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Paper Authors
Thangallapalli Shivakumar, Pulli Charan Chowdary,
Gajibinkar Chandan Lal, Arkelagudem Srishanth Goud, Ms.S.Samatha Goud

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ADVANCED VECHICLE CONTROL SYSTEM

Thangallapalli Shivakumar[1], Pulli Charan Chowdary[2], Gajibinkar Chandan Lal[3], Arkelagudem Srishanth Goud[4], Ms.S.Samatha Goud[5]

[1,2,3,4,5]ECE Department, CMR Institute of Technology, Medchal, Hyderabad, Telangana, India.

ABSTRACT- In the last few decades, Automobile Industry has been at its peak for developing revolutionary technologies to create a safe environment for both the driver and the Vehicle while driving on the road and to make them less prone to accidents. Two major causes of Road accidents are Fault detection using analog means or non-accurate information about the vehicle parameters and the ignorance of Driver. This paper presents the digital framework of a control system with integrated system of sensors connected to highspeed microcontroller and proper alert and warning systems to warn the driver of any unforeseen dangers. The idea to make driving more advanced and comfortable led to the designing of Digital Driver warning and control system that provides a real time performance by incorporating CAN protocol into the system. This paper also focuses on digital transmission of traffic light status to the driver inside the vehicle and to get rid of the glaring effect at night that is a health issue as well as one of accident causes.

I. Introduction

The World is changing every second, same is the case with different technologies being developed to make some aspects of our life easier and fail proof. Present time technologies that focus on vehicle protection and driver well-being are being improvised at continuous rate to eliminate any chances of error [8]. This paper talks about one such system that only aims at providing a mechanize framework that allows owner of the vehicle to exercise additional control over the vehicle functionality. This system consists of a transmitter and receiver section with their operations controlled by central PIC18F458 Microcontroller connected by CAN bus to transmit and receive jitter and noise free data at real time [1]. It is interfaced with temperature sensor, Light dependent sensor (LDR), Gas sensor at one end and warning systems like buzzer and a light dimmer circuit at other end and LCD to display accurate data [2]. The receiver is also incorporated with RF module to receive Status of traffic lights shown by signal LEDs from an additional RF Transmitter section controlled by PIC18F4520 which function as the actual changing traffic lights [10].

II. Literature review

This system is an attempt to analyze Intelligent Driver Alert System Using CAN Protocol. CAN (Controller Area Network) offer an efficient communication protocol among sensors, actuators, controllers, and other nodes in real-time applications, and is known for its simplicity, reliability, and high performance [3]. It has given an effective way by which can increase the car and driver safety. This system presents the development and implementation of a digital driving system for a semi-autonomous vehicle to improve the driver-vehicle interface using microcontroller-based data acquisition system that uses ADC to bring all control data from analog to digital format [6]. In this system, the signal information like temperature (LM35 sensor) if the temperature increase above the 60 ^{o}C and ultrasonic sensor is adapted to measure the distance between the object and vehicle, if obstacle is detected within 75cm from the vehicle, the controller gives buzzer to the driver, speed measure using RPM sensor if revolution increase up to 1200 per minute controller act and to avoid the maximum revolution and to check the fuel level continuously and display in the percentage if fuel level below 20 percent the controller also gives buzzer to the driver and distance, fuel level and temperature continuously display on the LCD. This system helps in achieving effective communication between transmitter and receiver modules using CAN protocol with multiple sensors to monitor the various parameters and visualize them to the vehicle driver through a LCD display and alarm [4]. The CAN modules interfaced with the sensors for this system are, temperature sensor capable of detecting engine heat, fuel level indicator using level detecting sensor, ultrasonic sensor for detecting the distance between obstacle and vehicle and RPM sensor to detect the speed of the engine [9]. This is important that human drivers control over the vehicle and check the parameters in vehicle on LCD screen at the same time of driving, parameters like engine temperature, fuel level and obstacle's distance. CAN protocol (bus) is used for data transmission. A CPU is needed to manage the CAN protocol [5]. The PIC18F458 microcontroller is used as the CPU that can manage bus arbitration, assigning priority for the message addressing and identification. The PIC18F458 microcontroller is chosen to control the altitude in this system and it is used in a CAN bus–based project. For the CAN bus– based designs it is easier to use a PIC microcontroller with a built-in CAN module, such devices include built-in CAN controller hardware on the chip. For implementation of this digital circuitry need a different component the main part for controlling all information to check working for this purpose use a processor for the sensing purpose use a temperature sensor, fuel level sensor, obstacle detection sensor, RPM sensor and power supply are main parts [7].

III. System Model

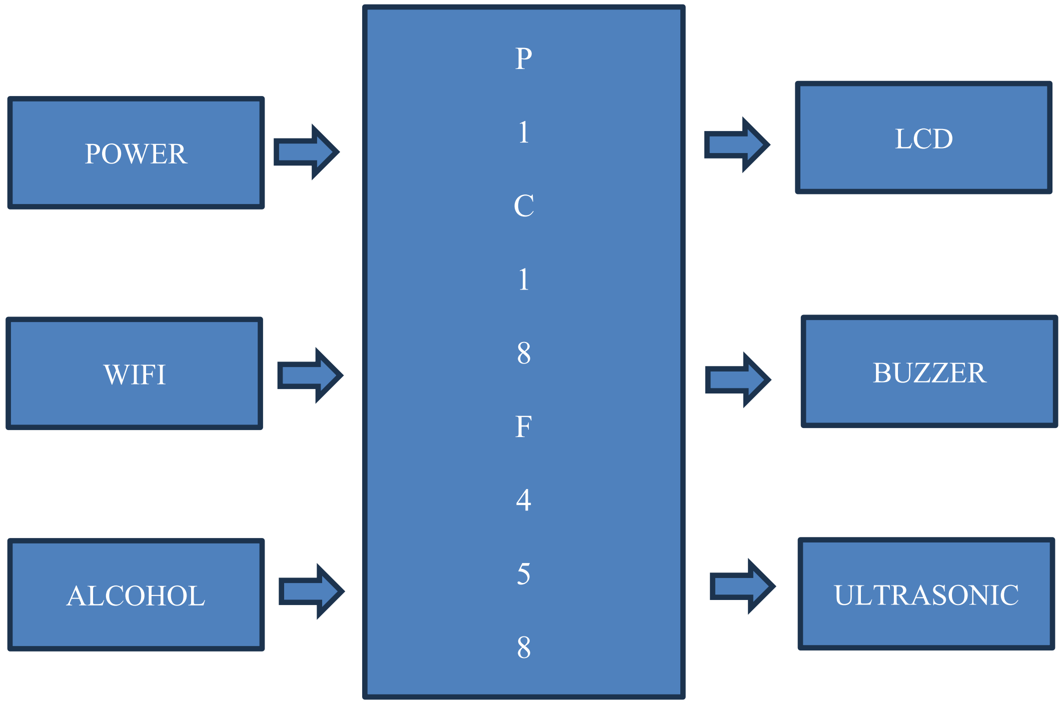

Fig 1: Block Diagram of Advanced vehicle Control System

1.DataCollection:

Sensors such as ultrasonic, LiDAR, infrared, GPS, and cameras monitor the environment and the vehicle's internal state. They collect data on parameters like obstacle distance, lane position, speed, temperature, and fuel levels, providing the system with comprehensive inputs.

2.Data Processing:

The microcontroller or processor processes raw sensor data in real-time. Noise filtering, pattern recognition, and decision-making algorithms interpret this data to make actionable insights about the vehicle's surroundings and conditions.

3.Decision Making:

Using control algorithms or machine learning models, the system determines the optimal actions, such as braking, steering, or alerting the driver, to ensure safety and efficiency.

4.Actuation:

Actuators and motor drivers carry out commands from the control unit, performing tasks like steering, braking, and speed adjustments. These components physically implement the system's decisions.

5.Driver Interaction:

Output devices such as LCD displays, LED indicators, and buzzers provide real-time feedback and alerts to the driver. They convey information like speed, fuel status, warnings, and system health, enabling informed decision-making.

6. Feedback and Communication:

The system continuously monitors the impact of its actions through feedback loops, refining its responses in real-time. Communication modules enable interaction with external devices, such as remote monitoring systems or other connected vehicles, ensuring seamless integration and adaptability.

RF MODULE:

It provides extensive hardware support for packet handling, data buffering, burst transmissions radio. It can be used in 2400-2483.5 MHz ISM/SRD band systems. (e.g. two way Remote Keyless Entry, wireless alarm and security systems).

Fig 2: RF Module

ARUDINO:

Arduino is used in Advanced Vehicle Control Systems as a central processing unit to collect and process data from various sensors like ultrasonic and GPS. It controls actuators for functions like steering, braking, and speed adjustment.

Fig 3: Arduino

LCD:

LCD is the part of digital interface used to display accurate parameter values to the driver. It supports up to 16 Characters in a single row. LCDs allow displays to be much thinner than cathode ray tube technology. Used to display real-time data, alerts, and system status to the driver or operator.

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Fig 4: LCD Display

BUZZER:

Provides auditory feedback (e.g., audio alerts such as warnings or errors). A buzzer is any mechanical, electromechanical, electronic, etc. device designed to produce a buzzing sound or vibration when activated. A buzzer is in the mechanical form of a small rectangular or cylindrical housing, with electrical connection for direct mounting on rigid printed circuit.

Fig 5: Buzzer

GAS SENSOR:

Gas sensor used is MQ-6, used to detect gas leakage inside the vehicle. It can also detect many different types of gases like LPG, iso-butane, propane –they are flammable in nature. Detection process is very simple all we have to do is to heat the coil with 5V, add a load resistance, then connect the output to ADC. MQ-6 is defined by its high sensitivity and fast response time.

Fig 6: Gas Sensor

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IV. RESULT

We observed that our Advanced Vehicle Control System project effectively integrated sensors and actuators to automate vehicle operations and enhance safety. The system's microcontroller efficiently processed real-time data from ultrasonic sensors, cameras, and GPS to perform tasks such as obstacle detection, lane keeping, and speed control. Key challenges included optimizing sensor calibration for varying environmental conditions and ensuring seamless communication between components. Future enhancements could involve incorporating LiDAR for more precise object detection, implementing machine learning algorithms for adaptive driving behavior, and integrating connectivity features for vehicle-to-vehicle (V2V) communication. Overall, the project showcased the potential of automation to improve driving safety, efficiency, and user experience in modern vehicles.

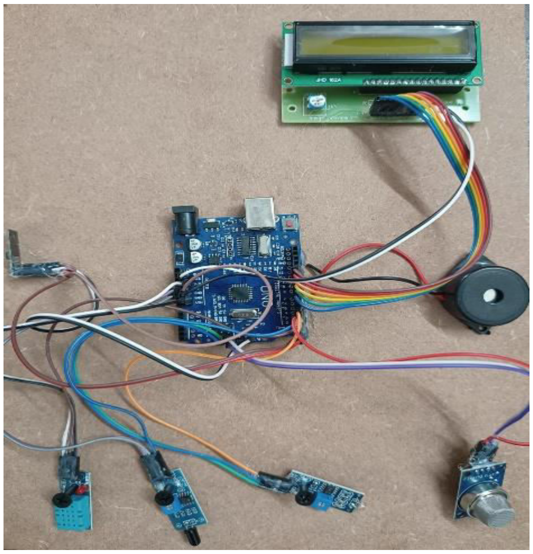

Fig 7: Setup of Advanced Vehicle Control System

V.CONCLUSION

The Advanced Vehicle Control System demonstrates the transformative potential of integrating modern technologies like sensors, microcontrollers, and actuators to enhance vehicle safety, automation, and efficiency. By enabling real-time data processing and intelligent decision-making, the system contributes to safer driving, reduced human error, and a better overall transportation experience. With future advancements in technologies such as LiDAR, machine learning, and V2V communication, the system has the potential to revolutionize mobility, paving the way for fully autonomous and connected vehicles.

This project has growth potential and can be improvised in the near future. This system can be made compulsory in every vehicle to achieve success at greater level. We can also integrate GSM, GPS, and voice module in this system to maximize the overall functioning of the system. RFID based wireless locking and unlocking system could be integrated with this system.

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