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**Mini Project Report on
Smart Glasses for Drivers
with Auto Braking System**

Submitted

**In Partial Fulfillment of the Requirements for the
Mini Project (KEC-354)**

by

Payal Mohnani (2000040310032)

Priyanka Mittal (2000040310034)

Shruti Bhardwaj (2000040310040)

Vandana (2000040310045)

Vidhi Gupta (2000040310047)

Under the Supervision of

Er. Rahul Agarwal
(Assistant Prof., ECE Dept.)



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**P.G. Department of Electronics & Communication Engineering
RAJA BALWANT SINGH ENGINEERING TECHNICAL
CAMPUS
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Abstract

Driver fatigue is one of the major causes of Road Accidents across the world, which causes nearly 30-40% of the accidents that usually occur. It is estimated that the chances of accidents increase quite a few times due to sleepiness. It is, however, inevitable to get bored or sleepy during long road journeys, especially on straight highways. Drowsiness increases the reaction time of a person too. Thus, making them unable to make the right decision in time. It is equally dangerous to drive while feeling sleepy as it is after consuming alcohol, if not more. Detection of fatigue is thus quite important to avoid any mishap from occurring. This prototype is a real-time recognition system that uses an IR sensor to detect driver fatigue conditions. Thus, it can alert the driver and stop the vehicle too, if necessary to prevent any accident. This way it can be lifesaving in many situations.

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Introduction

In today's times, owing to hectic schedules, it becomes tougher to stay active all the time. Consider a situation where a person is driving back home, exhausted from work, and has drained all his/her energy. His/her hands are on the wheel and foot on the pedal, but suddenly begins to feel drowsy, eyes begin shuttering and vision blurs and before he/she knows it, he/she's asleep. Falling asleep on the wheel can not only cause accidents and be fatal for oneself but can also be dangerous for others on road.

The above situation is much more common than it seems. Past few decades' statistics show that there are quite many accidents on highways occurring due to fatigue among drivers. Long-distance truck drivers can fall asleep by driving too long hours due to pressure put on them to get the goods to their destinations at certain times. It causes a lack of attention on the road, especially in the case of straight mundane highways.

To address this situation, smart glasses have been made. Smart Glasses for drivers consist of two main parts, one is the glasses that have IR sensor attached to it, which serves the purpose of detecting if the eyes of the wearer are closed and microcontroller, that takes the input from the sensor and rings the buzzer and stops the vehicle if driver's eyes are closed.

Literature Review

Although many researchers have worked in the field of fatigue detection, the fundamental problem still remains unsolved. Only few researchers use methods depending on inputs from devices which are not visual information. But most of the algorithms depend on visual information. But it has many drawbacks including time-costing, not fit for real-time applications. Some researchers work on static scene images, but movement blur, bad illumination, etc. might cause difficulties for object detection and recognition in video streams. It becomes more difficult in the cases when the driver is wearing glasses or night vision.

Driver fatigue is intensively studied during the last two decades. Few commercial products are also available in the market like Lumeway's Eye Alert, Toyota's driver attention monitor and similar Lexus' products using IR technique. SMI's In-sight system uses cameras to monitor driver. DADS used cloud-based system to monitor driver. Other in-vehicle systems include Volvo's Driver Alert, Ford's Driver Alert, Volkswagen's Fatigue Detection, and Subaru Eyesight Driver Assist. These use different ways to alert the driver each having its own benefits and drawbacks.

The practical use and efficiency of these devices in preventing accidents is under inspections. UK royal society for the prevention of accidents published a literature review on the driver fatigue and road accidents (RoSPA, 2001). The study investigated different devices to detect driver drowsiness. The researchers are still working on finding the different and effective approaches.

Methodology Used

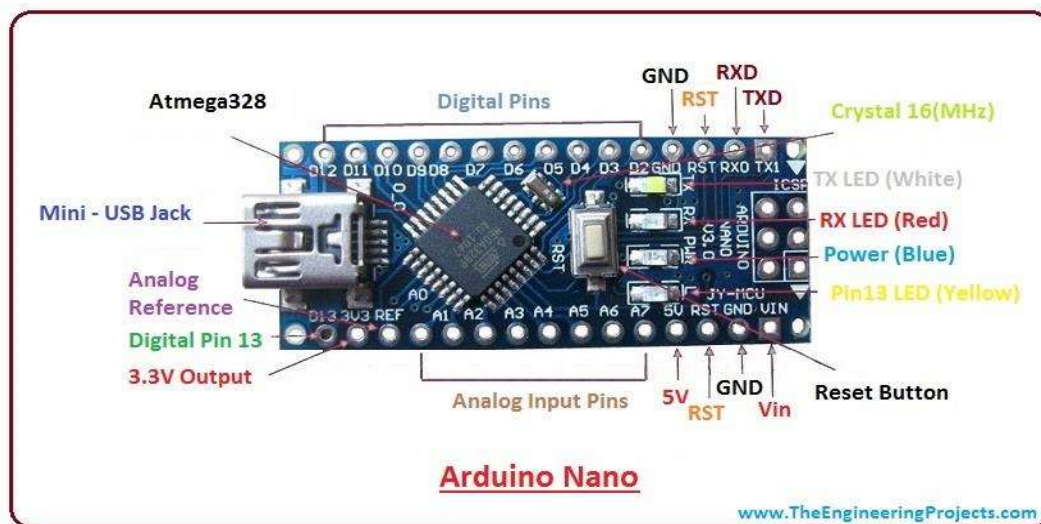
This project is based on Arduino's functioning of science & technology. The application of the project is for drivers, especially those on a long journey. As we know, drowsiness among drivers is among the most critical causes of highway accidents. Smart glasses keep the driver awake & alert while driving. The principal connectivity is done around the microcontroller and eye blink sensor, along with proper connection among the rest of the components. All this makes its effect by alerting when eyes stay closed for 3 seconds or more.

The model principle has been done around the microcontroller and IR Sensor technique with the proper technique and proper connection. IR sensor is attached to the glasses. The variation across the eye will vary as per the eye blink according to the given time of 3 seconds. The device is based on the analysis of the time of eye blinking.

The Infrared technique typically uses a transmitter and receiver that are mounted on a pair of driver's spectacles and directs a beam of IR radiation on the driver's eyes. The IoT-based Drowsiness detection system detects the driver's drowsiness over the spectacles, initiates a buzzer sound, and stops the vehicle. The program can also be designed in such a way that it detects the eye according to the intervals of the time.

❖ Arduino Nano

The Arduino Nano is equipped with 30 male I/O headers, in a DIP30-like configuration, which can be programmed using the Arduino software integrated development environment (IDE), which is common to all Arduino boards and running both online and offline. The board can be powered through a type-B micro-USB cable or from a 9 V battery.



A relay is an electrically operated switch, consisting of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as making contacts, break contacts, or combinations thereof. Relays are used where it is necessary to control a circuit by an independent low-power signal, or where several circuits must be controlled by one signal. Here, a single-channel relay is used.



❖ IR Sensor

The IR sensor is used as a eye blink sensor which helps to detect the eye blink of the driver. It is a reflective sensor that includes an infrared emitter and phototransistor in a lead package that blocks visible light. One main condition is that the IR transmitter and receiver should be in a straight line for optimum performance. The transmitter transmits IR rays into the eye of the driver. Depending on whether the eye is closed or open, there will be high output for closed eyes and low output if eyes are open. The transmitted signal is captured by the IR receiver..



❖ Glasses

Any pair of transparent glasses of suitable design and fitting can be used, on which IR sensor is to be mounted.



❖ Gear Motor

A gear motor is an all-in-one combination of a motor and gearbox. The addition of a gear head to a motor reduces the speed while increasing the torque output. We have used 100RPM DC Geared Double Shaft Motor. It is used in this project to demonstrate vehicle.



©-photo by electro-rock

❖ Wheel

A wheel of 65mm diameter is used to demonstrate the vehicle.



❖ Piezo Buzzer

Piezo buzzers are simple devices that can generate basic beeps and tones. The piezoelectric element is made out of piezoelectric ceramic as well as the metal plate, they are held together in or piece by the adhesive. Externally driven Piezo 3V-4kHz 75dB buzzer is used in this project.

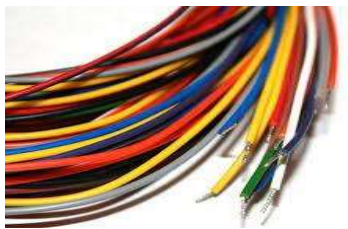


❖ **Voltage Source**

For powering the device, any DC voltage source of suitable rating, i.e. 9V can be used. 2 Batteries or power supply via USB can be used to power device. We have used power through USB.

❖ **Wires**

Wires are used for making connection between different components of the device. Jumper wires are mainly used because of their ease of making solderless connection.



Project Details

Smart Glasses broadly consists of two sections: Glasses with IR sensor and controlling part.

Glasses with IR sensor: Glasses have an IR sensor mounted on them. It detects the motion of the eyes of the person wearing the glasses. It checks whether eyes are closed or opened.

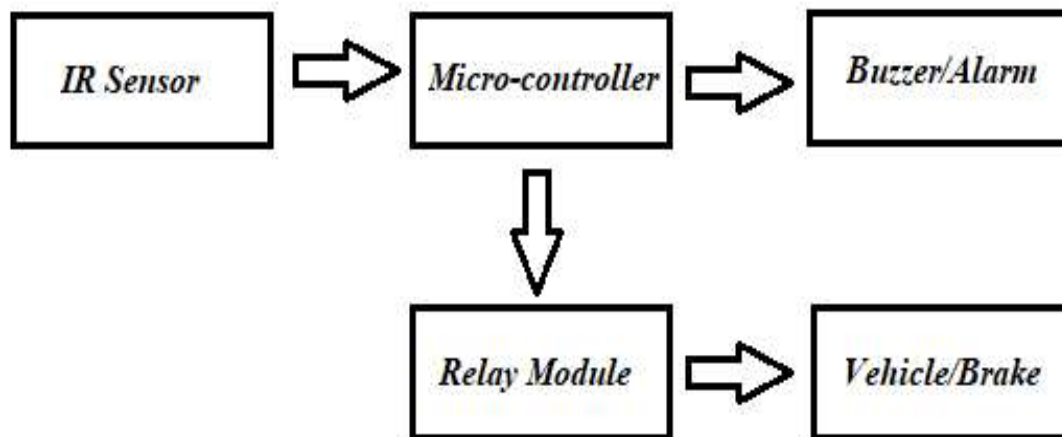
The eye-blink sensor, which is IR sensor with lower sensitivity, illuminates the eye with IR light, monitoring the changes in the reflected light.

The sensor output is active high for closed eyes and active low for opened eyes. This output can be directly given to microcontroller for interfacing applications.

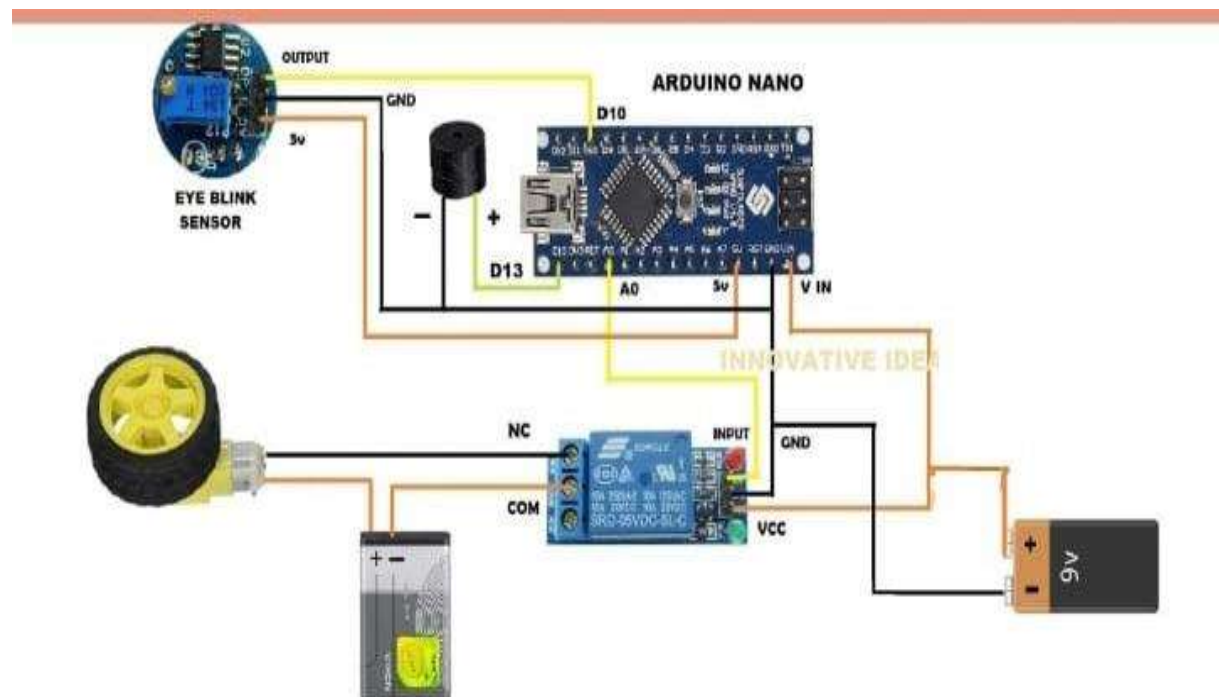
Controlling part: The controller takes the input from the sensor, processes it, and creates output in accordance. Here, we may get 3 cases:

- ❖ When the eyes are blinking, the IR sensor sends the signal to the controller. Although the controller receives the signal, it does not respond to it as the signal keeps changing alternatively between high and low states (i.e., the signal is not in the high state for 3ms or more). And no alarm rings.
- ❖ When the eyes stay closed for a time period of more than 3ms, i.e., the signal stays in the high state for that long. The controller sends the signal to digital pin 13, where the buzzer is connected. The buzzer thus rings and alerts the person. As the person is alerted and opens his/her eyes, the signal breaks and the alarm stop ringing.
- ❖ If the person still doesn't open his/her eyes and the signal persists for more than 6ms, the controller sends the signal to relay module. The module thus breaks the circuit that gives power to the motor and the vehicle stops.

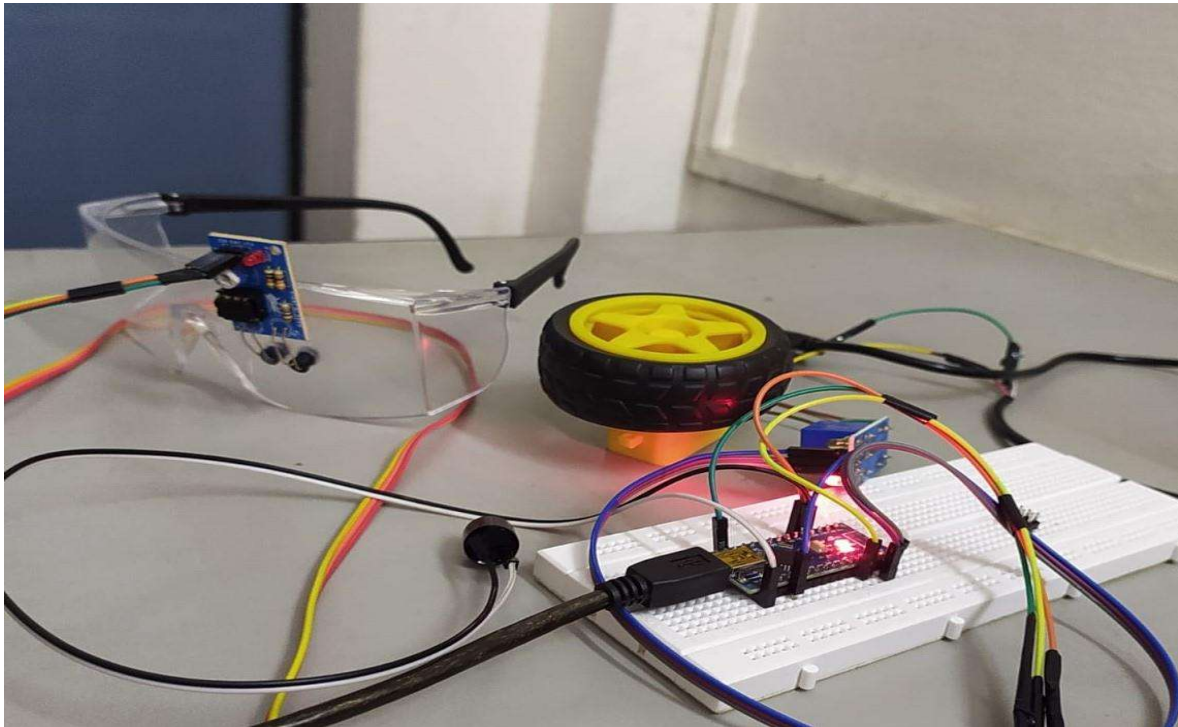
Block Diagram



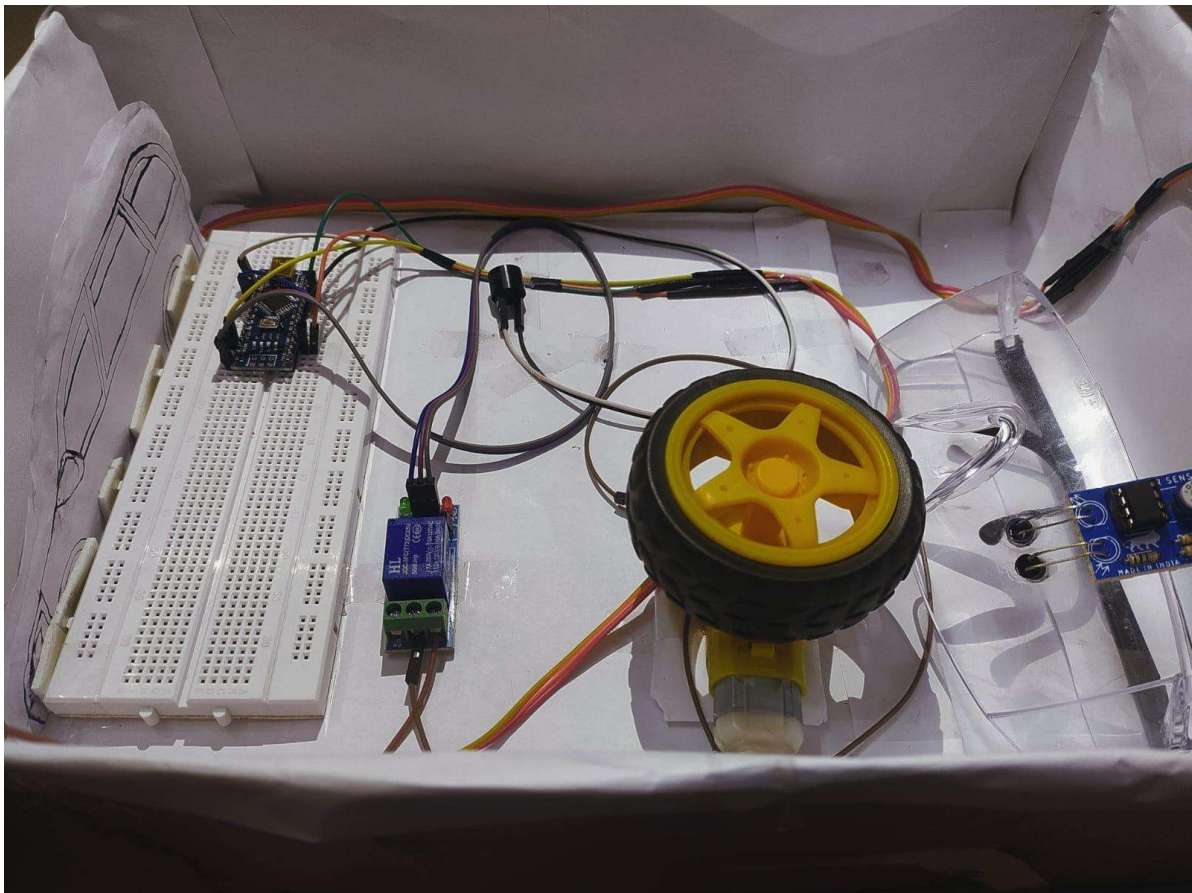
Circuit Diagram



Prototype Testing:



Final Project:



Major Software Required: Arduino IDE

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. This software can be used with any Arduino board. It runs on Windows, MacOS, and Linux. The environment is written in Java and based on Processing and other open source software. The link for the latest version of software is:

<https://www.arduino.cc/en/Main/Software>

Conclusion

The drowsiness detecting smart glasses proposed here is the minimum intrusive approach for dealing with driver drowsiness. It is based on IR sensing technology and micro controlling using an Arduino. Unlike detection using visual data, the detection mechanism is unaffected by the ambient light present and can work irrespective of what time of the day it is. Thus, it is an effective way to detect drowsiness.

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Future Scope

As day-by-day traffic on the road is increasing, so is the need for a more reliable method to track the cause of the accident and prevent it. Smart Glasses are an important tool in the preventive measures for fatal and seriously injuring accidents. Besides its use for drivers, it has various other use cases too. These would require a bit of modification in regard to their usage for different fields. These use cases include:

1. For Students: Many students study late at night, especially the night before the exams. But it is very easy to fall asleep when the person is already tired of the hectic schedule. In this case, it can be used to keep them alert while studying.

2. For watchmen: Night Watchmen and sleep are quite an infamous duo. But it is actually a very difficult job to stay awake during the night and important for the purpose of safety at the same time. The Smart Glasses can be modified to do this job too.

The device can also be improvised in the future with other features like sending alerts along with the location to the emergency services, nearest toll Plazas. in case of any mishap.