought of minimizing the death rates of people in these disasters by early detection of underground earthquakes and helping the people of disaster prone radius with alerts to try and move them to places that are above the sea level.

Let us see a tsunamis detection technique proposed by [5, 6 and 7] where they use BPR i.e. bottom pressure recorders so that real time tsunamis can be detected. These BPRs make use of Genetic algorithm and wind weather forecasting. Here first the amplitudes of pressure fluctuations within the frequency band of tsunamis is estimated and these amplitudes are tested against the threshold value. The amplitudes are then calculated by subtracting the predicted pressures recorded in the observations and this computation is done whenever the predicted pressures match the tides with lower frequency fluctuations. Suppose the amplitudes cross certain threshold then there is a device 'tsunameter' that triggers the detailed information about tsunami to the public or the rescue team.

These are few of the techniques how researches have been fighting against disasters and in our paper we consider a specific scenario of disaster where we can see there are so many empty bore wells which are left open when they generate no more water. So when certain animals or babies while playing fall into that pit, rescue is very big thing as the depth so high and it's very difficult even to get the status of the baby who has fell into the well. So we come up with an approach which uses wireless technology in specific few specialized sensors like temperature sensor, Infrared sensor and breathe sensors and conclude baby is dead or alive so that rescue team can proceed accordingly.

2. PROPOSED WORK

We have proposed a system for immediate rescue operations in disasters and it performs all the pre requisites before starting the rescue operations by the trained rescue team that will help the team take appropriate decisions and make accurate planning's. The pre requisites are like collecting the information about victims are they making any movements, are they alive or dead, is the victim a human or an animal, where exactly is the victim located in a large disaster place and is he or she alive or dead what the possibilities we can save him or her. Is the rescue operations save the person life is all what our system going to collect and help the rescue team to perform their job in a better way.

The proposed approach has 3 main modules

a) Sensing module
b) Communication module
c) Processing and results module

Sensing module

This is our input module which consists of Arduino Board, PIR Sensors. Here PIR Sensors are connected to the Arduino board as shown in the circuit below. PIR Sensors take the input from battery where the voltage is supplied by connecting left most pin of sensor to VCC. Sensors recognizes the input by the embedded code that was written and burnt into the Arduino Board using Arduino IDE (Integrated Development Tool Kit)

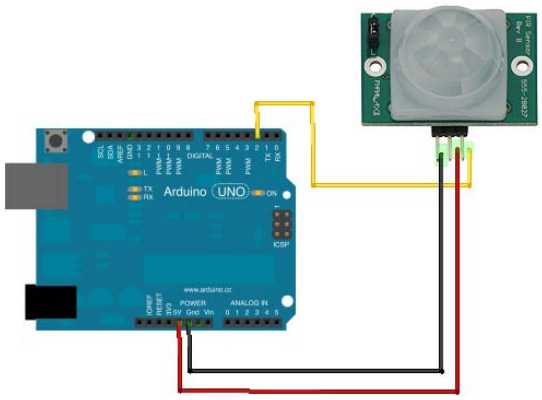

Figure-1. Circuit connection PIR sensor to Arduino.

Working of PIR Sensors

PIR Sensors when thrown into the disasters place, it starts sensing for thermal radiations that are generated when a live human makes any body movements. The PIR Sensor is put into sensing mode and proper power and voltage inputs are provided on which it goes on sensing and whenever it finds a thermal radiation or the body movement the same in sent as a information to the base station.

In our project we are throwing these sensors in to the pit holes or the bore well whenever the baby is struck inside the pit. If the baby is conscious and making movements the same are immediately detected by the sensors and informs to the base station using wireless communication.

This module also uses temperature sensors and breathing sensors which refines the results to the further level where we know that the live human body temperature differs from the dead human body temperature. Temperature sensors find the skin temperature of the baby that is stuck in the pit hole. Temperature sensors we are using in particular or Infrared Thermometer Sensors.

Breathing sensors add accuracy to our results which confidently detects the whether the baby is breathing or not on which we can conclude whether the baby is alive or dead. Breathing sensors are helpful because we get the accurate results whenever the baby is unconscious.

Communication module

We now have the sensed information which has to be sent to the base station which is 300 to 400 feet above. The communication has to be wireless and we are using XBee module to achieve the same.

XBee Module consists of XBee transmitter and XBee Receiver. XBee transmitter is embedded with the sensors and left into the pit hole. XBee transmitter is configured using Arduino Board to transmit the sensed information immediately and periodically.

XBee Transmitter send the information and the same is transmitted to the XBee Receiver which is on the ground acting as a base station.

Processing and Results module

This module consists of receiving the sensed information from the communication module i.e. the XBee receiver now this receiver is again programmed through Arduino Board to use the results as input glowing the LED bulb or sound a buzzer if the baby is alive or just keep the status idle or waiting till we get the positive results or we wait till the timeout after which further actions could be carried out. It is also connected to the central system where we can display the exact temperature recorded and the intensity of breathing if we are using temperature and breathing sensors also.

Architecture diagram of the proposed architecture

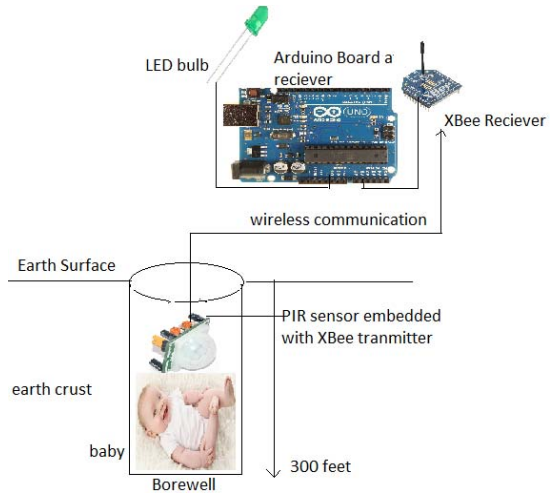

Figure-2. High level architecture diagram.

Here the PIR sensors are thrown into the pit which are embedded with the transmission and power module they sense for the baby s status and send the information to the receiver on the ground.

Flow diagram of the project

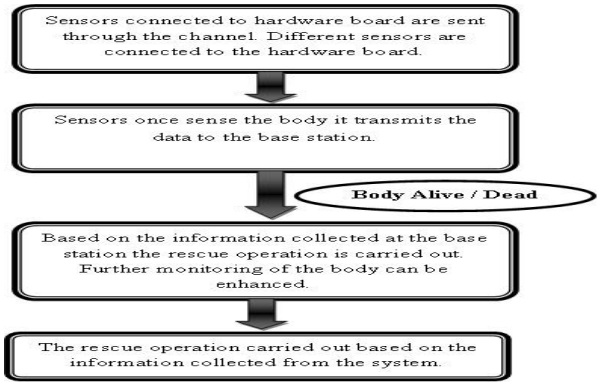

Figure-3. The data flow diagram for the disaster monitoring.

RESULT AND DISCUSSIONS

We have implemented our proposed algorithm and we have got the results as expected. We are able to see that whenever there is movement made we are able to see the LED blinking and even the same is communicated to XBee receiver within the range of 5 meters from XBee transmitter. Below are Figures of same.

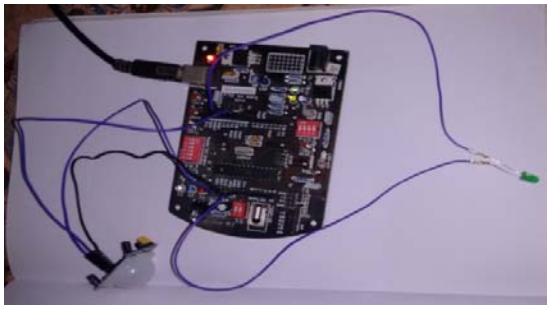

Figure-4. PIR Sensor circuit before movement.

This Figure is the circuit showing the initial connections where the PIR sensor is connected to the Arduino Board.

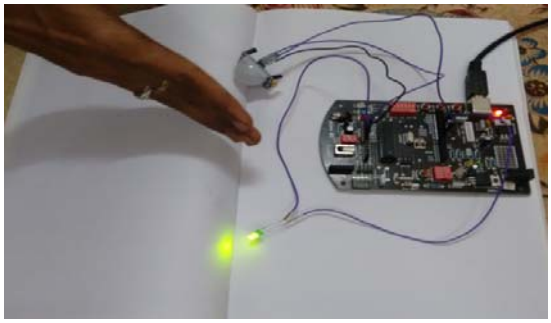

Figure-5. PIR Sensor circuit after movement.

This Figure is the circuit showing the output by blinking a LED whenever the body or the hand movement

is made near to the sensing area of the sensor that is the semi circumference of the PIR sensor.

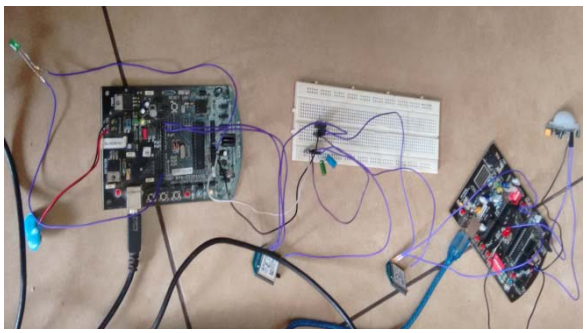

Figure-6. Sensor circuit embedded with XBee module.

This Figure is the circuit showing connections of PIR sensors with both the XBee modules and where the output generated at one end is transmitted to the base station or the receiver separated by a 5 meters distance and on which the LED blinks at the receiver board.

Body temperature sensor simulation data

As part of the implementation process the body temperature sensor data is simulated due to unavailability of the sensor. The sample data is taken in to consideration for the simulation process. The sample graph is plotted with time axis against temperature values. The various temperature values are considered.

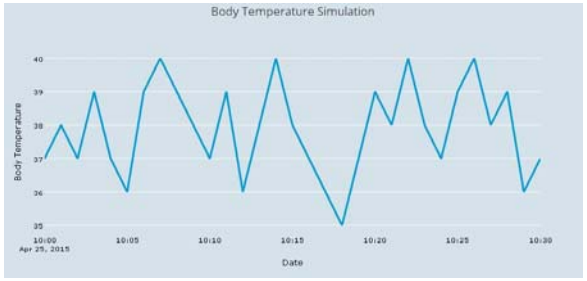

Figure-7. Mock sensor data for body temperature.

Breathing sensor simulation

Human respiration rate can be measured by counting the number of times the chest of a person rises per minute. An optical breath rate sensor is used to measure the same in case of monitoring patients during MRI (magnetic resonance imaging) scan. A noticeable phenomenon is this respiration rate increases with illness, fever and other medical conditions.

The average respiratory rates of different age group are as below:

From Birth to till 6 weeks: 30 to 60 births per min (bpm)

a) Age of 6 months: 25 to 40 bpm
b) Age of 3 years: 20 to 30 bpm
c) Age of 6 years: 18 to 25 bpm
d) Age of 10 years: 12 to 15 bpm
e) Age of Adults: 16 to 20 bpm
f) Age of Elderly people ≥ 65 years old: 12 to 28 bpm
g) Age of Elderly ≥ 80 years old: 10 to 30 bpm

Simulation is carried out between person normal breathing and difficulty breathing. The innermost graph indicates the normal respiration and outermost graph exhibits the difficulty breathing. The inhale of oxygen and exhale of carbon-dioxide can be measured using ppm (parts per million). The below diagram depicts the simulation result.

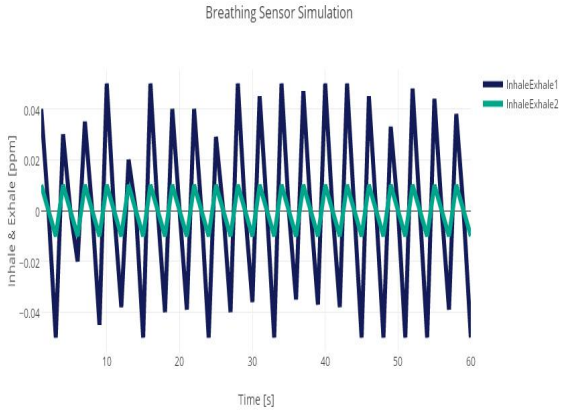

Figure-8. Breathing sensor simulation data.

CONCLUSIONS

The results show that the sensors are working properly and the PIR sensors are very helpful in detecting the body movements and recognizing the thermal radiations generated by human beings. Further to this the simulation from temperature results helped refining our results to the next level which actually records the temperature of the baby that is in the pit and the recorded temperature of the baby is measured with the normal human body temperature to confirm if the baby is alive or dead. This system saves the time and resources of rescue system by a great extent and also achieves minimal death rates in the disastrous places.

FUTURE WORK

Our project is limited to small scale where we have restricted ourselves to the condition that apply only to our application or the scenario when a baby falls into the pit hole and we just detect whether it is alive or not with the help of various sensors beginning with PIR, temperature and breathing sensors. This can be enhanced to large scale disasters like Nepal earthquake that hit recently with massive 7.9 rector map scaling where thousands of people died and majority of them did not get the timely help because it was difficult to find where are the actual victims? Are they alive? Due to which the rescue team could contribute a little. We can enhance this project to fit into this type of scenarios by embedding certain cameras, GPS modules to check the location of victims, deploying large number of breathing, temperature

and PIR sensors so that the percentage of disaster is minimized and death rates are reduced.

With the current work, we are able to detect the baby is alive if it is playing or making movements but if it is sleeping or unconscious then it is alive but it hardly makes any movements, at this situations we can enhance our project to include actual breathing sensors which conform further to this about the baby is alive or dead in the pit hole or bore well.

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