A New Approach towards preventing drowsy driving accidents.

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***Abstract*- Since the turn of the 21 st century, there has been an exponential increase in the population of India. This has also led to a growth in the number of vehicles used, in turn increasing the daily commute. One major flaw of having a large number of vehicles on the road is that it has also led to an increase in the number of accidents. To cope up with their busy schedules people are working overtime quite often, which leads to a lack of enough sleep, driving in such a condition which is commonly known as drowsy driving causes many accidents. According to a survey, India has had 480,652 road accidents in the year 2016, 19.8% of which have been due to drowsy driving.**

According to Mercedes Benz, it is proven that if the vehicle driver can obtain an 0.5 second head start in the warning period it will help in avoiding 60% of the overrun accidents[13]. In this paper, we have come up with a prototype to counter this problem. It senses the pulse of a person and compares the pulse rate with a threshold value assigned. This threshold value has been set after obtaining the pulse rates of sleepy people. If the pulse rate of the driver is slower than or equal to the threshold value then it sets of an alarm which alerts the driver enabling him to take the necessary precautions. We sincerely believe that it could make a huge difference between life and death.

Keywords*- *road accidents, drowsy driving, pulse rate.

1. INTRODUCTION

Being a home to 1.343 billion people, road accidents have proved to be one of the most fatal incidents resulting in deaths of thousands of people. Road accidents are mainly caused due to the following

- Distracted driving
- Drunk driving
- Speeding while driving
- Due to rain
- Running the red lights and stop signs
- Reckless driving
- Inexperienced teenagers driving
- Design defects of the automobiles being used
- Driving during the light
- Improper and poorly described turns
- Unsafe Lane Changes
- Driving after consuming drugs
- Tailgating
- Tire Blowouts
- Potholes
- Road Rage
- Drowsy driving

As per recent studies, it is revealed that at least 4,80,652 accidents are caused annually[5]. The rate of road accidents increases every year and it has been found out that at least 17 deaths occur due to road accidents in every hour in India. Delhi and Tamil Nadu are the states which are most prone to road accidents [5]. Among the various reasons for the road accidents, drowsy driving constitutes an important role. It is also found that out of the total accidents 20% of all the fatal accidents that happen in the United States of America are due to drowsy driving[3]. If that is the case for USA, we can very well imagine what statistics for India would be. The only difference

is that here ,in India we don't have effective measure to prevent these accidents. Analysts have also said that the risk of accidents due to alcohol consumption more or less equal to the risks of fatality from drowsy driving. It is difficult to avoid such accidents, as it is difficult to identify a drowsy driver for the local law authorities. In our research paper we have tried to find out various reasons which lead to drowsiness while driving and have created a model which will alert the driver once he experiences a little drowsiness.

Here described are some symptoms that the drivers can look out for to voluntarily come to an alert state.[11]

- If the driver has some trouble keeping his head up.
- Feels a little irritable and restless
- Repeated yawning
- If the driver is daydreaming and is having disconnected thoughts.
- If the driver doesn't remember the last few miles that he has driven, or misses traffic signals.
- If the driver has difficulty in focusing, or frequent blinking or has heavy eyelids.

The causes for drowsiness while driving are mentioned as follows- [12]

- If the driver hasn't had an adequate amount of sleep
- If the drivers have unattended sleep disorders
- If the driver has consumed medicines like tranquilizers, narcotic pain pills, cold or cough tablets, or some high blood pressure pills, sleeping pills or some antidepressants

The rate of the crashes of the automobiles are related directly to the sleep deprivation of the driver.[4]

i. Drivers with an average of 4 to 5 hours of sleep per night run a risk of a crash of 5.4times the driver who has had a sleep of 7 hours and above.

ii. Drivers who had slept for less than 4 hours ran a crash risk 10.2 times of that driver who had slept for usual hours.

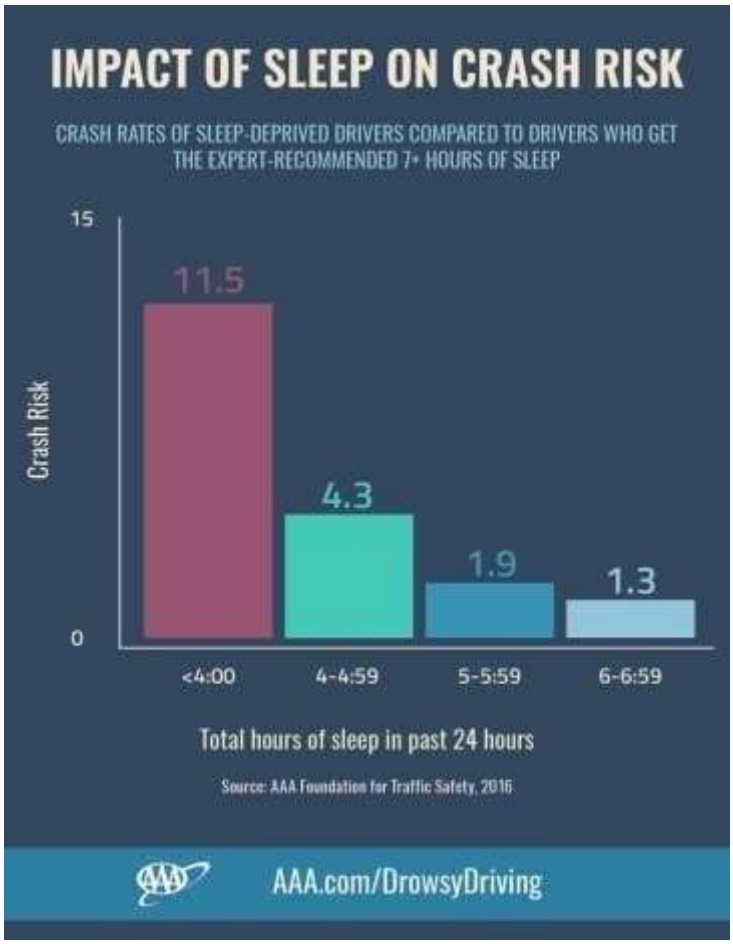


Fig.1, Source: [3] AAA.com/drowsydriving

There are various ways by which the drowsiness while driving can be avoided. They are mentioned below-

- In case the driver has had inadequate amount of sleep and so is feeling drowsy, he can take the vehicle off the road and get some sleep. This will reduce the risk of him getting into an accident
- Drivers can avoid taking medicines that induce sleep in them while they are driving
- Whenever it comes to alertness, the use of caffeine can drastically give you a boost, even if it's for a short span of time. Although, caffeine induces alertness in a person, it should not be used as a replacement to sleep
- The driver should be aware of what sleeping or other medical disorders that he has, so that it wouldn't inversely affect his sleep and increase his chances of getting into an accident.
- Initiate good sleeping habits which will eradicate the drowsiness problem right from the bottom

- Have driver alert systems installed in the vehicle which could alert the driver in case he is going to doze off.

- The driver can wear a smart band which will detect the drowsiness using heart rate monitoring by pulse oximetry. It will also provide a inbuilt alarm system which will be helpful to alert the driver at the appropriate time. [15]

- As shown in [16] we can detect drowsiness with the help of "Wireless Sensor Network Architecture" which includes an intelligent steering wheel sensor network (ISWN), a sensor data storage (SDS), a data analysis and feedback module (DAFM), and remote reporting center (RRC).

We have considered the above solution and therefore developed a circuit which will buzz a buzzer every time we find out that the driver's pulses are decreasing slowly, that it every time he starts feeling drowsy.

While there are other research papers that have come up with solutions to solve the same problem, most of them have the pulse sensors attached to the steering wheels. In our paper, we have described a method where the pulse sensor will be attached to the wrist of the driver and then detect the pulse of the driver. By this paper, we hope to achieve a successful and efficient method to alert the driver from the drowsiness so that a lot of road accidents can be reduced.

2. METHODOLOGY

Materials and Equipment

Materials used in this project are Arduino-nano, buzzer, potentiometer(10K), pulse sensor(SEN-11574), OP-Amp(LM358).

Data Acquisition and processing

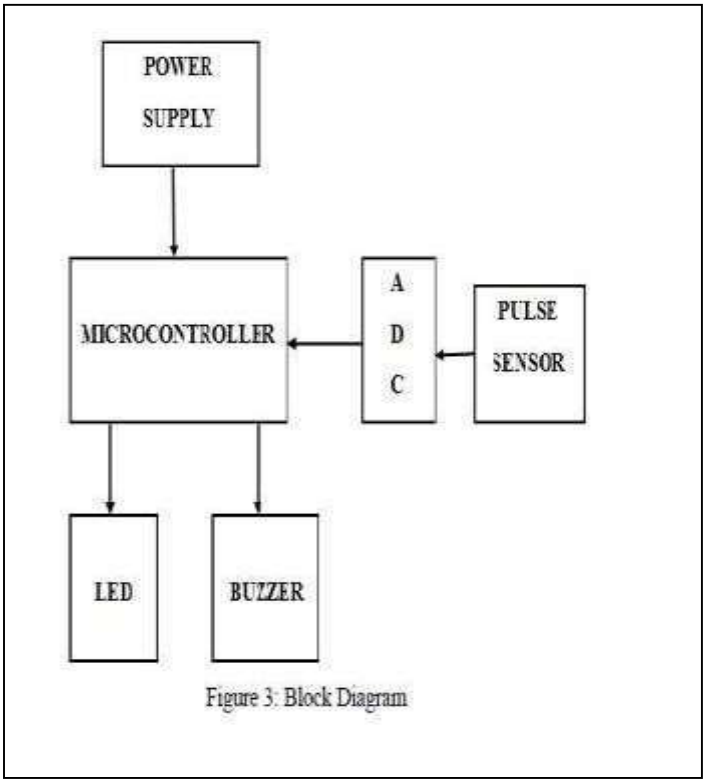
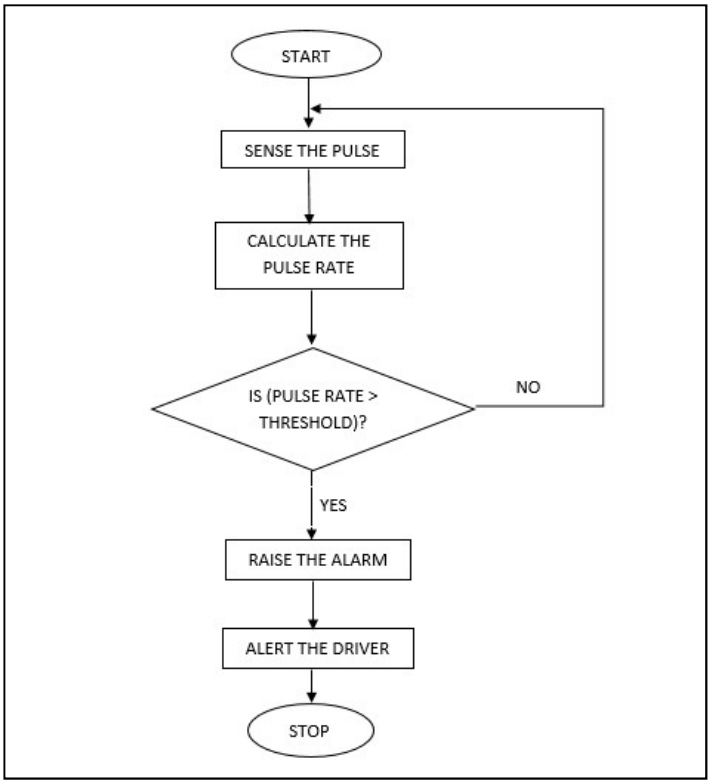


Figure 3: Block Diagram



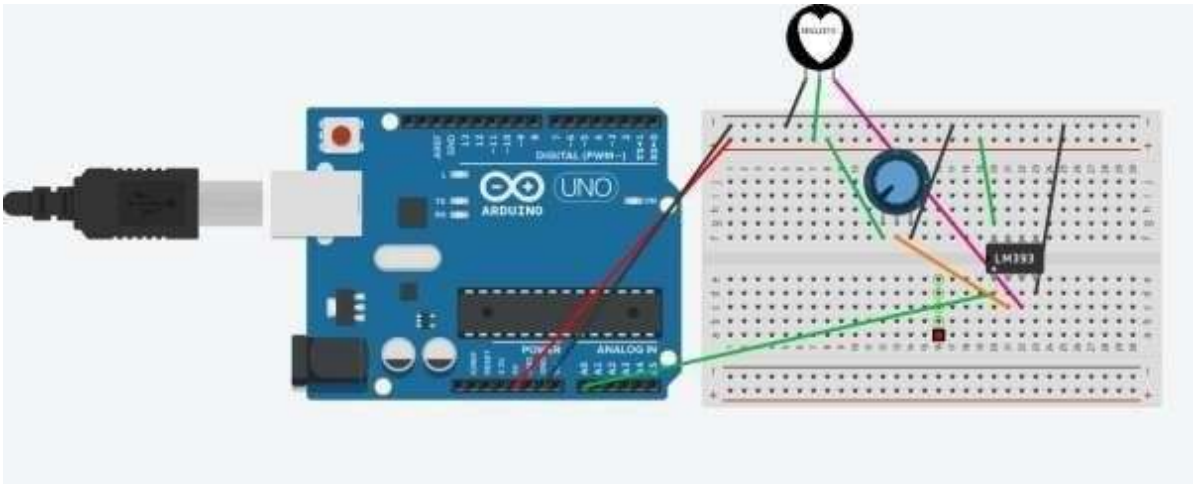
For data acquisition Arduino-nano is used. Here we want processing as fast as possible, that is why we used analog filter instead of digital filter. We used comparator circuit for converting signal to square wave. Then we count the number of beats using positive edge trigger, to get 5 peaks. According to that we approximate beats per minute and calculate the deviation from previous value. If the deviation is more than threshold value (acquired by hit and trial), then buzzer will set off (beats per minutes decreases as person fall asleep).

3.IMPLEMENTATION

Hardware:

The pulse sensor is connected to the wrist of hand while a driver is being in either normal condition or drowsiness condition. When the driver is drowsy his BPM will reduce by approximately 20 BPM.

Architecture:



The pulse rate sensor collects the information on beats per minute, which is later sent to the Arduino board. After the uploadation is done, a buzzer will ring if the driver to which the pulse sensor is attached to the wrist becomes drowsy. Thus, this will generate an alarming signal to become cautious.

Components used in this project:

- Pulse Sensor

The Pulse Sensor is a simple optical heart rate sensor available with amplification and noise cancellation to get reliable fast pulse readings.

Pulse sensor has three pins:

- VCC pin
- GND pin
- OUT pin

The Sensor connections are as follows:

- The positive railing of the breadboard is connected to the VCC pin
- The negative railing of the breadboard is connected to the GND pin
- Analog pin A0 of the Arduino is connected the OUT pin
- Buzzer: The buzzer has two Wire as anode and cathode.

The connections are as follows:

- The anode is connected to the Digital pin 13 of the Arduino.
- The cathode is connected to the Negative railing of the breadboard.
- Potentiometer: A three-terminal resistor forming an adjustable voltage divider while sliding or rotating contact.
- OP-AMP

These devices are basically high-gain frequency-compensated operational amplifiers which operate from a single supply.

Software:

Arduino Uno microcontroller is used to depict the beats per minute of a driver. The sensor is placed on the wrist of the driver, to detect the blood flow. The oxygenation quantity of the blood flowing inside the finger makes the infrared light to reflect off the skin and that to the transmitter. The sensor picks the fluctuations occurring and the result is analysed through a graph. A comparator is used to generate the square wave of the pulse obtained.

3. RESULT AND DISCUSSIONS

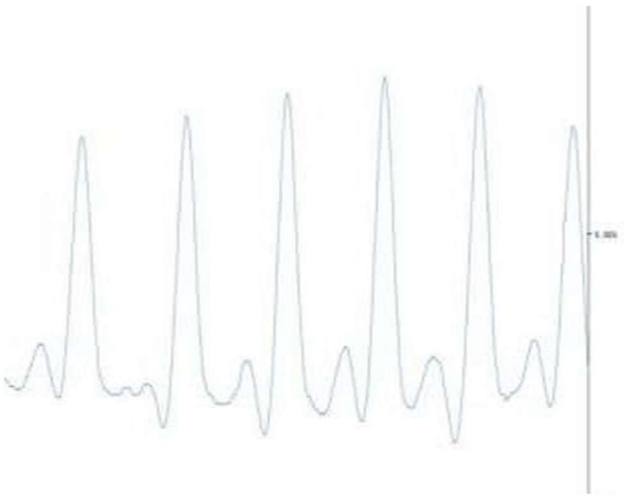


Fig x: Pulse signal acquired by pulse sensor

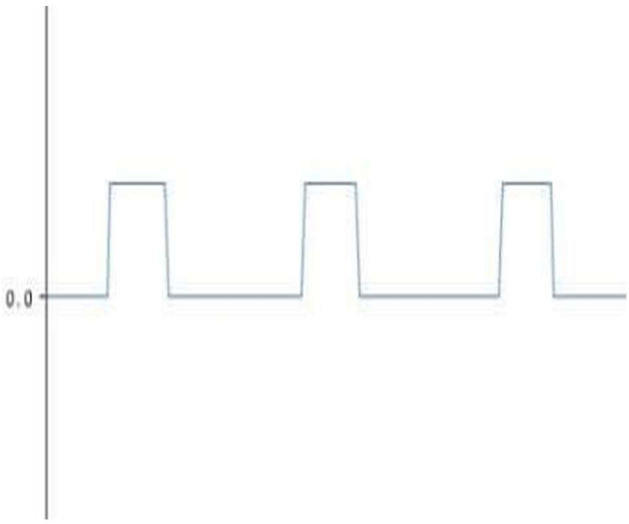


Fig x: Output of Comparator (input was

BPM results

Type of stages	Male	Female
Normal	75BPM < BPM <100BPM	70BPM< BPM <95BPM
Drowsiness	50BPM < BPM <65BPM	45BPM <BPM <63BPM

Discussion

This Project is basically focused on to alert driver using buzzer and pulse sensor. Basically, here we are calculating here we are calculating

How much time will 5 pulses take, if 5 pulses will take 'T' sec, so in 60sec we will get "5∗60/T".

Here we get 2 values of BPM for 2 minutes. By finding the difference between these values, we will set the threshold, which will turn on the alarm if this value is more than threshold value

4. CONCLUSION

In this paper, we have successfully designed a driver alert system. The major component of this prototype is a pulse sensor which senses the pulse rate of the heart and compares it with that of a sleepy person, thereby setting off the alarm accordingly. This project is very easy to implement and the cost of the device is affordable to daily commuters. This prototype ensures the driver's safety by providing a very efficient safety measure. The only problem is that, sensor needs to be stable. If it is not stable we get garbage value. This is one of the major disadvantage of this project, the only option to improve is to use more sensitive sensor or to fix sensor to the skin properly, which ensures less garbage value and better response

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