



IOT BASED ENERGY METER RATING

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ABSTRACT

This paper is described to measure energy consumption in the house and generate its bill automatically using telemetric communication. This can help in reducing energy consumption in house as the owner is continuously being notified about the number of units that are consumed. Its objective is to generate bill automatically by checking the electricity unit's consumption in a house and in a way to reduce the manual labor. The calculations are performed automatically and the bill is updated on the internet by using a network of Internet of Things. The bill amount can be checked by the owner anywhere globally.

Design and implementation of project is mainly based on ARM controller using IOT concept. In electricity transmission human involvement is not required. Consumer pays the electricity bill for the consumed power. If in case consumer fails to pay the bill on time then electricity transmission can automatically be turned off. Also power theft can be detected if any tampering happens it will send the information to the server as well as it will cut the electricity automatically. WIFI performs the IOT operation where and through which the information is sent to the Web server.

Keywords: *ARM 7 Controller, Arduino Controller, WIFI ESP8266 MODULE, WIFI Display.*

I. INTRODUCTION

The internet of things allows objects to be sensed and controlled remotely across existing network infrastructure, creating opportunities for more direct integration between the physical world and computer-based systems, and resulting in improved efficiency, accuracy and economic benefit.

The increasing generation needs empowered gadgets by wireless technology which includes Bluetooth, Radio Frequency Identification, Embedded sensors and many more. In that IOT technology has grown from its beginning and now is presently widely used. The electricity plays an important role in our life. Now-a-days as the consumers are increasing rapidly it became very hard to handle the electricity requirements. Without electricity it's impossible to survive and also it is important to save the electricity loss. As the generation increases the consumer's requirements also increase so in accordance with it the technology improvement is needed. So we developed the system with faster and improved technology i.e. IOT. The electricity also contains some issues like power theft. Power theft is a measure crime and it also directly affects the economy of our country. Transmission, generation and distribution of electricity include the loss of electricity. To avoid the losses we need to monitor the power consumption and losses, so that we can efficiently utilize the generated power. Meter tampering is part of power theft and also an illegal crime which we can minimize. Billing is a process in general the human operator goes to every consumer's home then providing bill it will take a lot of time. To resolve these issues we developed a system on the basis of IOT energy meter reading.



IOT based energy meter reading consists of three parts: Controller, Theft detection and WIFI part. Controller part plays a major role in the system. Where all the information can send through this controller to the other part of the system and it also stores the information in it. WIFI part performs IOT operation in accordance with the Arduino controller. The energy meter connected with theft detection part if any temper happens it will send the information to the company as well as it will take automatic action by making power off

II. PROPOSED METHOD

2.1 block Diagram

The block diagram of the project consists of controller part, theft detection part and wifi unit. Controller part consists of ARM 7 controller and Arduni Uno. WIFI ESP8266 for the IOT operation. LCD, Relay, Buzzer, 555 monostablemultivibrator these are other components present in the system. Microcontroller is the core component of the project that connects input and outputs of the devices. The microcontroller used is ARM 7 LPC2148 and ARDUINO UNOInitially DC power supply to give voltage to the circuit. Amplifier circuit and isolation circuits are connected with relays and load. The load and relays in this circuit represent the devices that need energy or electricity to operate and are used at homes. Energy meter is connected to ARM 7 controller through 555 timers which are used Monostablemultivibrator. This gives the information to the controller about the energy consumed, bill and if any theft occur. The bill is calculated using the formula as shown below.

$$\text{Bill} = \text{consumed units} * 3 + 50$$

Once the information is sent the ARM 7 controller it will further communicate to Arduino and it will display on the LCD. If in case any theft occur automatically buzzer will beep by making load OFF. Also the information is sent to the web server through wifi which is attached to Arduino controller. The information uploaded on the internet is accessed through a webpage. And the programming of the whole system is done using embedded 'c'.

III. SYSTEM IMPLEMENTATION

The proposed IOT based Energy Meter Reading is implemented using two nodes, one on the consumer end and one for the Web server

3.1 Consumer end Implementation

In this project we are using ARM 7 LPC2148 microcontroller, Aduino controller and WIFI ESP8266 module for the IOT operation. The project mainly focuses on the billing, and power theft.

A. ARM 7 LPC2148

The ARM7 is a part of Advanced RISC Machine (ARM) family of general purpose 32-bit microprocessors, which offers low power consumption for and low cost for high performance devices. It was developed in 1980s and now widely used 32-bit instruction architecture. ARM 7 processor requires significantly lesser transistors because as it is based on RISC based approach. Reduced complexity and design allows company to build a low-energy system on chip for embedded C.

Functionalities of LPC2148 board:

1. It has RS232 Communication for UART0 and UART1.
2. 16/32 bit ARM7TDMI-S MCU from Philips (NXP).
3. It support USB device.
4. It has JTAG connection which performs debugging/programming application.

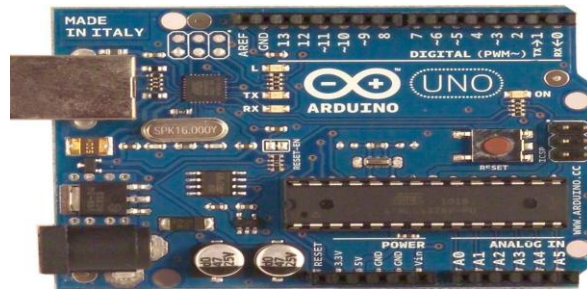
5. EEPROM interface can be done using I2C.

6. On board contains Buzzer and Relay function.

7. Segment displays via I2C (Inter-Integrated Circuit).

3.2 Controller Unit

Arduino is a microcontroller board and it is based on ATmega328P. Board consists of 14 digital input/output pins. Out of which 6 input pins are used as PWM outputs, 6 as analog inputs, quartz crystal of 16MHz, having USB connection, power supply jack, an ICSP header and reset button. Simply we can connect the Arduino board to the computer using USB connection to get start. Also we can supply power to it with AC – to – DC adapter or we can use battery to get started. As we compare Arduino UNO board with other it differs from the proceeding board which doesn't use FTDI USB – to – serial driver chip. Instead of that the ATmega8U2 is programmed as USB – to – serial converter.



3.3 WIFI ESP8266 MODULE

Wifi ESP8266 is a low cost chip with TCP/IP stack and microcontroller. In our project main importance of wifi is it performs IOT operation. The simple device is connected from microcontroller to send the information.

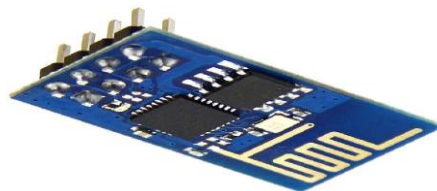


Figure 3: ESP18266 WIFI module

3.4 WEB SERVER

In our project we are displaying the information about the energy consumed in terms of units, about the bill and if any theft occurs that will be displayed in the website. Hence every user can check the information any where globally. Thingspeak web page is used for displaying the information of the project.

IV. RESULTS

The results of the project are shown below step by step in the form of picture representation.

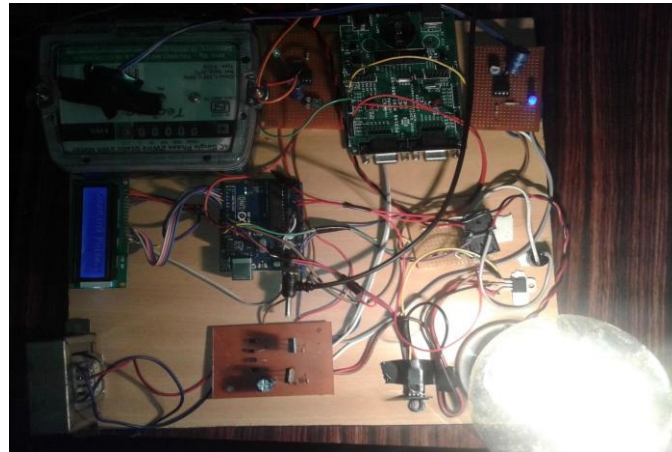


Figure4 : IMPLEMENTATION OF BOARD

The figure 4 shows the representation of consumers end implementation IOT board consists of ARM 7 controller, Arduino Uno, theft detection and WIFI ESP8266

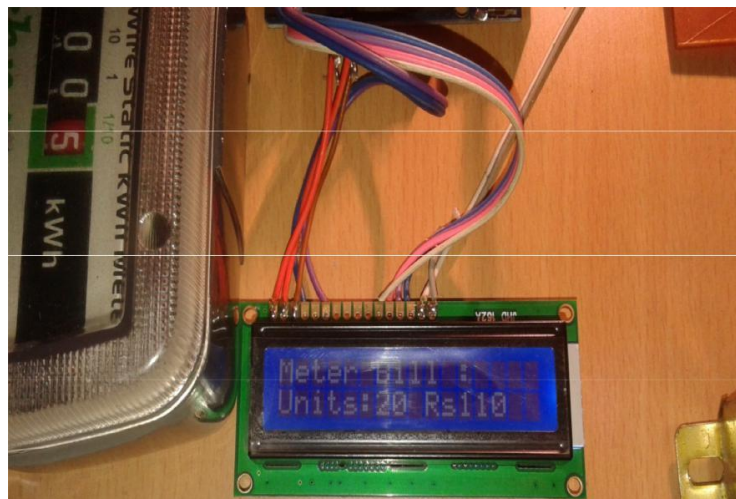
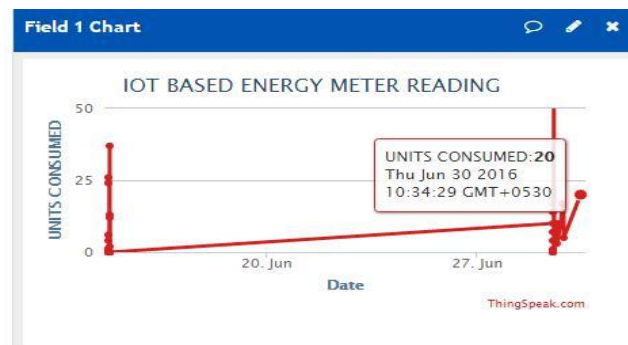


Figure 5: LCD display of energy meter bill and consumed units



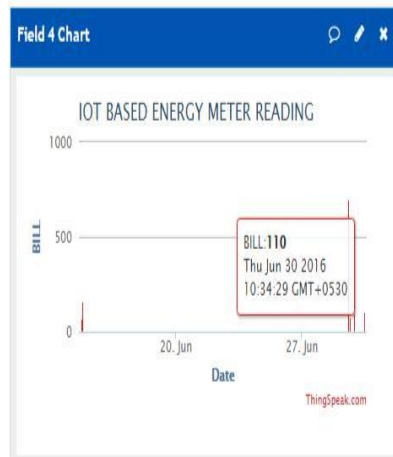


Figure 7 shows the bill for the consu med units on the web server with time and date.



Figure 8 shows tamper happened in energy meter which is displayed on the LCD display.

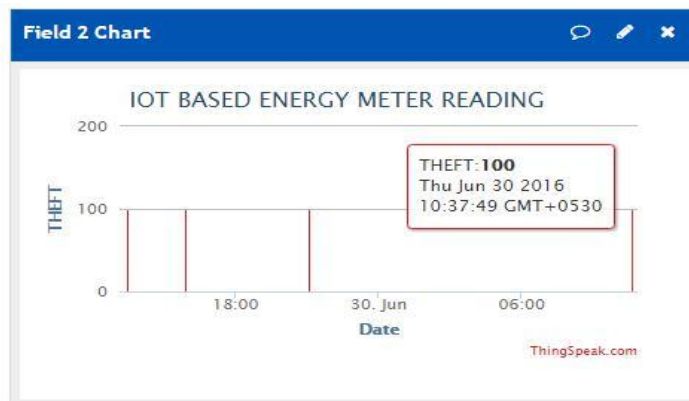
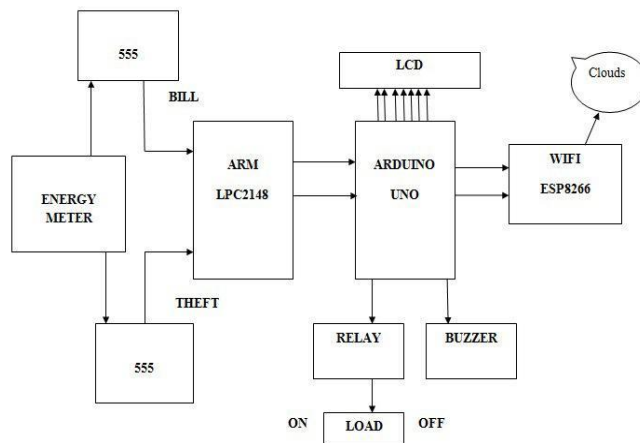


Figure 9: Theft detected part displays on the web server

IV. BLOCK DIAGRAM OF IOT BASED ENERGY METER READING

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V. CONCLUSION

The Project is mainly concentrated on IOT network. When we discussed about the project there are certain points to notify first we are converting conventional energy meter into a digital meter. We are doing automatic reading and also connection and disconnection of meters using WIFI module. Then meter reading has come faster. It is publically available for the customers as well as for the KPTCL. Both the peoples will be using the information as per their requirements and they will be having freedom to check the bill, tampering, when the meter has been connected and disconnected before the due date. All the information will be displayed by using smart app. Finally concluding our project that we are successfully monitored the tampering i.e. seal tampering and we have read the meter bills which also be uploaded on the website using IOT concept. Overall the new things we are worked with in our project are ARM controller coupled with Arduino controller and the IOT model.

VI. FUTURE SCOPE

The project mainly aims at providing overall infrastructure of the energy meter presently used for the smart city concept. The main improvement for the future is going to make energy meter readings, tampering identification techniques, and connection and disconnection and also the pre information providing to the users all is going to happen on wifi internet. Where we are going to develop some wifi hotspots in each area through which all the energy meters are get connected and set 4 to 5 parameters which is also going to be monitored. And the overall improvement information will be providing to the energy meter i.e. KPTCL will be easy for them to handle the things. Also in future we can go with some standard apps or standard tools, where in which it makes work easy for KPTCL people by reading the meter readings faster than the fastest method. And connect and disconnect of every meters on the on – payment and non – payment that will be fast as compared to the present method

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