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Design and Development of Accident Prevention and Control System

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***Abstract*- In this paper, three basic circuits for prevention of accident and control measures are been explained. One is accelerometer circuit which is used for detection of drowsiness and second is alcohol sensor circuit which is used for detection and control of a vehicle due to alcohol consumption. Accident due to drowsiness can be prevented using alert mechanism which is controlled by relay when tilt motion is detected and it is sensed by single step accelerometer. Similarly relay turnoff the ignition process of a vehicle if level of the alcohol is sensed above the normal by a sensor. Along with this brake failure detection is also done by checking the continuity if not the vehicle owner is made alert to prevent the accidents from brake failure.**

Keywords— Accelerometer, alcohol sensor.

I INTRODUCTION

The Global status report on road safety 2014 shows information on road safety from 182 countries, evaluating for almost 99% of the world's population. The report demonstrates that worldwide the total number of road traffic death remains undesirably high at 1.24 million per year. Nearly 3,400 people die on the roads every day in world [1]. 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. Aim of the project is to develop a prototype and prevent accidents.

In today's world where science has made amazing advances so have the recent cars. These cars are more advanced than ever. But now days, as the alcohol consumption are increasing, so the accidents are also increasing day by day. Driver consumes alcohol and then they do rash driving as of that they do not have control on themselves. Here we are designing a system which will detect the consumption of alcohol by the driver. Once detected, the vehicle will turn off the ignition and the buzzer rings and vehicle doesn't allow the driver to start the vehicle.

II LITERATURE SURVEY

The ever increasing numbers of traffic accidents all over the world are due to diminished driver's vigilance level. Drivers with a diminished vigilance level suffer from a marked decline in their perception, recognition and vehicle control abilities & therefore pose a serious danger to their own lives and the lives of the other people. . It mainly focus on road accidents occurring due to drowsy state and drunken state of driver. The zones are indicated by placing the transmitter modules at particular zones. It also describes a real-time online prototype driver-fatigue monitor. This system was validated under real-life fatigue conditions with human subjects of different ethnic backgrounds, genders, and ages; with/without glasses; and under different illumination conditions. It was found to be reasonably robust, reliable, and accurate in fatigue characterization [2]. In real time it makes use of imported glass sensors for high accuracy. The eye blink module works against drowsiness and makes the driver aware of accident. It consists of infrared sensors which helps in detecting the cause of accidents and prevents the vehicle [3]. A drowsy driving detection system in which sensors like alcohol sensor, accelerometer, IR sensors are used for detection of drowsiness and alcohol consumption by driver [4]. Some of the system includes a video camera either externally attached or inbuilt camera in Laptop [5].And also the system is used for security purpose [6] Vehicle Theft is prevented by making use of Transmitter-Receiver module [7]. In some of the system, region prop with EDAMAS techniques are used [8].It also combines the application of computer vision with embedded systems and are targeted for reducing road accidents due to driver drowsiness and alcoholic intoxication [9]

III SYSTEM DESIGN

The block diagram of system is shown in the Fig 1. The system consists of MEMS sensor that is an Accelerometer, Alcohol sensor, Driver circuit, Relays, LCD display, Power supply, PIC Microcontroller, Brake failure detector. Alarm is used in a system to indicate regarding an emergency situation occurred. Alcohol Sensor is used to detect weather the person has consumed the alcohol or not. Here MQ3 sensor is used as an alcohol sensor. An accelerometer is a device that measures proper acceleration or it is an instrument which is used for measuring the acceleration of vibrating or moving body. Microcontroller is used to perform various function and operations. Here PIC microcontroller is used. Brake fail is used in a system to indicate the brake failure in vehicle. SCU (Signal Condition Unit) signal conditioning means it will manipulate the signal in such a way that it meets the need of next stage for further processing.

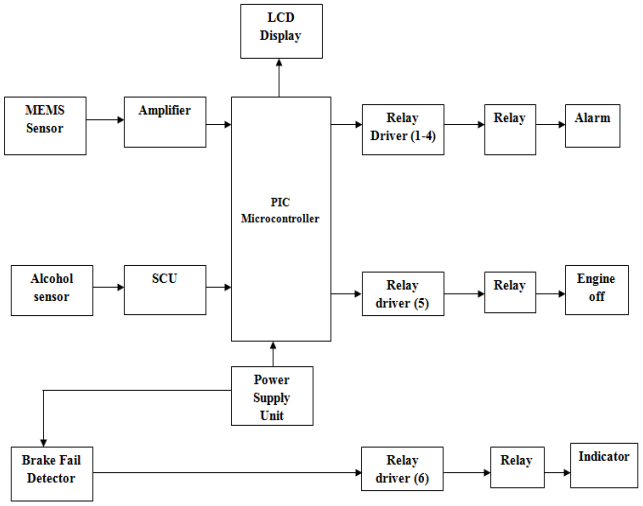

Fig 1 System block diagram

Here the system is designed to detect the alcohol consumption and drowsiness of a person and also brake failure in a vehicle. As alcohol consumption is increasing within the youth so the accidents are increasing day by day. When a person drinks and drives he may not have a presence of mind and most of them loose the control on a vehicle that he drives. So we are using an alcohol sensor which will detect the smell of alcohol. This will generate a voltage which is a weak signal. So we are using SCU (Signal Condition Unit) to boost up the signal. This signal is passed to PIC Microcontroller. This will perform two tasks. First it will display the information on LCD and secondly it will operate the corresponding relay which will turn off the engine automatically.

If a driver is drowsy then MEMS sensor (Accelerometer) will activate which work on tilt motion that is nothing but head movement. This will generate a voltage which is very weak signal. So to amplify the signal we are using an amplifier. This signal is fed to PIC Microcontroller which will Perform two operation one is to display the information on LCD and then it will operates on the corresponding relay which will operate an alert mechanism that is alarm. A Relay is an electrical device, typically incorporating an electromagnet, which is activated by a current or signal in one circuit to open or close another circuit.

Here we are using continuity principle to prevent the accidents from brake failure. In this we are passing a continuous signal. If there is no brake failure, output will be high and the continuous signal is passed over the system. And if there is occurrence of brake failure due to any grease or oil on brakes or due poor maintenance, continuity opens and a low signal is passed which is detected by the relay driver. Then the corresponding relays will be ON which in turn will activate the indicator. In Fig 2 a description for the circuit diagram of a system is shown. In power supply circuit the potential transformer of 230V will step down the power supply voltage to (0-15V and 0-9V) a level. If the secondary has less turns in the coil then the primary, the secondary coil's voltage will decrease and the current or AMPS will increase or decrease depending upon the wire gauge.

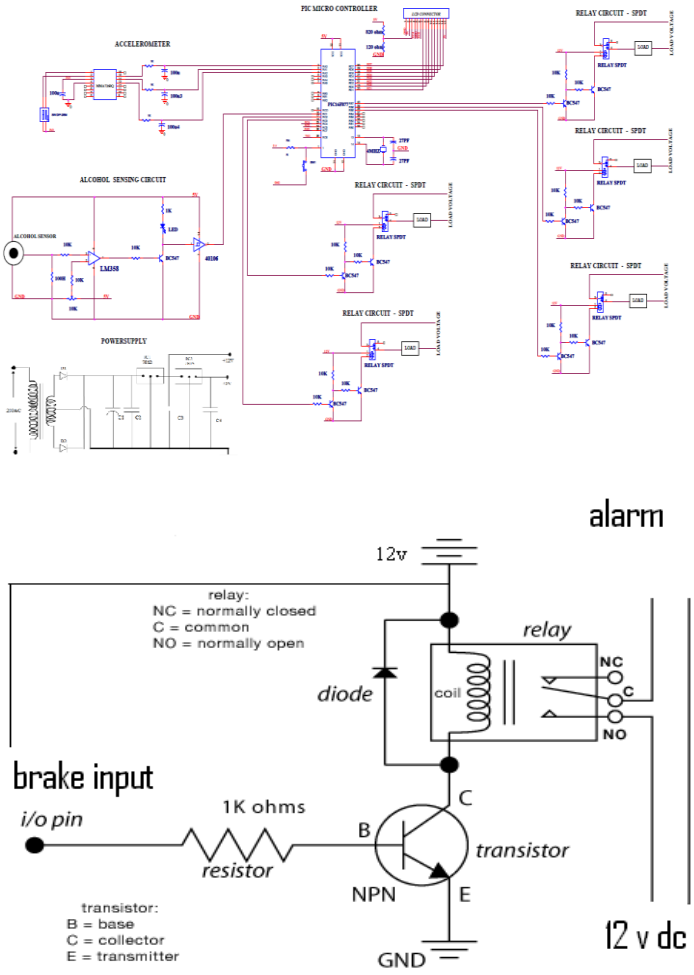

Fig 2 Circuit diagram of the system

This is called a STEP-DOWN transformer. And four diodes are connected to form a bridge rectifier. Input is applied across point A and B and output is taken across the remaining 2 corners. A simple capacitor filter of 1000µF that transforms the rectifier output into a more stable DC voltage.

In this circuit we are using two IC regulators 7805 for 5V and 7812 for 12V. These convert variable DC voltage to constant 5V and 12V power supply, respectively.

The alcohol sensor will detect the presence of alcohol vapors. The output of the alcohol sensor applied to inverting terminal of the comparator. The comparator is constructed by the op-amp LM358 the reference voltage is given to the non-inverting input terminal The comparator compare the signals and gives the corresponding output error signal which is given to the microcontroller to determine alcohol content.

In accelerometer g1 and g2 are logic input pins to select one of the four conditions. Pin 12 is used to enable the sleep mode. When sleep mode is active, the device output is turned off. In PIC microcontroller the crystal oscillator is connected across pin 13 and 14 to produce the clock frequency. In port A, RA0, RA1, RA2 receive the output of accelerometer. The output of alcohol sensor is given to RC1 of port C. Relay is controlled by a pair of switching transistor (BC547). The load is turned ON and OFF through the relay.

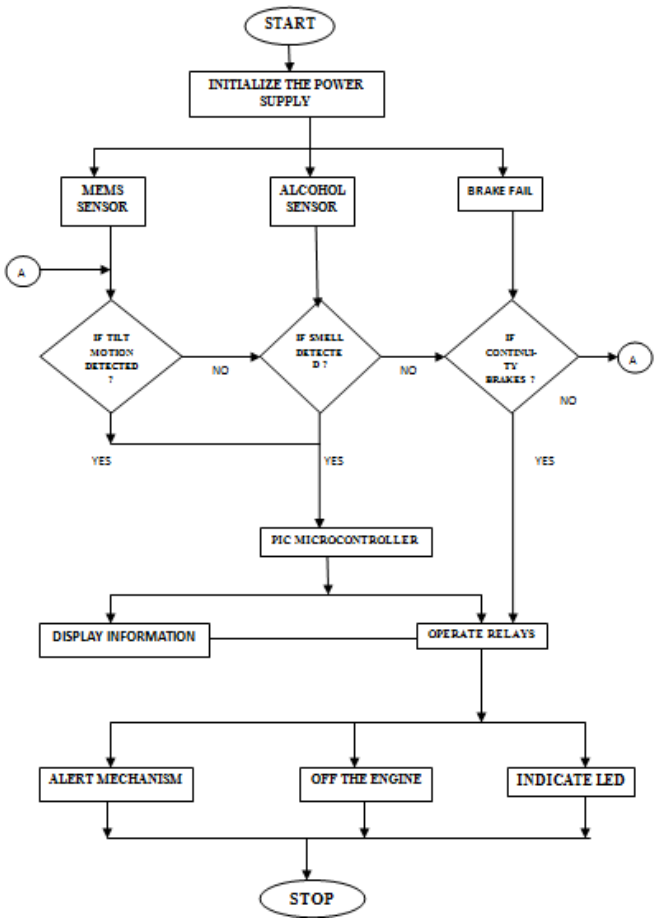

Fig 3 Flowchart

Fig 3 shows the flowchart of a system. The process will start from the power supply. First step is to turn ON the power supply. There are three inputs given here is MEMS sensor, other is alcohol sensor and third is brake failure. The MEMS sensor will work on Tilt motion, so it is going to detect the tilt angle. If it detects then the signal is given to the Microcontroller PIC. Then the Microcontroller will perform two operations. It displays the information on LCD and activates the corresponding relay. The first four relays drivers will operates for MEMS sensor, and these relay drivers will give one alert mechanism. And if tilt motion is not detected then it will check the next condition that is alcohol smell if an alcohol sensor detects the smell of an alcohol then the signal is given to the Microcontroller PIC. Here Microcontroller will do same operation i.e., to display the information on LCD and operates relay, and Fifth relay driver will turn ON and OFF the engine. If smell of an alcohol is not detected then it will check for next condition that is brake failure. Here in brake failure first it will check for continuity. If continuity breaks then a signal is given to the microcontroller and it will perform two operations that are to display the information on LCD and to operate the corresponding relay which indicates the brake failure.

V SOFTWARE EXPLANATION

The software used is MPLAB IDE and PICkit3. MPLAB IDE is a software Program that run on a PC to develop applications for Microchip Microcontrollers and digital signal Controllers. It is called an Integrated Development Environment (IDE), because it provides a single integrated environment to develop code for embedded microcontrollers. The features of MPLAB IDE provides a new call Graph for navigating complex code, Supports Multiple Configurations within Projects, Supports for multiple debug tools of the same type. And in PICkit3 it allows debugging and programming of PIC microcontrollers Using powerful graphical user interface of the MPLAB IDE. This PICkit3 is connected to the design engineer's PC using a full speed USB interface and can be connected to the target via a Microchip debug (RJ-11) connector. The features such as Real-time execution, Supports low voltage to 2.0 volts (2.0 to 6.0 range), Erase of program memory space with verification.

VI APPLICATION

The prime purpose of this system is to provide safety measures from road accidents which occur due to drowsiness, alcohol consumption and brake failure. This system can also be used in Automobile industries and even in Security Guard Cabins where continuous monitoring is necessary. Pilots of airplane can use this system to provide safety measures for passengers. When there is no police for monitoring the accidents then this design will definitely reduce the road accidents.

VII ADVANTAGES

Here accelerometer which can detect and control the accident due to drowsiness and hence it can be reduced by using this system. And component establishes interface with other drivers very easily. Even it is helpful to save driver's life by locking the ignition system of the car if the driver has consumed alcohol. In this system alcohol sensing method is used for analyzing or detecting the presence of alcohol in breath which is relatively a quick analysis as compared to other techniques. These sensors which are used in this project are smaller in size not so bulky, hence can be fixed easily in any vehicles.The major disadvantage is this design cannot be used in two wheelers. And the project will indicate the brake failure in LCD as a precaution to driver but it cannot control the vehicle once brake failure occurs.

VIII RESULTS

As soon as system is turned ON based on the working of the microcontroller the system starts gathering readings from different sensors such as alcohol sensor and accelerometer. All those readings are then displayed on the LCD. The various results for MEMS sensor, Alcohol sensor and Brake failure can be observed on display as shown below in table 1,Fig 9 and Fig 10.In normal condition the readings in LCD will be:

Fig 4 Normal condition of an accelerometer

MEMS sensor works on tilt motion. The corresponding readings are observed in table 1 The inputs are position of head movement (Front,Back,Left,right) and the reference outputs are X=24:Y=29:Z=99 which is shown in above Fig 4.

Table 1 MEMS Sensor (output)

Input	Output		
Position of head movement	*X*	*Y*	*Z*
Front	77	32	83
Back	226	28	47
Left	33	92	53
Right	13	232	61

The graph shows the X-coordinates, Y-coordinates, Z-coordinates with respect to head movement. Fig 5 shows front direction of head movement with the corresponding outputs which intersect at the points X=77: Y=32: Z =83.

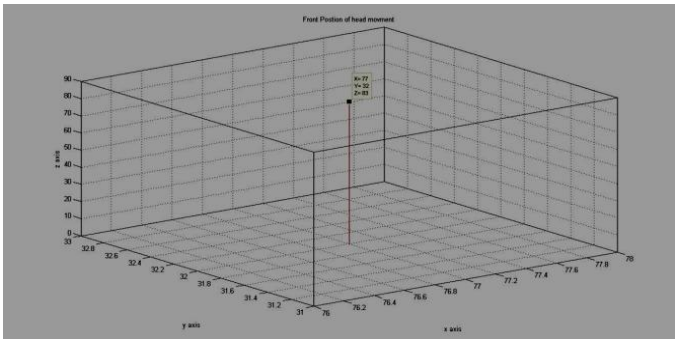

Fig 5 Tilt motion of front direction

Fig 6 shows front direction of head movement with the corresponding outputs which intersect at the points X=226: Y=28: Z =47.

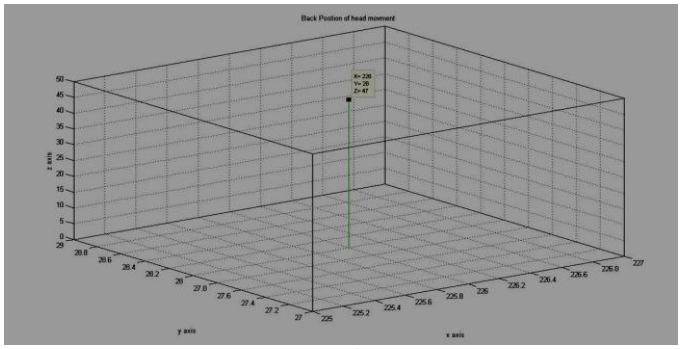

Fig 6 Tilt motion of back direction

Fig 7 shows front direction of head movement with the corresponding outputs which intersect at the points X=33: Y=92: Z =53.

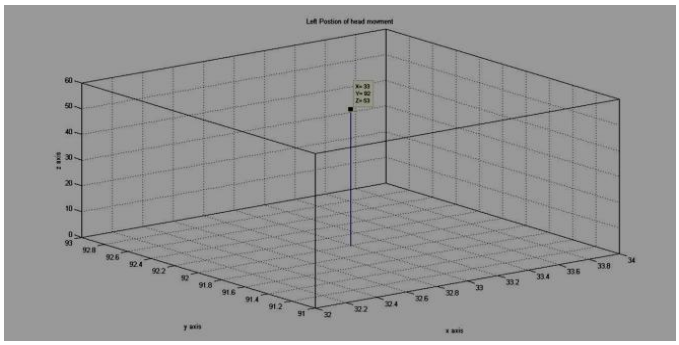

Fig 7 Tilt motion of left direction

Fig 8 shows front direction of head movement with the corresponding outputs which intersect at the points X=13: Y=232: Z =61

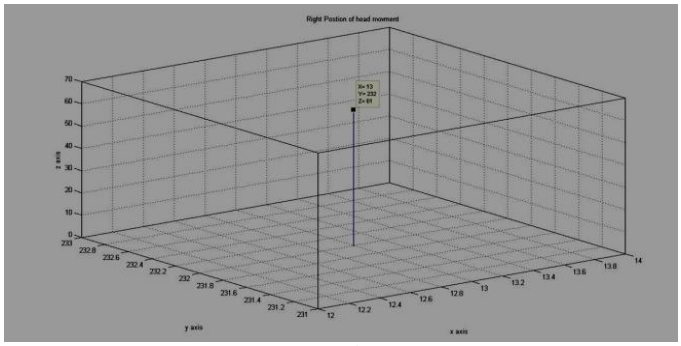

Fig 8 Tilt motion of right direction

Alcohol sensor output: When alcohol smell is detected, the alcohol concentration is displayed on LCD which is as shown in below Fig 9

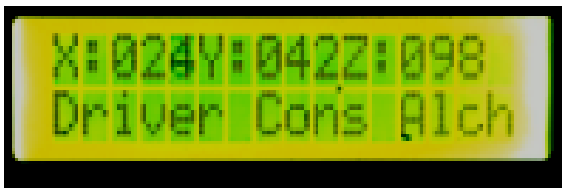

Fig 9 Alcohol sensor output

Brake failure output: If there is occurrence of brake failure, continuity opens and a low signal is passed which is detected by the relay driver. Then the corresponding relays will be on which will activate the indicator as shown in the below Fig 10

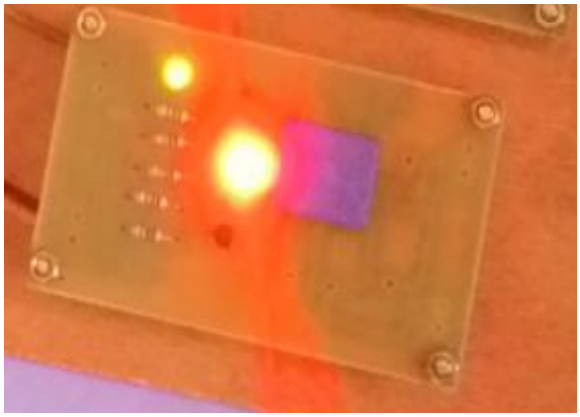

Fig 10 Brake failure output

IX CONCLUSION

The outcome of project is basically has three applications one is to prevent and control the vehicle from the accidental situations due to drowsiness, second is to detect the drunk drivers through alcohol sensors which does not allow driver to start the vehicle and third is to indicate the brake failure of an vehicle and using microcontroller it displays the information on LCD

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