IARJSET

ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.066 ⋇ Peer-reviewed & Refereed journal ⋇ Vol. 11, Issue 5, May 2024

DOI: 10.17148/IARJSET.2024.11569

CAN Protocol Based Vehicle Monitoring System

Dr Revanesh M[1], Sanjay H U[2], Gireesha C P[3], Swaroop B K[4], Tarun Ranga[5]

Associate Professor, Department of Electronics and Communication Engineering, PES College Of Engineering, Mandya, India[1]

Final year UG Student, Department of Electronics and Communication Engineering, PES College Of Engineering, Mandya, India[2-5]

Abstract: The application and importance of vehicle monitoring systems based on the Controller Area network (CAN) Protocol in the contemporary automotive engineering are examined in this research. These systems make use of the CAN Protocol's dependability and efficiency to allow electronic control units (ECUs) in cars to communicate with one another in real time. They offer thorough monitoring of important characteristics including engine performance, vehicle speed, fuel level by collecting the information from components like sensors. This paper highlights the role that CAN Protocol-based vehicle monitoring systems play in improving vehicle performance, safety, and maintenance efficiency. It also analyzes the design, functioning, diagnostic capabilities, and advantages of such systems.

Keywords: CAN, ECU, Vehicle Monitoring System, Diagnostics capabilities, maintenance efficiency.

I. INTRODUCTION

Modern car design, performance, and functionality have all been transformed by the incorporation of cutting-edge technologies. The Protocol named Controller Area Network (CAN) Protocol is one such technology that is essential to contemporary automotive systems. Because of its durability, dependability, and efficiency, the CAN Protocol-which was first created by Robert Bosch GmbH in the 1980s has evolved into the industry standard for communication in automotive applications.

Modern automobile has more capability because to the introduction of CAN Protocol-based vehicle monitoring systems, which allow real-time communication between several electronic control units (ECUs) dispersed throughout the vehicle. These systems gather information from modules, sensors, and other parts, enabling thorough tracking of critical variables necessary for vehicle upkeep, safety and performance. The design, features, and advantages of CAN Protocol-based car monitoring systems are examined in-depth in this research. We go through the ways in which these systems create communication networks within cars using the CAN Protocol, making data interchange between various ECUs simple. In addition, we examine the diagnostic capabilities of these systems, emphasizing their capacity to identify errors, malfunctions, and anomalies in real time, thereby enabling prompt maintenance and resolution. This study highlights the importance of CAN Protocol-based vehicle monitoring systems in contemporary automotive engineering through an analysis of their benefits like safety, better vehicle performance, and lower maintenance expenses.

II. LITERATURE REVIEW

- Yavuz Ozturk and Abdullah Durmus, "**A Review on Controller Area Network (CAN) Based Automotive Applications and Security"**: This paper covers security concerns and solutions pertaining to CAN networks and offers an overview of CAN-based automotive applications, such as vehicle monitoring systems.

- **"Design of Vehicle Monitoring System Based on Controller Area Network"** by Wang Lihua and Zuo Qi: This study focuses on data gathering, communication, and integration with onboard sensors. It proposes a design framework for a vehicle monitoring system that uses the CAN protocol.

- The authors of "**Development of a Controller Area Network (CAN) Based Smart Vehicle Health Monitoring System**" are S. K. Nandy and Amit Kumar Dutta. In this study, problem detection algorithms, data processing, and sensor integration are discussed and construction of a CAN-based smart vehicle health monitoring system.

- Feng et al.'s "**An Intelligent Vehicle Monitoring System Based on CAN Bus and GPS**": The vehicle monitoring system that this study suggests monitors and analyzes vehicle performance and behavior in realistic behavior by fusing GPS data with CAN bus data.

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.066 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 11, Issue 5, May 2024

DOI: 10.17148/IARJSET.2024.11569

- The article **"Implementation of a Vehicle Health Monitoring System using OBD-II and CAN Protocol"** was written by Abhijit J. Khodke and colleagues. In order to facilitate diagnostic data collection and analysis for maintenance and performance monitoring, this paper describes the installation of the system according to OBD-II and CAN protocol.

III. PROPOSED WORK AND OBJECTIVES

In the hope of facilitating reliable serial communication for automotive applications, Robert Bosch first developed the Controller Area Network (CAN) in 1980s. The objective was to decrease the weight and complexity of wiring harnesses while increasing vehicle dependability, safety, and fuel efficiency. The CAN protocol was first introduced and because of wide use of CAN in automotive and truck applications as well as industrial automation. Instead of being an address-based system, the CAN protocol is message-based. This implies that addresses are not the basis for transmission of message from one ECU to other.

Each CAN Node consists of Host, CAN Controller and CAN Transceiver.

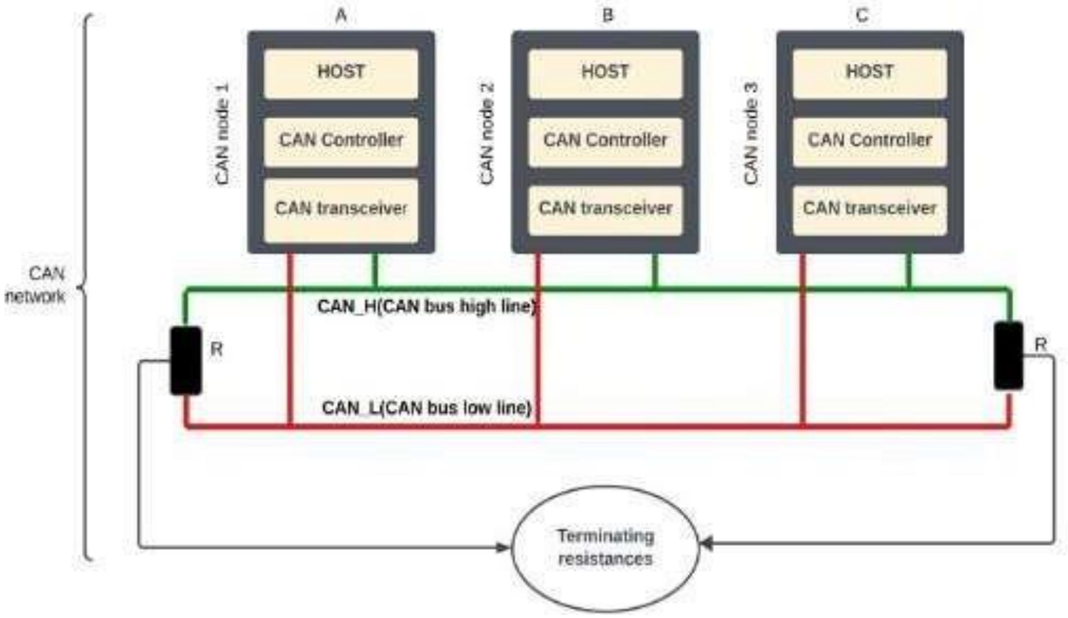

Fig 1: Communication system with CAN nodes

Host Can be the microcontroller and functions of each part as follows:

Host: The microcontroller serves as the brain of the node, executing program logic and controlling overall system operation. It manages communication tasks, processes data, and interacts with other components.

CAN Controller: The CAN controller is a hardware module within the MCU responsible for handling the communication protocol of the CAN bus. It manages the transmission and reception of messages, error checking, and ensures adherence to the standards of our CAN Protocol.

CAN Transceiver: The CAN transceiver interfaces between the CAN controller and the physical CAN bus. It converts the digital signals from the controller into the differential signals required for communication over the bus and vice versa.

Terminating Resistances: Terminating resistors play a crucial role in a Controller Area Network (CAN) by preventing signal reflections and ensuring signal integrity. They are typically placed at both terminations of the CAN bus.

Real-time vehicle parameter monitoring, prompt fault detection and reporting, performance and fuel efficiency optimization, remote diagnostics and maintenance facilitation, and enhanced safety through features like stability control, tire pressure monitoring, and collision detection are our goals.

IARJSET

ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.066 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 11, Issue 5, May 2024

DOI: 10.17148/IARJSET.2024.11569

The technology also seeks to facilitate fleet management activities including efficiently scheduling repairs, tracking vehicle locations, and keeping an eye on driver conduct. It should easily interface with other gadgets and systems to provide complete vehicle management. The system's overall objectives are to guarantee vehicle operation, raise safety standards, cut downtime through preventative maintenance, and increase fleet operations' general productivity and efficiency.

IV. BLOCK DIAGRAM

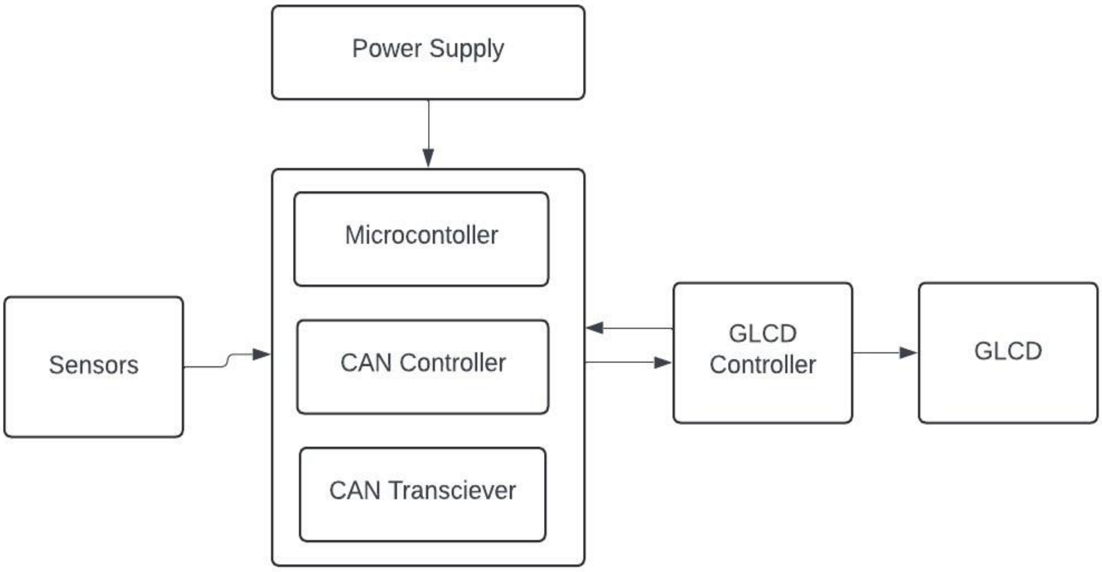

Fig 2: Block Diagram of the proposed solution

The intricate network of parts that makes up the CAN-based vehicle monitoring system block diagram is intended to effectively monitor and control a number of different aspects of a vehicle's performance and condition.

Sensors are important parts that collects data from different areas of the car. Temperature, pressure, speed, and many other types of sensors can be among them. Every sensor picks up particular parameters and converts them into electrical signals the system can use.

The **power supply** unit makes sure that every part of the system has a consistent and dependable supply of electrical power. In order to prevent voltage spikes or fluctuations and guarantee continuous functioning, it usually comprises of voltage regulators, filters, and protection circuits.

The **microcontroller** is the brains of the system; it manages data processing and communication tasks by executing software algorithms. The CAN communication protocol, which permits communication between different parts of the car, is implemented by the **CAN controller**.

Through the conversion of digital signals into the differential voltage levels required for CAN communication, the **CAN transceiver** serves as an interface between the microcontroller and the CAN bus. This part manages how the Graphical LCD (GLCD) display functions. In addition to changing the content based on data received from the microcontroller, it performs functions including rendering text, graphics, and images on the display screen. The information on the screen is provided in a clear and easy- to-use style thanks to the **GLCD controller.**

The **Graphical LCD** display acts as a visual feedback tool on several vehicle parameters and acts as an interface between the user and the system. It gives users the ability to keep an eye on real-time data, including fuel level, temperature, engine RPM, and diagnostic information, and makes informed decisions on the upkeep and operation of the vehicle. The integration of these elements results in an all-encompassing vehicle monitoring system that gathers, analyzes, and presents sensor data in real-time, offering users insightful information about the health and operation of the vehicle.

ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology
Impact Factor 8.066 ⁂ Peer-reviewed & Refereed journal ⁂ Vol. 11, Issue 5, May 2024
DOI: 10.17148/IARJSET.2024.11569

V. HARDWARE REQUIREMENTS

a. CAN Controller

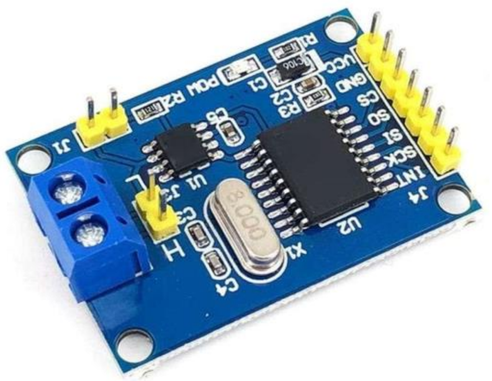

Fig 3: CAN Controller and Transceiver

In industrial and automotive applications, CAN (Controller Area Network) controllers are used to facilitate communication between microcontrollers and other devices. It oversees the data transfer and reception on the CAN bus, guaranteeing dependable and effective connection between nodes. CAN controllers are in charge of things like arbitration, error detection, and message prioritizing.

b. CAN Transceiver

component called a CAN transceiver translates digital signals from a microcontroller into signals that can be sent over a CAN bus and vice versa. To maintain dependable communication between nodes on the CAN network, it manages functions including noise reduction, signal conditioning, and voltage level shifting. In addition to being necessary for attaching nodes to the CAN bus, transceivers are also vital to the communication system's general dependability and performance.

c. Microcontroller

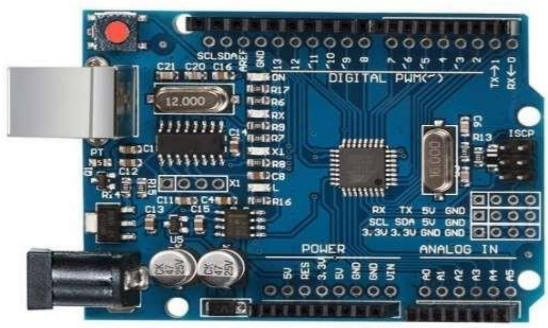

Fig 4: Arduino

A well-known microcontroller board built on the ATmega328P is the Arduino Uno. Because of its ease of use and versatility, it's frequently used for DIY electronics projects and prototyping. The Uno has several compatible shields and modules, integrated voltage regulation, USB connectivity for programming and power, and digital and analog input/output pins. It's a great option for both novice and seasoned producers.

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology
Impact Factor 8.066 ⁘ Peer-reviewed & Refereed journal ⁘ Vol. 11, Issue 5, May 2024
DOI: 10.17148/IARJSET.2024.11569

d. Graphical Liquid Crystal Display (GLCD)

Fig 5: 3.5 inch GLCD

Real-time parameters such as vehicle speed, engine rpm, temperature, fuel level, and any diagnostic information obtained from the CAN bus can be shown visually in a CAN-based car monitoring system by using a 3.5" GLCD (Graphics LCD). In order to collect data from various modules in the vehicle, the GLCD can be interfaced with a microcontroller (such as an Arduino or a more specialized controller) that talks with the CAN bus.

e. GLCD Controller (S1D13781)

Fig 6: 100 Pin GLCD Controller

To drive TFT LCD panels in embedded systems, the S1D13781 graphics LCD (GLCD) controller is frequently utilized. Although it lacks native CAN (Controller Area Network) connection support, it can be included into a system in conjunction with a microcontroller or other peripheral that does support CAN communication. We can construct a graphical interface for monitoring and displaying real-time data from the vehicle's CAN bus by integrating the S1D13781 GLCD controller into a CAN-based system in this manner, which improves the system's usability and functionality.

IARJSET

ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.066 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 11, Issue 5, May 2024

DOI: 10.17148/IARJSET.2024.11569

VI. SOFTWARE FLOW OF THE PROPOSED SYSTEM

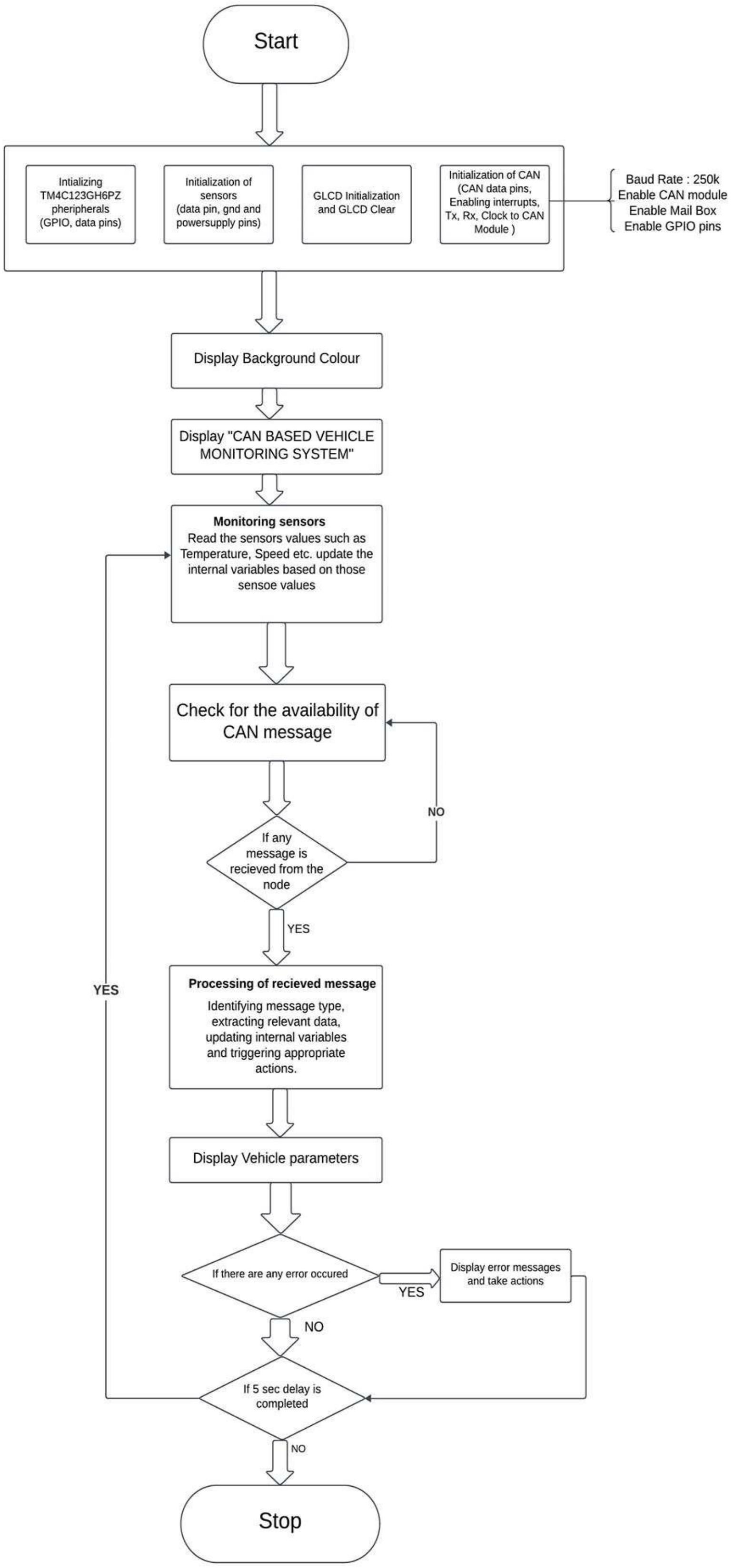

Fig 7: Software Flow of the system

DOI: 10.17148/IARJSET.2024.11569

VII. CONCLUSION

An important advancement in automotive technology is the installation of a Vehicle Monitoring System based on a Controller Area Network (CAN). We have examined the many benefits and features that CAN provides in monitoring and managing several facets of vehicle performance and operation throughout this study. The capacity of CAN technology to provide real-time communication between various vehicle components is one of its main advantages. CAN facilitates the smooth transfer of data between sensors, actuators, and electronic control units (ECUs), thereby enabling vehicle monitoring systems to acquire, analyze, and react to vital data with unmatched swiftness and effectiveness.

Moreover, robustness and dependability in data transmission are guaranteed by the decentralized CAN architecture, even in the face of noise and interference. CAN's intrinsic durability makes it the perfect option for applications like automotive systems, where dependability is crucial. We have shown in our investigation how CAN allows for the thorough monitoring of critical vehicle data, such as fuel usage, engine speed, and temperature. Through the constant and real-time monitoring of these metrics, vehicle monitoring systems that incorporate CAN technology can furnish drivers and operators with significant insights into the condition and functionality of their automobiles.

REFERENCES

[1]. Renjun Li, Chu Liu and Feng Luo, "A Design for Automotive CAN Bus Monitoring System", *IEEE Vehicle Power and Propulsion Conference (VPPC)*, September 3-5, 2008.
[2]. Priyanka A. Wagh, Rohit R. Pawar and L. Nalbalwar, "Vehicle Speed Control and Safety Prototype Using Controller Area Network", *IEEE International Conference on Computational Intelligence in Data Science (ICCIDS)*, 2017.
[3]. A. A. Salunkhe, Pravin P Kamble and Rohit Jadhav, "Design and Implementation of CAN bus Protocol Design and Implementation of CAN bus Protocol", *IEEE International Conference On Recent Trends In Electronics Information Communication Technology*, May 20-21, 2016.
[4]. Keith Pazul, "Controller Area Network (CAN) Basics", *Microchip Technology Inc. AN713*, Aug 2002.
[5]. BOSCH CAN Specification version 2.0, Stuttgart, Germany:Robert Bosch GmbH, 1991.
[6]. Karl Henrik Johansson, Martin Törngren and Lars Nielsen, "Vehicle Application of Controller Area Network", *proc of The Handbook of Networked and Embedded Control Systems Control Engineering*, vol. VI, pp. 741-76, 2005.