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VEHICLE CONTROL SYSTEM IMPLEMENTATION USING CAN PROTOCOL

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ABSTRACT:

Present Automobiles are being developed by more of electrical and electronic parts for efficient operation. Generally, a vehicle was built with an analog driver-vehicle interface for indicating various vehicle status like speed, fuel level, Engine temperature etc., This project presents the development and implementation of a digital driving system for a semi-autonomous vehicle to improve the driver-vehicle interface. It uses an Arduino & Raspberry Pi Pico based data acquisition system that uses ADC to bring all control data from analog to digital format and visualize through LCD. The communication module used in this project is embedded networking by CAN which has efficient data transfer. It also takes feedback of vehicle conditions like Vehicle speed, Engine temperature etc., and controlled by main controller. Additionally, this unit equipped with GPS, ESP01 for various other purposes.

Keywords: Digital Driving System, Arduino, Raspberry Pi Pico, CAN, GPS, ESP01.

INTRODUCTION:

Present Automobiles are being developed by more of electrical and electronic parts for efficient operation. Generally, a vehicle was built with an analog driver-vehicle interface for indicating various vehicle status like speed, fuel level, Engine temperature etc., This project presents the development and implementation of a digital driving system for a semi-autonomous vehicle to improve the driver-vehicle interface. It uses an Arduino & Raspberry Pi Pico based data acquisition system that uses ADC to bring all control data from analog to digital format and visualize through LCD. The communication module used in this project is embedded networking by CAN which has efficient data transfer. It also takes feedback of vehicle conditions like Vehicle speed, Engine temperature etc., and controlled by main controller. Additionally, this unit equipped with GPS, ESP01 for various other purposes.

LITERATURE SURVEY :

A lot of attempts for hacking into the CAN bus of a vehicle have been made, in the past. [4] discusses different hacking techniques and implementation of a bench-top Simulator. People have used OBD-II port for hacking into the CAN bus of a car. Also in a blog [5], White & Orange and White & Grey wires, behind Radio Connector of a Jeep Wrangler 2010, have been used for tapping into the CAN bus. The author programmed Arduino to accept message from the bus. On the top of the Microcontroller, CAN Bus shield was mounted to acquire the CAN data. The data was saved in .csv format and reverse engineering was applied to make sense out of the data. But the data obtained, in such a way, is vague and irrelevant without the database file. Simulation and testing of automotive CAN bus has been discussed competently in [1]. The use of CANoe and CANdb++ has been demonstrated for a development method for simulation of CAN network. The authors used CAPL (Communication Access Programming Language) for programming each virtual node and simulating function of real physical node to transmit and receive messages. [2] talks about different hardware and software solutions to collect data from CAN bus. It suggests techniques for frame data logging to generate files with smaller size. in [3], the authors focus on the real time capability of the CAN bus data transmission. Frame delay using frame length and baud rate has been analyzed for different situations. Attempt to minimize this delay have been made by implementing the Dynamic Priority Algorithm. Multiple other Electrical Engineering enthusiasts have made efforts to hack the Automotive CAN using MATLAB, CANoe [6],[7] to sniff data like steering wheel angle, Engine Efficiency, Throttle position etc.

PROPOSED METHODOLOGY :

1. The system consists of Arduino UNO, ESP01 and Raspberry Pi Pico as the microcontrollers.
2. Arduino UNO collects data from various sensors and send this over CAN protocol.
3. Ultrasonic sensor is used for fuel measurement.
4. IR sensor is used for obstacle detection. If the obstacle is detected the speed of the motor is reduced and motor is finally stopped using L293D Motor Driver.
5. Vibration sensor and Temperature Sensor are also used.
6. Neo6M GPS module is used for live tracking of the vehicle.
7. MCP2515 modules are used for data transmission.
8. Received data is forwarded by Arduino UNO to Raspberry Pi Pico.
9. Raspberry Pi Pico resolves this data and displays It over I2C LCD.
10. ESP01 is used to log GPS data to ThingSpeak

FLOWCHART :

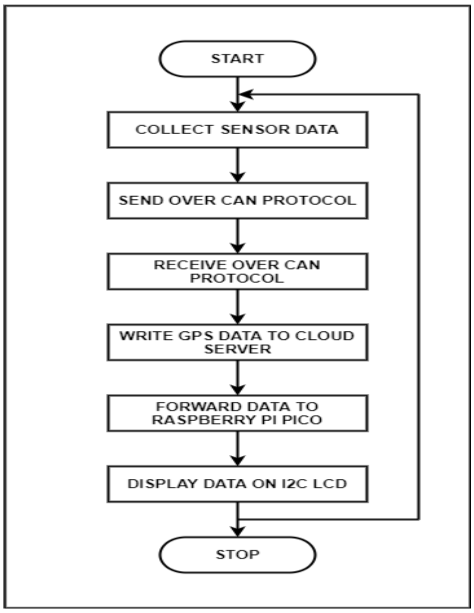

Fig1.Flowchart

SYSTEM ARCHITECTURE / BLOCK DIAGRAM :

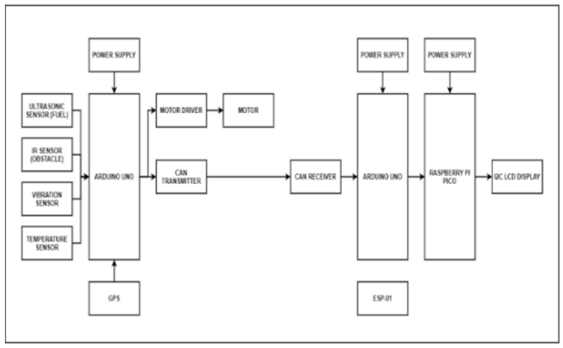

Fig 2. Block Diagram

CIRCUIT DIAGRAM :

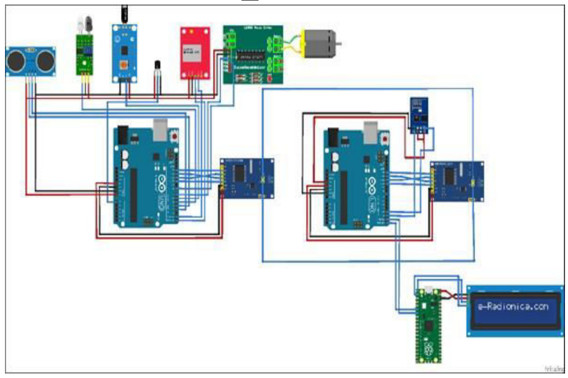

Fig 3. Circuit Diagram

WORKING:

The system consists of Arduino UNO, ESP01 and Raspberry Pi Pico as the microcontrollers. Arduino UNO collects data from various sensors and send this over CAN protocol. Ultrasonic sensor is used for fuel measurement. IR sensor is used for obstacle detection. If the obstacle is detected the speed of the motor is reduced and motor is finally stopped using L293D Motor Driver. Vibration sensor and Temperature Sensor are also used. Neo6M GPS module is used for live tracking of the vehicle. MCP2515 modules are used for data transmission. Received data is forwarded by Arduino UNO to Raspberry Pi Pico. Raspberry Pi Pico resolves this data and displays It over I2C LCD. ESP01 is used to log GPS data to ThingSpeak.

RESULT:

Fig 4. Sensor Result

Ultrasonic sensor used for fuel measurement is shown in output with the intervals of 10 upto 100 and has a threshold point of around 2-3 cm as it has given the length of 10cm of depth of container to be measured. Next is obstacles sensor if any obstacle is detected the output on LCD is 1 and if no obstacle is detected it shows 0 for output.While, vibration sensor shows the vibration that a vehicle can normally handle if it is showing 1 on display it is harmful for vehicle and if it is showing 0 for output then vibration can be handled by vehicle Temperature sensor shows the engine temperature.

Fig 5. Location

Latitude and Longitude is also displayed on for showing location of vehicle while the same is updated on cloud as well.

CONCLUSION :

Digital control of the vehicle is an important criterion of modern cars. With the rapid development of embedded technology, high-performance embedded processor is penetrated into the auto industry, which is low cost, high reliability and other features to meet the needs of the modern automobile industry. This project introduces an embedded system with a combination of CAN bus systems. The proposed high-speed CAN bus system solves the problem of automotive system applications, has a certain practical value and significance. With Arduino UNO and Raspberry Pi Pico as the main controller and double gateway in a control computer within a car, it makes full use of the high-performance of microcontrollers, high-speed reduction of CAN bus communication control networks and instrument control so as to achieve full sharing of data between nodes and enhance their collaborative work. This system features efficient data transfer among different nodes in the practical applications.

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