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Arduino Based Automatic Vehicle Control System

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ABSTRACT

Accidents occur throughout the year due to various factors such as drunken driving, texting while driving, speeding, distractions, sleeping on the wheel, etc. These accidents may cause huge misery to the families of the affected persons. However, the onus of safe driving depends on the driver. To alert the driver any prevent any unwarranted accidents, technology can be introduced into the vehicles. The objective of this paper is to develop a safety feature in cars to avoid colliding with a vehicle or an obstacle in the way.

Keywords: Eye-blink sensor, Arduino, IR Sensor.

I. INTRODUCTION

With the advent of economic growth, the traffic congestion has increased rapidly. The increasing number of vehicles has led to a rise in the number of road accidents. The major causes for road accidents these days includes rash driving, traffic congestion, poor conditions of roads, poor weather conditions, sleeping behind the wheel, etc. Drowsy driving is a major problem these days in our country. The risk, danger, and often-tragic results of drowsy driving are alarming and can prove to be fatal at times [1][2][3].

The main objective of this system is to help driver prevent car collisions due to drowsiness and their carelessness while driving. This module can be connected to the braking system of the vehicle and can be used to reduce the speed of the vehicle. The alarm inside the vehicle will go on for a period until the driver is back to his senses [4][5].

If the driver is unable to take control of the vehicle after that stipulated amount of time the system automatically steers the car to one side of the road and comes to halt. This action is taken after taking into consideration the various safety measures such as proximity of nearby vehicles, available room for taking the vehicle to roadside, etc [6][7][8]. The sensors in the car would be capable of informing the driver distance from the various objects in front of the car, which will help the driver to drive safely, and an arduino would be able take decisions according to different situations [9][10][11][12].

The subsequent sections of this paper is organized as follows. The section II describes the operational principle of the system through the architecture. In section III, the hardware implementation and the components in the system involved are discussed.

II. SYSTEM ARCHITECTURE

In this work, the eye blink sensor mounted on a goggles, consists of an IR transmitter and receiver, which detects whether the driver is in a state of drowsiness or not as shown in Fig. 1 [13][14][15].

The sensor is able to do so by detecting the intensity of the reflected IR rays from the eye. This will convert the output of closed eye as high (binary 1) and that of the open eye as low (binary 0). The output of the eye blink sensor is send to the arduino, which controls the entire mechanism. These operational commands are categorised in to two cases:

Case 1: If the driver is in a normal state, i.e. the eyes remain open, then the eye absorbs most of the IR rays and the receiver will receive less intensity of IR rays.

This will indicate that the driver is focused, and the system operates in normal mode.

Case 2: If the driver feels drowsy or falls asleep, the intensity of the reflected IR rays is high since the eyes are closed. The high intensity signifies that drowsy state of the driver and the accident prevention system comes in to play. The system detects if the eyes remain shut for 2 seconds, a buzzer is switched on, due to the program command that has been given to the arduino.

If the driver's eye is closed for next 2 seconds then the vehicle will reduce the speed and will take a specified degree of turn to the left to get the vehicle to the side of the road. This will automatically align the vehicle to the roadside and will stop eventually. The braking aspect of the system is realised through a servomotor, as the movement of the motor depicts the application of brake. The servomotor operates a mechanical shaft to apply brake to stop the vehicle instead of manual pedal braking which is not possible when the driver has fallen asleep [16][17].

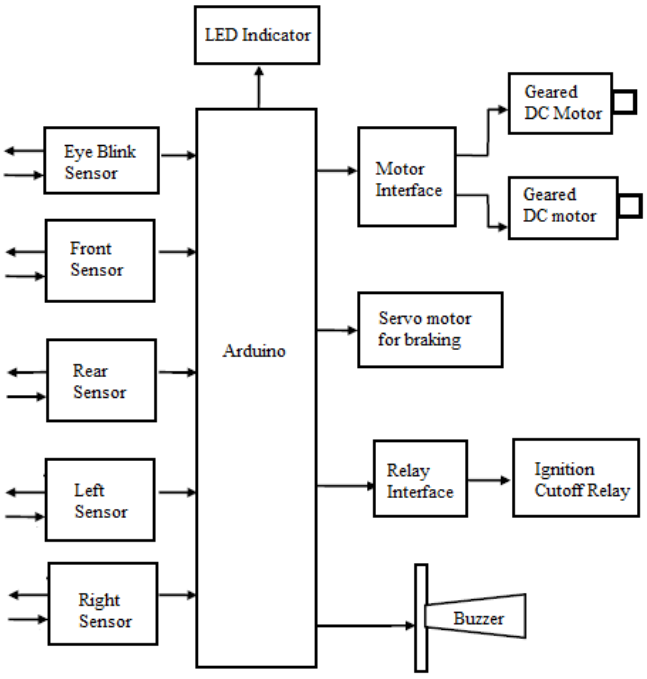

Figure 1: Block diagram

A Relay control is used to cut the ignition as soon as the vehicle comes to a halt. The functioning of relay and servo motor in our desired way is possible because of the use of the arduino as an interface medium. In the programming of the arduino we have specified for the timing of eye blinking that is after what time if the eye remains close the buzzer will go on, while in the programming it is specified when the relay will be triggered and the application of servo motor will be applied on the braking system.

III. HARDWARE IMPLEMENTATION

In this section, the components used in this work are presented. The hardware model is shown in Fig. 2.

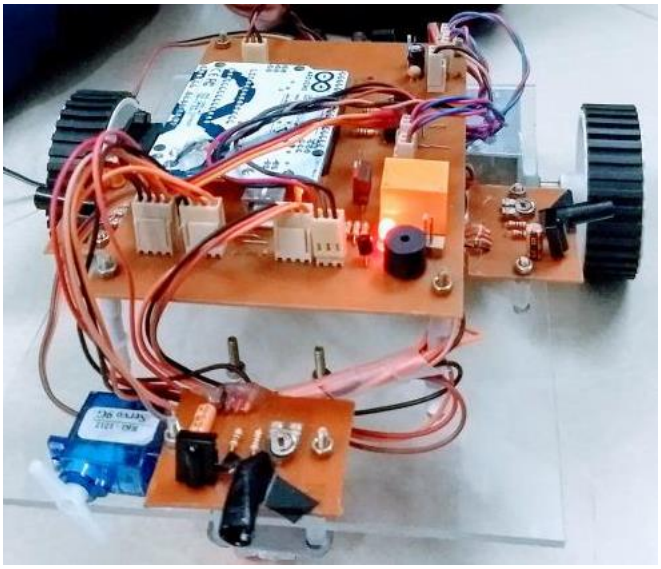

Figure 2: Hardware Model

A. Eye Blink Sensor

Eye Blink Sensor is used to detect whether the driver's eye is closed or not, or to find if the driver suddenly falls asleep. The sensor is attached close and in-line to the driver's eye and continuously monitors the state of the driver's eye and informs the Microcontroller [18].

Figure 3: Eye blink Sensor

The Eye Blink Sensor shown in Fig. 3 is an IR based sensor which gives digital logical level output on each state of the eye. It gives Logic 0 on output when eye is open as all the transmitted IR rays are absorbed by the eye and very low intensity of IR rays reaches the receiver and gives Logic 1 during eyes are closed, as the majority of rays are reflected back by the eyelid and the sensor receives back a high intensity of IR rays. It

works on 5V DC supply and output is TTL logical level [19].

B. IR Sensor

IR sensor consists of an IR transmitter and IR receiver. Infrared Transmitter as shown in Fig. 4 is a Light Emitting Diode (LED), which emits infrared radiations. Hence, they are called as IR LED's. Even though an IR LED looks like a normal LED, the radiation emitted by it is invisible to the human eye. The IR sensor used as TSOP-1738 [20][21].

Infrared receivers are infrared sensors as they detect the radiation intensity from an IR transmitter and based on the intensity received the output received is corresponding binary logic 0 or 1 to indicate whether the eye is open or closed respectively.

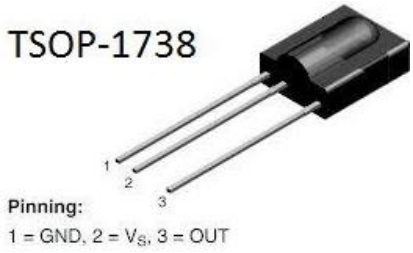

Figure 4: IR Sensor

C. Arduino Board

Arduino board has a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits the Arduino project provides an integrated development environment (IDE) based on the Processing language project. The board is used to compile the program [22].

D. Servo Motor

A servomotor is used to control the vehicle break lever to stop the vehicle. The servo motor operates a mechanical shaft to the break system to stop the vehicle instead of manual pedal braking which is not possible on driver in sleep. A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback.

Figure 5: Servomotor

E. Motor Driver

L293D motor driver circuit is required to provide an interface between the 5V logic signal from the microcontroller & the high current / high voltage power side to drive the motor, because motor is an electromechanical device, which convert electrical energy to rotation/ mechanical energy. For this energy conversion large current excitation is required. These much energy cannot be provided by the logical signal pins from the microcontroller. So a motor interface is used here. The motor drive section should have the capability for accepting the low level logical signal from the controller and to provide necessary voltage and current excitation to the motor.

F. Geared DC Motor

Geared Motor is used to drive the robotic vehicle. The motor should have torque and rpm to meet the requirement like move the vehicle by carrying battery and circuit load. DC motors are the best choice for this purpose. But DC motors are always comes with high rpm 2000 to 3000, and with lesser torque. So usually geared DC motors are used. Geared DC motors are well suitable because they have lesser rpm like 30 or 45 and have sufficient torque to drive the all mechanical load. A 12V motor is preferable because which can be easily connected to 12V battery. Hence we use geared DC motor for drive the robotic vehicle

G. Buzzer

A buzzer is an audio signalling device, typical type of buzzers include alarm devices, timers and confirmation of user input such as a mouse click or keystroke. A buzzer is used to give alert driver to awake from the sleep. As soon as any idle state discovered the Micro-controller switch on the Buzzer to inform the driver.

IV. RESULTS AND DISCUSSION

The aim of this paper is to prevent a vehicle getting involved in an accident. The system was built according to the required specifications and on-ground

trials were conducted in a controlled environment. The robotic vehicle will respond according to the intended programs.

The developed system could take the following actions precisely. They are

- Judge the drowsy state of the driver
- Keep track of the vehicle's proximity to nearby obstacles
- Take control of the wheel in case of no response from the driver's side
- Intelligent actions in the advent of an emergency
- Ensuring the driver and vehicle safety

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