SMART BILLING SYSTEM FOR HOME

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Abstract:

The demand for power has increased exponentially with time. One avenue through which today's energy problems can be address through the reduction of energy usage in households. This has increased the emphasis on the need for accurate and economic methods of power measurement. The goal of providing such data is to optimize and reduce their power consumption. This project presents a smart energy meter for an automatic and superior metering and billing system. The integration of the Arduino and GSM Short Message Service (SMS) provide the meter reading system with some automatic functions that are predefined. The proposed energy meter system can incorporate with embedded controller and GSM modem to transmit the data like consumed energy in kWh, generated bill, security services (line Cut/On) over GSM mobile network such as data can be then fed and integrated into existing energy management systems located at power companies or organizations to provide the services among the customers without man-power.

I. INTRODUCTION

The world is changing towards automatic wireless technologies, which prefer not only reducing human efforts but is helping in making systems automatic and efficient. A system is said to be intelligent when it can decide what to do without any instruction and can work automatically. An Electric or Energy meter measures the total electrical energy in units used by the appliances which consume electrical energy from the main power supply. Electromechanical and Electronic meter are two types of meter Available in the market to measure the unit consumption. Electromechanical meters are commonly used in village areas, where the uses of modern technology are not as high as it is in cities.

Electromechanical meters have become out of date nowadays. Electronic meters replace electromechanical meters. This meter consists of LCD/LED to display the reading. Calibration Led is used on the meter which shows the units consumed. Manpower is required to read the meter and note down the reading. The reading on the meter is increasing which is used to generate the electricity bill. An IOT Based Smart Electricity Meter and billing System does the same task without human efforts. IOT Based SEM system is controlled using Arduino Mega, which is a microcontroller board. The purpose behind choosing this board is its efficiency and memory. It is more efficient in terms of memory and GPIO. The data obtained is then sent to the cloud through the internet. Data obtained can be easily sent wirelessly over long distance without any noise disturbance using the internet. As the data is directly sent to the cloud there is no occurrence of range and distance problem and is highly accurate and efficient because of no human interference. Other wireless technologies such as Zigbee, Bluetooth etc. have limited range thus cannot be used over very long distances effectively. This project envisages the use internet and the concept of IOT by which the base station, as well as users, remain updated with the current consumed units, changing the present problems faced by the electricity board and the user.
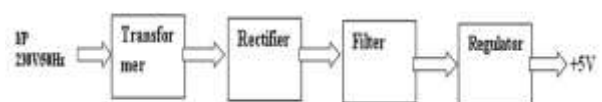
II. POWER SUPPLY

Figure.1. Power Supply

III. HARDWARE

Arduino

Arduino is a prototype platform (open-source) based on an easy-to-use hardware and software. It consists of a circuit board, which

can be programed (referred to as a microcontroller) and a ready-made software called Arduino IDE (Integrated Development Environment), which is used to write and upload the computer code to the physical board.

The key features are −

- Arduino boards are able to read analog or digital input signals from different sensors and turn it into an output such as activating a motor, turning LED on/off, connect to the cloud and many other actions.
- You can control your board functions by sending a set of instructions to the microcontroller on the board via Arduino IDE (referred to as uploading software).
- Unlike most previous programmable circuit boards, Arduino does not need an extra piece of hardware (called a programmer) in order to load a new code onto the board. You can simply use a USB cable.
- Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program.
- Finally, Arduino provides a standard form factor that breaks the functions of the micro-controller into a more accessible package.
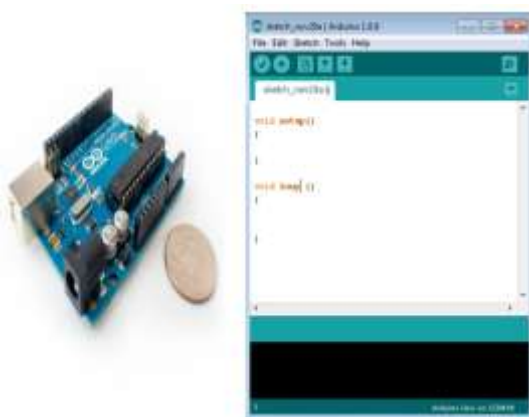
Liquid Cristal Display

A liquid crystal display (LCD) is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector. Each pixel consists of a column of liquid crystal molecules suspended between two transparent electrodes, and two polarizing filters, the axes of polarity of which are perpendicular to each other. Without the liquid crystals between them, light passing through one would be blocked by the other. The liquid crystal twists the polarization of light entering one filter to allow it to pass through the other.

A program must interact with the outside world using input and output devices that communicate directly with a human being. One of the most common devices attached to an controller is an LCD display. Some of the most common LCDs connected to the contollers are 16X1, 16x2 and 20x2 displays. This means 16 characters per line by 1 line 16 characters per line by 2 lines and 20 characters per line by 2 lines, respectively.

Many microcontroller devices use 'smart LCD' displays to output visual information. LCD displays designed around LCD NT-C1611 module, are inexpensive, easy to use, and it is even possible to produce a readout using the 5X7 dots plus cursor of the display. They have a standard ASCII set of characters and mathematical symbols. For an 8-bit data bus, the display requires a +5V supply plus 10 I/O lines (RS RW D7 D6 D5 D4 D3 D2 D1 D0). For a 4-bit data bus it only requires the supply lines plus 6 extra lines(RS RW D7 D6 D5 D4). When the LCD display is not enabled, data lines are tri-state and they do not interfere with the operation of the microcontroller.
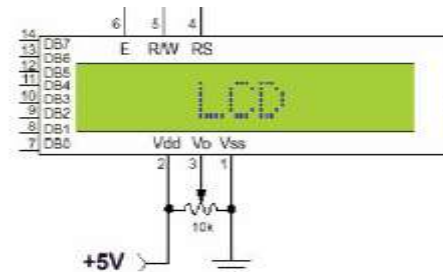

Figure.2.Pin diagram of 1x16 lines LCD

Relays

A relay is an electrically operated switch. These are remote control electrical switches that are controlled by another switch, such as a horn switch or a computer as in a

power train control module, devices in industries, home based applications. Relays allow a small current pin, 4-pin, 5-pin, and 6-pin, single switch or dual switches. Relays are used throughout the automobile. Relays which come in assorted sizes, ratings, and applications, are used as remote control switches. A typical vehicle can have 20 relays or more.
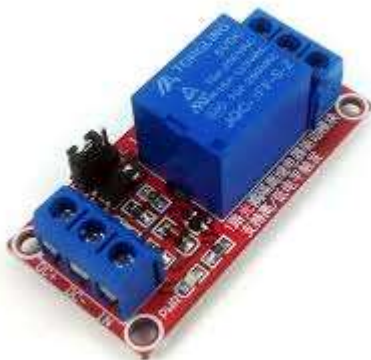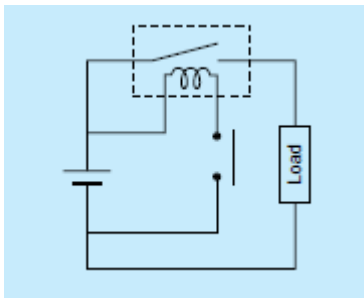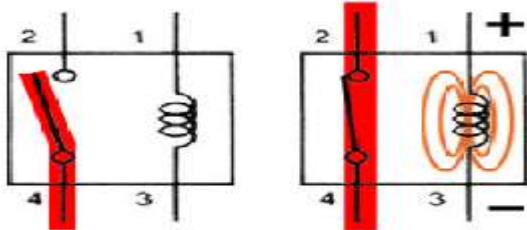

Figure.3. Relay

GSM :

GSM (Global System for Mobile communications) is an open, digital cellular technology used for transmitting mobile voice and data services.

GSM (Global System for Mobile communication) is a digital mobile telephone

system that is widely used in Europe and other parts of the world. GSM uses a variation of Time Division Multiple Access (TDMA) and is the most widely used of the three digital wireless telephone technologies (TDMA, GSM, and CDMA). GSM digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own time slot. It operates at either the 900 MHz or 1,800 MHz frequency band. It supports voice calls and data transfer speeds of up to 9.6 kbit/s, together with the transmission of SMS (Short Message Service).

GSM Modem:

A GSM modem is a wireless modem that works with a GSM wireless network. A wireless modem behaves like a dial-up modem. The main difference between them is that a dial-up modem sends and receives data through a fixed telephone line while a wireless modem sends and receives data through radio waves.

Bulb:

A **light bulb** produces light from electricity.[1] In addition to lighting a dark space, they can be used to show an electronic device is on, to direct traffic, for heat, and for many other purposes. Billions are in use, some even in outer space.

Early people used candles and oil lamps for light. Crude incandescent lights were made in the early and middle 19th century but had little use. Improved vacuum pumps and better materials made them shine longer and brighter late in the century. Electric power stations brought electricity to urban and later rural areas to power them. [2] Later gas

discharge lights, including fluorescent lights, use less electricity to make more light.

SWITCHES

A switch is an electrical component that can break an electrical circuit, interrupting the current or diverting it from one conductor to another. The most familiar form of switch is a manually operated electromechanical device with one or more sets of electrical contacts. Each set of contacts can be in one of two states: either 'closed' meaning the contacts are touching and electricity can flow between them, or 'open', meaning the contacts are separated and non-conducting.

Figure:4. switches in a row

LIGHT DEPENDENT RESISTOR (LDR)

A photo resistor is an electronic component whose resistance decreases with increasing incident light intensity. It can also be called a light-dependent resistor (LDR), or photo conductor.

Other light dependent resistors, or photo resistors have been made using materials including Cadmium Sulphide, Lead Sulphide and the more commonly used semiconductor materials including Ge ,Si and GaAs.
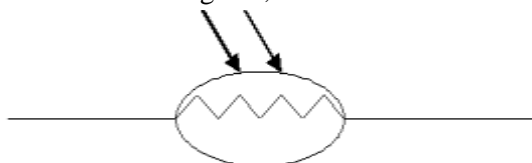

Fig.5: - Schematic Symbol of LDR

The photo resistor, or Light Dependent Resistor, finds many uses as a low cost photo sensitive element and was used for many years in photographic light meters as well as other applications. such as flame, smoke, and burgler detectors, card readers and lighting controls for street lamps.

Units for the light intensity are Lux or Lumence.

Energy Meter

Definition: The **meter** which is used for **measuring** the **energy utilises** by the electric **load** is known as the energy meter. The **energy** is the total **power consumed** and utilised by the load at a **particular interval** of **time**. It is used in **domestic** and **industrial** AC circuit for measuring the power consumption. The meter is less **expensive** and **accurate**.

Construction of Energy Meter

The construction of the single phase energy meter is shown in the figure below.


Induction Type Energy Meter
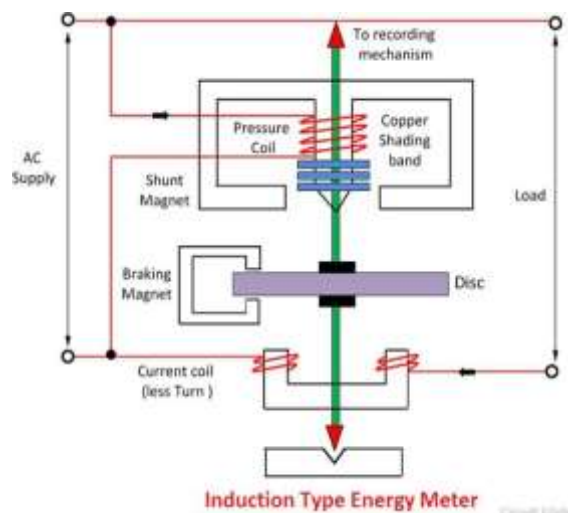
Voltage Sensor:

A voltage sensor is a sensor is used to calculate and monitor the amount of voltage in an object. Voltage sensors can determine both the AC voltage or DC voltage level. The input of this sensor can be the voltage whereas the output is

the switches, analog voltage signal, a current signal, an audible signal, etc.

Sensors are basically a device which can sense or identify and react to certain types of electrical or some optical signals. Implementation of **voltage sensor** and current sensor techniques have become an excellent choice to the conventional current and voltage measurement methods.

$$V_{out} = \frac{C_1}{C_1 + C_2} \times V_{in} \qquad V_{out} = \frac{R_2}{R_1 + R_2} \times V_{in}$$
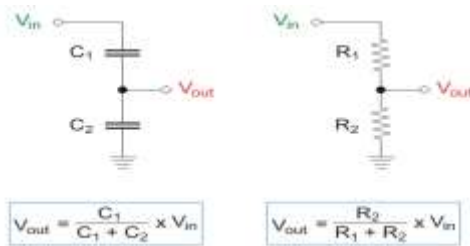
WIFI Module:

The ESP8266 is a low-cost WiFi module that can be integrated easily into IoT devices. We've featured several projects using this module, such as **How To Make Smart Home Electronics: A Smart Mailbox** and **How To Read Your Arduino's Mind: Building A Childproof Lock**. This tutorial will walk you through setting up ESP8266 Wifi module which can be used with Arduino. The ESP8266 comes in many models with different functionalities. We'll be focusing on the ESP8266 ESP-01 module, the most common and basic one available.

The ESP8266 is a small WiFi module built around the ESP8266 chip that can connect your microcontroller to the internet wirelessly for a very small cost. It can be a great option for Internet of Things (IoT) projects, but can be difficult to work with for beginner hobbyists who do not have prior experience with the module. In this tutorial, we hope to show you how to interface the ESP8266 with an Arduino and perform some basic functions like connecting it to a WiFi network.
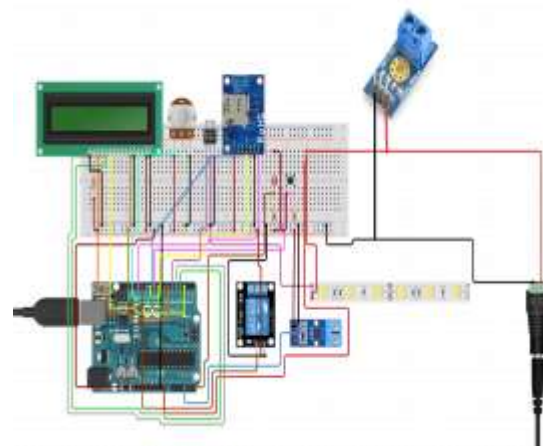
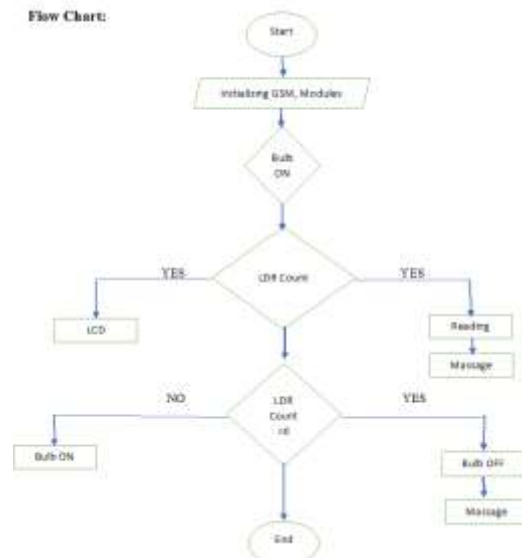ESP8266 ESP-01 module / ©Sparkfun

IV. RESULT

Block Diagram:
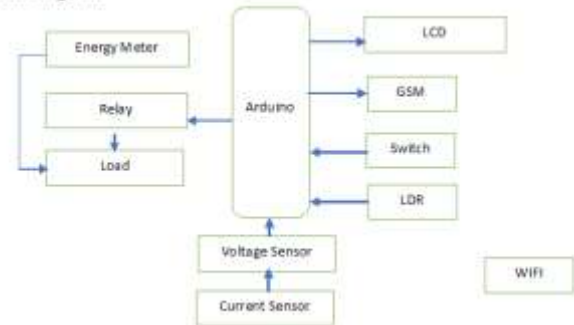
Schematic Diagram:

Flow Chart:

Working:

In this Project smart billing system has been design with help of a controller. For energy consumption reading we are using energy meter and for unit count we take help of LDR sensor, this sensor count the led flash of cal in energy meter. Based on the cal led flash we take count of units. When all the units consumed the power will shutdown automatically with help of a relay and a massage will be sent to the consumer by using GSM module.

V. CONCLUSION

The existing system has some of the problems like manual work, Human errors, inaccurate meter reading, corruption, Power theft. In the proposed system the electricity connection to each user will be given only to the registered user and the smart billing will be done via IoT (Internet of **Things).**

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