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Design and Construction of Drowsy Driver Detector, Using Eye Blinking Monitoring System for Vehicle Accident Prevention

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ABSTRACT: Drowsiness is one of the main causes for major accidents which lead to injuries, deaths and damages to human. To reduce the rate of road accident caused by drowsiness, eye blinking monitoring system was implemented. The circuitry of this system comprises of seven components which are microcontroller, eye sensor (infrared), voltage regulator, voice recorder, vibrator, speaker and battery. The microcontroller serves as the controlling unit that accept signal from all other components. The IR sensor is used to amplify the input and output of the microcontroller. The battery serves as the power source of the system while the voltage regulator regulates the power from the source. The speaker and the vibrator are used as the output of the system. The system was implemented inform of an eye glass which is worn by the driver while driving the vehicle after the system have been switched ON. In case the driver becomes drowsy, that is, the situation whereby the driver closes his or her eyes for 3 seconds, there will be a voice sound that will awake the driver by saying "WAKE UP" four times through the speaker and the vibrator will be vibrating alongside. With the construction of Drowsy Driver Detector Using Eye Blinking Monitoring System, vehicle accident will be reduced to the bare minimum.

KEYWORDS: Microcontroller, Eye Blinking Monitoring System, Voltage Regulator, Eye Sensor, Battery, Vibraor

I. INTRODUCTION

Vehicle accidents are most common if the driving is inadequate. These happen on most factors if the driver is sleeping or if he/she is an alcoholic. This paper focused mainly on road accidents occurring due to drowsy state of drivers in four wheelers as the increased in fatality rates due to the growth of accidents day by day. Driver drowsiness is recognized as a crucial aspect in the vehicle accidents. It was demonstrated that driving performance deteriorates with increased sleepiness with resulting crashes constituting more than 30 percent of all vehicle accidents. But the life lost once cannot be re- winded.

Driver drowsiness has also been implicated as a causal factor in many accidents because of the marked decline in drivers' perception of risk and recognition of danger, and diminished vehicle-handling abilities[1]. In 2012, the National Highway Traffic Safety Administration (NHTSA) reported that about 0.7% of drivers had been involved in a crash that they attribute to drowsy driving, amounting to an estimated 800 000 to 1.88 million drivers in the past five years ("Sleep facts and stats ,National Sleep foundation Washington, D.C).

The National Sleep Foundation (NSF) also reported that 51% of adult drivers had driven a vehicle while feeling drowsy and 17% had actually fallen asleep[2].

This paper involves measure and controls of the eye blinking using IR sensor. The IR transmitter is used to transmit the infrared rays in our eye. The IR receiver is used to receive the reacted infrared rays of eye. If the eye is closed means the output of IR receiver is high otherwise the IR receiver output is low. This is to know the eye closing or opening Position. This output is given to circuit to indicate the alarm. This project involves controlling accident due to unconscious through Eye blink. Here one eye blink sensor is in vehicle where if driver loses conscious and indicate through alarm.

Drowsiness of drivers is the major cause of vehicle accidents in recent times. Recent analyses estimates that 1200 deaths and 76000 injuries has been attributed to drowsiness related accidents annually[3]. Drowsy driver detector using eye blinking monitoring system is a device that can monitor the drowsiness of a driver which will in turn reduce vehicle accidents.

The specific objectives are to detect the drowsiness of a driver when driving, to design a drowsy devices using eye blinking monitoring metrics and also to alert the driver through vibration and sound. The significant of this project is that; it is mobile, cost effective, very easy to use, high efficient performance, portable and light in weight etc.

II. LITERATURE REVIEW

The world's first demonstration of forward collision avoidance was performed in 1995 by a team of scientists and engineers at Hughes Research Laboratories in Malibu, California. The project was funded by Delco Electronics, and was led by HRL physicist Ross D. Olney[4]. The technology was labeled for marketing purposes as FOREWARN. The system was radar based on a technology that was readily available at Hughes Electronics, but virtually no place else in the world. A small custom fabricated radar-head was developed specifically for this automotive application at 77 GHz. The forward radar-head, plus the signal processing unit and visual-audio-tactile feedbacks were first integrated into a Lexus SC400, and shortly thereafter into a Cadillac STS An SUV-style concept vehicle known as SSC (Safety Security & Communications), that contained many other of Delco's most advanced technologies also received the FOREWARN collision avoidance system and was shown to the public for the first time at the North American International Auto Show at Cobo Hall in Detroit in 1996. This was a fully functional vehicle, and demonstrations were concurrently being provided by a duplicate vehicle while primarily a warning system, with various feedbacks, the system did have minor control of the brakes which were pulsed to begin a braking action in the event of a potential collision, making it also the beginning of avoidance systems. These SSC vehicles were sent around the world, including Europe and Asia, to share this very important life-saving technology with all the major automotive manufacturers in an effort to quick-start their individual development efforts. It took almost 20 years for this important technology to reach the consumer marketplace. In the early-2000, the U.S. National Highway Traffic Safety Administration (NHTSA) researched whether to make frontal collision warning systems and lane departure warning systems mandatory. In 2011, a question was submitted to the European Commission regarding stimulation of these "collision mitigation by braking" systems. The mandatory fitting of Advanced Emergency Braking Systems in commercial vehicles will be implemented on 1 November 2013 for new vehicle types and on 1 November 2015 for all new vehicles in the European Union. This could, according to the impact assessment, ultimately prevent around 5,000 fatalities and 50,000 serious injuries per year across the EU. A 2012 study by the Insurance Institute for Highway Safety examined how particular features of crash-avoidance systems affected the number of claims under various forms of insurance coverage. The findings indicate that two crash-avoidance features provide the biggest benefits, autonomous braking that would brake on its own, if the driver does not, to avoid a forward collision and that would shift the headlights in the direction the driver steers. They found lane departure systems to be not helpful, and perhaps harmful, at the circa 2012 stage of development.

S.P. Bhumkar,et.al (2019) investigated in a paper “Accident avoidance and detection on highways” is when you think of work-related safety hazards, you probably think about what goes on inside the work place. Boneo the greatest threats to your safety are not in the workplace, but rather on the road. Someone is injured every 18seconds. Over 2 million of those injuries turn out to be disabling. A person dies in a crash on U.S. roads every 11 minutes. In fact, motor vehicle accidents are the most common cause of death in the United States more than cancer or heart attacks. When we think about the serious accident, it could change your life- and not for the better[5].

Also S.P. Bhumkar,et.al (2020) investigated in, “Intelligent Car System for Accident Prevention Using ARM-7” that is about making cars more intelligent and interactive which may notify or resist user under unacceptable conditions, they may provide critical information of real time situations to rescue or police or owner himself. Driver fatigue resulting from sleep deprivation or sleep disorders is an important factor in the increasing number of accidents on today's roads. In this paper, we describe a real-time online safety prototype that controls the vehicle speed under driver fatigue[6].

K. Srijayathi, et.at (2016) investigated in, “Implementation of the Driver Drowsiness Detection System” is Driver fatigue is a significant factor in a large number of vehicle accidents. The development of technologies for detecting or preventing drowsiness at the wheel is a major challenge in the field of accident avoidance systems. Because of the hazard that Drowsiness presents on the road, methods need to be developed for counteracting its affects .The aim of this project is to develop a prototype drowsiness detection system. The focus will be placed on designing a system that will accurately monitor the open or closed state of the driver’s eyes in real-time. In today’s world where science has made amazing advances so have the recent cars[7].

These cars are more advanced than ever. But now a day, due to driver drowsiness accidents are increasing day by day. Driver Drowsiness and then they do rash driving as of that they do not have control on themselves. Here we designed a system which will detect driver drowsiness.

Abhi R. Varma, et.al (2017) proposed “An Accident Prevention Using Eye Blinking and Eye Movement” is that describes a real-time online prototype driver fatigue monitor. Various visual cues that typically characterize the level of alertness of a person are extracted in real time and systematically combined to infer the fatigue level of the driver. The visual cues

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employed characterize eyelid movement, gaze movement, head movement, and facial expression. A probabilistic model is developed to model human fatigue and to predict fatigue based on the visual cues obtained[8].

Morris, et.al (2017) used a variance map for the real-time detection of eye blinks. But the performance of this approach strictly depends on head movements. Others used the optical flow, template matching and deformable templates. The two main problems of the previous approaches are the high computational time and the initialization procedure. In this paper, we present a real-time approach that detects visual changes in eye locations using the horizontal symmetry feature of the eyes which does not require any initialization procedure. In addition, the proposed system can detect the state of the eye via a single frame without requiring additional frames[9].

III. METHODOLOGY

The system is made up of seven principal blocks: the microcontroller and its working circuitry; the eye sensor, voltage regulator, buzzer, vibrator, speaker and battery. The microcontroller, AT89S52, is the heart of the system: it stores all the instructions required for this control system to run an effective operation and coordinates the operations of all other parts. An eye sensor is used to monitor the opening and closing of the eye. The eye sensor is also used to amplify the output of the microcontroller to alert the driver through speaker and vibrate when the eye is closed.

Design Analysis

- Microcontroller unit
- Eye sensor (infrared) unit
- Voltage regulator unit
- ISD1820 voice recorder unit
- Vibrator unit
- Battery unit
- Speaker unit

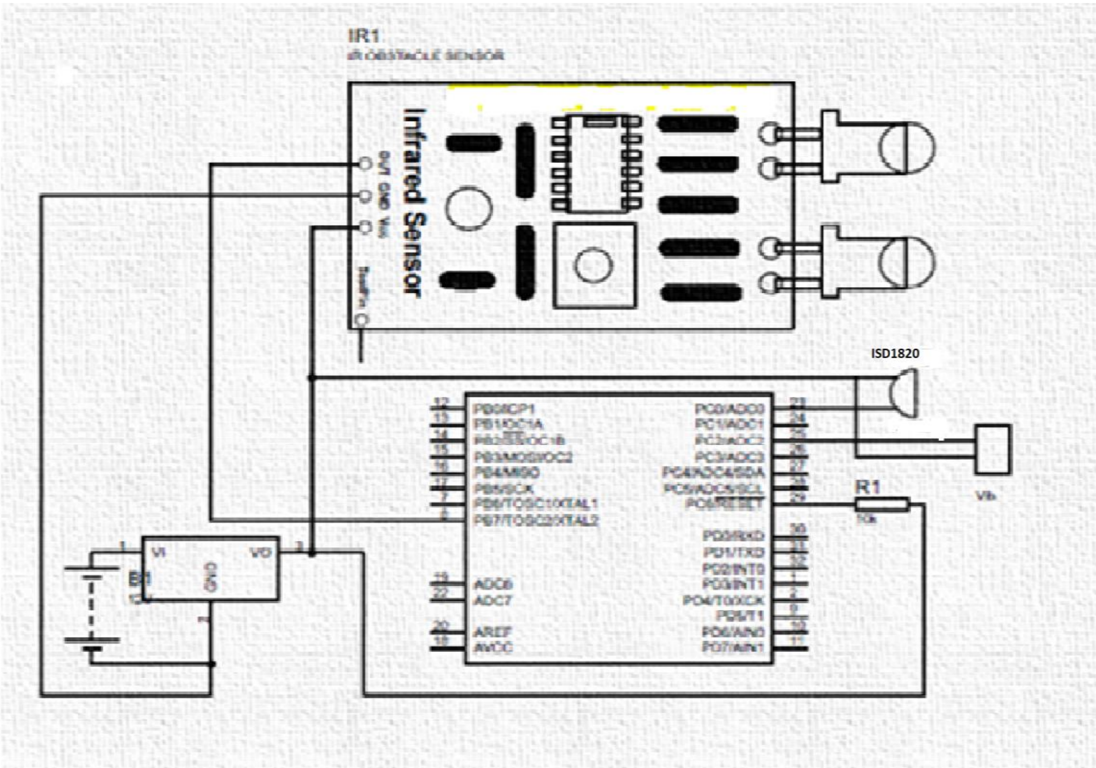

Fig.1: Circuit Diagram of Drowsy Driver Detector Using an Eye Blinking Monitoring System

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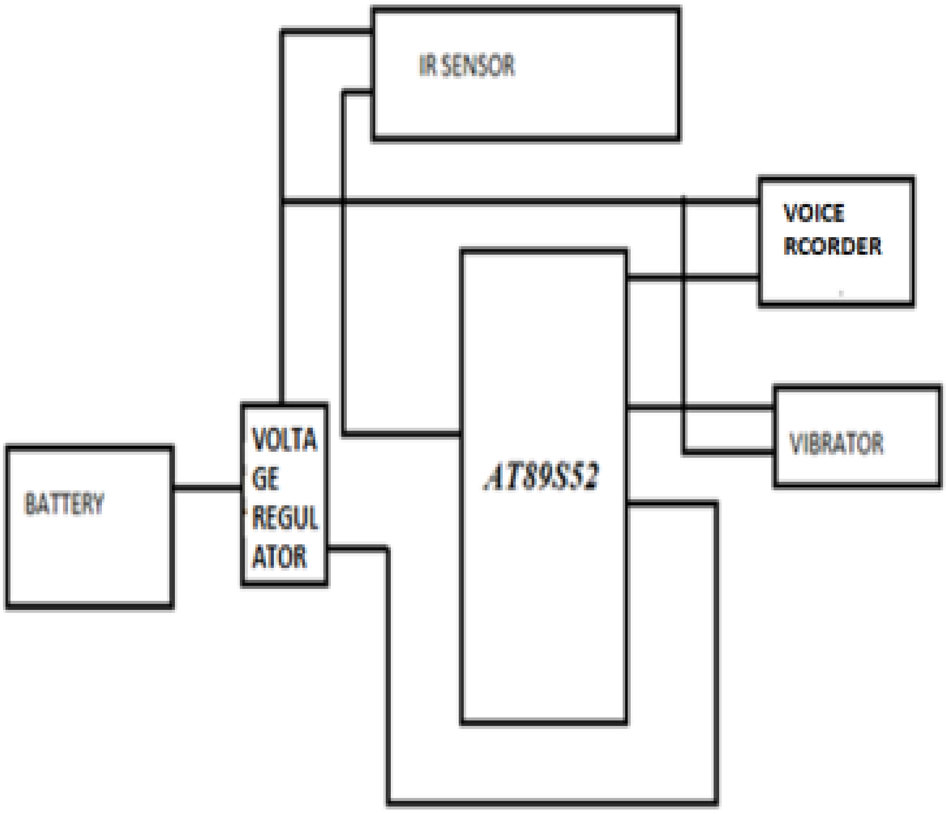

Fig.2: Block Diagram of Drowsy Driver Detector Using an Eye Blinking Monitoring System

Fig.2 shows the block diagram, the battery supplied the power to the system, whereby the voltage regulator regulate the power supplied to the system, all other components are interfaced with the microcontroller (AT89S52) such as vibrator, isd1820, and IR sensor.

1. Microcontroller Unit

Intel Corporation introduced an 8 bit microcontroller called 8051. This microcontroller had 128 bytes of RAM, 4K bytes of chip ROM, two timers, one serial port, and four ports all on a single chip. At the time it was also referred as "A SYSTEMON A CHIP".

The 8051 is an 8-bit processor meaning that the CPU can work only on 8 bits data at a time. Data larger than 8 bits has to be broken into 8 bits pieces to be processed by the CPU. The 8051 has a total of four I\O ports each 8 bit wide. There are many versions of 8051 with different speeds and amount of on-chip ROM and they are all compatible with the original 8051. This means that if you write a program for one it will run on any of them. The 8052 is an original member of the 8051 family. There are two other members in the 8051 family of microcontrollers. They are 8052 and 8031. All the three micro controllers will have the same internal architecture, but they differ in the following aspects.

- 8031 has 128 bytes of RAM, two timers and 6 interrupts.
- 89S51 has 4KB ROM, 128 bytes of RAM, two timers and 6 interrupts.
- 89S52 has 8KB ROM, 128 bytes of RAM, three timers and 8 interrupts of the three microcontrollers, 89S51 is the most preferable. Microcontroller supports both serial and parallel communication. In the concerned project 89S52 microcontroller is used. Here microcontroller used is AT89S52, which is manufactured by ATMEL laboratories.

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2. Eye Sensor Unit

As shown in figure 3, an Infra-red LED emits the light of a particular intensity which is received by an Infra-red Photodiode. The Infra-red photo diode is connected at the input of the operational amplifier, whose output is proportional to intensity of light falling on the Infra-red photo diode.

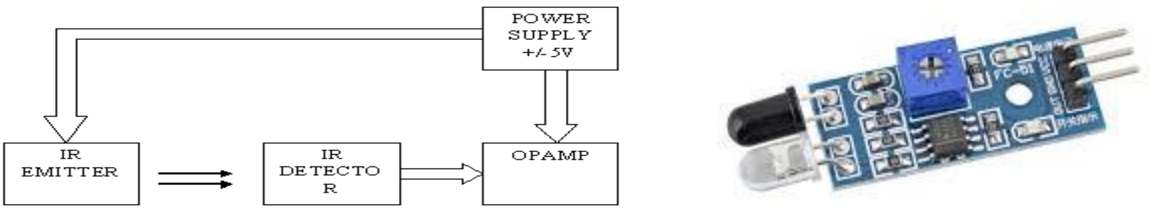

Fig. 3: Eye Blinking Sensor.

3.Voltage Regulator Unit

As the output of IR detector is connected to the inverting terminal of Op-Amp, the input voltage of Op-Amp varies as per the intensity of light falling on IR detector. Hence the output of Op-Amp varies accordingly. While driving, the IR emitter will continuously emit the light, which falls on the driver's eye. This light will be reflected from the driver's eye and detected by the IR detector. When the eye is open, maximum amount of light will be reflected from the eye, as our eye is transparent. So maximum amount of light will be detected by IR detector and so its output will be of maximum. Hence, voltage at inverting input of Op-Amp will be more compared to non-inverting input of Op-Amp. So the output of Op-Amp will be logic 0. When the eye is closed, minimum amount of light will be reflected from the eye, as the skin part is opaque. In this case minimum amount of light will be detected by IR detector hence its output will be of minimum. This causes less voltage at inverting input of Op-Amp as compared to non-inverting input. So the output of Op-Amp will be logic 1. These two states of output will be provided to the micro-controller to drive the buzzer circuit.

4. ISD1820 Unit

Voice Record module is based on ISD1820, which has a multiple message record/ playback device. It can offer true single-chip voice recording, no-volatile storage, and playback capability for 8 to 20 seconds. The sample is 3.2k and the total 20s for the Recorder. This module use is very easy which you could direct control by push button on board or by Microcontroller such as Arduino, STM32, ChipKit etc. It is easy to control record, playback and repeat and so on.

5. Battery Unit

The battery used is rechargeable, 9v with the capacity of 280mAh as shown in figure 4.

Fig. 4: The Battery

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Principle of Operation
When the project is ON by pressing by power switch button. The eye glass is to be put on by the driver while driving the vehicle, should incase the driver's become drowsy the **IR sensor** receives abnormal blinking rate within 3 seconds there will be a voice sound saying "WAKE UP" four times that will to wake him/her up and the vibrator will also vibrate. Driver should switch OFF the system when he/she reach his destination or have a short break while driving so that the battery will not be drained.

IV. TESTING

Construction
The construction of drowsy driver detector using eye blinking monitoring system was done by first gathering the components that were needed. Most of the components used were locally sourced though some were hard to get but all components needed were realized. The construction was started by assembling the components on a Ferro board as specified by the circuit diagram. After which the soldering of the components were done. The fig. 5 shows the circuit panel of the project.

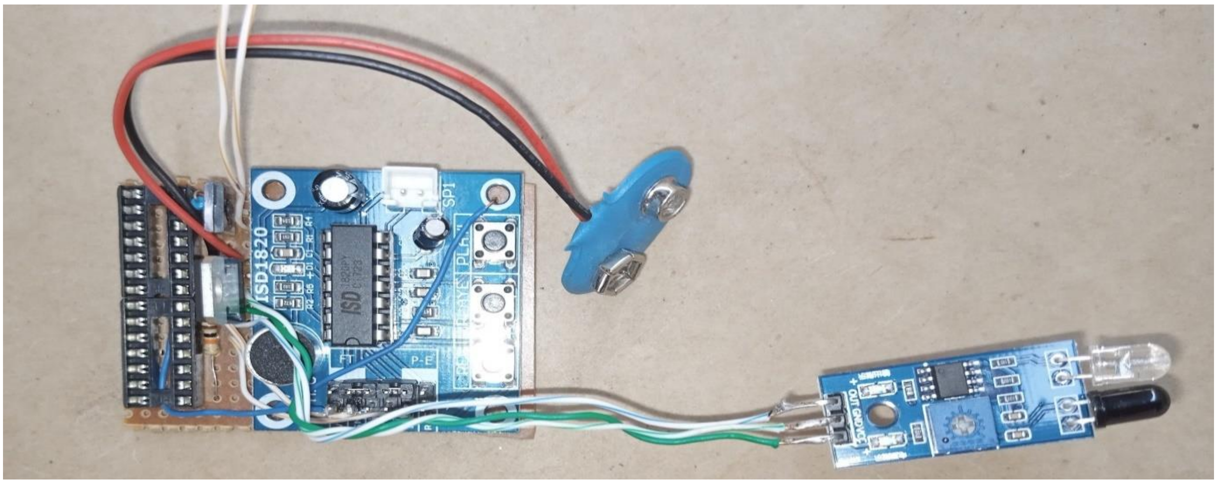

Fig 5: Circuit Panel of Eye Blinking Monitoring System

Packaging/ Casing
As shown in Fig.6. The hardware was cloned together using different component such as eye glass, buzzer, vibrator, IR sensor, 9volts battery, wire, ferro board, and switch. The hardware was being packaged with care to avoid damage to the circuit and to prevent incorrect operation of the system.

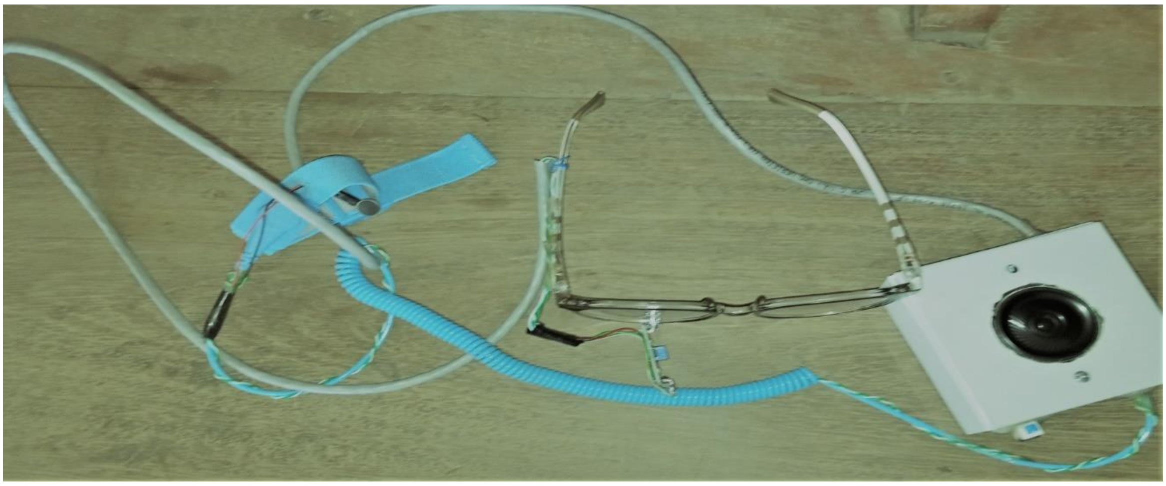

Fig. 6: Finished Design.

Software Test

As shown in Fig.7, the project was facilitated by C Language programming Compiler provided by AtmelStudio used to compile and debug the software code written for the microcontroller.

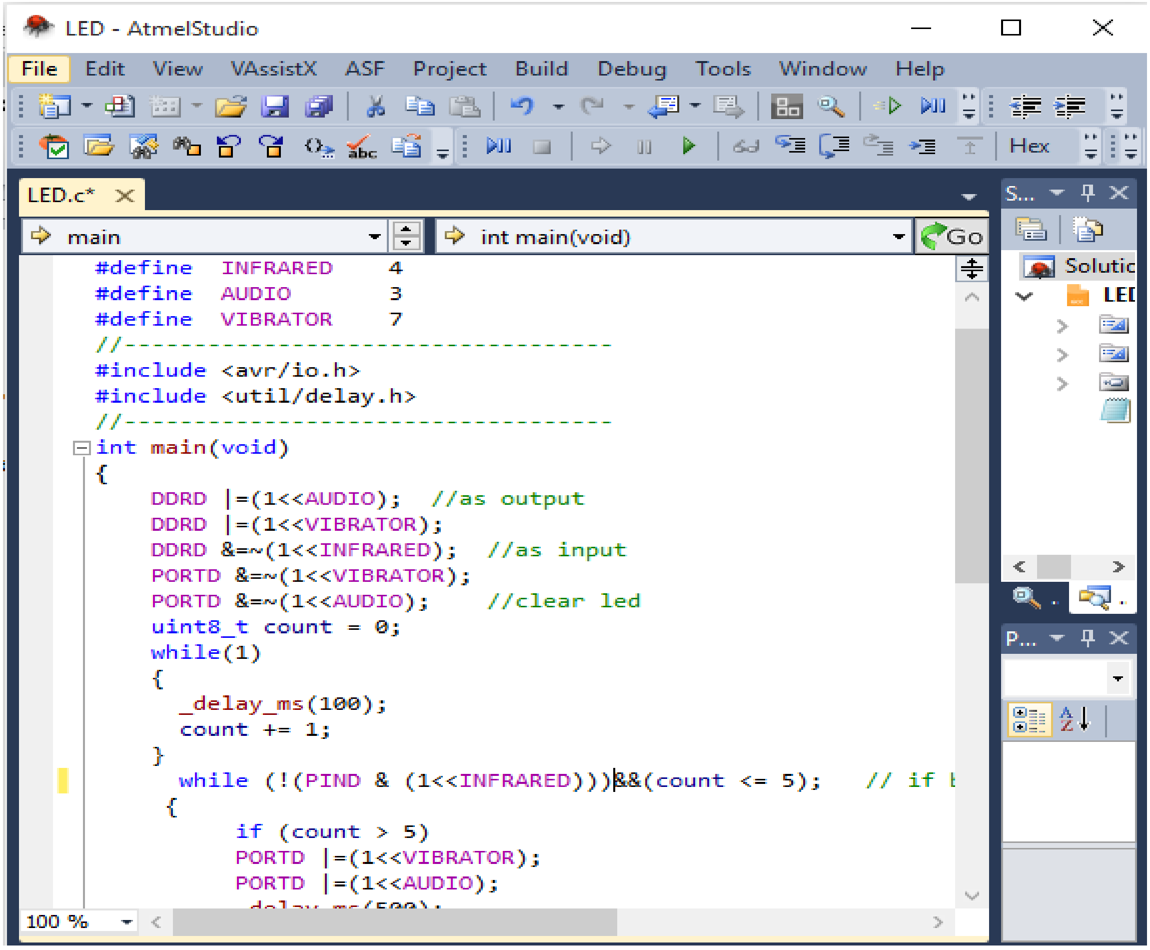

Fig. 7: Software Test of The Project

Hardware Test

All the sections of the project were coupled together using microcontroller and power supply circuit. When the eye blinking monitoring system was powered with 9volts battery, the buzzer gives the alarm. The 5V generated from power supply was connected to power the circuit. Fig4.5 shows the operation of (EBM) once the eye is closed and the infrared sensor receives an abnormal signal for at least 3seconds, the speaker will gives a warning sound.’

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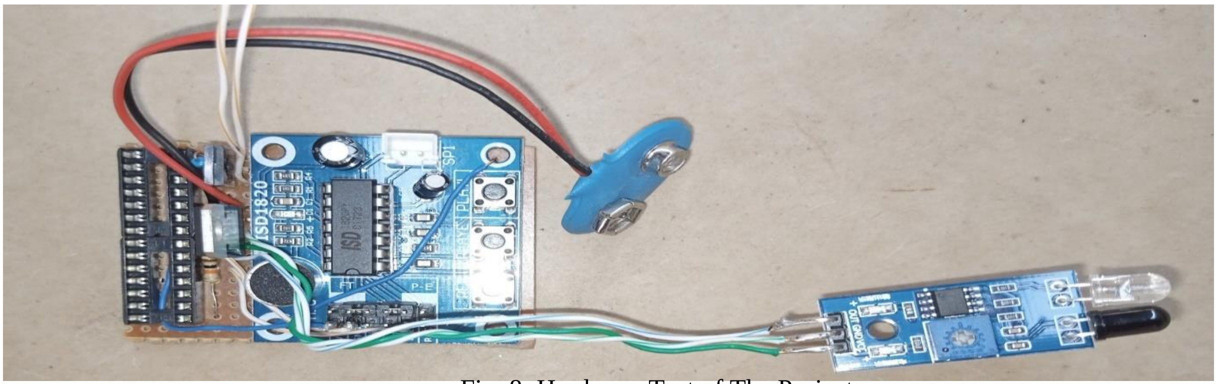

Fig. 8: Hardware Test of The Project.

V. CONCLUSION

This project involves controlling road accident due to drowsiness with eye blink sensor fixed at the right side of the eye glass, using IR sensor. The IR transmitter is used to transmit the infrared rays into the eye. The IR receiver is used to receive the reflected infrared rays of eye in case the driver slept or become drowsy. If the eye is closed, it means the output of IR receiver is high otherwise the IR receiver output is low [10]. This output is given to logic circuit to indicate the alarm.

The frequency of correct eye blink is dependent on the nervous system, which noted that time between blinks takes o.26seconds for men and 0.51seconds for women. The time when eyes are closed during blinking is called time of obfuscation,[11][12]. By observing the work of drowsy driver detector using eye blinking monitoring system, it is found that while driving, the driver wears the Eye glass with the vibrator, the IR sensor will not affect normal blinking rate of eyes. However, if the driver tends to sleep, the system sounds an alarm saying "WAKE UP" four times and vibrates, causing the driver to be awake so as to concentrate on driving and the system will be in standby mode when the driver is awake that is not sleeping.

REFERENCES

[1] Abhi R. Varma, Seema V. Arote, ChetnaBharti (2017) "Accident Prevention Using Eye Blinking And Eye Movement".
[2] Ayoob,S.P. Bhumker, V.V. Deotac, R.V.Baber. (2003) "Group of Researcher at Carnegie Mellon University". Ask International .com Retrieved 2003-10-22.
[3] Bhumker, S.P Deotac, V.V. R.V.Babar (2019)."Accident avoidance and detector on high way" United State.
[4] Bhumker, S.P. Deotac, V.V. R.V.Baber (2019). "Intelligent Car System for Accident Prevention using ARM-7".
[5] Bracha, V. (1998)."Eye Blink Conditioning Laboratory Setup".
[6] FabioloCasto(2018). "Class 1 Eye Blink Detector" CNR-Institute of Acoustics, Via Del Fosso Del, Rome, Italy.
[7] HRL Physicist Ross D. Olney (2018)."Hughes Electronics" Hughes Research Laboratories, Malibu, Califonia.
[8] Kenneth J. Ayala (1997)."Micro Controller Architecture, Program and application, 2nd Edition.
[9] Morris Anirban dasgupta, anjith george, (2017) "A Vision Based System For Real time detection of eye blink".
[10] Onken, Feraric (2016) "Researcher and Development on Driver Assistances".
[11] Piluttiand Tamid, Artem A. Lenskiy and Jong-Soo Lee (2017). "The National Sleep Foundation" Washington D.C
[12] Rau Lopes, D.J Sanghvi, Aditya Shah (2017),"Drowsiness Detection basedon EyeMovement, Yawn Detection and Head Rotation", Vol. 2,No.6,
[13] Sirjayathi V, M.Vadachary (2016)."Implementation on Driver Drowsiness Detector System" Roma,Italy.
[14] Steven B. Ryan, kryle H. Holland, Micheal A. Hord and VlastislavBracha (2019).A long-range, wide field-of-view infrared Eye Blink Detector".