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SMART GRID ROBOT FOR DETECTING POWER LOSS IN HIGH POWER TRANSMISSION LINE

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Abstract : **From past decades, the demand for electricity is rapidly increasing. Science and technology with all its miraculous advancements has fascinated human life to a great extent that imagining a world without these innovations is hardly possible. An integrated environment with distributed generation sources, a good transmission management system, Outage management system etc. are also inevitable in this environment. All these have to be brought into the existing power grid in a very cost effective manner. A smart grid is an evolved grid system that manages electricity demand in a sustainable, reliable and economic manner, built on advanced infrastructure and tuned to facilitate the integration of all involved. Smart grid will make use of technologies such as state estimation that improve fault detection and allow self healing of the network without the intervention of technicians that will ensure more reliable supply of electricity and reduced vulnerability to natural disaster or attacks. By monitoring it can provide information about power flow and demand and help to identify the cause of power system disturbances. Conventionally, the electricity power has one side of work flow which is from the supply to demand side. However, the purpose of future grid is to ensure the flow of electricity supply and demand should be in bi-directional way.**

IndexTerms **- Smart grid, Transmission lines, Energy, Power loss, GPS, IoT.**

I. INTRODUCTION

When a power line is cut off, the sensor will sense the power cut and send a signal to ix the Wi-Fi module that the power line is cut off. The WIFI will send data to AWS cloud and cloud module will send a message to the nearest electricity board regarding the power cut. Simultaneously a buzzer starts buzzing to alert the people and animals around the area about the damage. The current system used in most rural areas is that when the power line is damaged, the electricity board disconnects the main power supply of that area until the system is back running. In detection and location of the point of failure in the power line is used in wireless sensor network. This paper demonstrates that the power transmission line is divided by the use of wireless sensor networks. The energy difference and deviation in the transmission lines, if any, is informed to the concerned officials.

II.PROPOSED SYSTEM

Smart sensing especially read-time, dynamic analysis plays a crucial role in a smart grid system. Unwavering and accurate power line tracking of energy consumption is a very conspicuous issue. To precisely track and make perfect calibrations, the swing path of a power line should be anticipated using a robot. We develop robots with GPS for tracking the location of the robot and various sensors for the detection of faults in the grid lines. Different types of sensors like current sensors, temperature sensors, color sensors etc. are used in it for finding the faults. NodeMcu is used for wireless transmission and to intimate the concerned authority to rectify the problem before it becomes an issue. It consists of different types of sensors like current sensors, temperature sensors, color sensors etc. as shown in Fig(1) are used in it for finding the faults.The major difficulties our product resolves to solve are:Conventional methods need manual inspections which are dangerous due to the high power in the transmission lines. Through these devices, periodical check-ups can be avoided.

Any damage in the transmission lines can be detected only after conditions like low-voltage or power cuts occurs. By using these machines, future mishaps can be prevented.

High power transmission lines stretch out for long distances, sometimes exceeding 50-100 kms. It is futile to check every inch of these lines to pinpoint the location of the distress. This device contains an GPS which will intimate the necessary authority about the precise latitude and longitude.

Theft of power: In India, financial loss due to theft of electricity may be around $16 billion yearly. Some power companies continue to bleed and lead to bankruptcy due to one of these factors. This may also lead the legalized users to pay more. This creates a scenario where numerous villages have huge cut in power supply and altogether availability of power in the grid with no purchase.Losses in the connector systems connections leading to premature failure of capital equipment's like transformer. As the robot prototype runs along the line, it can detect the obstacles, current fluctuations, abnormal sag and convey the information about the fault to the control room, i.e. user mobile phone.

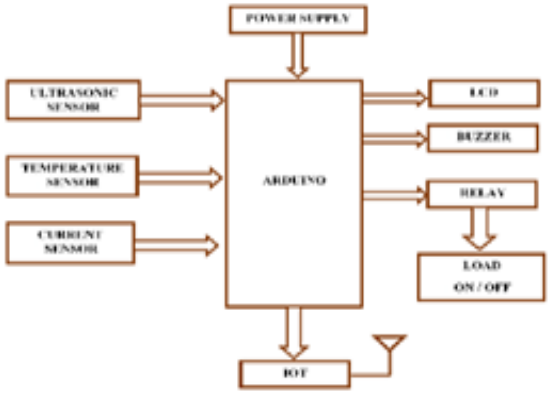

Fig.1.Block diagram

III. IDENTIFICATION OF FAULT

Fault Measurement

- Maximum change of current and voltage magnitudes (phase and neutral), calculated over a time period, one quarter of a cycle before and after the fault starts.

Energy Management work consists of

1. Metering consumption of energy and data collection.
2. Finding and quantifying opportunities to save energy.
3. Targeting the opportunities to save energy.
4. Tracking progress at a saving energy.

To discuss continuity of supply management by early detecting various faults on lines & minimize outages by using the live line maintenance work.

1. Different types of faults & reason for occurrences on lines.
2. Failure of line equipment, hardware & its reasons.
3. Condition monitoring of substations, line equipment's & its associated hardware fittings, etc.
4. Type of maintenance required.

Maintenance Management by early fault detection reduces outages & improves the of transmission system.

- No outage & no interruption to consumers.
- Switchgear switching cycles can be reduced.
- It reduces the incident risks as avoided emergency outages.
- No revenue loss minimizes penalties during downtime of utilities.
- More safe, less man-power and less time is required as compared to maintenance planning under outages.
- All above provides life extension to equipment's, economic benefits & gives new way for improvement of live line technologies.
- Dispatch crews with appropriate equipment to resolve a fault.

IV.POWER LOSS CODE

```
// include the library code:
#include <LiquidCrystal.h>
#include <SoftwareSerial.h>
#define USE_ARDUINO_INTERRUPTS true    // Set-up low-level interrupts for most acurate BPM math.
#include <PulseSensorPlayground.h>     // Includes the PulseSensorPlayground Library.
#include <Wire.h>
#define RX 2
#define TX 3
// initialize the library by associating any needed LCD interface pin
// with the arduino pin number it is connected to
const int rs = 13, en = 12, d4 = 11, d5 = 10, d6 = 9, d7 = 8;
LiquidCrystal lcd(rs, en, d4, d5, d6, d7);
String AP = "iot project";       // CHANGE ME
String PASS = "123123123"; // CHANGE ME
String API = "5K676JS803FW55SN";   // CHANGE ME
String HOST = "api.thingspeak.com";
String PORT = "80";
String field1 = "field1";
String field2 = "field2";
String field3 = "field3";
String field4 = "field4";
int countTrueCommand;
int countTimeCommand;
boolean found = false;
```

```
const int triggerpin = 6;     //Connect the trigger pin at pin 2
const int echopin = 7;
long time;                    //Variable for storing the time traveled
int S;                        //Variable for storing the distance covered
int inch;
int current_sensor = A0;
int thermister = A2;
int buzzer = A4;
int relay = 5;
int ThermistorPin = A2;
int Vo;
float R1 = 1000;
float logR2, R2, T;
float c1 = 1.009249522e-03, c2 = 2.378405444e-04, c3 = 2.019202697e-07;
SoftwareSerial esp8266(RX, TX);
 int ct,current,ctrf,crnt;
void setup()
{
  Serial.begin(9600);
  esp8266.begin(115200);
  pinMode(current_sensor, INPUT);
 pinMode(buzzer, OUTPUT);
 pinMode(relay, OUTPUT);
    digitalWrite(buzzer, LOW);
    digitalWrite(relay, LOW);
  lcd.begin(16, 2);
  pinMode(triggerpin, OUTPUT);  //Setting the triggerpin as output pin
  pinMode(echopin, INPUT);
  lcd.setCursor(0, 0);
  lcd.print("   POWER  LOSS  ");
  lcd.setCursor(0, 1);
  lcd.print("DETECTION SYSTEM");
  delay(2000);
  lcd.setCursor(0, 0);
  lcd.print("CONNECTING...   ");
  lcd.setCursor(0, 1);
  lcd.print("                ");
  sendCommand("AT", 5, "OK");
  sendCommand("AT+CWMODE=1", 5, "OK");
  sendCommand("AT+CWJAP=\"" + AP + "\",\"" + PASS + "\"", 20, "OK");
  lcd.clear();
}
void loop()
 {
   current = analogRead(current_sensor);
  digitalWrite(triggerpin, LOW);
delayMicroseconds(2);
digitalWrite(triggerpin, HIGH); //Setting the triggerpin high for 10us to generate a wave
delayMicroseconds(10);
digitalWrite(triggerpin, LOW);
time = pulseIn(echopin, HIGH); //Setting the echopin high to receive the wave
S= time*0.034/2;              //Calculating the distance traveled in cm
inch = time*0.0133/2;
delay(100);
  Vo = analogRead(ThermistorPin);
  R2 = R1 * (1023.0 / (float)Vo - 1.0);
  //Serial.println(R2);
  logR2 = log(R2);
  T = (2.0 / (c1 + c2 * logR2 + c3 * logR2 * logR2 * logR2));
  T = map(T, 800, 0, 0, 800);
  //T = T - 273.15;
  //T = (T * 9.0) / 5.0 + 32;
  T = (T - 32) * 5 / 9;
 // ct=current/10;
  ctrf=current-420;
  crnt= ctrf/5;
  lcd.setCursor(0,0);           // Sets the location at start
  lcd.print("ULT:");
  lcd.print(S);
```

```
  lcd.print("cm  ");
  lcd.setCursor(0,1);
  lcd.print("CT:");  // Sets the location at start
  lcd.print(crnt);
  lcd.print("A  ");
  lcd.setCursor(7,1);            // Sets the location at start
  lcd.print("T:");
  lcd.print(T);
  lcd.print("c");
//   if (distance1 >= 500 || distance1 <= 0)
//   {
//    //Serial.println("Out of range");
//  }
//  else {
//    //Serial.print ( "Sensor1  ");
//    //Serial.print ( distance1);
//    //Serial.println("cm");
//  }
  if (S <= 10)
  {
    digitalWrite(buzzer, HIGH);
    delay(100);
  }
   else{
    digitalWrite(buzzer, LOW);
    }
  if (T >= 50)
  {
   digitalWrite(buzzer, HIGH);
  }
  else
  {
    digitalWrite(buzzer, LOW);
  }
   if (T >= 50 || S <= 10)
  {
   digitalWrite(relay, HIGH);
   digitalWrite(buzzer, HIGH);
  }
  else
  {
    digitalWrite(relay, LOW);
    digitalWrite(buzzer, LOW);
  }
//  if (current <= 45)
//  {
//   digitalWrite(buzzer, HIGH);
//  }
//  else
//  {
//    digitalWrite(buzzer, LOW);
//    lcd.setCursor(12,1);            // Sets the location at start
//    lcd.print("NO ");
//  }
   //delay(200);
  String getData = "GET /update?api_key=" + API + "&" + field1 + "=" + String(S) + "&" + field2 + "=" + String(T) + "&" +
field3 + "=" + String(crnt);
  sendCommand("AT+CIPMUX=1", 2, "OK");
  sendCommand("AT+CIPSTART=0,\"TCP\",\"" + HOST + "\"," + PORT, 3, "OK");
  sendCommand("AT+CIPSEND=0," + String(getData.length() + 4), 2, ">");
  esp8266.println(getData); delay(1); countTrueCommand++;
  sendCommand("AT+CIPCLOSE=0", 2, "OK");
}
void sendCommand(String command, int maxTime, char readReplay[]) {
  Serial.print(countTrueCommand);
  Serial.print(". at command => ");
  Serial.print(command);
  Serial.print(" ");
  while (countTimeCommand < (maxTime * 1))
```

```
  {
   esp8266.println(command);//at+cipsend
   if (esp8266.find(readReplay)) //ok
   {
    found = true;
    break;
   }
   countTimeCommand++;
  }
  if (found == true)
  {
   Serial.println("OYI");
   countTrueCommand++;
   countTimeCommand = 0;
  }
  if (found == false)
  {
   Serial.println("Fail");
   countTrueCommand = 0;
   countTimeCommand = 0;
  }
  found = false;
}
```

Fig.2. Hardware Implementation of Detecting power loss in high Power transmission line.

This paper is about design and implementation of a mobile embedded system to monitor and record key parameters of a distribution transformer fault status as shown in Fig.2. The idea of on-line monitoring system integrates a wi-fi modem, with a standalone single chip microcontroller. It is installed at the distribution transformer site and the above parameters are recorded using the Analog to Digital Converter (ADC) of the embedded system. The obtained parameters are processed and recorded in the cloud memory. If any abnormality or an emergency situation occurs the system sends messages to the mobile server containing information about the abnormality according to some predefined instructions programmed in the microcontroller. This mobile system will help the transformers to operate smoothly and identify problems before any catastrophic failure occurs.

V.CONCLUSION

The paper has been designed in a way so as to improve efficiency and to be as much user friendly as possible. Simplicity of component use also works as a factor for low power consumption and easy maintainability. We are also working on a Webinar training link which can be attached to the product to guide the first time users to utilize the product efficiently. These power line loss detection smart grid robots will be very much effective and, we hope, will bring about a revolution in the Power and Electricity Board of our nation leading to a greener future and unlimited and uninterrupted power for all.

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