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Journal of Advanced Design
November 2025, Vol. 1, Issue 1

Article

Design of a Drowsiness Alert System

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ABSTRACT

Drowsiness while driving is very dangerous and it is very difficult to recognize the state of the driver. As a result, if the driver neglecting the focus while driving diminishes the driver response time, a very short frame of time is to respond within that driver have to respond otherwise misfortune of life and property can happen, by taking into consideration a forward step has been made to concur the life on the road. We will monitor the drivers' focus on the road with the spectacle glass mounted with the infrared module and Arduino on the eye to monitoring the eyelid of eyes and transmitting the signals to the receiver end, and receiver end will process the signal with the microcontroller and gives the alert signal according to data programmed in the microcontroller. Its prototype is developed and it is working successfully which keeps the driver awake. This device will prevent the sleepless condition of the driver the prevent accidents.

Keywords - IR Sensor**,** Drowsy, Infrared module, Driver, Driver monitoring Device, Microcontroller.

1. Introduction

The purpose of the Drowsy Detection device is to build a system that can decrease the number of accidents from careless driving of the vehicle. The loss of attention in the driving of the drivers is found to be the major issue of devastating road accidents. And this rate of accidents can be reduced by avoiding the unconscious situation of the drivers. The onboard monitoring system will help to prevent this, IR sensor that detects the obstacle that is going to monitor the eyelid and with the input of IR sensor that is transmitted through the HT12E encoder I/C that will provide input to the microcontroller. A microcontroller (Arduino) (Figure 4) is embedded with the program to detect the input and make decisions whether have to alert the driver or reprocess the program and keep monitoring the eyelid.

According to the report of the ministry of road transport and highways published in 2021 that the no of road accidents in India in the year 2019-20, no of persons killed in road accidents 4,49,002 and 1,51,113 respectively [1]. Concerning the article published in 'The HINDU' on Feb 20, 2020, by G. Krishnakumar that 40 % of road accidents are happened by the driver dozing off [6]. Another report published in 'The Financial Express' by Rahul Chhabra on July 30, 2019, also states that the 'Exhausted drivers who doze off at the wheel are responsible for about 40% of road accidents [7]. Taking all this into account a drowsy detection device has been prototyped using Arduino,

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microcontroller, sensor-based setup, system uses the sensors at those points directly towards the driver's face and monitors the driver's eyes to detect fatigue such a case when fatigue is detected, a signal is generated to alert the driver. This paper describes how the device detects the eyes and also determines that the eyes are open or closed state. The system deals with using signals obtained from the sensor.

Going on a long driving hour the driver gets exhausted and the driver feeling drowsy but still driver has continue driving for reaching the destination. The driving is in not safe condition due to driver tries to exert himself. When the driver feels sleepy, he/she still goes on driving it leads very risky. [1]

2. Drowsiness detection techniques/methods

There is the various method that can be used to detect the drowsiness of the driver. Techniques for detecting drowsiness in the driver can be categorized into the following

2.1 Recognizing of physiological property

This method is based on the human psychological phenomena, it is one of the best techniques based on accuracy on human physiological phenomena. This technique applies in two ways- calculating changes in physiological signals, such as brain waves, heart rate, and eye blinking, and monitoring physical changes such as sagging posture, leaning of the driver's head, and the open/closed states of the eyes.[2]

2.2 Recognizing driving operation

This is also a useful technique that to monitor the correct pattern of the driving, that should follow by the driver if the is acceleration too fast breaking sudden, or anything that obstructs the smooth driving that also can determine as improper driving and system can issue signals to alert, etc. [3]

2.3 Other techniques

Driver operation and vehicle behaviour can be applied by monitoring the steering wheel movement, brake patterns or accelerator, vehicle speed, lateral displacement, and lateral acceleration. These are also non-intrusive ways of detecting drowsiness, but they are limited to vehicle type as well as driver conditions. The final technique for detecting drowsiness is by monitoring the response of the driver. This involves regulating the driver by sending a response to the system to indicate alertness. The problem with this technique is that maybe it will become irritating to the driver [4].

3- Drowsy detection system developed

A system to detect drowsiness has been developed consisting sensors, microcontrollers, electronic devices and circuits as described herewith.

3.1 IR Sensor Infrared transmitter

This is a device that emits infrared rays. Similarly, IR Receiver is used to receive the IR rays transmitted by the IR transmitter. (Figure 1) IR sensor constantly emits infrared

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rays. Since the IR sensor (white) emits the rays when the IR rays fall on a surface, the reflected light rays are received by the photodiode (Black) and the photodiode converts the received signals into the electrical signal. (Figure 1) The signals are Encoded in the HT 12E encoder and emitted at RF 433 MHz.

3.2 HT 12 E /HT 12 D (Encoder/Decoder)

The HT12E Encoder are Remote Control system applications. These are capable of Encoding the 12 bits of data which consists of 8 address bits and 4 data bits. Every address and data input are externally programmable using switches.

HT12D Decoder is for Remote Control system applications. These ICs are paired with each other. For proper operation, a pair of encoder/decoders with the same number of addresses and data format should be select (HT12E is paired with HT12D). The Decoder receives the data, transmitted by a carrier using an RF transmission medium, and gives output after processing the data.

3.3 Arduino and other components

Arduino is a microcontroller board. It has 20 digital input/output pins, a 16 MHz resonator, a USB connection, a power jack, an in-circuit system programming (ICSP) header, and one reset button. It contains everything needed to support the microcontroller, simply connect it to a computer with a USB cable or power it with the DC adapter or battery to get started (figure 4).

This microcontroller board is a removable, dual-inline-package (DIP) microcontroller. Programs can be loaded into it from the easy-to-use Arduino computer programming. The Arduino has an extensive support community, which makes it a very easy way to get started working with embedded electronics.

The Arduino different from all preceding boards in that it does not use the serial driver chip. Instead, it features a programmable through a USB. This auxiliary microcontroller has its own USB, which allows advanced users to reprogram it. Buzzer and relays are connected with the Arduino and relay and both communicating at 433 MHz. With simple programming to the Arduino. [8]

Figure 1 IR sensor with pulse generator

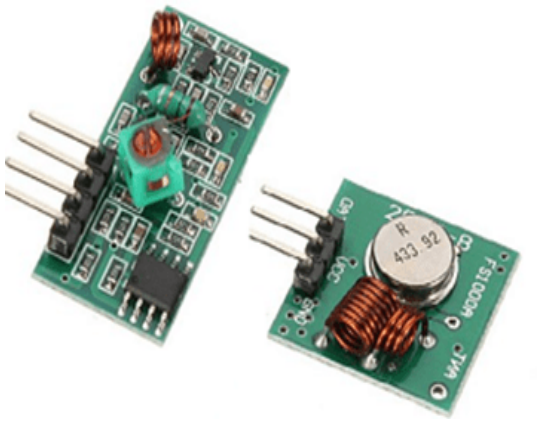

Figure 2 RF module

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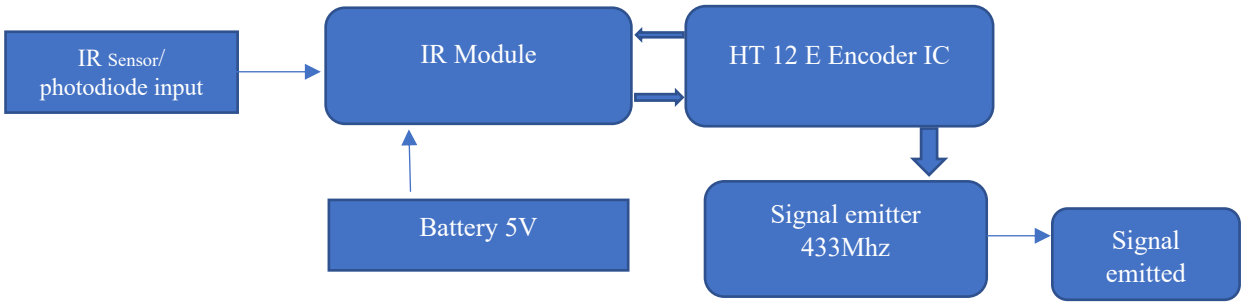
3.4 Radio Frequency module

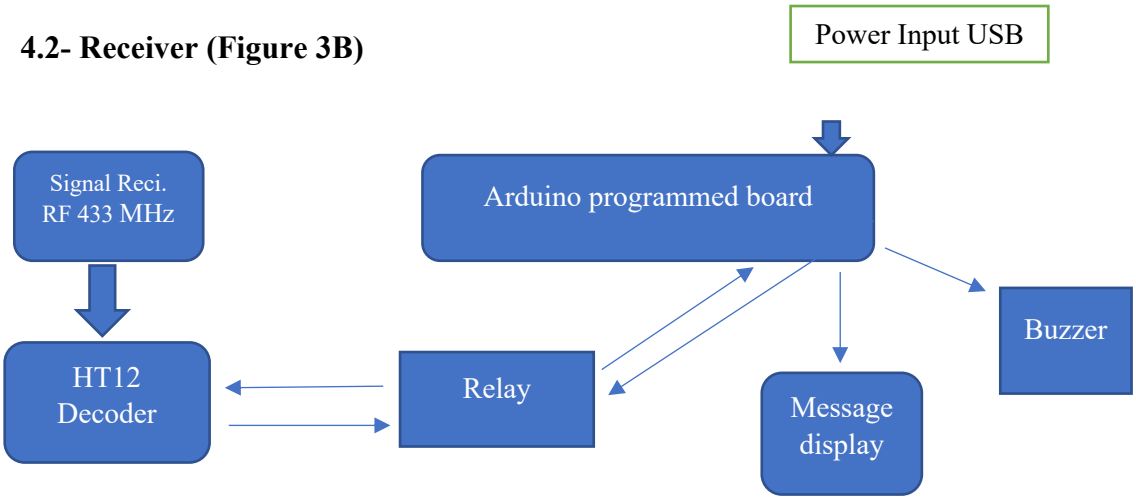
RF module operates at Radio Frequency ranges varies between 30 kHz & 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave. (Figure 2) This RF module is a combination of RF Transmitter and RF Receiver. The transmitter/receiver (Tx/Rx) pair operates at a frequency of 433 MHz.

4- Layout of the system developed

4.1 Transmission (Figure 3A)



4.2- Receiver (Figure 3B)



5- Working of the drowsiness detection system

The working of the drowsiness detection device is given below.

5.1 Transmission part

5.1.1-Input Mounting an eye blink sensor which continuously monitors the eye blink, once when the eye blinks for a longer duration than expected (that means the driver is sleepy).

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5.1.2 Sensor IR sensor is used to detect the eyes through the infrared rays emitted by the sensor that takes the input and sends to the IR module.
5.1.3 IR module It receives the signal light signal and convert it inti the pulse form that is easy to transmit through the electronic circuit. And IR module send the pulse signal to the HT 12 E (Encode) to transmit through antenna to the receiver part. The IR transmitter is used to transmit the input from our eyes. The IR receiver is used to receive the reflected infrared rays from the eye. This is to see whether the eye is at close state or open state in this condition.

5.2 Receiver part Information is transmitted in the form of pulses and is given the signal is received by the RF 433 MHz signal receiver and sent to HT 12 Decoder to decode.
5.2.1 Arduino microcontroller is placed to analyse the input received by the decoder. The microcontroller uses this information to compare the input with the programmed in it and if any abnormal situation arises, the buzzer indication is given to the driver to alert him, this operation is run by means of the circuit connected to the buzzer and the signal is transmitted through RF-transmitter at the frequency of 433 MHz.
5.2.2 LED and buzzer The received signal is given to the command unit, which use this information for displaying the alert message on the LCD as programmed along with buzzer alert. It gives the emergency light to the driver and driver has to manually stop the device to ensure the body movement of the driver.
5.2.3 Rebooting We have designed the device which driver have to reset it manually to ensure the body movement, if the driver is neglecting in that case, buzzer is open to alarm and alerts the driver in the vehicle and saves from the worst-case.

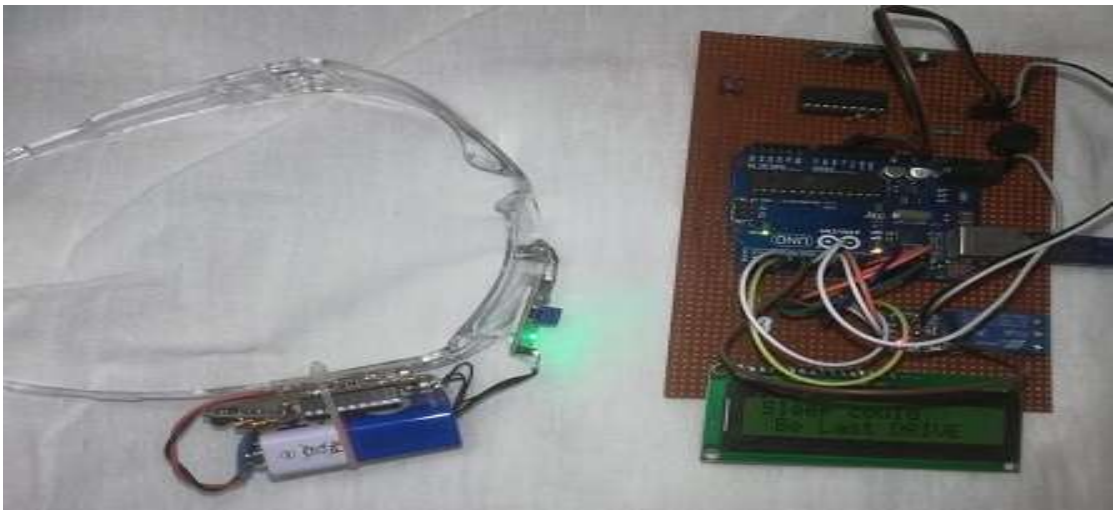

Figure 4 Drowsy detection device.

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Figure 4A Arduino

6- Result and Conclusion

The results of the drowsiness detection system with the are as follows

The system detects eyeblink using the IR sensor so it is in-dependent from the head movement.The proposed system detects the eye blink with the accuracy up to 85 % and false signal detection rate up to 10-15 %.Buzzer indication is a successful alarming system attached with the device it always reacts with the impressive response time that driver could control the vehicle.Manual resetting the device makes it confiscated device but it showed very positive response that the driver has to move from his/her position that leads to movement of the body.The prototyped device shows overall finding is that system is able to detect the drowsiness to the efficiency up to 85% and it is wearable device, it is able to duck the accidents caused by the drowsiness of the driver. Wearable Drossiness detection device is able to detect the unconscious through the eyes and the results are satisfying.

7- Discussion and Future scope

It also can possible to Develop a hybrid microcontroller for a vehicle which also consists of an alcohol and temperature detector inside the vehicle which will sense it can be connected through the relay at the above-given circuit if the driver is drunk and would not start the vehicle. A study report can be on road safety for the automobile industry to surviving every human from the risk of life. Also, further, it can be planned to work on the Car database for further comparison of our approach. Further, we can do more experiments in a driving environment, collect more data to do statistical analysis, design good algorithms, drowsiness is detected.

It will give vehicle high security to the driver and the passengers, by designing such a system.

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