# SMART SENSING SPECTACLES-A DEVICE FOR DRIVER DROWSINESS ALERTING SYSTEM

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**Abstract**

The growth of research and inventions in preventing road accidents has lead to the development of many driver inattention monitoring systems. Some of the companies have adopted and implemented several techniques but lack the efficiency in providing the expected results. As a part of driver drowsiness detection, this paper deals with the efficient method of preventing accidents. The prevention and the control of the road accidents are possible with the help of the Smart sensing spectacles which can sense the frequency of the eye blinking and predict the drowsiness by comparing with the threshold value fed before. If the number of blinks crosses the threshold value, it gives the notification to the vibrator, which is arranged on the spectacles and alerts the driver. This notification is also sent to the mobile by Bluetooth protocol, so the mobile produces odd loud sounds to gain the attention of the driver. If the driver is unable to take control after the vibrator gives the response, this alarming sound system can be useful to alert the driver and prevent the cause of any sort of destruction. This smart sensing spectacle material is of with slim and sleek design that adds comfort and ensure driver to have a safe and proper journey.

**Keywords**:-Smart Sensing Spectacles, Drowsiness, Vibrator, Bluetooth protocol.

## I. INTRODUCTION

Imagine a situation that a person is going on a car for a longer distance. Suppose if the person is driving for a long-time, then the person may feel sleepy and start closing his eyes. Drowsiness may lead to an accident that causes the loss of property, loss of life, loss of money, etc. [1]. An article addressed by DC newspaper in the middle of 2018. They quoted that 2/3rd of the accidents in motorcycles and four-wheelers are due to lack of attention or due to drowsiness or sleep of the driver [2]. Moreover, the drivers in the car fall asleep due to various factors and lead to the cause of many accidents. Many surveys show that major accidents are caused due to the sleep of the driver [3]. The technological advancements must often provide some solution to overcome the problem and ensure safe and secure driving [4]. Around 1.3 billion people dead and 20 to 30 million people are bedridden due to road accidents based on the data in [5]. Out of these accidents around one-fourth are due to the drowsiness[7]. The survey reports give us a real picture of the accidents due to the drowsiness of the driver.

Many survey reports on accidents caused due to drowsiness of driver are due to the factors like the observation of the driver behaviour that include yawning, [8] the closing of the eye, head movement and vehicle movement based include deviation in the lane position, overpressure on

the acceleration pedal, etc. The rate of death due to the accidents caused on the highways is very much high as mentioned by the road safety statistics. Many solutions based on the sensors have been published in the market related to driver sleep, causing incidents [9]. Maintainance of the system relative to the frequency of the eye blinking on the threshold value is an essential factor for detecting driver drowsiness. Many algorithms of the existing type have evaluated based on collected data from any of these three measures-Vehicle Based, Behavioral Based, and Physiological measures as researched by the ArunSahayadhas [10]. The present system was built by using the Raspberry Pi 3 is embedded in the car in such a way that image detection is shown using the screen that displays the drowsy state of the driver and alert is done by ringing the alarms in the vehicle. But the exposure of drowsiness by the usage of the camera by image processing does not give excellent accuracy and costly as identified by Alexis Arcaya-Jordan et al. [11].In the present system, eye movement is continuously observed by using image processing for continuous detection of the eyes of the driver. The decrease in efficiency of detection is low if continuous detection is not done as identified by RatnaKaavya M et al. [12]. So, the developed system will overcome the disadvantages of the existed system and with multiple different features. This proposed method has not been implemented due to less efficiency, and the inaccurate results during the trails with this proposed system [13]. The cost of the system, ability of the lens to identify and entire unit to process the images continuously cause the delay in the output and cannot be used in the real-time progress to solve the issue of drowsiness detection [14] [15].

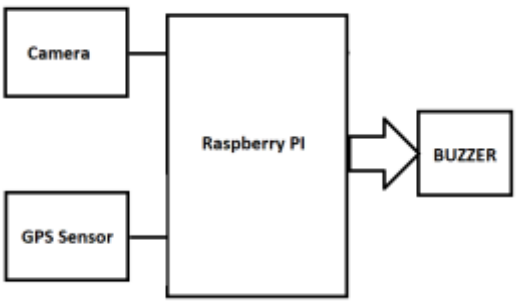


Fig.1. Existing Architecture

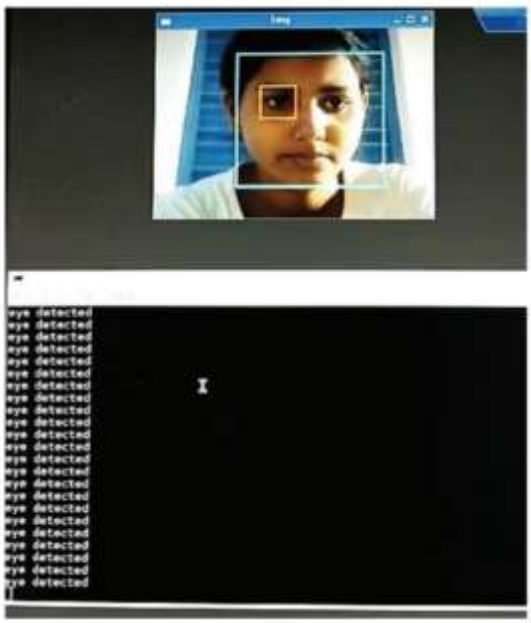

Fig.2. Eye and eye blink detection using Harcascade Algorithm

# II. Proposed Algorithm

### 4.1 Better Design Of Spectacles

The design of the spectacles used for this drowsiness detection is very slim and compact, where drivers can easily adapt to use these, [16] and the lens of these spectacles can be changed if any sight error related problems to the driver. Moreover, the spectacles contain the control options within the edges, where the driver can control it accordingly [17].

### 4.2 Infrared Proximity Sensor

This sensor emits, Infrared rays and the light reflected is recorded by an IR photodiode. This blinking sensor is based on IR; there will be variations across the eye as per the blinking. The exact function depends on the position and aiming of the detector and emitter concerning the eye [18]. If the eye of the driver is closed, we get an output of digital logic 1. If the eye seems to be opened, then it gives the output as low(Digital logic 0). At last, the output of the proximity sensor is given to digital pins of the development board.

### 4.3 Compact Microcontroller with Bluetooth Enabled

The development board used here STM32 is very fast, and its compact size adds a benefit It is used for calculating the eye blink rate based on the input of the Ir sensor and the alarm based on comparison with the threshold value fed by the user or the manufacturer. This microcontroller is connected to the external sound alarm system using the Bluetooth communication within the vehicle and to the mobile phone where the alert sounds and the data can be sent to driver mobile.

### 4.4 Vibrators

The spectacles design consists of micro vibrators, [19] which can help to alert the driver with minimal delay after the drowsiness detection and these vibrator motors were placed on either side of the spectacles, to ensure high efficiency [20] [21].

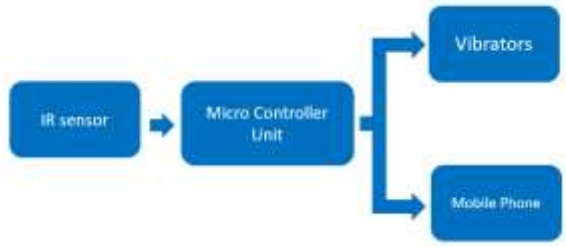


Fig.3. The Proposed Architecture of the Smart Sensing Spectacles.

This invention is a smart spectacle which consists of IR modules, Bluetooth module, microcontroller, and vibrator. This is a solution for the accidents due to the effect of sleep, drowsiness, and also due to the lack of attention of the driver. This proposed model is the solution for the above type of problems. The basic mechanism is IR sensors count the blinking of eyes per minute [22], and the whole information is monitored by the microcontroller, which is embedded in the spectacles. If the blinking of eyes crosses the

threshold value [23], then a notification is sent to the vibrator and to the mobile phone which is connected using Bluetooth [24] to the spectacles then the phone makes some odd loud sounds and the vibrator start vibrating till the person gets into the normal state and he/she needs to turn off the button which is embedded beside the microcontroller. This total mechanism uses energy so it gets charged by a rechargeable battery which is fixed beside the Bluetooth module and can be charged accordingly with the power supply within the vehicle or externally. The advantageous feature of this spectacle is that it can work on 5Volts voltage and can stand up with the battery for a longer time. The smart spectacles and the flow of the commands from the IR sensor detection of the eye blinking rate to the input to the microcontroller and the output of the microcontroller to the external vibrator and the mobile phone connected by Bluetooth if an alert has to be sent to the driver in the procedure of drowsiness detection.

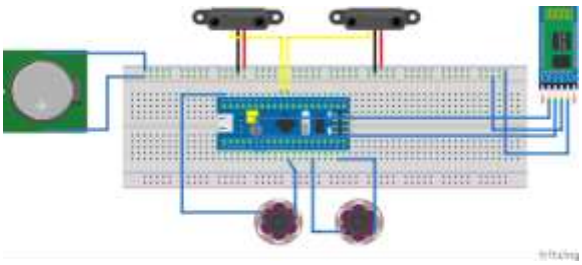

Fig.4. Circuit Design of Working Prototype

The above shown is the circuit diagram of the entire setup with connections of the battery and the other sensors on the macro scale with breadboard connections. This entire setup can be designed on the micro-scale using a printed circuit board so that the reduced circuit can be easily implemented on the spectacle and promote the proper design within the outfit to act as a driver alerting system.

## III. Experiment and Result

The design of the spectacles in the form of a prototype is shown with all the sensors and other components attached to it.

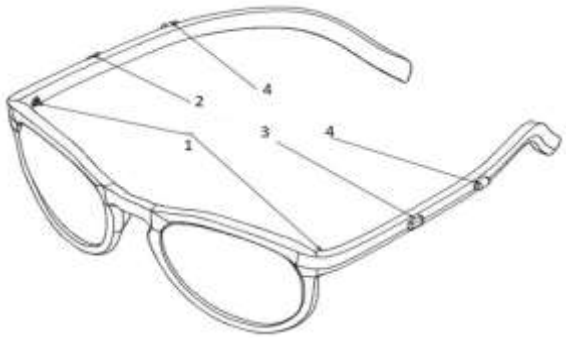


Fig.5. Design of the Prototype

1. In this position of the spectacle, IR sensors are placed on both sides and will help in quick detection of eye blinking rate.

2. In this position, the microcontroller and battery are placed within the compact size by obtaining the printed circuit design of the microcontroller

3. The Bluetooth module is ensured to place in this position with a compact size printed circuit board by connecting it internally to the microcontroller.

4. The vibrators are placed on either side along the length of the spectacles to have a sleek design and provide comfort to the user while using them.

| **EXISTING SYSTEM** | **PROPOSED SYSTEM** |
|---|---|
| Detection using camera | Detection using IR rays |
| Needs high processing power | This model can work with microcontroller based system |
| Complicated design | Smart design which adds comfort to the user |
| Consumes more power | Work with less power consumption |
| Less efficient | Provides much efficiency |

5. In this way, the design of the spectacles enhances to provide a solution to the drowsiness detection and promote safety feature in driving.

## IV. CONCLUTION

In this prototype, the entire spectacle module with different sensors, microcontrollers and other components interfacing with proper code and enhancing built it as a single module will help to develop the solution in preventing the accidents that are caused due to the drowsiness of the driver. Moreover, this solution can make an impact in many ways of providing good efficient output in detecting the rate of eye blinking accurately and intimate the driver as an alert by vibrations and sounds through the Bluetooth communication and acts as an efficient solution for driver drowsiness detection and warning system with higher effective output results.

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