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Electricity Theft Detection Using RF

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ABSTRACT:Power theft is a big issue in developing countries. Stealing electricity is considered as a crime. Power theft in a country hits its GDP hard. So it is very important to prevent power theft for undisturbed supply of good quality power everywhere. This paper aims at designing and implementing a power theft detection system in customer and distribution side. Normally power theft is done by directly tapping power from the lines. This system helps in detecting the power theft and in locating the area in which power is stolen. With the help of sensors placed in respective regions power theft is identified and alert is sent to authorities. The ultimate goal is to prevent power theft and it helps in providing good quality power to legal users.

KEYWORDS:Electricity, Thief, detection.

I. INTRODUCTION

Electricity is one of the main requirements for sustainment of comforts of life. It should be used very judiciously for its proper utilization. Therefore it is an important issue to provide electricity to the consumers of different areas in the country with minimum amount of losses. Also the electricity will be provided to the consumers by an economical method and will be as cheap as possible. Sometime the consumers are not satisfied with the services of power companies. Most of the times, they have complaints regarding statistical errors in their monthly bills. Thus we are trying to present an idea towards the minimization of technical errors and to reduce human dependency at the same time with the help of this project we are aiming to detect energy theft with the help of wireless communication. In this way we can reduce the power thefting as we are living in country where electricity shortage is the biggest problem. It requires less human efforts because all the process is done automatically if any theft is detected. With the help of this project we can ensure error free communication and the system will only maintain by the authorized department in case of power theft. Our system is economical and with great effective result. Our system consists of two microcontroller, RF transmitter, RF receiver, Relay, Led lights and regulated power supply. This implementation is done in such a way that our system is interfaced with energy meter as well to the load line. Initially the sensor senses the meter pulses and line pulses. In normal condition if energy meter giving same result as load is consuming the RF transmitter transmits to RF receiver which is connected at substation which is interfaced with PC that everything is O.K. there is any tempering in meter or meter pulses are not matching with line pulses then power theft has been done then microcontroller guides the relay. RF transmitter sends information to substation that power theft is at House or etc.

Few other ways for power theft are-

The electricity theft is of two types. Consumers do not show that they are stealing electricity and they steal whenever no one sees them. There is involvement of meter readers or line men who know about their corruption and they do not stop them and take some money to shut their mouth. So in both ways WAPDA is bearing losses. This is not only due to the nature of the people or WAPDA employees but also due to the system that we are using to calculate their electricity units or so called energy meter. These meters are so simple that everyone knows its operation and its drawbacks. And another drawback is that people do not deposit their electricity bills and when WAPDA workers go there to terminate their connection, they start quarrelling with them that type of cases happens in urban areas especially

- Use from single phase supply from three phase supply.
- Disconnected neutral from both ends.
- Used earthed neutral for return circuit.
- Connecting phase voltage to neutral of used single phase supply. Potential difference w.r.t neutral of used single phase supply is zero.



- Isolating neutral from both ends.
- Drilling pin hole in meter box.
- Distrusting electronic common reference point of measurement

II. LITERATURE REVIEW

[1] "A novel power theft detection algorithm for low voltage distribution network," IECON 2017 – "43rd Annual Conference of the IEEE Industrial Electronics Society, Beijing, 2017, pp. 3603- 3608". This paper deals with power theft identification in low voltage distribution networks. By injecting low magnitude high frequency low interfering signal into the line, it detects the power theft by tapping on the lines. [2] "Smart Power Theft Detection System," 2019 "Devices for Integrated Circuit (DevIC), Kalyani, India, 2019, pp. 302-305". This paper deals with detecting power theft by tapping from the lines and communicates the authority through gsm module and locates the area in which power is theft. [3] "Power Theft Identification System Using Iot," 2019 "5th International Conference on Advanced Computing & Communication Systems (ICACCS), Coimbatore, India, 2019, pp. 825- 830". In this Paper with the help of raspberry pi power theft is identified. With threshold voltage and current fixed, whenever the voltage level get increased power theft is identified.

III. OBJECTIVE AND PROBLEM ANALYSIS

Our project will be capable of

- Sensing the power theft.
- Real time power monitoring at house.
- Transmitting the information over wireless, to substation.

Benefit

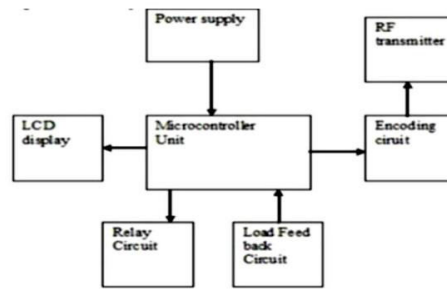
- In this system the tempering of energy meter will not possible.
- In case of tempering the maintenance will only done by the authorized department.
- The most important benefits of this system are that the consumer will use energy according to their use as they know that there is no tempering of their meter.
- The detection of power theft will be easily detected and no use of human effort require for cutting off the power supply .the system itself cut off the power supply In case of power theft.
- As in our country 20% to 25% are transmission and distribution losses and 10% to 15%are power theft so in case of implementation 5% to 10% theft will reduce.
- This system is easily maintainable.

Problem Analysis

In this project wireless technology is used to monitor theft in Electricity meter. An electric meter is a device used for measuring the amount of electrical energy supplied to a residential or commercial building. Due to the increasing cost of electricity, the electricity related theft increases and thus tampering and security in electric meters has become a major concern for government agencies across the globe. Ineffective and inefficient present methods of detecting and preventing Power and electricity theft cause a revenue loss along with damage to personal and public property

IV. CONSTRUCTION AND MANUFACTURING

We have designed the system in such a way so that it finds out the power theft by monitoring the total power consumption and also by receiving the delivered power data that includes data delivered to a number of users. It will guide and help us to find if power theft has occurred by determining the amount of difference between them.



Block Diagram of Installed System

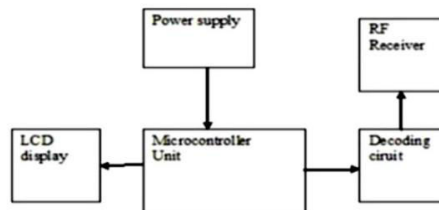


Figure 1: Block diagram

RF transmitter and RF remote controls are built using HT12E and HT12D chips. The remote control is built using RF encoder chip HT12E that will generate different codes. These codes will be transmitted by 434 MHz RF transmitter. At the receiving end these codes will be received by 434 MHz RF receiver and decoded by RF decoder chip HT12D. Sensors will give signal to HT12E and in response to the signal HT12E will respond accordingly. It is a 18 pin IC. Its functioning includes conversion of bit data input to serial output. It has 12 address lines to send data to particular receiver. Output of HT12D is connected to MCU at port pin no 1 to 4. In this project we are using UHF frequencies of RF. LED's connected at port 2 pin p2.0,p2.1,p2.2,and p2.6. LCD rs, rw, en are connected to p2.5, p2.4 and p2.3. HT12 E and HT12D s pin 1 to 9 connected to ground. These are address pins of HT12E and HT12D. Pin no 10 to 14 of HT12 E are inputs of IC and 17 no pin is the output pin. Pin no 10 -14 of HT12D is the output pin and pin no 14 is input pin. Crystal pin of HT12E is 15 and 16. In this project we will make one transmitter and RF receiver. RF remote control is built using HT12E and HT12D chips. The remote control is built using RF encoder chip HT12E that will generate different codes. These codes will be transmitted by 434 MHz RF transmitter. At the receiving side these codes will be received by 434 MHz RF receiver and decoded by RF decoder chip HT12D.

Study of hardware components

The main components being used in the project are:

- Arduino Microcontroller
- Current Sensor.
- Ac Adaptor
- LCD Display.
- RF Transmitter (Sending & Receiving).
- Buzzer.
- Relay.

Current Sensor

ACS712 Current Sensor Module - 20A can sense upto 20A of current flow. Sensing and controlling the current flow is a fundamental requirement in wide variety of applications, which includes over-current protection circuits, battery chargers, switching mode power supplies, digital watt meters, programmable current sources, etc.

ACS712 Current Sensor Module - 20A is based on ACS712 sensor, which can accurately detect AC or DC current. The maximum AC or DC that can be detected can reach 20A, and the present current signal can be read via analog I / O port of a microcontroller or an Arduino.



Figure 2: Current Sensor

Specifications:-

- Supply Voltage: 4.5V ~ 5.5V DC
- Measure Current Range: -20A ~ 20A
- Sensitivity: 100mV/A

Arduino UNO

This Arduino Uno is an original microcontroller board from Arduino officials based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started..

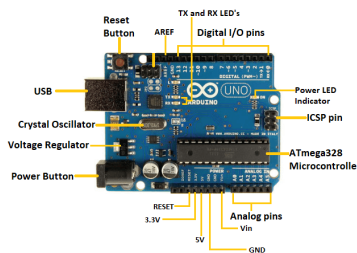


Figure 3: Arduino UNO

The technical specifications of the Arduino UNO are listed below:

There are 20 Input/Output pins present on the Arduino UNO board. These 20 pins include 6 PWM pins, 6 analog pins, and 8 digital I/O pins. The PWM pins are Pulse Width Modulation capable pins. The crystal oscillator present in Arduino UNO comes with a frequency of 16MHz. It also has an Arduino integrated WiFi module. Such Arduino UNO board is based on the Integrated WiFi ESP8266 Module and ATmega328P microcontroller. The input voltage of the UNO board varies from 7V to 20V. Arduino UNO automatically draws power from the external power supply. It can also draw power from the USB

Arduino UNO Expansion Shield

Sensor Shield allows you to connect to various modules like sensors, servos, relays, buttons, potentiometers and many more directly to your Arduino through this Sensor Shield.

Each functional module has buckled port with VCC, GND, and Output, which has the corresponding port on the Sensor Shield; connected with a plain 2.54mm dual-female cable you may start playing already.

Buckled brick cables are like cement for bricks, make the connections easier, secure and more professional looking.

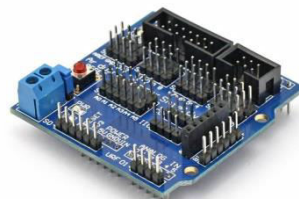


Figure 4: Arduino UNO Expansion Shield

LCD

To display our parameters, 16x2 LCD is used.

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines.



Specification- LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs



Figure 5: LCD

RELAY

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

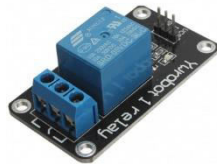


Figure 6: Relay

Specifications:-

Operating Voltage (VDC)	2.5 ~ 5.5
Trigger Voltage (VDC)	5
Trigger Current (mA)	20
Switching Voltage (VAC)	250@10A
Switching Voltage (VDC)	30@10A
Operating Temperature (C)	-40 to 85
Opt. Relative Humidity(RH)	20% 85%
Storage condition	65 o 125

ADAPTOR

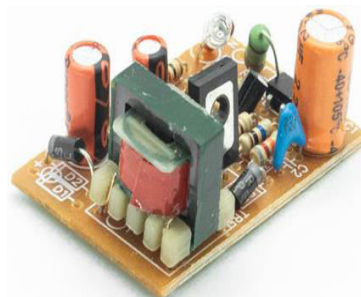


Figure 7: Adapter

This 12V 1A power supply is mainly used in, chargers, microcontroller, portable amplifiers, audio-video players, Bluetooth/wifi modules, DC motors, led light circuits. Despite being small in size these power supplies work effectively. The input voltage of this supply is 220VAC and output is 12V DC. This supply can provide upto 1A current.

Specifications

Input Voltage Rating	220 VAC
Output Voltage Rating	12 VDC
Maximum Output Current	1A

RF TRANSMITTER RECEIVER WIRELESS MODULE

This hybrid RF Transceiver Module provides a complete RF transmitter and receiver module solution which can be used to transmit data at up to 3KHz from any standard CMOS/TTL source.

The transmitter module is very simple to operate and offers low current consumption (typical. 11mA). Data can be supplied directly from a microprocessor or encoding device, thus keeping the component count down and ensuring a low hardware cost.

The RX – ASK is an ASK Hybrid receiver module. The RF Transmitter Receiver Module is an effective low-cost solution for using 433 MHz. The TX-ASK is an ASK hybrid transmitter module. TX-ASK is designed by the saw resonator, with an effective low cost, small size and simple to use for designing.

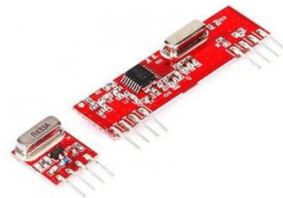


Figure 8: RF Transmitter Receiver Wireless Module

Specifications of 433MHz RF Transmitter Receiver Wireless Module:-

- Range in open space(Standard Conditions) : 100 Meters
- RX Receiver Frequency : 433 MHz
- RX Typical Sensitivity : 105 Dbm
- RX Supply Current : 3.5 mA
- RX IF Frequency : 1MHz
- RX Operating Voltage : 5V
- TX Frequency Range : 433.92 MHz
- TX Supply Voltage : 3V ~ 6V
- TX Out Put Power : 4 ~ 12 Dbm

BUZZER

An Active Buzzer Alarm Module for Arduino is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. Just like what you are viewing now, it is 3.3V-5V DC Electronic Part Active Buzzer Module. Using top quality material, it is durable in use.

An active buzzer rings out as long as it is electrified. Compared with a passive buzzer, it is a bit expensive but easier to control. Typical uses of buzzers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

Specifications of Active Buzzer Module:-

1. Product Name:3.3 to 5V Active Buzzer Alarm Module Sensor
2. Transistor drive module uses 8550
3. with fixed bolt hole- easy installation- 2.6mm aperture.
4. Operating voltage 3.3V-5V
5. PCB Dimensions: 34.28 mm (L) * 13.29 mm (W) * 11.5 mm (H)



V. RESULTS AND DISCUSSION

Significance- The daily reports and complains concerning the theft related to Electricity can be brought under control and also eliminated to a larger extent · in most of the cases the consumers where not know about the theft of electricity in his/her electricity meter so due to this project the consumers will also be benefitted since now they will aware of any mishap or theft in their electricity meter. Also with the help of this project we can reduce the total illegal use of power and hence save electricity for both present and future use. The system only requires a onetime installation cost and then can be used for lifetime without any inconvenience.

ALGORITHM - The Testing and Troubleshooting algorithm is carried out as follows: 1. Prepare the complete hardware by mounting as per the circuit diagram. 2. The software is prepared for microcontroller (DEPENDING ON MODEL) 3. Required programming is done and after programming the IC was put on PCB. 4. A 5 volt Dc supply from the power supply was connected to the hardware after the soldering of circuit is over 5. Lastly the problem occurred during testing was initiated.

Testing And Calibration - To begin with the test we have to firstly inspect visually the PCB for proper connectivity and then we have to apply power supply to the bare board checking all the Vcc and ground tracks. Next we have to mount the components step by step keeping its size, width, weight etc it to consideration

Testing Of Powersupply - For power supply we have used regulator IC 7805. It has 3 pins that is input, output and ground. Input range of IC 7805 regulator varies from 7.5 to 35 volt and the maximum current is about 1 ampere. The current more than 1 ampere tends to damage the IC. To check the functioning of the IC we can apply any voltage within range and at the output we must get 5 volt reading. Also vary the input voltage or output current and check the output voltage and if must give a constant 12 volt reading. If both the above mentioned condition is satisfied then we can consider the IC to be good.

VI. ADVANTAGES, LIMITATIONS AND APPLICATIONS

Advantages

- The system consumes very little power for its operation.
- System operation is independent of time (24 hours functioning).
- Automatic user identification.

Limitation

- Since the techniques employed in this module are based on simple electronics, the chances of making the system inoperative are more. But, if a Microcontroller chip is used for feeding the modulating input, we can make the system more efficient.
- Wide range of frequencies is required to facilitate large number of users. To overcome this, carrier levels can be changed from region to region.
- Presently, it requires a power supply (230 V) for the operation, but a small battery with automatic charging facility can be provided in real time.

Application

- The system can be incorporated for almost all types of users.
- The concept is well suited especially for villages and interior areas.

VII. CONCLUSION

There have been may electricity related theft and in this way we will bring it under control and also design the microcontroller based power theft identifier. The major motive of designing such system is that it will eventually and ultimately reduce the illegal used of electricity and will save lot of money because it directly affects the economy of nation as well as the consumer who suffers a lot of loss due to power theft. Thus this system will be beneficial to consumer as well as for government. The best thing about this project is that it will require only one time installation cost and can be used in future with ease without any future investments. Thus this project will be a great advantage and relief to all the consumers and the entire nation as a whole



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REFERENCES

1. Mazdi Muhammad Ali, Majdi Janice Gillespie, McKinley Rollin D, "The 8051 Microcontroller and Embedded System", Prentice hall India, 3rd edition, 2002.
2. GayakwadRamakant A., "Op-amps & integrated circuits" Prentice hall India,4th edition.
3. Steven Holzner, "Visual Basic.net Black Book" paraglyph press,2nd edition,2002.
4. R.S. Kandpur, "Printed Circuit Board Design, Fabrication,Assembly and Testing", Tata McGraw-Hill, Second edition.
5. Paul Horowitz, Winfield Hill, "The Art of Electronics", Cambridge , second edition.
6. M. D. Singh, K. B. Khanchandani, "Power Electronics , McGraw-Hill companies, Second edition.
7. Muhammad H. Rashid, "Power Electronics- Circuits Devices and Application" , PrenticeHall of India, Second edition



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