

A SURVEY ON SMART ENERGY METER WITH BILLING AND THEFT DETECTION

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Abstract - In energy management system the fundamental limitations are exact metering, energy checking and visual information for Shopper load profile. This paper spotlights the design of Smart Energy Meter (SEM) with online billing for domestic consumers. Utilizing microcontroller work, consistent readings of energy meter are gathered and saved in Arduino UNO, at that point the information is moved to a far-off worker of Things Speak application which is an android application utilized for energy observing and controlling. A PIR motion sensor is connected to Arduino UNO for theft detection.

Key Words: Energy consumption, online billing, continuous reading of energy consumption ,checking the consumption limit ,theft detection,

1. INTRODUCTION

Electricity is one of the most essential features of all matter ,Electricity is used many purposes like industrial, medical or personal use. A major population depends on a firm and dependable power source on a daily basis. In this situation, it is impossible to imagine a life without electricity. Energy monitoring aims is to provide users with information about their consumption patterns and that is carried out using Energy Monitoring application that gathers consumption data, analyze it and then provides useful information The purpose of this paper is to provide an implementation methodology for electricity theft detection which provides warning messages if motion detected via wireless sensors and providing data for billing and consumption of each component connected. Using microcontroller function, constant readings of energy meter are collected and saved in Arduino UNO, then the data is transferred to Things Speak application which is an android application used for energy monitoring and controlling. Node MCU is used to provide internet to the meter and Thing Speak application is used for receiving virtual messages about bill and consumptions.

1.1 GENERAL DESCRIPTION

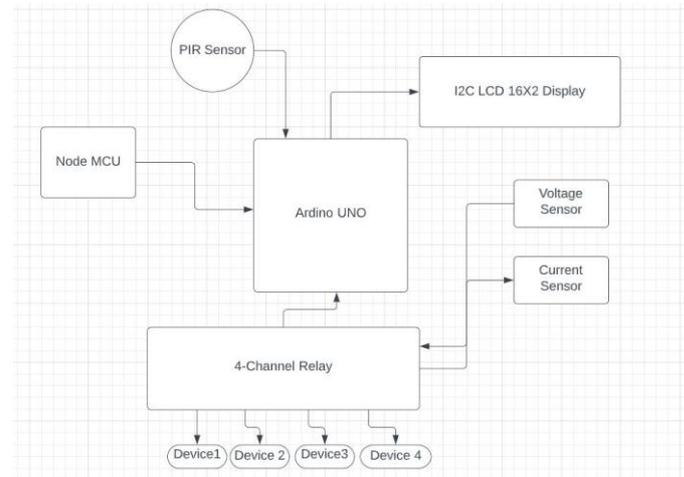


Figure-1: Block Diagram

The above-mentioned diagram shows the complete connections involved in our project.

In this circuit we have Arduino UNO as our main functioning block. The 4-channel relay ,current and voltage sensors are connected to arduino and the devices used. I2C LCD is also connected to arduino for display and Node MCU is used for internet connection of circuit. PIR is attached to arduino for motion detection.

1.2 HARDWARE IMPLEMENTATION

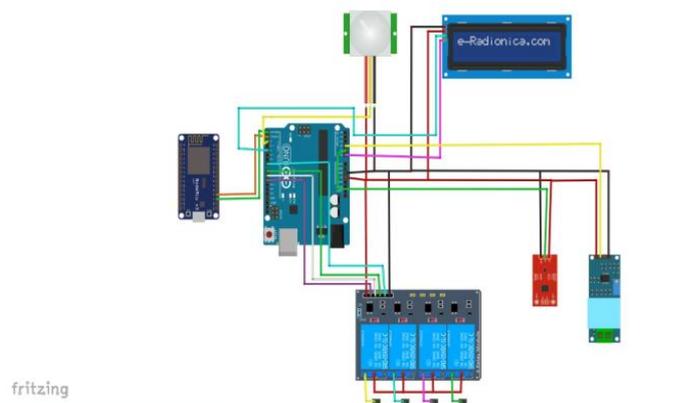


Figure-2: Circuit Diagram

The controlling and monitoring functions of our project are all handled by Arduino UNO. ACS712 current sensor and ZMPT102B voltage sensor are used to measure the current and voltage consumption by the load. And the sensors are connected to Arduino UNO. Node MCU is connected to Arduino UNO to provide internet connection to the circuit. 4-channel relay is connected to Arduino UNO and its each channel is connected to 4 different load devices. One PIR sensor is connected to Arduino UNO for theft detection purposes. The data from all the sensors is collected in Arduino UNO and from there it is provided to Blynk application and I2C 16x2 LCD which will display total amount of bill. On Things Speak application we can see total consumption and bill of the devices connected in detail and an email. The warning message for theft will be also received through Thing Speak Application.

1.3. SOFTWARE IMPLEMENTATION

The software used in the project are Arduino IDE, Things Speak, IFTT, Google Assistant.

1.3.1 ARDUINO IDE

It's simple to write code and upload it to the board using the open-source Arduino Software (IDE). Windows, Mac OS X, and Linux are all supported. The environment is written in Java and is built on open-source applications such as Processing. Any Arduino board is compatible with this software. A text editor, a message area, a text console, a toolbar with buttons for common operations, and a series of menus comprise the Arduino development environment. It communicates with and uploads programmes to the Arduino hardware. Sketches are the name for the software created with Arduino. The text editor was used to create these sketches. The file extension.ino is used to save sketches. It provides text cutting/pasting and searching/replacing capabilities. The message section indicates faults and provides feedback while storing and exporting. The console shows text from the Arduino environment, such as complete error messages and other data. The current board and serial port are displayed in the bottom right-hand corner of the window. You may validate and upload programmes, generate, open, and save sketches, and open the serial monitor using the toolbar buttons.

1.3.2 THING SPEAK APPLICATION

Thing Speak is a Ruby-based open-source programme that allows users to speak with internet-connected objects. By giving an API to both devices and social network websites, it makes data access, retrieval, and logging easier. IoBridge first introduced Thing Speak in 2010 as a service to help IoT applications.

1.4. RESULTS AND OUTPUT

Here Figure 3 shows voltage and current consumptions of bulb and Figure 4 shows the bill consumption of bulb which is displayed on LED screen.

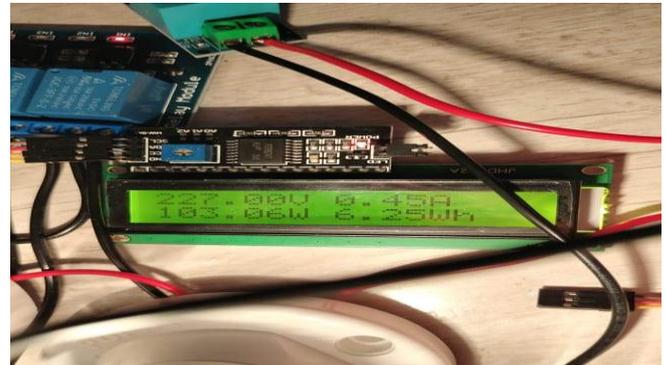


Figure- 3: Current and Voltage Consumption



Figure-4: Bill Consumption

1.5. APPLICATIONS

It can be used for real time information on your energy use, so you can save money and reduce emissions.

1.6. ADVANTAGES

1. No need to manually submit the readings
2. Easy to monitor energy usage and spending using in-home display and our credit can also be easily visible.

1.7. DISADVANTAGES

1. Switching energy suppliers becomes difficult
2. Renters can't install smart meters.
3. Over the top smart meters sales pitches from energy suppliers.

1.8. CONCLUSION

In this study, a smart metre is proposed that takes advantage of the GSM network, which provides nearly unrestricted access to every household and area across many nations. GSM connectivity not only enables utilities to combat energy theft using our smart energy metre, but it also enables them to implement the concept of prepaid electricity usage. As a result, utilities can take prompt legal action against the guilty consumer, thereby controlling electricity theft. The linked PIR sensor detects any motion around the metre and alerts the client.

1.9. FUTURE SCOPE

The project can be further extended to detect the zone and probable consumers which are involved in power theft which can analyze the electricity theft going on in percent with area wise.

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REFERENCES

- [1] Himanshu K. Patel, TanishMody, Anshul Goyal Institute of Technology, Nirma University,. Arduino Based Smart Energy Meter using GSM 978-1-7281-1253-4/19/\$31.00 , 2019 IEEE
- [2] Visalatchi S, Kamal Sandeep K, Smart Energy Metering and Power Theft Control using Arduino & GSM Automated Smart Metering, 978-1-5090-4307-1/17/\$31.00 ,2017 IEEE
- [3] Naziya Sulthana, Rashmi N, Prakyathi N Y, Bhavana S, K B Shiva Kumar, 28-08-2020 , IJERTCONV8IS14011
- [4] Brinda.S , Vishal Kumar Sah, Jaladi Harish , Akshay.U, Vishal Deo Mahto, Swetha Umapathy, International Journal of Engineering Science and Computing, March 2018

[5] Rakhi.S,Rushali Poovamma PJ,Varshitha R,Sahana SB, Swathi P. (2020). Smart Energy Meter using LoRa. International Journal of Advanced Science and Technology, 29(10s), 4233-4242.

[6] Soumyadeep Mukherjee, Debjyoti Dey Disha Ghosh) & Sourav, IOT BASED PREPAID SMART METERING SYSTEM, Maulana Abul Kalam Azad University of Technology (MAKAUT) © 2020

[7] Elakshumi, S.; Ponraj, A., A Server Based Load Analysis Of Smart Meter Systems, 978-1-5090-5913-3/17/\$31.00 ,2017 IEEE

[8] Maha Aboelmaged, Yasmeen Abdelghani, Mohamed A. Abd El Ghany , Wireless IoT based Metering System for Energy Efficient Smart Cites , 978-1-5386-4049-4/17/\$31.00 ,2017 IEEE

[9] Hui Miao, Guo Chen, Member, IEEE, Zhiheng Zhao, and Fangfei Zhang, Evolutionary Aggregation Approach for Multi-hop Energy Metering in Smart Grid for Residential Energy Management, 1551-3203 (c) 2020 IEEE.

[10] Md Redwanul Islam , Supriya Sarker , Md Shahradian Mazumder, Mehnaj Rahman Ranim, An IoT based Real-time Low Cost Smart Energy Meter Monitoring System using Android Application , ISSN: 2395-1303

[11] Apoorva, Ashwini, Nisarga and Dr.P K Kulkarni, Dr. Somashekhar Swamy, IOT Based Smart Energy Meter for Automatic Billing, Power theft Detection and Disconnection , Volume XIII, Issue VII, JULY 2020

[12] Rishabh Jain, Sharvi Gupta, Chirag Mahajan, Ashish Chauhan, IOT based Smart Energy Meter Monitoring and Controlling System , IJRECE VOL. 7 ISSUE 2 APR.- JUNE 2019.