IoT Based Emergency Alert System

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Abstract- There is rapid increase in population, due to which associated challenges in safety and health care are also in raise. No proper assurance is given to safety, especially for women. Moreover, elder people in isolation are facing many health issues due to which continuous monitoring is essential. In order to pave path for these issues, a method is proposed which will ensure road safety, women safety as well as elder people safety. On the whole, the major threats and difficulties faced by people will be prevented or solved using this application.

Keywords: IoT, Geo fencing algorithm, sensor, fall detection, safety.

I INTRODUCTION

The personal security of women and elderly people are highly vulnerable in the modern society at different times and venues. Sexual harassments and also other forms of sexual violence are very often in public places such as nearby schools, colleges, parks. This way, the freedom to girls and women is not ensured thereby, preventing them from exploring this competitive world with hidden talents. A wearable smart band is designed which will ensure safety for women during emergencies [4]. Many systems were designed for women's safety of which, a safety system is described in [5]. In addition to this, road safety is not ensured now a days, a certain proportion of which results from untimely treatments and secondary accidents. These accidents need to be prevented before occurring or immediately further action must be taken to rescue the victim. The accidents are detected using different algorithms such as weighted extreme learning algorithm which is explained in [2]. To detect the accidents, the collision of vehicles need to be detected which is done using speed sensors and it is described in [3] . Also, [7] discusses about controlling the speed of the vehicles using accelerometer sensor so that the speed can be controlled. Moreover, the traffic incidents that occurred needs to be classified to find

the severity of the incident. This can be achieved using advanced machine learning and active learning algorithms [12]. Further, the number of elder people living alone at old age homes and the number of single-resident houses are also increasing worldwide. In order to monitor the elder people, their heart beat rate is taken into consideration but many real time heart beat signals contain artifacts that needs to be removed and the buried accurate signals must be recovered which is discussed in [1]. However, the independent life becomes quite difficult for them. The cause of injuries in the elderly people is maximum due to instability that leads to falls. These falls need to be detected using a corresponding device that is handy to use. The falls must be detected efficiently which is discussed in [6]. The general activities of old age people such as their walking speeds are measured which can be used to train the support vector machine and random forests algorithms so that the cognitive impairments were detected earlier [8]. In [9], without any physical contacts with the people, a face-based heart rate evaluation technique is proposed. In [10], the person's front-door events such as entry, exits etc. are classified using an algorithm to prevent dementia. Also, the emergencies occurring with different severities are captured and responded immediately which is described in [11].

The existing systems mentioned above includes few demerits due to which the purpose of those systems were not served as expected. These demerits include unfashionable designs so that the people find it difficult to access those applications with ease. Moreover, the existing applications include facilities like tilts that are done unnoticed due to which the authorities are alerted without necessity. In order to overcome those hurdles, an application is developed which can be accessed by public with ease. This application is can be accessed even to ensure general safety such as road safety and importantly , the elder people living as single residents can lead a healthy life without health issues. The section II describes about the

proposed method which includes wireless alert, the modules used and the algorithm. The section III depicts the results and discussion. Finally, the section IV provides the conclusion

II   PROPOSED METHOD

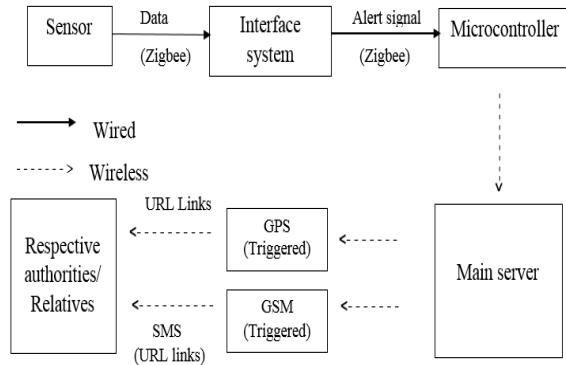### 1.   WIRELESS ALERT THROUGH INTERNET OF THINGS (IOT)

Fig: 1 Block diagram of wireless alerting System

The figure 1 depicts the alert to the respective authorities which is wireless. The problem is detected by the sensor which sends the data to the interface system for the amplification process. The alert signal after amplification will be sent to the microcontroller to proceed with the further action of sending the data to the main server. From the main server, the location, voice and picture of the victim's location will be sent to the respective authorities as URL links via GPS and GSM modules. In the proposed system, the android application includes three sensors for three different purposes. Vibration sensor is used for accident detection, heart beat sensor is used for health monitoring and MEMS sensor is used for fall detection.

Whenever an accident is detected, the vibration sensor will be triggered, if an old age person is suffering from health issues, the heart beat sensor will be triggered and also if the person faints, the MEMS sensor will detect the fall. The sensor's output as values will be interfaced using an interface system. The interface system includes amplification of the output signal. The amplified output will be sent to the PIC microcontroller which will be paired to the sensor using Zig bee. The alert signal is sent to the main server (mobile server) after which the GPS and GSM modules will

be activated. Using GPS, the location will be tracked and sent as URL links to the concerned people of the victim (Hospitals, patrols, relatives, friends, neighbors). Similarly, using GSM, the Short Message Service (SMS) will be sent to the respective authorities with the location of the incident. In case of harassment, the victim's image and recorded voice as URL links will be sent via SMS. The wireless communication plays a major role in sending alert messages to the server and to the respective authorities.
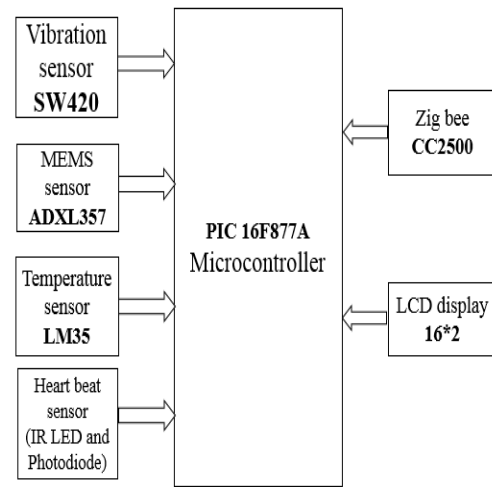

Fig 2: Block diagram of the alerting system

The figure 2 depicts the block diagram of the proposed system to indicate the inputs and output of the design. The components involved in the proposed system are four sensors namely vibration sensor, MEMS sensor, temperature sensor and heart beat sensor. These sensors will play the role of detecting the hurdle faced by the victim. The vibration sensor senses the collisions during accidents, the MEMS sensor detects the fall in case of elderly people and the temperature sensor will sense the abnormal temperatures to treat the victim. The heart beat module is used to detect the abnormal heart beat rates of the victim.

PIC 16F877A

The PIC16F877A is a 40 pin micro controller which is used to implement the programs with ease. It requires an operating voltage of 2 to 5.5 volts. The micro controller supports communication protocol. The output of this controller is the alert signal sent in the form of URL links to the mobile

server. The main merit is its fast performance with less power consumption.

SENSORS

The sensors used in this project are vibration sensor, heart beat sensor and MEMS sensor. These three sensors are used for three different purposes. The vibration sensor to detect the accident, the heart beat sensor to monitor the health condition of old age people and the MEM sensor to detect the fall of a person which will be applied to women's safety. The MEMS sensor is an analog to digital sensor which will be connected to the ADC pin of the micro controller. Its output will include the ADC values which consists of three coordinate angles namely X, Y and Z angles based on which the fall of old people can be detected. The MEMS sensor output along with the output signals of the other two sensors each will be sent to the interface

2. MODULE

ZIGBEE

The Zig bee is a wireless technology which is used to control and monitor the devices with low power consumption at low cost. Its low data rate makes this standard more suitable to handle many devices where data rate of 250 kbps is used for transmission between embedded systems both the ways. Zig bee operate at 2.4 GHZ and also between 902 to 928 MHZ. This project uses zig bee instead of Bluetooth as there is no pairing required with other devices as in Bluetooth so that even other devices can connect to it without un-pairing the existing device.

3. ALGORITHM

GEO FENCING

STEP 1-The algorithm used for the detection of the above mentioned problems is geo fencing algorithm.

STEP 2-It is a location-based application that uses GPS, wireless fidelity and RFID that are preprogrammed in it.

STEP 3-Geo fencing fetches the longitude and latitude values of the location.

STEP 4-The fetched values will be converted as URL links which will be sent via SMS to the respective authorities.

STEP 5-By selecting the received links, the concerned location of the incident will be viewed.

STEP 6- This algorithm is accurate in spotting the location and in fetching the corresponding latitude-longitude values. For example, the latitude of Chennai is 13.0827° N, 80.2707° E.

STEP 7-This value will be displayed which must be selected to view the current location.

STEP 8-Importantly, the geo fencing algorithm is introduced in this project as java codes.

STEP 9-The respective coding is written for this logic to make it fetch the location of the incident.

STEP 10-Hence, the mobile application is developed with the frame work of java.

III   RESULTS AND DISCUSSION

The objective of the project is to ensure safety to all people in general by providing them with an android application so that they can access the facility whenever required. The components used are inexpensive with low power consumption which is the ultimate aim of the project. The uniqueness of the project is that, a single application is developed to ensure road safety, women safety and good health of people.
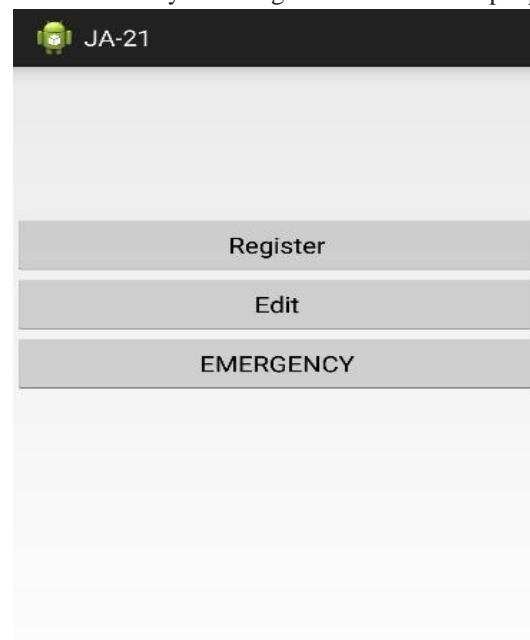

Fig 3: The application with options to register one's details.

The figure 3 indicates the main three options displayed in the application that will enable the user to register their details such as name, guardian name and respective address.

Fig 4: The details of an individual to contact them when required.

The figure 4 depicts the details to be entered by the user such as their guardian's name, guardian's address and their mail address. These details of the individual will help the application to contact the respective authorities during any emergencies such as during accidents or harassments or during any health issues.
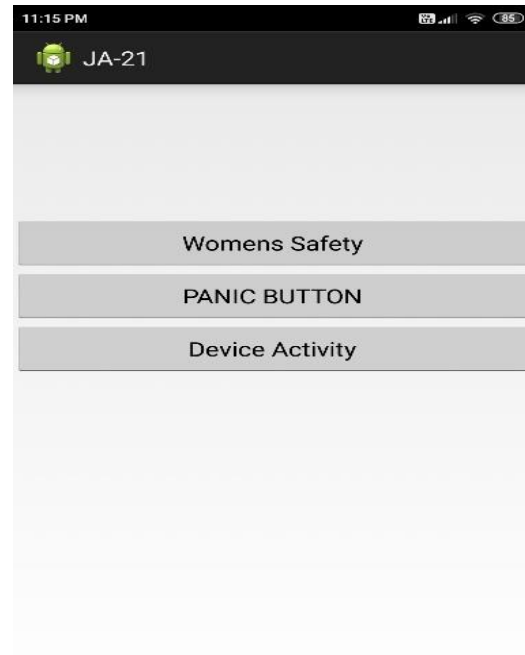

Fig 5: The three access facilities for women, panic button for elder people and during accidents.

The figure 5 represents the options displayed by the application for women to access it in case of any emergencies. By selecting the panic button or the volume down button thrice, the front camera will be enabled so that the picture of the victim will be captured and sent to the respective authorities to draw their attention and to take further actions.

By downloading this application, the public can access it whenever required. This application is not specific for any particular purpose, it can be accessed to ensure safety while driving vehicles, while walking in an isolated place or while residing as a single resident such as in old age homes meant for elder people. The existing applications were designed in order to help women especially during their hard times. By accessing those applications, other people cannot serve their purposes. Applications such as kavalan SOS and Life360 were designed and developed especially for women's safety. The proposed application will serve the purpose of people in general which is the uniqueness of this application

Table 1: Comparison between the proposed application and other safety applications including kavalan SOS.

Purpose	Kavalan SOS and other safety applications	Proposed application
Functionality	Ensures safety especially for women	Ensures women safety, road safety and elder people safety.
Tilt facility	Tilt is sometimes done unnoticed which alerts all the authorities by mistake.	Such discomforts are avoided.

The table 1 depicts the uniqueness of the proposed application over other applications. The difficulties that are faced in few other applications such as unnoticed tilts are overcome in our proposed IoT based emergency alert application.

Table 2: The success rates of the proposed system

Locations	Response time	Percentage of Achievement
Location 1	40 seconds	90%
Location 2	30 seconds	94%
Location 3	35 seconds	92%

The table 2 shows the experimental results of the emergency alert system by alerting the respective authorities during emergencies in case of women or accident detection or of elder people to monitor their health.

IV CONCLUSION

An emergency alert system using IoT has been designed. The proposed system includes three sensors to operate for different purposes such as for road safety, health monitoring of old age people and for women's safety. This module is designed to alert the respective authorities such as patrols, hospitals and relatives during emergencies. These emergencies include accidents, harassments and abnormal health conditions. The system is capable of ensuring safety among public rather than a particular safety such as women safety alone which implies that this alert system can be accessed by everyone in general.

REFERENCES

[1] Liang Zou, Xun Chen, Amir Servati, Saeid Soltanian, Peyman Servati and Z.Jane Wang,"A Blind source separation framework for monitoring heart beat rate using nanofiber-based strain sensors", *IEEE transactions on intelligent transportation system,* vol.16, no.3,pp 762-772,February 1, 2016.

[2] Yuanlong Yu, Miaoxing Xu and Jason Gu,"Vision-based traffic accident detection using sparse spatio-temporal features and weighted extreme learning machine",*IET intelligent transportation system ,*vol.13, no.9,pp 1-12, August 29, 2019.

[3] Luca Canzian, Ugur Demiryurek and Mihaela Van du Schaar,"Collision detection by networked sensors",*IEEE transactions on signal and information processing over networks,* vol.2, no.1,pp 1-15, March 2016.

[4] B. sathyasri, U. Jaishree, T.Pratheeba and K. Ragapriya,"Design and implementation of women safety system based on IOT technology",*International Journal Of Recent Technology and Engineering,* vol.7, no.6S3, pp 177-181, April 2019.

[5] Mr.Vaibhav, Guided assistant professor-Ashish Manusmare, Coguided-assistant professor-Trupti Bhoskar,"A study based on women security system",*International Journal Of Science, Engineering and Technology,* vol. 6, no.8, pp 1241-1243,August 2017.

[6] Changhong Wang, Wei Lu, Michael R.Narayanan, David C. W. Chang, Stephen R. Lord, Stephen J. Redmond, Nigel H. Lovell, "A Low-Power Fall Detector using Triaxial

Accelerometry and Barometric Pressure Sensing", *IEEE Transactions on Industrial Informatics,* vol . 12, no. 6, pp 1-10, December 2016.

[7] K.R.Tharani and A. Jeyapriya,"Autonomous Accident Detection and Information System", *Indian Journal of Science and Technology*, Vol 9, no.25, pp 1-4, July 2016.

[8]Ahmad Akl, Babak Taati, and Alex Mihailidis,"Autonomous Unobtrusive Detection of Mild Cognitive Impairment in Older Adults", *IEEE transactions on biomedical engineering*, vol. 62, no. 5,pp 1383-1394, may 2015.

[9] Duan-Yu Chen, Jun-Jhe Wang, Kuan-Yi Lin, Hen-Hong Chang, Han-Kuei Wu,Yung-Sheng Chen and Suh-Yin Lee," Image Sensor-Based Heart Rate Evaluation From Face Reflectance Using Hilbert–Huang Transform", *IEEE sensors journal*, vol. 15, no. 1, pp 618-627, january 2015.

[10] Tan-hsu tan, munkhjargal gochoo1, fu-rong jean1, shih-chia huang and sy-yen kuo, "Front-Door Event Classification Algorithm for Elderly People Living Alone in Smart House Using Wireless Binary Sensors",*IEEE access*, vol.5, pp 10734-10743, June 27, 2017.

[11] nazeeruddin mohammad , shahabuddin muhammad, abul bashar, and majid a. khan," Formal Analysis of Human-Assisted Smart City Emergency Services", *IEEE access,* vol.7, pp 60376-60388,may 21,2019.

[12] Hoang Nguyen, Chen Cai, Fang Chen," Automatic classification of traffic incident's severity using machine learning approaches", *IET the institution of engineering and technology,* Vol. 11, no.10, pp. 615-623, 2017.