

MARCH 19, 2018



GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING

SUBMITTED BY: G SURAJ RAJU

CLASS: ECE-C

ROLL NUMBER: 15241A04D9

INDEX

- Introduction
- Overview
- Requirements
- Block Diagram
- Circuit Diagram
- Hardware Description
- Softwares used
- Program
- Advantages
- Conclusion

MOTIVATION

Every month we see a person from electricity board, standing in front of our house whose duty is to read the energy meter readings and handover the bills to the owner of that house. We have to pay the bills according to that reading. The main drawback of this system is that person have to go area by area and he has to read the meter of every house and handover the bills. Many a time we come across some errors like extra bill amount, notification from electric board even though the bills are paid etc., To overcome this drawback I have come up with an idea which will eliminate the third party between the consumer and service provider and eliminate the error possibilities.

OVERVIEW

Energy meter is an electrical instrument used to calculate the amount of electrical energy used by the consumers. Usually different meters have different readings, most commonly 3200 blinks are considered as 1 unit. Those blinks can be identified by using a light dependent resistor (LDR) sensor which works according to intensity of light around it. So, an LDR can be used to calculate the power consumed and this data will be transmitted to a mobile phone through Bluetooth. A custom built android application serves the purpose of monitoring energy consumption and generating bills automatically.

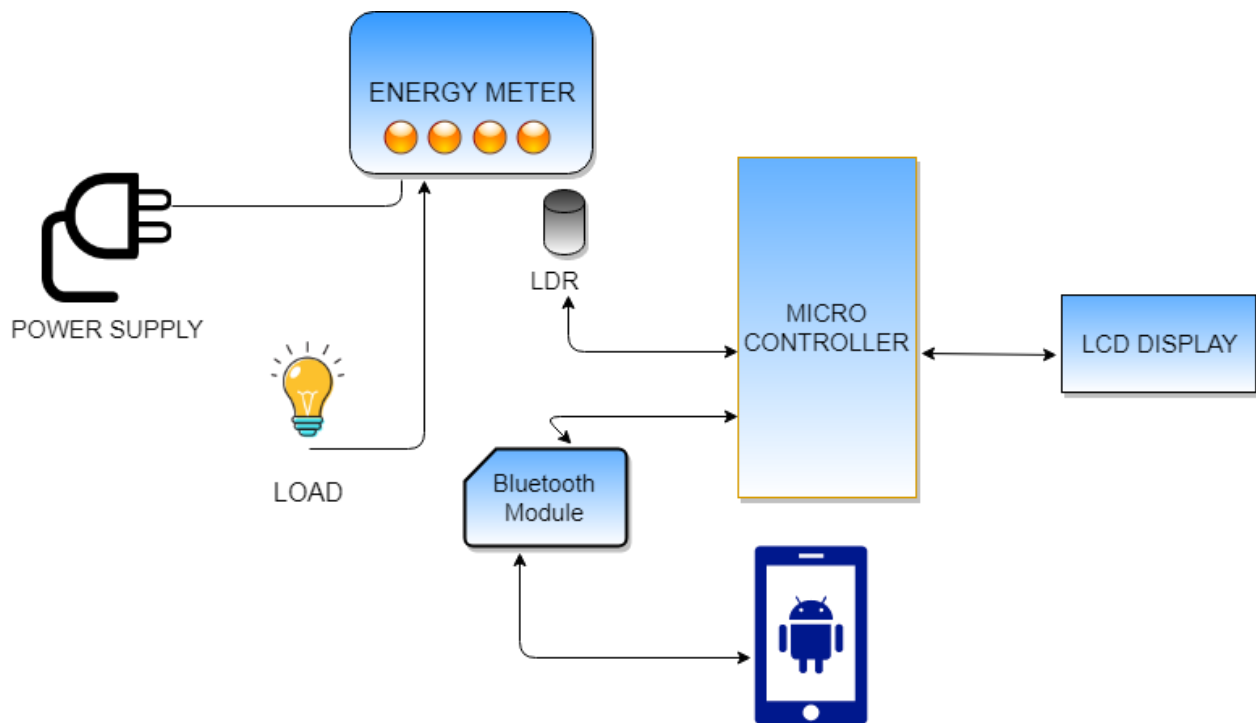
FUNCTIONAL REQUIREMENTS:

- The system should be able to calculate the total power consumed by the load.
- System should continuously keep track of consumed power and find out the cost of power utilized.
- The day to day analysis of power usage should be sent to user through Bluetooth.
- A custom-built Android application will be displaying all the data retrieved from the Bluetooth and it helps to keep the track of our household power consumption.

NON-FUNCTIONAL REQUIREMENTS:

- The hardware is to be attached to an energy meter, hence it should be compact in size.
- Power consumption of the board should be optimal.
- External wiring should be as few as possible.

BLOCK DIAGRAM



HARDWARE:

The custom-built board contains following resources

- Micro-Controller: ATmega328 microcontroller with Arduino boot loader
- Power Supply: An adapter that provides a 5V supply and 3.3V is required for some modules is generated on board
- A HC-05 Bluetooth module to send the data from microcontroller to a mobile phone.
- An LDR to detect the blinks on energy meter
- Diagnostic LEDs

SOFTWARE:

The programming will be done using Arduino IDE which is possible since the microcontroller is loaded with Arduino boot loader.

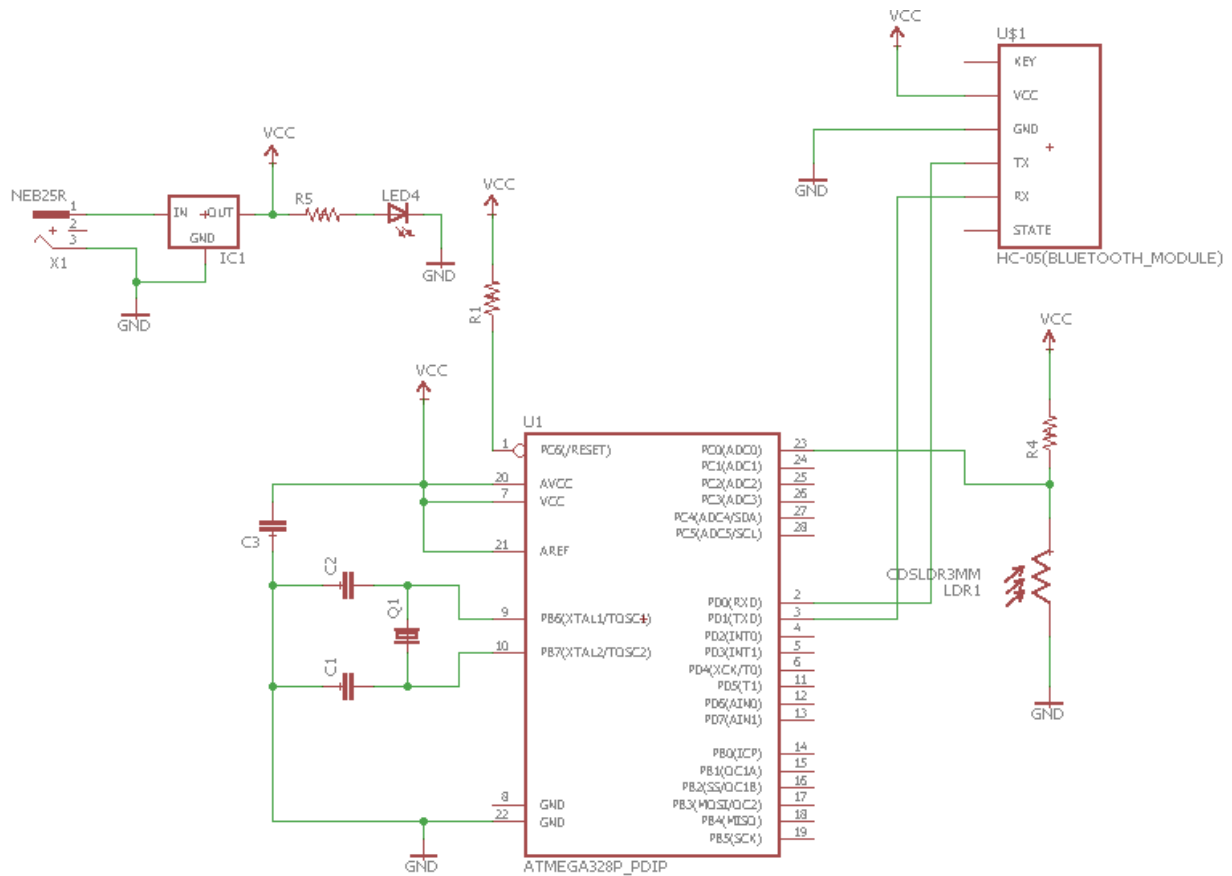
The Firmware will do the following tasks:

- Take readings from LDR sensor
- Calculate the total energy consumed and generating the bill.
- Send the required data to an Android application using Bluetooth.

CUSTOM BUILT PCB:



SCHEMATIC (CIRCUIT DIAGRAM):



HARDWARE DESCRIPTION:

ATMEGA328:

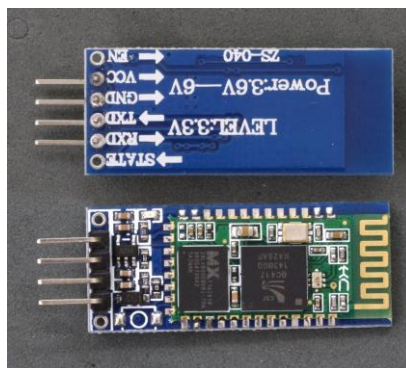
The Atmega328 is a very popular microcontroller chip produced by Atmel. It is an 8-bit microcontroller that has 32K of flash memory, 1K of EEPROM, and 2K of internal SRAM.

Atmega328

(PCINT14/RESET) PC6	1	28	PC5 (ADC5/SCL/PCINT13)
(PCINT16/RXD) PD0	2	27	PC4 (ADC4/SDA/PCINT12)
(PCINT17/TXD) PD1	3	26	PC3 (ADC3/PCINT11)
(PCINT18/INT0) PD2	4	25	PC2 (ADC2/PCINT10)
(PCINT19/OC2B/INT1) PD3	5	24	PC1 (ADC1/PCINT9)
(PCINT20/XCK/T0) PD4	6	23	PC0 (ADC0/PCINT8)
VCC	7	22	GND
GND	8	21	AREF
(PCINT6/XTAL1/TOSC1) PB6	9	20	AVCC
(PCINT7/XTAL2/TOSC2) PB7	10	19	PB5 (SCK/PCINT5)
(PCINT21/OC0B/T1) PD5	11	18	PB4 (MISO/PCINT4)
(PCINT22/OC0A/AIN0) PD6	12	17	PB3 (MOSI/OC2A/PCINT3)
(PCINT23/AIN1) PD7	13	16	PB2 (SS/OC1B/PCINT2)
(PCINT0/CLKO/ICP1) PB0	14	15	PB1 (OC1A/PCINT1)

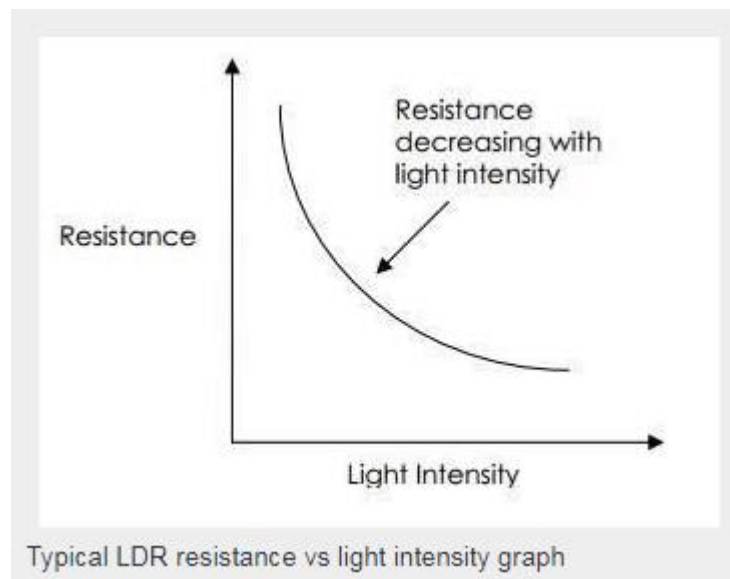
BLUETOOTH:

The Bluetooth module HC-05 is a MASTER/SLAVE module. By default, the factory setting is SLAVE. The Role of the module (Master or Slave) can be configured only by AT COMMANDS. The slave modules cannot initiate a connection to another Bluetooth device, but can accept connections. Master module can initiate a connection to other devices. The user can use it simply for a serial port replacement to establish connection between MCU and GPS, PC to your embedded project, etc.



LIGHT DEPENDENT RESISTOR (LDR):

An LDR is a component that has a (variable) resistance that changes with the light intensity that falls upon it. This allows them to be used in light sensing circuits.



FIRMWARE (ARDUINO CODE):

```
// Bluetooth tx - Arduino rx-0
// Bluetooth rx - Arduino tx-1
int sensorPin = A0; // select the input pin for LDR
int sensorValue = 0; // variable to store the value coming from the sensor
int unit=0;
void setup() {
  Serial.begin(9600);

}
void loop() {

  sensorValue = analogRead(sensorPin); // read the value from the sensor
  //Serial.println(sensorValue); //prints the values coming from the sensor on the screen
  if(sensorValue<200){
    unit= unit+1;
    delay(1000);
  }
  //Serial.println(sensorValue);
  Serial.print(" Units: ");

  Serial.println(unit); // displays the no.of units through bluetooth
  delay(1000);
}
```

ADVANTAGES:

- Smart meters show you what you're spending in rupees.
- No more estimated bills or supplying meter readings.
- Smart meters allow you to take control of your energy use.

CONCLUSION:

So, by using a Smart Energy Meter instead of traditional energy meters we can generate electricity bills automatically without any human intervention.