TRANSMISSION LINE MONITORING ROBOT

Prof. Sandeep Godhade[1], Sandesh Koli[2], Sangram Gite[3], Rahit Mujawar[4], Abhang Joshi[5], Rushikesh Dubal[6]

[1]*Professor, Department of Electrical Engineering, Sanjay Ghodawat Group of Institute Atigre , Maharashtra, India*
[2,3,4,5,6]*UG student, Department of Electrical Engineering, Sanjay Ghodawat Group of Institute Atigre, Maharashtra, India*

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ABSTRACT-*Real time monitoring and analysis of electrical overhead conductors for performance parameter such as temperature, sag, humidity using robotic platform controlled remotely through a RF module .Transmission of the gathered data to maintenance department by internet using microcontroller with Wi-Fi module.*

Keywords-Microcontroller, Temperature and Humidity Sensor, DC Motor, RF Module, Sag

1. INTRODUCTION

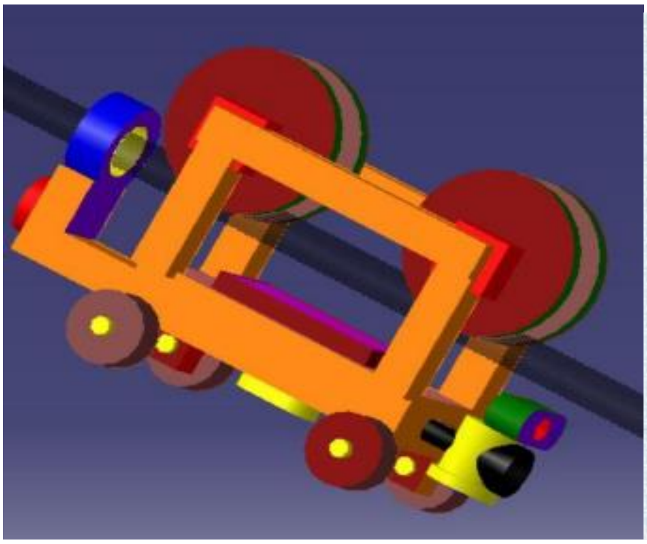
As strategic assets, power line networks must remain reliable and available. Nowadays, grid owners are being pressured to developed innovative tools and methods to perform inspection and maintenance on their energized circuits. As a result, interest in power line robotic tools has increased dramatically over the past few years. A new class of application robots is emerging, targeting live-line maintenance on transmission systems .In addition to sensitivity improvement and subsequent system reliability enhancement, the use of robotic platforms for power system maintenance has many other advantages.

Replacing human workers for dangerous and highly specialized operations, such as live maintenance of high-voltage transmission lines, has been a long-standing effort in the power community. Usually the workers who inspect these lines conduct helicopter surveys or must climb the tower to check them in close proximity In order to rectify this problem, we propose a robot whose purpose is to monitor the transmission lines which would act as an alternative to a human technician. The robot is suspended from the conductor through a roller wheel mechanism and travels along the conductor.

1.1 TRANSMISSION LINE MONITORING ROBOT

It requires robotic control manoeuvres such as conductor grasping, require appropriate sensors, measuring devices, and power supply. By using such an automated system, the level of human involvement can be minimized. The robot consists of a temperature and Humidity Sensor, ultrasonic sensors, rotating pulley-wheel assembly, transmitter, receiver, Wifi and a micro-controller unit ESP8266 NodeMCU. Temperature sensor is used to measure the temperature of components and this data is used to identify the components that are defective due to normal wear & tear, fatigue and faulty assembly in transmission systems. Overheating can occur in virtually all electrical components including generators, transformers, pole top connections, insulators, jumpers, shoe connections, fuse connections, switchgears and starters. DC motors are used for mechanical action of the robot and thus are responsible for the locomotion of the robot. The ultrasonic sensors are used to detect the ground clearance to measure the sag in the transmission line. Pulley-wheels for the robot movement are fixed over the line conductors. These pulley-wheels are connected to the DC motors which provide mechanical energy required for the rotating the wheel. Wi-Fi module is used forcommunicating the monitored data to the control room and various authorized users. The micro-controller unit integrates all these elements into a single system

2. FIGURES AND TABLES



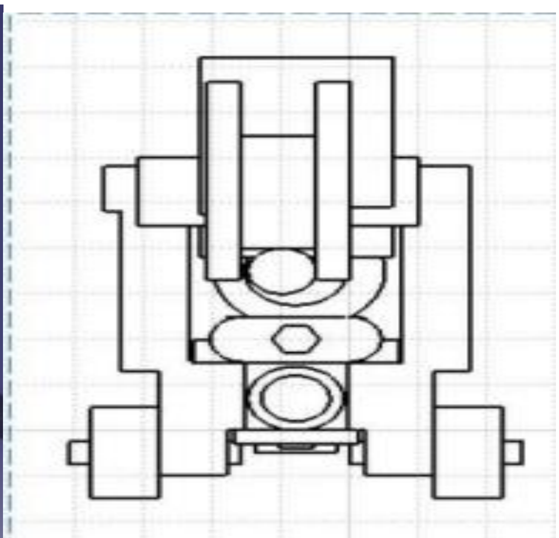


Fig 1. Designing and Modelling of the robot

Fig 2. Front view of model

3. SOFTWARE SIMULATION

Program-

```
#include <DHT.h> // Including library for dht

#include <ESP8266WiFi.h>

String apiKey = "41R8ZH7BUKK71JAF"; // Enter your Write API key from ThingSpeak

const char *ssid = "qwertyuiop"; // replace with your wifissid and wpa2 key const char *pass = "asdfghjkl";

const char* server = "api.thingspeak.com";

#define DHTPIN 0 //pin where the dht11 is connected

const int trigPin = 4; //D2

const int echoPin = 5; //D1

// defines variables

long duration;

int distance;

DHT dht(DHTPIN, DHT11);

WiFiClient client;

void setup()

{

pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output

pinMode(echoPin, INPUT); // Sets the echoPin as an Input

Serial.begin(115200);
```

```
delay(10);
dht.begin();
Serial.println("Connecting to ");
Serial.println(ssid);
WiFi.begin(ssid, pass);
 while (WiFi.status() != WL_CONNECTED)
 {
delay(500);
Serial.print(".");
 }
Serial.println("");
Serial.println("WiFi connected");
}
void loop()
{
 float h = dht.readHumidity();
 float t = dht.readTemperature();
 // Clears the trigPin
digitalWrite(trigPin, LOW);
delayMicroseconds(2);
// Sets the trigPin on HIGH state for 10 micro seconds
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);
// Reads the echoPin, returns the sound wave travel time in microseconds duration = pulseIn(echoPin, HIGH);
// Calculating the distance
distance= duration*0.034/2;
 float sag = 180-distance; // Enter the height of tower
 if (isnan(h) || isnan(t))
 {
Serial.println("Failed to read from DHT sensor!");
 return;
```

```
 }
 if (client.connect(server,80)) // "184.106.153.149" or api.thingspeak.com {
 String postStr = apiKey;
postStr +="&field1=";
postStr += String(t);
postStr +="&field2=";
postStr += String(h);
postStr +="&field3=";
postStr += String(sag);
postStr += "\r\n\r\n\r\n";
client.print("POST /update HTTP/1.1\n");
client.print("Host: api.thingspeak.com\n");
client.print("Connection: close\n");
client.print("X-THINGSPEAKAPIKEY: "+apiKey+"\n"); client.print("Content-Type: application/x-www-form-urlencoded\n"); client.print("Content-Length: ");
client.print(postStr.length());
client.print("\n\n\n");
client.print(postStr);
Serial.print("Temperature: "); Serial.print(t);
Serial.print(" degrees Celcius, Humidity: "); Serial.print(h);
Serial.print("Sag: ");
Serial.println(sag);
Serial.println("%. Send to Thingspeak."); delay(1000);
 }
client.stop();
Serial.println("Waiting...");
 // thingspeak needs minimum 15 sec delay between updates delay(3000)
```

4. RESULT & DISCUSSION

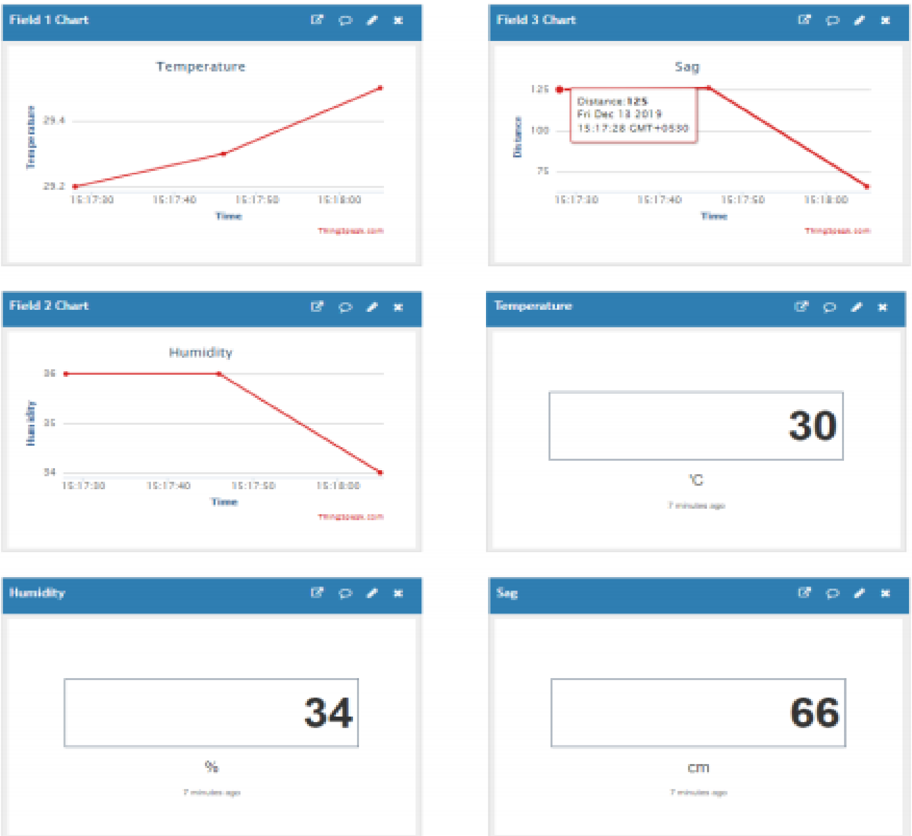


Fig 3. Value of Temperature, Humidity and Sag

Fig shows the values of temperature, humidity and sag measured by the robot. In field 1,2,3 it shows the value of temperature, humidity and sag by graph. In remaining three parts it shows the value directly

5. CONCLUSION

This paper presents an integrated and cost-effective approach for real-time development of TLMR. A mobile autonomous robot for detection of incipient faults in electric power Overhead conductors has been developed and tested in laboratory and in field conditions. Mechanical design and autonomous control system of the robot is optimized for the requirements of the operating environment is an example concept that combines robotics and other intelligent systems in order to supervise Intelligent robots such as the one used for this project provide high computational capabilities and enough resources to enable a multivalent control system capable of setting up different robot processes simultaneously. This methodology allows the robot to work on its main assistive tasks while executing an ambient supervision routine which is constantly gathering and processing additional sensor data.

6. FUTURE SCOPE

Future work should mainly be oriented toward battery technologies, getting power from live lines, 100% reliable obstacle detection and identification, and sensor fusion to increase the autonomy level. Future transmission line robots must leverage progress achieved in other robotic fields such as planetary rovers or autonomous vehicles: advanced control, expert systems, advanced materials, image processing, localization and mapping, etc. The next immediate step of this research project is to test performance of the sensors and the platform itself in a wide variety of field conditions. Ultimately, the robot platform will have to work in many different environments with many different Overhead conductor configurations. Therefore, the miniaturization and the improvement of mechanical mobility of the robot are important areas of further research. The use of multiple platforms, in the framework of mobile sensor networks, is also an important direction of future work

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