SLEEP DETECTION SYSTEM IN AUTOMOBILES INTEGRATED WITH AUTOMATIC BRAKING

A PROJECT REPORT

submitted by

ALDY DEGULLE GEORGE (VJC15ME019)
AMAL SHAJU (VJC15ME023)
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in partial fulfillment for the award of the degree

of

BACHELOR OF TECHNOLOGY

in

MECHANICAL ENGINEERING

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

DEPARTMENT OF MECHANICAL ENGINEERING

VISWAJYOTHI COLLEGE OF ENGINEERING AND TECHNOLOGY, VAZHAKULAM

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of

Mr. Arun K,
Assistant Professor, ME Dept.

DEPARTMENT OF MECHANICAL ENGINEERING

VISWAJYOTHI COLLEGE OF ENGINEERING AND TECHNOLOGY, VAZHAKULAM

MAY 2019

DECLARATION

We undersigned, declare that the project report "SLEEP DETECTION SYSTEM IN AUTOMOBILES INTEGRATED WITH AUTOMATIC BRAKING", submitted for partial fulfillment of the requirements for the award of degree of Bachelor of Technology from the APJ Abdul Kalam Technological University, Kerala is a bonafide work done by us under supervision of Mr. Arun K, Assistant Professor,VJCET. This submission represents our ideas in our own words and where ideas or words of others have been included, We have adequately and accurately cited and referenced the original sources. We also declare that we have adhered to ethics of academic honesty and integrity and have not misrepresented or fabricated any data or idea or fact or source in our submission. We understand that any violation of the above will be a cause for disciplinary action by the institute and/or the University and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been obtained. This report has not been previously formed the basis for the award of any degree, diploma or similar title of any other University.

Aldy Degaulle George

Date:.....

Amal Shaju

Place: **Vazhakulam**

Gayus Eldho

Juan Joy Paul

VISWAJYOTHI COLLEGE OF ENGINEERING AND

TECHNOLOGY, VAZHAKULAM

DEPARTMENT OF MECHANICAL ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that the project report entitled **"SLEEP DETECTION SYSTEM IN AUTOMOBILES INTEGRATED WITH AUTOMATIC BRAKING"** is a bonafide record of the work done by **ALDY DEGAULLE GEORGE (VJC15ME019), AMAL SHAJU (VJC15ME023), GAYUS ELDHO (VJC15ME051), JUAN JOY PAUL (VJC15ME072)** in partial fulfilment of the requirements for the award of the **Degree of Bachelor of Technology** in **Mechanical Engineering** of APJ Abdul Kalam Technological University.

External Examiner(s) **External Examiner**

Project Coordinator **Head of the Department**

VISWAJYOTHI COLLEGE OF ENGINEERING AND TECHNOLOGY, VAZHAKULAM

DEPARTMENT OF MECHANICAL ENGINEERING

Vision

"Moulding socially committed engineers capable to meet the global challenges in the mechanical engineering stream"

Mission

1. To provide ample facilities to foster excellent ambiance for teaching, learning process in the department.
2. To enhance the creative ideas, analytical talents and soft skills in the students to cope with emerging trend in technical field.
3. To enable the students to meet real life problems in mechanical engineering with a zeal to human and ethical values.

Program Educational Objectives

Our graduates shall have

1. Strong base in Mathematics, Science, and Mechanical Engineering to face and handle the challenges in real world engineering problems in society and industry
2. Passion for Mechanical Engineering to select an area of specialization, pursue higher studies, choose a career, lifelong learning in industry, research and academics.
3. Basic knowledge in other disciplines to tackle and coordinate Interdisciplinary real life problems.
4. Soft skills, discipline, confidence, self-esteem, and ethical values.

Program Outcomes

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design / development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific outcomes

1. Students shall be competent, creative and imaginative mechanical engineers employable in fields of design, research, manufacturing, safety, quality, technical services.

2. Students shall be able to progress through advanced degree, certificate programs or participate in continuing education in mechanical engineering, business, and other professionally related fields.

ACKNOWLEDGMENT

First and foremost, We thank God Almighty for his divine grace and blessings in making all this possible. May he continue to lead us in the years. It is our render to heartfelt thanks and gratitude to most beloved manager, **Msgr.Dr.Cherian Kanjirakompil** and Principal **Dr.Josephkunju Paul C** for providing us the opportunity to do this Project during the final year of our B.Tech degree course. We are deeply thankful for our Head of the Department, **Mr.Vinoj K,** Associate Professor, Department of Mechanical Engineering for his support and encouragement. We would like to express our sincere gratitude to our Project Guide **Mr.Arun K** Assistant Professor, Department of Mechanical Engineering for his motivation, assistance and help for the project. We also express our sincere thanks to our tutor **Mr.Arun K**, Assistant Professor, Department of Mechanical Engineering for his guidance and support. We convey our sincere thanks to all other faculties in the Mechanical Engineering department for their support and encouragement. We thank all our friends who have helped us during the work with their inspiration and cooperation. We truly admire our parents for their constant encouragement and enduring support, which was inevitable for the success of this venture. Once again we convey our gratitude to all those who directly or indirectly influenced our work.

Aldy Degaulle George
Amal Shaju
Gayus Eldho
Juan Joy Paul

ABSTRACT

Sleep deprivation affects driving as much as alcohol. It has been estimated that approximately 20% of vehicle accidents have sleep deprivation as a cause. The aim of the project named ‘sleep detection system in automobiles integrated with automatic braking’ is to reduce such accidents by detecting the sleep of the driver. Noticing the trend and studying the factors of the person sleeping few common things could be noticed the person starts blinking eye quickly and with longer durations, there could be difference in the driving way. Exploiting the above condition, we have used sensors to determine the eye blink duration of the driver. Using those readings the system determine if the person is sleeping or not and based upon that an alarm will be raised as a means of 1st warning then the seat vibrates when no response is found and if he don’t respond to both these system within a fixed time, the car will brake automatically. Sleep detection systems are a luxury these days that only the top end cars are equipped with it. With this project we are trying a make an add on like feature with which even the lowest variants can be equipped with this system. We are trying to integrate two existing systems i.e. sleep detection system and the Automatic Braking System.

Keywords: - Sleep deprivation, sleep detection, automatic braking, add on feature

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List of Abbreviations

2D	2-Dimensional
SAR	Synthetic Aperture Radar
CCD	Charged Coupled Device
IR	Infra Red
DCV	Direct Current Volts

CHAPTER-1

INTRODUCTION

Nowadays the accidents on roads are increasing day by day and mostly during nights. In many cases the major accidents are due to the drowsiness of a driver in light vehicles such as cars, tempos, auto rickshaws, tourist cars etc. And heavy vehicles like truck, buses and etc. Due to drowsiness, the driver may have an accident or the driver with his light or heavy vehicle may crash with the rural local persons walking on route and can lost one's life. This may be problematic to person walking on streets and more to the drivers. To avoid such things, the project 'Sleep detection with automatic braking system' has been introduced which may not completely eradicate the accidents but will minimize it up to some extents.

The project proposes a safety system in which an image processing system involving a webcam and a raspberry pi module detects the drowsiness of the drivers by analyzing the eye blink rate and if the situation is found prone to cause accidents, the system will send an electronic signal to a solenoid valve which operates a pneumatic cylinder which will bring about the braking in automobiles automatically. This can reduce the chances of accidents to a great extent. Simultaneously the system will alert the driver himself and the drivers nearby of the vulnerability of the situation using an alarming system.

CHAPTER 2
LITERATURE SURVEY

2.1.Driver Drowsiness Detection With Automated Braking And Crash Alert

Puneeth Reddirajula1, ARPN Journal of Engineering and Applied Sciences

These days with the increase in a working a corporate world many people have to sacrifice their time and sleep to survive in the competitive world. This takes a heavy toll on the person's life cycle and sleep cycle. To make sure that the company is operating profitably and the personal expenses are met the employees are sacrificing their sleep. This difference in the sleep cycle makes them drowsy while commuting to their work place. In case of carpooling or using the government transport people are left unharmed however if they are driving themselves then this drowsiness can put them in a great danger. For e.g. in Situbondo, a worker lost his hand because of drowsiness while working in a wood cutting machine. The system is based on processing the driver's eyes using ARM 7 processor by using a VGA camera that is affixed at the dashboard of the car. We have utilized the canny edge detection process to detect the iris point and find a threshold. In case the observed threshold is met then the brakes of the car are applied and the driver is woken up.

The main aim of eye gaze tracking based driver monitoring system is to reduce accidents caused by drowsiness. Drowsiness is mentioned as main cause in 78% of crashes and 65% of near-crashes in NHTSA (National Highway Traffic Safety Administration) study (2013).Drowsiness is a major factor in more than 20% of all accidents including fatalities and serious injuries . Drowsy drivers tend to decrease attention to important information needed for safe driving which makes them prone to severe car accidents Proposed driver monitoring system based Eye gaze tracking can help in continuously monitoring the driver. In case of drowsiness the system will track driver drowsiness and alerts him with an alarm and applies brake automatically. If the car crashes then the system sends location to emergency number through the hardware system. To reduce number of accidents caused by drowsiness is the motivation behind this project in order to improve traffic safety.

2.2. Safety System to Detect Drowsiness of Drivers and Brake Automatically

Vinod Yeldho Baby1, International Research Journal of Engineering and Technology (IRJET)

The importance of automobile safety has grown by leaps and bounds in the last two decades. Methods to detect and avoid fatal crashes have hence been identified. Drowsy driving is lethal, especially to taxi drivers and drivers of heavy motor vehicles, who cover long routes during nights. These vehicles pose a security threat to the passengers onboard, as well as other vehicles on the road. Our project involves the fabrication of a system which will detect the drowsiness of the driver and if the situation is found to be accident prone, send an electronic signal to the mechanical braking unit which engages the brakes automatically through a pneumatic arrangement. In parallel, the system will alert the driver and also the drivers nearby.

The technology of pneumatics has gained tremendous importance in the field of workplace rationalization and automations. It is therefore important for engineers and technicians to have good knowledge about pneumatic systems, air operated valves and accessories. The project proposes a safety system in which an image processing system involving a webcam and a raspberry pi module detects the drowsiness of the drivers by analyzing the eye blink rate and if the situation is found prone to cause accidents, the system will send an electronic signal to a solenoid valve which operates a pneumatic cylinder which will bring about the braking in automobiles automatically. This can reduce the chances of accidents to a great extent. Simultaneously the system will alert the driver himself and the drivers nearby of the vulnerability of the situation using an alarming system.

2.3. LiveEye: Driver Attention Monitoring System

Apoorva Sood, International Journal of Computer Science and Mobile Computing

Driver fatigue is a significant factor in a large number of vehicle accidents. In today's competitive world, people make their schedule so hectic that they start compromising on precious sleep. By consuming caffeine or other stimulants people continue to stay awake. The lack of sleep builds up over a number of days and the next thing that happens is that the person

feels fatigued while driving. Recent statistics estimate that annually 1,200 deaths and 76,000 injuries can be attributed to fatigue related crashes. From the fatigue, inattention is caused which finally results in drowsiness. Another cause for road accidents i.e., driver distraction occurs when an object or event draws a person's attention. It is caused by random and unavoidable circumstances. Unlike distraction, drowsiness involves no triggering event but, instead, is characterized by a progressive withdrawal of attention from the road and traffic demands. Both driver drowsiness and distraction, however, might have the same effects, i.e., decreased driving performance, longer reaction time, and an increased risk of crash involvement.

A driver who falls asleep at the wheel loses control of the vehicle which often results in a crash with either another vehicle or stationary objects. In order to prevent these devastating accidents the state of drowsiness of the driver should be monitored.

The driver attention monitoring system implements a non-intrusive machine vision based concept. The system uses a small monochrome security camera that points directly towards the driver′s face and monitors his eyes in order to detect fatigue. This system will analyse the state of driver′s attention through a sequence of images of his face, with real time eye movements and blink patterns. The percentage of time the pupils of the eyes are 80% or more occluded over a specified time interval is termed as PERCLOS and this method is used for early detection of drowsiness. The behavior is then analyzed and classified as normal, slightly drowsy or highly drowsy using MATLAB. In case when fatigue is detected, the LiveEye warns the driver through a special indication in the front panel and a loud alarm which ensures that the driver is alerted before any mishap.

2.4. Real-time Driver Fatigue Detection System

Ashish Jain1, Association of Computer Electronics and Electrical Engineers, 2013

Many researchers have been done on measuring the fatigue degree of drivers' physiology. After development of decades, researches based on image processing and pattern-recognition technology have been widely adopted. The focus will be placed on designing a system that will accurately predict and alert a drowsy driver by obtaining real-time video and using Matlab

algorithms to conclude drowsiness by blink patterns of the eye.

Detection of fatigue involves a sequence of images of a face, and the observation of eye movements and blink patterns. Techniques for detecting drowsiness in drivers can be generally divided into the following categories: sensing of driver's eyes using image acquisition tool box, sensing of driver operation, sensing of vehicle response, monitoring the response of driver. Sensing of driver's eyes using image acquisition tool box-Image acquisition toolbox was used to acquire video in real-time and convert it into frames. This technique is well suited for real world driving conditions since it can be non-intrusive by using optical sensors of video cameras to detect changes

The system monitors the driver's eyes in order to detect fatigue. In such a case when fatigue is detected, a warning signal is issued to alert the driver. This report describes how to find the eyes, and also how to determine if the eyes are open or closed. The system deals with using information obtained for the binary version of the image to find the edges of the face, which narrows the area of where the eyes may exist. Once the face area is found, the eyes are found by computing the horizontal averages in the area. Taking into account the knowledge that eye regions in the face present great intensity changes, the eyes are located by finding the significant intensity changes in the face. Once the eyes are located, measuring the distances between the intensity changes in the eye area determine whether the eyes are open or closed. A large distance corresponds to eye closure. If the eyes are found closed for 5 consecutive frames, the system draws the conclusion that the driver is falling asleep and issues a warning signal.

CHAPTER 3

OBJECTIVE AND PROBLEM STATEMENT

The Fact Sheet published by the AAA Foundation for Traffic Safety lists drowsy driving as one of the major causes for road accidents, and lists the following points:

- 42.4% of drivers have at least one or more days where they get less than six hours of sleep in a typical week.
- The majority of motorists view drowsy driving as a serious or somewhat serious threat to their safety (87.9%) and an unacceptable behavior (95.2%); yet around 3 in 10 (30.8%) admit to driving when they were so tired that they had a hard time keeping their eyes open at some point in the past month.

It may be concluded that there needs to be a system that can be implemented in most vehicles, which can detect the drowsiness of the driver and bring the vehicle to stop. This project focuses on reducing the accidents caused by sleeping, while driving the car, by automatically applying braking system integrated with a IR sensor based sleep detection system.

CHAPTER 4

COMPONENTS

4.1. Eye Blink Sensor:

A sensor is a transducer used to make a measurement of a physical variable. Any sensor requires calibration in order to be useful as a measuring device. Calibration is the procedure by which the relationship between the measured variable and the converted output signal is established.

This project involves measure and controls the eye blink using IR sensor. The IR transmitter is used to transmit the infrared rays in our eye. The IR receiver is used to receive the 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 to know the eye is closing or opening position. This output is given to logic circuit to indicate the alarm. If the eye blinks sensor sense it will indicates to the microcontroller. In the first time the microcontroller activates the alarm and the vibration in the seat. It will continuously sense the microcontroller activates the driver circuit for relay. Through this relay we can control the breaking in the vehicle. So whenever the eye blink sensor detected in a particular constant time the break will be applying. So we can avoid the accident in the vehicle. This eye blink sensor can be placed in the eye. The vibration set up is placed along with the seat. The motor is run, the cam is to be rotate and the driver seat will be vibrated. After few seconds break will be automatically apply.

Care should be taken in the choice of sensory devices for particular tasks. The operating characteristics of each device should be closely matched to the task for which it is being utilized. Different sensors can be used in different ways to sense same conditions and the same sensors can be used in different ways to sense different conditions.

Passive sensors detect the reflected or emitted electro-magnetic radiation from natural sources, while active sensors detect reflected responses from objects which are irradiated from artificially generated energy sources, such as radar. Each is divided further in to non-scanning and scanning systems.

A sensor classified as a combination of passive, non-scanning and non-imaging method is a type of profile recorder, for example a microwave radiometer. A sensor classified as passive, non-scanning and imaging method, is a camera, such as an aerial survey camera or a space camera,

for example on board the Russian COSMOS satellite.

Sensors classified as a combination of passive, scanning and imaging are classified further into image plane scanning sensors, such as TV cameras and solid state scanners, and object plane scanning sensors, such as multi-spectral scanners (optical-mechanical scanner) and scanning microwave radiometers.

An example of an active, non-scanning and non-imaging sensor is a profile recorder such as a laser spectrometer and laser altimeter. An active, scanning and imaging sensor is radar, for example synthetic aperture radar (SAR), which can produce high resolution, imagery, day or night, even under cloud cover.

The most popular sensors used in remote sensing are the camera, solid state scanner, such as the CCD (charge coupled device) images, the multi-spectral scanner and in the future the passive synthetic aperture radar.

Laser sensors have recently begun to be used more frequently for monitoring air pollution by laser spectrometers and for measurement of distance by laser altimeters.

Fig 4.1: Eye Blink Sensor

4.2 Arduino Board

Arduino is an open-source hardware and software company, project and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control both physically and digitally. Its products are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL), permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form or as do-it-yourself (DIY) kits.

Arduino board designs use 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 or breadboards (shields) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler toolchains, the Arduino project provides an integrated development environment (IDE) based on the Processing language project

Fig 4.2: Arduino Board

4.3 3/2 Solenoid Valve

A solenoid valve is an electromechanical device in which the solenoid uses an electric current to generate a magnetic field and thereby operate a mechanism which regulates the opening of fluid flow in a valve.

Solenoid valves differ in the characteristics of the electric current they use, the strength of the magnetic field they generate, the mechanism they use to regulate the fluid, and the type and characteristics of fluid they control. The mechanism varies from linear action, plunger-type actuators to pivoted-armature actuators and rocker actuators. The valve can use a two-port design to regulate a flow or use a three or more port design to switch flows between ports. Multiple solenoid valves can be placed together on a manifold.

Solenoid valves are the most frequently used control elements in fluidics. Their tasks are to shut off, release, dose, distribute or mix fluids. They are found in many application areas. Solenoids offer fast and safe switching, high reliability, long service life, good medium compatibility of the materials used, low control power and compact design.

Fig 4.3: 3/2 Solenoid Valve

4.4. 4 Channel 5V Relay

The directional valve is one of the important parts of a pneumatic system. Commonly known as DCV, this valve is used to control the direction of air flow in the pneumatic system. The directional valve does this by changing the position of its internal movable parts.

This valve was selected for speedy operation and to reduce the manual effort and also for the modification of the machine into automatic machine by means of using a solenoid valve. A solenoid is an electrical device that converts electrical energy into straight line motion and force. These are also used to operate a mechanical operation which in turn operates the valve mechanism. Solenoids may be push type or pull type. The push type solenoid is one in which the plunger is pushed when the solenoid is energized electrically. The pull type solenoid is one in which the plunger is pulled when the solenoid is energized.

The name of the parts of the solenoid should be learned so that they can be recognized when called upon to make repairs, to do service work or to install them.

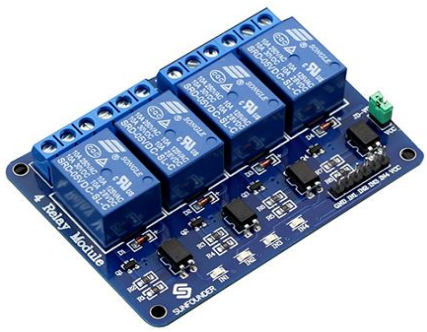

Fig 4.4: 4 Channel Relay

4.5 AC Motor

An AC motor is an electric motor driven by an alternating current (AC). The AC motor commonly consists of two basic parts, an outside stator having coils supplied with alternating current to produce a rotating magnetic field, and an inside rotor attached to the output shaft producing a second rotating magnetic field. The rotor magnetic field may be produced by permanent magnets, reluctance saliency, or DC or AC electrical windings.

Fig 4.5: Single Phase Motor

4.5 Pneumatic Single Acting Cylinder

Pneumatic cylinder consists of a piston and a cylinder. Here the air pressure moves forward and spring moves backwards the cylinder used is a single acting cylinder. The air coming from the compressor is passed through a regulator. The regulator is used to control the pressure to the required amount by adjusting its knob. Line pressure is shown in the regulator by means of a pressure gauge attached on it. Single acting 3/2 solenoid valve is used for supplying compressed air to one end of the cylinder. Connectors are used to attach hoses which take the output of the DCV and are attached to one end of the cylinder. An output from the DCV is send to the flow control valve. Hoses are attached to each components of the pneumatic system only with the help of connectors.

Fig 4.6: Pneumatic Single Acting Cylinder

4.5 Piston

The piston is a cylindrical member of certain length which reciprocates inside the cylinder. The diameter of the piston is slightly less than that of the cylinder bore diameter and it is fitted to the top of the piston rod. It is one of the important parts which convert the pressure energy into mechanical power.

The piston is equipped with a ring suitably proportioned and it is relatively soft rubber which is capable of providing good sealing with low friction at the operating pressure. The purpose of piston is to provide means of conveying the pressure of air inside the cylinder to the piston of the oil cylinder.

4.6 Piston rods

The piston rod is circular in cross section. It connects piston with piston of other cylinder. The piston rod is made of mild steel ground and polished. A high finish is essential on the outer rod surface to minimize wear on the rod seals. The piston rod is connected to the piston by mechanical fastening. The piston and the piston rod can be separated if necessary.

One end of the piston rod is connected to the bottom of the piston. The other end of the piston rod is connected to the other piston rod by means of coupling. The piston transmits the working force to the oil cylinder through the piston rod. The piston rod is designed to withstand the high compressive force. It should avoid bending and withstand shock loads caused by the cutting force. The piston moves inside the rod seal fixed in the bottom cover plate of the cylinder. The sealing arrangements prevent the leakage of air from the bottom of the cylinder

while the rod reciprocates through it.

4.7 Air compressor

An air compressor is a device that converts power into potential energy stored in pressurized air by using an electric motor, diesel or gasoline engine, etc. By one of several methods, more and more air is forced into a storage tank, increasing the pressure with the help of an air compressor. The air compressor automatically shuts off when the tank pressure reaches its engineered upper limit. The compressed air, is then held in the tank until called into use. By utilizing the kinetic energy of the air as it is released and the tank depressurizes, the energy contained in the compressed air can be used for a variety of applications. The air compressor turns on again and re-pressurizes the tank as the tank pressure reaches its lower limit. The main difference between an air compressor and a pump is that a compressor works for any gas or air, while pumps work on a liquid.

Fig 4.7: Air Compressor

CHAPTER 5
WORKING

5.1 working

The important components of our project are,

- Eye blink sensor,
- Control Unit with Power supply,
- Solenoid Valve,
- Flow control Valve,
- Air Tank (Compressor).

The sleep detection system uses an arduino powered circuit board with c programming where the braking occurs after 2 warning the break is achieved using a pneumatic piston which activates a drum break mechanism to stop the vehicles wheel in 2 to 3 seconds according to the time set in the program.

Before the breaking when the driver drowses off, as a warning an alarm is raised. If the person continues to sleep, then the 2nd warning system activates and the driver's seat vibrates. And finally, if the driver is not up to his consciousness, the vehicle stops and the front bumper is pushed out as a safety measure.

The breaking and front bumper activation is done using 2 pneumatic piston and cylinder arrangement. The air is supplied from a compressor with a pressure limit of 6-8 bar. The air flows through a tube to a 3 position 2 way solenoid valve the flow is controlled by the control board which allows air to enter pneumatic piston and also opens exhaust valve to remove air from the piston.

In case of the bumper system as the air enters the piston the bumper is pushed out and for the breaks as air enters the piston the drum break is activated i.e. the pads or shoe of the drum break pushes out against the drum which stops the wheels rotation.

And there is a reset button to reset the whole process to the initial stage.

5.2 2D Drawing

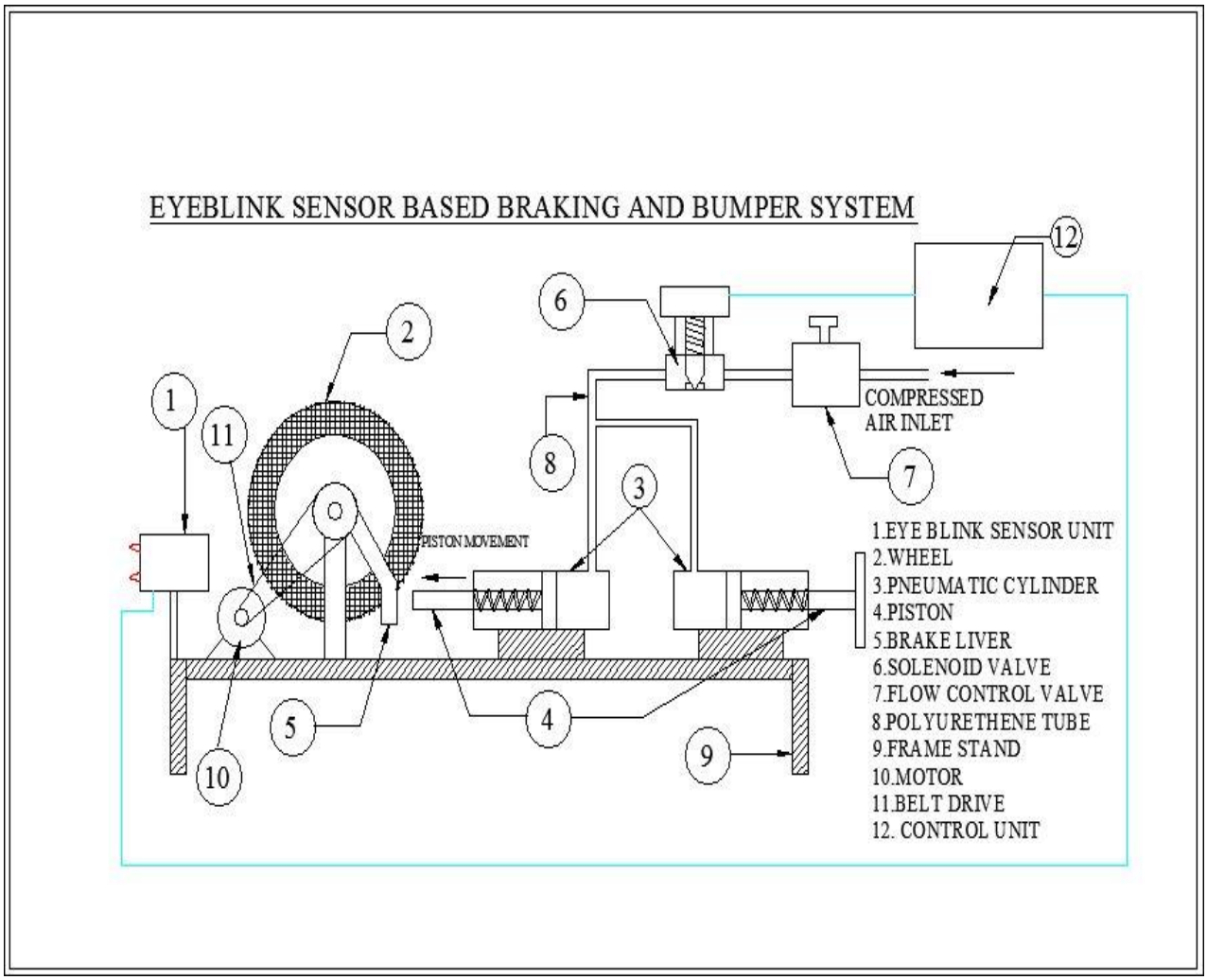

Fig 5.1 2D Drawing

5.3 Program Code Used

```
#include <LiquidCrystal.h>
const int rs = 13, en = 12, d4 = 11, d5 = 10, d6 = 9, d7 = 8;
LiquidCrystal lcd(rs, en, d4, d5, d6, d7);
int ir_pin = 7;
int Alarm = 6;
int Seat_vib=5;
int Break =4;

void setup() {
  pinMode(7,INPUT); // SENSOR
  pinMode(6,OUTPUT);
  pinMode(5,OUTPUT);
  pinMode(4,OUTPUT);
  Serial.begin(9600);
}

void loop() {

 digitalWrite(6,HIGH);
 digitalWrite(5,HIGH);
 digitalWrite(4,HIGH);
    lcd.begin(16, 2);
  lcd.setCursor(5, 0);
  lcd.print("EYE BLINK");
  lcd.setCursor(3, 1);
  lcd.print("BUMPER BREAK");
  delay(100);
  lcd.clear();
 int s = digitalRead(ir_pin);
```

```
  Serial.print(digitalRead(ir_pin));
if(s==1){
  delay(1000);
  lcd.setCursor(0,0);
 lcd.print("Checking for");
 lcd.setCursor(0,1);
 lcd.println("Eye Movement....");
 delay(1000);
  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("Normal Status");
  digitalWrite(6,HIGH);
  digitalWrite(5,HIGH);
  digitalWrite(4,HIGH);
  }

if(s==0){
  delay(1000);
    lcd.clear();
  lcd.setCursor(0,0);
 lcd.print("Checking for");
 lcd.setCursor(0,1);
 lcd.println("Eye Movement....");

 delay(1000);
 int g = digitalRead(ir_pin);
 if(g==0){
 digitalWrite(6,LOW);
 digitalWrite(5,HIGH);
 digitalWrite(4,HIGH);
 lcd.clear();
```

```
 lcd.setCursor(0,0);
 lcd.print("Sleep Detected");
 delay(1000);
 }
}
else{
 digitalWrite(6,HIGH);
 digitalWrite(5,HIGH);
 digitalWrite(4,HIGH);
 delay(500);
}
int t = digitalRead(ir_pin);
 if(t==0 && s==0){
 delay(1000);
 int f = digitalRead(ir_pin);
 if(f==0){
 digitalWrite(6,LOW);
 digitalWrite(5,LOW);
 digitalWrite(4,HIGH);
  lcd.clear();
 lcd.setCursor(0,0);
 lcd.print("Sleep Seeked");
 delay(500);
 }
 }
else{
 digitalWrite(6,HIGH);
 digitalWrite(5,HIGH);
 digitalWrite(4,HIGH);
 delay(500);
```

```
}

int u = digitalRead(ir_pin);
 if(u==0 && t==0 && s==0){
 delay(1000);
 int h = digitalRead(ir_pin);
 if(h==0){
  delay(500);
 digitalWrite(6,LOW);
 digitalWrite(5,LOW);
 digitalWrite(4,LOW);
  lcd.clear();
 lcd.setCursor(0,0);
 lcd.print("Sleep Confirmed");
 delay(1000000);
 }

 }

 }
```

5.4 Advantages

- Reduces sleep related accidents on the road to a minimum.
- Easy to install and maintain.
- Low cost..
- Can be added to both new and old vehicles.

5.4 Disadvantages

- Since the technology is new, proper testing on the road has to be done.
- A separate control unit and power supply is needed for the device.
- Sometimes the system may detect sleep even when the driver is not up.
- 'Plan B' should be there every time if any of the components malfunction.

CHAPTER 6
FUTURE SCOPE

- In future we can implement drowsiness detection system in aircraft in order to alert pilot.
- It can be made a mandatory system in all vehicles
- The system can be produced commercially and then sold in a reasonable price
- Infra red blasters can be used in order to detect sleep at night

REFERENCES

[1] AAA Foundation for Traffic Safety – Fact Sheet- April 2018

[2] Eugene Aidman, Carolyn Chudanow, Kayla Johnson, John Reece. (2015) Real-time driver drowsiness feedback improves driver alertness and self-reported driving performance, April 2015 Accident Analysis and Prevention.

[3] Javed Ahmed,Jian-Ping Li,Saeed Ahmed Khan, Riaz Ahmed Shaikh (2016), Eye behaviour based drowsiness Detection System, IEEE Xplore: 20 June 2016.

[4] Jibo He, William Choi, Yan Yang, Junshi Lu, Xiaohui Wu, Kaiping Peng. (2017) Detection of driver drowsiness using wearable devices: A feasibility study of the proximity sensor. February 2017 Applied Ergonomics.

[5] Jose Solaz, Jose Laparra-Hernandez, Daniel Bande, Noelia Rodriguez, Sergio Veleff, Jose Gerpe, Enrique Medina. (2016) Drowsiness detection based on the analysis of breathing rate obtained from real time image recognition, 6th transport Research Arena April 18-21, 2016.

[6] Pia M Forsman, Bryan J Vila, Robert A. Short, Christopher G. Mott, Hans P.A. Van Dongen (2012), Efficient driver drowsiness detection at moderate levels of drowsiness, May 2012 Accident Analysis and Prevention

[7] D. Fell, “Safety update: problem definition and countermeasure summary: Fatigue,” Technical report, New SouthWales Road Safey Bureau, Australia, 1994

[8] L. Fletcher, L. Petersson, and A. Zelinsky, "Driver assistance systemsbased on vision in and out of vehicles, " in Proceedings of" The IEEE Symposium on Intelligent Vehicles, p. 322327