Research on Implementation of Energy Monitoring and Control Devices based on IoT

Neha Gangurde[1] Swati Desmukh[2]
[1,2]Department of Information Technology
[1,2]B.K. Birla College of Arts, Science and Commerce, Kalyan (West), India

Abstract— Smart, integrated power consumption monitoring system has been implemented with the use of open standard technology, commercial research and household items which actively monitors the voltage and current ratio in remote system. The main target for this system is to have it designed and implemented as cost e client as possible. The system allows for a user to keep a track on the consumption of the energy by the load at remote place anywhere in the world. Presented here is ATMEGA328 based power consumption monitoring system that senses these parameters and shows on an LCD display. This proposed system gives reliable and accurate information regarding Electrical power usage through Internet of things (IoT).

Keywords: Internet of Things (IoT), LCD Display, GSM Module

I. INTRODUCTION

The signals for these load settings will be detected and analyze. This data will then be utilized to adjust the current settings as required. In this research we are using ATMEGA328 Processor which is a single-board controller, intended to make the application of interactive objects or environments more accessible. The hardware consists of a simple hardware board designed around an 8-bit Atmel microcontroller.

When the readings from the sensors deviate with respect to the input values from the controller, the microprocessor sends out a signal to the effecters to adjust the settings back to the input values.

IOT (internet of things) is a model for enabling ubiquitous, convenient, on-demand access to a shared pool of configurable resources. IOT and storage solutions provide users and enterprises with various capabilities to store and process their data in third-party data centers. It relies on sharing of resources to achieve coherence and economies of scale, similar to a utility (like the electricity grid) over a network. At the foundation of IOT is the broader concept of converged infrastructure and shared services.

IOT architectures consist of front-end platforms called clients or cloud clients. These clients comprise servers, fat (or thick) clients, thin clients, zero clients, tabletsand mobile devices. These client platforms interact with the cloud data storage via an application (middleware), via a web browser, or through a virtual session.

II. REVIEW OF LITERATURE

Al-Ali and Al-Rousan, 2004 & Saito et al., 2000 & Burger and Frieder, 2007 the literature related to the research topic has been reviewed for last twenty years in order to find out work carried out by various researchers. There are many systems for remote monitoring and control designed as commercial products or experimental research platforms. It is noticed that most of the research carried out belongs to the following categories.

Internet based Monitoring using Servers, GPRS modems, etc. with different approaches. GSM-SMS protocols using GSM module individually or in combination with Internet Technologies. The study of GSM module in this explain is very much easier than others papers also for implementation of gsm system is much easy.

GSM-SMS protocols using GSM module individually or in combination with Internet Technologies The system consists of client/server, programmable logic controller, D/A modules, inverters, induction motors and the temperature sensing modules. The client accepts the command from the user and can also access the database created in server, using Internet Explorer (IE) Browser.

The server performs function of fuzzy logic control, communication interface between server and PLC, and receiving command from client. Furthermore, the server also creates a database of the sensed temperature, speed of inverter-controlled motor drives, and reference command. (Ximin et al., 2005) designed and implemented an Internet home automation system.

III. PROBLEM DEFINITION

A. Circuit Diagram

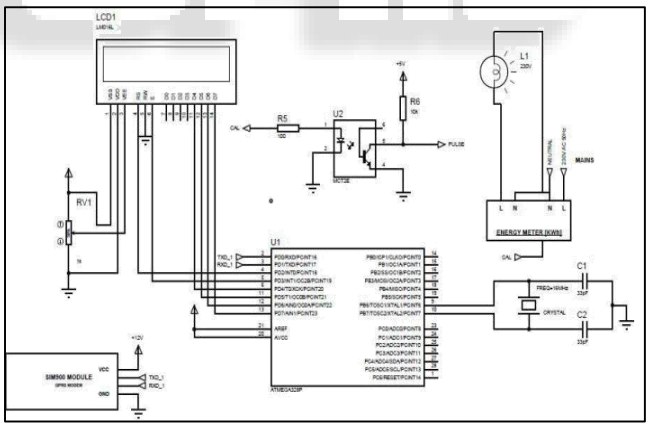


Fig. 1: Circuit diagram of IOT based remote network station power consumption meter with GPRS technology

IV. APPLIED METHODOLOGY

A. Block Diagram

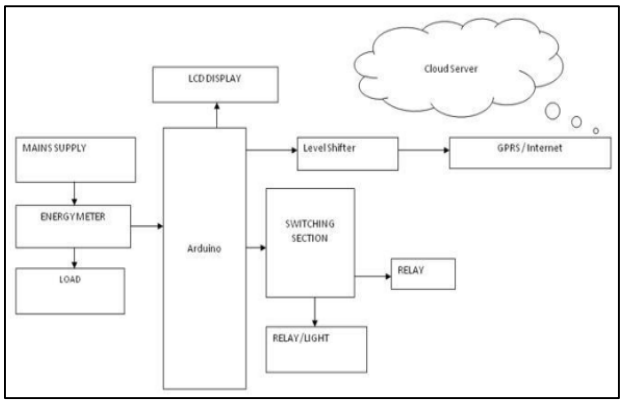


Fig. 2: Block diagram of IOT based remote network station power consumption meter with GPRS technology

V. HARDWARE

A. Arduino

Arduino is a single-board microcontroller, intended to make building interactive objects or environments more accessible. The hardware consists of an open-source hardware board designed around an 8-bit Atmel AVR microcontroller, or a 32-bit Atmel ARM. Current models feature a USB interface, 6 analog input pins, as well as 14 development environment (IDE) that runs on regular personal computers and allows users to write programs for Arduino using C or C++.

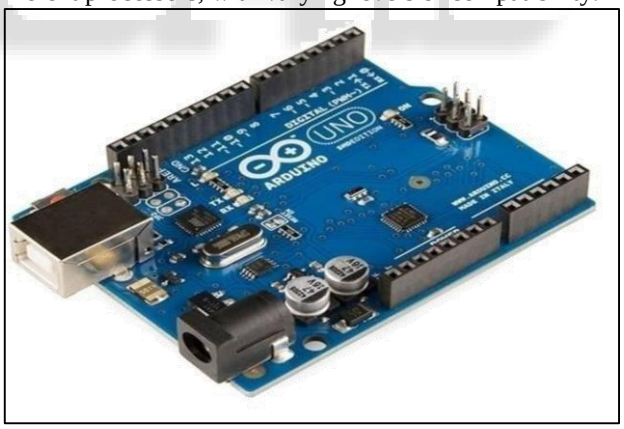
The current prices of Arduino boards run around €20, or $27 and those of related "clones" as low as $9. Arduino boards can be purchased pre-assembled or as do-it-yourself kits. Hardware design information is available for those who would like to assemble an Arduino by hand. It was estimated in mid-2011 that over 300,000 official Arduinos had been commercially producedand in 2013 that 700,000 official boards were in users' hands.

An Arduino board consists of an Atmel 8-bit AVR microcontroller with complementary components that facilitate programming and incorporation into other circuits. An important aspect of the Arduino is its standard connectors, which lets users connect the CPU board to a variety of interchangeable add-on modules known as shields. Some shields communicate with the Arduino board directly over various pins, but many shields are individually addressable via an I²C serial bus—so many shields can be stacked and used in parallel. Official Arduinos have used the megaAVR series of chips, specifically the ATmega8, ATmega168, ATmega328, ATmega1280, and ATmega2560. A handful of other processors have been used by Arduino compatibles. Most boards include a 5 volt linear regulator and a 16 MHz crystal oscillator (orceramic resonator in some variants), although some designs such as the LilyPad run at 8 MHz and dispense with the onboard voltage regulator due to specific form-factor restrictions. An Arduino's microcontroller is also pre-programmed with a boot loader that simplifies uploading of programs to the on-chip flash memory, compared with other devices that typically need an external programmer. This makes using an Arduino more straightforward by allowing the use of an ordinary computer as the programmer.

At a conceptual level, when using the Arduino software stack, all boards are programmed over an RS-232 serial connection, but the way this is implemented varies by hardware version. Serial Arduino boards contain a level shifter circuit to convert between RS-232-level and TTL-level signals. Current Arduino boards are programmed via USB, implemented using USB-to-serial adapter chips such as the FTDI FT232. Some variants, such as the Arduino Mini and the unofficial Boarduino, use a detachable USB-to-serial adapter board or cable, Bluetooth or other methods. (When used with traditional microcontroller tools instead of the Arduino IDE, standard.

The Arduino board exposes most of the microcontroller's I/O pins for use by other circuits. The Diecimila, Duemilanove, and current Uno provide 14 digital I/O pins, six of which can produce pulse-width modulated signals, and six analog inputs, which can also be used as six digital I/O pins. These pins are on the top of the board, via female 0.10-inch (2.5 mm) headers. Several plug-in application shields are also commercially available. The Arduino Nano, and Arduino-compatible Bare Bones Board and arduino boards may provide male header pins on the underside of the board that can plug into solderless breadboards.

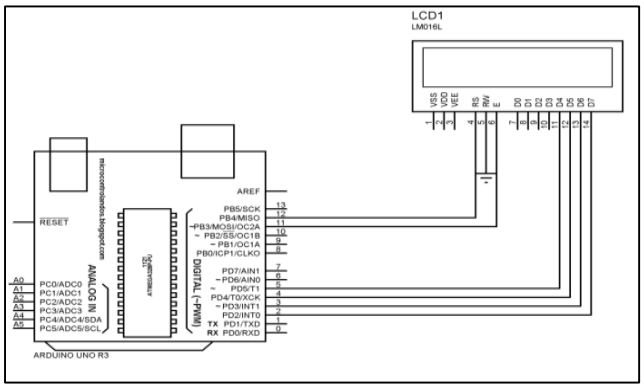
There are many Arduino-compatible and Arduino-derived boards. Some are functionally equivalent to an Arduino and can be used interchangeably. Many enhance the basic Arduino by adding output drivers, often for use in school-level education to simplify the construction of buggies and small robots. Others are electrically equivalent but change the form factor— sometimes retaining compatibility with shields, sometimes not. Some variants use completely different processors, with varying levels of compatibility.



B. LCD Display

The LCD screen is more energy efficient and can be disposed of more safely than a CRT. Its low electrical power consumption enables it to be used in battery-powered electronic equipment. It is an electronically modulated optical device made up of any number of segments filled with liquid crystals and arrayed in front of a light source (backlight) or reflector to produce images in color or monochrome. Liquid crystals were first discovered in 1888.By 2008, annual sales of televisions with LCD screens exceeded sales of CRT units worldwide, and the CRT became obsolescent for most purposes.

C. LCD Interfacing



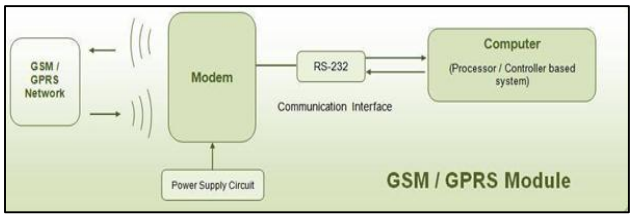
D. Energy Meter

An electricity meter, electric meter, or energy meter is a device that measures the amount of electric energy consumed by a residence, business, or an electrically powered device. Electric utilities use electric meters installed at customers premises to measure electric energy delivered to their customers for billing purposes. They are typically calibrated in billing units, the most common one being the kilowatt hour. They are usually read once each billing period.

When energy savings during certain periods are desired, some meters may measure demand, the maximum use of power in some interval. "Time of day" metering allows electric rates to be changed during a day, to record usage during peak high-cost periods and off-peak, lower-cost, periods. Also, in some areas, meters have relays for demand response load shedding during peak.

E. GSM Module

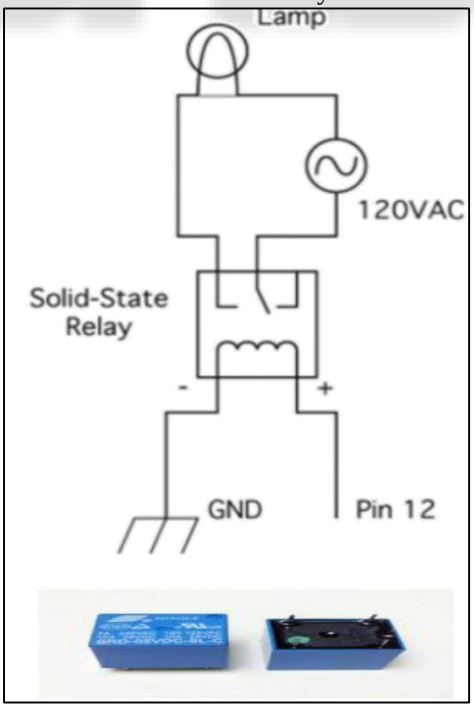
Module is used to establish communication between a computer and a GSM-GPRS system. Global System for Mobile communication (GSM) is an architecture used for mobile communication in most of the countries. Global Packet Radio Service (GPRS) is an extension of GSM that enables higher data transmission rate. GSM/GPRS module consists of a GSM/GPRS modem assembled together with power supply circuit and communication interfaces (like RS-232, USB, etc) for computer. The MODEM is the soul of such modules.



F. Relay

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

A type of relay that can handle the high power required to directly control an electric motor or other loads is called a contactor. Solid-state relays control power circuits with no moving parts, instead using a semiconductor device to perform switching. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called Relay.



VI. P.C.B. FABRICATION

P.C.B. is printed circuit board which is of insulating base with layer of thin copper-foil.

The circuit diagram is then drawn on the P. C. B. with permanent marker and then it is dipped in the solution of ferric chloride so that unwanted copper is removed from the P.C.B., thus leaving components interconnection on the board.

The specification of the base material is not important to know in most of the application, but it is important to know something about copper foil which is drawn through a thin slip.

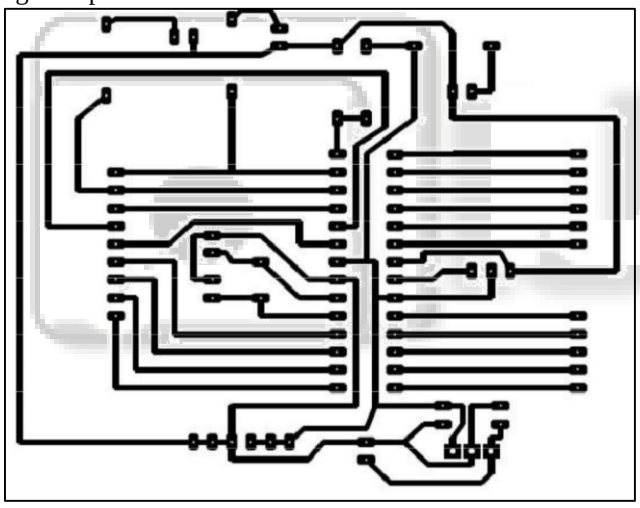
The resistance of copper foil will have an affects on the circuit operation.

Base material is made of lamination layer of suitable insulating material such as treated paper, fabric; or glass fibers and binding them with resin. Most commonly used base materials are formed paper bonded with epoxy resin.

It is possible to obtain a range of thickness between 0.5 mm to 3 mm.

Thickness is the important factor in determining mechanical strength particularly when the commonly used base material is "Formea" from paper assembly. Physical properties should be self-supporting these are surface resistivity, heat dissipation, dielectric, constant, dielectric strength.

Another important factor is the ability to wishstand high temperature.



VII. SOLDERING

For soldering of any joints first the terminal to be soldered are cleaned to remove oxide film or dirt on it. If required flux is applied on the points to be soldered.

Now the joint to be soldered is heated with the help of soldering iron. Heat applied should be such that when solder wire is touched to joint, it must melt quickly.

The joint and the soldering iron is held such that molten solder should flow smoothly over the joint.

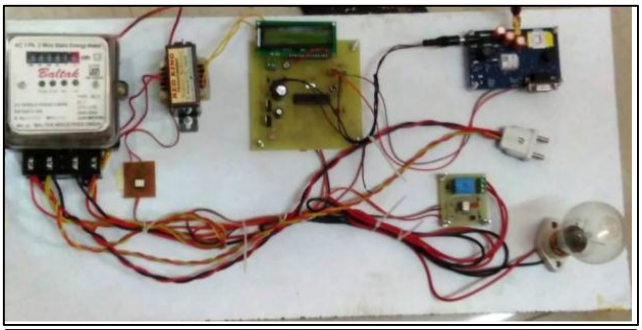
When joint is completely covered with molten solder, the soldering iron is re-moved.

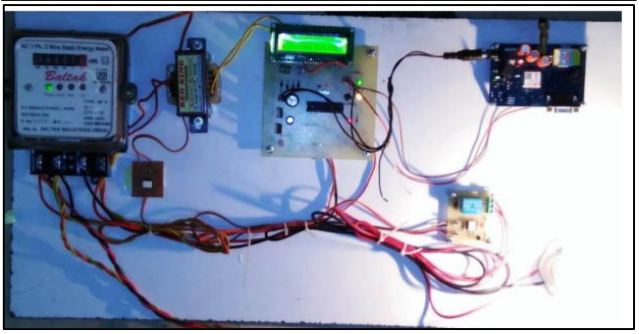
The joint is allowed to cool, without any movement.

The bright shining solder indicates good soldering.

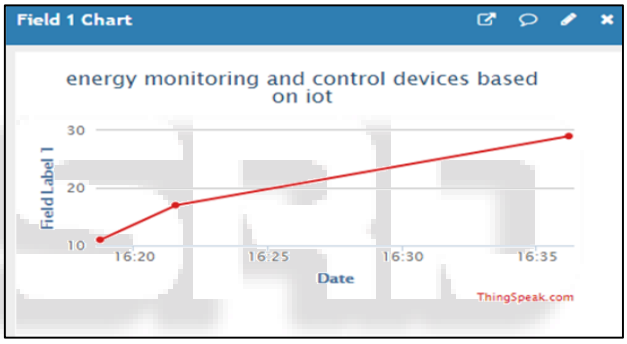
In case of dry solder joint, a air gap remains in between the solder matenal and the joint. It means that soldering is improper. This is removed and again soldering is done.

Thus, is this way all the components are soldered on P. C. B.





VIII. RESULTS



Thus, we can get the result as a graph of date vs pulse count by using this graph we can able to get the exact pulse count and also chart is showing the day wise pulse count so that user can able to understand day wise pulse count.

This graph is use to tract the energy consumption by user also those who are going to make the bill for them also it is use full for them to tract the pulse count and also user can also able to get the pulse count.

Thus, we can get the result as a graph of date vs pulse count by using this graph we can able to get the exact pulse count and also chart is showing the day wise pulse count so that user can able to understand day wise pulse count.

IX. CONCLUSION

The designed energy monitoring system has proven to successfully acquire accurate measurements for energy meter. A very systematic approach was used for the overall design of the research, in which power consumption factors were to be controlled.

Thus, we can conclude that actually we transferring the live data on internet. Also, time to time monitoring. Also, we can able to use in medical applications.

REFERENCES

[1] Al-Ali and Al-Rousan, 2004 & Saito et al., 2000 & Burger and Frieder, 2007GSM module.
[2] Kristian saethe for GSM module. 2004
[3] Several online Video tutorials and Wikipedia® articles.
[4] Basic Electronics – B.Ram edition 5
[5] Digital Electronics – R.P.Jain. edition 4
[6] Kumari and Malleswaran, 2010 for real time system
[7] Digital Electronics by Puri edition 2014
[8] Electrical network Ravish singh Edition 2008(Mc Graw hill)
[9] Tarun Agrawal GSM module 2008.

