



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

# IJRSET

International Journal of Innovative Research in  
**SCIENCE | ENGINEERING | TECHNOLOGY**

# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 11, Issue 5, May 2022

**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA

Impact Factor: 8.118

9940 572 462

6381 907 438

[ijrset@gmail.com](mailto:ijrset@gmail.com)

[www.ijrset.com](http://www.ijrset.com)



# IOT Based Integration in Substation Monitoring and Maintenance

Rode Sonali<sup>1</sup>, Thorat Akshay<sup>2</sup>, Turkane Abhishek<sup>3</sup>, Dhone Avinash<sup>4</sup>, Ritesh Patil<sup>5</sup>

U.G. Student, Department of Electrical Engineering, AVCOE Sangamner, Maharashtra, India<sup>1</sup>

U.G. Student, Department of Electrical Engineering, AVCOE Sangamner, Maharashtra, India<sup>2</sup>

U.G. Student, Department of Electrical Engineering, AVCOE Sangamner, Maharashtra, India<sup>3</sup>

U.G. Student, Department of Electrical Engineering, AVCOE Sangamner, Maharashtra, India<sup>4</sup>

Associate Professor, Department of Electrical Engineering, AVCOE Sangamner, Maharashtra, India<sup>5</sup>

**ABSTRACT:** Monitoring of power substation usually involves monitoring of so many data and parameters that occur within minutes, hours, or days. Now, large amount of digital data can be exchanged, analysed and easily accessed through modern technology called the Internet of Things (IoT). In this paper, an IoT (using Wi-Fi development kit called ESP32) is used to control and monitor the performance of the of substation. This includes monitoring of each phase voltage, current oil level and temperature of transformer on users smart phone app (Blynk legacy App). The system also applies a safety feature to completely close the power plant in case of serious condition such as a fire and at the time of maintenance. Blynk app is used in this paper as an IoT analytics platform service which lets the programmers collect, visualize and analyse incoming data streams to the cloud. The collected data is sent to the Blynk Legacy app by the ESP32 module, create instant visualization of live data related to the monitored station, and send the required alerts. The engineers responsible for the station can monitor the progress of the work of the station through a smartphone or a computer - from anywhere in the world and even reprogram the system during operation, if necessary. This will improve the reliability of the power being delivered by speedy detection and isolation of the fault and maintaining a constant voltage level, which will make the project utmost reliable and compatible.

**KEYWORDS:** IoT, Substation Monitoring, ESP32, Blynk Legacy App.

## I. INTRODUCTION

Internet of Things is a modern typical path in IT arena, it is a revolution in transducing the data from things-to-things, human-to-human and human-to-things. It was created in the year 1998 and the Internet of Things term was first emanated by Kevin Ashton in 1999. Smart devices can be transferred, connect information and make orders instead of people. Connectivity for anything is a new technology that can communicate anytime, anything and anywhere.

IoT architecture is a framework that specifies the physical elements, network technical arrangement and setup, operating procedures, and data formats to be used. IoT architecture can differ greatly based on execution; it must be flexible enough for open protocols to handle many network applications.

### 1. Application Layer:

The user communicates with this application layer. It is in-charge of providing the customer with software resources.

Example: in smart home application, where users press a

button in the app to switch on a coffee machine, for example. The application layer is in-charge of providing the customer with application-specific resources. It specifies different uses for the IoT, such as smart houses, smart cities, and smart health.

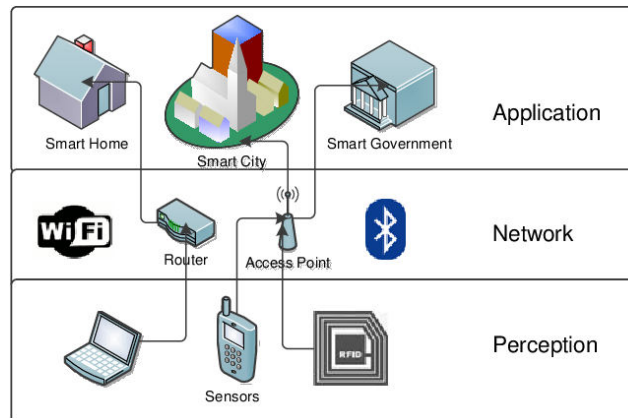


Fig.1 Three layers of IoT.

## 2. Network Layer:

The data obtained by these devices must be distributed and stored. This is the responsibility of the network layer. It binds these intelligent objects to other intelligent/ smart objects. It is also in charge of data transfer. The network layer is in-charge of linking smart objects, network devices, and servers. Its is also used to distribute and analyze sensor data.

## 3. Perception Layer:

This perception layer is the IoT architecture's physical layer. In these sensors and embedded systems are used mainly. These collect large amounts of data based on the requirements. This also includes edge devices, sensors, and actuators that communicate with the surroundings. It detects certain spatial parameters or detects other intelligent things /objects in the surroundings.

Many articles discuss the role of the Internet of Things in improving and controlling energy Efficiency in buildings . The Internet of Things is also used in environmental monitoring, health care systems, and efficient energy management in transport, as well as in drone applications. In the field of monitoring and controlling of power systems, for example, the authors in, built an "Automatic Power Factor Correction Unit (APFC)", for a purpose monitor the system's power consumption and automatic power factor improvement using Arduino microcontroller., design a smart energy monitoring system based on an IOT device "Photon microcontroller" and sensors. The system is used to sense or measure voltage and current levels in a house and integrated of web interfaces that are can keep analytical and graphical reports of daily power consumption. The main idea of the current paper is to design and build a system for monitoring and management power distribution substation of University of Mosul with automatic power factor correction technique and fire detecting/alariming unit. The system based on IoT using Photon device to send the measured data via the internetto blynk legacy app, visualize and analyse this data information. The most important design features are build a cheap energy monitoring system with power factor correction unit, real-time measure data visualization and system protection from fire or any other fault.

Paper is organized as follows. Section II describes automatic operation in substation. The flow diagram represents the working of a smart grid and things included in smart grid. The working of the model is explained in Section III. Section IV presents experimental results showing results of app and image of project model. Finally, Section V presents conclusion.

## II. RELATED WORK

With the rapid development of communication technology, information technology, electronictransformer technology, digital protection and measurement and control technology, variousmanufacturers and research institutes have done a lot of research work in the field of digital substationtechnology. According to incomplete statistics, since 2005, the State Grid Corporation hassuccessively launched more than 100 digital substations of different degrees, different voltage levelsand different modes, and has obtained a large number of digital substation research results andconstruction experience. From the statistical point of view, the main equipment used in the digitalstations that have been invested and under construction can be divided into:

- (1) Equipment based on IEC61850 standard is used above the interval layer;
- (2) The process layer adopts electronic transformers and conventional transformers; the switchgear Adopts intelligent operation box and cable connection;
- (3) Process layer device composition may be various combinations of the above device applications;

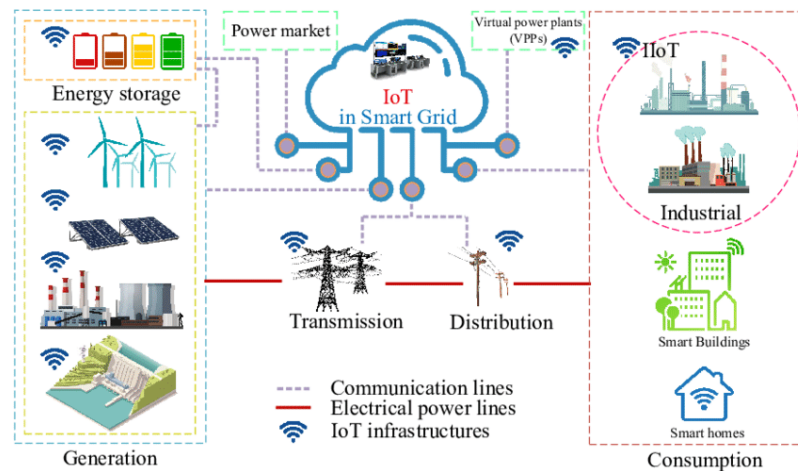


Fig 2 IOT in Substation(Smart Grid)

A Wi-Fi-based system is also integrated into the design which is used to send a data to substation if any fault in substation or at load side is detected. The primary operation of this system is to monitor all substation parameters on smart phone app and control all possible control from remote place. This system automatically controls and screens the equipment's of the substation. It can break circuit breakers at time of fault to ensure safety of substation equipment.

### III. METHODOLOGY

The purpose behind this undertaking is to secure the unknown electrical parameters like Voltage, Current and Frequency and send these ongoing qualities over IOT based checking and control with the temperature at the power station. This venture is additionally intended to ensure the electrical hardware by working an Electromagnetic Relay. This Relay gets enacted at whatever point the electrical parameters surpass the predefined esteems. The Relay can be utilized to run a Circuit Breaker to turn off the fundamental electrical supply. The client can send orders as IOT to peruse the remote electrical parameters. This system additionally can consequently send the continuous electrical parameters intermittently (in view of time settings) as SMS. This system can be intended to send SMS alarms at whatever point the Circuit Breaker trips or at whatever point the Voltage or Current, recurrence surpasses as far as possible.



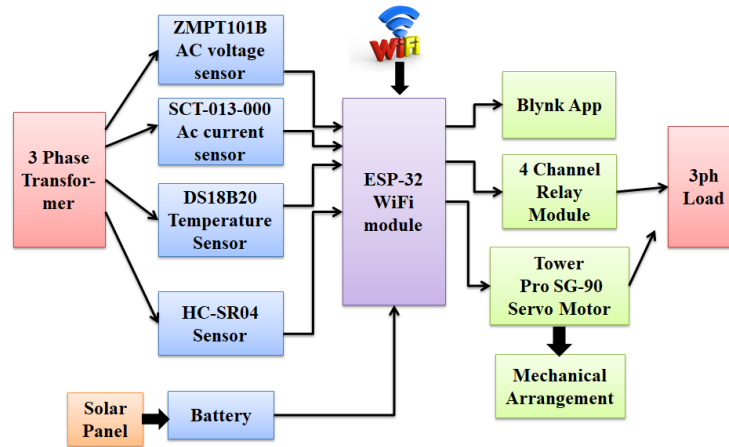


Fig 3 Monitoring System Block Diagram

Microcontroller (ESP 32) is powered with battery supply. Microcontroller will automatically get connected with WiFi which is mention in the code. Sensors start sensing voltage and current using voltage and Current sensors and send data to ESP 32 module. This will analyse all data and after that it will be send to Mobile app and operate relay accordingly in faulty condition. We are using Blynk app for monitoring purpose. App will give us real time monitoring of substation and also give notification alerts in abnormal conditions like over voltage, voltage drop, open circuit, short circuit, low oil level and Oil temperature. In Faulty Condition Circuit breaker will break Circuit. An disconnect switch is provided on app to open contacts from remote place to break supply. The whole system is powered with Solar power and battery to provide continuity of supply at the time of unavailability of power in substation.

For maintenance purpose a separate microcontroller i.e. Arduino Uno is used to avoid speed reduction in monitoring system and healthy operation of monitoring as well as maintenance system. At the time of maintenance it will ask to enter password with the help of keypad provided to ensure more safety of worker at the time of maintenance. After maintenance with a single key press it will close CB again to continue power supply.

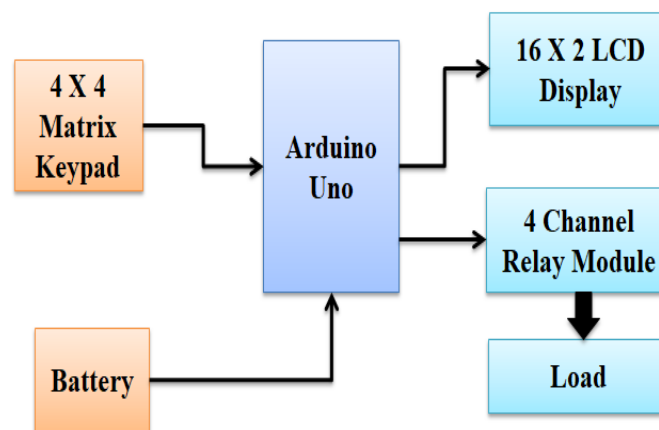


Fig. 4 Maintenance System Block diagram



IV. EXPERIMENTAL RESULTS

Table shows the results of Actual and Values given by IoT cloud to blynk App. voltage, current, oil level and temperature of oil. The reading showed on app is nearly equal to the actual value of all parameters measured by standard meters. In case of any abnormal condition like over voltage, open circuit, short circuit, low oil level, and increased oil temperature , system will give notification to user so he/she can take preventive action on it.

Parameters	Actual Value		Values On App
Voltage	R	231	230
	Y	229	228
	B	225	225
Current	R	0.38	0.47
	Y	0.52	0.62
	B	0.56	0.6
Oil Level	5		5
Oil Temperature	122		121

Table 1 Observation Table

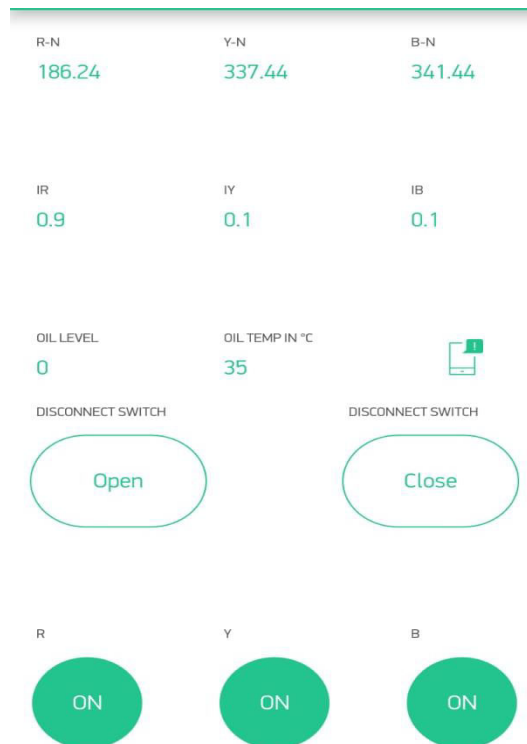


Fig.5 Blynk Legacy App Output

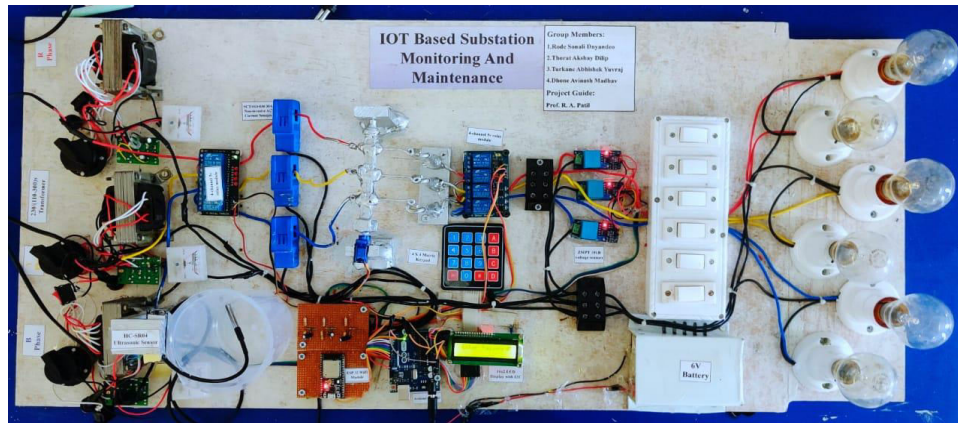


Fig.6 Project Model

#### Advantages

- The immediate attention can take place if a variation happens in the sub-station parameters.
- IOT based control is easy to identify the fault in any variant.
- The various parameters can be modified and analyzed continuously through a network.

#### Application

- Sub-station
- Power generation
- Distribution area.

## V. CONCLUSION

We made a prototype for monitoring and maintenance the substation and transformer factors like voltage, current, power and temperature. All these considerations will be observed using Arduino. We went for programming in such a way that it can monitor all parameters and comparative coding logic is set so that when parameters goes beyond the limit or below the limit it will tell fault occurred as described in coding logic, will be displayed on OLED Screen. All the output devices like buzzer, LED indicator will alarm the people sitting on substation. The automatic command will be given to trips the relay so that further destruction would stop. We enhanced this by adding IOT module so that it can be monitored and controlled from sitting at any corner of the world. We added one more feature of power supply sharing between two areas if grid of one area gets failed as well as total cut off of power supply in case of emergency

## REFERENCES

- [1]. JyotishmanPathak, Yuan Li, VasantHonavar and James D. McCalley, "A Service-Oriented Architecture for Electric Power Transmission System Asset Management", In ICSOC Workshops, pp: 26-37, 2006.
- [2]. B. A. Carreras, V. E. Lynch, D. E. Newman and I. Dobson, "Blackout Mitigation Assessment in Power Transmission Systems", Hawaii International Conference on System Science, January 2003.
- [3]. Xiaomeng Li and Ganesh K. Venayagamoorthy, "A Neural Network Based Wide Area Monitor for a Power System", IEEE Power Engineering Society General Meeting, Vol. 2, pp: 1455-1460, 2005.
- [4] Mur-Artal R, Montiel J M M, Tardos J D. ORB-SLAM: a versatile and accurate monocular SLAM system [J]. IEEE Transactions on Robotics, 2015, 31(5): 1147-1163.
- [5] Zhang Zhigang, Zhao Liqiang. GaoTianying. Research on training program of computer science professionals for big data applications [J], Tianjin Education. 2017, (1): 32-33.
- [6] Zhang Fan. Thinking on the cultivation of computer professional application talents in the direction of mobile internet [J]. Science and Technology Information. 2015, (24): 129-130.
- [7] J-M. Filhol et al. "Operation and performance upgrade of the SOLEIL storage ring", PAC'09, pp.2312-21314, Vancouver (2015).



[8] Maalla A (2016) Construction of Information Ecosystem on Enterprise Information Portal (EIP). J Electra Electron Syst 5: 205. doi:10.4172/2332-0796.1000205 .

[9] F. Bouvet, “Design of the DC and AC magnet power supplies for the SOLEIL synchrotron radiation source”, EPE’09, Alborg (2015).





**INNO SPACE**  
SJIF Scientific Journal Impact Factor  
**Impact Factor: 8.118**



**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

9940 572 462 6381 907 438 [ijirset@gmail.com](mailto:ijirset@gmail.com)



[www.ijirset.com](http://www.ijirset.com)

Scan to save the contact details