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An Intelligent Systemto Detect Faultsand Condition Monitoringin Transformers

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ABSTRACT: Thispapermainlyproposesageneralov erviewabouttransformer condition monitoring. Winding deformation could be a common drawback that takes place inside in operation power transformers because of numerous internal and external conditions because of their progressive nature, winding deformations ought to be detected and corrected as they emerge, the sole reliable technique to notice such faults at this stage is that the frequency response analysis that is conducted offline. In this paper, we tend to proposing a concept to notice power electrical device inchoate winding deformations in real time through measure voltage and current level in electrical device. during this technique, we tend to square measure observation the live standing of electrical device victimization low value and simply out there sensors. Winding deformation could be a common downside that takes place among operative power transformers because of varied internal and external conditions because of their progressive nature, winding deformations ought to be detected and corrected as before long as they emerge. sadly, the sole reliable technique to observe such faults at this stage is that the frequency response analysis that is conducted offline. In this technique, we have a tendency to observe the live standing of electrical device mistreatment low price and simply accessible sensors.

I. INTRODUCTION

An electric power supply system includes the generating station, transmission lines and therefore the distribution system. In generating station, power is generated by 3 section alternators operative in parallel. To transmit the electricity from the purpose of generation to the top user, AN interconnected network of electrical grid is employed. The network of electrical grid consists of calculable range of generating stations, high-voltage transmission lines and distribution lines. we all know that once a coffee voltage power is transmitted over
long distance, the facility loss we have a tendency to acquire are going to be a lot of. Winding deformation could be a common downside that takes place among operative power transformers because of varied internal and external conditions. because of their progressive nature, winding deformations ought to be detected and corrected as before long as they emerge. sadly, the sole reliable technique to observe such faults at this stage is that the frequency response analysis that is conducted offline. during this paper, we have a tendency to ar proposing an inspiration to observe power electrical device inchoate winding deformations in real time through activity voltage and current level in electrical device. during this technique, we have a tendency to ar observation the live standing of electrical device mistreatment low price and simply accessible sensors. Winding deformation could be a common drawback that takes place inside in operation power transformers because of numerous internal and external conditions. because of their progressive nature, winding deformations ought to be detected and corrected as presently as they emerge. sadly, the sole reliable technique to notice such faults at this stage is that the frequency response analysis that is conducted offline. during this paper, we tend to square measure proposing a concept to notice power electrical device inchoate winding deformations in real time

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through measure voltage and current level in electrical device. during this technique, we tend to square measure observation the live standing of electrical device victimization low value and simply out there sensors.

II. METHODOLOGY USED FOR IOT MONITORING SYSTEM

According to statistical data, winding deformation represents the main failure mode in the current worldwide power transformer fleet. The current conventional techniques to detect transformer winding deformations including sweep frequency response analysis (SFRA), short-circuit impedance (SCI) and low-voltage impulse (LVI) are of offline nature that call for the disconnection of the power transformer for testing. The main advantage of proposed technique over other techniques is that the V-I technique is conducted in online and does not call for additional equipment or sensors as it utilizes the existing metering devices attached to power transformers. The proposed system consists of two crucial input sections namely, voltage sensing unit and current sensing unit. These two units continuously measure the amount of voltage and current in transformer respectively. Output values from these units are sent to microcontroller that compares output values with predetermined range of values. Both output values and comparison result are updated to central monitoring unit through Internet of Things(IoT). If Output values cross predetermined range to some extent, an intimation will be activated in central unit.

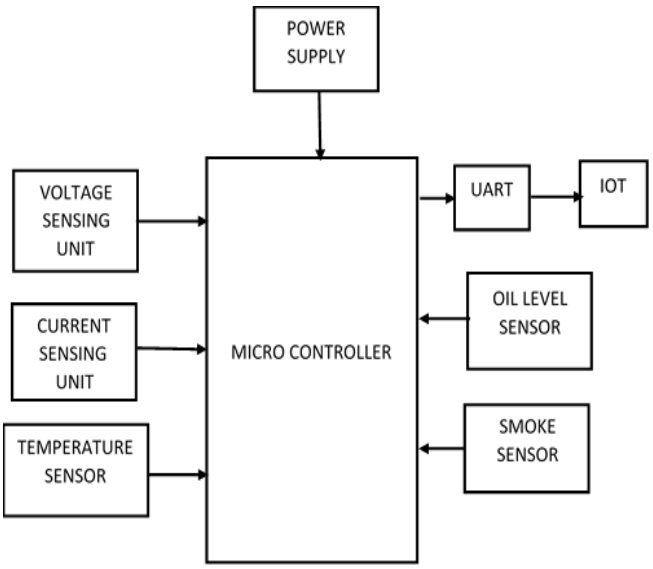
- **Proposed System**

  The proposed system consists of two crucial input sections namely, voltage sensing unit and current sensing unit. These two units continuously measure the amount of voltage and current in transformer respectively. Output values from these units are sent to microcontroller that compares output values with predetermined range of values. Both output values and comparison result are updated to central monitoring unit through Internet of Things(IoT). If Output values cross predetermined range to some extent, an intimation will be activated in central unit. It is also important to monitor the condition of transformer. For that, some sensors are incorporated with the controller to monitor live status of transformer. Temperature sensor is used to measure amount of heat produced in transformer, oil sensor is for measuring the level of insulation oil and smoke sensor is for measuring the quantity of gases produced in transformer.

  ADVANTAGES

  - Real time monitoring can be done.
  - Time delay can be reduced for repair due to continuous monitoring

III. BLOCK DIAGRAM



IV. BLOCK DIAGRAM DESCRIPTION

AC Power Supply

The ac voltage, usually 220V rms, is connected to a electrical device, that steps that ac voltage all the way down to the extent of the required dc output. A diode rectifier then provides a full-wave corrected voltage that's at first filtered by an easy condenser

filter to supply a dc voltage. This ensuing dc voltage sometimes has some ripple or ac voltage variation. A regulator circuit removes the ripples and conjointly remains an equivalent dc worth albeit the input dc voltage varies, or the load connected to the output dc voltage changes. This voltage regulation is sometimes obtained victimization one among the popular transformer IC units.

Transformer

The potential electrical device can step down the ability offer voltage (0-230V) to (0-6V) level. Then the secondary of the potential electrical device are going to be connected to the exactitude rectifier, that is built with the assistance of op–amp. the benefits of victimisation exactitude rectifier area unit it'll provide peak voltage output as DC, remainder of the circuits can provide solely RMS output.

Bridge Rectifier

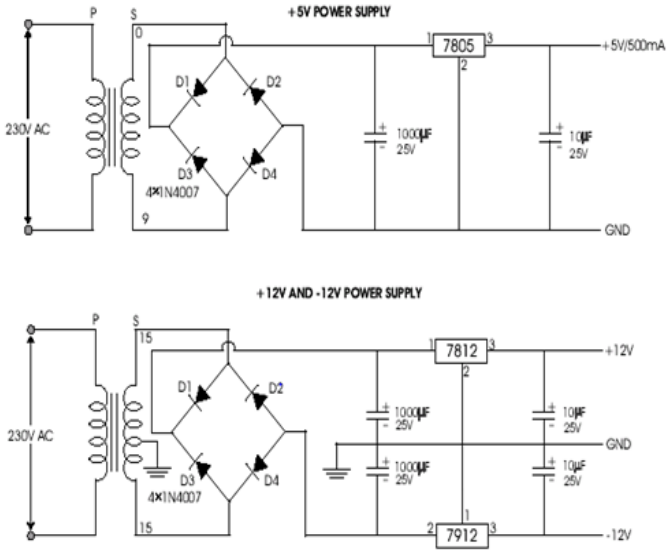
In this electronic circuit we need a corrected DC power provide to power varied electronic basic parts from the offered AC mains provide. Rectifiers area unit accustomed convert Alternating current AC power to a Direct current DC power. Among the rectifiers, the bridge rectifier is that the best rectifier circuit.

We can outline bridge rectifiers as a kind of rectifier that uses four or additional diodes during a electrical circuit configuration to with efficiency convert alternating (AC) current to an immediate (DC) current. within the next few sections, allow us to learn additional concerning its construction, working, and more.

IC Voltage Regulators

A voltage regulator is a microcircuit (IC) that has a relentless mounted output voltage in spite of a modification within the load or input voltage. It will try this many ways looking on the topology of the circuit among, except for the aim of keeping this project basic, we are going to primarily target the linear regulator. A linear transformer works by mechanically adjusting the resistance via a feedback circuit, accounting for changes in each load and input, all whereas keeping the output voltage constant.

V. CIRCUIT DIAGRAM



Transformer Section

- This device transfers electric energy from one alternating-current circuit to one or more other circuits, either increasing (stepping up) or reducing (stepping down) the voltage. Transformers are employed for widely varying purposes; e.g., to reduce the voltage of conventional power circuits to operate low-voltage devices, such as doorbells and toy electric trains, and to raise the voltage from electric generators so that electric power can be transmitted over long distances.
- Transformers change voltage through electromagnetic induction; i.e., as the magnetic lines of force (flux lines) build up and collapse with the changes in current passing through the primary coil, current is induced in another coil, called the secondary. The secondary voltage is calculated by multiplying the primary voltage by the ratio of the number of turns in the secondary coil to the number of turns in the primary coil, a quantity called the turns ratio.

Bridge Rectifier

- When four diodes area unit connected as shown in figure, the circuit is named as bridge rectifier. The input to the circuit is applied to the diagonally opposite corners of the network, and therefore the output is taken from the remaining 2 corners.
- Let us assume that the electrical device is functioning properly and there's a positive potential, at purpose A and a negative potential at purpose B. The positive potential at purpose A can forward bias D3 and reverse bias D4.
- The negative potential at purpose B can forward bias D1 and reverse D2. At {this time|this purpose|now} D3 and D1 area unit forward biased and can enable current flow to have them; D4 and D2 area unit reverse biased and can block current flow the trail for current flow is from point B through D1, up through RL, through D3, through the secondary of the electrical device back to purpose B. This path is indicated by the solid arrows. Waveforms (1) and (2) is ascertained across D1 and D3.
- One-half cycle later the polarity across the secondary of the electrical device reverse, forward biasing D2 and D4 and reverse biasing D1 and D3. Current flow can currently be from purpose A through D4, up through RL, through D2, through the secondary of T1, and back to purpose A. This path is indicated by the broken arrows. Waveforms (3) and (4) is ascertained across D2 and D4. this flow through RL is usually within the same direction. In flowing through RL this current develops a voltage reminiscent of that shown undulation (5). Since current flows through the load (RL) throughout each 0.5 cycles of the applied voltage, this bridge rectifier could be a rectifier. One advantage of a bridge rectifier over a standard rectifier is that with a given electrical device the bridge rectifier produces a voltage output that's nearly double that of the standard full-wave circuit. • This could also be shown by distribution values to a number of the elements shown in views A and B. assume that constant electrical device is employed in each circuits. the height voltage developed between points X and y is one thousand volts in each circuits. within the standard full-wave circuit shown—in read A, the height voltage from the middle faucet to either X or Y is five hundred volts. Since only 1 diode will conduct at any instant, the utmost voltage that may be corrected at any instant is five hundred volts.
- The most voltage that seems across the load resistance is nearly-but ne'er exceeds-500 v0lts, as results of the little drop across the diode. within the bridge rectifier shown visible B, the utmost voltage that may be corrected is that the full secondary voltage, that is one thousand volts. Therefore, the height output voltage across the load resistance is sort of one thousand volts. With each circuits victimisation constant electrical device, the bridge rectifier circuit produces the next output voltage than the standard rectifier circuit.

IC Voltage Regulators

Voltage regulators comprise a category of wide used ICs. Regulator IC units contain the electronic equipment for reference supply, comparator electronic equipment, management device, and overload protection dead one IC. IC units give regulation of either a set positive voltage, a set negative voltage, or AN adjustably set voltage. The regulators may be designated for operation with load currents from many milli amperes to tens of amperes, appreciate power ratings from milli watts to tens of watts.

- A fastened three-terminal transformer has an unregulated dc input voltage, Vi, applied to 1 input terminal, a regulated dc output voltage, Vo, from a second terminal, with the third terminal connected to ground.
- The series seventy eight regulators give fastened positive regulated voltages from five to twenty four volts. Similarly, the series seventy nine regulators give

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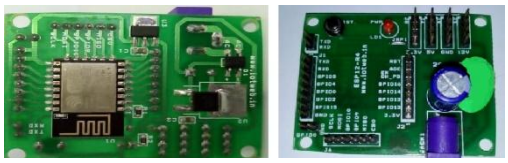
fastened negative regulated voltages from five to twenty four volts.

- A mounted three-terminal transformer has associate unregulated dc input voltage, Vi, applied to at least one input terminal, a regulated dc output voltage, Vo, from a second terminal, with the third terminal connected to ground.

The series seventy eight regulators offer mounted positive regulated voltages from five to twenty four volts. Similarly, the series seventy nine regulators offer mounted negative regulated voltages from five to twenty four volts.

VI. IOT AND WEB SERVER DETAILS

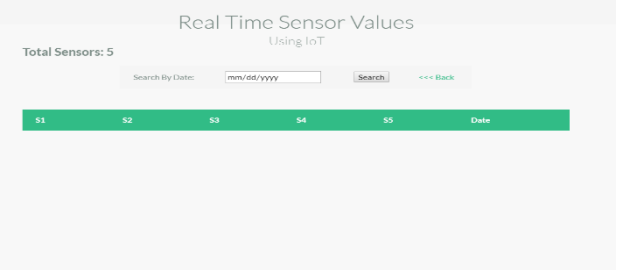
The Internet of things (IoT) is that the network of everyday objects — physical things embedded with physics, software, sensors, and property sanctionative information exchange. Basically, a touch networked laptop is hooked up to a issue, permitting info exchange to and from that issue. Be it lightbulbs, toasters, refrigerators, flower pots, watches, fans, planes, trains, vehicles, or anything around you, a touch networked laptop is combined with it to just accept input (especially object control) or to collect and generate informational output (typically object standing or alternative sensory data). This means computers are going to be permeative everything around U.S. — present embedded computing devices, unambiguously identifiable , interconnected across the net. thanks to low-priced, networkable microcontroller modules, the net of things is admittedly getting down to begin.



The distribution electrical device directly provides the low voltage users with power provide. Thus, the operating condition of the electrical device plays a crucial role in distribution network. The transformers should be operated in rated condition for his or her long life. this is often unfeasible throughout entire operating periods. Overloading and deficient cooling of transformers will cause sudden failure in transformers which might disturb delivering of electricity over several shoppers. The manual medical of rise in voltage, rise in close temperature, load current etc. tends to be a lot of advanced as incidental parameters can not be accessed.

WEB SERVER

Espresso's ESP8266EX delivers extremely integrated Wi-Fi SoC answer to fulfill users' continuous demands for economical power usage, compact style and reliable performance within the net of Things business.



With the whole and self-contained Wi-Fi networking capabilities, ESP8266EX will perform either as a standalone application or because the slave to a bunch MCU. once ESP8266EX hosts the appliance, it promptly boots up from the flash. The integrated high speed cache helps to extend the system performance and optimize the system memory. Also, ESP8266EX is applied to any microcontroller style as a Wi-Fi device through SPI / SDIO or I2C / UART interfaces. ESP8266EX integrates antenna switches, RF balun, power electronic equipment, low noise receive electronic equipment, filters and power management modules. The compact style minimizes the PCB size and needs marginal external circuitries. Besides the Wi-Fi functionalities, ESP8266EX conjointly integrates associate degree increased version of Tensilica's L106 Diamond series 32-bit processor and on-chip SRAM. It is interfaced with external sensors and alternative devices through the GPIOs. package Development Kit (SDK) provides sample codes for varied applications. Espressif Systems' sensible property

Platform (ESCP) allows subtle options as well as quick switch between sleep and wakeup mode for energy-efficient purpose, reconciling radio biasing for low-power operation, advance signal process, spur cancellation and radio co-existence mechanisms for common cellular, Bluetooth, DDR, LVDS, liquid crystal display interference mitigation.

Channel Frequencies:

• The RF transceiver supports the subsequent channels in step with IEEE802.11b/g/n standards

GHz Receiver:

• The 2.4 gigacycle receiver down-converts the RF signals to construction baseband signals and converts them to the digital domain with two high resolution high speed ADCs. To adapt to variable signal channel conditions, RF filters, automatic gain management (AGC), DC offset cancelation circuits and baseband filters area unit integrated at intervals ESP8266EX.

GHzTransmitter:

• The 2.4 gigacycle transmitter up-converts the construction baseband signals to two.4 GHz, and drives the antenna with a dynamic CMOS power electronic equipment. The perform of digital standardization additional improves the dimensionality of the facility electronic equipment, sanctioning a state of art performance of delivering +19.5 dBm average power for 802.11b transmission and +16 dBm for 802.11n transmission.

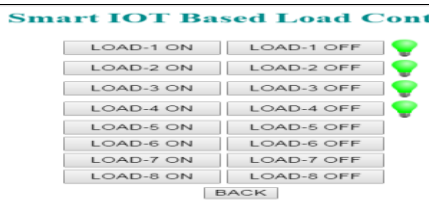
• Additional calibrations area unit integrated to offset any imperfections of the radio, such as: • Carrier outpouring

• I/Q part matching

• Baseband nonlinearities

• These integral standardization functions scale back the merchandise take a look at time and build the equipment unnecessary.

WEB SERVER : Controlling Section



FEATURES

• Power Supply: DC +12v 1Amp.

• Auto data updating: 30sec

• Digital Output port Pins: +5V DC

• Message Format: *message or Data # (Start with * and End with #).

• Provided with 3 links

• Data updating to a specific web site

• Device controlling web site

• Data updating to a social network

APPLICATIONS

• Online Traffic monitoring

• Online Health monitoring

• Real time Transport and Logistics monitoring

VII. SOFTWARE DETAILS

EMBEDDED C

High-level language programming has long been in use for embedded-systems development. However, assembly programming still prevails, notably for digital-signal processor (DSP) based mostly systems. DSPs square measure typically programmed in programming language by programmers WHO apprehend the processor design within out. The key motivation for this follow is performance, despite the disadvantages of assembly programming when put next to application-oriented language programming.

If the video secret writing takes eighty % of the CPU-cycle budget rather than ninety %, for example, there square measure double as several cycles on the market for audio process. This coupling of performance to

end-user options is characteristic of the many of the time period applications during which DSP processors square measure applied. DSPs have a extremely specialised design to realize the performance needs for signal process applications among the bounds of price and power consumption set for shopper applications. in contrast to a traditional Load-Store (RISC) design, DSPs have an information path with memory-access units that directly feed into the arithmetic units. Address registers square measure taken out of the general register file and placed next to the memory units during a separate register file.

an extra specialization of the info path is that the coupling of multiplication and addition to make one cycle Multiply-accumulate unit (MAC). it's combined with special-purpose accumulator registers, that square measure break free the general registers. knowledge memory is metameric and placed near to the mack to realize the high bandwidths needed to stay up with the efficient knowledge path. Limits square measure typically placed on the extent of memory-addressing operations. The localization of resources within the knowledge path saves several knowledge movements that generally occur during a Load-Store design.

The foremost necessary, common arithmetic extension to DSP architectures is that the handling of saturated fixed-point operations by the arithmetic unit. Fixed-point arithmetic may be enforced with very little further price over number arithmetic. Automatic saturation (or clipping) considerably reduces the quantity of control-flow directions required for checking overflow expressly within the program.Changes in technological and economic needs build it costlier to continue programming DSPs in assembly. Staying with the itinerant as associate degree example, the signal-processing algorithms needed become progressively complicated. options like stronger error correction and secret writing should be adscititious. Communication protocols become a lot of subtle and need way more code to implement. In bound markets, multiple protocol stacks square measure enforced to be compatible with multiple service suppliers. additionally, backward compatibility with older protocols is required to remain synchronic with supplier networks that square measure during a slow method of upgrading.

Today, most embedded processors square measure offered with C compilers. Despite this, programming DSPs continues to be exhausted assembly for the signal process elements or, at best, by mistreatment assembly-written libraries provided by makers. The key reason for this is often that though the design is similar temperament to the necessities of the signal-processing application, there's no thanks to specific the algorithms with efficiency and during a

natural approach in commonplace C. Saturated arithmetic.

for instance, is needed in several algorithms and is provided as a primitive in several DSPs. However, there's no such primitive in commonplace C. to specific saturated arithmetic in C needs comparisons, conditional statements, and correcting assignments. rather than employing a primitive, the operation is meet variety of statements that square measure troublesome to acknowledge as one primitive by a compiler.

SOURCE CODE

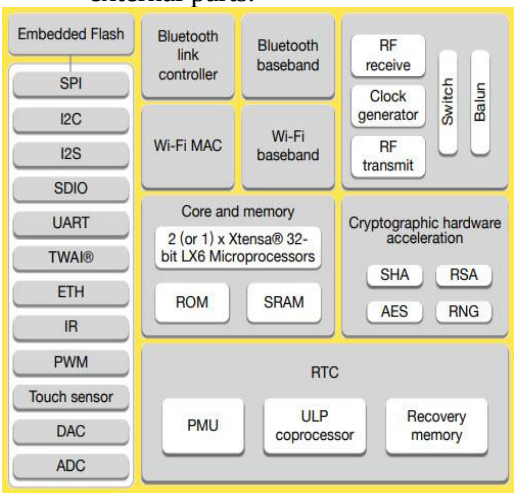
```
#include <LiquidCrystal.h>
#include <HTTPClient.h>
#include <WiFi.h>
#include <ArduinoJson.h>
// initialize the library by associating any needed LCD interface pin
// with the arduino pin number it is connected to
const int rs = 5, en = 18, d4 = 19, d5 = 21, d6 = 22, d7 = 23;
String sensor1_status,sensor2_status,sensor3_status,sensor4_status,sensor5_status,lattitude_1,longitude_1,sms_status;

int temp,oil,gas,voltage,current,hb;
int count,T,location_f;
LiquidCrystal lcd(rs, en, d4, d5, d6, d7);
void setup()
{
 pinMode(25, INPUT);
 //pinMode(32, INPUT);

 Serial.begin(9600);
Serial.println("iotbegin031 ");
 WiFi.begin("iotbegin031", "iotbegin031");  //WiFi connection
  lcd.begin(16, 2);
   while (WiFi.status() != WL_CONNECTED)
   {   //Wait for the WiFI connection completion
    lcd.setCursor(0, 0);
 lcd.print("connect to WIFI   ");
  lcd.setCursor(0, 1);
 lcd.print("iotbegin031");
 //delay(3000);

    Serial.println("Waiting for Wi-Fi connection");
   }
 lcd.clear(); delay(1000);
       lcd.setCursor(0, 0);
 lcd.print("connected!!!!!!!!!");
 delay(3000);
 lcd.clear();
 Serial.println("Wi-Fi connected");delay(1000);

lcd.setCursor(0, 0);
 lcd.print("FAULTS & CONDITION MONITOR  ");
 lcd.setCursor(0, 1);
 lcd.print(" IN TRANSFORMER  ");
 delay(3000);
 lcd.clear();
}
void loop()
{
 HTTPClient http;
 T++;
  temp = analogRead(36);
  temp = temp - 180;
  lcd.setCursor(0, 0);
 lcd.print("T:");
lcd.print(temp);
lcd.print("  ");
sensor1_status= temp;
if(temp>80)
{
  sensor1_status= sensor1_status + " STATUS: ABNORMAL";
}
else
{
   sensor1_status= sensor1_status + " STATUS: NORMAL";
}
  oil = analogRead(34);
  oil=oil/40;
  lcd.setCursor(9, 0);
 lcd.print("O:");
lcd.print(oil);
```

```
lcd.print(" %  ");
sensor2_status= oil;
if(oil>80)
{
 sensor2_status=  sensor2_status  +  "
STATUS: HIGH";
}

else if(oil<20)
{
 sensor2_status=  sensor2_status  +  "
STATUS: LOW";
}
else
{
  sensor2_status=  sensor2_status  +  "
STATUS: NORMAL";
}
 voltage = analogRead(35);
 voltage=voltage/400;
//if(heart_beat < 500)
//{
//  hb = random(69,85);
//}
//else
//{
//  hb=0;
//}
 lcd.setCursor(0, 1);
 lcd.print("V:");
lcd.print(voltage);
lcd.print("  ");

sensor3_status=voltage;
//if(hb>84)
//{
//    sensor3_status=  sensor3_status  +  "
STATUS: ABNORMAL";
//}
//else
//{
//     sensor3_status=  sensor3_status  +  "
STATUS: NORMAL";
//}
 gas = digitalRead(25);
 lcd.setCursor(13, 1);
 lcd.print("G:");
lcd.print(gas);

sensor4_status= gas;
if(gas==0)
{
 sensor4_status=  sensor4_status  +  "
STATUS: ABNORMAL";
}
else
{
  sensor4_status=  sensor4_status  +  "
STATUS: NORMAL";
}
 current = analogRead(32);

if(current >3000)
{
 current=current/3000;
}
else
{
 current=0;
}

 lcd.setCursor(7, 1);
 lcd.print("I:");
lcd.print(current);

sensor5_status= current;

if((temp>80)||(gas==0)||(oil <20))
{
 sms_status="1";
}

else
{
 sms_status="0";
}

//if(location_f ==1)
//{

      int httpCode_string = http.GET();
      String  payload_string  =
http.getString();      //Get the response
payload

      //Serial.println(httpCode_string);  /
 /Print HTTP return code
      //Serial.println(payload_string);
//Print request response payload

      http.end();  //Close connection
      delay(500);
      StaticJsonDocument<300>
parseserial_string;
```

```
        deserializeJson(parseserial_string,
payload_string);
        //Serial.println();
        JsonObject serial_string =
parseserial_string["data"][0];
        //Serial.println("sensor_data");
        //Serial.println(serial_string);
        String lattitude =
serial_string["latitude"];
        String longitude =
serial_string["longitude"];
lattitude_1="lat:" + lattitude;
longitude_1="long" +longitude;

        //Serial.print("serial_string=");
        //Serial.println(output_string);
Serial.print(lattitude);
Serial.print(",");
Serial.println(longitude);//location_f =0;
//}


 if (WiFi.status() == WL_CONNECTED)
//Check WiFi connection status
  {
    DynamicJsonDocument
jsonBuffer(JSON_OBJECT_SIZE(3) +
300);
 JsonObject root =
jsonBuffer.to<JsonObject>();

 root["sensor1"]=sensor1_status;
 root["sensor2"]=sensor2_status;
 root["sensor3"]=sensor3_status;
 root["sensor4"]=sensor4_status;
 root["sensor5"]=sensor5_status;
 root["sensor6"]= lattitude_1;
 root["sensor7"]=longitude_1;
 root["sensor8"]="NA";
 root["sms"]=sms_status;
 //serializeJsonPretty(root, Serial);
 //Serial.println();

 // Serialize JSON document
 String json;
 serializeJson(jsonBuffer, json);

 if((sensor1_status !="null")&&(T>10))
       {


    http.addHeader("Content-Type",
"application/json");
  int httpCode = http.POST(json);  //Send the
request
  String payload = http.getString();
//Get the response payload

  //Serial.println(httpCode);      //Print HTTP
return code
  //Serial.println(payload);      //Print request
response payload
//lcd.clear();
  http.end();  //Close connection

T=0;
lattitude_1="---";
longitude_1="---";
        }
   }
 delay(500);
}
```

VIII. MICROCONTROLLER SEGEMENT

ESP32 could be a affordable System on Chip (SoC) Microcontroller from Espressif Systems, the developers of the illustrious ESP8266 SoC. it's a successor to ESP8266 SoC and comes in each single-core and dual-core variations of the Tensilica's 32-bit Xtensa LX6 microchip with integrated Wi-Fi and Bluetooth. The good factor concerning ESP32, like ESP8266 is its integrated RF parts like Power electronic equipment, Low-Noise Receive electronic equipment, Antenna Switch, Filters and RF Balun. This makes coming up with hardware around ESP32 terribly simple as you need only a few external parts.



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Another necessary factor to understand concerning ESP32 is that it's factory-made victimization TSMC's ultra-low-power forty nm technology. So, coming up with battery operated applications like wearables, audio instrumentality, baby monitors, sensible watches, etc., victimization ESP32 ought to be terribly simple.

Specifications of ESP32

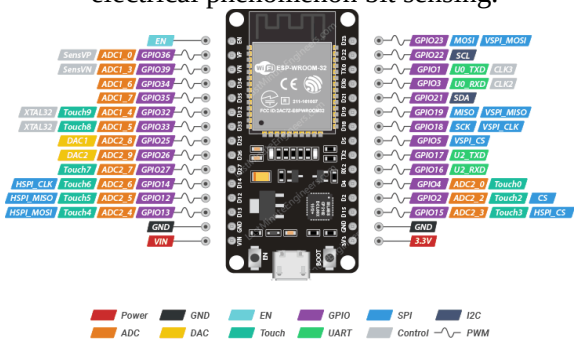
ESP32 encompasses a ton additional options than ESP8266 and it's tough to incorporate all the specifications during this obtaining Started with ESP32 guide. So, I created an inventory of a number of the necessary specifications of ESP32 here. except for complete set of specifications, I powerfully counsel you to visit the Datasheet.

• Single or Dual-Core 32-bit LX6 microchip with clock frequency up to 240 megacycle.
• 520 kilobyte of SRAM, 448 kilobyte of store and sixteen kilobyte of RTC SRAM.
• Supports 802.11 b/g/n Wi-Fi property with accelerates to a hundred and fifty Mbps.
• Support for each Classic Bluetooth v4.2 and BLE specifications.
• 34 Programmable GPIOs.
• Up to eighteen channels of 12-bit SAR ADC and a pair of channels of 8-bit DAC
• Serial property embrace four x SPI, 2 x I2C, 2 x I2S, 3 x UART.
• Ethernet raincoat for physical LAN Communication (requires external PHY).
• one Host controller for SD/SDIO/MMC and 1 Slave controller for SDIO/SPI.
• Motor PWM and up to 16-channels of light-emitting diode PWM.
• Secure Boot and Flash cryptography.
• Cryptographic Hardware Acceleration for AES, Hash (SHA-2), RSA, computer code and RNG.

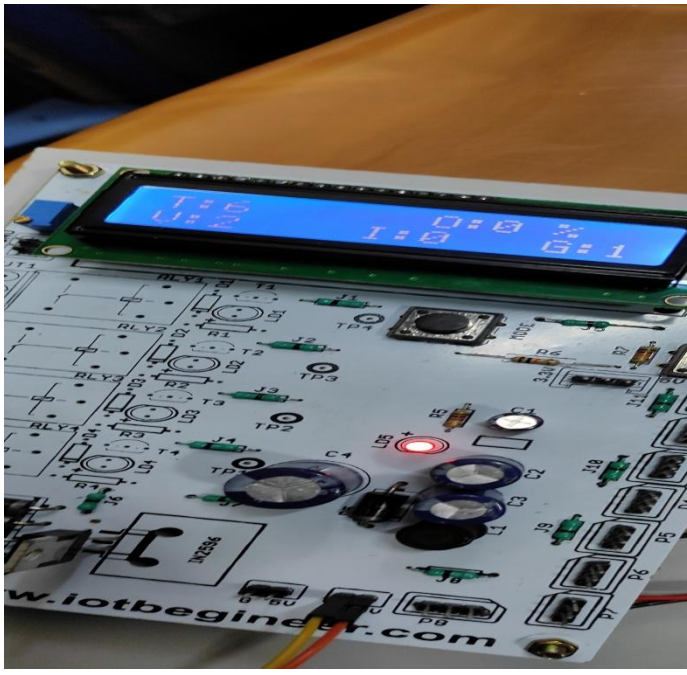
ESP32 Peripherals and I/O

Although the ESP32 has total forty eight GPIO pins, solely twenty five of them square measure broken resolute the pin headers on either side of the event board. These pins may be allotted to any or all types of peripheral duties, including:

• 15 ADC channels fifteen channels of 12-bit SAR ADC's. The ADC vary may be set, in microcode, to either 0-1V, 0-1.4V, 0-2V, or 0-4V
• UART interfaces two UART interfaces. One is employed to load code serially. They feature flow management, and support IrDA too!
• 25 PWM outputs twenty five channels of PWM pins for dimming LEDs or dominant motors.
• DAC channels 8-bit DACs to provide true analog voltages.
• SPI & one I2C interfaces There square measure three SPI and one I2C interfaces to attach all types of sensors and peripherals.
• 9 bit Pads nine GPIOs feature electrical phenomenon bit sensing.



IX. HARDWARE RESULTS



X. OUTCOME OF PROJECT

Application

- Distribution transformer monitoring
- Smart Grid
- Power Transformer Monitoring

ADVANTAGES

1. Detect of the faults in real time supported current, voltage, temperature, and internal flux
2. Increase system responsibility and stability by the observation system.
3. The system prevents faults and losses of the facility provide that considerably advantages utility customers
4. Overcurrent, overtemperature measure prevented using this system.
5. Sends message about health status of transformer frequently to the registered mobile number.

LIMITATIONS

1. This proposed method can be only attained with single transformer rather than multiple.
2. The setup should always be connected with a hotspot to a device for monitoring status.
3. It only provides the status of the transformer and if it operates in any abnormal condition it can only be rectified with man powers.

XI. CONLUSION

The transformers play an important role in distribution a part of installation. thus the observance and protection of electrical device is extremely crucial. this technique} introduces a replacement and improved method of electrical device health parameter observance victimisation IoT. The sensors incorporated within the system collect the info of electrical device health parameters like voltage, temperature and current. These datas are send to associate IoT platform. These data is sent and accessed victimisation HTTP protocol. The model design in such a way to solve the problems faced by consumer. By using such method, we can easily detect the fault and resolve it. It is highly reliable and locate the fault in three phase transmission line and also supposed to data storage. It works on real time so we maintain all data sheet and avoid the future problem in transmission line.

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