

# **DATA ACQUISITION AND MONITORING OF ELECTRICAL POWER SYSTEM**

**AN OPEN LAB REPORT**

*submitted by*

**CB.EN.U4EEE16145**

**RAHUL ASHWIN M.**

*in partial fulfillment for the award of the degree  
of*

**BACHELOR OF TECHNOLOGY  
IN  
ELECTRICAL AND ELECTRONICS ENGINEERING**

**AMRITA SCHOOL OF ENGINEERING, COIMBATORE**



**COIMBATORE- 641112**

**March 2019**

**Amrita School of Engineering**

# **Department of Electrical and Electronics Engineering**

## **Vision of the Department**

Mould generations of electrical and electronics engineers on global standards with multi disciplinary perspective to meet evolving societal needs.

## **Mission of the Department**

- Empower students with knowledge in electrical, electronics and allied engineering facilitated in innovative class rooms and state-of-the art laboratories.
- Inculcate technical competence and promote research through industry interactions, field exposures and global collaborations.
- Promote professional ethics and selfless service.

## **Program Educational Objectives – B.Tech (Electrical and Electronics Engineering)**

### **PEO1:**

Graduate can demonstrate electrical and electronics engineering problem solving skill along with proficiency in communication and professional excellence in project management and execution.

### **PEO2:**

Graduate can be employable in engineering services including ICT enabled sectors and also motivated for entrepreneurship.

### **PEO3:**

Graduate will be competent for higher studies in world class universities and research in industrial organizations.

### **PEO4:**

Graduate will manifest social commitment, environmental awareness and moral and ethical values in professional and other discourses.

**AMRITA VISHWA VIDYAPEETHAM  
AMRITA SCHOOL OF ENGINEERING, COIMBATORE, 641112**



**BONAFIDE CERTIFICATE**

This is to certify that the open lab project report entitled “**DATA ACQUISITION AND MONITORING OF ELECTRICAL POWER SYSTEM**”

*submitted by*

**CB.EN.U4EEE16145**

**RAHUL ASHWIN M.**

in partial fulfillment of the requirements for the award of the **Degree Bachelor of Technology** in “Electrical and Electronics Engineering” is a bonafide record of the work carried at Amrita School of Engineering, Coimbatore.

## **ABSTRACT:**

This project presents the development of a software supported acquisition system for monitoring and analysis of the basic electrical power system parameters. The experiment consists of two functionally connected segments. The first segment involves obtaining the real time values of single phase voltage, current, power, power factor through CTs and PTs. The second part of this procedure includes the real-time recording of these parameters. This is done by uploading the values obtained through a private server to the cloud. Then the values are taken from the cloud and displayed through a mobile app that has been designed. The mobile app designed for this system displays real time values of the measured parameters. The mobile app also presents a graphical representation of the measured and calculated parameters.

## **I. INTRODUCTION:**

In the upcoming modern generation and transmission systems, monitoring, collection of data from different points called as nodes of the system are necessary. This project presents data acquisition at different nodes such as voltage generated by solar panels, energy generated as a whole, secondary voltages of step up and step down transformers using PT etc. These measurements are important in the development of a smart grid which requires control based on the measured values. With a mobile application developed, these data are sent to the app so that any user can know the amount of energy consumed. This can also be used in electricity board to find the power losses occurring in the transmission lines. Data acquisition generally relates to the process of collecting the input data in digital form as rapidly, accurately and economically as necessary. A typical Data Acquisition System consists of individual sensors with the necessary data conversion, data processing, data handling and associated transmission, storage and display systems. This experiment is restricted only to monitoring and acquisition of data and no control actions are performed.

## **II. METHODOLOGY:**

A single phase AC system with R load and RL load is taken as the system. The supply voltage, current are measured using PT and CT respectively. The controller used to process the measured signals is ARDUINO UNO. The PT used is ZMPT101B and the CT used is ACS712. These modules give outputs that are proportional to the input signals. Adjusting the sensitivity of the

modules, accurate values can be measured. The sampling rate and finding the accurate results from the proportional signals is done by coding the ARDUINO microcontroller. For high accuracy “energy monitor” (emon) library is used to find the power factor which measures the zero crossings of voltage and current, thereby finding the time difference between these two signals. The time difference is multiplied by 18 degrees for a 50Hz system to get the difference in time in terms of electrical angle. Cosine of this angle will give the power factor. Once all these values are measured, the values are to be sent to the mobile app. The values are sent to the mobile application through a server which is an open source platform. This platform can support all boards like Arduino Uno, Raspberry Pi etc. The app can be used through both cloud server as well as private server. When private server is used, multiple number of labels can be used in the blynk app else a paid subscription has to be used. In the blynk app, virtual pins are used which are connected to the ports of the Arduino through the server. Port number used is 8080. Data security is also taken care because prevention of data theft is important. Hence to access the server, an authentication code is generated which has to be verified for connecting to the server. Once this connection is established all values can be communicated through the server to the application. With this configuration, all the above listed applications are possible

**III. BLOCK DIAGRAM:**

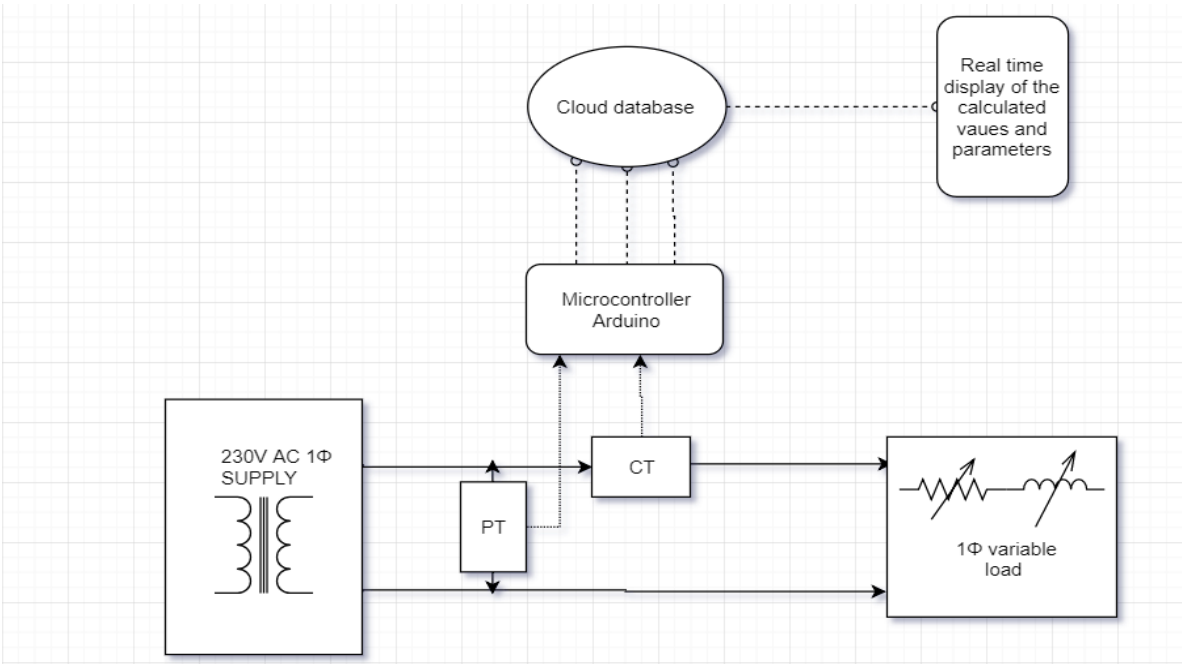


Fig 1: Block diagram of the experiment

#### IV. HARDWARE SETUP:

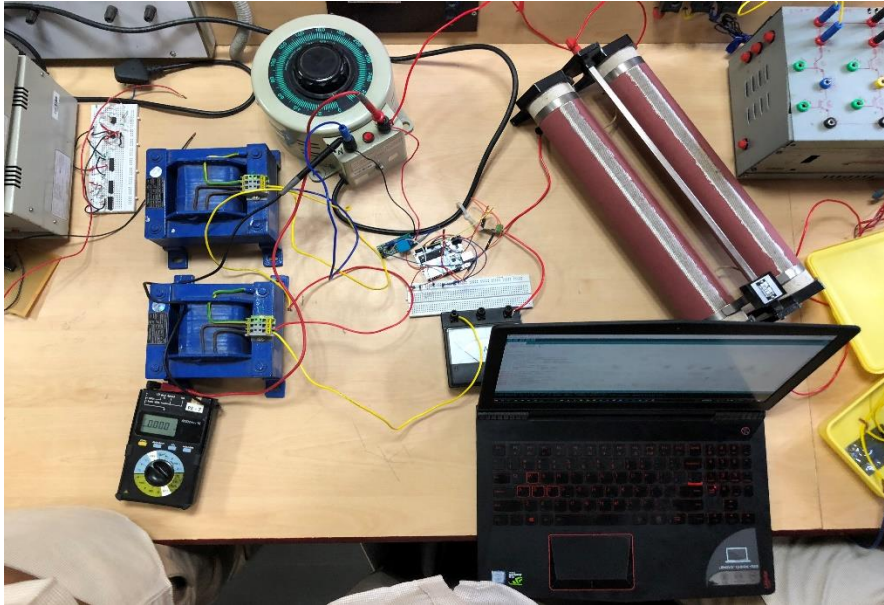


Fig 2: Hardware setup for the experiment

An auto transformer is used so that variable voltage source can be obtained so that the system can be tested with different levels of voltage and current. The system is tested for both R and RL loads. All the values obtained in the mobile app are verified with meters connected in series and parallel.

#### V. RESULTS AND DISCUSSION:

##### VOLTAGE AND CURRENT MEASUREMENT WITH METERS:



Fig 3: Voltage and current measurement readings from meters for  $V=65V$  and  $I=0.5A$

## VALUES DISPLAYED IN THE MOBILE

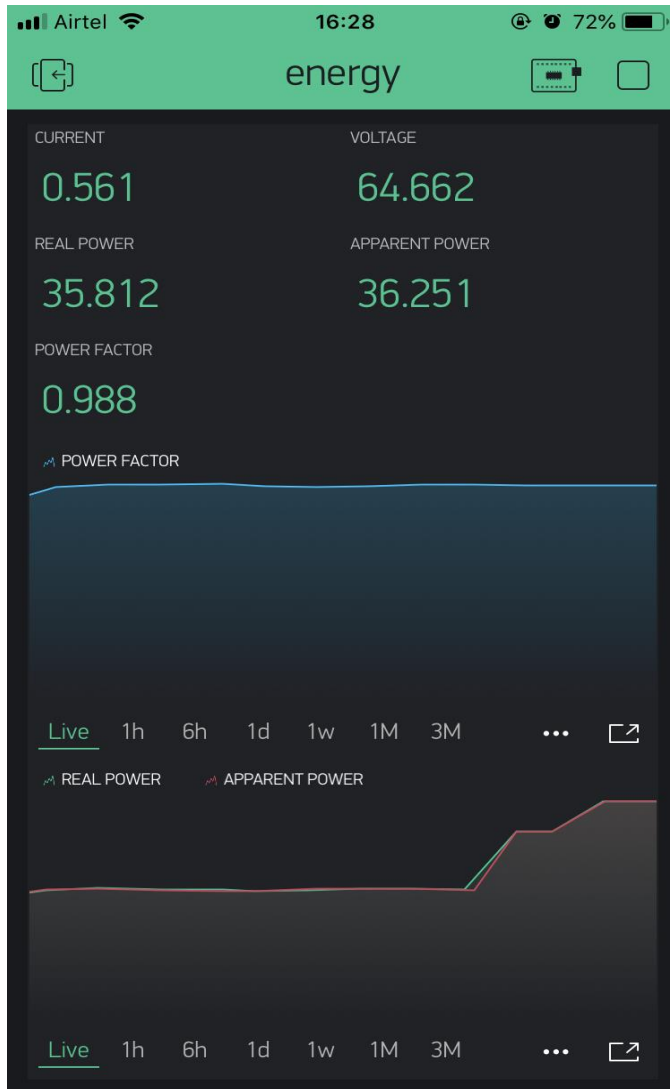


Fig 4: Values displayed in the blynk

application

## VALUES DISPLAYED IN THE METERS:



Fig 5: Voltage and current values from meters for  $V=120V$  and  $I=1A$

**VALUES DISPLAYED IN THE MOBILE APP:**

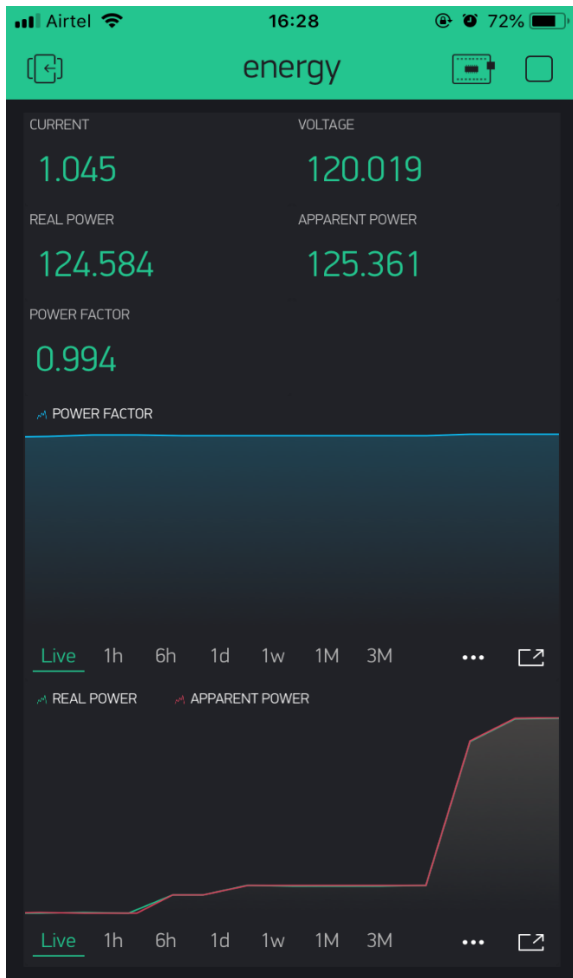


Fig 6: Values displayed in mobile application

For both conditions, it can be seen that the values of voltage and current obtained are almost similar. The values, once measured are sent to the blynk application through a private server.

## **VI. CONCLUSION:**

The collection of data from different points called as nodes of the system are necessary for monitoring the transmission network. Hence in this project we have implemented a small prototype to verify the measurement of values and its accuracy, values sent to the mobile application through the server. This experiment can be extended to taking control actions based on the obtained values which are more practical.

## **REFERENCES:**

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