A

Project Stage I Report on

"INTELLIGENT CLOUD BASED REMOTE ELECTRICITY METERING AND BILLING SYSTEM OVER IOT"

Submitted in partial fulfillment of the requirements for the

degree of

BACHELOR OF ENGINEERING

In

ELECTRICAL ENGINEERING

Submitted By

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CERTIFICATE

This is to certify that the project work entitled **"INTELLIGENT CLOUD BASED REMOTE ELECTRICITY METERING AND BILLING SYSTEM OVER IOT"** is a bonafide work carried out in the VII semester by

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in partial fulfillment for the award of Degree of Bachelor of Engineering in **"ELECTRICAL ENGINEERING "** from Savitribai Phule University, Pune during the academic year 2019-20 who carried out the project work under my guidance.

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INDEX

ABSTRACT

- The advantages of remote meter reading and spot billing are well recognized by the various electricity boards in the country today. Not only does spot billing lead to much greater revenue- collection efficiency and better decision systems, it also brings intangibles like transparency and better customer service to the system.

- In India, the electricity usage is very high. And there is no such system that can take the reading on its own.

- Energy meter monitoring and keeping track of energy consumption is generally done manually. This process is quite complex, it sometimes produces few problems due to human errors.

- It will take the reading itself and will display it using server this will make consumer also to access their account on server and check their usage and bill even on daily basis and at will disconnect the connection if bill is not paid in time.

- An IoT module is interfaced to the controller to update the information in the web server about the condition of the field.

- Arduino and GSM based smart energy meters for advanced metering and billing system is able to read and send data.

- Smart Energy Meter uses SMS or/and Wi-Fi to send the power/unit data to cloud, so that user can access the data room module Apps and websites. Using cutting edge technology smart energy meters will save money, labour, efforts and time and at the same time it will effectively monitor the electricity consumption, usage and fraud. It is safe and easy to use and user friendly.

- The metering system uses cheap components which will decrease the overall cost of the equipment increasing its affordability and penetration in non-metered areas.

Keywords: Smart Meter, GSM, IOT, Tariff Based Metering, Wii-Fi Data Logging

1.INTRODUCTION

- Electricity is the heart of today's world. Now the world is going to be digital so electricity is very much important aspect. Generation and supply of electricity is the primary task of electricity board but it is also important to measure the power used by the consumer that is taking readings and generate the bills.
- In current scenario taking a reading and generating bills is manual work. It is very time consuming.
- Power theft is the one of the biggest problems in India. Sometimes user did not pay the bills on time so the electricity board worker cut the power supply manually.
- In this case, sometimes corruption done by the user or that worker which leads to the loss of electricity board. In some areas cameras also used to take a reading but it is a very complicated system and not so user-friendly.
- To avoid all these problems, we proposed a wireless system for smart electricity meter and billing system using IOT (Internet of Things).
- We also used the relays to cut down the power supply of unpaid user which would be controlled wirelessly using IOT concept.
- Reading will be taken automatically and users get the notification through message using GSM.

1.1. PROBLEM STATEMENT

- In the existing system have many drawbacks such as manual work, Human errors, inaccurate meter reading.

- Some cases camera used to read the meter reading but it also faces environmental issues, corruption, Power theft.

- The billing will be automatic through the server-based unit. For defaulter, customer electricity connection can be cut through the relay on the electric meter.

1.2.OBJECTIVES

- To provide automated meter reading over an immediate basis.

- To use the electricity in an optimized manner .

- Each consumer is provided with a unique energy meter with different Plan.

- Data will be saved at the could storage system .

1.3. Methodology

- The method used to carry out this IOT Based Smart Electricity Meter and billing System does the same task without human efforts.

- IOT Based 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.

2. LITRATURE SURVEY

| Sr No	Title	Author	Review
1	Arduino Mega and IOT based Intelligent Energy Meter (IEM) to Increase Efficiency and Accuracy in Current Billing Methodology	Osmi Jaiswal, Dilip Chaubisa	In this paper, a wireless method is proposed which puts emphasis on Intelligent Energy meter (IEM) ,reading and bill generation using Arduino Mega
2	Camera Click Energy Meter Reading System.	Manisha V Shinde, Pradip W Kulkarni.	Transistor-transistor logic (TTL) serial camera is used to take the image and wirelessly send this to server Personal Computer (PC) where it undergoes processing to extract digits and with reference to a previous month database new bill is generated with tariff consideration
3	Smart Electricity Billing System.	Krishnarao.Kundeti, Saikumar Pallagani.	Power consumption through the IR sensor unit. After getting the power consumption the ARM processor will detect the unit pulse and the unit will be converted as per our currency based on government tariff values and displayed on the LCD screen for a specific user.

SPECIFICATION

HARDWARE REQUIREMENT

- LCD

- Atmega328p

- v/I sensor

- Wi-Fi module

- Relay circuit

SOFTWARE REQUIREMENT

- Arduino IDE

- Proteus

- Thingspeak

6. BLOCK DIAGRAM
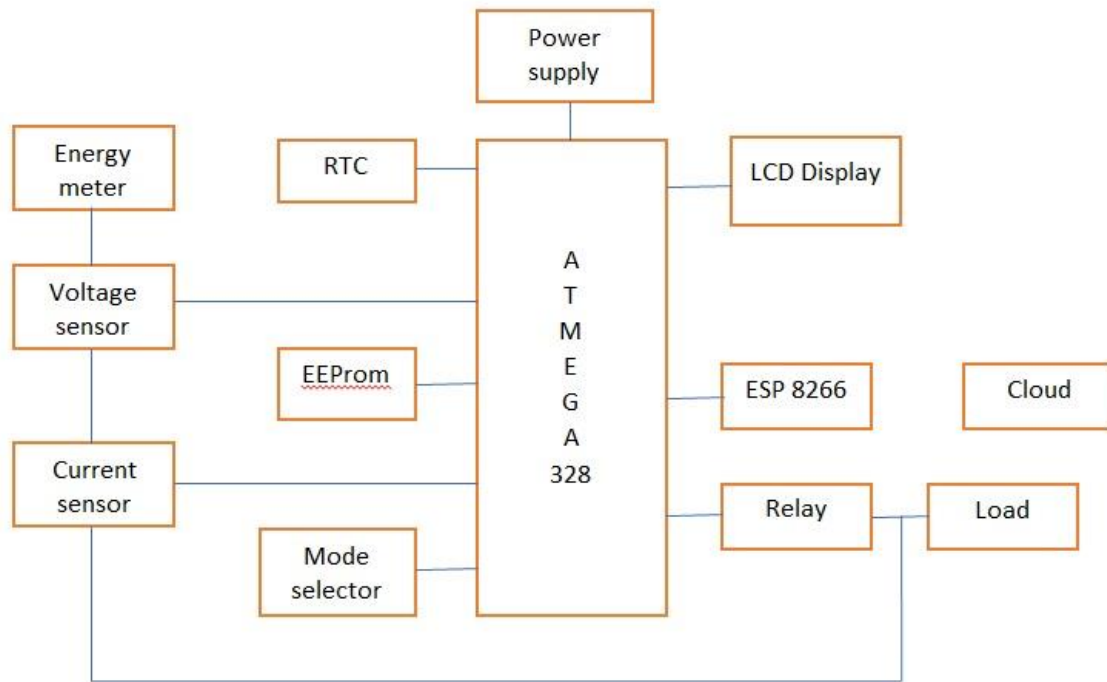
WORKING

- Vtg sensor used to get DC motion from an AC framework for contribution to a microcontroller the current sensor is detected from by utilizing current transformer. & corrected at the main operation.

- EEPROM (Electrically Erasable Programmable Read Only Memory) used as flash memory to store a data.

- Mode selection (automatic & manual) is used to Select Different Mode.

- RTC is Real Time Clock Is Used to Indicated Time and Date.

- The data obtained is then sent to the cloud through the internet

- This meter consists of LCD/LED to display weather the Pack are activated or Expired.

- An IoT module is interfaced to the controller to update the information inthe web server about the condition of the field.

Simulation
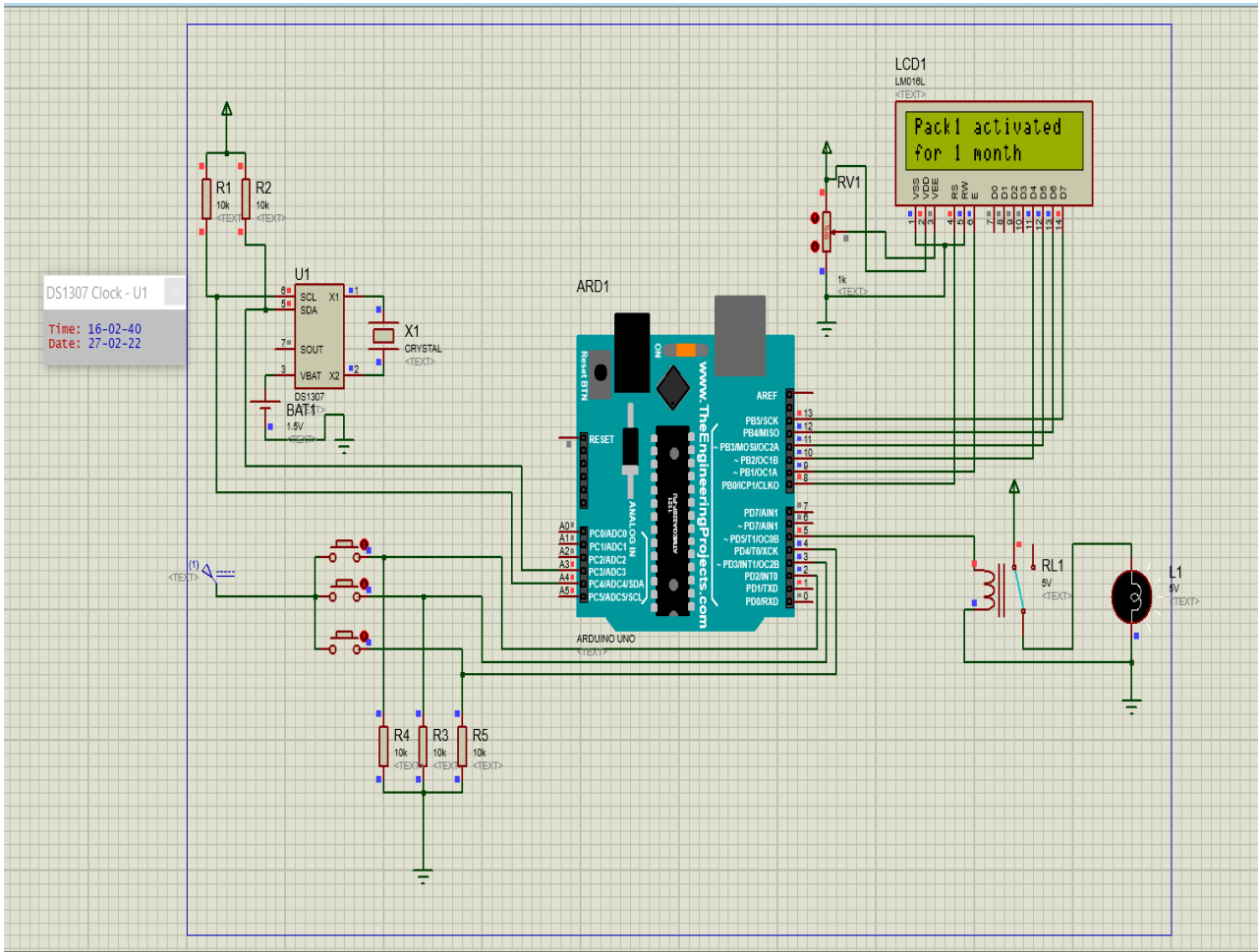
At-mega 328

Arduino was born at the Ivrea Interaction Design Institute as an easy tool for fast prototyping, aimed at students without a background in electronics and programming. As soon as it reached a wider community, the Arduino board started changing to adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for IoT applications, wearable, 3D printing, and embedded environments.
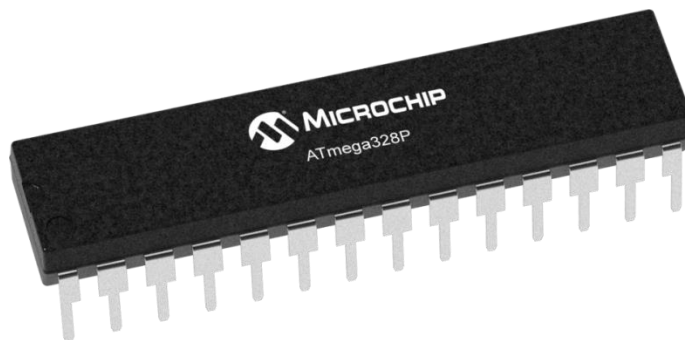
Arduino is a single-board microcontroller to make using electronics in multidisciplinary projects more accessible.

The hardware consists of a simple open source hardware board designed around an 8-bit Atmel AVR microcontroller, or a 32-bit Atmel ARM. The software consists of a standard

programming language compiler and a bootloader that executes on the microcontroller.
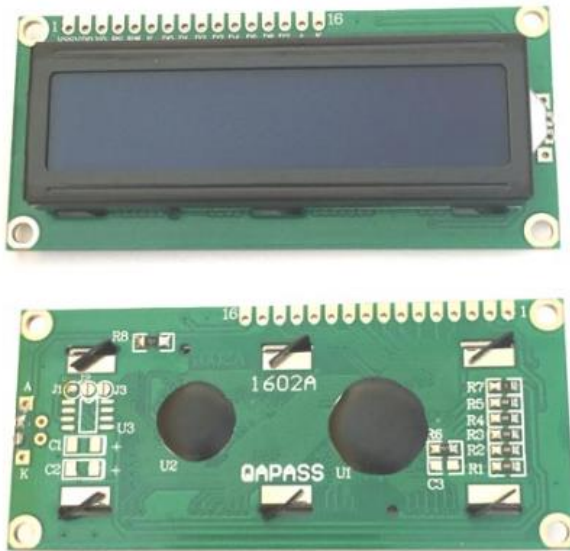
Microcontroller:

ATmega328

• Operating Voltage: 5V

• Input Voltage(recommended):7-12V

• Input Voltage (limits): 6-20V

• Digital I/O Pins: 14 (ofwhich 6 provide PWM output)

- Analog Input Pins: 6
- DC Current per I/O Pin: 40mA
- DC Current for 3.3V Pin: 50mA
- Flash Memory: 32 KB(ATmega328)
- SRAM: 2 KB (ATmega328)
- EEPROM: 1 KB (ATmega328)

16X2 LCD display

LCD stands for Liquid Crystal Display. LCD is finding wide spread use replacing LEDs (seven segment LEDs or other multi segment LEDs) because of the following reasons:

1. The declining prices of LCDs.

2. The ability to display numbers, characters and graphics. This is in contrast to LEDs, which are limited to numbers and a few characters.

3. Incorporation of a refreshing controller into the LCD, thereby relieving the CPU of the task of refreshing the LCD. In contrast, the LED must be refreshed by the CPU to keep displaying the data.

4. Ease of programming for characters and graphics.

These components are "specialized" for being used with the Atmega 328s, which means that they cannot be activated by standard IC circuits. They are used for writing different messages on a miniature LCD.

POWER SUPPLY
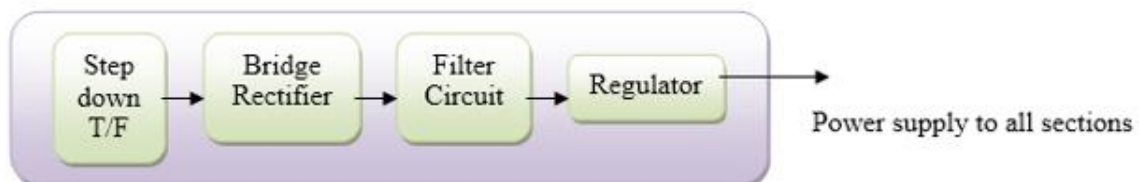
IOT module
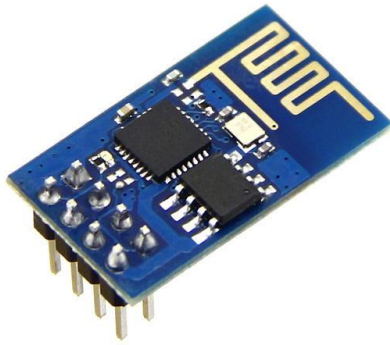
The ESP8266 is a system on a chip (SOC) Wi-Fi microchip for Internet of Things (IoT) applications produced by Espressif Systems.

Given its low cost, small size and adaptability with embedded devices, the ESP8266 is now used extensively across IoT devices. Although it's now been succeeded by the newer generation ESP32 microcontroller chip, the ESP8266 is still a popular choice for IoT developers and manufacturers.

The ESP8266 module enables microcontrollers to connect to 2.4 GHz Wi-Fi, using IEEE 802.11 bgn. It can be used with ESP-AT firmware to provide Wi-Fi connectivity to external host MCUs, or it can be used as a self-sufficient MCU by running an RTOS-based SDK. The module has a full TCP/IP stack and provides the ability for data processing, reads and controls of GPIOs.

ESP8266 Specifications

This is based on the ESP-12 module, which we discuss below.

ESP8266	DESCRIPTION
Core	1
Arquitecture	32 bits
Clock	Xtensa LX106 80-160MHz
WiFi	IEEE802.11 b/g/n support for WPA and WPA2
Bluetooth	No

ESP8266	DESCRIPTION
RAM	160KB - 64KB Instruction - 96KB Data
Flash	Extern QSPI - 512KB A 4MB
GPIO	16
DAC	0
ADC	1

ENERGY METER

Energy Meter or **Watt-Hour Meter** is an electrical instrument that measures the amount of electrical energy used by the consumers. Utilities are one of the electrical departments, which install these instruments at every place like homes, industries, organizations, commercial buildings to charge for the electricity consumption by loads such as lights, fans, refrigerator, and other home appliances.


Watt-Hour Meter

The basic unit of power is watts and it is measured by using a watt meter. One thousand watts make one kilowatt. If one uses one kilowatt in one-hour duration, one unit of energy gets consumed. So energy meters measure the rapid voltage and currents, calculate their product and give instantaneous power. This power is integrated over a time interval, which gives the energy utilized over that time period.

VOLTAGE SENSOR

A voltage sensor is a sensor used to calculate and monitor the amount of voltage in an object. Voltage sensors can determine the AC voltage or DC voltage level. The input of this sensor is the voltage, whereas the output is the switches, analog voltage signal, a current signal, or an audible signal.
Sensors are devices that can sense or identify and react to certain types of electrical or optical signals. The implementation of a **voltage sensor** and current sensor techniques have become an excellent choice for the conventional current and voltage measurement methods
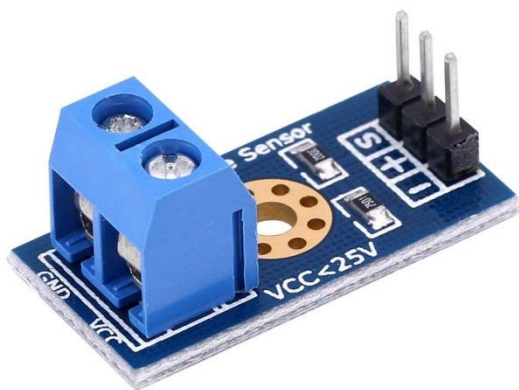
SOFTWARE REQUIREMENT

1. PROTEUS

What Is Proteus ??

Basically PROTEUS is also a simulating software but it helps you attach many components with the Arduino. Like resistors, capacitors, LEDs, LCDs, keypads, ICs etc. and these are just few that I have named in general. It has a complete library and you will find everything that you will ever need. You can design your complete circuit and then simulate it to view the final output. This means that after perfecting your project on the programming side in <u>KEIL</u>, you'll need to simulate it on PROTEUS to determine the output of the hardware components and change it if need be. This will completely ensure your project's success.

USING PROTEUS

PROTEUS is designed to be user-friendly and you will get the hold of it instantly. There is no need to worry about some complex configuration / settings prior to simulation. Here are the basic steps.

- Place your components from the library
- Connect them accordingly
- Load HEX file (if Arduino is involved)
- Simulate the circuit

Advantages

1. This system overcome human work. This system also takes an automatic reading and create a database.
2. Prevent From Power theft
3. IT Tackle of human error
4. To reduce wastage of energy
5. The system is Cost Effective
6. Easy Connection Without Corruption
7. It is Energy Efficient and Consume less power

Application

1.For Gas supply lines as well as Water supply.

2. The system can be used in the Domestic and Commercial area for electric supply.

3. PUBLIC POWER SOURCES.

4. Residential and commercial building in a public energy supply system

5.MSEB

6.Govt. Energy plant

Future Scope

1. In the present system,IOT energy meter consumption is accessed using internet and it will help consumers to avoid unwanted use of electricity.In future the following objectives can be achieved to save the power.

2. We can make a system which can send SMS to the concerned meter man of that area when theft detected at consumer end.

3. We can send the GPS location of the meter to the Electricity board when theft detected.

8. Conclusion

- This system makes trouble-free for electricity department to access the energy consumed by the consumer It works both automatically and manually.

- This system makes trouble-free for electricity department to access the energy consumed by the consumer It works both automatically and manually.

- This meter will directly cut electricity after the pack get over.

- This will prevent system from inaccurate meter reading, corruption, Power theft.

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