Accident Detection and Alerting System for Two Wheeler and Pedestrians

Pankaj Yadav
Department of CSE
AMC Engineering College
Bangalore, India

Arun Kumar
Asst. Prof. Department of CSE
AMC Engineering College
Bangalore, India

***Abstract*— Nowadays, traffic on roads and highways is increasing day by day. Due this increase in traffic the accidents are also increasing. According to the latest statistics the most number of fatalities are suffered by two wheeler riders or pedestrians. The intention of this paper is to develop an accident detection and alerting system based on pulse sensor that will be in a smart watch. The application of this system is to measure the pulse. The normal pulse rate of a human being is 60 to 100 bpm, now if there is any variation in the normal pulse ,then the system will detect if it is an accident or not. If it is an accident then the system will transmits its GPS location to the nearest hospital or control station. The system will also provide the best route to reach the victim.**

***Keywords*— Accident detection, pulse rate sensor, GPS, Wearable technology, Bluetooth.**

I. INTRODUCTION

The automobile industries has shown a very large growth in recent years. Millions of vehicles are produced and they take the road instantly. But along with these, the rate of accidents are also increasing. According to the report of Ministry of road transport and highway transport research wing (New Delhi), the total number road accidents are increased by 2.5% from 489400 in 2014 to 501423 in 2015.

The total number of person killed in road accident is increased by 4.6% from 139671 to 146133 in 2015. Road accident injuries are also increased by 1.4% from 493474 in 2014 to 500279 in 2015. [4] The severity of person killed per 100 accident has increased form 28.5 in 2014 to 29.1 in 2015. The analysis of road accident data 2015 reveals that about 1374 accidents and 400 death takes place every day on Indian roads.[4] Two wheeler and pedestrians are accounted for highest share in total road accidents and next to it was the share of the group of Cars, Jeeps and Taxies in 2015 as reported by the States/UTS. Share of two wheelers has increased from 26.3% in 2003 to 27.3 in 2014 and 28.8% in 2015 while in case of pedestrians it has increased from 20.6% in 2013 to 23.9% in 2015.[4] Most of these accidents occur due to negligence. Reckless driving and bad infrastructure adds to the accident count. Every second waiting for the help could cost life of the victim. The manual reporting of such incidence is time taking. So in such cases an automatic reporting system is more reliable. The device explained in this paper will reduce the time gap in reporting the occurrence of an accident to the nearest emergency stations or hospitals. The proposed system in the paper will identify the accident location .The physiological parameters such as pulse rate, body temperature and blood pressure will be sent to the nearest hospitals or emergency control center if the system detects any variation in these vital signs.

The device that is explained in this paper based on wearable technology which can be used by pedestrians and two wheeler riders. Though there are already suggestions placed in automobile industries for this technology to be implemented in cars and SUVS for improving safety standards. But this can be used for pedestrians and two wheelers as well, as India has large share of people travelling by two wheelers and on foot. The rest of this paper discuss about the different sections such as working, Algorithm for accident detection and conclusion.

II. WORKING

The modules that will be required for the working of this system are GPS Receiver, Bluetooth module, optical pulse sensing module and a microcontroller.

A. GPS Reciever

One of the sensor that will be used for accident detection is GPS receiver. A GPS receiver is a L_Band radio processor capable of solving navigation algorithm in order to determine user's position. Nowadays GPS technology has become very crucial in find position of a person. In order to achieve accurate position at very low power consumption, a very sensitive GPS module is required. ORG1411 Nano Hornet [5] of OriginGps is used for this purpose. The module is specifically designed for smart watches, wearable, camera. The module tracks all the satellite in a view and provide accurate positioning data. The module provide short startup time which is < 1 hot start [5] and <35 seconds in cold start [5]. The module provide tracking sensitivity of -163 dBm [5] even in urban canyons having limited sky. The module also contains the option of advanced power management (APM) [5]. The APM allows power saving while maintain the Quality of service (QoS) when signal level drops. In APM mode the module is intelligently cycled between full power and hibernate state.

Figure 1.1 NANO HORNET (ORG1411) GPS Module [5]

B. *Bluetooth Module*

Bluetooth is a wireless technology used to transfer data over short distance (using short wavelength UHF – radio waves in the ISM band from 2.4 to 2.485 ghz) from fixed and mobile devices and building personal area network (PAN).The Bluetooth module that we are going to use for this system is SESUB-PAN-T2541 Bluetooth 4.0 LE module by the company TDK. The size of the module is just 4.6mm * 5.6 mm and the slim insertion height of 1.0mm [6]. The new SESUB-PAN-T2541 Bluetooth module is the world's smallest Bluetooth smart device. The device is specifically designed for wearable such as smart watches [6]. The purpose of Bluetooth in the proposed system is to send the data to the connected GSM/GPRS enabled device.

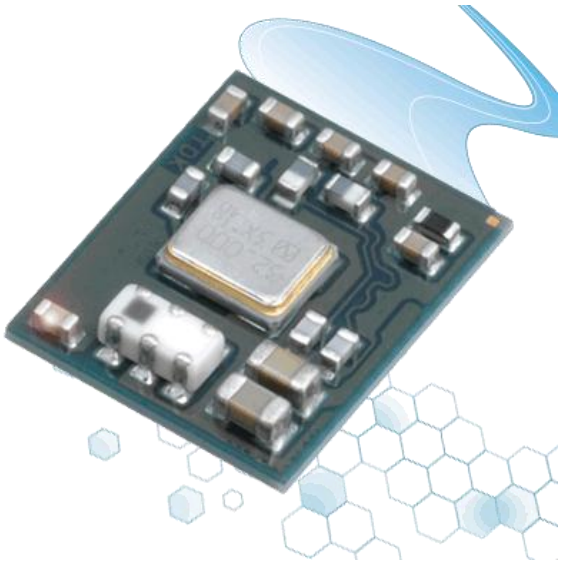

Figure 1.2 SESUB-PAN-T2541 Bluetooth 4.0 LE module [6]

C. *Microcontroller*

A microcontroller is a computer on a single integrated circuit that is used to process the data. In modern technology, it is a system on a chip or SoC. A microcontroller usually contains more than one CPU along with memory with programmable input/output peripheral. A microcontroller (MCU) is the heart of system. The proposed microcontroller for this system will be used is PIC18F4550. The large amount of RAM in the device and enhance flash program memory make it ideal for the proposed system.

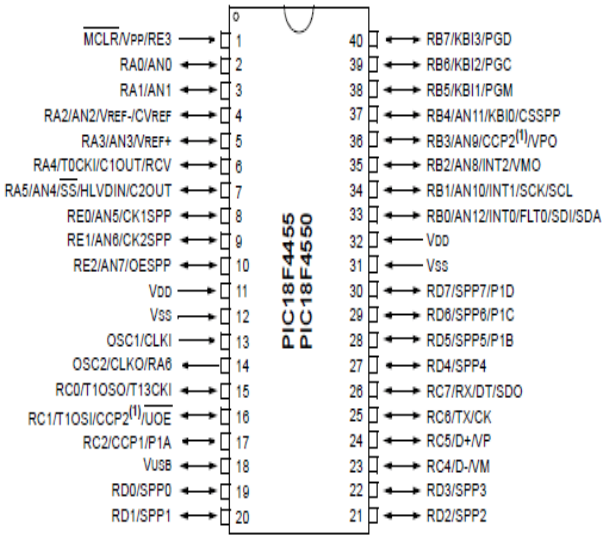

Figure 1.3 PIC18F4550 microcontroller [7]

D.*Optical pulse based sensing module*

Optical pulse rate sensor has been used for detecting pulse and blood pressure via pulse oximetry, a measurement technique that take the advantage of the fact that oxygenated hemoglobin and deoxygenated hemoglobin have different optical properties.[8] With every spike in oxygenated blood which is detected as change the absorbance or reflection of red and or infrared light. The device that will be tied to the wrist to detect the pulse rate and the blood pressure is shown in figure 1.4. The figure 1.5 shows the sketch of pulse oximeter data where x axis is the time and y axis is the reflected optimal power [8]. The same principle can be used to measure oxygenated blood, and many heart rate monitor in wearable claim to this too.

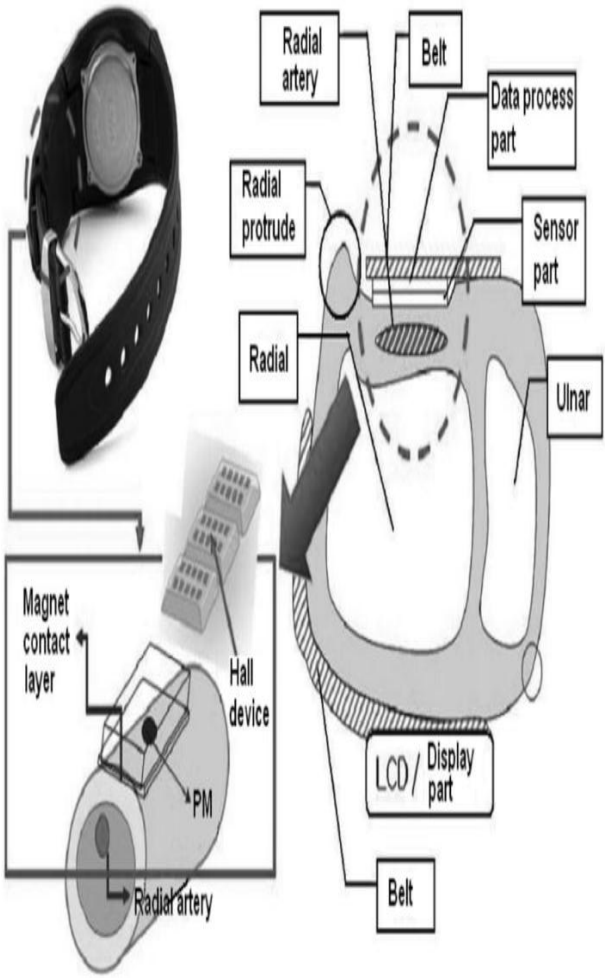

Figure1.4. Wrist wearable arterial pulse meter. [9]

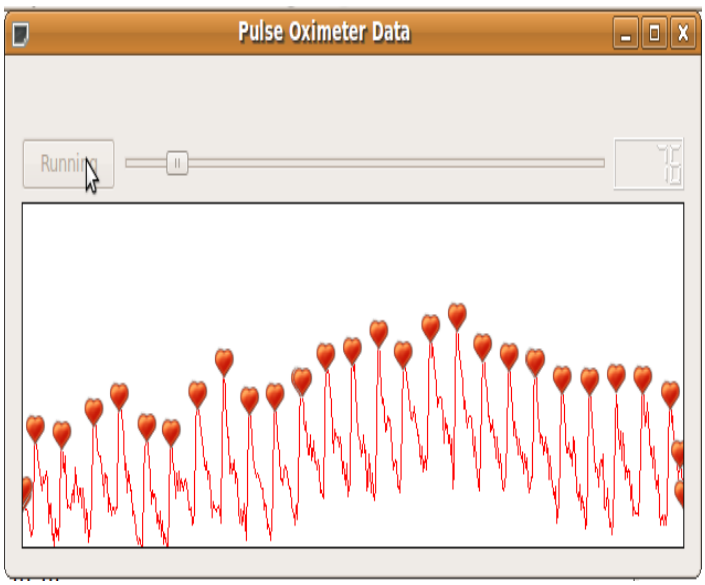

Figure 1.5. Diagram show the sketch of pulse oximeter data.[8]

III. ALGORITHM FOR ACCIDENT DETECTION

According to the medical science. [10] When a human body is subjected to physical trauma, the symptoms of trauma includes increased pulse rate, increased blood pressure, increased cardiac output, increased rate of metabolism, fever, altered mental status. Now the proposed system in this paper will monitor the pulse rate and the blood pressure of the rider/ pedestrian by an optical pulse rate sensor. The data from the pulse rate sensor will be then fed to the microcontroller. The microcontroller will process the GPS co-ordinates and the data from the optical pulse rate sensor .This data will be sent to the mobile application through Bluetooth module that has been implemented in the proposed system. The mobile application will constantly monitor the pulse rate. If it finds any sudden variations in the pulse rate, then the GPS co-ordinates of the person will be sent to the nearest hospital or emergency stations. The flowchart of this algorithm is shown in the figure 1.6..

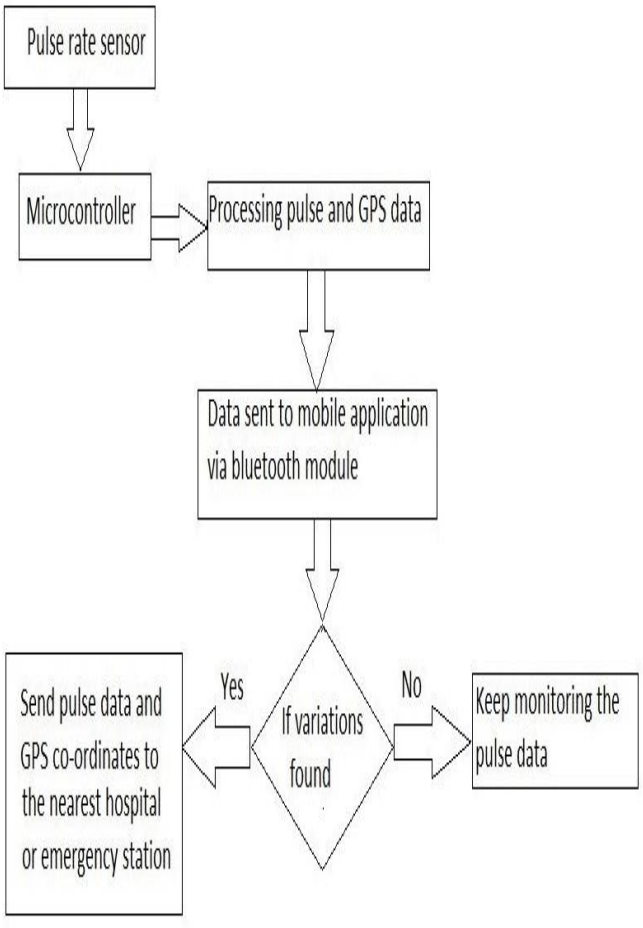

Figure 1.6. Flowchart of algorithm for accident detection

A. Accident reporting procedure

When the mobile application detects any sudden variation in the pulse rate of the victim. It will wait for fifteen seconds for the victim to press the button to cancel the accident reporting procedure. This will not send any false alarm to the emergency services. But once the fifteen second timer is over. The mobile application will send the real time pulse rate of the victim and GPS co- ordinates of the victim to the nearest hospital. Now if the hospital is not equipped with emergency facilities. The hospital will reject the alert request and the alert request will be sent to the next nearest hospital. Now consider the figure1.7. As we can see, there are four hospitals near the accident site, hospital 1(0.2km), hospital 2(0.5km), hospital 3(1.0 km), hospital 4(1.5km). The alert request is sent to hospital 1(0.2km), since it is nearest to the accident site. Now if the hospital 1 reject the alert request, the alert request will be sent to the next nearest hospital that is hospital 2(0.5km).

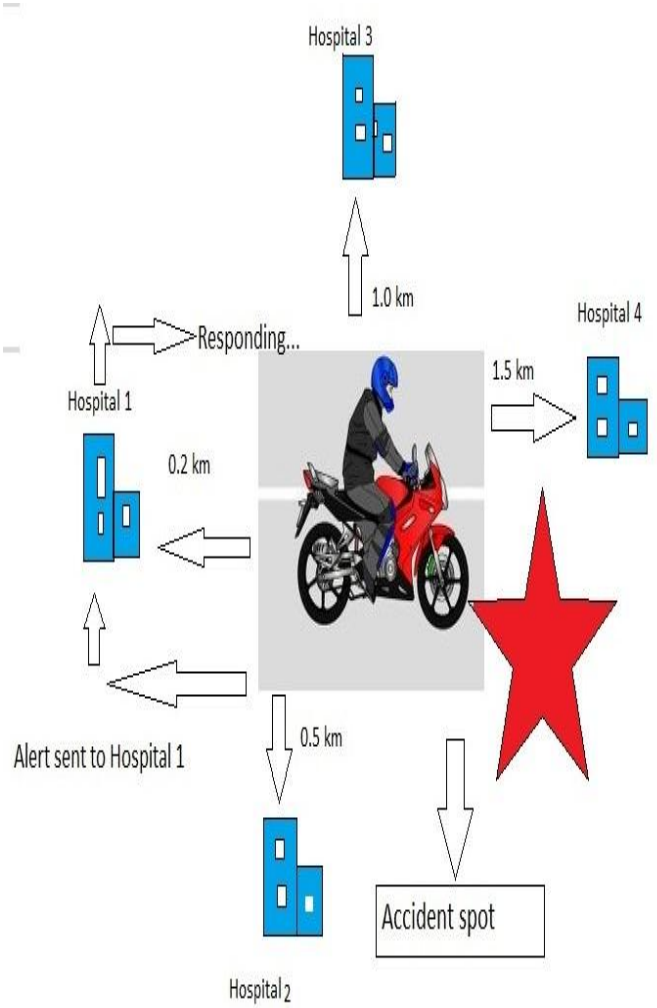

Figure 1 .7 Accident reporting procedure

IV.CONCLUSION

As the number of vehicles are increasing on roads day by day, the number of accidents are also increasing. In these accidents two wheeler riders and pedestrian are at greater risk. The optical pulse rate sensor and the GPS has become the integral part to alert the emergency services. GPS can also monitor the real time speed of the vehicle and accordingly the severity of the accident can be determined. While the pulse rate monitor can monitor the pulse rate of the victim and send the real time pulse rate of the victim to the emergency service. By the information from the pulse monitor the physical condition of the victim can be determined. The proposed system will also reduce the time gap in reporting the occurrence of the accident to the nearest emergency station.

REFERENCES

[1] Fahin Bin Basheer, Jinu J alias, Mohammed Favas c, Navaas V,Naveed K Farhan,Raghu C V "Design of accident detection and alert system for motor cycles," (IEEE 2013)

[2] P.Kaladevi, T. Kokila, S. Namratha, V.Janani "Accident detection using android smart phine," (IJIRCCE 2014)

[3] Alexander Fanca, Adela Puscasiu, Honoriu Valean "Accident reporting and guidance system",(IEEE 2016)

[4] (Online Source) Minstry of road transport and highway tarnsport research wing (New delhi) Available:http://pib.nic.in/newsite/PrintRelease.aspx?relid=146093

[5] Nano Hornet GPS module data sheet. Available: https://www.origingps.com/wp-content/uploads/2014/11/Nano-Hornet-ORG1411-Datasheet2.pdf

[6] SESUB-PAN-T2541 Bluetooth Module. Available: https://en.tdk.eu/tdk-en/373562/tech-library/articles/applications---cases/applications---cases/benchmark-for-miniaturization/1110306

[7] PIC18F4550 microcontroller pin diagram. Available: http://www.rakeshmondal.info/pic18f4550-microcontroller

[8] Working of optical heart rate sensor. Available: https://www.quora.com/How-do-optical-heart-rate-sensors-work

[9] Measurement of blood pressure using arterial pulse sensor. Available: http://www.mdpi.com/1424-8220/11/2/1784/html

[10] https://en.wikipedia.org/wiki/Major_trauma