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INTERNET OF THINGS AND DRIVER SAFETY

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Abstract: Internet of things (IoT) is an ecosystem of connected physical objects that can be accessed through internet. Here, "things" can be any digital or mechanical device with sensors which has an IP address that enables them to transmit and receive data without any manual assistance. IoT can be used in various fields like agriculture, health care, sports, telecommunication, and transportation, etc. As a result , it leads to the development of the nation by providing innovative ideas in various industries.IoT smart - connected products and the services they provide become essential for the development of smart cities. Smart city spans a wide variety of use cases from traffic management and road safety to water distribution and waste management. The major problem in the current society regarding road safety is accidents that occur due to drowsiness of night drivers. IoT is applied in the prevention of road accidents. There are systems that are made for this purpose, which finds if the driver is drowsy or not and if so it uses various methods to alert the driver as well as the co-passengers. In some systems this detection is done by the eye and head movements while there are some which does the same by detecting brain signals or by the pulse rate of the driver. In this system eye and head movements are detected using IR sensors and accelerometer. This paper deals with the development of these alerting systems using various data collected by monitoring driver. Driver safety system like these using IoT would make our road travel safer.

Keywords: IoT; smart cities; road safety alerting system

I.INTRODUCTION

Road accidents are most undesirable thing that can happen to road users. These are increasing nowadays and many surveys show that they occur due to human errors such as over speeding, drunken driving, distractions to drivers, red light jumping, avoiding safety measures like not wearing seat belts and helmets. They finally result in fatal injuries and even sometimes results to death. However they can be avoided by creating awareness among drivers. On the other hand there are situations where any of these training cannot be effective like felling drowsy while driving. This is common among night drivers.

According to recent research, it shows that most of the accidents that occur are only at night. Of these about 60% of such accidents were because of the abnormal sleep pattern of the drivers.

Drowsiness is a state of feeling sleepy i.e, a transition state between awake and asleep. This occurs generally when:

- when the driver is sleep deprived
- when a person is driving at times like 12 am to 7am or during mid afternoons (2 pm - 4pm).
- most common in the people of age groups 16-25 years.

Preventing accidents caused by drowsiness can be done by alerting the drivers and co-passengers. This requires a device which can detect and alert them. This can be done by detecting the eye and head movements and can also be done by tracking the brain signals. There are various methods of measuring the level of drowsiness, which may include:

- ✧ **Behavioral measures** which determine the state of drowsiness by eye and head movements. Eye and head movements are detected by a camera which are installed in-front of the driver and these cameras can find the movements even in the minimum presence of light
- ✧ **Physiological measures** include determining the state of drowsiness by the pulse rate, sensing brain signals which contain electrodes fixed on various sites in our body and on head which helps to detect the signals and infer from them.

II.EXISTING SYSTEM

As said earlier there are various systems which detect drowsiness where each has a unique concept or way of determining while all do the same job of detecting the level of drowsiness. Each of these systems have their own advantages as well as its disadvantages. Some of these techniques are:

- EBM and Head Movement Monitoring Technique
- Brain Wave Monitoring Technique
- Pulse Rate Monitoring Technique

EYE BLINKING AND HEAD MOVEMENT MONITORING TECHNIQUE

There are various facial expressions with which we can detect if the driver is drowsy or not. Blinking of eyes, movement of head and yawning frequently are common signs of a drowsy

driver. This system was developed on such factors that enable to alert the driver.
This system uses blink detectors which contain a IR sensor and camera module which differentiates normal and sleepy eye blinking rates and thus provides an alert call when it detects abnormal blinking rates.

Sensor use light with IR wavelength which are invisible to human eye. These are absorbed when open, while when they are closed for a longer time they get reflected and sensed by the sensor which in turn alerts the driver and sends the location to the registered mobile number in the system.
Head movement detection is done by detecting the tilted angle of head of the driver. This is done using accelerometer which measures with 3 axis detection. An angle based accelerometer is used to achieve this.

The following are the types of rotation:
I. PITCH MOVEMENT is looking up or down
i. ROLL HEAD MOVEMENT is rotating head towards shoulders.
ii. YAW HEAD MOVEMENT is looking left or right.

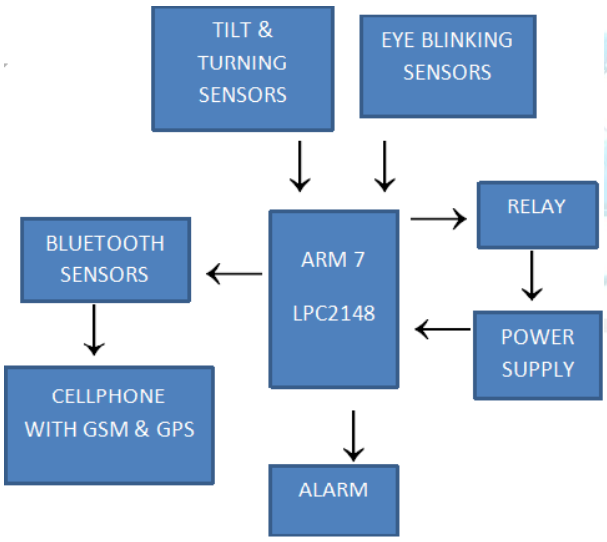

Figure 1: This is the block diagram showing the control blocks in EBM and head movement monitoring system.

➢ **BRAIN WAVE MONITORING TECHNIQUE**

Human brain emits EEG (Electroencephalograph) with which the state of brain can be recognized. In this system the EEG is made in the form of headsets which contain electrodes which transmits the signals to the Bluetooth module where the signals are processed and if it lies between theta and alpha frequencies then the driver is alerted as well as the speed of the vehicle is controlled using programmable cruise controls. Nowadays this system is being tried to be applied in helmets but its accuracy are not yet determined.

S.NO	BAND	FREQUENCY	ACTIVITY
1.	Delta	<4	Wave when the person is doing some attention
2.	Theta	4-7	Refers drowsiness
3.	Alpha	8-15	When someone is relaxing or closing eyes
4.	Beta	16-31	During intense alert, anxiety or being anxious
5.	Gamma	>32	Seen during combine use of senses

DISADVANTAGE

- The brain wave detecting system is much advanced and it is not cost effective.
- This systems require a continuous internet connectivity which is not possible
- These systems cannot be transported from one vehicle to another
- The eye blinker and head movement detecting system is not great because these detect the drowsy state only in the later stage.
- With these systems the vehicle can easily be tracked by any one which affects the security.

III.PROPOSED SYSTEM

Another method for detecting the drowsiness is by detecting the pulse rate. There are various ways of detecting the pulse rate of the person. These methods vary only in the place where the sensors are placed but the concept of the alerting system remains the same. Each of them has its own advantages. The following are the various places where these sensors are placed:

- The steering wheel
- Seat belts
- Watches of the driver

On the **STEERING WHEEL** the electrocardiogram sensors are fitted from where the heart rate is sensed from the hands gripping the steering.
ON WATCHES OF DRIVERS: The detection of pulse rate with the help of wrist band is an existing idea. It only does the detection of heart rate and not used for any other purpose.

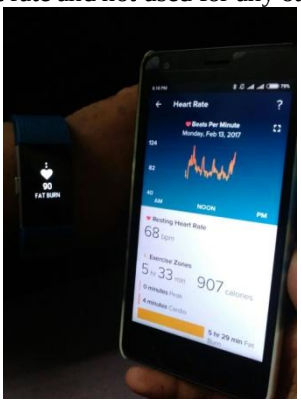

Figure 2: Smart watch showing heart rate

These watches detects pulse rate with a heart beat sensor which is placed at the back of your watch dial. Here it has a LED and a photo diode sensor. This LED emits green light at a rate of 100 times per minute.

There is more flow of blood when the heart beats while compared to its flow between beats. The blood absorbs these light and the amount of absorption helps to determine the heart beat of the person . This is already being used in present day smart watches.

Figure 3: LED and photo diode sensor

This wrist watch is similar to that of the currently available smart watches. The proposed system is about adding a new mode called "DRIVE MODE". When switched to drive mode it records the pulse rate and when it goes closer to the appropriate heart beat, it alerts the driver.

Working of the system is as follows:

- Initially the watch is connected with the mobile phones via blue-tooth.
- The normal pulse for men is 75-100 while for female70-95, whereas when he /she is in drowsy state the rate falls to 50-65 and 45-63 for them respectively.
- When the system detects heart rate at this range it alerts the driver in various ways as below:
  - The watch vibrates which alerts the person.
  - Even then, if the driver did not become attentive, then it connects to the speakers of vehicle automatically and gives a buzzer sound thus alerting the co passengers as well.
  - Even if the previous two alerts fail then it shares the location of the driver to the registered mobile number. If there is poor net connectivity then it sends SMS to the respective number.

ADVANTAGES

- ✓ This system alerts the driver at an earlier stage even before the person shows physiological symptoms.
- ✓ It need not be fixed to the vehicle and it is portable .It can be used by anyone who is driving any vehicle.
- ✓ It is user friendly.
- ✓ It is cost effective.

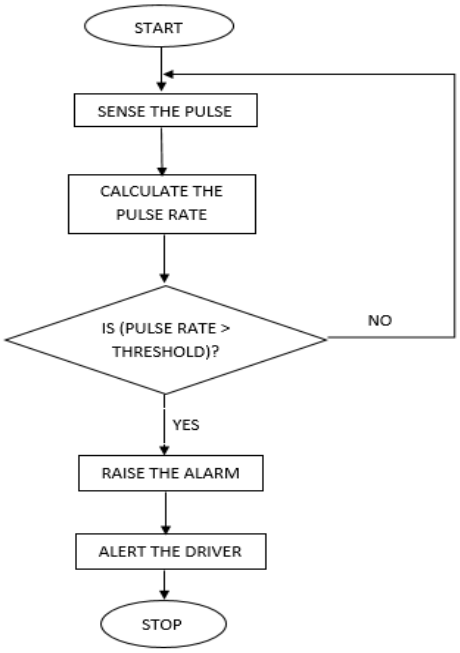

Figure 4: The flow chart of working of the pulse detecting and monitoring system

IV.CONCLUSION

This paper discusses about various methods that can be used to provide safety to drivers using one of most evolving technology IoT. Here it mainly discussed about the new method of adding additional features to existing smart watches with pulse detection system and how it can be used for improving driver's safety. Thus the proposed system would prevent the accidents due to drowsy drivers.

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