# A Project Report on IOT Based Substation Transformer Protection

Jayarajesh vattam,Dakshata Vishe, Prachi Pawar, Pratiksha Kapse,Aniket Suryawanshi

**Department of Electrical Engineering,**

**Mumbai University**

***Abstract-*** ***The main purpose of this project is to protect the transformer. A substation transformer is the most important equipment in power network. It is achieved by using the smart voltage and current monitoring system. By the means of maicrocontroller it gets the information and then remotely conveys it on the screen through the other PC. It is all done by using Internet of Things (IOT) that uses the Wi-Fi module that helps to connect the hardware and software. The data collected is then shared to the ThingsSpeak platform in which it is displayed by using the graphs of different parameters. By all this means manual operational efforts will be reduced.***

## CHAPTER 1: INTRODUCTION

Power is a very helpful and advantageous form of energy. Power plays a very vast and helpful job in our industrialized society. The power framework are firmly non-straight, and dynamic organizations. This electric power frameworks are brought together for practical and functional advantages. Various parts like generator, transformer, switches are used in power organizations.

The power generated at the primary generating stations are moved by using the transmission lines until this power enter in the substations. It contains the major aspects of checking the voltage, current and temperature varieties in the dispersion transformer in the substation. By fully backed up by chip and regulators for ceaseless observing the test fixations, are the activities of the expert at various time stretches, some of these important activities are been done in the Past recent years. Because of the expansion in the temperature at the transformers the current and voltage levels at the substation gets shifted radically. The normal of the force which is provided by the client can be deficient along these lines.

## CHAPTER 2: METHODOLOGY

### 2.1. Hardware implementation

This step involves material and component selection, hardware installation, and prototyping design. This project consists of using several electronic components to build up the voltage and current monitoring system. The main components used are Thermistor, Transformer, Buzzer, Microcontroller ATMEGA328, Voltage regulator, etc.

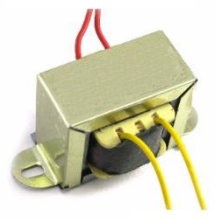
#### 2.1.1. Thermistor

An thermistor is a type of temperature sensor. It is a resistor in which the resistance varies according to the temperature. Thermistors are widely used in temperature sensors, current limiters, etc. This are classified into two types- Positive and Negative. The material used in the thermistor is generally a ceramic or polymers.

#### 2.1.2. Transformer

The transformer is an electric device which transfers energy by inductive coupling between its windings.

The transformer gives output of 12V, 12V and 0V. This transformer acts as a step-down transformer. The transformer core is made with the high permeability silicon steel.



#### 2.1.3. Buzzer

The buzzer is a type of signaling device which gives signal in type of audio signaling. The buzzer is powered by the DC voltage and is used in many parts like timers, alarms, printers, etc.

#### 2.1.4. Microcontroller ATMEGA328

The microcontroller is a type of integrated circuit designed for a specific operation in the embedded system. The ATMEGA328- PU is a low power microcontroller. It is an 8-bit microcontroller. The memory of the microcontroller includes 32KB of the programmable FLASH, 1KB OF EEPROM and 2KB of SRAM.

#### 2.1.5. Voltage Regulator

The voltage regulator is a type of voltage sensor which is used to maintain the constant voltage. The voltage regulator uses the simple feed- forward design and it also includes the negative feedback. The voltage regulator used is a IC 7805 which maintains the output voltage at a constant value.

### 2.2 Research Design

Provide an overview of substation transformer protection and the need for advanced monitoring and control systems. The next path that unravels is firstly the method to be adopted the system to protect the transformer at its maximum level which further. The project called "IOT BASED SUBSTAION TRNSFORMER PROTECTION''.

Culminating towards making the said project caviar in its utilization several components have been unleashed, some of which are mentioned so

1. Transformer,
2. Current Sensor,
3. Voltage Sensor ,
4. Microcontroller ATmega328 ,
5. Buzzer,
6. Thermistor

All in consolidation of the said components the Identify the types of sensors required for transformer monitoring, such as temperature sensors, current sensors, voltage sensors, and oil level checker.

Determine the optimal sensor placement locations on the transformer for accurate data collection. Discuss the selection criteria for sensors, considering factors such as accuracy, reliability, cost, and compatibility with IoT platforms. Explore the available communication options for transmitting sensor data to a central control system or a cloud-based platform, such as Wi-Fi, cellular networks, or dedicated communication platform

### 2.3 Hardware Design

Designing hardware for IoT substation protection involves creating a system that monitors and safeguards the substation's equipment, ensuring its proper functioning and preventing failures or damages. it's important to consult with electrical engineers and experts in substation protection to ensure compliance with industry standards and specific requirements. Here are some key aspects to consider when designing IoT substation protection hardware:

1. Sensors: Identify the types of sensors needed to monitor various parameters such as voltage, current, temperature, humidity, pressure, and gas levels. Choose sensors that are accurate, reliable, and suitable for the substation environment. Common sensor types include current transformers (CTs), voltage transformers (VTs), temperature sensors, and oil sensors.
2. Communication: Determine the communication protocols and networks to transmit data from the sensors to a central monitoring system or a remote control center. wireless protocols like Wi-Fi.
3. Microcontroller/Processor: Select a suitable microcontroller or processor to interface with the sensors, perform data processing, and control the substation protection system. Consider factors such as processing power, memory, input/output capabilities, and compatibility with the chosen communication protocols.
4. Security: Implement strong security measures to protect the IoT substation protection system from unauthorized access, data breaches, and cyber threats. Use encryption, authentication mechanisms, and access controls to secure the communication channels and prevent tampering or malicious activities.
5. Scalability and Modularity: Design the hardware system with scalability in mind, allowing for easy expansion and addition of new sensors or functionalities. Consider a modular approach that enables easy maintenance and replacement of components without disrupting the entire system

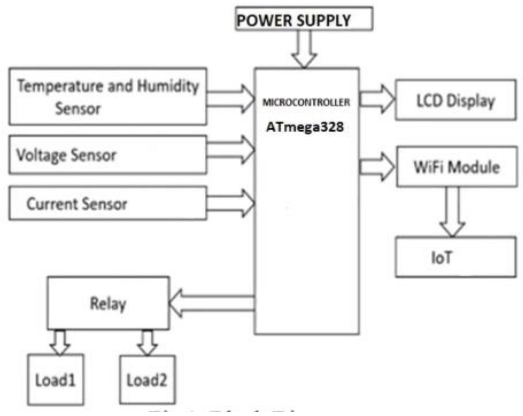



**Figure 2.2: Block diagram**

**Block Diagram Explanation**

First, we have a controller that has the number ATMEGA328.It has 28 pin chips. Now a Vcc pins connected (5V) Supply with Ground (power Supply) We have a crystal (5V) Supply with Ground (Power Supply) We have a crystal oscillator that is connected with 2 capacitors which are used to start the clock. The crystal oscillator value is 16mhz. It will execute the cycle of the programme on our clock (the clock used for executing the instructions). The 2 capacitors will push the crystals and our clock will start. We have a reset pin (reset bar) which is active low. Therefore, we will pull up the bar with a 5V resistor. We have the reset switch. Generally, control will be reset, rather than having a built-in logic. When we use the power supply, our constructor will first reset and then it will start. It will help to start smoothly. Now the main controller has A0 to A5, which are 6 analog pins and 0 to 13 total 14 digital pins are used to interface with the controller. As we have analog pins, we will start from the sensor part. We will use a transformer in our circuit when we have to protect it (with 230V). with a load (the same 230 V) (output input 230V) With will work as isolation. Now we have to connect our first Sensor (PT) (voltage fluctuation so PT will be at input. Side) PT will be connected in parallel to the monitor voltage input rating 230V and output voltage 3v (because if our Input Voltage increases due to some load, then output. Voltage will be increased from 5v to 10-12 v. Then our control will be changed. Therefore, we will use less voltage output. Then 5V PT is Connected parallelly 3V output is obtained as it is AC and we require DC. Then for that, then we will use a diode Capacitor to rectify it, then it will give DC but it will not give an exact voltage of 3v. Therefore, we will use a resistor for calibration of our output and then this will be given to the ADC line AO with Common ground (diode IN4007 1 amp filter capacitor 100uf). Now we will connect CT in Series in Output side (ratio 10:1) output will be AC and we require DC. So, for AC to DC, we connect a resistor current. Then it will develop as voltage and we will rectify the voltages by using the diode capacitor as it will not be the exact value then a resistor for calibration and output will be sent to ADC line A1. For temp sensors, we will be using a Thermistor (10K NTC negative temp coefficient) for the temp. Changing resistance will change but we need a change in voltage connect, so we will connect. One more resistor (which will be a potential divider) & its output will be sent to A2. Both (thermistor & resistor 10k) If the temp increases, then resistance will drop in comparison. Second, resistance will increase, then the voltage drop between junction & ground will increase. This voltage will be sent forward. (Same as for dec.) In the tank of oil we will keep afloat. The float will be outside of the shaft and that will contain an angular potentiometer 5V side 5V. One will be grounded and between shaftsters will be used for sensing, which will be connected to pin A8. The LCD display (16x2) is being connected. Here we have a VCC pin (Supply of 5V), ground pin (with ground) contrast pin. There will be a resistor in between the contrast & the ground pin (as resistor varies the brightness of LCD will

be varied). On the other hand, we have 3 pins. RS (data Command), Retrieve a and enable. RS & enable will be connected directly to the controller but the retrieve will be grounded and will have 8 duty pins. from 0 to 7, but due to spacing, we will connect only 4 pins. D4, DS, D6, D7 (called 4-bit mode) the pins will send 4 bit data 2 times in order 8 bit data will be displayed on the LCD) (This will be connected on the ADC line from 3,4,5,6,7,8 pins). From pin 9&10 we will get the output that we have set the limits to our sensor. This information from 9 and 10 is a logic signal which is low, so to amplify, if we take 2 transistors (an emitter will be common ground) , the collector will be connected to a coil of relay contactor (12v) contacts (both NO and NC), 1st relay, 1st contactor in series with 12v connected with buzzer Now to send data to the internet, pins 0&1 are Rx & Tx (common pin ) pins.

We will take an Ethernet module. Tx pin will be connected to RX (RJ45 JACK) given as a lane cable jack connected with a WIFI modem. Now this data will be sent to the cloud (we use Blynk cloud Service)

**Advantages and pitfalls of Substation monitoring:**

**Advantages: -**

- Detection of fault in real time based on current, voltage, temperature, and internal flux.
- Increase the system reliability.
- Increase the system stability.
- This system prevents fault and losses.
- Overcurrent and over temperature is been avoided by using the system.
- As losses are reduced it benefits to the consumers.
- Substation automation is a significant factor in preventing the electrical outage.
- This system saves the time for utility and the power distribution staff.

Saves the cost and reduces the need for onsite staff.

**Pitfalls: -**

- Maintenance cost will be more.

## CHAPTER 3: SCREEEN SHOT

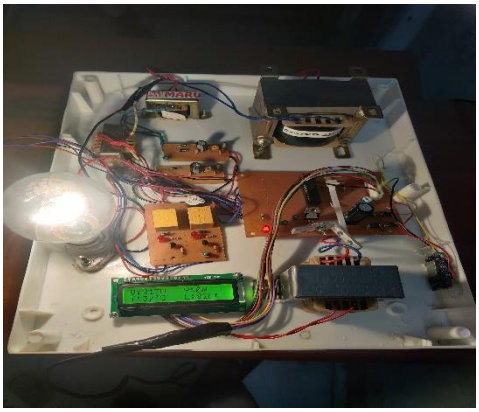


**Figure 3.1: Complete Setup of IOT Based Substation Transformer Protection**

**Where the IOT Based Substation Transformer Protection?**

Initially, the mainly system is used in the Substation. As we know the Transformer is the expensive and main component in the Substation

## CHAPTER 4: CONCLUSION, FUTURE SCOPE

### 4.1 Conclusion

The typical technology using the IOT wireless is being designated in this project. The energy management and the efficiency of the energy system is taken into consideration in this project. By employing this project, the effectiveness of the cost is also been considered by cutting down and the power consumption is also being reduced. As from the experiment one can typically understand that by using the wireless sensors, we can achieve best results for smart grid and monitoring system.

### 4.2 Future Scope

**A. Addition of GSM module:**

By joining the GSM module, it will actually send personalized SMS to the specialist. As microcontroller is customized so that a specific configuration of SMS can be utilized as a contribution for a microcontroller for the given activities.

**B. Addition of wireless camera:**

By introducing the wireless remote cameras in the area of the substation will give us an option for screening the substation in the superior manner. This will help in the observation of the transformer more frequently.

**C. Development in GUI:**

The window shown uses the Graphical User Interface (GUI). It can check the cooling temperature, hesitance load impedance, etc. and then this information can be coordinated into the displayer. This will assist the administrator in checking of the gadgets and equipment's properly and then it could control the trouble in the system without any disturbance in the overall system.

## REFRENCES

1. www.google.com
2. www.wikipedia.org