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SMART DRIVER MONITORING SYSTEM TO PREVENT ACCIDENTS USING MACHINE LEARNING TECHNIQUES

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Abstract- A consequence of accidents on the roads has been recognized as a serious problem. The main factors which are responsible for the most of the road accidents are the driver errors due to affected by fatigue, being drunk or reckless driving. Building on the familiar existing technology of knob and voice controls introduced a new feature that would provide unprecedented ease in controlling a car's functions. The new feature is called MMI touch, but it has only in heighten modules. Monitoring the driver behaviour is one of the ways to prevent the fatal accidents and it is necessary to alert the driver when they are drowsy or in a distracted state. A custom-made webcam is placed on the dashboard of the driver seat to capture the image of the driver. The webcam is connected via USB port, with resolution up to 800×600 VGA 30 frames per second. If the eyelid closes for a relatively longer duration (sleeping), the vehicle is automatically decelerated and flash lights are switched on to indicate that the vehicle is facing an issue.
Keywords- MMI touch, custom-made webcam, alert system.

1. INTRODUCTION

This approach collects information available when a traffic accident occurs, which is captured by sensors, installed onboard the vehicles. The data collected are structured in a packet and forwarded to a remote-Control Unit through a wireless communication. Based on this information, our system directly estimates the accident severity and reduces the vehicle speed with alert message. The sensors will be placed inside the vehicle and it will continuously focus on the driver eyeball. If he closes his/her eyes continuously for few minutes, the alert message will be enabled followed by the speed gets reduced, e.g., about the driver's degree of attention, drowsiness, etc.

The numbers of death and disability are very high because of late assistance to people who got the accident. These cause huge social and economic burdens to people involved. Therefore, several research group and major motorcycle manufacturers including have developed safety devices to protect riders from accidental injuries. However, good safety device for motorcycle is difficult to implement and very expensive. So that we installed sensors in vehicle to monitor driver and avoid accidents

1.1 INTERNET OF THINGS

The Internet of things (IoT) refers to the concept of extending Internet connectivity beyond conventional computing platforms such as personal computers and mobile devices, and into any range of traditionally

"dumb" or non-internet enabled physical devices and everyday objects. Embedded with electronics, Internet connectivity, and other forms of hardware (such as sensors), these devices can communicate and interact with others over the Internet, and they can be remotely monitored and controlled. The definition of the Internet of things has evolved due to convergence of multiple technologies, real-time analytics, machine learning, commodity sensors, and embedded systems. Traditional fields of embedded systems, wireless sensor networks, control systems, automation (including home and building automation), and others all contribute to enabling the Internet of things. In the consumer market, IoT technology is most synonymous with products pertaining to the concept of the "smart home", covering devices and appliances (such as lighting fixtures, thermostats, home security systems and cameras, and other home appliances) that support one or more common ecosystems, and can be controlled via devices associated with that ecosystem, such as smart phones and smart speakers. The IoT concept has faced prominent criticism, especially in regards to privacy and security concerns related to these devices and their intention of pervasive presence.

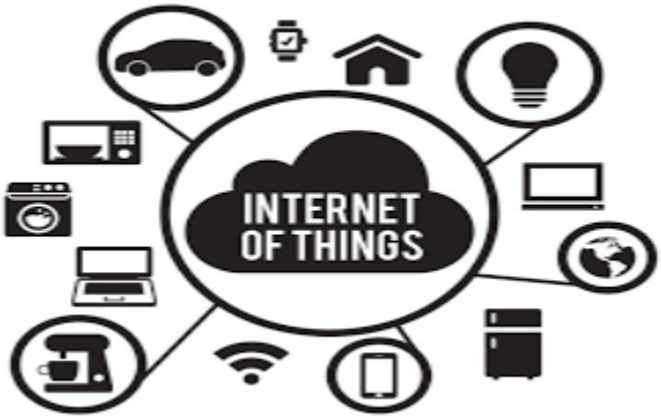

Fig: Internet of Things

IoT applications collect tons of data. Data retrieval and processing is integral part of the whole IoT environment. Most of this data is personal and needs to be protected through encryption. Encryption is widely used on the internet to protect user information being sent between a browser and a server, including passwords, payment information and other personal information that should be considered private. Organizations and individuals use encryption to protect sensitive data stored on computers, servers and mobile devices like phones or tablets. After successful encryption of data chances of device itself being hacked still exist. If there is no way to establish the authenticity of the data being communicated to and from an IoT device, security is compromised. For instance, say you built a temperature sensor for smart homes. Even though you encrypt the data it transfers is there is no way to authenticate the source of data then anyone can make up fake data and send it to your sensor instructing it to cool the room even when its freezing or vice versa.

1.2 CLASSIFICATION

Considering the variety of IoT systems, it can be difficult for business players to decide what they really need. The number of IoT solutions is increasing at quite an impressive pace, and these systems are

designed to perform various functions. Basing on our experience in IoT development, we want to bring more clarity to this variety and introduce our approach to the IoT systems classification.

IoT solutions for monitoring

With the help of sensor data, a user of a smart, connected thing can monitor its real-time state and environment. In a longer-term perspective, the results of monitoring can be gathered and applied for advanced insights. Accumulated sensor data helps to get detailed and meaningful statistics, assess the performance of equipment from different perspectives, uncover new patterns and tendencies and more. Monitoring is important assistance in proactive maintenance as IoT system users get an opportunity to identify the problems before the damage is done and take necessary measures.

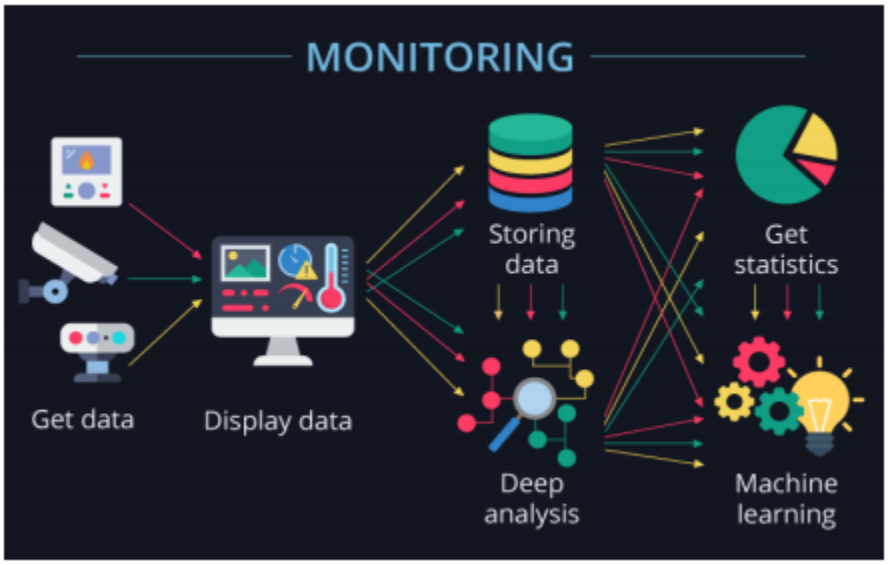

Fig: Iot Solutions for Monitoring

Storing data and showing to users

Connected devices can give an expanded picture of patients' health, environmental conditions, equipment state in factories and power plants, help users monitor their pets, cars, homes and more. Remote monitoring of facilities, processes and events brings better operational insights: sensors can gather the data that helps to see and assess real-time state of smart connected things.

Deep analysis and detection of specific situations

An IoT system can not only take and display sensor data (for example, temperature or humidity), but also make conclusions about what certain values of data could mean. Processing the data coming from sensors, an IoT system can not only detect anomalies, but also predict operational malfunctioning and point at the root causes of problems. Thus, comparing current data coming from sensors and the data stored in the cloud as acceptable values, an IoT solution monitoring trains and railways can show that a certain part is about to be out of order. The historical data about the conditions of using trains and the breakdowns that happen can help identify (and then – predict) the conditions leading to failures.

IoT solutions for monitoring with automated control

In IoT systems with automated control, control applications send commands to actuators. The choice of the commands to be sent depends on the data coming from sensors and/or previously defined schedules.

Rule-based control

An IoT system with rule-based control is designed to act in accordance with the algorithms featuring what should be done in response to certain data coming from sensors. Rules are stated before the system is put into action. In freight trains, sensors can measure temperature, vibrations and other parameters critical for cargo. This big data goes to the cloud, and, when the smart system identifies that some parameters differ from acceptable values, control applications send commands to adjust these parameters (for example, increase or decrease refrigerating). In such freight trains, it's also possible to set acceptable values in different carriages before the trip begins (as soon as various goods can be transported in different cars and each type of transported goods requires corresponding conditions).

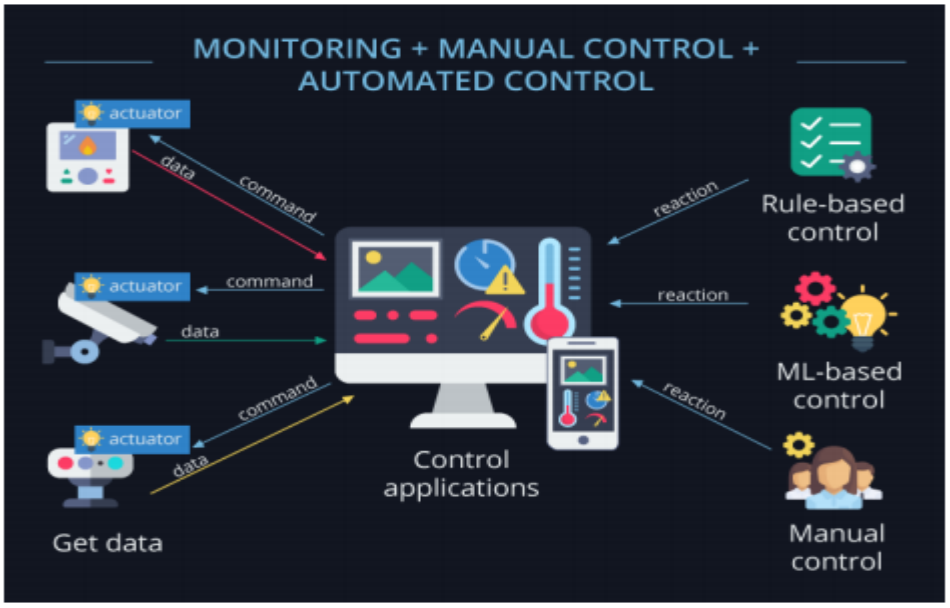

Fig: Rule Based Control

Machine learning-based control

The next stage of IoT systems evolution is the systems with machine learning based control when IoT potential is used to its fullest extent. In machine learning, sensor data is continuously collected and regularly used in standard machine learning algorithms. New models are generated, and their applicability is then tested by analysts and / or data scientists. When the models are approved, they can be used by an IoT system. In a smart railway, such learning can be performed with analyzing human commands. The responses of humans to certain sensor data are accumulated in a big data warehouse, and then the models of how to act are built accordingly (considering the actions of humans in certain situations). Cameras can

take photos of potential problems (suspicions that there are some problems) and send them for further analysis (either manually or with computer assistance). As soon as various images are collected in the cloud (and the problems are identified), smart systems "learn" to determine the types of problems without human participation and send corresponding notifications. Machine learning potential can contribute to optimizing subway trains' schedules. Smart system accommodates the data about the passenger flow on different days and at different times of the day. Then, it defines the days and the time slots when additional trains should be put on the line, and, thus, offers schedule optimizations. It makes sense to notice that, even if an IoT solution can, in most cases, successfully operate without human participation, there should be an option of manual control.

2. EXISTING SYSTEM

In current technology the airbag is released only after the vehicle was crashed. The major defect of previous methods is they cannot operate correctly and recognize drowsiness when driver wears glasses. This may lead to an accident of that particular vehicle. "Smart driver monitoring system" led to avoid such an accident. This project includes placing sensors in the vehicle, which will slow down the speed of vehicle. Limitations: • Highly expensive. • It can't detect driver face with specs.

2.1 CHALLENGES

There is a serious move toward adding ever-more technology to cars in an effort to reduce accidents that take 32,000 human lives a year and cause some 2 million injuries. Crash avoidance technologies, which use sensors such as cameras and radar, can observe a vehicle's visible surroundings and issue warnings to the driver when certain types of collisions with other vehicles or obstacles appear to be imminent. These technologies also facilitate the sharing of data, such as vehicle speed and location, among vehicles to warn drivers of potential collisions, the GAO stated. The GAO said efforts by the U.S. Department of Transportation (DOT) and the automobile industry have focused on developing: 1) in-vehicle components such as hardware to facilitate communications among vehicles, 2) safety software applications to analyse data and identify potential collisions, 3) vehicle features that warn drivers, and 4) a national communication security system to ensure trust in the data transmitted among vehicles.

3. PROPOSED SYSTEM

The drivers of any running vehicle (car, bus, truck) may feel sleep at any moment. This may lead to prevent an accident of that particular vehicle, before the car was crashed. Only drowsy driver issue is gaining more attention while the other 2 issues are less considered. Existing drowsy driver system relies on eye motion capture and brain wave analysis using brain wave sensor. Various algorithms may be employed to detect and differentiate opening and closure of eye & the rate of closure. In most cases, Viola-Jones algorithm is used in detection process. SURF Cascade method for fast and accurate detection of eye activity in unconstrained practical environment (Framework based on VJ algorithm) and brain wave analysis using sensor. Heart beat sensor placed in the seat-belt to monitor heart activity. Alcohol odour sensors placed in the steering detects alcohol consumption through perspiration in palms. Additional alcohol sensors may be employed in the driver's vicinity for better accuracy. Based on the results from the above-mentioned sensor modules, the car is uniformly decelerated to halt with flash light/alert lights switched on, in the event of, ill-health or drowsiness of driver.

3.1 ADVANTAGES

The main advantages to observe in proposed (improved) Viola-Jones algorithm are which are not there in existing algorithm. It will be fastest response. It will be easier to rescue people who suffered in accident. Advanced collision avoidance is possible here. It requires less battery power than Raspberry board.

4. LITERATURE SURVEY

4.1 Data-driven formal reasoning and their applications in safety analysis of vehicle autonomy features

AUTHOR: Chuchu Fan, Bolun Qi.

PUBLISHED IN: International Electrical and Electronics Engineering Design and Test, 2018.

CONTEXT: Safety analysis of Autonomous Vehicles and Advanced Driver Assist Systems (ADAS) is a central challenge facing the automotive industry. In this paper, we present a recently developed data-driven formal verification technique and demonstrate its applicability in a case study involving integrated safety analysis of an Automatic Emergency Braking (AEB) system. Our technique combines model-based, hybrid system reachability analysis with sensitivity analysis of components with possibly unknown or inaccessible models. The scenarios we consider for safety analysis are representative of the most common type of rear-end crashes, which are used for evaluating AEB and forward collision avoidance systems. We show that our verification tool DryVR can effectively establish safety of these scenarios (specified by parameters like braking profiles, initial velocities, uncertainties in position and reaction times), and compute the severity of accidents for unsafe scenarios. The analysis can quantify the safety envelope of the system in the parameter space which is valuable for both design and certification. We also show how the reachability analysis can be combined with statistical information about the parameters, to assess the risk-level of the system, which in turn is essential, for determining Automotive Safety Integrity Levels (ASIL) mandated by the ISO26262 standard.

DISADVANTAGE:

It consumes more time to collects data from sensors.

4.2 Design of Enhanced Vehicle Safety System Based on the Evaluation of Driving Errors

AUTHOR: Hussain A. Attia1 , Shereen Ismail.

PUBLISHED IN: International Conference on Electrical and Computing Technologies and Applications (ICECTA), 2017.

CONTEXT: An enhanced electronic safety system design with simulation results for teenagers and older drivers is presented in this paper. Because of their physiological characteristics that lead to multiple driving errors, which need monitoring to avoid their recurrence. Comparing to the initial design, the presented safety system in this study considers additional two parameters; the number of driving errors

and the errors duration. Based on these two parameters, the total number of recorded driving errors (lower/higher than the low/high front distance limits respectively) will be considered. If this number exceeds a certain limit of error then a suitable response will be taken as a safety reaction. Simulation results are demonstrating the recognition capability among the three cases of driving conditions, which are safe front distance, short front distance alarm, and long front distance alarm. In addition, the results are reflecting the highly effectiveness of the system in term of response and promising the possibility of obtaining high performance system in the fields of driving safety.

DISADVANTAGE:

Automatic alert system is not installed

4.3 Design and Implementation of Real Time Wireless System for Vehicle Safety and Vehicle to Vehicle Communication

AUTHOR: Mallikarjuna Gowda C P, Raju Hajare.

PUBLISHED IN: International Conference on Electrical, Electronics, Communication, Computer and Optimization Techniques (ICEECCOT), 2017.

CONTEXT: The proposed system aims at developing and designing a suitable system for automobile purposes using ZigBee protocols. The main problems faced in the existing system are inaccuracies in the calculation of speed, distance measurement, and slow response time, etc. The proposed system solves many of the problems faced by the existing systems by using a GPS module instead of the conventional speedometer and also uses sensors which are reliable in areas where human intervention is either unintended or where it puts life to risk. The problems of traffic congestion in urban arterials are increasing day by day and it is very difficult to handle it during emergencies. So we are developing a communication unit within the system to interact with other vehicles in order to clear the lanes. This system aims at communicating with the vehicle in its surrounding with the help of its location (i.e., using the latitude and longitude) to indicate their proximity. When these vehicles are very close in proximity the drivers are cautioned with the help of a message. In this way the drivers can communicate with each other and act according to the situation.

DISADVANTAGE:

More possibilities for traffic collision.

4.4 Estimation of Tire-Road Friction Coefficient and Frictional Force for Active Vehicle Safety System

AUTHOR: Shouvik Chakraborty, Sachidananda Sen.

PUBLISHED IN: 2015 International Conference on Industrial Instrumentation and Control (ICIC).

CONTEXT: An increasing number of accidents of Vehicles have led to the study and design of Active safety systems in modern automobiles. For the purpose, a number of sensors for the measurement of Vehicle yaw, wheel velocities and acceleration are deployed. However, some key parameters like slip angle and frictional forces are hard to be determined using sensors and also cost prohibitive. Estimation of friction coefficient and frictional forces has been of wide importance for the design of Active safety systems as the information is required for the design of efficient control system. Besides, the system being highly nonlinear in nature, linearized estimation technique may lead to high approximation errors. This paper presents an unscented Kalman Filter based estimation algorithm for a specific nonlinear tire model for the estimation of friction coefficient and lateral and longitudinal frictional forces.

DISADVANTAGE: Sensors are disabled when driver wears specs.

5. SYSTEM ARCHITECTURE

An Architectural diagram is an representation of concepts, their principals elements and components that are part of an architecture.

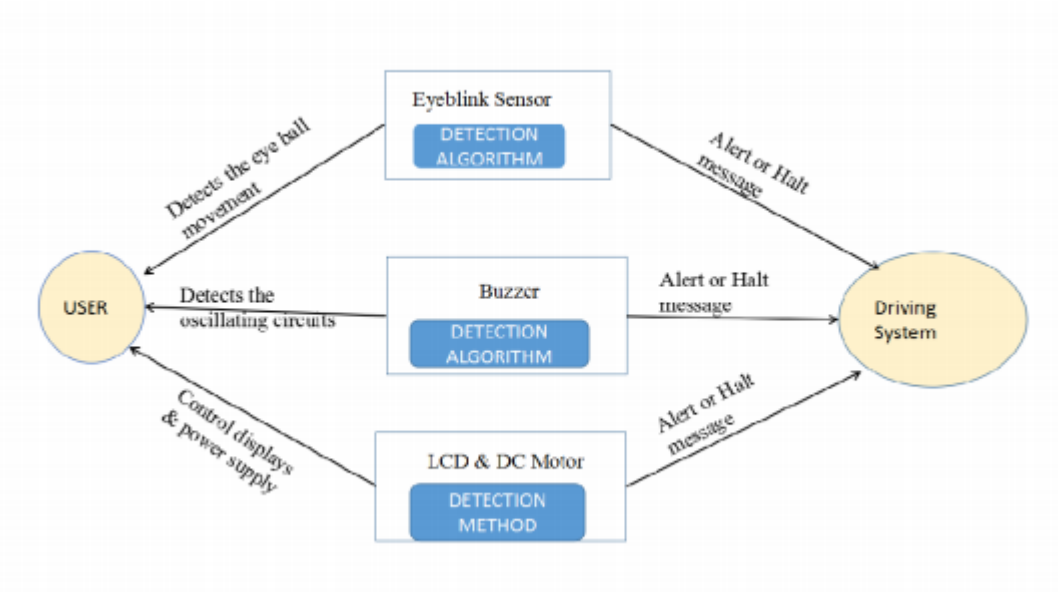

Fig: System Architecture

6. LIST OF MODULES

6.1 VIEW OF HARDWARE

- **Arduino UNO**

Fig: Arduino UNO

Arduino/Genuino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

- **LCD**

LCD screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable. Have no limitation of displaying special & Even custom characters (unlike in seven segments), animations and so on.

- **Buzzer**

Buzzers like the TMB-series are magnetic audible signal devices with builtin oscillating circuits. The construction combines an oscillation circuit unit with a detection coil, a drive coil and a magnetic transducer. Transistors, resistors, diodes and other small devices act as circuit devices for driving sound generators. With the application of voltage, current flows to the drive coil on primary side and to the detection coil on the secondary side. The amplification circuit, including the transistor and the feedback circuit, causes vibration. The oscillation current excites the coil and the unit generates an AC magnetic field corresponding to an oscillation frequency.

- **Dc motor**

DC motor is any of a class of rotary electrical machines that converts direct current electrical power into mechanical power. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic; to periodically change the direction of current flow in part of the motor.

- **Eye blink sensor**

Sensing element detects the optical muscles movement continuously and amplified to give pulse output the elastic strap holds the sensing element in place of vision muscle movement. The active element in formed by two metallic electrodes A and B are placed in a feedback loop of high frequency oscillator. When no target in present the sensor capacitances are low therefore the oscillator amplitude is small. When a target the face of the sensor it increases the capacitances. This increase in capacitance results in an increased amplitude of oscillator.

- **GSM**

A GSM modem is a wireless modem that works with a GSM wireless network. A wireless modem behaves like a dial-up modem. The main difference between them is that a dial-up modem sends and receives data through a fixed telephone line while a wireless modem sends and receives data through radio waves. The working of GSM modem is based on commands, the commands always start with AT (which means Attention) and finish with a character. For example, the dialing command is ATD. ATD3314629080. Here the dialing command ends with semicolon. The AT commands are given to the GSM modem with the help of PC or controller. The GSM modem is serially interfaced with the controller with the help of MAX 232. Here max 232 acts as driver which converts TTL levels to the RS 232 levels. For serial interface GSM modem requires the signal based on RS 232 levels. The T1_OUT and R1_IN pin of MAX 232 is connected to the TX and RX pin of GSM modem

Fig: GSM

- **Motor driver**

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single L293D IC.

6.2 EXPRESSIONS REORGANIZATION

Facial expressions are the results of the action taken through face with respect to conversations. • Face muscles are also another way to express the content of conversations. • In this paper, work presents recent work done on facial expressions and supportive LBP algorithm. • It is not only four parts of face image but these are four identification pillars which are Left and Right Eye, Nose and Mouth. The experiments demonstrate that which facial part plays important role in classification of particular expression.

6.3 ALERT SYSTEM

• Feeling sleepy while driving could cause hazardous traffic accident. • When driving alone on highway or driving over a long period of time, drivers are inclined to bored and feel sleepy, even fall asleep. • There will be camera that constantly takes image of driver, a beagle board that implement image processing algorithm, and a feedback circuit that could generate alarm and a power supply system. • Vehicle informs drivers so that he/she could wakeup before accident. • The algorithm includes two parts: daytime detection and night detection. • For daytime detection, the RGB mode is used, while for night detection, the IR mode is used instead.

6.4 DECELERATION

• The aim of the project to develop automatic speed control of vehicle and accident avoidance using eye blink sensor and ultrasonic sensor. • Whenever any obstacle is detected in running vehicle depends on distance automatically control the speed of vehicle. • The driver in sleeping/drowse position the eye blink sensor detects the eye blink is not more than 30 sec eye closed vehicle stop the automatically, it is not manually. • When any obstacle or vehicle detected by ultrasonic sensor system it will send signal to the embedded board. After receiving this signal embedded board sends a signal to motor to reduce the vehicle speed automatically which can control car speed immediately.

7. EXPERIMENT RESULTS

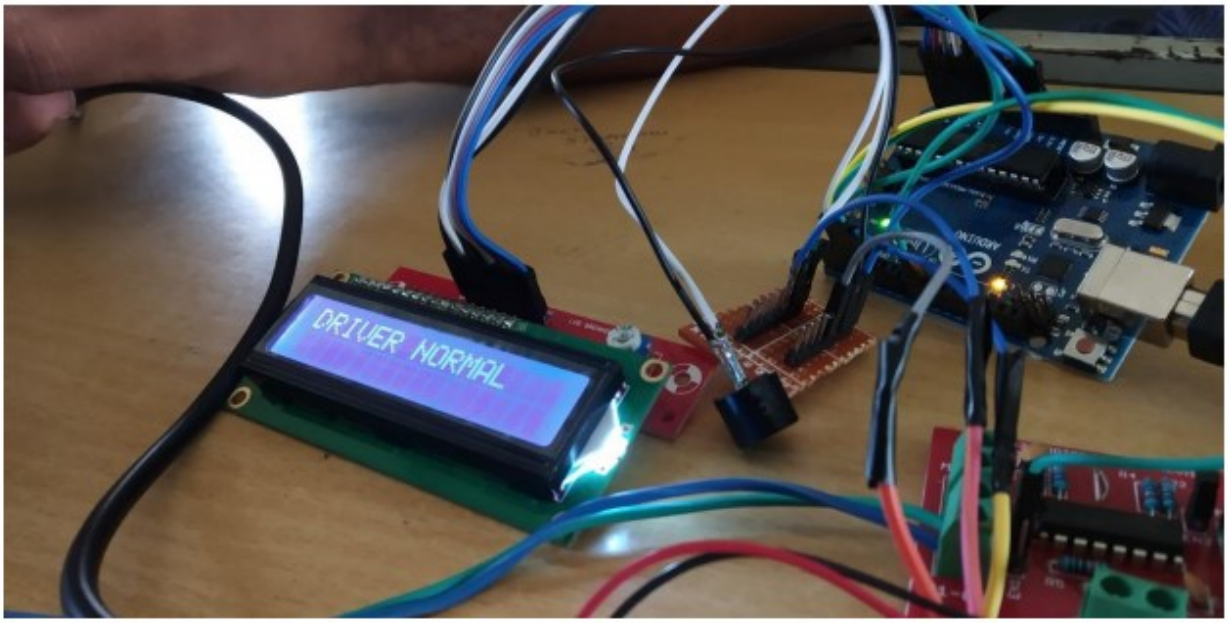

Fig: Normal Mode Indication

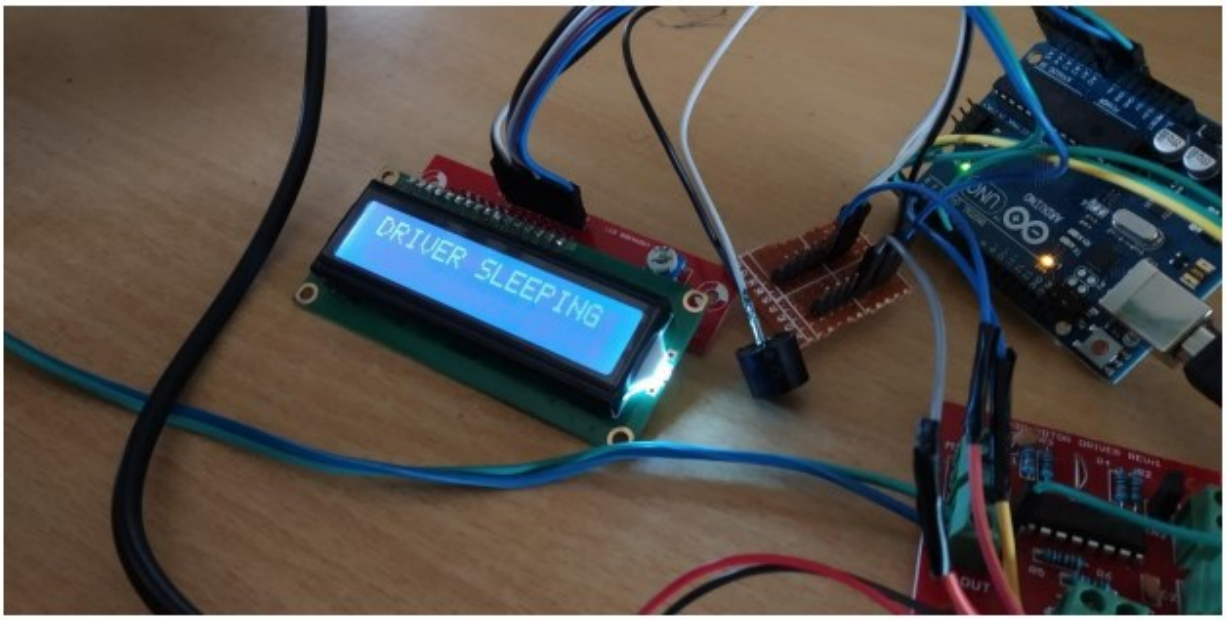

Fig: Sleeping Mode Indication

8. CONCLUSION

Based on the results, it is observed that the various feature Algorithm is used to reduce the accidents. In the current study, the improved algorithm was iteratively applied on the training data set to enhance the classification accuracy. In the final result, it is evident that the informative features are better chosen by the classifier even for the high accuracy in prevention. In every iteration the selected features are compared with final subset array to discard the duplicate features. This enables to converge the solution faster and more relevant features are selected.

9. FUTURE WORK

Using radar system & camera, the car can detect nearby vehicles and edge of road to park it without obstructing the path. Message alert sent to emergency health Centre if illness detected. Currently our system is optimized to Car, in future it will be deployed in long-run buses. Our project system can be collaborated with government and can be installed in government buses which can greatly reduce the accident rate in roads. This system can be installed in budget cars allowing middle class people to have a save journey.

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