International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

Advanced Monitoring System for Electric Vehicle Real-Time Condition Monitoring

Dr. Bhargava Ramu T[1], Sai Ram Koganti[2], Narender Mangali[3], Vamsi Krishna Pathapati[4], Sathwik Kadirikanti[5]

[1, 2, 3, 4, 5] Department of Electrical & Electronics Engineering, MLR Institute of Technology, Dundigal, Hyderabad, Telangana, India

Abstract: ***The main intention of this design is to build an advanced monitoring model which helps to know various aspects of the BLDC Motor, Controlling, Location, Speed, Battery Capacity, Battery temperatures in an electric vehicle. These days many electric vehicles are bursting out into burn because of the unmonitored system in electric vehicle which is the most important thing to be considered while moving from combustion engine to an electric. This system uses internet of things and helps it to send the critical information to the cloud and then to the user. This further helps in analysis using the artificial intelligence. The model proposed contains the BLDC Motor, Controller, Power supply and battery, Smart Monitoring system attached to it to monitor the whole.***

Keywords: BLDC Motor, Battery, Monitoring system

1. Introduction

Electric vehicles (EVs) are considered to be the clean, efficient, intelligent and a good replacement for the combustion engine vehicles. One of the reasons that is limiting the application of the electric vehicle is that there is no proper battery monitoring in the Electrical vehicles.

During the time of battery charging and may be during the running time there may be chance of excess heat generated in the battery which is very dangerous to the rider in the latter case. The battery monitoring needs to be real-time and continuous throughout the motor or the vehicle is in running condition. Not only the monitoring but the indication is also necessary for efficient operation of the vehicle.

2. Literature Review

In order to know the existing techniques and their significance in monitoring the electric vehicle, a literature survey is conducted.

In a studied paper [1] with the aid of Zhiping Liu, Wei Tao, Lei Jiang and Cunle Zhu the proposed system turned into delivered to display the actual-time nation of the electric automobile with a module incorporated with the GSM verbal exchange module and GPS chip, three-axis digital ADXL345. Acceleration sensor and microcomputer manipulate unit PIC16F1823 one.

As in studied paper [2] by Mohd Helmy Abd Wahab., etal. described that using the internet of things technology a battery monitoring system is built to ensure the battery performance degradation can be monitored online. The system is capable of displaying the battery condition and time via internet of things and sending notification to the user based on GPRS technology.

3. Integrated Design of system

The complete tracking machine is made up of nearby circuits and far off servers. far off servers are available on computers and cell telephones. they are used to reveal actual-time conditions, along with battery voltage, cutting-edge to the battery, battery temperature, battery level, speed of the car, region [G. P. S]. Following are the distinctive modes available inside the proposed machine

1) Normal mode. Upon continuous monitoring of the battery temperature if there is no deviation in temperature with respect to the normal running temperature of the battery I. e.27° Celsius the circuit is treated to be normal and no indication is necessary.
2) Moderate mode. In the second mode if the temperature of the battery is increased slightly i.e. above 27° and below or equals to 29°. the circuit is treated as in moderate mode and the cooling fan provided will be switched ON, which will help in providing cool air to decrease the temperature of the battery.
3) Emergency mode. The third mode which is the emergency mode is achieved when the temperature of the battery lies in between 29° and 31° (both are inclusive). In this case the buzzer provided will be acting as the indicating device and alerts the rider that the battery is about to burn.
4) Critical mode. This is the final mode of the four modes and it is achieved when the temperature of the battery is reached above 31° and the motor, which is the heart of the electric vehicle will gets disconnected from the supply thereby separating it from the faulty section. This is achieved by the provided electric relay which acts as an automatic electric switch.

Apart from the above provided modes, there are additional features in monitoring the EV like locating the vehicle in case of theft, monitoring the speed of the vehicle, also switching it ON / OFF remotely through the developed mobile application.

4. Design of the hardware

The hardware of the monitoring system is mainly introduced in this part, shown in Fig.1. It is made up of integrated circuit combination of ARDUINO UNO and ESP 32 module, DHT 11 temperature sensor, buzzer, cooling fan, LCD display, relays, DC battery, BLDC motor and

peripheral interfaces.

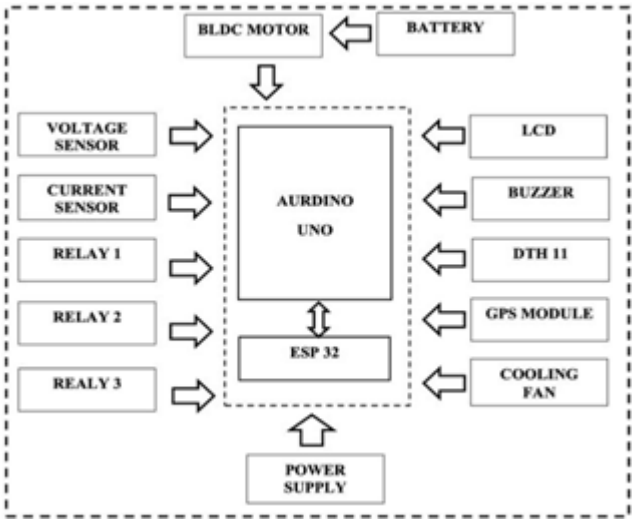

Figure 1: Block diagram of the hardware model

a) Integrated Module

The Arduino UNO microcontroller and the ESP32 module incorporate this module of terminal gadget. The records collected by means of the DHT11 temperature sensor, voltage sensor, current sensor, global positioning sensor, potentiometer can be obtained by the module. For this reason, the records may be read, in addition to interrupt by means of the micro controller.

b) Brushless DC motor [BLDC]

The biggest feature of brushless DC motors is that they do not care. There are many variations in DC motors one of these differences is its small size brushless DC motor that operates magnets that are more active in a smaller area than the standard DC motors. Efficient and suppresses heat production. In all parts of the engine, the coil produces extremely high temperatures. And as the DC car coil is located inside the engine, it is covered with air in the car, which prevents heat from the coil being blown off. In comparison, as the brushless motor coil is placed on the side of the stator, the performance of the car's radiation temperature is improved.

c) DHT11 Sensor

DHT11 is a standard temperature and humidity sensor that includes NTC dedicated to measuring temperature and eight micro-bit controls to extract temperature and humidity values as serial realities. It operates at a voltage of 3.5 V to 5.5V and an operating limit of 0.3mA (average) and 60uA (set aside). It has a temperature range of 0 ° C to 50 ° C and an accuracy of ± 1 ° C and ± 1%.

d) Relay module (1 Channel)

The transmission module is the electric transfer utilized by the electromagnetic field. The 6 pins at the left side of the transmission module connect high voltage, and the proper pins join the low-voltage factor - the Arduino pins. The excessive voltage aspect has 2 connectors, every with 3 bases: general (COM), generally closed (NC), and typically open (NO).

- COM: ordinary PIN
- NC (usually closed): Closed suspension is used in case you need to download to automatically shut down, meaning that the current flows without sending a signal from Arduino to the transmission module to open the circuit and avoid the current date.
- NO (usually switch on): The open configuration works differently: the relay is usually open, so the circuit is interrupted unless you send a signal from Arduino to close the circuit.
- The right hand set combines VCC and GND to allow the module, then enter 1 (IN1) and then enter 2 (IN2) to control the lower and upper relays, respectively.
- The second set of anchors contains the GND, VCC, and JD-VCC anchors. JD-VCC PIN allows for relay magnetic title.

e) GPS Sensor

The Global Positioning System (GPS) is a fully satellite-based tool that uses satellites and terrestrial channels to measure and calculate the planet's orbit. GPS is also called a Navigation system with Time and range (NAVSTAR) GPS. The GPS receiver wishes to receive records on at least 4 satellites for the exact reason. The GPS receiver no longer sends any records to satellites. This GPS receiver is used in many applications such as smartphones, cables, Fleet control etc.

f) DC Battery

A capacity of one amp-hour battery should be able to continuously deliver the current day of 1 amp on 1-hour direct, or 2 half-hour amps, or 1/3 amp 3 hours, etc. before it is completely removed. With a very good battery, this combination between the non-stop time and the outgoing time is stable and complete, but the actual batteries do not work the way this simple line method can show. Therefore, when the battery power is given in amp-hour power, it is very special to both modern given time, given time, or assumed to be limited to 8 hours (if no limited feature is provided).

5. Tests and results

The examination of this system is mainly comprised of three tests I. e. Battery temperature test, remote test and GPS location test.

a) Battery temperature test

In this test the entire system is divided into four modes and different temperature levels are used to switch the appropriate indicator. The following fig depicts the values for various modes

Table 1: Tabular column showing various values for different modes

Mode	Temp	Voltage in Volts	Current in amps.	FAN status	Buzzer status	Motor status
Normal	*<27°*	11.3	0.8	OFF	OFF	ON
Moderate	27° *to* 29°	11.21	0.81	ON	OFF	ON
Emergency	29° *to 31°*	11.2	0.91	ON	ON	ON
Critical	>31°	11.13	0.96	ON	ON	OFF

b) Remote test

In this test the system is tested against the switching ON / OFF of the vehicle and also the speed of the vehicle is observed in the mobile application / personal computer.

There is a delay of 0.1 seconds in switching ON the vehicle or switching OFF using the relay module. The following figure depicts the result of the remote test. It can be observed the speed and ON / OFF condition of the vehicle remotely from the PC / Cell phone and in LCD Display.

Figure 2: Remote test Results

c) GPS Location test

As shown in the below figure we can locate the vehicle remotely and the deviation is less than 50m.

Figure 3: GPS Location test Result

6. Conclusion

A complicated tracking device of electric vehicle is supplied in this paper. The gain of internet of factors is used to connect the vehicle with the rider together. With the usage of personal pc or mobile telephone it's far an awful lot handy and reliable. It has the blessings of lower strength consumption, excessive performance and accuracy. Additionally, we additionally have capabilities like finding out the robbery vehicles and tracking the whole.

References

[1] Zhiping Liu, Wei Tao, Lei Jiang and Cunle Zhu, Design and "Application on Electric Vehicle Real-time Condition Monitoring System by Internet of Things Technology, " 978-1-4799-3279-5 /14 IEEE 2014.
[2] Chengpeng Ru. Vehicle monitoring system design based on the ARM Beidou navigation/GPRS/GIS [J]. Railway Transport and Economy, 2013, no.3, pp.80-84.
[3] Zeming Li, Jinming Li, Yanjiao Yang. Remote target positioning system based on GPS/GPRS [J]. Computer Measurement & Control, 2013, vol.21, no.6, pp.1644-1647.
[4] ABUZALATA M, MOMANI M, FAYYAD S, et al. A practical design of anti-theft car protection system based on micro-controller [J]. American Journal of Applied Sciences, 2012, vol.9, no.5, pp.709-716.
[5] Changlong Cao, Yong Ji, Xuchu Dai. Wireless mobile video monitoring terminal design and implementation based on Beidou satellite navigation [J]. Journal of Telemetry, Tracking and Command, 2013, no.4, pp.33-38.
[6] Lei Zhang, Yingjie Chen, Mengqian Sun, Zicong Xiao. Tilting accident vehicle alarm system design based on GPS and GSM [J]. Computer Measurement and Control, 2011, vol.19, no5, pp.1127-1129.
[7] SONG Yong-Hua, YANG Xue-Xi, HU Ze Chun. Present status and development trend of batteries for electric vehicles [J]. Power System Technology, 2011, 35 (4): 1-7.
[8] WANG Dan, XU Dan, Cao Bing-Gang. Overview on key techniques of electric vehicle [J]. Engineering Sciences, 2013, 15 (1): 68-72.
[9] LI Jin-Bo, et al. Development of wireless monitoring terminal for electric vehicle lithium battery based on GPRS [J]. I. C. E & Power plant, 2011 (3): 23-27
[10] CHEN Hao, GUO Li-Jin. Design of embedded electric vehicle battery management system [J]. Chinese Journal of Power Sources, 2013, 37 (8): 1429-1434.
[11] ZHAN Xiang-zhen, LIU He-ping, YUAN Shan-shan. Design of battery management system for electric vehicle based on LIN bus [J]. Chinese Journal of Power Sources, 2011, 35 (9): 1115-1118.