

# Smart Electrical Monitoring of VIVA Institute of Technology

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**Abstract-** Energy monitoring and conservation holds prime importance in today's world because of the imbalance between power generation and demand. Currently, there are very accurate electronic energy monitoring systems available in the market. Most of these, monitor the power consumed in a domestic household, in case of residential applications. But there are applications where the fluctuations of electricity can prove hazardous and can cause a substantial damage to the equipments. Hence the proposed project implements the use of Internet of Things (IoT) platform using Raspberry Pi to monitor the values of voltage and current which are an essential parameters to be monitored for the proper functioning of the equipments. The values of voltage and current being monitored are sent over the internet to the cloud and they can be accessed over the mobile app or by logging to the website where data is logged. Also the increase in value of current depicted can make understand the occurrence of a problem at the load side. The concept of energy efficient devices has come up in various arenas such as lighting, air conditioning and so on. An be identified by such a monitoring.

**Keywords—**Internet of Things (IoT); Raspberry Pi 3; ADC; Current sensor; Voltage Sensor; VPN server

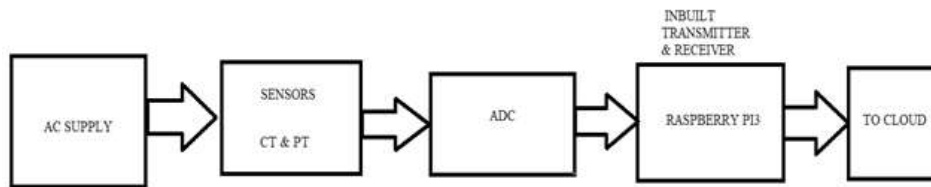
## I. INTRODUCTION

Conservation of energy is one of the most important need of the day. The current scenario says that the power generated, which is primarily contributed by fossil fuels may get exhausted within the next 20 years. The concept of energy efficient devices has come up in various arenas such as lighting, air conditioning and so on. Electrical monitoring is an important tool for determining the efficiency of various devices. It is also useful in determining whether there is an increase in consumption of electricity by comparing it with regular electrical consumption. Also many of the critical equipments in Industries and Healthcare facilities need to have precise voltages and current levels failing which the equipments may fail causing permanent damage to such costly equipments. Employing an employee for monitoring purposes was the method adopted by the industries till date. However, due to advancement of technology, there is no need to be physically present at the system to be monitored. By means of APIs and IoT, the data can be sent via the internet to a server connected to a cloud wherein the data is logged and can be accessed by the user for monitoring purposes. It consists of three phases:- Sensing phase, Processing phase, Transmission and data storage phase. The sensors connected are included in sensing phase. The Data Processing is done with the help of ADC connected which generates the signals in form PWM signals for the Raspberry pi controller to read and process it for data transmission. Transmission and data storage is done via the internet and the cloud server where the data is logged on and the user can access it by entering appropriate credentials which are only allowed to access by the designated officials. Thus theft and tampering of data is also prevented.

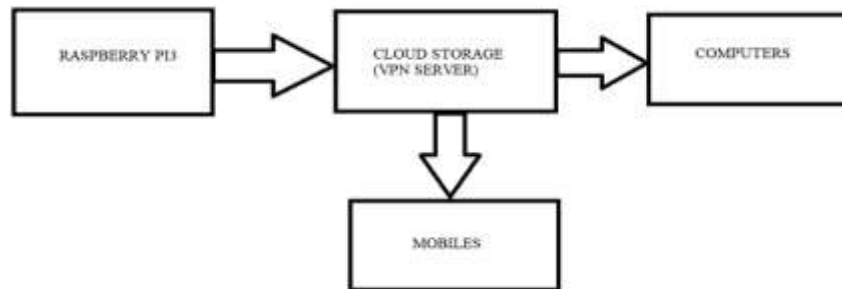
## II. CURRENT SCENARIO AND PROBLEM DESCRIPTION

In India, the power sent to end users i.e. to the load side consumers is controlled by the distribution utility companies. Hence, there is a lot of fluctuations in the voltages as switching loads are present in the power systems. Also harmonics and transients are present in the power system which are harmful for operation of critical loads. They not only affect the life of the equipments due to fluctuations but also may cause permanent damage incase of shortcircuits or temporary rise of surge currents and occurrence of transients. These harmonics and transients are uncontrolled at the user end by the utilities. Hence, the critical loads need to have accurate systems in place to monitor the quality of power supplied to them. Also, if the load current rises too much then it results in decrease of powerfactor which infact decreases the overall powerfactor of the system drawing more power. This results in the utility companies penalizing the consumers. Therefore, a proper monitoring system needs to be in place to ensure power quality is maintained and appropriate measures are undertaken to ensure the same.

### III. BLOCK DIAGRAM



**Fig. 1 Sensing and Transmission Phase**

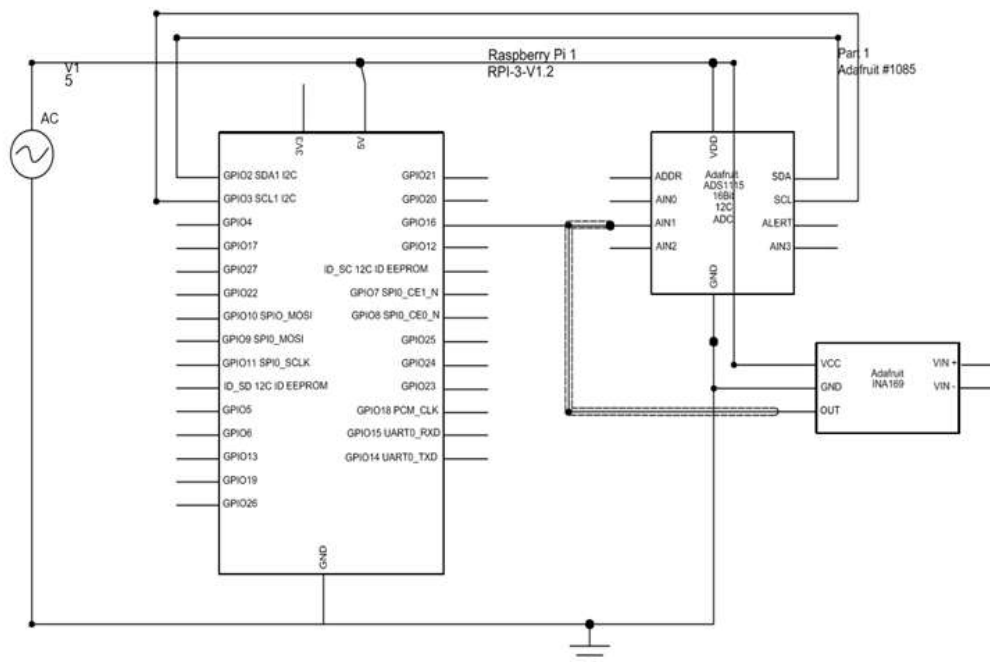


**Fig. 2 Receiver Stage**

### IV. WORKING

The sensors collect the data of current & voltage of the supply system. The values of current and voltages are sensed by the Current Transformer. The Raspberry Pi3 fetches the data from current transformer which is further processed. Now the data is sent via the ADC which converts the signals into the corresponding pulses which are generated by PWM method. These pulses are sent to Raspberry Pi3 which processes the data and sends it over the web to the cloud server and stores it on the cloud. The cloud can be accessed by the required credentials over the authorized systems and handled by the authorized personnel.

### V. CIRCUIT DIAGRAM



## VI. COMPONENTS

### 6.1 Raspberry Pi3



The biggest change that has been enacted with the Raspberry Pi 3 is an upgrade to a next generation main processor and improved connectivity. The Raspberry Pi 3 features the same 40-pin general-purpose input-output (GPIO) header as all the Pis going back to the Model B+ and Model A+. Any existing GPIO hardware will work without modification; the only change is a switch to which UART is exposed on the GPIO's pins, but that's handled internally by the operating system.

### 6.2 Current Transformer



It is used for measurement of current passing in the phase line. This is an invasive type CT which has a very low output current and a very high input sensing range, in this case being 150 amps. Output is of 50mA.

### 6.3 ADC



For microcontrollers without an analog-to-digital converter or when you want a higher-precision ADC, the ADS1115 provides 16-bit precision at 860 samples/second over I2C. The chip can be configured as 4 single-ended input channels, or two differential channels. As a nice bonus, it even includes a programmable gain amplifier, up to x16, to help boost up smaller single/differential signals to the full range.

#### **6.4 VPN server**

Real VNC or VNC server and viewer is a simple secure remote access and support software solution for Raspberry Pi platform. Remote access to the server by accessing direct and cloud connections which is free for noncommercial users and can connect upto 5 users per account. It can transfer and store data on cloud according to hardware configuration of the server.

#### **6.5 IP Scanner**

Advanced IP Scanner is software which is used to scan the available IP address to enter into the IP of the Raspberry Pi3. It is an useful software in determining all the network devices, gives access to shared folders, provides remote control of computers and can even turn off computers remotely

### **VII. ADVANTAGES**

- Real time tracking
- No Physical presence needed
- High level security access
- Saves time and cost
- High level Accuracy

### **VIII. CONCLUSION**

Reduction in cost and Decrease in manpower is possible due to advancement of technology. As such, different types of monitoring which previously employed manpower, is being replaced by robotics and automation. The project proposes to replace continuous monitoring needed to be done by human beings with changing technology, that is, Internet of Things (IoT). The accuracy of such system is way greater than what the human accuracy is. Also there is a cost benefit in such systems. Due to automation, much of the time is also saved which in turn helps in reduction for execution time.

### **IX. FUTURE SCOPE**

Internet of Things is a rapidly emerging field and it is expected that almost all the things which could not interact or virtually respond can be monitored and controlled using this technology. Monitoring system particularly Smart Electrical Monitoring system can be put to use in various industries like chemical industries and power plants where boilers and furnaces need to have a precise supply system for their operation. Also, it can be used in healthcare facilities where the medical equipments need to have a precise values of voltage and currents for the proper and timely operation. Emergency facilities need to have proper supply system as continuity of supply system cannot be compromised as such. And by suitable means, the voltages and currents can be controlled by the same circuit with suitable modifications.

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