IMPROVED ESM NETWORK THROUGH INTERNET-AN EFFICIENT APPROACH FOR SMART CITIES

Devika.M[1], Dhameen Anushiya Begam.N[2], Gowthami.S[3],Sreedevi.B[4]

[1,2,3]*Jeppiaar SRR Engineering College. Tamil Nadu, India.*
[4]*Dept. of ECE, Jeppiaar SRR Engineering College, Tamil Nadu, India.*

Abstract - *An Internet of things (IoT) connected society has various worldwide applications in the current scenario. Both the hardware and software are present in the smart systems which represents a large inter-connected system. This system represents an efficient approach for smart cities. The data sensed by the sensor is fed to the Arduino controller (Node MCU) which is viewed in the webpage. Accessing the consumed data over worldwide describes the efficiency of IoT which tends to make the cities smart. For security purpose, login system is provided to each user in home and electricity board. By which the user can monitor their voltage and current consumption of their own home even they might present in any part of the world.*

***Key Words*: Arduino Controller, Internet of Things (IoT), Sensors, Wi-Fi.**

1. INTRODUCTION

The Electric Smart Meter (ESM) segment is rapidly expanding with increased use of smart meter in smart cities. Recent study called Allied Business Intelligent Research [1] suggests more than 1.1 billion smart meter bases will have been installed globally by 2021. Advent of more sophisticated technologies will be an added advantage of industrial specialists. Internet has changed the way we work and communicate by connecting us through World Wide Web. IoT aims to take this connectivity to next level by connecting various devices to the internet and facilitating human-machine and machine-machine interactions. The visionaries have also realized that this IoT ecosystem has applications in area of Home Automation, Automotive Factory/Assembly line Automation, Retail, Medical/Preventive Health care and more.

2. PROBLEM IDENTIFIED

In existing system, the digital energy meter is based on PIC microcontroller. Calculation of the phase difference between current and voltage using zero cross detection capability of op-amp is a distinct feature of this project. Current transformer is used to measure the current signal and a step down potential transformer is used to measure the voltage. GSM module is chosen as a possible wireless solution to this issue. GPS is used to track the location of the customer.

The disadvantages of the existing model are as follows:

a. Low level communications
b. Limited connections
c. Less efficiency
d. Low coverage area

3. PROPOSED MODEL

A recent huge interest in Machine to Machine communication is known as Internet of Things (IoT), to allow the possibility of autonomous devices to use internet for exchanging the data. This project can minimize working efforts and improve parameters of voltage and current. This sensor data is sent to microcontroller and this controller checks parameter limits which is further sent to the IoT web server software using Wi-Fi module. Of these data make sure the right information in hand to the operator and they can make useful decisions before the occurrence of any catastrophic failure on the basis of parameters. Electric Smart Meter sensing devices are deployed in networks to collect and send in real-time data through internet to reach data center.

The advantages of the proposed model are as follows:

a. Cost efficiency
b. High coverage area
c. Reliability
d. Easy maintenance

4. PROPOSED DIAGRAM

The proposed model block diagram is represented as follows:

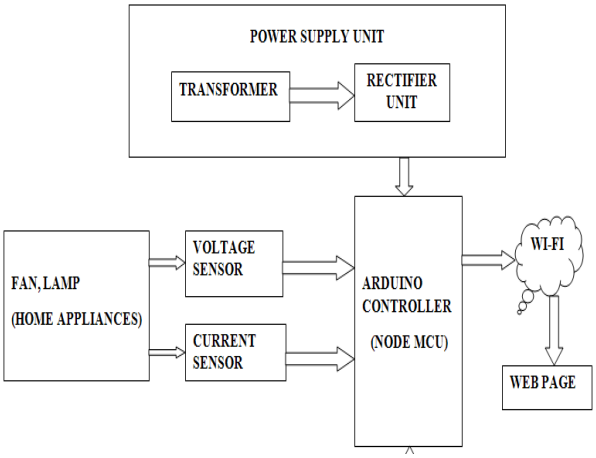

Figure 1. Architecture Diagram

4.1. SOFTWARE SECTION

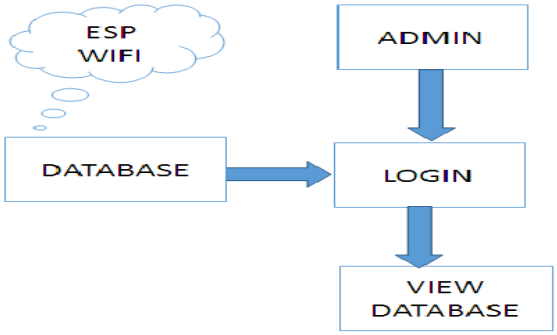

Figure 2. Software Architecture

4.2. DESCRIPTION

The current sensor and the voltage sensor data's are given to the microcontroller (Refer Figure1). Depends on the usage of power the data readings will be varied and those data's will be updated by using Wi-Fi module on the web page. The lamp and the fan are considered as a load here, so the usage of those appliances will be measured by the current and voltage sensors. Every data will be updated on the web page instantly for every 5 seconds (Refer Figure2). So we easily monitor the usage of power for home appliances. If interrupt occurs, it is given as an input to the controller which is then updated to the webpage.

5. MODULES DESCRIPTION

The modules present in the proposed diagram are as follows:

5.1. CURRENT SENSOR

A device (Figure3),used for detecting the electrical current flowing in the load (fan, lamp). The signal generated might be voltage or current in analog or digital form. The utilization of the current sensor is for displaying the current value measured in an ammeter or it can be stored for further analysis.

Figure 3. Current Sensor

5.2. VOLTAGE SENSOR

This block represents a voltage sensor (Figure4), which is a device used for voltage between two points of an electrical circuit. Load such as fan and lamp produces voltage which is sensed by the voltage sensor.

Figure 4. Voltage Sensor

5.3. WIFI DEVICE [NODE MCU]

The Wi-Fi device ESP-12 is popular due to its size and the number of pins brought to the side of the board. The Wi-Fi used here is called as ESP8266. It can run between voltages of 2.8 to 3.5 volts. Most people use a 3.3 volt regulated power source. Since the maximum current drawn is 300mA, using of 500mA to be safe. The Node MCU Development Board (Figure5), requires 3.3V power supply.

Figure 5 . Microcontroller-Node MCU

5.3.1. JUMPER

a. Connect Vcc to CH_PD to enable the chip
b. Connect GP10 to GND to enable flash reprogramming.

5.4. WEBPAGE SECTION

NAME	ADDRESS	DATE/ TIME	VOLTAGE CONSUMPTION	CURRENT CONSUMPTION

Figure 6. Webpage Section

6. TECHNIQUES USED

6.1. IOT TECHNOLOGY

IOT is a technology or an architecture which is an aggregation of already available technologies. Devices and objects with built in sensors are connected to an IOT platform, which integrates data from different devices and applies analytics to share the most valuable information. These powerful IoT platforms can pinpoint exactly what information is useful and what can safely be ignored. This information can be used to detect patterns, make recommendations and detect possible problems before they occur.

6.2. CODING LANGUAGES

6.2.1. Embedded C

Embedded C is the most popular embedded software language, through which most of the embedded software is written. In the proposed approach, coding is written in Embedded C in the Arduino controller.

6.2.2. JAVA

Java is a platform independent language which is used here to get the inputs from the controller to the webpage.

6.2.3. PHP

PHP is a server scripting language, and a powerful tool for making dynamic and interactive WebPages. To make the web page dynamic and efficient, the proposed model uses this technique.

7. RESULTS AND DESCUSSION

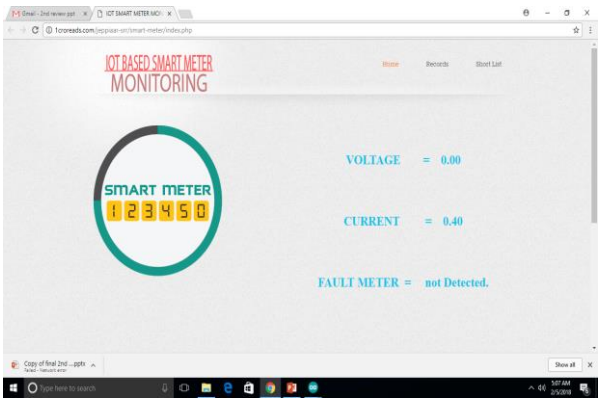

Figure 7. Homepage

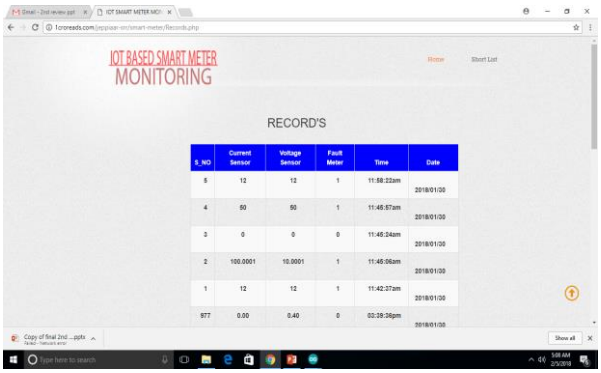

Figure 8. Records

When the URL is viewed through internet, the Webpage get open(Figure7). The Webpage consists of the information such as voltage and current consumed, fault occurred, date and time(Figure8). Each data is updated to the webpage on an average of every 5 seconds.

8. CONCLUSIONS

This project presents a data-driven decision-support system to improve ESM operations within the IoT ecosystem. The proposed methodology is novel and efficient since it has more coverage area. The need to ensure the cost efficiency of network operations and high component availability is driving reconsideration of network maintenance strategies, such as when and where to deploy cost field maintenance resources. Decision models that are sensitive to transient network dynamics will be required to assist in this process and ensure ESM system cost efficiency. The proposed model, which is driven by continuous analysis of ecosystem communication quality.

9. REFERENCES

[1]Joseph Siryani, Ph.D. Candidate, Bereket Tanju,Ph.D., and Timothy Eveleigh,D.Sc."A Machine Learning Decision – Support System Improves the Internet of Things' Smart Meter Operations" .IEEE Internet of Things Journal, pp.2327-4662, 2017.

[2]Hussain, G. A., Kumpulainen, L., Kluss, J. V., Lehtonen, M., & Kay, J. A. "The Smart Solution for the Prediction of Slowly Developing Electrical Faults in MV Switchgear Using Partial Discharge Measurements". IEEE Transactions on Power Delivery Journal, 2309-2316,2013.

[3]Luan,W., Peng,J., Maras,M.,Lo,J.,d Harapnuk,B."Smart Meter Data Analytics for Distribution Network on Smart Grid Journal, 1964-1971,2015.

[4]Mainetti, L.,Mighali, V.,& Patrono, L."A Software Architecture Enabling the Web of Things. IEEE Internet of Things Journal, 445-454,2015.