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A New Innovative Prepaid Energy Meter Using Arduino and IOT

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Abstract- **In present generation technology has been developed to a large extent. Smart phones play the major role in everyone's life. By using best technology I am designing a prepaid electricity bill using arduino and IOT module for domestic and commercial purpose. Generally the electricity reading is done by human beings. Humans are going to each and every house for electric reading. Sometimes it is not possible for them to go to some places because of bad weather conditions or floods etc. Sometimes the electric meter is not accessible for the human operator. So, by using this we can avoid such problems.**

Index Terms: — Arduino Kit, IOT module, Energy Meter, Current sensor, etc.

I.INTRODUCTION

Prepaid Electricity card is a good concept in which we can recharge the balance because like, we do recharge in our phones. In this project we are designing a system by using Arduino and IOT module. We can recharge the prepaid card by using the RFID card. In this project we are using an app called blink. If the balance is low or zero then it can automatically cutoff the power supply connection and intimates to the user by sending a message to their phone.

The system will read the recharge card and automatically sends the updates to the user like low balance alert, cutoff alert and recharge alert. We can recharge the prepaid card in various ranges like Rs.50, Rs.150 etc. According to the power consumption, the amount will be reduced. We are using a relay system which shutdown or disconnect the power supply when the recharge amount is over. Here we are using a buzzer which acts like alarm when it reaches to minimum balance.

Why Prepayment- From supplier point of view?

- Pay before use
- Keep customers on supply
- No bill production
- No bill distribution
- No need to chase payments
- Customer responsible for disconnection
- Social acceptability
- Load and demand side management

1.1 Why prepayment – From customer point of view?

- >80% mobile phones used in India are prepaid Flexible payment solution
- Pay to suit your income status
- Daily, weekly, monthly budgeting
- Show true cost of consumption and money left

II. LITERATURE REVIEW

Electricity meter reading is done by human operator, this requires more number of time for billing. Due to the development of number residential buildings and commercial buildings the electricity meter task can be done by more number of human operators. It should be clear that such type of methods will take long time and doesn't complete the work within the time. In addition to this we can get large number of errors incorporated in the reading process and this type of system can't provide transparency.

III. COMPONENTS USED

- ARDUINO(ATMEGA328P-PU)
- ANALOGUE ENERGY METER
- OPTOCOUPLER(4n35)
- CURRENT SENSOR(ACS712)
- RELAY DRIVER(ULN2003)
- LCD 16*2

3.1 ARDUINO (ATMEGA 328P-PU):-

The ATMEGA328 is a single chip microcontroller created by "ATMEL" in the mega AVR family. It has a modified "HARDVARD" Architecture 8-bit RISC processor code.

Features:

- The ATMEL 8-bit AVR RISC based microcontroller combines 32KB and 1SP flash memory with read-write capabilities
- 1KB EEPROM
- 2KB SRAM
- 23 general purpose I/O lines

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- 32 general purpose working registers
- 3 flexible timer/counters with modes internal and external interrupts
- serial programmable USART
- A byte-oriented 2 wire serial interference
- SP1 serial port
- 6-channel 10-bit A to D converter
- Programmable watchdog with internal oscillator and with 5 software selectable power saving modes
- The device operates between 1.8-5.5 Volts. The device achieves throughput approaching 1MIPS per MHZ.
- A common alternative to the ATMEGA328 is the "PICOPOWER".

Fig.1. Arduino (ATMEGA 328P-UP)

3.2 ANALOGUE ENERGY METER:-

Analogue or Analog meter is also known as electromechanical. The simple meter spins or moves forward when you are using electricity. The number of times the disc moves forward or backward determines how much electricity you are using to the electric grid.

Features:

- Cost-effective and flexible single-phase Energy Meter
- Detects signals and continues to measure accurately under at least 20 different tamper conditions
- Secure and reprogrammable Flash memory
- One-time, quick and accurate digital calibration
- Active power, voltage and current measurements are easily accessible
- USART interface
- Low-power AVR Microcontroller allows operation down to 1.8V

Fig.2. Analogue Energy Meter

3.3 Opto-coupler (4n35):-

An Opt coupler is a semi conductor device that uses a short optical transmission path to transfer an electrical signal between circuits or elements of a circuits, while keeping them electrically isolated from each other. Opt coupler prevent high voltages from effecting the system receiving the signal.

Opt coupler or Opt isolator means the control signal is used purely as a differential signal between Vcc and the control signal both sourced from the controlled circuit. Ground potential difference won't affect the operation.

Features:

- Isolation test voltage 5000 VRMS
- Interface with common logic families
- Input-output coupling capacitance<0.5pF
- Industry standard dual-in-line 6 pin package

Applications

- AC mains detection
- Reed relay driving
- Telephone ring detection
- Logic ground isolation

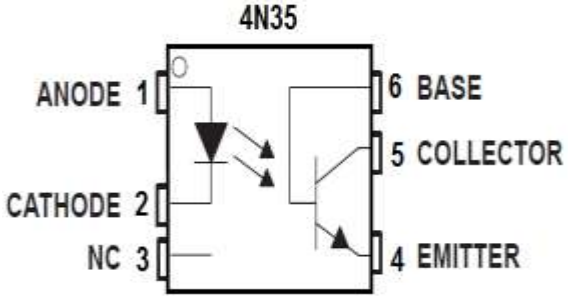

Fig.3. Opto-coupler (4n35)

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3.4 Current Sensor (ACS712):-

A Current sensor is a device that detects electric current in a wire, and generates a signal is proportional to that current. The generated signal will be analog voltage or current or even a digital output. A current carrying wire produces a magnetic field. Current sensing resistors are used when the current is directly measured in the circuit.

Features and Benefits:

- Low-noise analog signal path
- Device bandwidth is set via the new filter pin
- 80 KHZ bandwidth
- Small footprint, low-profile SOIC8 package
- 66 to 185 mV/A output sensitivity
- Output voltage proportional to AC or DC currents
- Factory-trimmed for accuracy
- Nearly zero magnetic hysteresis

Fig.4 Current Sensor (ACS712)

3.5 Relay Driver (ULN2003):-

A Relay driver IC is an electro-magnetic switch that will be used whenever we want to use a low voltage circuit to switch a light bulb ON and OFF which is connected to 220V mains supply. The ULN2003 is an array of 7 NPN Darlington transistor capable of 500MA, 50V output. It features common-cathode fly back diodes for switching inductive loads. It can come in PDIP, SOIC, SOP (or) TSSOP packaging.

Features:

- 500-mA-Rated Collector current
- High-voltage outputs:50 V
- Output clamp diodes
- Relay drivers
- Stepper and DC Brushed Motor Drivers
- Lamp Drivers
- Display Drivers
- Line Drivers

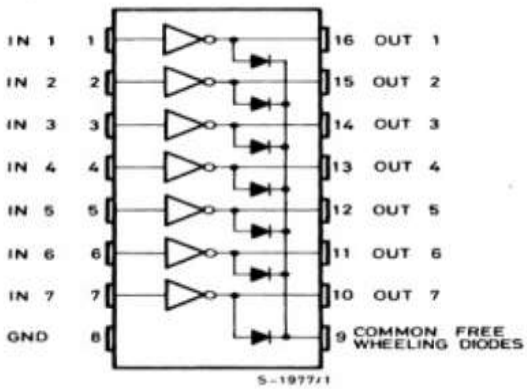

Fig.5. Relay Driver

3.6 LCD Display (16*2):-

LCD stands for LIQUID CRYSTAL DISPLAY.LCD is the technology used for displays in notebooks and other smaller computers like light emitting diode (LED) and gas-plasma technologies, LCD allows displays to be thinner than cathode ray tube (CRT) technology. A 16*2 LCD display is basic module and is commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segments LED's. In 16*2 alphanumeric LCD there are 2 rows and 16 columns. There are 8 data lines from pin number 7 to pin number 14 in an LCD. In this LCD each character is displayed in 5*7 pixel matrix and it has two registers namely, command and data.

Fig.6. LCD Display

IV. WORKING PRINCIPLE

Here we have interfaced electricity energy meter with arduino using the pulse LED. When we switch on the system then it reads the previous values stored in the EEPROM and then it checks the available balance with the predefined value and work according to them. If available balance is greater than Rs 20 then arduino automatically turns on and provide power supply to the home. If the balance is less than Rs 20 then it sends the alert message to the user phone. If the balance is less than Rs 5 then the arduino turns off and the connection will lost and sends the

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message to user phone. We can get all the messages in a app called blynk. We need to recharge the prepaid card by placing the card in front of the RFID reader then it scans the card and automatically recharges the amount. We are using a current sensor for calculating the total power consumption of the system.

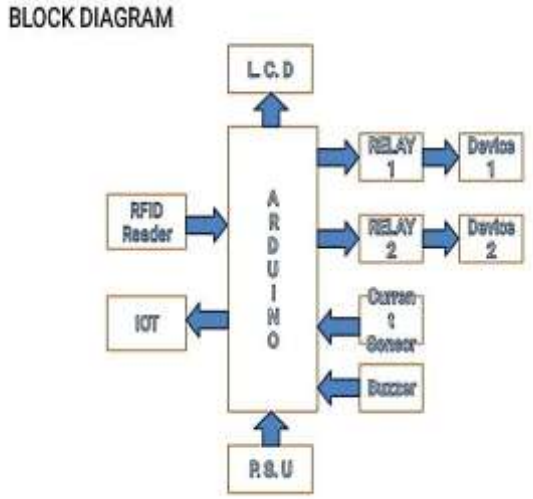

Fig.7 Block Diagram

Working Flow Chart:

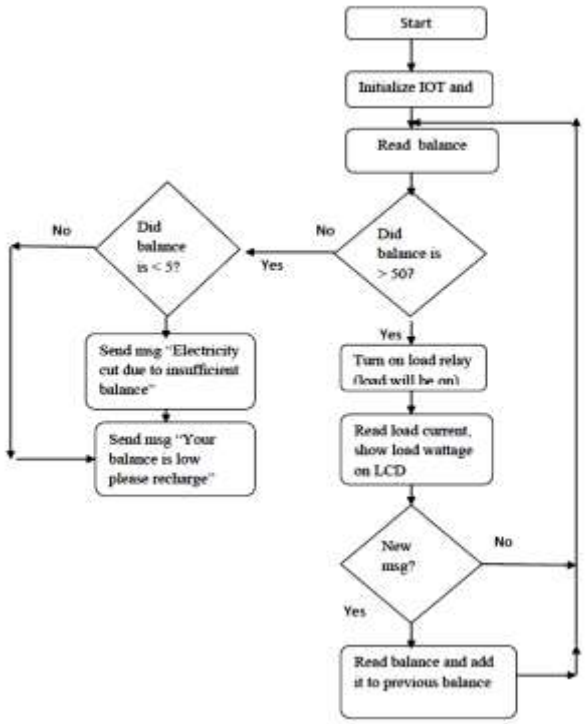

Fig.8 .Flow chart

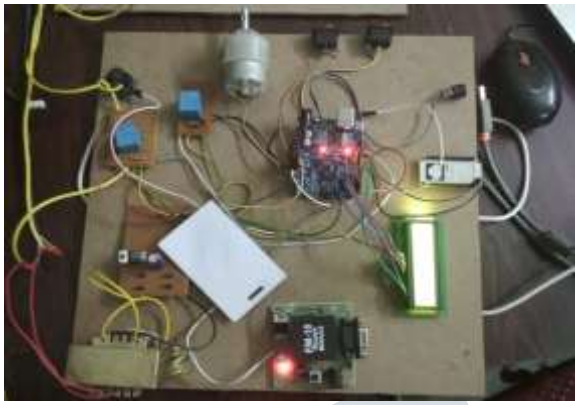

Fig.8. Energy Meter Using Arduino and IOT

V. RESULT

When the supply is provided to the meter, initially the LCD will turn on. We have set the recharge amount up to Rs 999. The costumers can recharge according to their requirement. Whenever they switch on the supply the power will consume and reading are updated in the app .If the customer wants to know how much amount used how much amount left then they can see the LCD display or they can check the app also. If the balance is low then the customer will get the alert message and the buzzer also sounds.

VI. CONCLUSION

In present situation all customers are using manual communication. To reduce the manual efforts and human efforts we are implementing a automated system which monitors all the parameters and functionality between the customer and electricity board. Also, by implementing this system we can control the usage of electricity and avoid wastage of power. By using this system we can save the customer and human operator time and customers can easily monitor their usage of current. An attempt is made in which interfaced with static electronic energy meter is avoided where in complexity of the circuit is reduced and cost also gets reduced.

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