Driver Drowsiness Detection System using Image Processing Technique by the Human Visual System

R.Sasikala [1], S.Suresh [2], J.Chandramohan [3], M.Valanrajkumar [4]
[1] Post-Graduate Scholar, Department of Electrical and Electronics Engineering, Gnanamani College of Technology, Namakkal, Tamilnadu, India.
[2] Assistant Professor, Department of Electrical and Electronics Engineering, Gnanamani College of Engineering, Namakkal, Tamilnadu, India
[3, 4] Professor, Department of Electrical and Electronics Engineering, Gnanamani College of Engineering, Namakkal, Tamilnadu, India

Abstract – The purpose of this paper was to device a way to alert drowsy drivers in the act of driving. One of the causes of vehicle accidents comes from drowsiness of the driver. In recent years, we have used many technologies to detect the drowsiness of a driver in the field of accident avoidance system. To develop such a system we need to install some hardware components like camera inside the vehicle, which can capture the image of the driver at a fixed interval, and an alarm system, which will alert the driver after detecting his/her level of drowsiness and in the next level it will stop the vehicle automatically. Now apart from these hardware components, we need a software part also, which can detect the level of drowsiness of the driver and is the main concern of our paper. In this paper, we develop a drowsiness detection system that will accurately monitor the open or closed state of the driver's eyes in real-time.

1. INTRODUCTION

Driver drowsiness is one of the biggest safety issues facing the road transport industry today and the most dangerous aspect of driver fatigue is falling asleep at the wheel. Fatigue leads to sleep, it reduces reaction time a critical element of safe driving. It also reduces vigilance, alertness and concentration so that the ability to perform attention-based activities such as driving is impaired. The speed at which information is processed is also reduced by sleepiness. The quality of decision-making may also be affected.

Driver falls in micro sleep, results in collision with object or vehicle, or they cannot recognize that he or she has drifted into a wrong lane. The consequences of a drowsy driver are very dangerous and lead to loss of lives, casualties and vehicle damage. As the most important safety factor, it is necessary to make some serious measures, in order to improve working conditions of drivers, so that negative consequences subjected by a drowsy driver can be minimized.

Computer Science and Engineering contributes their responsible role for development and betterment of society by providing their valuable services in various fields belong to different aspects of life. Driver drowsiness detection system is such an example that can be used as a security measure that alerts the drowsy driver while driving, in order to safeguard himself as well as others.

A few systems already had been created, in light of recording of head developments, movement of steering wheel, heart rate variability or grip quality. Systems that utilize a camera for the tracking of eye movements have already been created. In any case, so far no framework has turned out to be adequately reliable. Previous method relies on the LED's and multiple cameras to estimates the facial expressions however moving vehicle introduces new difficulties like variable lighting and running backgrounds. This paper presents a solution for minimizing the road accident caused by the drowsiness of driver by alerting through a single camera placed on the dash board of vehicle. Smart vehicle vendors have developed this technology by applying different techniques. The algorithm of eye detection system integrated with hardware to develop the smart vehicles, which can implement nationwide to avoid the road accidents. Microcontroller and camera are used to make and intelligent hardware and software integrated system. The purpose of this study is to build up a model of Drowsiness Detection System. The system will precisely check in real time, the open or close condition of the eyes of driver. By checking the driver's eyes, the indications of driver drowsiness can be identified in the beginning to protect from vehicle accident.

In this paper we proposed a driver drowsiness alert system. It is non-intrusive system for monitoring driver drowsiness based on open and close conditions of eyes. Eye behaviors provide significant information about driver's alertness and that if visual behavior can be measured then it will be feasible to predict driver's state of drowsiness, vigilance or attentiveness.

2. RELATED WORK

A literature review discusses published information in a particular subject area within a certain time period .A literature review can be just a simple summary and synthesis. it describes about the literature survey on various journals and explored mobile communication followed by existing for a digital

mobile telephony system to display the message using wireless networks.

2.1 Eye Behavior Based Drowsiness Detection System.

A non-intrusive computer vision based ideas has been utilized for the development of a Drowsy Driver Detection System. The sm all camera has been used by system that focuses straight towards the face of driver and checks the driver eyes with a specific end goal to recognize fatigue. A warning sign is issued to caution the driver, in such situation when fatigue is recognized. This paper illustrates the process of locate the eyes of driver, and to decide whether the eyes of driver are open or close. The system manages utilizing data gained for the image which is in binary form to locate the face edges, wh ich gets the location where the eyes of a person may exist. If the eyes of driver are found close for five successive frames, the proposed system assures that the driver is nodding off and a signal of warning has been issued. The framework is also capable to recognize in such situation when the eyes can ft be discovered, and works in sensible lighting circumstances. The result demonstrates that eye-tracking drowsiness functions admirably for a few drivers the length of the squint acknowledgment works appropriately. The camera based drowsiness measures give an appreciated contribution

2.2 Driver Drowsiness Detection using Eye-Closeness Detection

The purpose of this paper was to devise a way to alert drowsy drivers in the act of driving. One of the causes of car accidents comes from drowsiness of the driver. Therefore, this study attempted to address the issue by creating an experiment in order to calculate the level of drowsiness. A requirement for this paper was the utilization of a Raspberry Pi Camera and Raspberry Pi 3 module, which were able to calculate the level of drowsiness in drivers. The frequency of head tilting and blinking of the eyes was used to determine whether or not a driver felt drowsy. With an evaluation on ten volunteers, the accuracy of face and eye detection was up to 99.59 percent.

2.3 Real Time Eye Detection and Tracking Method for Driver Assistance System

Drowsiness and fatigue of automobile drivers reduce the drivers' abilities of vehicle control, natural reflex, recognition and perception. Such diminished vigilance level of drivers is observed at night driving or overdriving, causing accident and pose severe threat to mankind and society. Therefore it is very much necessary in this recent trend in automobile industry to incorporate driver assistance system that can detect drowsiness and fatigue of the drivers. This paper presents a nonintrusive prototype computer vision system for monitoring a driver's vigilance in realtime. Eye tracking is one of the key technologies for future driver assistance systems since human eyes contain much information about the driver's condition such as gaze, attention level, and fatigue level. One problem common to many eye tracking methods proposed so far is their sensitivity to lighting condition change. This tends to significantly limit their scope for automotive applications. This paper describes real time eye detection and tracking method that works under variable and realistic lighting conditions. It is based on a hardware system for the real-time acquisition of a driver's images using IR illuminator and the software implementation for monitoring eye that can avoid the accidents.

2.4 Driver's drowsiness detection using eye status to improve the road safety

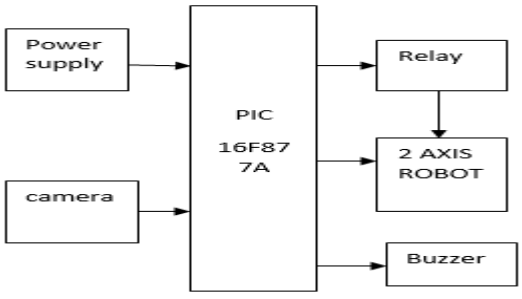
In recent years, we have used many technologies to detect the drowsiness of a driver in the field of accident avoidance system. To develop such a system we need to install some hardware components like camera inside the car, which can capture the image of the driver at a fixed interval, and an alarm system, which will alert the driver after detecting his/her level of drowsiness. Now apart from these hardware components, we need a software part also, which can detect the level of drowsiness of the driver and is the main concern of our paper. It is believed that, driver's fatigue can be easily detected by monitoring the eye status, which is either 'open' or 'closed'. In this paper, we develop a drowsiness detection system that will accurately monitor the open or closed state of the driver's eyes in real-time.

2.5 Driver Drowsiness Detection System and Techniques

Drivers who do not take regular breaks when driving long distances run a high risk of becoming drowsy a state which they often fail to recognize early enough according to the experts. Studies show that around one quarter of all serious motorway accidents are attributable to sleepy drivers in need of a rest, meaning that drowsiness causes more road accidents than drink-driving. Attention assist can warn of inattentiveness and drowsiness in an extended speed range and notify drivers of their current state of fatigue and the driving time since the last break, offers adjustable sensitivity and, if a warning is emitted, indicates nearby service areas in the COMAND navigation system.

3. PORPOSED MODELLING

3.1 Block Diagram



4. WORKING PRINCIPLE

In this project, driver's eye drowsiness is detected and alert the driver, also stop the vehicle automatically if the driver does not give response to the alert. For this, the camera is fixed on the vehicle that focuses straight towards the face of driver and checks the driver eyes with a specific end goal to recognize drowsiness using Mat lab.

A buzzer is issued to caution the driver, in such situation when drowsiness is recognized. If a driver does not give response to the buzzer means then the controller will stop the vehicle. For this pic microcontroller is used.

Hardware Requirement

- ✓ PIC microcontroller
- ✓ Camera
- ✓ Buzzer
- ✓ Relay
- ✓ Two axis Robot

Software requirement:

- ✓ Embedded C
- ✓ Mat lab

Hardware Description:

Power supply:

The ac voltage, typically 220V rms, is connected to a transformer, which steps that ac voltage down to the level of the desired dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation.

A regulator circuit removes the ripples and also remains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of the popular voltage regulator IC units.

Working principle

Transformer

The potential transformer will step down the power supply voltage (0-230V) to (0-6V) level. Then the secondary of the potential transformer will be connected to the precision rectifier, which is constructed with the help of op–amp. The advantages of using precision rectifier are it will give peak voltage output as DC, rest of the circuits will give only RMS output.

Bridge rectifier

When four diodes are connected as shown in figure, the circuit is called as bridge rectifier. The input to the circuit is applied to the diagonally opposite corners of the network, and the output is taken from the remaining two corners.

Let us assume that the transformer is working properly and there is a positive potential, at point A and a negative potential at point B. the positive potential at point A will forward bias D3 and reverse bias D4.

The negative potential at point B will forward bias D1 and reverse D2. At this time D3 and D1 are forward biased and will allow current flow to pass through them; D4 and D2 are reverse biased and will block current flow.

The path for current flow is from point B through D1, up through RL, through D3, through the secondary of the transformer back to point B. this path is indicated by the solid arrows. Waveforms (1) and (2) can be observed across D1 and D3.

One-half cycle later the polarity across the secondary of the transformer reverse, forward biasing D2 and D4 and reverse biasing D1 and D3. Current flow will now be from point A through D4, up through RL, through D2, through the secondary of T1, and back to point A. This path is indicated by the broken arrows. Waveforms (3) and (4) can be observed across D2 and D4. The current flow through RL is always in the same direction. In flowing through RL this current develops a voltage corresponding to that shown waveform (5). Since current flows through the load (RL) during both half cycles of the applied voltage, this bridge rectifier is a full-wave rectifier.

One advantage of a bridge rectifier over a conventional full-wave rectifier is that with a given transformer the bridge rectifier produces a voltage output that is nearly twice that of the conventional full-wave circuit.

The maximum voltage that appears across the load resistor is nearly-but never exceeds-500 v0lts, as result of the small voltage drop across the diode. In the bridge rectifier shown in view B, the maximum voltage that can be rectified is the full secondary voltage, which is 1000 volts. Therefore, the peak output voltage across the load resistor is nearly 1000 volts. With both circuits using the same transformer, the bridge rectifier circuit produces a higher output voltage than the conventional full-wave rectifier circuit.

IC voltage regulators

Voltage regulators comprise a class of widely used ICs. Regulator IC units contain the circuitry for reference source, comparator amplifier, control device, and overload protection all in a single IC. IC units provide regulation of either a fixed positive voltage, a fixed negative voltage, or an adjustably set voltage. The regulators can be selected for operation with load

currents from hundreds of milli amperes to tens of amperes, corresponding to power ratings from milli watts to tens of watts.

A fixed three-terminal voltage regulator has an unregulated dc input voltage, Vi, applied to one input terminal, a regulated dc output voltage, Vo, from a second terminal, with the third terminal connected to ground.

The series 78 regulators provide fixed positive regulated voltages from 5 to 24 volts. Similarly, the series 79 regulators provide fixed negative regulated voltages from 5 to 24 volts.

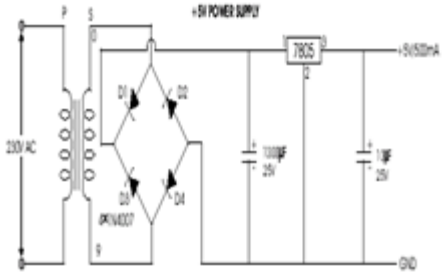
PIC microcontroller:

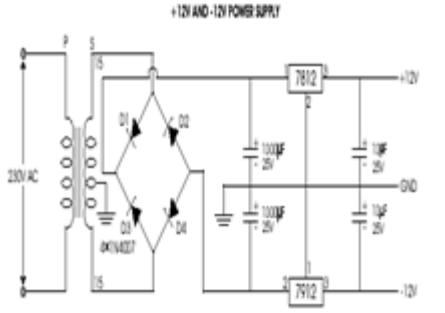
PIC 16f887 Microcontroller

The PIC16F887 is one of the latest products from Microchip. It features all the components which modern microcontrollers normally have. For its low price, wide range of application, high quality and easy availability, it is an ideal solution in applications such as: the control of different processes in industry, machine control devices.

Power supply voltage 2.0-5.5V

Consumption: 220uA (2.0V, 4MHz), 11uA (2.0 V, 32 KHz) 50nA (stand-by mode)





- Power-Saving Sleep Mode
- Brown-out Reset (BOR) with software control option

35 input/output pins

- High current source/sink for direct LED drive
- software and individually programmable *pull-up* resistor
- Interrupt-on-Change pin

8K ROM memory in FLASH technology

- Chip can be reprogrammed up to 100.000 times

IN-CIRCUIT SERIAL PROGRAMMING OPTION

- Chip can be programmed even embedded in the target device

256 bytes EEPROM memory

Data can be written more than 1.000.000 times

368 bytes RAM memory

- 14-channels
- 10-bit resolution
- Two analogue comparators
- Voltage reference (0.6V)
- Programmable on-chip voltage reference

Enhanced USART module

- Supports RS-485, RS-232 and LIN2.0
- Auto-Baud Detect

There are two types of PIC interrupts:

Software interrupts

Come from a program that runs by the processor and “request” the processor to stop running the program, go to make an interrupt and then to return to continue to execute the program.

Hardware Interrupts

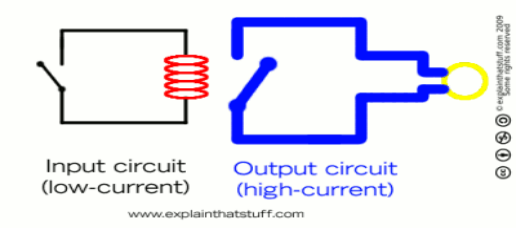
These are sent to microcontroller by hardware devices as a third-party; some of them can be s blocked - (masking) by Interrupt Enable bit (IE). When the interrupt is “blocked”, the PIC microcontroller does not "see" the request.

Relay

A relay is an electromagnetic switch operated by a relatively small electric current that can turn on or off a much larger electric current. The heart of a relay is an electromagnet (a coil of wire that becomes a temporary magnet when electricity flows through.

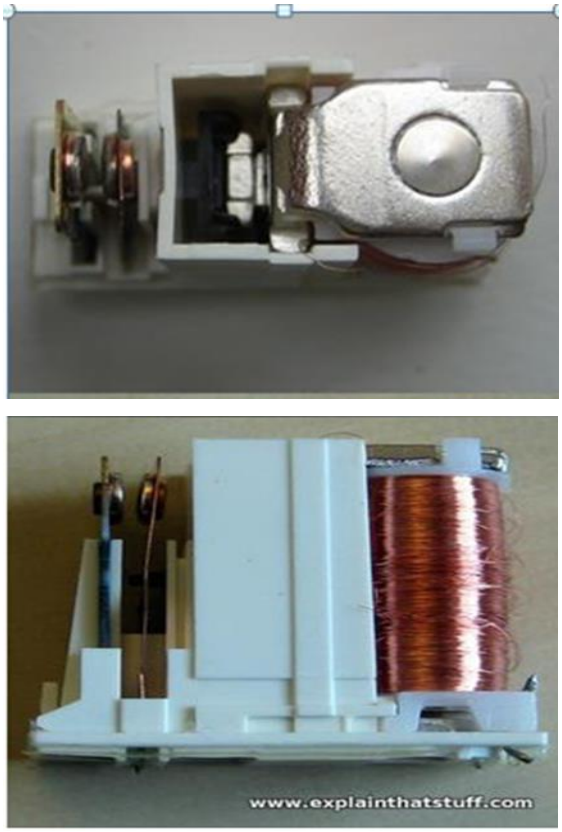
Here's another animation showing how a relay links two circuits together. It's essentially the same thing drawn in a slightly different way. On the left side, there's an input circuit powered by a switch or a sensor of some kind. When this circuit is activated, it feeds current to an electromagnet that pulls a metal switch closed and activates the second, output circuit (on

the right side). The relatively small current in the input circuit thus activates the larger current in the output circuit:



1. The input circuit (black loop) is switched off and no current flows through it until something (either a sensor or a switch closing) turns it on. The output circuit (blue loop) is also switched off.
2. When a small current flows in the input circuit, it activates the electromagnet (shown here as a red coil), which produces a magnetic field all around it.
3. The energized electromagnet pulls the metal bar in the output circuit toward it, closing the switch and allowing a much bigger current to flow through the output circuit.
4. The output circuit operates a high-current appliance such as a lamp or an electric motor.

Relays in Practice



Two-axis robot:

Industrial robot systems continue to transform the manufacturing landscape. They reduce labour costs and maximize quality, efficiency, and speed, driving down operational costs and getting products to market faster. Typical applications of robots include welding, painting, assembly, pick and place for printed circuitboards, packaging and labeling, palletizing, product inspection, and testing; all accomplished with high endurance, speed, and precision. They can help in material handling and provide interfaces.

Industrial robots have various axis configurations, depending on the task and the needed range of motion. They have also come down in size, which allows them to execute tasks in smaller-scale applications and reduces their footprint.

An axis in robotic terminology represents a degree of freedom(DOF). For example, if a robot has three degrees of freedom, it can operate in the x, y, and z planes. However, it cannot tilt or turn. Increasing the number of axes allows the robot to access a greater amount of space by giving it more degrees of freedom.

As provided below by Greg Martin, field engineer with Bastian Solutions, a firm that specializes in automation and information systems, more axes means more functionality:

- ✓ 1-axis robot: Linear guide system for transferring parts in a single line of motion.
- ✓ 2-axis robot: Typically in an XY or YZ configuration, these are often in the form of two adjoining linear guides.
- ✓ 3-axis robot: Typically in an XYZ configuration, these tend to be in the form of two adjoining linear guides and a third axis guide or cylinder.
- ✓ 4-axis robot: A more conventional arm that is typically used in palletizing applications in which the face plate is always parallel with the ground. Has the ability to rotate the object it is picking.
- ✓ 5-axis robot: Similar to a conventional four-axis robot but adds the ability to rotate the object it is picking.
- ✓ 6-axis robot: Offers the most flexibility with six axes all the way from the base axis for full robot rotation to the sixth axis for rotating the "wrist" or faceplate.
- ✓ 7-axis robot: A six-axis robot which is placed on a rail or some means to move it from one place to another in a linear direction.

"There are hundreds of software options that can typically be applied to a given robot and controller," adds Martin. "Thus it is important to understand the robotic programming details and requirements prior to implementation."

Advanced controls make the robots easier to use and program. In some cases, online tools allow operators and end users to quickly choose and configure robot features.

Camera

A camera is an optical instrument for recording or capturing images, which may be stored locally, transmitted to another location, or both. The images may be individual still photographs or sequences of images constituting videos or movies. The camera is a remote sensing device as it senses subjects without physical contact. The functioning of the camera is very similar to the functioning of the human eye.

Wireless security cameras are closed-circuit television (CCTV) cameras that transmit a video and audio signal to a wireless receiver through a radio band. Wireless cameras are proving very popular among modern security consumers due to their low installation costs and flexible mounting options; wireless cameras can be mounted/installed in locations previously unavailable to standard wired cameras. In addition to the ease of use and convenience of access, wireless security camera allows users to leverage broadband wireless internet to provide seamless video streaming over-internet.

It consists of a camera, a processor and a database system for capturing of image, further processing and maintenance of attendance log in an automated way. Then the camera captures the image and sends it to the processor, which employs the Morphological face recognition concept & FLANN (Fast library for Approximate Nearest Neighbour) algorithm for efficient face recognition.

Features:

- ♣ The system greatly improves the processing time and also minimizes the space required by using minimal sample photos when compared to existing systems.
- ♣ The system is fool-proof in the sense that, it can accurately recognize the candidate's face irrespective of change in factors like facial expressions, facial hair etc.
- ♣ The system is smart enough to differentiate between a photo of the candidate and the actual candidate standing in front of the camera thus preventing one of the obvious ways to fool the system.
- ♣ It provides a flexibility of 15 degrees tilt (max) on either side.

Basic elements of a modern still camera:

A camera may work with the light of the visible spectrum or with other portions of the electromagnetic spectrum. A still camera is an optical device which creates a single image of an object or scene and records it on an electronic sensor or photographic film. All cameras use the same basic design: light enters an enclosed box through a converging lens/convex lens and an image is recorded on a light-sensitive medium(mainly a transition metal-halide).

A shutter mechanism controls the length of time that light can enter the camera. Most photographic cameras have functions that allow a person to view the scene to be recorded, allow for a desired part of the scene to be in focus, and to control the exposure so that it is not too bright or too dim. A display, often a liquid crystal display (LCD), permits the user to view scene to be recorded and settings such as ISO speed, exposure, and shutter speed.

A movie camera or a video camera operates similarly to a still camera, except it records a series of static images in rapid succession, commonly at a rate of 24 frames per second. When the images are combined and displayed in order, the illusion of motion is achieved

Buzzer:

A buzzer or beeper is a signalling device, usually electronic, typically used in automobiles, household appliances such as a microwave oven, or game shows.

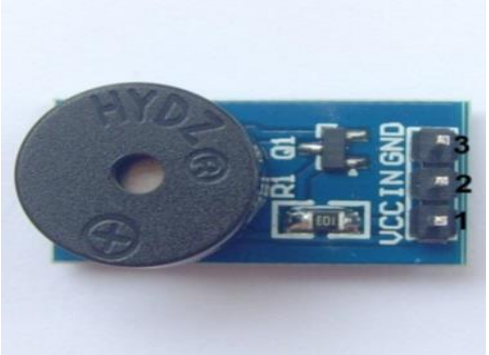
It most commonly consists of a number of switches or sensors connected to a control unit that determines if and which button was pushed or a preset time has lapsed, and usually illuminates a light on the appropriate button or control panel, and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound. Initially this device was based on an electromechanical system which was identical to an electric bell without the metal gong (which makes the ringing noise). Often these units were anchored to a wall or ceiling and used the ceiling or wall as a sounding board.

Another implementation with some AC-connected devices was to implement a circuit to make the AC current into a noise loud enough to drive a loudspeaker and hook this circuit up to a cheap 8-ohm speaker. Nowadays, it is more popular to use a ceramic-based piezoelectric sounder like a Sonalert which makes a high-pitched tone. Usually these were hooked up to "driver" circuits which varied the pitch of the sound or pulsed the sound on and off.

In game shows it is also known as a "lockout system," because when one person signals ("buzzes in"), all others are locked out from signalling. Several game shows have large buzzer buttons which are identified as "plungers".

The word "buzzer" comes from the rasping noise that buzzers made when they were electromechanical devices, operated from stepped-down AC line voltage at 50 or 60 cycles. Other sounds commonly used to indicate that a button has been pressed are a ring or a beep. Some systems, such as the one used on Jeopardy!, make no noise at all, instead using light.

Buzzer Module



General description:

A buzzer or beeper is an audio signalling device, which may be mechanical, electromechanical, or piezoelectric. Active buzzer 5V Rated power can be directly connected to a continuous sound, this section dedicated sensor expansion module and the board in combination, can complete a simple circuit design, to "plug and play."

Specifications:

• On-board passive buzzer

• On-board 8550 triode drive

• Can control with single-chip microcontroller IO directly

• Working voltage: 5V

• Board size: 22 (mm) x12 (mm)

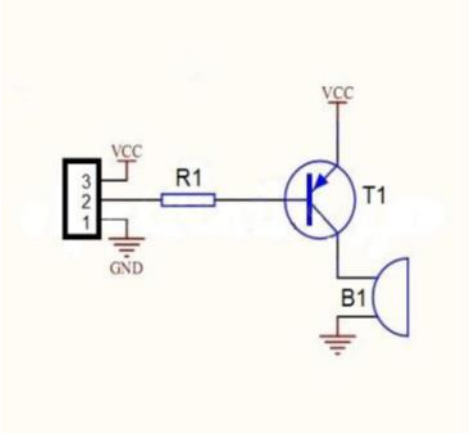
Pin configuration:

1. VCC

2. Input

3. Ground

Schematic diagram:



How to test:

1. Connect your Arduino microcontroller to the computer.

2. Connect the VCC pin of your module to the to the 5V pin of your Arduino.

3. Connect the GND pin of your module to the GND pin of your Arduino.

4. Connect the Input pin of your module to the pin 13 of your Arduino.

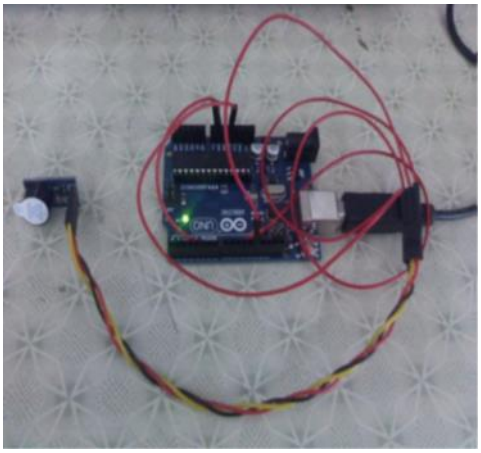
5. Enter this program to your Arduino Integrated Development Environment (IDE):

```
int buzzer = 13;

void setup()

{

pinMode(buzzer, OUTPUT);

}

void loop()

{

digitalWrite(buzzer, HIGH);

delay(1000);

digitalWrite(buzzer, LOW);

delay(1000);

}
```

6. Lastly, click the Upload Button.

Testing Results:

The sample sketch above is a blink which is also applicable for LEDs. The output is the turning on and off of the buzzer every other second. The picture below shows the setup of your module and Arduino:



Software Description:

Embedded C:

The C standard doesn't care about embedded, but vendors of embedded systems usually provide standalone implementations with whatever amount of libraries they're willing to provide. C is a widely used general purpose high level programming language mainly intended for system programming.

Necessity:

During immature years of microprocessor based systems, programs were developed using assemblers and fused into the EPROMs. There used to be no mechanism to find what the program was doing. LEDs, switches, etc. were used to check for correct execution of the program. Only a select few developers had In-Circuit Emulator's (ICE's), but they were too costly and were not very reliable.

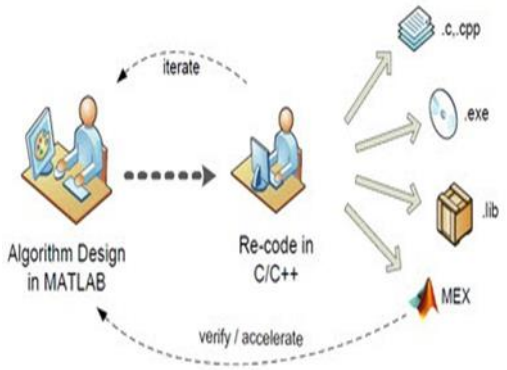
Advantages:

- It is small and simpler to learn, understand, program and debug.
- Compared to assembly language, C code written is more reliable and scalable, more portable between different platforms.
- C compilers are available for almost all embedded devices in use today, and there is a large pool of experienced C programmers.
- Unlike assembly, C has advantage of processor-independence and is not specific to any particular microprocessor/microcontroller or any system. This makes it convenient for a user to develop programs that can run on most of the systems.
- As C combines functionality of assembly language and features of high level languages, C is treated as a 'middle-level computer language' or 'high level assembly language'.
- It is fairly efficient.
- It supports access to I/O and provides ease of management of large embedded projects.

Basics of embedded c program and programming structure:

Embedded C Programming is the soul of the processor functioning inside each and every embedded system we come across in our daily life, such as mobile phone, washing machine, and digital camera.

Each processor is associated with an embedded software. The first and foremost thing is the embedded software that decides functioning of the embedded system. Embedded C language is most frequently used to program the microcontroller.



Embedded C Programming

Earlier, many embedded applications were developed using assembly level programming. However, they did not provide portability. This disadvantage was overcome by the advent of various high level languages like C, Pascal, and COBOL. However, it was the C language that got extensive acceptance for embedded systems, and it continues to do so. The C code written is more reliable, scalable, and portable; and in fact, much easier to understand.

About C Language

C language was developed by Dennis Ritchie in 1969. It is a collection of one or more functions, and every function is a collection of statements performing a specific task. C language is a middle-level language as it supports high-level applications and low-level applications. Before going into the details of embedded C programming, we should know about RAM memory organization.

Data types

Data Type	Size	Range
Char or signed char	1byte	-128 to +128
Unsigned char	1byte	0 to 255
Int or singed int	2byte	-32768 to 32767
Unsigned int	2byte	0 to 65535

Keywords

There are certain words that are reserved for doing specific tasks. These words are known as keywords. They are standard and predefined in the Embedded C. Keywords are always written in lowercase. These keywords

must be defined before writing the main program. The basic keywords of an embedded software are given below:

Keywords

sbit:

This data type is used in case of accessing a single bit of SFR register.

- Syntax: sbit variable name = SFR bit ;
- Ex: sbit a=P2^1;
- Explanation: If we assign p2.1 as 'a' variable, then we can use 'a' instead of p2.1 anywhere in the program, which reduces the complexity of the program.

Bit:

This data type is used for accessing the bit addressable memory of RAM (20h-2fh).

- Syntax: bit variable name;
- Ex: bit c;
- Explanation: It is a bit sequence setting in a small data area that is used by a program to remember something.

SFR:

This data type is used for accessing a SFR register by another name. All the SFR registers must be declared with capital letters.

- Syntax: SFR variable name = SFR address of SFR register;
- Ex: SFR port0=0x80;
- Explanation: If we assign 0x80 as 'port0', then we can use 0x80 instead of port0 anywhere in the program, which reduces the complexity of the program.

SFR Register:

The SFR stands for 'Special Function Register'. Microcontroller 8051 has 256 bytes of RAM memory. This RAM is divided into two parts: the first part of 128 bytes is used for data storage, and the other of 128 bytes is used for SFR registers. All peripheral devices like I/O ports, timers and counters are stored in the SFR register, and each element has a unique address.

The Structure of an Embedded C Program

- comments
- pre processor directives
- global variables
- main() function

{

- local variables
- statements
- ……..
- ……..

}

- fun(1)

{ss

- local variables
- statements
- ……..
- ……..

}

Pre processor directives:

All the functions of the embedded C software are included in the pre processor library like "#includes<reg51.h>, #defines". These functions are executed at the time of running the program.

Global variable

A global variable is a variable that is declared before the main function, and can be accessed on any function in the program.

```
#include<reg51.h>
sbit a=p1^5;          /*global declaration*/

void main()
{
```

Local variable

A local variable is a variable declared within a function, and it is valid only to be used within that function.

```
void main()
{
    unsigned int k;    /*local declaration*/
    a=0x00;
    while(1)
    {
```

Local variable

Main () function

The execution of a program starts with the main function. Every program uses only one main () function.

Advantages of embedded C program

- Its takes less time to develop application program.
- It reduces complexity of the program.
- It is easy to verify and understand.
- It is portable in nature from one controller to another.

MATLAB

MATLAB (matrix laboratory)is a multi-paradigm numerical computing environment. A proprietary programming language developed by Math Works, MATLAB allows matrix manipulations, plotting of functions and data, implementation of algorithms, creation of user interfaces, and interfacing with programs written in other languages,.

Math and computation

- Algorithm development
- Modelling, simulation, and prototyping
- Data analysis, exploration, and visualization
- Scientific and engineering graphics
- Application development, including Graphical User Interface building

MATLAB is an interactive system whose basic data element is an array that does not require dimensioning. This allows you to solve many technical computing problems, especially those with matrix and vector formulations, in a fraction of the time it would take to write a program in a scalar non interactive language such as C or Fortran.

The MATLAB System

The MATLAB system consists of five main parts:

The MATLAB language.

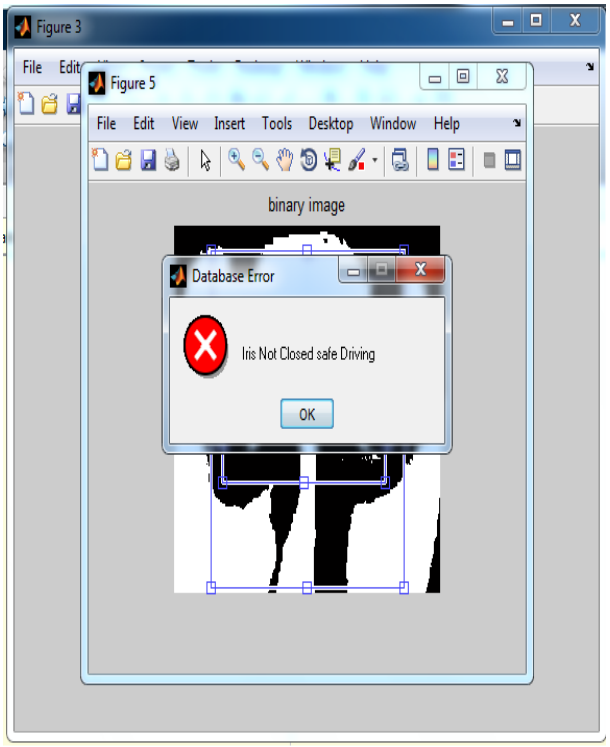
This is a high-level matrix/array language with control flow statements, functions, data structures, input/output, and object-oriented programming features. It allows both "programming in the small" to rapidly create quick and dirty throw-away programs, and "programming in the large" to create complete large and complex application programs.

The MATLAB working environment.

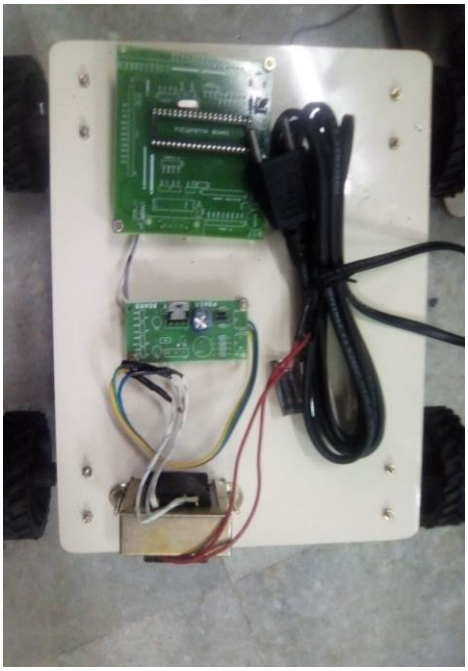
This is the set of tools and facilities that you work with as the MATLAB user or programmer. It includes facilities for managing the variables in your workspace and importing and exporting data. It also includes tools for developing, managing, debugging, and profiling M-files, MATLAB's applications

5. RESULTS AND DISCUSSIONS

5.1 Simulation Results



5.2 Experimental Result



6. CONCLUSION

Eye Drowsiness Detection was built to help a driver stay awake while driving in order to reduce car accidents caused by drowsiness. During the experiment the system has the capacity to choose whether the driver's eyes are opened or closed. At the point when the eyes are close for a really long time, warnings sign i.e. buzzer is issued to driver and also stop the vehicle if the driver does not response the buzzer. Also, throughout observation, the framework has the capacity suddenly identify any eye confining error that may have happened. If there should arise an occurrence of this kind of error, the system has the capacity to recover and accurately localize the person eyes. Image processing accomplishes greatly precise and trustworthy finding of sleepiness, a drowsiness detection system which judges the alertness level of driver on the basis of nonstop eye closures. The proposed system can be used for driver's safety and its consequences.

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