Internet of Things Based Smart Grid

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***Abstract*—Smart grid is an interconnected network for delivering electricity from suppliers to consumers. The power station act as a supplier it produces the electrical power, high-voltage transmission lines that carry power from a source to consumers. Smart grid helped to conserve power usage by monitoring an efficient management system. The proposed system provides communication between the supplier and consumer through the smart grid. The smart gird act as an intelligent device it cut down the power supply which is running up against its limitation remotely through the internet. The data can be updated on cloud service so that consumer and supplier can access that data through internet by fitting the smart meter. The one microswitch is fitted in meter to prevent a meter tempering.**

***Key Terms*: Internet of Things, sensors, smart grid meter.**

I. INTRODUCTION

Internet of Things sense and collect the data from the smart meters through internet after it processed share the data between the consumer and supplier. IOT allows object creating opportunities for more direct integration of the physical world into computer-based systems with improved efficiency, accuracy and economic benefits and too reduced human intervention.

The smart grid is an ecosystem of suppliers and consumers. Smart –grid technologies are made possible by two-way communication technologies.

The smart grid allows the system to use the electricity efficiently and economically as possible. It incorporates into the grid the benefits of distributed computing and communications to deliver real-time information and enable the near- instantaneous balance of supply and demand at the device level.

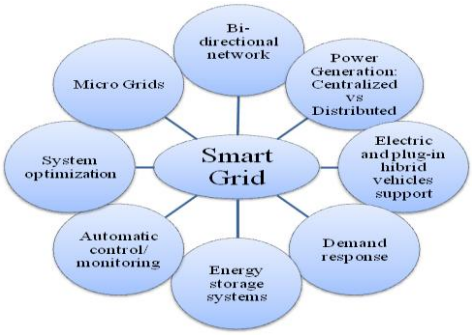

Figure-1 Architecture of smart grid

Benefits of Smart Grid

1. It avoids using unlimited electricity during a season
2. It conserves the power production.
3. It reduces the human intervention.
4. A highly efficient management system

Smart Meters provides interval measurement and storage of consumption data and display of consumption data to a consumer. Remotely can connect and disconnect it.

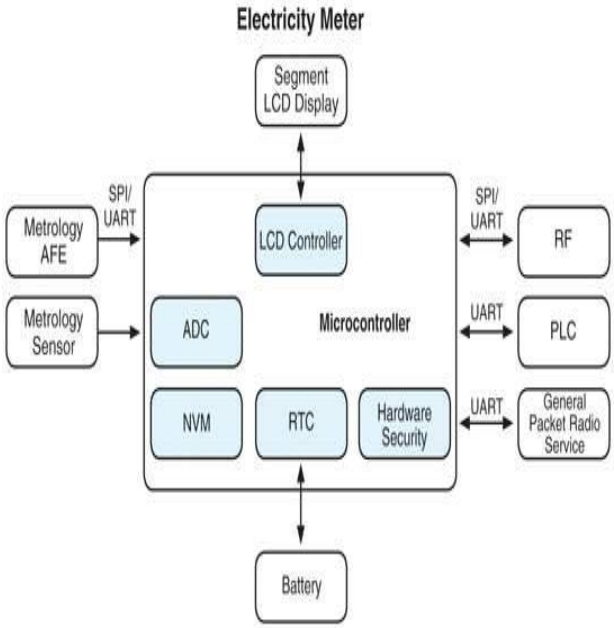

Figure-2 Electricity Meter

II. SMART GRID TECHNOLOGIES

The five basic technologies of smart grid

2.1 Real-time

All the components in smart grid can communicate with others which are connected to the open system.

2.2 Sensors and measurement technologies

Sensors are fixed at a different location using the different measurement technologies can collect information from the sensors at any point of time.

2.3 updated components

Advanced and updated components are used for the smart grid. It made an interrupt of human limitation.

2.4 Management system

Advanced control methods are used for the smart grid. So highly efficient management system takes place in the smart grid.

2.5 Decision support

Smart grid act as an intelligent system can take decision depends on the situation.

III. HARDWARE ARCHITECTURE

3.1Microcontroller

Microcontroller hastimers inbuilt memory and counters. Microcontrollers are otherwise called as single- chip microcomputer. Harvard Architecture often used the microcomputer for separate memory mapping of data and code.

In this project used ATmega328 Arduino Uno Microcontroller board is used. It has 14 input and output pins and 6 pins used for PWM outputs, 6 Analog inputs it can connect easily with the computer through USB cable for power supply.

The external supply of 6 to 20 volts and recommended range 7v to 12v. If supply reduced less than 5v the board may be unstable.

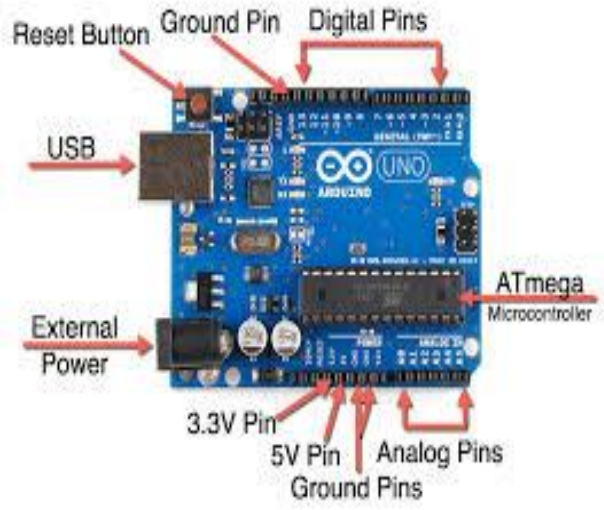

Figure-3ATmega328 Arduino Uno

3.2 Analog to digital converter

The Microcontroller can understand the binary digit. So the ADC or Analog to digital converter is used. ADC is used to convert the information into the binary number and follow it to CPU when can take place the further process.

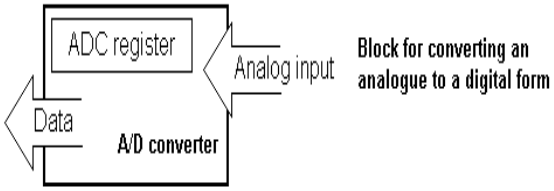

Figure-4 Analog to Digital converter

3.3 I^2C

I^2C is a serial protocol for connecting the slow speed devices like Microcontroller and ADC to an embedded system. I^2C need start and stop conditions in addition while using slower microcontrollers for reading and writing a byte.

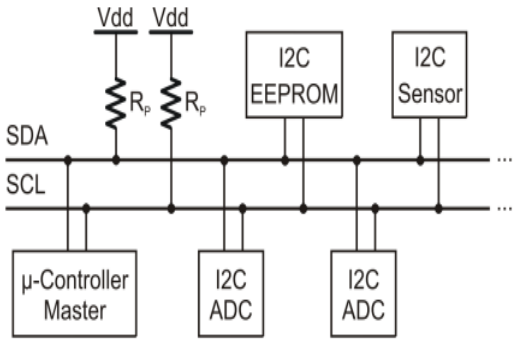

Figure-5 I^2C

3.4 Working on Proposed System

The RF transceiver is connected to PIC microcontroller through a Serial peripheral interface (SPI). SPI allows the bidirectional interaction between the CPU and Peripheral device. SPI preferred more than parallel interface because of simple and easy wiring.

LCD is connected to the microcontroller through I^2C.The result is displayed in LCD.

Steps to interface LCD with pic microcontroller

Step 1: Identify the LCD which is specified as AXB format. A refers the number of columns and B refers the number of rows.

Step 2: Connection is based on standard Hitachi Pinout

Step 3: Connect RS, RW, E, and D0 – D7 pins to a microcontroller pin.LCD required few commands and function.

After the connection is made, switched on the display mode and reference mode. The transmitting and receiving the RF signal made the power ON.

Once the power is ON the two mode starts communicating with each other. The modes are placed very close to each other. Monitor and note down the RSSI value.

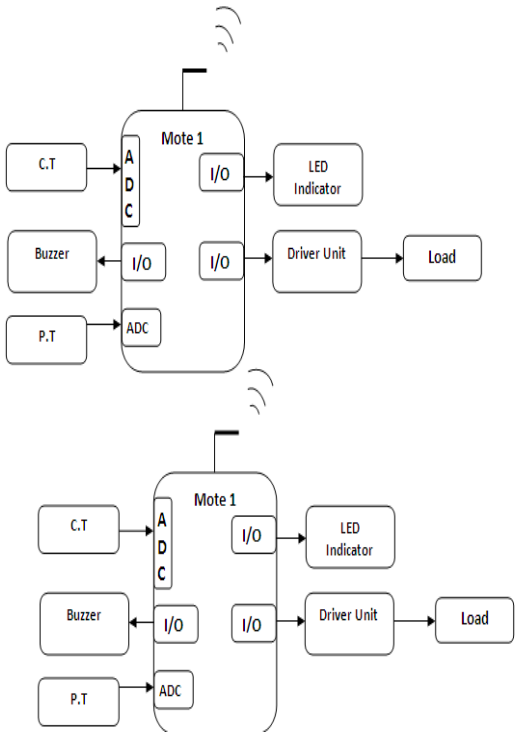

Figure-6 Monitoring unit

Increase the distance between the display mode and reference mode it makes the variation in the RSSI value. Note down the RSSI value.

Increase the distance between the two modes at certain distance RSSI Value is Zero. Again decrease the distance between the two modes and observe the RSSI value it starts to increase.

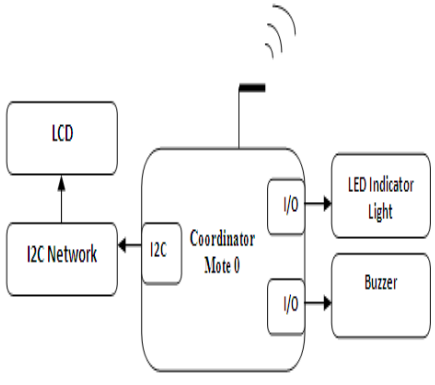

Figure-7 Display unit

Different position shows different RSSI values. According to the values noted the controller is programmed to monitor and compare the RSSI value and display the result in the LCD throughI^2C.

By this way, the power is been taken and noted down and power which is running against the limitation is cut down remotely ina smart grid system.

IV. SOFTWARE SIMULATION AND RESULTS

4. Software tools

- 1PROTEUS IDE
- HI-TECH compiler
- C- Language

4.1PROTEUS IDE

Proteus is simulation software for design with a microcontroller. It is easy to handle and test. After creating a circuit in Proteus software can easily make the PCB design with it.

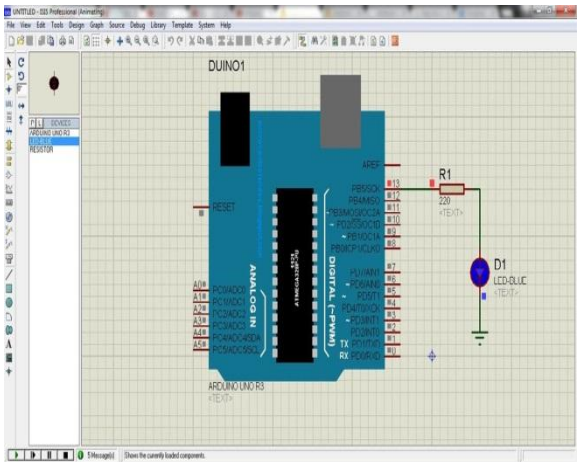

Figure-81PROTEUS IDE

4.2 HI-TECH

HI-TECH compiler offers a complete ANSI C an embedded package with a full development system for language C and assembler. Here HI-TECH compiler is used to compile the code.

4.3 C LANGUAGE

C language is High-level language and most commonly used programming language.

Reasons used for C language

1. Easy to understand

2. Various computer platforms can be used to compile the c program

Steps to upload the code.

- Step 1: writing the program or code
- Step 2: compiling and debugging the code
- Step3:uploading the code to the microcontroller

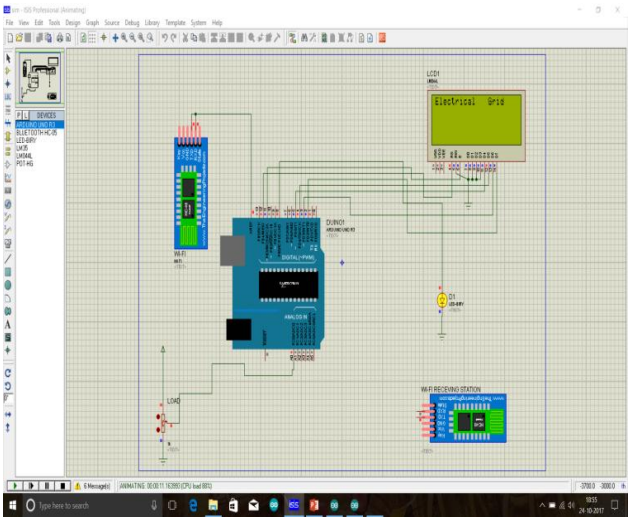

Figure-9 software simulation output

IV. RELATED WORKS

[1] Maximum demand controller is a device designed to satisfy the demand of industries load management. The value is fixed as pre-set value. When demand approaches a pre-set value automatically the alarm sounded. The user and supplier were predetermined by the programmed jointly. When the industries cross the load limit the monitoring unit identifies and gives an alert. The industry must reduce if industry failed to reduce the embedded system will automatically remove the load and inform this information to EB station using WPAN

[2] By using wireless sensor network with data display, overload cross warning and safety system is developed. We use advanced RF transceiver for wireless communication and current transformer. Address each unit with service number and located to identify the fault. Till the process are noticed and updated to the electricity board via RF and alert by buzzer sound system.

[3] This Paper discussed the Navigation methods LORAN and Theatrical Positioning systems. The geographic coverage is relatively long and provides the wavelength without satellite navigation via groundwave propagation. Comparing the value of TPS and GPS finding the distance called the TPS method.

[4] The sensors are placed at a different location it may cause a different errors due to sensors .To calculate the performance and verify the results using the on-spot verification and region verification. Echo is the protocol used to verify the sensors true location is same as the verified location. Compare and plotted the sensor performance.

V. PROPOSED SYSTEM

- By using wireless sensor network with data display with overload cross warning and safety system is developed.
- We use Wi-Fi for wireless communication and Current transformer and address each unit with service number and located to identify the fault.
- All the process are noticed and updated to the electricity board via the Internet.
- The project is constructed over Wi-Fi which stands for wireless fidelity.
- Avoid the failure of the transformer due to overload.
- Easily can locate the fault by monitoring the smart grid.

VI. ADVANTAGES AND DISADVANTAGES

Advantages

- Reduces the power cost of consumers by its efficient control management.
- It saves the time and power.
- The amount of power used and issues were updated to suppliers via internet instantly.
- This system designed to reduce the power theft.
- Transmission of power managed efficiently.
- This Systemfree from danger.

Disadvantages

- Required more components.
- The system is expensive.
- Required updated components
- Sensors may cause an error due to different location and environment.
- Customer support tools are required.

VII. CONCLUSION

Smart Grid is user-friendly technology. A Consumer can check daily usage data from any location using internet. Suppliers can control the power supply remotely.It has control unit. Smart grid represents one of the more promising and prominent internet of things application. More efficient transmission of electricity.

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