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Effectually Global Position Finding Of Accident Detection Using Wireless Sensor Network

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Abstract

This paper describes an original idea to detects accidents. The idea has been developed keeping in mind the considerations of cost and compatibility with existing system. The Short Message Service or SMS as it is popularly referred to the hospitals and Ambulance services. The solution offered is the Force-Transducer method in this paper. The victim is assumed to be unconscious and the accident is detected automatically by the mobile phone get the shock signal. The threshold level is set based on data collected from the experiments. One major problem in such design is the technique to find the victim's position if the force caused very high. The Global Positioning System (GPS) is found to be costly comparing to proposed system. So, an unorthodox design using Radio Direction Finders (RDF) and beacon signals is described. The Goniometer or Crossed Loop Antenna is used for this purpose. This reduces cost effectively when compared with the GPS system.

The paper proceeds to suggest an abstract view of the software robot required to perform the Emergency message routing task. It uses a special hierarchical message dispatch system wherein people nearby and more likely to help are contacted. The robot also acts as a proxy to the victim and monitors responses for him and it keep on monitoring is the message is false or not. The proposed system as include, it inform the local government hospital example, In TamilNadu the GH phone number is 108 and finding more than one like two or three victims at a time by using more than one antenna to detect the accident.

Keywords: Monometer, Force transducer, RDF, Beacon signal..

Introduction

There are many factors to be considered when designing like this system. In most of the accidents, the victim becomes unconscious so the message not sends. If the place have people then no problem the will inform about the incident otherwise this system is used to intimate. How is a Emergency signsl transmitted then? Here, many ideas can be implemented. One such solution is described here. The cell phone is fitted with a transducer, which detects shocks. The cell phone automatically transmits the Emergency signal if the shock level goes beyond a certain percentage. The cell phone must not trigger an accidental Emergency signal. To ensure this, the shock level that triggers the Emergency signal must be high enough. Based on the first condition, if the shock level is made very high, then an accident might not be identified at all because the mobile phone may crushed or device is damaged.

Having thus identified the situations in the accident, one needs to understand the actual requirements in each case. They are given below.

The solution requires a software program resident in the mobile phone provider's server, which can transmit the Emergency signals and monitor responses for them

i)Similarly, the solution needs a Positioning System to transmit the victim's where about to others. This has to be a cheap system and should not increase the cell phone receiver's cost greatly.

ii)The solution requires a shock transducer device and decoding circuit to identify the shock and it converts as message signals to hospitals.

iii)The Emergency signal has to be transmitted as soon as possible. So all systems must have a very small time delay. Above all, the new system must fit in with the present system that, there must be no difference in the information received between a user who requests this option and one who does not.

This system can inform to local Government hospitals' ambulance. Each state have different GH phone number it locate it and inform. Example in Our state 108 is for Government hospital like that each state have individual phone numbers.

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Force transducer: This device can detect the force. This can also convert the shock and vibration into messages.

Goniometer: A goniometer is an instrument this can measures an angle or allows an object to be rotated to a precise angular position. This can be used in this system to location identification.

RDF: A radio direction finder (RDF) is a device for finding the direction to a radio source. Due to low frequency propagation characteristic to travel very long distances and "over the horizon", it makes a particularly good navigation system for ships, small boats, and aircraft that might be some distance from their destination (see Radio navigation). The distinct technology Range and Direction Finding was the abbreviation used to describe the predecessor to radar. This RDF is reduces the cost of the system.

Related Works

Wireless sensor network implements computation, sensing, and wireless communication functions Monitoring the state of the environment is an essential task for ensuring safety of people. To date sensor networks or cameras are used for monitoring large areas. The combination of these two types of observers in practice rarely used because of complexity their coordination. In industrial area an operator cannot be located close to the surveyed area because of potential risks to his health. In this case the data gathered by environmental sensors are not always sufficient. For example, temperature and gas concentration cannot give full understanding of the processes that occur on a territory. To address this problem we have introduced video surveillance system in the sensor network. In our scenario the most crucial places which have to be monitored unceasingly are equipped with static sensor nodes. The sensor nodes are usually distributed in the way when they covered large areas. This leads to the appearance of not surveyed gaps between them. To address this problem and close these gaps the mobile robot or vehicle with a mounted sensor node is used. The camera automatically shows the area where environmental parameters became high. The image from a camera is used to confirm that fire occurred at that place. In the case of gas leak an operator can use a picture from the camera to assess accident presence based on secondary features, such as traces of destruction or the appearance of smoke. In the scenario where the sensors data are within normal limits, the camera rotates around its vertical axis and seeks the presence of fire. Increasing of mobile network speed and reducing its cost made it possible to translate video from server directly to mobile devices. So, an operator may monitor the area using both PC and mobile device (smartphone or tablet PC)[1]. Sometimes data could not be gathered in real time and sensor nodes are not always protected from rain and snow [2] or the sensor nodes become useless without wireless communication [3]. Video surveillance systems are one the the most universal ones used in the World. Many approaches were developed to use cameras to help people. Still there are many problems to be solved such as objects overlapping, multiple cameras cooperation, crowd monitoring, and so on. One of demerits of currently used surveillance cameras is the low resolution. To cope with this hardware disadvantage the super-resolution technique is used when it is required to apply the face detection algorithm when a distance between eyes can be less than 5 pixels [4].

Video surveillance systems are used for disaster detection too. There are commercial products which can detect fire in wide area using a camera only [5]. Unfortunately, vision sensors cannot detect transparent gases and do not always see fire behind the trees. Nowadays researchers and companies tend to develop distributed video surveillance systems which give more accurate information but require more expenses [6]. We have previously developed a wireless sensor network which surveys environmental conditions [7]. Our system overcomes some drawbacks of existing networks which were mentioned above. Sensor nodes are protected from snow and rain by a case. Sensor nodes use the mesh network ZigBee standard for communication. All the data are gathered by the server with a MySQL database and distributed via the Internet. Radius, colour, and thickness of circles reflect values of environmental parameters. For example, the higher the gas concentration, the thicker the circle. We have introduced the ways to increase reliability of the sensor network. Communication channel overlapping [8].

Data duplication, releasing a channel in Emergency cases, and other techniques are used. If wireless signal is lost, the sensor node continues to log data to its internal storage to share them later after the communication is restored. As in [9] sensors can be changed to detect different kinds of gases with minor changes in the code of a microcontroller. A pan tilt- zoom (PTZ) camera with fast rotation speed was used in [10].

Rapid and appropriate rescue operations should be taken in the scene when accidents or fires occur. It is very important for such operation that rescue team members constantly communicate with each other in the site, and the base station located

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near the site should be aware of the team members' positions and situations to direct the communicate, and also can enhance the security and work efficiency of rescue teams' performances at the scene[11].

Identifying the Position of the Victim

The problem of knowing where we are has been an interesting and difficult problem through the ages. Years of research have resulted in the Global Positioning System (GPS). This technique uses three satellites and pin points the location by the triangulation process, wherein the user's position is located as the point of intersection of the three circles corresponding to the satellites. Installing such a system is quite simple. But the major constraint here is the cost. A normal hand-held GPS costs around $100 and weighs quit heavy. Minimizing the above apparatus will increase the cost further. This would mean an extra cost of Rs.10000 to Rs.15000 for the Indian user.

The better option would be to wait for a Emergency signal and then identify the victim's position when the accident occurs. This being a faster technique also makes the design process easy and cheap in this system. This being the case, one could make use of certain obvious facts to identify the accidents. They are,

i). The mobile phone with in which the victim is present can be identified easily by the base station. However, this resolution is not enough because the mobile phone cannot be of a huge size.

ii). Accidents are exceptional cases, They occur rarely. Further, the probability of two users in the same cell getting into an accident is detected in proposed system by using more than one Radio Direction Finder fixed in the hospitals two get. One or Two message received from the accident place.

The mobile phone is fitted with a small reflector which reflects this signal as such. This is easily achieved by constructing a mismatched termination in the mobile phone for that frequency. Now, the to and fro travel of the signal introduces a time delay. So, from the signal reflected, the user's distance can be identified by the software program. The information got now gives only the radius of the circle within which the user might be present. This might be too large an area to identify the user even within the cell limits as there is no maximum limit on the cell area. Since we have got the radius, all that is required is to find the angle or direction within which the user might be present. To do this, we use the Radio Direction Finder (RDF) antenna system. This makes use of a highly directional loop antenna to identify the signal source which in this case is the mobile phone.

In order to do this, the mobile phone needs to transmit a microwave signal to the base station. This can be of any frequency that has not been allocated for the existing control frequencies. The base station is then fitted with the Crossed Loop or Goniometer type of direction finder. It has been proved mathematically that the meter points to the direction of the signal source . The user in distress sends out a microwave signal to the base station just as the

Base station sends its beacon signal. From the reflected beacon signal the radius of the victim's position is found in the accident. From the goniometer, the direction is found as well. This

system as assumed above presents a design for two a time user at. To do this a small electronic system, preferably a microcontroller based system maybe used. Such systems are available widely in the market and so there is no point in trying to design one. Thus, the problem of identifying the victim is overcome. Once the victim's location is identified, the base station transmits the Emergency sent by the cell phone along with his coordinates to the main server. The cell phone thus initiates the process and the base station propagates it.

Once the mobile phone send the Emergency message it keep on ringing, that the Emergency signal is send.

The Toy car Experiment

In case the victim becomes unconscious, the system must be able to automatically detect an accident and transmit the Emergency signal automatically. In order to achieve this, a shock transducer is used to measure the jerk experienced through the accident and trigger the Emergency signal circuit if the force level is very high. This system needs statistical data acquisition to find out the exact threshold level of the force in an accident. It is highly expensive to simulate the accident in real time. So, a scaled down experiment is used. Here, a pair of toy cars of mass 200g is made to collide with each other. The force caused by them is measured by simple piezoelectric transducers. The results of this experiment are tabulated below.

As seen from the experiment, the average force acting on a toy car in case of an accident is approximately 1N. For a car measuring 960kg and moving at 70kmph speed, the force will be scaled 18000 times or 18kN. These practical results can be verified by a simple theoretical calculation. A car weighing 960kg decelerates from approximately

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70kmph to 0kmph in 2 seconds in case of an accident. Hence, the force is given by F =ma which is, 960*70*1000/3600 or 18.67kN approximately. This confirms with the scaled down experimental results. However, in a four-wheeler, all of the total force does not act inside the vehicle. As per information got from Mercedes Benz, only 10% of the total force acts inside the car. Thus, the threshold can be set to approximately at 1kN. The scaled down experiment used a cheaper transducer

that does not measure high forces. The transducer required for the actual system costs Rs. 1000 a pair. Based on the statistical data collected above, the approximate threshold level is determined. More accurate results can be determined if the experiments are carried in real time to the exact detail.

In order to ensure that the force calculated above acts on the cell phone, it is essential to place the phone in the stand that normally comes as a standard part of cars. This stand requires a slight modification to provide the cell phone a small moving space so that it is jerked when an accident occurs. The alternate and better solution would be to attach the transducer to some part of the vehicle itself and connect the cell phone to it whenever the user is driving he/her car. This solution would require that the transducer be properly protected.

The problem of finding the position'svictim is now dealt

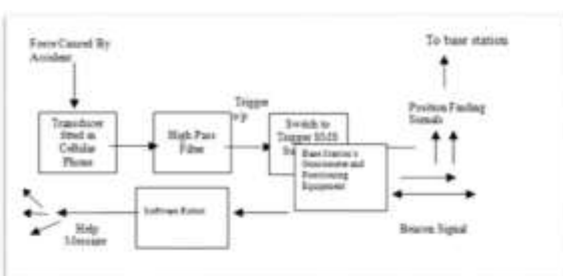

Fig1: Flow diagram of processes

Simulation

The existing system can measure the force up to 18kN. That shown in table 1.The force transducer used in existing is not calculate very high vibration or force caused from accident.

No	Weight of the car	Speed of the car	Sudden force by accident(kN)	No of Detecting(only up to 18kN
1	860	70	16.72222	1
2	960	66	17.6	1
3	860	50	11.94444	1
4	860	80	19.11111	It will not detect

Table 1: Existing system table for detecting force

The table shows it does not calculate the force above 18kN and it can detect one position at a time, if many accident occur at same it will not find. But this situation is very rare. The graph shown in fig 2 existing, Speed of the car in x-axis and the force caused by accident is in the y-axis. It shows 3 points of 18 and below kN.

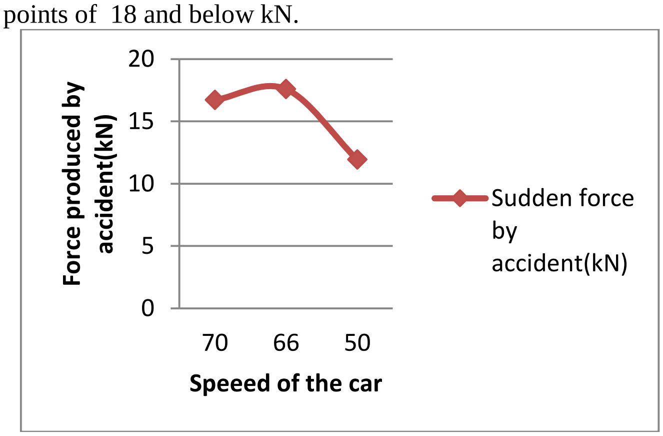

Fig 2: Force detection

No	Weight of the car	Speed of the car	Sudden force by accident(kN)	No of Detecting(only up to 20kN
1	860	70	16.72222	2
2	960	60	16	2
3	860	50	11.94444	2
4	860	80	19.11111	2

Table 2: Proposed system measurements for force

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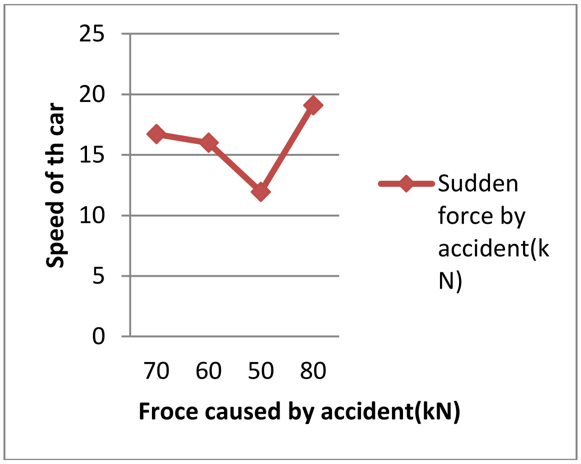

Fig 3: Force detection for proposed system

The transmitted through a Medium Wave receiver to a personal computer. The signal inward is passed through an ADC and received in a C program. This program checks the indicator price and sets a flag variable when it goes beyond a certain level. This flag is frequently checked by a thread of the JAVA front-end. If the flag is set, the program connects to the back-end database and displays a list of users to whom the mock message is sent based on the pecking order explained above. The simulation does not cover the positioning part of the system as that is too expensive to be done on small scale. The screen shot of the Java front-end is shown in the next section.

Conclusion

The system needs comprehensive surveying to decode the position of the user in polar coordinates to actual localities. This however is a one time job. The system does handle multiple victims simultaneously like placing more than one goniometer and Antennas. This system can detect two accident at a time. However, priority can be allocated to users based on the force measured. False alarms are bound to occur in such a system. This can be reduced by ringing the mobile phone every time an Emergency is sent and thereby warning the user. This system as include that it also inform to Local Government Hospitals.

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