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IoT Based Automatic Power Factor Correction & Energy Monitoring System

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ABSTRACT: This paper is review on the system which monitors different factors of the load and these data are continuously updated onto a webpage using IoT. If any defect occurs, the system sends alert messages to the concerned person and an electronic relay activates. As the inductive load rises there will be a fall in power factor, therefore this system incorporates a power factor improvement mechanism by switching the capacitor banks. The main objective is to build an Automatic Power Factor Correction (APFC) Unit, for variable load which is able to monitor the energy consumption of an inductive load and automatically improve its power factor. It will help to reduce the penalty due to low power factor and the utilities in the protection of induction motor in addition the problems are identified before any failure.

KEYWORDS: Power Factor, Automatic Power Factor Correction, Capacitor Banks, IoT.

I.INTRODUCTION

Automatic power factor correction techniques can be applied in the power systems, industrial units and also households to make the system stable. As a result, the system becomes stability and efficiency of the system as well as of the apparatus increases. The use of microcontroller based power factor correction system is used to reduce the overall costs for consumers and the suppliers of electrical energy. Power factor correction is made by capacitor banks it is a very efficient method.it reduces reactive power consumption and also minimizes the losses and at the same time increases the electrical system's efficiency. Power saving problems and reactive power management has led to the development of single phase capacitor banks for industrial and domestic applications. The development of the project is to improve and upgrading the operation of single phase capacitor banks by developing a micro-processor based control system. The control unit will be able to control the capacitor bank; it's based on the varying load current. Current transformer is used to measure the load current for sampling purposes current transformer plays a major role in it. Intelligent control using this micro-processor control unit ensures even utilization of capacitor steps, minimizes number of switching operations and optimizes power factor correction. This automatic power factor correction technique can be applied to the industries, power systems and also households to make them stable and due to that the system becomes stable and efficiency of the system as well as the apparatus increases. The use of microcontroller reduces the costs and the customers become beneficial according to the simulated output because the power factor of the specific selected industry is corrected from 0.66 to 0.92 improved value.

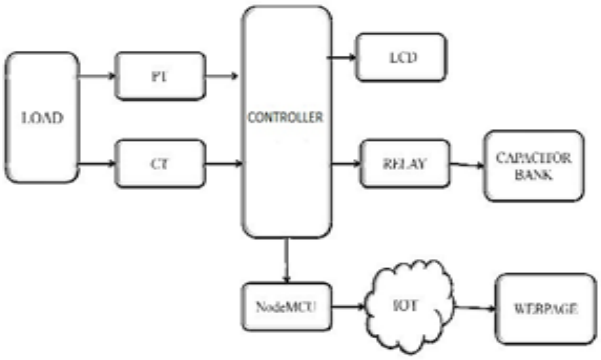

Fig.1. Block diagram of proposed system

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|| Volume 9, Issue 12, December 2020 ||

II.LITERATURE SURVEY

. In paper "Automated Power Factor Correction and Energy Monitoring System" written by Yusuf Mohammad Mohsin1and Mohammad MonirujjamanKhan , the author has pointed at the an Automatic Power Factor Correction (APFC) Unit, which is able to monitor the energy consumption of a system and automatically improve its power factor. An open source energy monitoring library was implemented in the design for accurate power calculation. The APFC device calculates the reactive power consumed by a system's inductive load and compensates the lagging power factor using capacitance from a capacitor bank.

In paper "IOT Based Power Factor Correction" by Grace Dias1, Rosmy Johnson2, Sajay Saju3, Sreelakshmi K.V4, Sunil V. Chandran5 state about power factor correction using IoT so as to operate it automatically in the power system and also to help understand the variation of power with respect to various load types. This would further enable efficient power management, power analysis and careful future designs for further expansions. Thus online power monitoring is enabled along with conventional power factor metering.

In paper "IoT Based Energy Monitoring System for Energy Conservation" by Prof.Ganesh K. Shirsat1, Nilesh U. Bhangale2, Urvesh Y. Gurav3, Suraj A. Jawale4 discuss about e layout and put into effect a low-price IoT energy monitoring system that can be used in many applications, which include power billing device, strength management in smart grid and home automation. The design is primarily based on a low-fee PZEM-004T, the use of non-invasive CT sensors, SD3004 electric powered electricity dimension chip and ESP8266 We maximum D1 mini microcontroller for retrieving data from sensor nodes and sending information to server via internet.

In paper"IoT based smart energy meter monitoring and controlling system" written by Lilavati Pujari, the author has pointed at scenario, energy saving holds prime significance because of inequality between demand and power generation. Using Wi-Fi module entire system will be controlled. Internet of Thing (IoT) is internally related to computing tricks transferring the data under the network with no any help of a human to human or human to computer interrelation. The load to the consumer is to consume regularly with regular monthly payment of the bill. When the electricity bill is paid then the supply will continuously flow or provides.

III PROPOSED SYSTEM DEVELOPEMENT

A. INTERNET OF THINGS

The Internet of Things (IoT) is a new revolution for Data Transfer and Storage. Objects that make themselves recognizable and they obtain intelligence by making or enabling context related decisions to the situations. They can transfer information about themselves. They can access information that has been used by other things, or they can be components of other services. The three factors thatmakes IoT look forward are Sensing Nodes, Embedded Processing and Communication. This transformation is accompanied by the emergence of cloud computing capabilities supported by an increased storage capacity and high-end data processing and the Machine-to-Machine communication for data transport with complete security for data. By introducing cloud computing, we can make a full call to the storage resource pool and computing resource pool in the cloud computing architecture, and provide high reliability for IoTcloud storage service and efficient cloud computing services to users. This Machine-to-Machine service layer will provide the needed services like data transport, security, devices, management and device discovery in a harmonized manner across a vertical domain to the application layer.

B. POTENTIAL TRANSFORMER

Potential Transformer is used to stepdown the input voltage because the maximum rating of Arduino is very less compared to the input voltage. So, the PT is used to stepdown the voltage. The rating of PT used to step down the supply voltage of 230 Volts required volts by the circuit to operate. The ratio of the number of turns on each coil, called the turn's ratio, determines the ratio of the voltages. A step down transformer has a large number of turns on its primary (input) coil which is connected to the high voltage mains supply, and a small number of turns on its secondary (output) coil to give a low output voltage.

C. CURRENT TRANSFORMER

Current Transformer is used to stepdown the input current because the maximum rating of Arduino is very less compared to the input current. So, the CT is used to stepdown the current. The CT is used to step down the supply current as required by the circuit to operate. When current in a circuit is very high it directly applies the measuring instruments, a current transformer produces a condensed current perfectly proportional to the current in thecircuit, which can be appropriately connected to recording andmeasuring instruments. It also isolates the measuring instruments from what may be very high voltage in the monitored circuit. They are frequently used in metering andprotective relays in the electrical power industry.

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D. CONTROLLER

Arduino or any other relevant platform which is an open-source platform. It is easy-to-use hardware and software. Arduino boards are able to read input from light on a sensor, a finger on a button, or a Twitter message and turn it into an output activating a motor or load, turningan LED on. You can tell your board what to be done by sending a set of instructions to the microcontroller on the board. There are many other microcontrollers and microcontroller platforms are available for computing. Parallax Basic Stamp, Net media's BX-24, Phi gets, MIT's Handy board, and many others offer similar functionality as the same.Arduino looks simple process of working than with microcontroller, but it offers some advantage for students, and interested amateurs over other systems. It will fetch input from source module and process them and decide the required action for them. Arduino is programmed to read the parameters the load. Real time voltage, current and power are uploaded to a webpage and checked whether these values are within the range. If the values are not within the specified range, then corresponding actions to be taken place. Arduino boards are inexpensive compared to the other microcontroller.

E. LCD

LCD (Liquid Crystal Display) is an electronic display module. A 16x2 LCD display is a very basic module and is frequently used in various devices and circuits. These modules are chosen over seven segments and other multi segment LEDs. The advantages are: LCDs are very economical, easyto program, have no limitation of displaying special & even custom characters, animations and so on. The image of 16*2 LCD display is used here. A 16*2 means display 16 characters per line and there are 2 such lines. On this 16*2 LCD display each character is displayed in 5*7-pixel matrix. This LCD has two registers that are Command and Data registers.LCD display is a most common device to attach the microcontroller. Some of the most common LCDs connected to the microcontroller are 16x2 and 20x4 displays. In this project a 16x2 LCD, model JHD 162A which shows the power factor and the phase lag between voltage and current in milliseconds

E.RELAY

The Relay is an electrically operated switch. Relays are used to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits need to be controlled by single signal. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the contact of the switch.

F. CAPACITOR BANK

In this method, the static capacitors are connected in parallel with the load for improving the power factor. Because thelagging current of the load is eliminated by the leading current of the static capacitor. Though it has some limitations like the inability to absorb harmonics and doesn't provide step-less correction, it is a popular choice for PFC for its low cost of installation and maintenance.

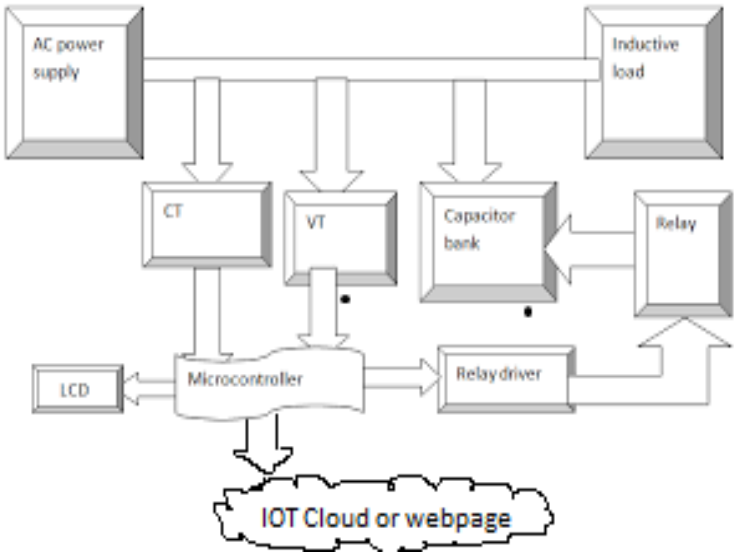

Fig.2. Diagram of proposed system for APFC using IOT

V. CONCLUSION

.Power factor correction equipment designed based on microcontroller and capacitor banks using IoT was used for measurement and monitoring of modelled electrical load and the following deductions were obtained: The power factor

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correction device was able to improve the power factor from 0.76 to 0.97.The average savings in energy consumption were increased of the designed load and different load patterns. With the proper amount of reactive power compensation, the system capacity is released as there is a reduction in current drawn. The economic analysis suggested the significant amount of savings in energy cost. Better power factor is responsible for better efficiency of machine it will improve power consumption in machine and reduces losses.

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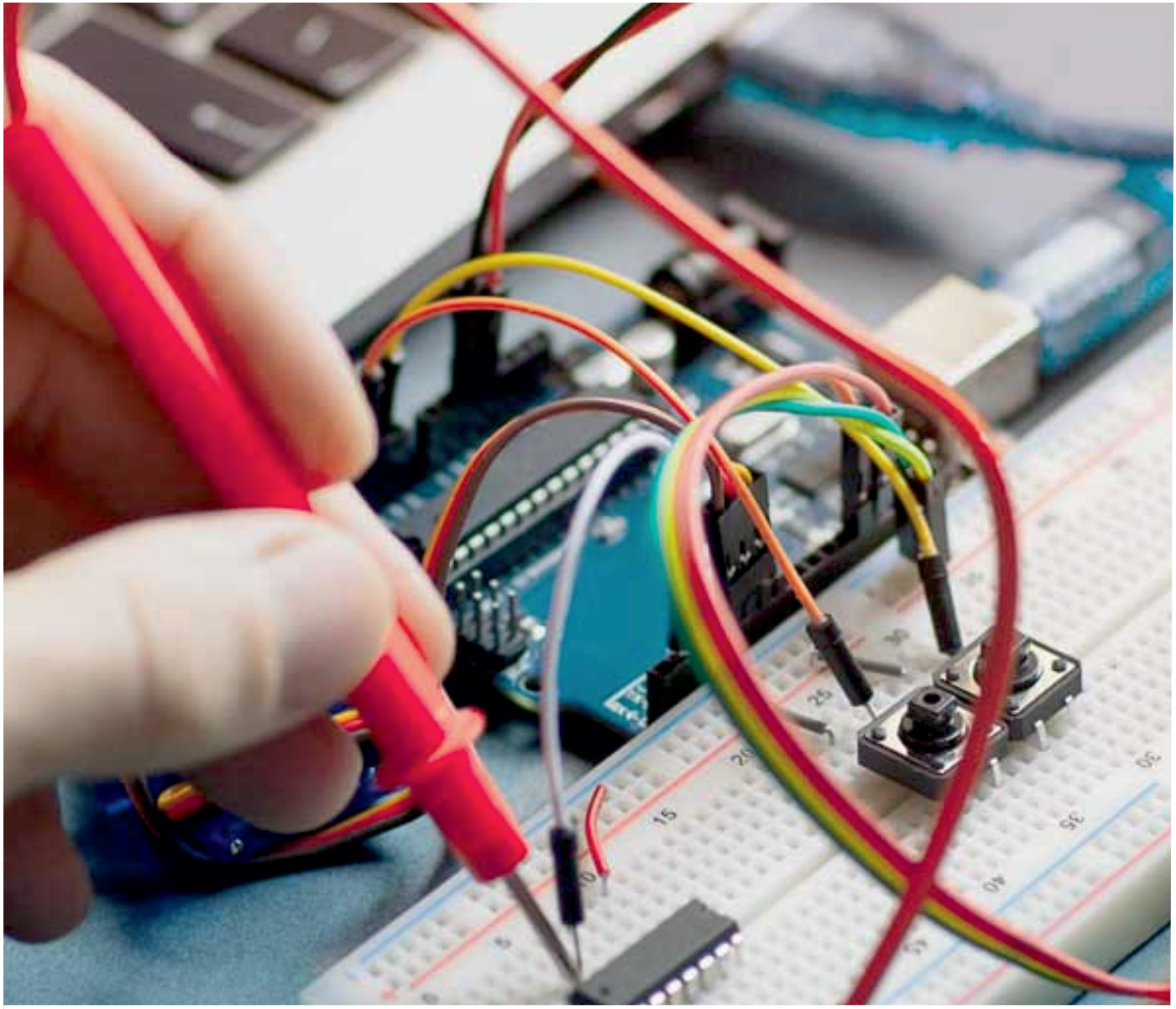

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