

# IOT BASED ENERGY METER MONITERING AND CONTROL SYSTEM

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**ABSTRACT:** In the Internet of Things (IoT) demonstrate, a considerable lot of the living and non-living things that envelop us will be on the web in some structure. Driven by the prominence of contraptions engaged by wire-less mechanical development, for example, Wireless Bluetooth, Radio Frequency Identification, Wireless-Fidelity, installed sensor, IoT has moved out from its starting stage and it is quite the edge of changing the present settled between net into a very much included up and coming Internet. Presently there are right around nine billion between associated devices and it is evaluated to contact just about fifty billion contraptions by 2020. The proposed framework configuration dispenses with the human inclusion in Electricity support. The Buyer needs to pay for the use of power on timetable, on the off chance that that he couldn't pay, the power transmission can be changed independently from the far off server. The client can screen the vitality utilization in units from a website page by giving gadget IP address. Robbery location unit associated with vitality meter will tell organization side when meter altering happens in vitality meter and it will send burglary recognize data through PLC modem and robbery identified will be shown on the terminal window of the organization side. Wi-Fi unit plays out the IoT activity by sending vitality meter information to page which can be gotten to through IP address. The Hardware interface circuit comprises of Raspberry Pi, LCD show, burglary recognition unit, Potential Transformer and Relay circuit. Wi-Fi unit plays out the IoT task by sending vitality meter information to site page which can be gotten to through IP address.

Index Terms: IOT, Rasspberry pi, PLC modem, Energy meter

## I. Introduction

Today the world is confronting such a situation, that offers difficulties. Vitality emergency is the principle issue looked by our general public. A pertinent framework to control and screen the power utilization is one of the answers for this issue. One methodology through which the present vitality emergency can be tended to is through the decrease of intensity utilization in family units[1]. The customers are expanding quickly and furthermore load on power offering divisions is pointedly expanding. The buyers must be encouraged by giving them a perfect arrangement: - for example the idea of IoT (Internet of Things) meters and then again specialist organization end channel so be educated about power burglaries utilizing robbery discovery unit and raspberry pi. By keeping above variables, the idea of IoT meters flourished comprising of 2 units: Raspberry pi 3 , Theft recognition unit and Wi-Fi unit. The paper depicts raspberry pi 3 demonstrate b based plan and execution of vitality meter utilizing IoT idea. The client can screen the vitality utilization in units from a page by giving gadget IP address. Burglary discovery unit associated with vitality meter will tell organization side when meter altering happens in vitality meter and it will send robbery recognize data through raspberry pi and robbery distinguished will be shown on the terminal window on the specialist organization [2]-[4].

This framework gives opportunity to power organizations to made a move against merciful clients who have remarkable contribution; generally organizations can separate the intensity of client. This framework additionally gives the power cut data and hardening alert. So IoT based metering framework is increasingly productive relevant tradition charging framework. Remote correspondence is the exchange of data over a separation without utilization of electrical conveyor or wires. The separation included might be short (a couple of meter as in TV remote control) or long (thousands or a huge number of kilometer for radio correspondence). Remote activity licenses administration, for example, long range correspondence, that are unimaginable or unrealistic to actualize with the utilization of wires. So we are goes for the remote correspondence utilizing Iot idea. The transmission of meters information by simple and increasingly efficient way is the significant extent of our undertaking[5]-[8].

## II. Proposed System

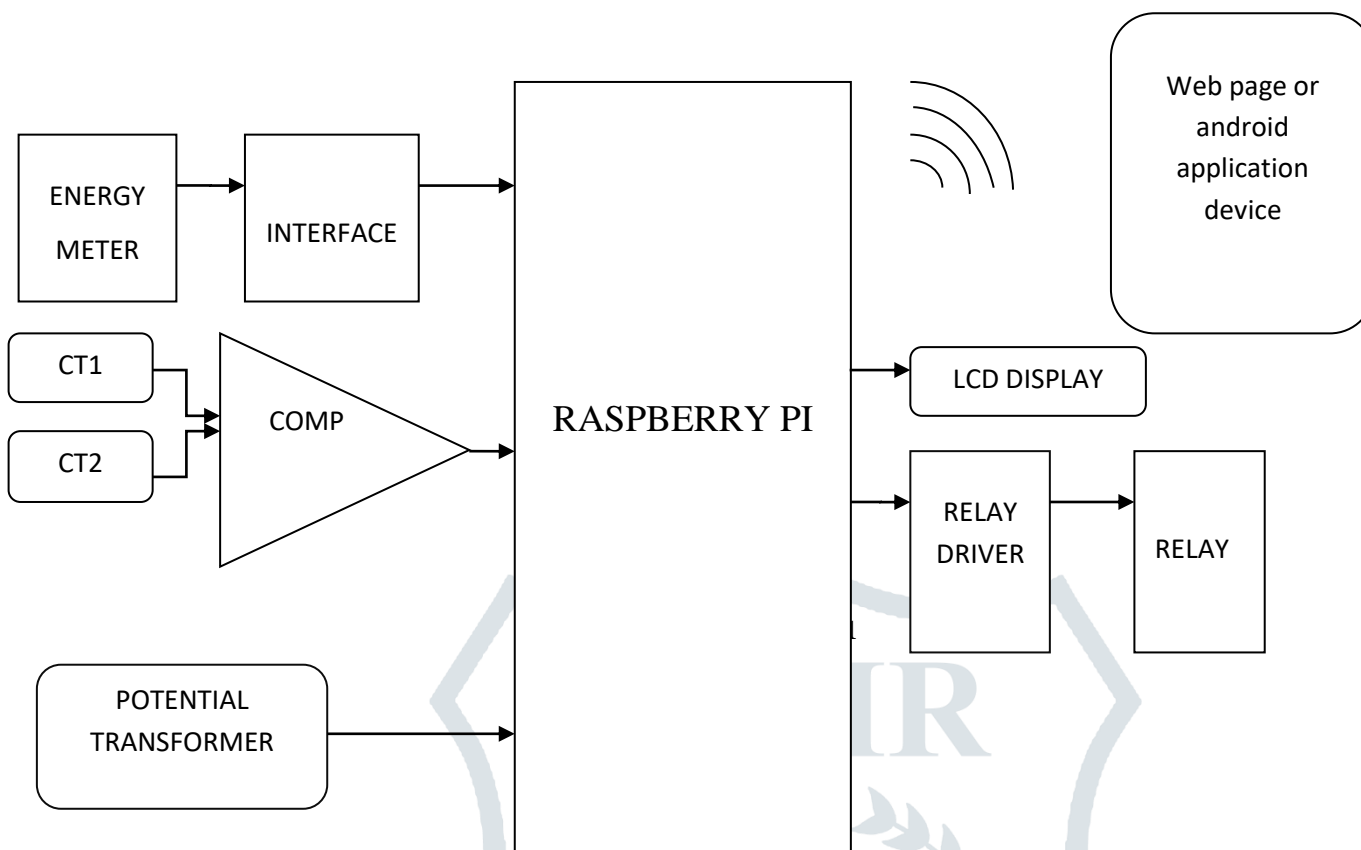


Figure 1 Block diagram of Proposed System

#### A. Energy meter

Electronic Energy Meter depends on Digital Micro Technology (DMT) and uses no moving parts. So the EEM is known as "Static Energy Meter". In EEM the exact working is constrained by an extraordinarily structured IC called ASIC (Application Specified Integrated Circuit). ASIC is built just for explicit applications utilizing Embedded System Technology. Comparable ASIC are currently utilized in Washing Machines, Air Conditioners, Automobiles, Digital Camera and so on [4]. Notwithstanding ASIC, simple circuits, Voltage transformer, Current transformer and so forth are likewise present in EEM to "Test" current and voltage. The 'Info Data' (Voltage) is contrasted and a modified "Reference Data" (Voltage) lastly a 'Voltage Rate' will be given to the yield. This yield is then changed over into 'Advanced Data' by the AD Converters (Analog-Digital converter) present in the ASIC. The Digital Data is then changed over into a "Normal Value". Normal Value/Mean Value is the estimating unit of intensity. The yield of ASIC is accessible as "Heartbeats" demonstrated by the LED (Light Emitting Diode) set on the front board of EEM. These heartbeats are equivalent to Average Kilo Watt Hour (kWh/unit). Diverse ASIC with different kWh are utilized in various makes of EEMs. Be that as it may, generally 800 to 3600 heartbeats/kWh creating ASICs are utilized in EEMs. The yield of ASIC is adequate to drive a Stepper Motor to give show through the pivot of digits emblazoned wheels. The yield beats are demonstrated through LED. The ASIC are fabricated by Analog Device Company. ADE 7757 IC is commonly utilized in numerous nations to make EEMs. ADE 7555/7755 ASIC keeps up the worldwide standard Class I IEC 687/1036.

#### B. Raspberry Pi

The Raspberry Pi is a fully functional credit card sized computer. The device is designed to be easy to use and as affordable as possible. The Raspberry Pi comes as a printed circuit board. The Raspberry Pi size is 85.60mm x 56mm x 21mm (or 3.37"x2.21"x0.83") and weighs 45g.

##### An available five models are:

- **Raspberry Pi Model A:** It has 256MB RAM, only one USB port and no network connection.
- **Raspberry Pi Model B:** It has 512MB RAM, 2 USB ports and a network connection.
- **Raspberry Pi Model B+ :** It has the similar specifications as the Model B, but comes with 4 USB ports, more GPIO pins, and uses less power than the Model B. This model costs \$35.

- **Raspberry Pi 2 Model B:** The latest version of the device, with 900 MHz quad-core ARM Cortex-A7 CPU and 1GB of RAM.
- **Raspberry Pi Zero:** This model is equipped with 1GHz ARM11 core and 512MB of RAM, but comes without an Ethernet port.

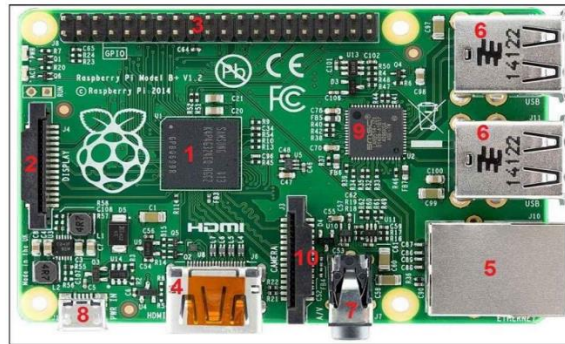


Figure 2 Rassberry Pi Hardware

### C. Internet of things

The Internet of things (adapted Internet of Things or IoT) is the between systems administration of physical gadgets, vehicles (additionally alluded to as "associated gadgets" and "smart devices"), structures, and different things inserted with hardware, programming, sensors, actuators, and network connectivity that empower these articles to gather and trade information. In 2013 the Global Standards Initiative on Internet of Things (IoT-GSI) characterized the IoT as "the framework of the data society." The IoT enables items to be detected or controlled remotely crosswise over existing system infrastructure, creating open doors for more straightforward combination of the physical world into PC based frameworks, and bringing about enhanced effectiveness, exactness and monetary advantage notwithstanding decreased human mediation. At the point when IoT is increased with sensors and actuators, the innovation turns into an occasion of the more broad class of digital physical frameworks, which additionally incorporates advancements, for example, shrewd matrices, brilliant homes, wise transportation and keen urban areas. Every thing is interestingly recognizable through its inserted registering framework yet can interoperate inside the current Internet foundation. Specialists gauge that the IoT will comprise of just about 50 billion articles by 2020.

Ordinarily, IoT is relied upon to offer propelled network of gadgets, frameworks, and administrations that goes past machine-to-machine (M2M) interchanges and covers an assortment of conventions, areas, and applications. The interconnection of these inserted gadgets (counting shrewd articles), is relied upon to introduce computerization in almost all fields, while additionally empowering propelled applications like a savvy framework and growing to zones, for example, keen urban communities.

"Things," in the IoT sense, can allude to a wide assortment of gadgets, for example, heart checking inserts, biochip transponders on homestead creatures, electric mollusks in waterfront waters, cars with implicit sensors, DNA investigation gadgets for ecological/nourishment/pathogen observing or field activity gadgets that help firemen in pursuit and salvage tasks. Legitimate researchers propose to take a gander at "Things" as an "inseparable blend of equipment, programming, information and administration". These gadgets gather valuable information with the assistance of different existing innovations and after that independently stream the information between different gadgets. Current market precedents incorporate home robotization (otherwise called keen home gadgets, for example, the control and mechanization of lighting, warming (like shrewd indoor regulator), ventilation, cooling (HVAC) frameworks, and apparatuses, for example, washer/dryers, automated vacuums, air purifiers, broilers or iceboxes/coolers that utilization Wi-Fi for remote checking.

Just as the extension of Internet-associated robotization into a plenty of new application zones, IoT is additionally expected to produce a lot of information from differing areas, with the subsequent need for snappy accumulation of the information, and an expansion in the need to list, store, and procedure such information all the more successfully. IoT is one of the stages of the present Smart City, and Smart Energy Management Systems.

### D. Current Transformers

Current transformers are utilized so ammeters and the present curls of different instruments and transfers need not be associated straightforwardly to high voltage lines. As such, these instruments and transfers are protected from high voltages. CT's likewise venture down the current in a known proportion. The utilization of CT implies that generally little and exact instruments, transfers and control gadgets of institutionalized plan can be utilized in circuits.

The CT has separate essential and auxiliary windings. The essential winding which comprises of few turns of substantial wire, twisted on an overlaid iron center is associated in arrangement with one of the line wires. The auxiliary twisting comprises of a more noteworthy number of turns of a littler size of wire. The essential and auxiliary windings are twisted on a similar center.

The present rating of the essential twisting of a CT is 100 A. The essential winding has three turns and the optional winding has 60 turns. The auxiliary winding has the standard current rating of 5A; therefore the proportion between the

essential and optional current is 100/5 or 20/1. The essential current is multiple times more noteworthy than the optional current. Since the auxiliary winding has 60 turns and the essential winding has 3 turns, the optional winding has 20 fold the number of turns as the essential winding. For a CT, at that point the proportion of essential to optional flows is conversely relative to the proportion of essential to auxiliary turns.

CT is utilized to venture down current in a 3300V, single stage circuit. The CT is evaluated at 100 to 5 An and the proportion of current advance down is 20 to 1. In different words, there are 20 An in the essential twisting for every ampere in the auxiliary winding. In the event that the ammeter at the optional demonstrates 4A, the real current in the essential is multiple times this esteem i.e. 80 A.

The CT in the figure has extremity markings in that the two high voltage essential leads are checked H1 and H2 and the auxiliary leads are stamped X1 and X2. When H1 is promptly positive, X1 is sure at a similar minute. Some CT makers mark just the H1 and X1 leads. While associating the CT's in circuits; the H1 lead is associated with the line lead encouraging from the source while the H2 lead is associated straightforwardly to the ammeter. The essential circuit is generally unaffected by the addition of the CT. The appraised auxiliary current is regularly institutionalized at 1 or 5 amperes. For instance, a 4000:5 CT would give a yield current of 5 amperes when the essential was passing 4000 amperes. The optional winding can be single proportion or multi proportion, with five taps being basic for multi proportion CTs. The heap, or weight, of the CT ought to be of low obstruction. On the off chance that the voltage time basic zone is higher than the center's structure rating, the center goes into immersion towards the finish of each cycle, contorting the waveform and influencing exactness.

### E. Circuit Description

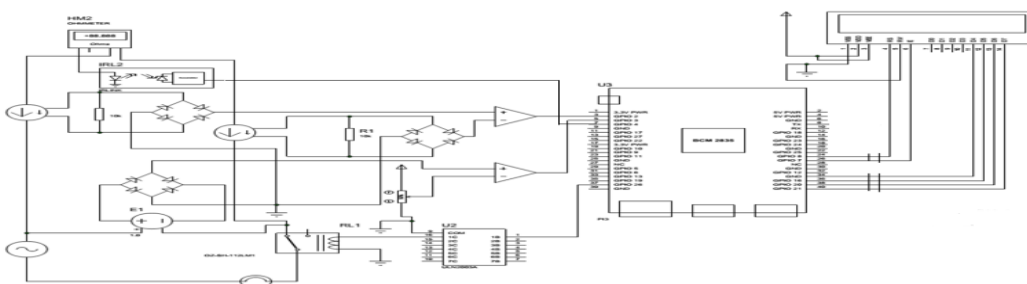


Figure 3 Circuit diagram

At the point when AC is connected to the essential twisting of the power transformer it can either be ventured down or up contingent upon the estimation of DC required. In our circuit the transformer of 230 V/15 V is utilized to play out the progression down task where a 230V AC shows up as 15V AC over the auxiliary winding. In the power supply unit, correction is typically accomplished utilizing a strong state diode. Diode has the property that will give the electron a chance to stream effectively one way at legitimate biasing condition. As AC is connected to the diode, electrons possibly stream when the anode and cathode is negative. Turning around the extremity of voltage won't allow electron stream. A usually utilized circuit for providing a lot of DC control is the scaffold rectifier.

An extension rectifier of four diodes (4\*IN4007) is utilized to accomplish full wave amendment. Two diodes will lead amid the negative cycle and the other two will direct amid the positive half cycle. The DC voltage showing up over the yield terminals of the extension rectifier will be fairly under 90% of the connected RMS esteem. Channel circuits, which more often than not capacitor is going about as a flood arrester dependably pursue the rectifier unit. This capacitor is likewise called as a decoupling capacitor or a bypassing capacitor, is utilized not exclusively to 'short' the swell with recurrence of 120Hz to ground yet in addition to leave the recurrence of the DC to show up at the yield. The voltage controllers assume a critical job in any power supply unit. The main role of a controller is to help the rectifier and channel circuit in giving a steady DC voltage to the gadget. Power supplies without controllers have an inalienable issue of changing DC voltage esteems because of varieties in the heap or because of vacillations in the AC liner voltage. With a controller associated with the DC yield, the voltage can be kept up inside a nearby tolerant area of the ideal yield. The controllers IC7812 and 7805 are utilized to give the +12v and +5v to the circuit.

### III. Hardware Implementation

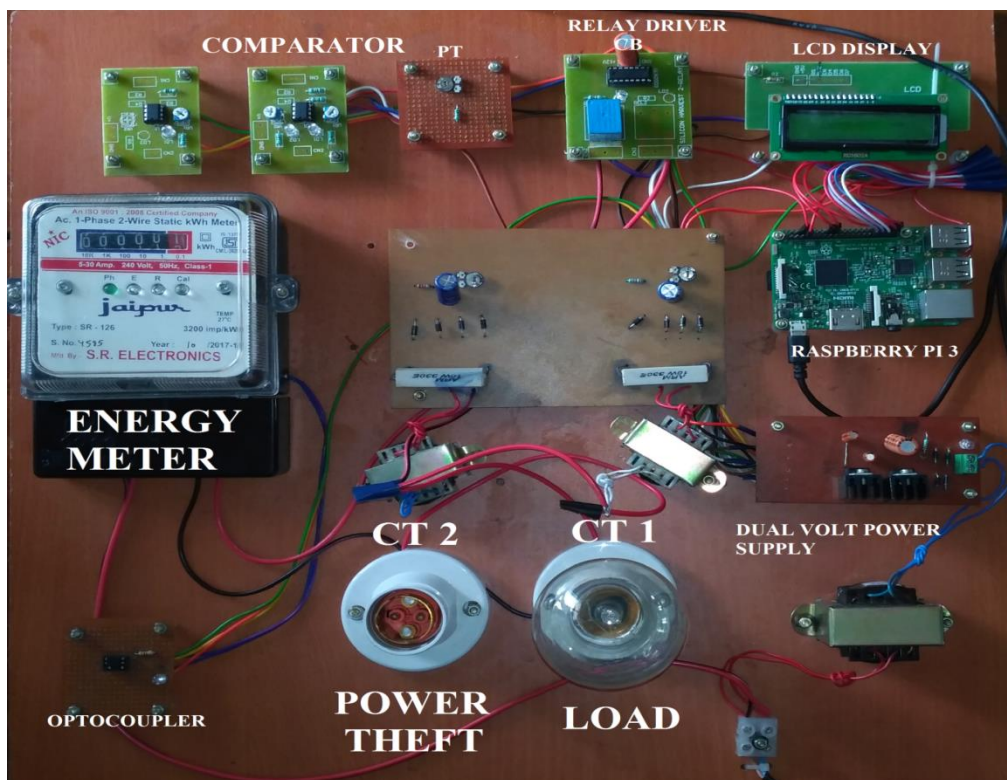


Figure 4(a) IOT based energy meter monitoring and control system

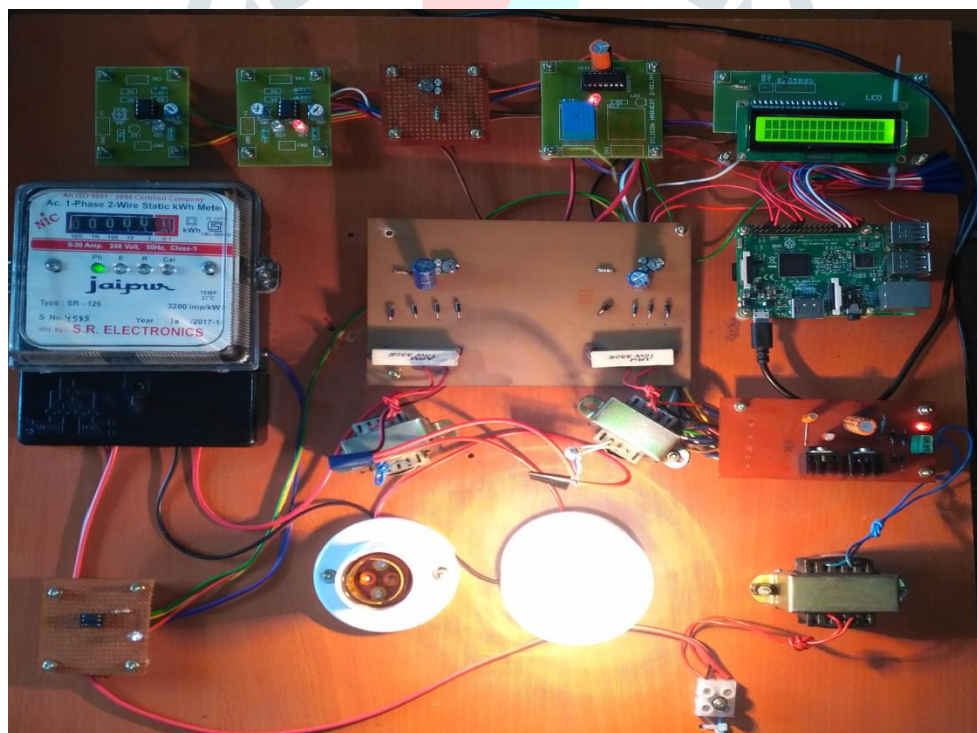


Figure 4 (b)Energy meter kit on condition

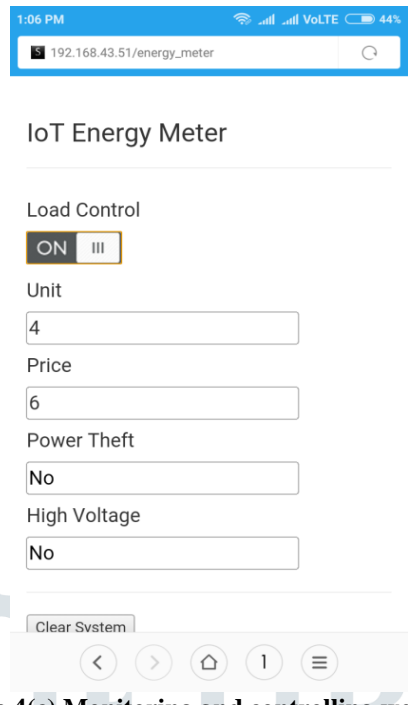


Figure 4(c) Monitoring and controlling web page

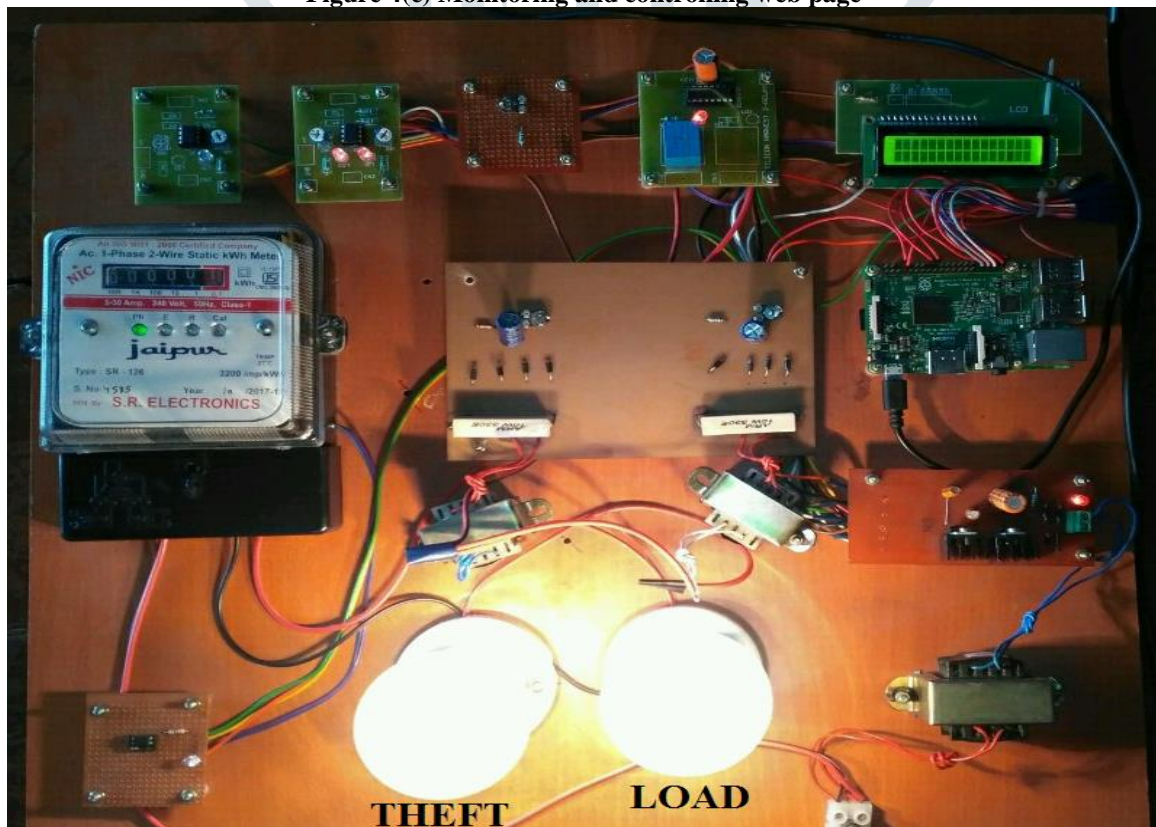


Figure 4(d) Power Theft occurs on power line

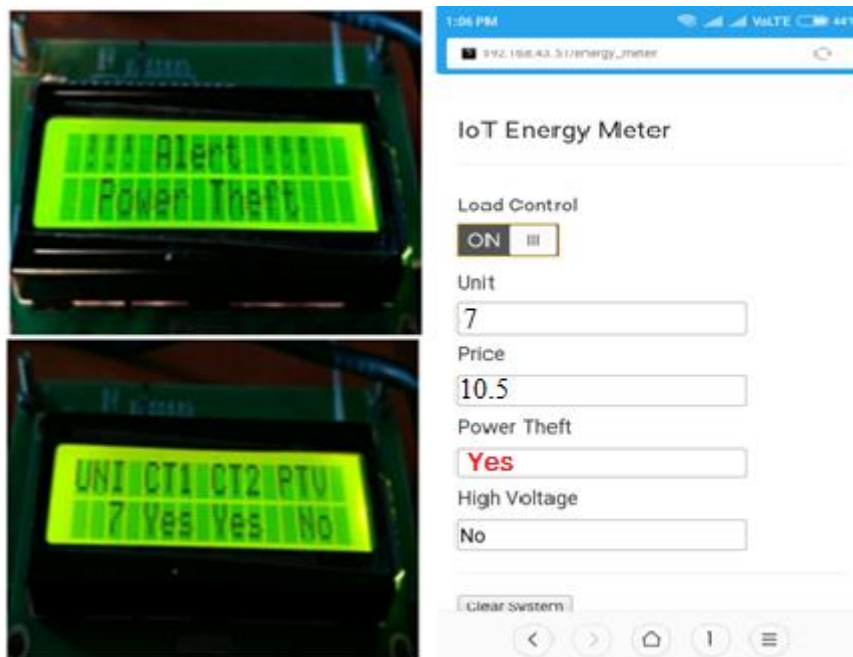


Figure 4(e) Power Theft notified on consumer side

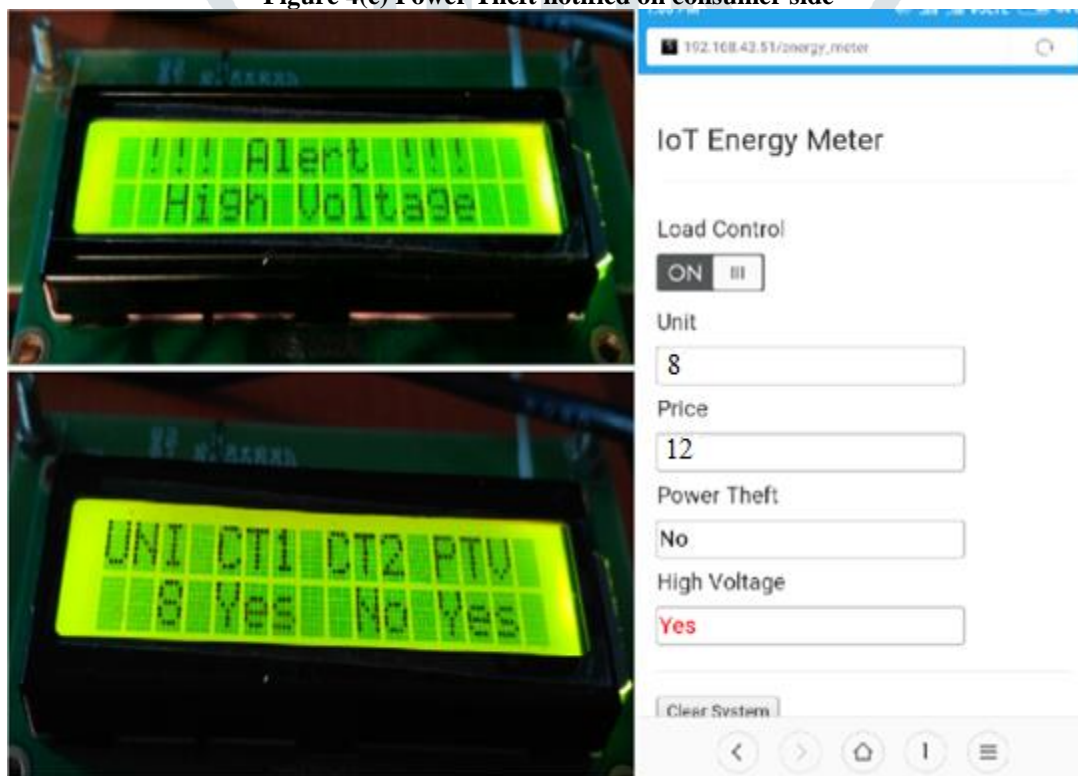


Figure 4(f) High voltage alert on consumer side

ENERGY METER IP ADDRESS:192.168.43.51/energy\_meter

**IV. Conclusion**

The paper IoT enabled Energy Meter has been completed successfully and the output results are verified. The results are in line with the expected output. The article has been checked with both software and hardware testing tools. In this work the energy meter,opto coupler and the wi-fi modem are chosen are proved to be more appropriate for the intended application. It is having enough avenues for future enhancement. This is a prototype model that fulfills all the logical requirements. The minimal improvements can be directly applicable for real time applications. Thus it contributes a significant step forward in the field of smart grid, and further paves a road path towards faster development s in the same field. In future it is further adaptive towards continuous performance and peripheral up gradations. This work can be applied to variety of industrial and commercial applications.

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