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IOT EDGE NODES AND ITS APPLICATIONS CSE4034 (L55+L56)

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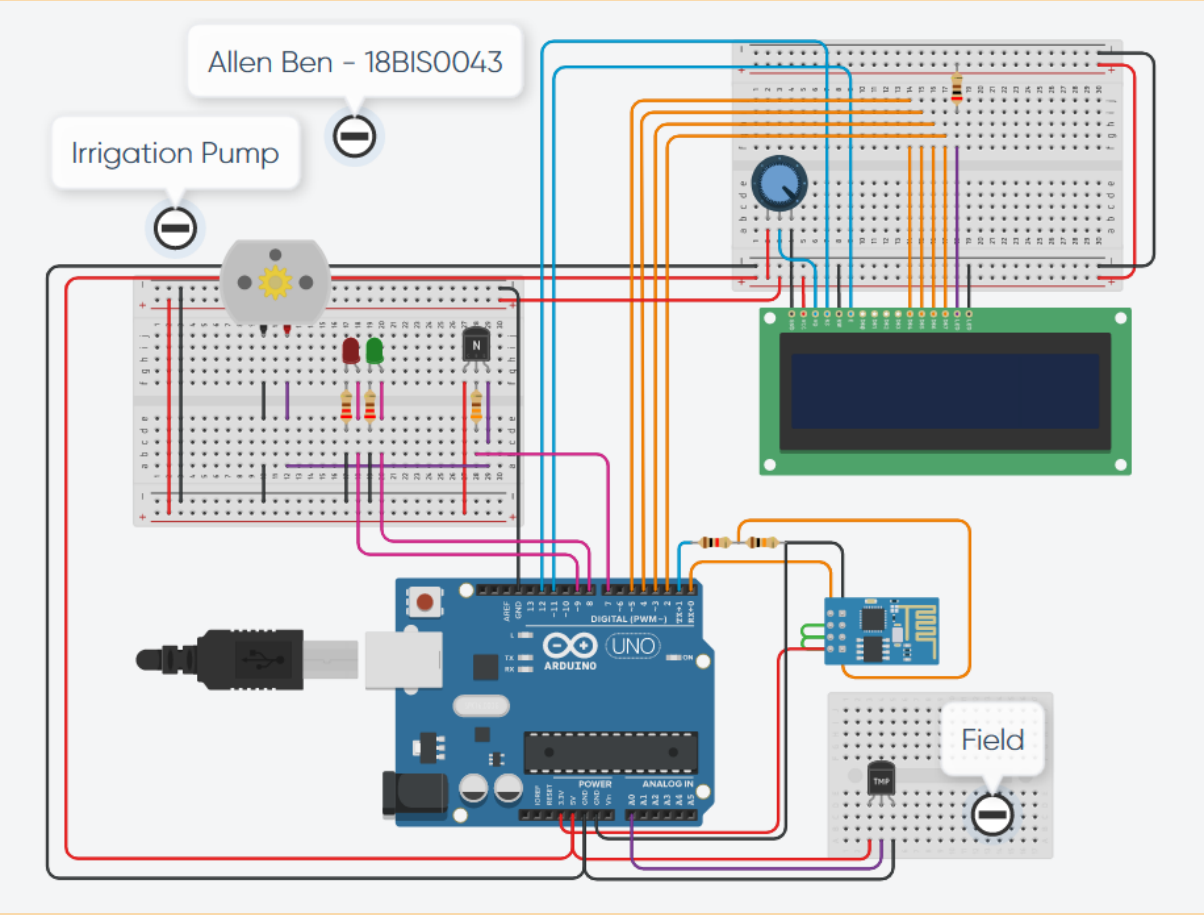
TASK – 4
SMART IRRIGATION

Aim

To design a circuit using Arduino for monitoring the temperature of a field and if the temperature is above a certain limit, give a command to turn on the irrigation motor. Also transmit the detected levels to ThingSpeak for further analysis.

Circuit Diagram

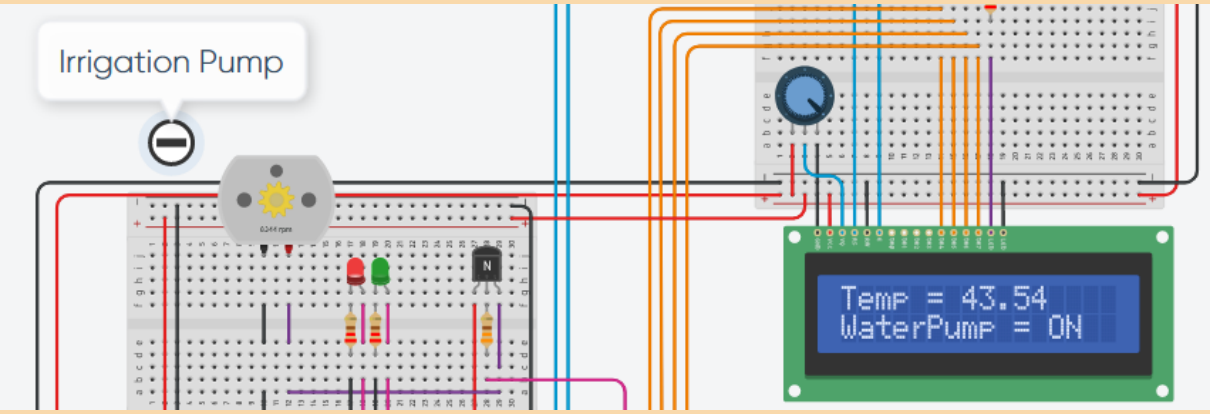


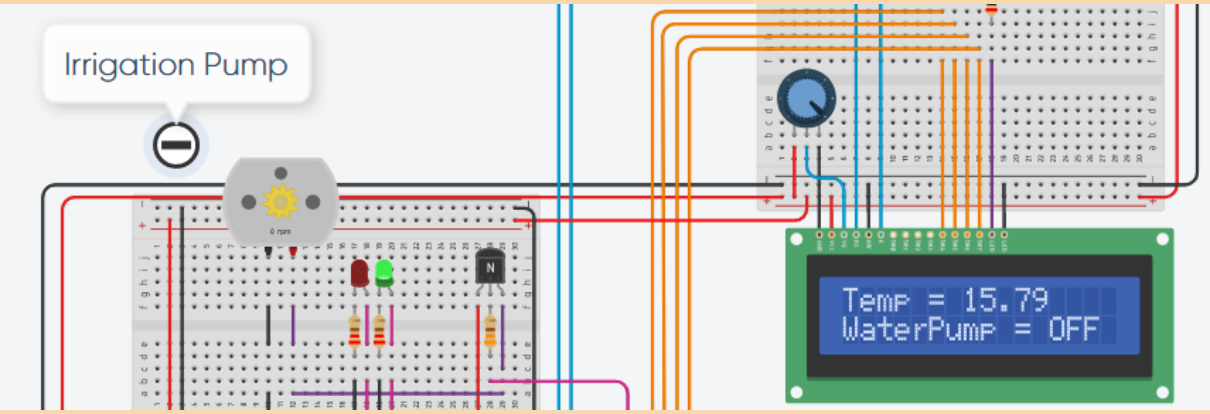
Tools Required

Tinkercad – for simulating the connection and coding of the Arduino circuit.

ThingSpeak – for plotting the graph.

Output from Tinkercad





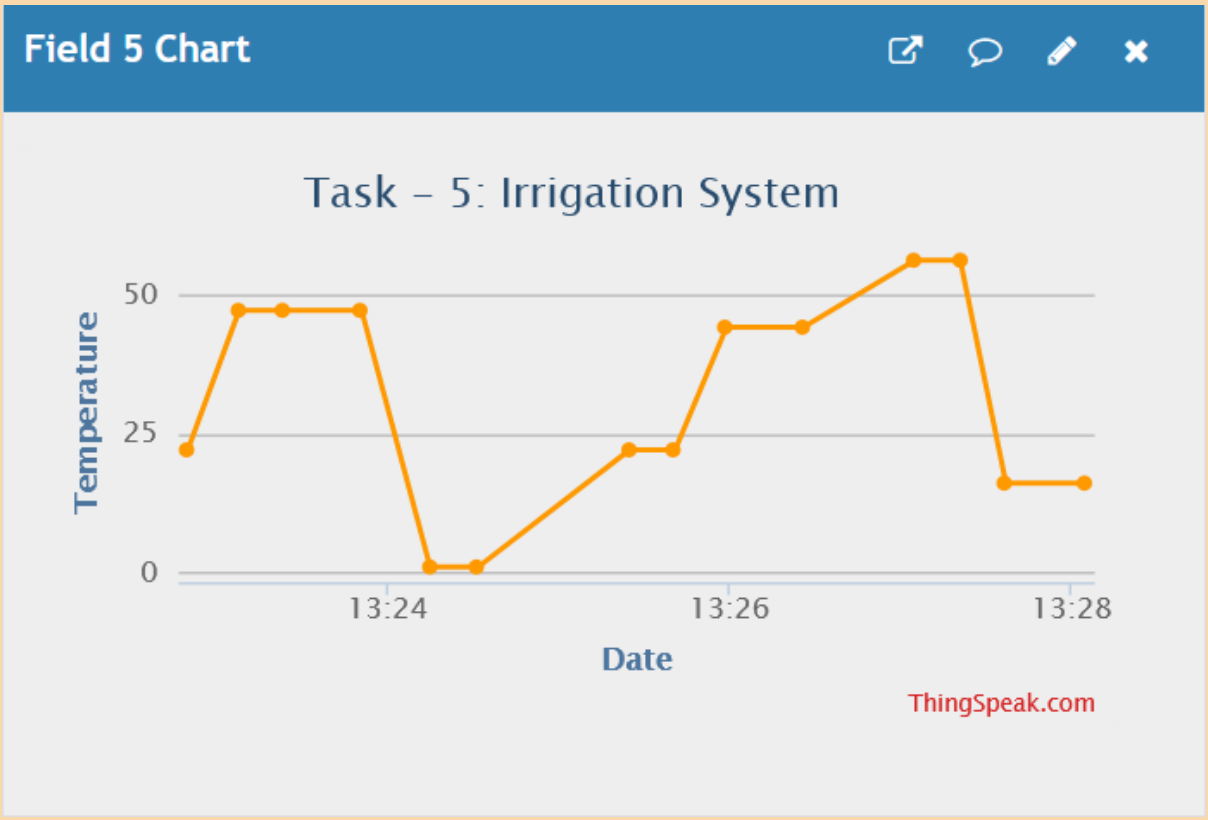
Serial Monitor

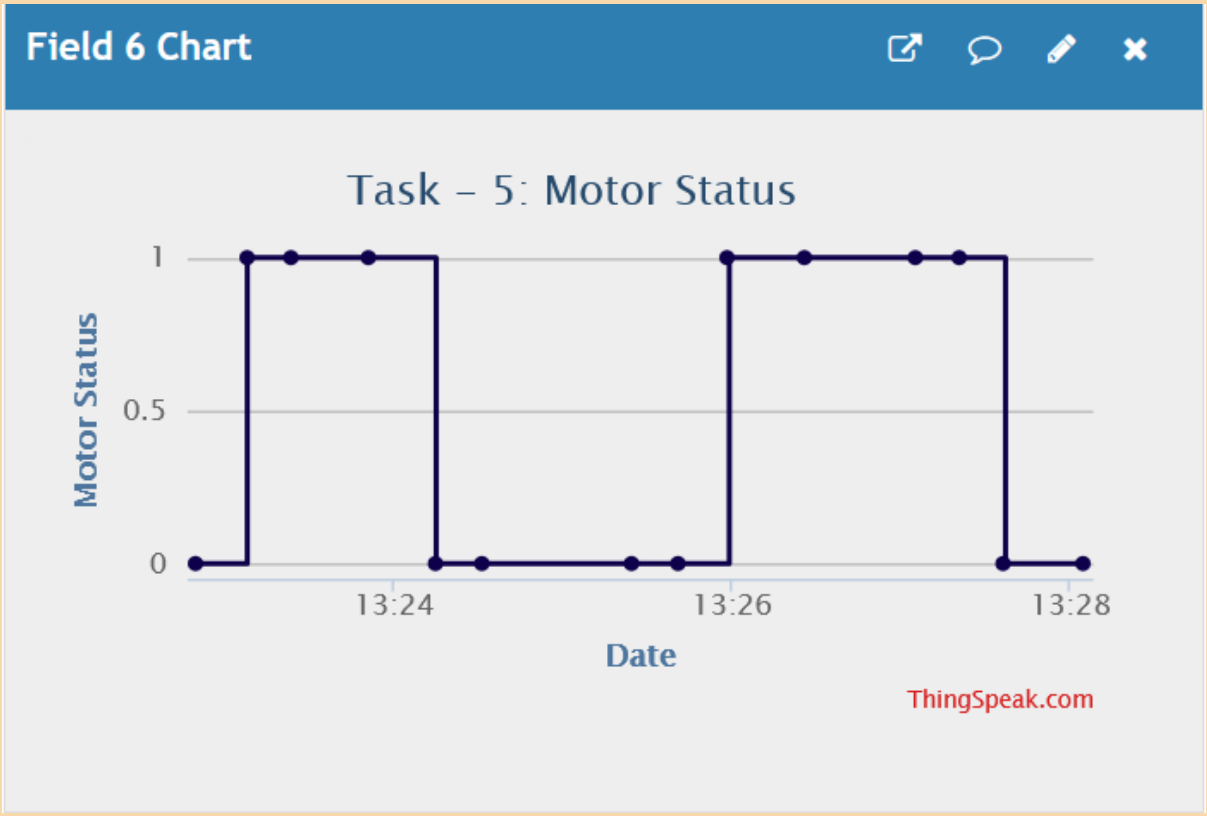
```
AT+CIPSEND=98
GET /update?api_key=8XN8RYFFNZRKNYZS&field5=22&field6=0&amp HTTP/1.1
Host: api.thingspeak.com

AT+CIPSEND=98
GET /update?api_key=8XN8RYFFNZRKNYZS&field5=47&field6=1&amp HTTP/1.1
Host: api.thingspeak.com

AT+CIPSEND=98
GET /update?api_key=8XN8RYFFNZRKNYZS&field5=47&field6=1&amp HTTP/1.1
Host: api.thingspeak.com
```

Output from ThingSpeak





Code

```
#include <LiquidCrystal.h>
String ssid     = "Simulator Wifi";
String password = "";
String host     = "api.thingspeak.com";
const int httpPort   = 80;
String      uri                                 =
"/update?api_key=8XN8RYFFNZRKNYZS&field5=";
LiquidCrystal lcd(12, 11, 5, 4, 3, 2);

int setupESP8266(void) {
  // Start our ESP8266 Serial Communication
  Serial.begin(115200);
  Serial.println("AT");
  delay(10);
  if (!Serial.find("OK")) return 1;
  Serial.println("AT+CWJAP=\"" + ssid + "\",\""
+ password + "\"");
  delay(10);
```

```
if (!Serial.find("OK")) return 2;

  // Open TCP connection to the host:

  Serial.println("AT+CIPSTART=\"TCP\",\""     +
host + "\"," + httpPort);

  delay(50);        // Wait a little for the ESP
to respond


if (!Serial.find("OK")) return 3;

  return 0;

}


void anydata(int t1, int t2) {

  int temp1 = map(t1,0,1000,0,1000);

  int temp2 = map(t2,0,1,0,1);

  String  httpPacket  =  "GET  "  +  uri  +
String(temp1)  +  "&field6="  +  String(temp2)
+"&amp"  +  "  HTTP/1.1\r\nHost:  "  +  host  +
"\r\n\r\n";

  int length = httpPacket.length();

  Serial.print("AT+CIPSEND=");

  Serial.println(length);

  delay(10);
```

```
  Serial.print(httpPacket);
  delay(10);
  if (!Serial.find("SEND OK\r\n")) return;
}

void setup() {
  pinMode(7, OUTPUT);
  pinMode(8, OUTPUT);
  pinMode(9, OUTPUT);

  lcd.begin(16, 2);
  lcd.print("Irrigation ");
  lcd.setCursor(0,1);
  lcd.print("System");
  delay(1000);
  lcd.clear();
  lcd.print("Temp = ");
  lcd.setCursor(0,1);
  lcd.print("WaterPump = ");
  setupESP8266();
}
```

```
void loop() {
  lcd.setCursor(0, 1);
  int temp1 = analogRead(A0);
  float temp = ((temp1 * 170.0/1023.0)-3.32);
  lcd.setCursor(7,0);
  lcd.print("       ");
  lcd.setCursor(7,0);
  lcd.print(temp);
  int t2 = 0;
  lcd.setCursor(12,1);
  // Upper limit of the temperature is 56 degrees
  // And the lower limit is 0 degrees
  // To simulate a real life scenario

  if (temp > 35){
    digitalWrite(7, HIGH);
    digitalWrite(9, HIGH);
    digitalWrite(8, LOW);
    lcd.print("ON ");
    t2 = 1;
  }
```

```
  else {
    digitalWrite(7, LOW);
    digitalWrite(9, LOW);
    digitalWrite(8, HIGH);
    lcd.print("OFF");
    t2 = 0;
  }
  anydata(temp, t2);
}
```

Components

1. **ESP8266** – Connection between the local system to cloud services for data analysis, visualization, and other forms of alerting methods.
2. **LEDs** – Red glows when the temperature is high, and the water pump is on and the green glows when the temperature drops, and the water pump is off.
3. **Temperature Sensor** – For detecting the temperature in the field to determine whether the pump should be on or off.
4. **Motor** – Standard issue motor used to represent the water motor that will pump water into the field. Once the parameter exceeds the necessary threshold, the motor is immediately notified about the temperature level and motor is shut off.
5. **LCD Monitor** – This helps is displaying the temperature level which is detected and the pump running state – on/off.

Usage Scenario

Program working as expected – minimal latency and accuracy of detecting temperature makes effective for analysis and for proactive response of the irrigation pump, in a real-world scenario. The response time of this system is short as the processing is done on the edge node even though cloud storages are integrated.

This developed circuit can be used for detecting temperature levels in a farming field using the standard temperature sensor, which will be placed on multiple areas. The temperature will be detected live and when it rises above a certain threshold value, the microcontroller connected to the sensor requests to rotate the motor which is used to pump water and sends real time situational alerts to the operator.

Alerting segment has 3 major components –

i. LED indication of motor running status.
ii. LCD Display to show details in a clean readable format, which can be easily understood by any layman.
iii. ThingSpeak collecting all the data produced.

Conclusion

Therefore, by using Tinkercad, we simulated a circuit for detecting the temperature of a field and updated the live situation in ThingSpeak for further analysis and storage. This system also allows the control for irrigation pump automatically based on the temperature detected and the values have been adjusted correspondingly for considering real-world situations.