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Automatic Transformer Insulator Fault Information and Street Light Fault Indicator Using Iot

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ABSTRACT:
In this project we are going to monitor the insulator. All above parameters are monitored with the following techniques. Voltage to the post line measured with the help of a potential transformer. The potential transformer will convert the mains supply voltage to low voltage AC. That AC voltage will be rectified with the help of a precision rectifier. Then the rectified output will be given to the ADC Current consumed by the post line is measured with the help of a current transformer. The current transformer will convert the load current in to lower values that current output will be converted in to voltage with the help of the shunt resistor. Then the corresponding the AC voltage will be rectified with the help of a precision rectifier. Then the rectified output will be given to ADC.Here the ADC is used to convert the acquired parameter with reference value. Then the corresponding digital value read from the microcontroller. If anyone acquired parameter such as voltage, current is above the reference level, the logic circuit activates the alarm driver circuit. Now the alarm is turned on to indicate and automatically switched off the post line by tripping relay. And then inform to the EB management office through in used of the IOT.
Key Words: *IoT , LDR , ADC.*

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I. INTRODUCTION

The objective of this project is to control the over voltage protect system. This project is used to control the post line and then street light post line. So this project very useful to many other shock prevention method of human life.

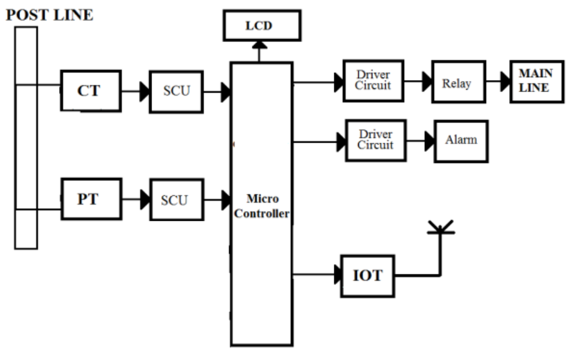
In this addition of this project is to control the street light automatically through microcontroller and real time clock in order to save the power. This project is used to control the street light automatically as per the timing is set in the real time clock. So this project very useful to the government due to save the power.

Electricity plays a critical role in modern society, and power transmission lines are responsible for transporting electrical energy from power plants to end-users. However, the proper functioning of power transmission lines is often compromised due to insulator faults. Insulators are used to prevent electricity from flowing to unintended paths, but they can develop faults due to various reasons such as aging, environmental factors, and pollution. Detecting and diagnosing these faults is crucial to maintaining the reliability and safety of power transmission systems.

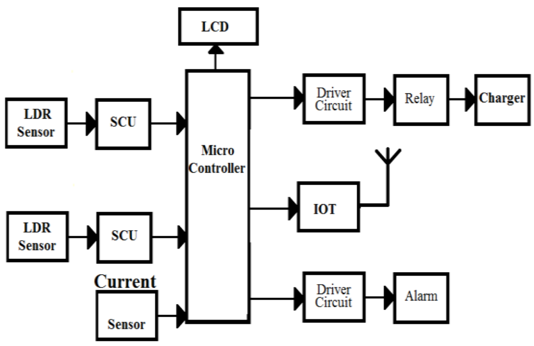
Street lighting is an essential part of urban infrastructure, providing safety and security for pedestrians and drivers. However, when street lights malfunction, it can lead to accidents and create dark spots in the city. Traditional methods of detecting and indicating street light faults are time-consuming and inefficient, relying on manual inspections or citizen complaints. With the advent of the Internet of Things (IoT) technology, there is an opportunity to leverage real-time data analysis to detect and indicate street light faults.

II. WORKFLOW OF THE PROPOSED APPROACH

The system consists power supply unit, lighting system, LDR (light dependent resistor), comparator, and a relay. The LDR is a light detecting resistor, which output voltage varies depends on the environmental light, it is connected with comparator for compare the reference voltage and input voltage, when the sun light is dark, the LDR sends low voltage to the comparator, so the reference voltage and LDR output voltage are not matched with each other, then the comparator triggers a high pulse from its output pin, this is given to the relay driver circuit for ON the street light.



BLOCK DIAGRAM FOR INSULATION FAULT FINDING



BLOCK DIAGRAM FOR LDR

If the environmental light is in normal power the LDR output voltage will be equal to the reference voltage then the comparator triggers a low pulse to the relay driver circuit, so the street light will switch OFF by relay. And then any other time street light not working, information through EB office in IOT system.

In this proposed system is used to monitor the transformer parameter using temperature sensor, current sensing and voltage sensing. Here we used PIC microcontroller to read the sensor data. The data will be sent to server via Wi-Fi and the data will be displayed in LCD. If the transformer's temperature is goes to abnormal, the relay will be automatically trip the load and the status of load condition will be sent to server through Wi-Fi.

Relay works on the principle of electromagnetic induction. When the electromagnet is applied with some current, it induces a magnetic field around it.

Above image shows working of the relay. A switch is used to apply DC current to the load.In the relay, Copper coil and the iron core acts as electromagnet.

When the coil is applied with DC current, it starts attracting the contact as shown. This is called energizing of relay. When the supply is removed it retrieves back to the original position. This is called De energizing of relay. A microcontroller is a kind of miniature computer that you can find in all kinds of Gizmos. Some examples of common, every-day products that have microcontrollers are built-in. If it has buttons and a digital display, chances are it also has a programmable microcontroller brain.

Every-Day the devices used by ourselves that contain Microcontrollers. Try to make a list and counting how many devices and the events with microcontrollers you use in a typical day. Here are some examples: if your clock radio goes off, and you hit the snooze button a few times in the morning, the first thing you do in your day is interact with a microcontroller. Heating up some food in the microwave oven and making a call on a cell phone also involve operating microcontrollers. That's just the beginning. Here are a few more examples: Turning on the Television with a handheld remote, playing a hand held game, Using a calculator, and Checking your digital wrist watch. All those devices have microcontrollers inside them, that interact with you. Consumer appliances aren't the only things that contain microcontrollers. Robots, machinery, aerospace designs and other high-tech devices are also built with microcontrollers.

The ac voltage, typically 220V rms, is connected to a transformer, which steps that ac voltage down to the level of the desired dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation.

A regulator circuit removes the ripples and also remains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of the popular voltage regulator IC units.

The transformer will step down the power supply voltage (0-230V) to (0-6V) level. Then the secondary of the potential transformer will be connected to the precision rectifier, which is constructed with the help of op–amp. The advantages of using precision rectifier are it will give peak voltage output as DC; rest of the circuits will give only RMS output.

When four diodes are connected as shown in figure, the circuit is called as bridge rectifier. The input to the circuit is applied to the diagonally opposite corners of the network, and the output is taken from the remaining two corners.

Let us assume that the transformer is working properly and there is a positive potential, at point A and a negative potential at point B. the positive potential at point A will forward bias D3 and reverse bias D4. The negative potential at point B will forward bias D1 and reverse D2. At this time D3 and D1 are forward biased and will allow current flow to pass through them; D4 and D2 are reverse biased and will block current flow.

The path for current flow is from point B through D1, up through RL, through D3, through the secondary of the transformer back to point B. this path is indicated by the solid arrows. Waveforms (1) and (2) can be observed across D1 and D3.

One-half cycle later the polarity across the secondary of the transformer reverse, forward biasing D2 and D4 and reverse biasing D1 and D3. Current flow will now be from point A through D4, up through RL, through D2, through the secondary of T1, and back to point A. This path is indicated by the broken arrows. Waveforms (3) and (4) can be observed across D2 and D4. The current flow through RL is always in the same direction. In flowing through RL this current develops a voltage corresponding to that shown waveform (5). Since current flows through the load (RL) during both half cycles of the applied voltage, this bridge rectifier is a full-wave rectifier.

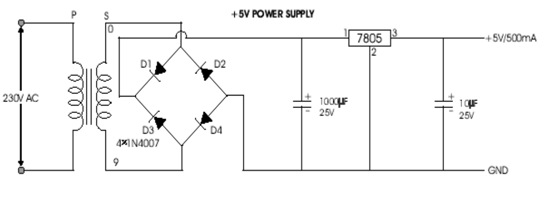
One advantage of a bridge rectifier over a conventional full-wave rectifier is that with a given transformer the bridge rectifier produces a voltage output that is nearly twice that of the conventional full-wave circuit.

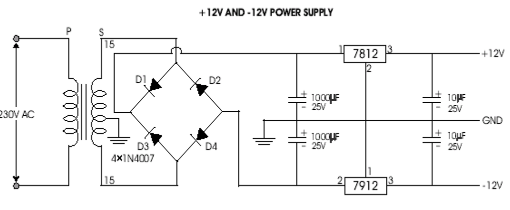
This may be shown by assigning values to some of the components shown in views A and B. assume that the same transformer is used in both circuits. The peak voltage developed between points X and y is 1000 volts in both circuits. In the conventional full-wave circuit shown—in view A, the peak voltage from the center tap to either X or Y is 500 volts. Since only one diode can conduct at any instant, the maximum voltage that can be rectified at any instant is 500 volts.

The maximum voltage that appears across the load resistor is nearly-but never exceeds-500 v0lts, as result of the small voltage drop across the diode. In the bridge rectifier shown in view B, the maximum voltage that can be rectified is the full secondary voltage, which is 1000 volts. Therefore, the peak output voltage across the load resistor is nearly 1000 volts. With both circuits using the same transformer, the bridge rectifier circuit produces a higher output voltage than the conventional full-wave rectifier circuit.

IC voltage regulators

Voltage regulators comprise a class of widely used ICs. Regulator IC units contain the circuitry for reference source, comparator amplifier, control device, and overload protection all in a single IC.





IC units provide regulation of either a fixed positive voltage, a fixed negative voltage, or an adjustably set voltage. The regulators can be selected for operation with load currents from hundreds of milli amperes to tens of amperes, corresponding to power ratings from milli watts to tens of watts.

A fixed three-terminal voltage regulator has an unregulated dc input voltage, Vi, applied to one input terminal, a regulated dc output voltage, Vo, from a second terminal, with the third terminal connected to ground.
The series 78 regulators provide fixed positive regulated voltages from 5 to 24 volts. Similarly, the series 79 regulators provide fixed negative regulated voltages from 5 to 24 volts.
•For ICs, microcontroller, LCD --------- 5 volts
•For alarm circuit, op-amp, relay circuits ---------- 12 volts.
Embedded C is designed for programmers with desktop experience in C, C++ or Java who want to learn the skills required for the unique challenges of embedded systems.

CODING:

```
#define BLYNK_TEMPLATE_ID "TMPL35OGcMO_c"
#define BLYNK_TEMPLATE_NAME "Insulator"
#define BLYNK_AUTH_TOKEN "Mh8eYk4qhJyR6c-YnZk0ZXRfo_3JwnXv"
#define BLYNK_PRINT Serial
// Your WiFi Credentials.
// Set password to "" for open networks.
char auth[] = "Mh8eYk4qhJyR6c-YnZk0ZXRfo_3JwnXv";
char ssid[] = "phoenixiot1234";  // type your wifi name
char pass[] = "phoenixiot1234";  // type your wifi password

// define the GPIO connected with Sensors & LEDs

#define WIFI_LED      16 //D0

//#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>
 #include <LiquidCrystal_I2C.h>
LiquidCrystal_I2C lcd(0x3f,16,2);
const int Current = D6;
const int LDR1 = D4;
const int LDR2 = D5;
const int Relay = D7;
const int Alarm = D8;
#define VPIN_BUTTON_1    V1
#define VPIN_BUTTON_2    V2
#define VPIN_BUTTON_3    V3
long previousMillis = 0;
long interval = 2000; //Read sensor each 2 seconds
bool isconnected = false;

BlynkTimer timer;
void checkBlynkStatus() { // called every 2 seconds by SimpleTimer
  getSensorData();
  isconnected = Blynk.connected();
  if (isconnected == true) {
    digitalWrite(WIFI_LED, LOW);
    sendSensorData();
    //Serial.println("Blynk Connected");
  }
  else{
    digitalWrite(WIFI_LED, HIGH);
    Serial.println("Blynk Not Connected");
  }
}
```

```
void getSensorData()
{

   if (digitalRead(D4) == 1  )
   {
    lcd.clear();
lcd.setCursor(0,0);
  lcd.print("  STREET LIGHT  ");
  lcd.setCursor(0,1);
  lcd.print("       ON       ");
     Blynk.virtualWrite(VPIN_BUTTON_2, "NIGHT TIME");
   digitalWrite(D7, LOW);
   digitalWrite(D8, HIGH);
   delay(200);

  if (digitalRead(D5) == 1  )
  {
    lcd.clear();
lcd.setCursor(0,0);
  lcd.print(" STREET LIGHT   ");
  lcd.setCursor(0,1);
  lcd.print("    FAULT       ");
   Blynk.logEvent("Alert", "SERVICE LINE4215 LIGHT FAULT!!");
   Blynk.virtualWrite(VPIN_BUTTON_1, "LIGHT FAULT");
 digitalWrite(D8, LOW);
  digitalWrite(D7,HIGH);
 delay(2000);
  }
  if (digitalRead(D5) == 0  )
  {
    lcd.clear();
lcd.setCursor(0,0);
  lcd.print("LIGHT CONDITION ");
  lcd.setCursor(0,1);
  lcd.print("   OK     ");
  Blynk.virtualWrite(VPIN_BUTTON_1, "LIGHT CONDITION GOOD");

 delay(2000);
  }

   }
  else
  {
     lcd.clear();
lcd.setCursor(0,0);
  lcd.print("  STREET LIGHT  ");
  lcd.setCursor(0,1);
  lcd.print("      OFF       ");
   Blynk.virtualWrite(VPIN_BUTTON_2, "DAY TIME");
   digitalWrite(D7, LOW);
   digitalWrite(D8, LOW);
   delay(200);
    }
  }
void sendSensorData()
{

 }
void setup()
```

```
{
  Serial.begin(9600);

lcd.init();                    // initialize the lcd
  lcd.init();
  // Print a message to the LCD.
  lcd.backlight();
  lcd.setCursor(0,0);
  lcd.print("  STREET LIGHT  ");
  lcd.setCursor(0,1);
  lcd.print("    MONITOR     ");

  pinMode(D4, INPUT_PULLUP);
pinMode(D5, INPUT_PULLUP);
pinMode(D6,INPUT_PULLUP);
  pinMode(D7, OUTPUT);
  pinMode(D8, OUTPUT);
  pinMode(WIFI_LED, OUTPUT);
  digitalWrite(D7, LOW);
  digitalWrite(D8, LOW);
  digitalWrite(WIFI_LED, HIGH);

  WiFi.begin(ssid, pass);
  timer.setInterval(2000L, checkBlynkStatus); // check if Blynk server is connected every 2 seconds
  Blynk.config(auth);
  delay(1000);
}
void loop()
{
 if (digitalRead(D6) == 0  )
  {
    lcd.clear();
lcd.setCursor(0,0);
  lcd.print("INSULATORFAULT");
  lcd.setCursor(0,1);
  lcd.print("EARTH WARNING ");
   Blynk.logEvent("Alert", "SERVICE LINE4215 INSULATOR FAULT!!");
  Blynk.virtualWrite(VPIN_BUTTON_3, "INSULATOR FAULT");

  digitalWrite(D7,HIGH);
 delay(2000);
  }
  else
  {
    digitalWrite(D7,LOW);
    Blynk.virtualWrite(VPIN_BUTTON_3, "Normal");
    delay(2000);
  }
{
  Blynk.run();
  timer.run();
}
}
```

IV.RESULTS AND DISCUSSION

Initially, we design a prototype to estimate the arranging process of the whole system and can be done as part of future research, development. After completion of the entire work, we design a proposed system as displayed. After developing the system, it has been tested for many months for verifying the whole functionality in real-time.

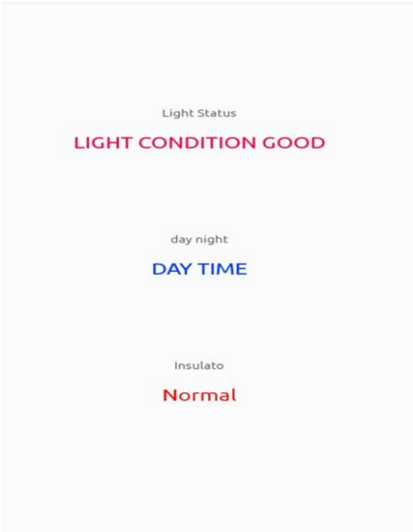
The use of our methodology resulted in the fault detection accuracy and the lights are automatically ON/OFF which also saved electricity. In the above figure, the first street light is OFF because of the fault in it. At the point of time, the red color LED will start glowing. In the success case of street light ON no action is performed. For our experimental purpose, we used basic LEDs in the place of lights the message sent to the authorized person from the Twilit account.

Damage is the message which we have written as the indication and the URL is fetched using GPS.Fig. 3. Overall view of the Research Work.Fig. 4. Output Message from Twilio Account.Fig. 5 shows the location of the damaged light. The indicator indicates the exact location. In the case of more lights are in one place then the damaged light can be known with the help of a red LED.

The detection success rate of the power transformer fault diagnosis system model established in this paper is as high as 95.6%, the training error is less than 0.0001, and it can correctly identify the fault types of the non-training samples. It can be seen that the technical support of the Internet of Things is helpful to the upgrading and maintenance of the power transformer fault diagnosis system

The Parameters such as Temperature, Humidity and Leakage current are continuously monitored by the sensor and displayed in the LCD display. The above graph shows the output of the temperature sensor and humidity sensor. If there is any fault or the temperature and humidity increases or decreases over the threshold value it is indicated to the control unit.

The location of the fault is communicated to the appropriate people or unit, and the amount of leakage current is determined using IoT technology. Instead of visiting all poles, we can quickly identify the faulty ones using this precise location. In the control unit, temperature, humidity, and leakage current data are displayed. The information is saved and can be exported whenever necessary.



V.CONCLUSION

This project may be implemented in the industries i.e., to communicate between the staffs or employees in addition to this we may implement it in the houses where there is a need. In future we can add much more control appliances. It is a beautiful thing to those who are in business or in other activities. It is a less expensive one so that all the people can be monitored and implement this in day-today life. In future we can access the data more and similarly we can increase speed according to the need. In this automatic street light system, we can try to reduce manual work to ON and OFF switches. The system itself detects whether there is a need for light or not. When darkness rises to a certain value and a person is detected. The proposed streetlight automation system is cost-effective and the safest way to reduce power consumption. It helps us to get rid of today's world problems of manual switching and most importantly, primary cost and maintenance can be decreased easily. It reduces the unnecessary use of electricity. It provides an efficient and smart automatic streetlight control system with the help of LDR and PIR sensors. It can reduce energy consumption and maintains the cost. This system is very versatile, extendable, and adjustable to user needs. We do not have to manually turn on and off these street lights as they turn on and off all by themselves according to the intensity of the surrounding's light. The main purpose of this project is to prevent the loss of electricity unnecessarily during the daytime and in absence of any person to make the system more efficient than before.

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