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IOT BASED BATTERY MONITORING AND TEMPERATURE CONTROLLING SYSTEM FOR ELECTRICAL VEHICLE

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Abstract— In this proposed system, we have developed the battery monitoring and temperature controlling system for electrical vehicle using IOT application. This system consists of major two parts 1) monitoring device and 2) Controlling device. It is clear that overheating of battery is one of cause to reduce the life cycle of the battery and performance degradation. Sometimes it may cause to explosion of battery. In this work, the IoT based continuous temperature monitoring and controlling the temperature of battery using IoT technique. When the temperature of EVs battery reaches to maximum acceptable range, the system will send the notification to mobile user and starts coolant flow though battery package automatically using IoT technique. The results, the system is capable of continuous streaming the temperature of EVs battery and keeps it within acceptable range by providing cooling to the battery package.

Key Words — Internet of Things, Arduino IDE, Blynk App, Node MCU, Temperature Sensor, Cooling pump.

1. INTRODUCTION

Today, Internet application development demand is very high. So IoT is a major technology by which we can produce various useful internet applications. Basically, IoT is a network in which all physical objects are connected to the internet through network devices or routers and exchange data. IoT allows objects to be controlled remotely across existing network infrastructure. IoT is a very good and intelligent technique which reduces human effort as well as easy access to physical devices. This technique also has autonomous control feature by which any device can control without any human interaction. Its demand is growing exponentially in most of industries like manufacturing, robotic, automobile, aerospace space industries to improve quality of product and work efficiency.

Similarly, on other hand, EVs battery (Lithium-ion battery) life cycle can be shortened by some reasons such as overheating. This occurs when vehicle moving at high speed. The overheating of the battery can be a reason for battery explosion.

By considering this problem into account, we have designed and developed an IoT project that is IoT based battery monitoring and temperature controlling system for electrical vehicle. This system provides coolant to battery when the battery temperature exceeds its limit (say 40 centigrade) using IoT technique. So that ultimately battery temperature gets reduced and battery gets cooled.

2. STRUCTURE DESIGN

In this structure design we use coolant pump, temperature sensor are in the front of the door and it is controlled by an Node MCU. The device operates from temperature sensing of battery and that temperature displays continuously per every five mill seconds using BLYNK app applications. If the temperature is above acceptable range controller allows coolant pump to start just after sent notification alert to mobile using IoT technique.

3. PLAN OF IMPLEMENTATION

Phase 1: Selection of Battery, Controller, Sensor and Solar panel, Pump for running coolant and software environment for developing source code in it.
Phase 2: Circuit Diagram and power plan with complete simulation.
Phase 3: PCB Design, Circuit Building on board, prototype. Software and hardware Integration and testing of prototype.

COMPONENTS USED

3.1 NODE MCU

NODE MCU is also called wi-fi module. It is operated through internet by using BLYNK APP.NODE MCU is used to receive the information from the app and transfer information to the AVR controller. NODE MCU consists of antenna to receive the information. NODE MCU development board featured with wi-fi capability, analog pin, digital pins and communication protocols. NODE MCU is the open source platform, their hardware design is open for edit/modify/build.

Fig: Node MCU

3.2 LM35

LM35 is a temperature sensor it is a temperature measuring device having an analog output voltage proportional to the temperature. It gives output in centigrade. The sensitivity of LM35 is 10mV/degree Celsius. As temperature increase, output voltage also increases.

Fig: LM35 temperature sensor

3.3 COOLANT PUMP

Uses advanced electronic components and high-quality wear-resistant shaft. Smooth operation, high efficiency, good performance, long service life. Can be a long time continuously work, low noise, safety and environmental protection.

Fig: Coolant Pump

Specifications:

- Material : ABS Plastic
- Power: 8 Watt
- Flow: 10L/min
- H-Max: 5 m
- Voltage: 12V
- Outlet Diameter: 7.5 mm

3.4 RELAY MODULE

Fig: Relay Module

The relay is the device that open or close the contacts to cause the operation of the other electric control. It detects the undesirable condition with an assigned area and gives the commands to thecircuit breaker to disconnect the affected area through ON or OFF.

Every electromechanical relay consists of
1. Electromagnet
2. Mechanically movable contact
3. Switching points and spring

COM: Common pin
NO: Normally open – there is no contact between the common pin and the normally open pin. So, when you trigger the relay, it connects to the COM pin**NC:** Normally closed – there is contact between the common pin and the normally closed pin. There is always connection between the COM and NC pins, even when the relay is turned off. When you trigger the relay, the circuitis opened and there is no supply provided to the load.

3.5 LI-ION BATTERY

This is an original 2500mAh 18650 battery. 18650 battery is a Li-ion rechargeable battery with a 2500 mAh Battery Capacity. A 18650 cell can be charged and discharged up to 1000 cycles without much loss in battery capacity. They are safe to use, environment friendly and have long battery life.

Fig: Li-Ion Batteries

Specifications:

- Voltage: 3.7 Volts
- Capacity: 7500 mAh(2500 mAh each)
- Rechargeable: Yes
- Battery Size: Diameter- 18mm x Length- 67mm
- Charging Method CC-CV
- Brand: Hongli ICR18650

3.6 Arduino IDE Software

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them.

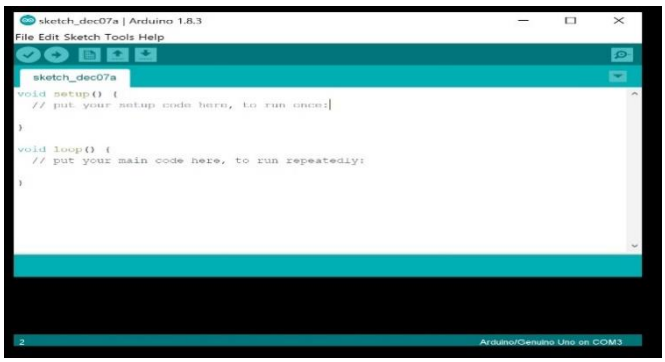


Fig: Arduino IDE Interface

SOURCE CODE:

```
#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>
char auth[] = "QWUgh3kiRe2VxOm6yIj95la-mxoCJkOO";
char ssid[] = "Mini Project";
char pass[] = "123456790";
void setup()
{
  pinMode(0, OUTPUT);
  Serial.begin(9600);
  Blynk.begin(auth, ssid, pass);
}
void loop()
{
  Blynk.run();
  float val = analogRead(A0);
  float mv = ( val / 1024.0) * 3300;
  float cel = mv / 10;
  Blynk.virtualWrite(V4, cel);
  if (cel > 40)
  {
    Blynk.notify("Battery temperature is above 40°C. Coolant
pump is running.");
    Blynk.virtualWrite(V4, cel);
    digitalWrite(0, LOW);
    delay(5000);
  }
  else
  {
    digitalWrite(0, HIGH);
  }
}
```

4. FINAL STAGE

Now a days, Temperature monitoring and controlling of EVs battery is a crucial thing in order to enhance battery performance and to avoid unexpected battery fires. It also provides notification alert when the temperature of battery maximum limit at which battery may get fire. So that the vehicle operator will get alert and take safety precautions.

FLOW CHART

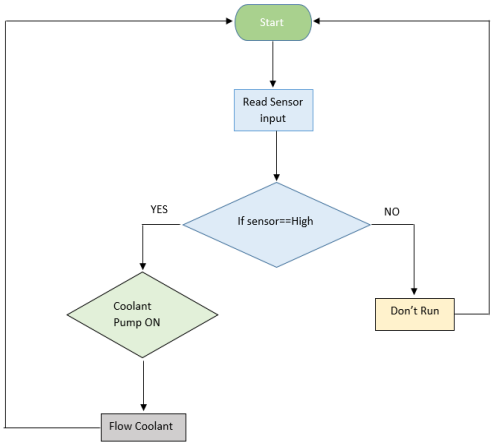


Fig: Flow Chart

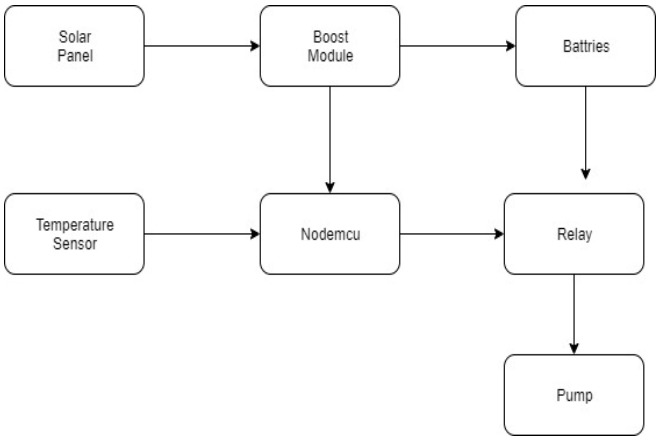
The above flow chart explains the clear control of cooling pump which detects the temperature of battery first and then it allows the centrifugal pump to be controlled with the relay.

TEMPERATURE DISPLY :

The above figure represents continuously temperature display

of EVs battery though BLYNK app. Generally it show high when vehicle moving at high speed vice versa**.**

CIRCUIT DIAGRAM:



The above figure represents continuously temperature display of EVs battery though BLYNK app. Generally it show high when vehicle moving at high speed vice versa**.**

5. ACKNOWLEDGMENT

This research was to present IoT based battery monitoring and temperature controlling system for electrical vehicle as our project to express our appreciation to all those people theone assisted us in accomplishment concerning this paper.

6. CONCLUSION

The paper described the design and development of an IoT-based continuous battery monitoring and the temperature controlling system for electric vehicle to reduce the battery performance degradation and to improve battery life. The continuous temperature display is done by using blynk app and temperature controlling is done by providing coolant to battery package. The objective is to implement the idea of IoT in mechanical devices. The system displays temperature of EVs battery and controls the temperature by providing coolant to battery package when temperature of the battery exceeds its acceptable range. So that we can reduce overheating of the battery and can improve the performance. It can also reduce chance of battery fire accuracy.

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