Industrial load analysis using IOT

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ABSTRACT

We all know that humans have evolving need of electricity which is rising day by day. This electricity is not proving sufficient according to need as the non- renewable sources are limited during a period. They are depleting soon, so there is need of energy conservation. By using this work, we can save the energy while the load is not needed much power. This module describes the design & development of a single-phase power meter using instantaneous power calculation method. It is an electrical device that is used in power system to measure the amount of electric power consumed by electrical appliance. It is closely related to the field of monitoring electric energy consumption which it involves both current & voltage signal from. In this study, an accurate power meter is to be produced by using instantaneous power calculation method from the signal obtained from voltage and current sensors. Voltage and current signal are sampled and analysed by using Arduino UNO as control unit, where the instantaneous power calculation takes place.

Keywords- *Arduino uno, Ethernet Sheild, Thing Speak Server, IOT*

INTRODUCTION

As the awareness of electrical energy is increases, more and more individual home and institution are

opting for electrical energy. Power is rate at which

electric energy is transferred by an electric circuit. It is important electrical quantity and everything is our world today depends on having the power to keep them running. Hence it is necessary to measure and monitor the power consumption of electrical appliances to help in estimation of monthly electrical usage. We use 5V AC adapter because controller can

understand 5V of power.

This work aims to develop a power measurement meter to determine the power consumption and to display it graphically. By providing such data to user in a way that they will optimize and reduce their power usage. Thus, it will provide platform in reducing the wastage of electrical energy. The microcontroller contains programmable instruction which control the intensity of voltage and current sensor & current sensor and display the output on

screen.

PROPOSED WORK

The current sensor and voltage sensor detect the current and voltage of load. After detecting status, the sensors send the signals to the Arduino board using

jumper wires or connectors. When the status of load is transfer to the microcontroller then it will convert the analog signals into digital single using inbuilt ADC. Then the Arduino performs all the calculations that are written in code of Arduino IDE. If all the conditions are satisfied then the microcontroller shows the real time

output on the screen of LCD display.

There are several methods for current sensing. The current sensor used in this project was current sensor ACS 712 as shown in Figure-4. It is a closed loop Hall Effect current sensor which only requires unipolar voltage supply in order for it to operate. It is a convenient sensor which it direct convert current into voltage signal which correspond to the magnitude of the current sensed. The output of the sensor can be directly connected to the Arduino for data processing. Closed-loop Hall effect method contains of five building blocks which includes the Hall generator, magnetic core, amplifier, driver

circuit and a coil wound around the magnetic core.

While performing calculations, the Ethernet now connected to the server. In our project, we are using an open server named as "Thing Speak' which is free of cost. This server is able to show the data is graphical representation and it maintains the log of last entry which helps us to find the previous status of

load.

COMPONENTS AND DESCRIPTION

1.ARDUINO UNO

It is an open-source microcontroller board based on the MicrochipATmega328P microcontroller and developed by Arduino.cc. The board is equipped with

sets of digital and analog input/output (1/0) pins that

may be interfaced to various expansion boards (shields) and other circuits. The board has 14 Digital pins, 6 Analog pins, and programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable. It can be powered by a USB cable or by an external 9 volt battery, though it accepts voltages between 7 and 20 volts. It is also similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under a

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license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0.The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform. The ATmega328 on the Arduino Uno comes preprogrammed with a bootloader that allows uploading new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol. The Uno also differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it uses the Atmega16U2 (Atmega8U2 up to version R2)

programmed as an USBto-serial converter.

Fig 1. Arduino UNO

2. ETHERNET SHIELD

The Arduino Ethernet Shield V1 connects your Arduino to the internet in mere minutes. Just plug this module onto your Arduino board, connect it to your network with an RJ45 cable (not included) and follow a few simple instructions to start controlling

your world through the internet.

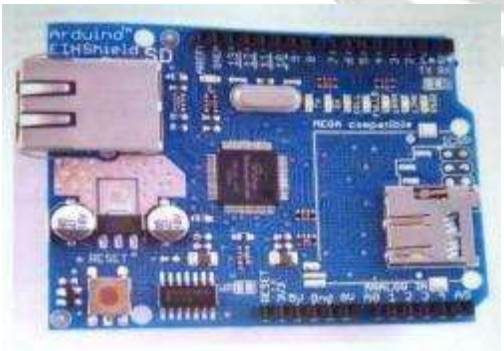

Fig 2: Ethernet Shield

The Arduino Ethernet Shield V1 allows an Arduino board to connect to the internet. It is based on the Wiznet W5100 ethernet chip (datasheet). The Wiznet W5100 provides a network (IP) stack capable of both TCP and UDP. It supports up to four simultaneous

socket connections.

3. Current Sensor

1. The working principle of the current sensor is; once current is supplied throughout a circuit or a wire then a voltage drop takes place and magnetic field will be generated nearby the current-carrying conductor. So, there are two kinds of current sensing direct current sensing & indirect current sensing.

2. Direct sensing mainly depends on Ohm's law whereas indirect sensing depends on Ampere's & Faraday's law. Direct Sensing is used to measure the

voltage drop associated with the flow of current throughout passive electrical components. Similarly, indirect sensing is used to measure the magnetic field nearby a current-carrying conductor. After that, the magnetic field which is produced is used for inducing proportional current o voltage which is afterward

changed to use measurement or control purposes.

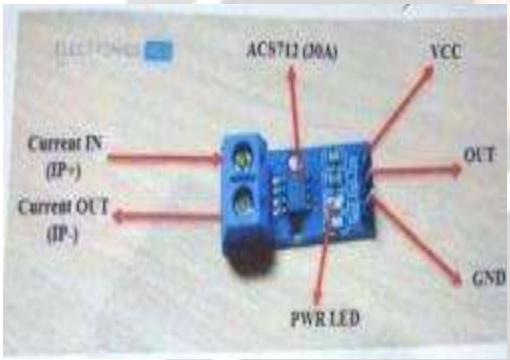

Fig 3: Current Sensor

4. VOLTAGE SENSOR

The Voltage Sensor Module is a simple but very useful module that uses a potential divider to reduce an input voltage by a factor of 5. The 0-25V Voltage Sensor Module allows you to use the analog input of a microcontroller to monitor voltages much higher

than it is capable of sensing.

Fig 4. Voltage Sensor

5. Electric Battery

It is a device consisting of one or more electrochemical cells with external connection

provided to power electrical devices such as flashlights, smartphones, and electric cars. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that will flow through an external electric circuit to the positive terminal. When a battery is connected to an external electric load, a redox reaction converts high-energy reactants to lower- energy products, and the free-energy difference is delivered to the external circuit as electrical energy. Historically the term "battery" specifically referred to a device composed of multiple cells, however the usage has evolved to include devices composed of a

single cell.

6. I2C Display module

12C_LCD is an easy-to-use display module, it can make display easier. Using it can reduce the difficulty of make, so that makers can focus on the core of the

work.

Fig 5. I2C display module

It will be develop as the the Arduino library for 12C_LCD, user just need a few lines of the code can achieve complex graphics and text display features. It can replace the serial monitor of Arduino in some place, you can get running information without a computer.

More than that, it will develop the dedicated picture

data convert software (bitmap converter) now is

available to support PC platform of windows, Linux, Mac OS. Through the bitmap convert software you can get your favorite picture displayed on 12C_LCD,

without the need for complex programming.

7. THING SPEAK SERVER

According to its developers, "ThingSpeak is an open- source Internet of Things (IoT) application and API to store and retrieve data from things using the HTTP protocol over the Internet or via a Local Area Network. ThingSpeak enables the creation of sensor logging applications, location tracking applications,

and a social network of things with status updates.

Fig 6. ThingSpeak Server

RESULT

In order to ensure that the completed prototype can be use to measure voltage and current of electrical appliances, it is necessary to carry out testing by using reactive load. The reactive load used in this test was a 12V battery and a LED. The prototype will be connected to the reactive load together with the server and measurement parameters were obtained by using the two equipment as the measurement

parameters and open server.

Fig 7: Server Interface

- Easy to use, no need of technical person to operate the prototype. Less consumption of power.
- Easy to monitor devices remotelessly.
- Over voltage and current protection.
- The circuit is simple and cost effective.
- No need of periodic maintenance.
- This system can be functioned automatically as well as manually.

It can use in the home appliances which of course reduces the electrical accidents. By using this method, we can easily safe our costing equipment such as battery solar panel. Easily reduce the cost and increase the efficiency of the electric system. It will provide a platform in reducing the wastage of

electricity.

CONCLUSION

The objective of this paper is to develop single phase power meter that can accurately measures true power regardless of the type of connected load by using a purpose microcontroller board. The design prototype will be able to display voltage shows the data over

the internet on open server.

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