Development & Real-time Analysis of Automotive Systems

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Abstract **- As the electric vehicle is coming to mainstream on the commercial vehicle, it is being used in our day-to-day life and has great demand in the market. The main objective of this project to design and develop a feedback control and automation system for the electric vehicle. The unknown small fault in the electric system can becomes major when it is not detected and cleared in early stages. For getting that thing fixed professional help is needed. To overcome this problem, we have introduced this system. The feedback system will detect fault and notify the user on the smartphone application.**

Index Terms **- Electric Vehicle, Smart Car, Vehicle Safety, Can Bus System.**

I.INTRODUCTION

The need for environmentally friendly technology has a significant impact on the automotive world. Fuel consumption in conventional vehicles gets attention from all over the world. So, the demand for environmentally friendly electric vehicles is becoming increasingly urgent. At present, a lot of research has been done on electric vehicles, especially research on battery design and performance.

When asking people on the street about their opinion on electric vehicles1 (EV), they will name beneficial aspects such as environmentally friendly, zero emissions (especially no CO2 emissions), low operating costs as no fossil fuel is needed and low noise emissions. However, humans are commonly reluctant towards technological changes such as the electrification of electric drivelines. Thus, drawbacks will be present in their minds as well, namely low range, long charging times, safety of the battery pack and high vehicle prices. A small failure of EVs' core components may result in a very costly breakdown or even a life safety threat. The focus is on typical faults of the electric drive and its control system.

II.LITERATURE REVIEW

1. Recent Development on Electric Vehicles - K.W.E CHENG
2. Faults and their influence on the dynamic behaviour of electric vehicles- Daniel Wanner
3. Online multi-fault detection and diagnosis for battery packs in electric vehicles Yongzhe Kang, Bin Duan, Zhongkai Zhou, Yunlong Shang, Chenghui Zhang
4. Summarize of Electric Vehicle Electric System Fault and Faulttolerant Technology Zhang Liwei Huang Xianjin, Yang Yannan, Xu Chen, Liu Jie

III. COMPONENTS

A. Arduino UNO

Arduino UNO is an open-source microcontroller board based on Microchip ATmega328P Microcontroller. This project requires three Arduino UNO boards. Separate Arduino is connected to each system. One for control system, second for automation system, and third one for automation system.

B. Bluetooth module

Bluetooth HC05 module is used for wireless, transparent communication. It is used for collecting the data from the Arduino and pass it to smartphone by using Bluetooth connection.

C. Battery

We have used 12 V 1.2 Ah lead acid battery for this project we can give our whole system about 30 min of run time.

D. Electric motor

We have used 9–12-volt 100 rpm small dc permanent magnet motor there are total 4 motor used in the project.

Fig.1 Arduino

Fig.2 Bluetooth Module

Fig.3 Battery

Fig.4 Motor

E. Relay module

Relay module is used for controlling the circuit at its high voltage side by the signal which is passed from the Arduino board. We have used 4 channel relay module which enable us to control 4 circuits like Air conditioner, Car lock/unlock, smoke sanitization system, etc.

F. Ultrasonic Sensor

Ultrasonic sensor is used in the feedback and automation system is senses the thing around the vehicle and pass that data to Arduino.

G. Motor Controller

As we have used 4 different motor in our project it is to be control precisely for this purpose this device is used, we enable used to properly manage the all 4 motors in termers of its speed and for its forward and backward direction control.

H. Led lights

As we have made the prototype the LED and Buzzer are used for the indication purpose for indicating that the system is working properly.

I. LCD display

LCD display is used for the indication of the data directly onboard the vehicle. It is placed at the top of the model in which the battery indication, speed, temperature readings can be seen.

J. I2C module

This module is connected to the LCD display it reduces the connecting wire between the LCD and the Arduino and pass all the data from only 2 wires that is SDA and SDL.

Fig.5 Relay Module

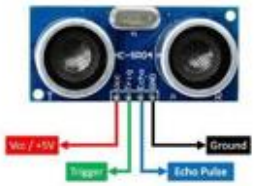

Fig.6 Relay Module

Fig.7 Motor Controller

Fig.8 LED

Fig.9 Buzzer

Fig.10 LCD Display

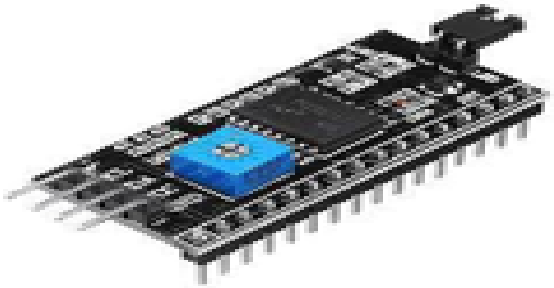

Fig.11 I2C Module

IV. DESIGN AND DEVELOPMENT

A. Hardware design

The hardware used for this prototype is such that is includes control system in the front of the car and

driving system is in back side of the car, battery is placed in between for the proper weight distribution. For turning on/off each circuit differently two different toggle switches are connected in either side of the battery. For connection of the circuit's mm wire is used where circuit connected from 12V supply and mm of wire is connected where 5V supply is there.

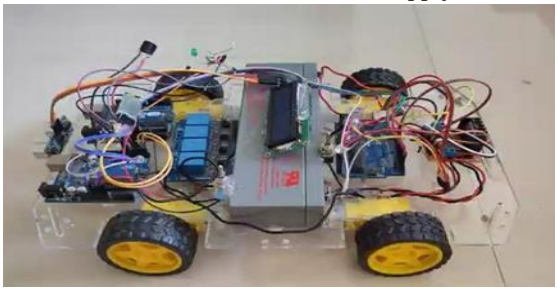

Fig.12 Hardware Design

B. Application design

We have made this application by using the using the MIT app inventory software. The application can be seen and download by below link it is a .aia file. https://drive.google.com/file/d/12hhzREYFgURyHT0neBN5xJXn8D3isvoD/view?usp=sharing

C. Control circuit

For the user to be able to control the vehicle wirelessly we are going to use relay which can be controlled by using Bluetooth module. The NO and NC terminal relay will be connected in the parallel with the switches already present in the vehicle and the low voltage terminal is connected to the Bluetooth module and by installing the app in the smartphone the user can control the relays and perform different tasks like controlling AC, turning on light, locate his Vehicle etc.

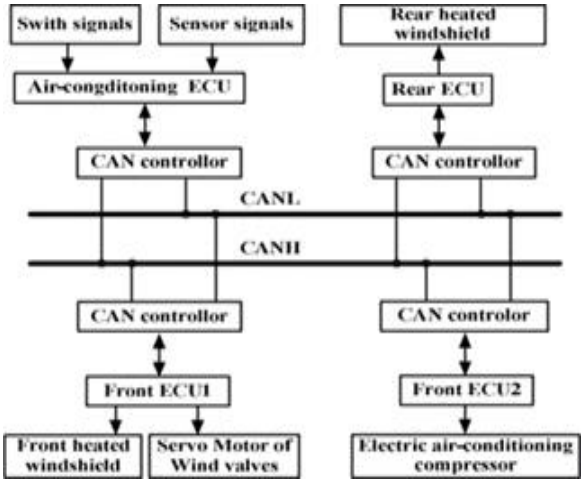

Fig.12 Control Circuit

D. Automation circuit

By using this system, the vehicle will become somewhat autonomous like vehicle can apply its own brakes by sensing the traffic condition or can automatically dipper the light. It can be achieved by sensor and micro controller (Arduino UNO). The working of this system can be explained by using the example of the automatic speed control system. In these two ultrasonic sensors is used one is in front of vehicle and another one is in back of vehicle is connected which will measure the distance between the vehicle from front and back and itself and send that data to the micro-controller and that micro-controller will control the speed of the vehicle.

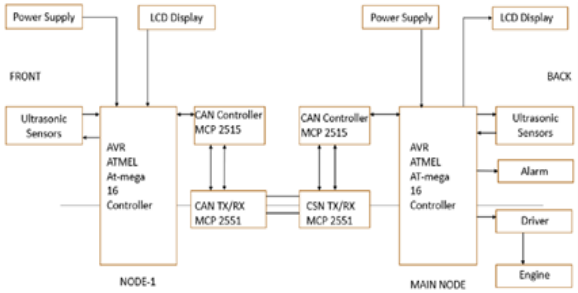

Fig.12 Automation Circuit

E. Feedback circuit

In this system we will use Sensors like depth, temperature, pressure, etc. which will sense the data and pass it to the microcontroller (Arduino UNO) which will convert that analog signal to digital and pass it to the digital LCD display from where user can read it or that signal can be received by the user on its phone on the app which we have built ANALYSI by connecting smartphone by Bluetooth.

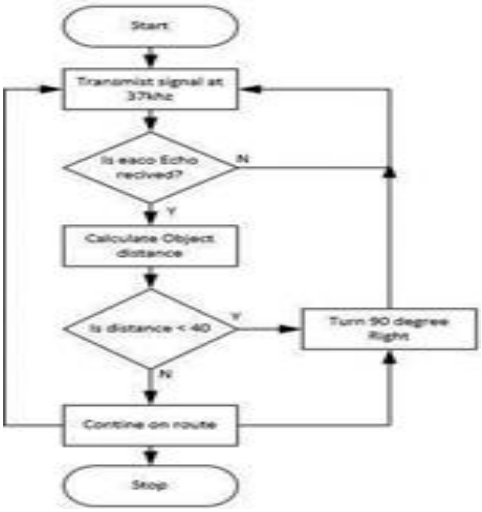

Fig.12 Feedback Circuit

IV. SOFTWARE

1. Arduino IDE

This software is required to program all the Arduino UNO which we have used in the prototype. Software Serial, LiquidCrystal_I2C, TinyGPS and HCSR04 libraries are necessary to program of all the systems. For checking the code there is a debagging option and data can also be seen on the serial monitor by using Serial.println command.

2. Proteus ISIS professional

This software is used for the simulation of the accident alert system. For doing the simulation we have to install the Arduino, GPS module, Vibration Senor library which can be downloaded from the GitHub website.

3. MIT App inventor

MIT App Inventor is an intuitive, visual programming environment that allows us to develop applications for Android phones using a web browser and either a connected phone or emulator.

VI. CONCLUSION

The work presented in this report aims to improve the vehicle safety of electric and hybrid electric vehicles. Implementing new electric driveline systems can lead to unforeseen failures, resulting in unpredictable vehicle behavior and threaten passengers and other traffic participants. The potential failures have been analyzed and classified in a systematic approach regarding their consequences on the vehicle's dynamic behavior. Strategies to compensate for the failures are developed, enabling the vehicle to come to a safe stop. Real-time, reliability, and flexibility, all these characteristics make CAN bus an indispensable network communication technology applied in the automobile network communication field. It also gives the basic software and hardware implementations of the CAN bus network. Finally, test results show that the CAN bus network communication structure's hardware circuit is stable, and software design is reasonable, achieving this design's goal.

This design enables the electric vehicle control network design based on the CAN bus. In the process of communication, a variety of control commands and data transmission are stable and accurate. The results show that the design can transmit commands and data from the vehicle central node to the slave nodes when the automotive air-conditioning works. The design also focuses on controlling the electric vehicle, hybrid vehicles, pure electric vehicles, and fuel cell vehicles. A complete CAN communication network can be established by expanding the number of CAN bus-connected nodes according to different site conditions and user requirements.

Design of monitoring and diagnosing instruments are by a Controller Area Network (CAN) protocol displayed on an android smartphone to provide the vehicle performance and alert if the interruption or damage occurs.

This project will develop practical and reliable fault detection and recovery system.

VII.ACKNOWLEDGMENT

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