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Monitoring and controlling electric car through IoT using NodeMCU

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ABSTRACT

An application is a set of programs created for the end-user. This Project implements the functionality of an application that allows us to take control over the electric vehicle. Progress in humanity is spread in all areas. Electric vehicle has been providing a promising future for automobiles since so far no suitable alternatives are found. Switching to electric vehicles provides the advantage but the limitations of EV's should also be overcome in short duration. Usage of smartphones over EV's helps us to overcome the plethora of limitations. There are several important technologies and emerging trends in electric vehicle. This technology exchanges information about and for applications of the vehicle with a cloud system by use of IoT. It tends to make vehicles smarter and more intelligent, facilitating safe, efficient and comfortable driving. IoT-enabled infotainment systems are capable of providing information on navigation, telematics, a range of entertainment options, mobility tracking support connectivity with smartphones.

Keywords: *Electric vehicle, IOT, nodemcu, Firebase, Sensor, database*

1. INTRODUCTION

At present, EV plays a vital role in India because it has high demand and future vehicles depends upon it. If we replace EV in place of petroleum-based vehicles, many technologies will arise and IoT plays an important role in it. So, our project is to develop an IoT based application using firebase from which it can control vehicle locking, starting, temperature. It can also monitor battery temperature, range and location of the car through different sensors.

In previous years Engine Control Module(ECM) has been used to monitor and control various parameters of fuel cars. Apart from their primary functions they also controlled various parameters using sensors like ultrasonic sensor, humidity sensor, temperature sensor. All these information gathered from various sensors enables the user to take decisions only when seated in the vehicle. This limitation is overcome by the application of IoT. In this paper, we present an IoT based Electric Vehicle Monitoring system that allows the user to monitor the EV from a distance using a Smartphone. This involves the concept of cloud-based application. By using this technology we can monitor our vehicle from anywhere in the world.

2. LITERATURE REVIEW

This section consists of information that is relevant or appropriate to this topic's method or mode of operation. IoT Based Car Automation Using Raspberry Pi: In this method, the authors have used Raspberry pi as the controller, ultrasonic sensor for avoiding collisions, moisture sensor for detecting rain to activate wipers, temperature sensor to measure temperature status inside the car, LDR to detect light intensity to show the status whether it is day or night to turn the headlight ON and OFF, AND gate for showing door status as open or closed. Fuel level sensor to monitor the fuel level of the vehicle. Raspberry pi is interfaced with laptop screen using putty software. By using the IP address of raspberry pi and password both are connected. Raspberry pi as a central unit and various sensors connected to it. The Raspberry pi senses the data and transfer it over the web. This information stored in the cloud can be accessed anywhere from the world using a smartphone, which in turn helps to monitor via IoT platform. The authors have attempted to control the parameters from anywhere using an IoT platform called 'UBIDOTS'.

3. PREDICTED MODULE

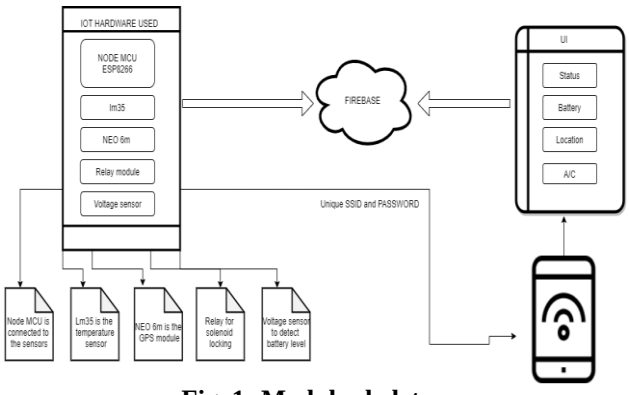

Fig. 1: Module skeleton

In this figure, the connection between the various modules are depicted. This model explains about the data transmission between the hardware, cloud and software. This predicted framework explains the complete workflow of the methodology, describing every step in depth that will help to implement work easily and clearly. The chief aim of this model is to create an IoT system that provides convenience and

safety. With the help of the above model, the user can easily control his car's certain functions from a distance. Apart from controlling, it plays a vital role in the BMS system. It calculates the battery temperature continuously and also the battery percentage. The MCU Esp8266 is connected to many other sensors using a breadboard. Smartphone application is used to control and monitor the MCU with the help of Firebase platform.

4. IOT HARDWARE

It consists of the setup concerning the sending of the required information regarding the electric car to the app. It is made up of

1) nodemcu esp8266
2) Lm35
3) NEO 6m
4) Relay module
5) Voltage sensor

NODEMCU ESP8266 is a low-cost wifi enabled microchip possessing microcontroller capabilities. Having 12 analog pins and 1 digital pin it is very powerful, cheap and small. All the sensors in this setup are connected to the NODEMCU. LM35 is a form of transducer that converts atmospheric temperature into voltage. It consists of 3 pins in total. The voltage increases with the temperature. This is used for the estimation of the battery temperature. NEO6m is a compact yet advanced GPS module which provides the user with position and velocity and has very good tracking capabilities. It can track the electric car within the specified radius. Relay module is a remote switching device with which devices can be powered on or off over the internet. This method is applied to check the power ON/OFF conditions for the electric car via smartphone. It is also used to control A/C in the car via smartphone. This helps the user to control the air temperature inside the car, adjusting it to preferable temperature before reaching the car. The solenoid locking in the electric car is monitored but this module. The principle of solenoid locking is to lock and unlock depending upon the pulse of the voltage of the solenoid. Voltage sensor is used to determine the amount of voltage in the battery of the electric car

5. USER INTERFACE

The user interface is very simple and easy to use. Upon opening the application, the home page shall appear

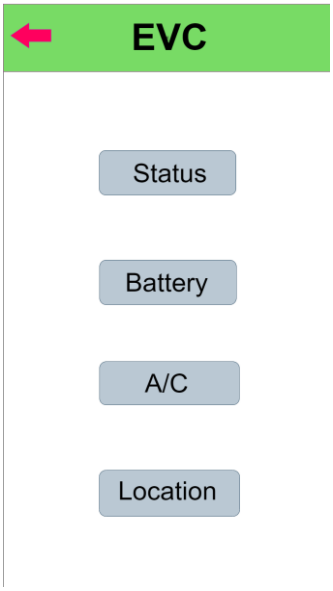

Fig. 2: Home page UI

It consists of 4 buttons - status, battery, location and A/C. Upon clicking the status button, it leads to a page which consists of 2 options - Locking and system. From the locking option, we can check whether the car has been locked or not and from the system option we can check if the car has been turned on or not. Upon clicking the battery button, the battery percentage, battery temperature and the range of the electric car can be viewed. On clicking the location button, the user will be lead to a map where the location of the electric car can be viewed. When the AC button is clicked. It leads the user to a page which consists of ON and OFF buttons of the AC. we can also control the temperature of the AC using the buttons assigned for temperature control.

Fig. 3: UI of other functions

6. MODULE IMPLEMENTATION

The IoT hardware proposed above is designed in such a way no Ambiguity occurs since the topology is well defined. Arduino IDE platform is used to define the function for each sensor and calibrate the results digitally. This database is uploaded to the Firebase which acts as a cloud platform.

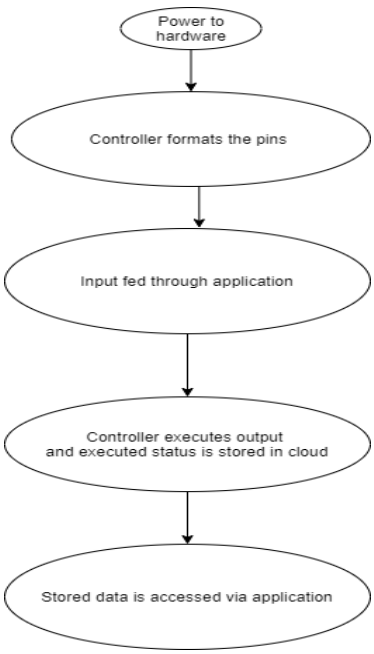

Fig. 4: Flow of the module

The uploaded database is accessed by the application developed in Android Studio. Each vehicle is provided with a unique SSID and Password at the production. Various status of the car can be monitored remotely. Solenoid locking system connected with a smartphone enables the application to act as an additional key to the vehicle. Vehicle's ON/OFF condition can be monitored and controlled remotely which can be used to save the battery from draining. While draining of auxiliary battery is a major problem in ignition of fuel vehicles, which can be even driven after a drained battery, it will be a greater problem for Electric vehicles. A/C status mechanism provides comfort by adjusting temperature before driving the car. GPS location of the car can be accessed easily. Battery is the main power source for the Electric vehicle. Battery monitoring ensures optimal usage. The temperature, charging times and range from battery percentage is measured and calculated. This will be helpful in effectively avoiding over or undercharging times of batteries, increasing the battery life, by an unwavering performance of the batteries. The above system combined with a certain Battery Management System and GPS location can give more advantages not only by increasing efficiency but also in identifying the charging stations. The range of the hardware can be increased by connecting the module via TP-Link WR841N router. The battery life of the battery used to power Node MCU can be prolonged by using various sleep modes.

7. CONCLUSION

The main objective of the project is to ease up functions for the user by connecting and controlling from a smartphone while being cost-effective at the same time. Hence IoT based application is used here. With every part of the vehicle being connected to the internet, the user will have greater access to outlying areas and control over your vehicle's functionality with your phone. The above-proposed model's parameters can be easily improvised for superior working. With growing technologies in car automation and various vehicle communications like V2V, V2I, V2R, this methodology provides a better communication solution. This project can be extent to control infotainment, various Vehicle communication systems and autonomous cars development.

8. REFERENCES

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