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MINIMIZING ELECTRICITY THEFT USING INTERNET OF THINGS

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Abstract:

IOT use things to things connection to access the web of things allow data to store and access services. Services over internet of things developed as per need of person to person, thing to person, machine to machine interactions without human interference. Energy crisis is one among the main problems that the planet faces today. The simplest solution for this is often not the rise in energy production, but the effective use of obtainable energy. By avoiding energy wastage and properly monitoring our energy consumption, energy crisis are often reduced to a particular extent. Various wireless communication systems are available to identify the power theft, but lacks the specified infrastructure needed to use them. This project's aim is to style a system to watch the power consumed by load and to detect and eliminate the power theft in transmission lines. This work is additionally focused on communicating the theft information to Electricity Board (EB) through IoT. Power theft detector kit has been implemented using IOT. The implementation of this technique will help and save great deal of electricity.

Keywords — **IOT, Arduino UNO, ESP8266, Current Sensor, Blynk Software.**

I. INTRODUCTION

Now-a-days the demand for electricity is increasing at a constant rate in the population and is being utilized for various purposes like agriculture, industries, household purposes, hospitals etc., so it is becoming more and more complex to handle the electricity maintenance and requirements. Therefore there's an instantaneous requirement to save lots of the maximum amount electricity as possible. As the demand from the newer generations of population for electricity is increasing so in alongside it the technology improvement is required. The proposed system provides a technical twist to the traditional energy meters using the IOT technology. Also there are other issues like power theft which successively generate economic loss to the state.

II. OBJECTIVES

Monitoring optimized power usage and reduction of wastage in electricity is the major objectives of the system. System is designed depends on three major objectives.

They are:

1. It provides automatic reading of energy consumption of load immediately.
2. It helps in using the electricity in an optimized manner.
3. System reduces the power wastage.

III. BLOCK DIAGRAM

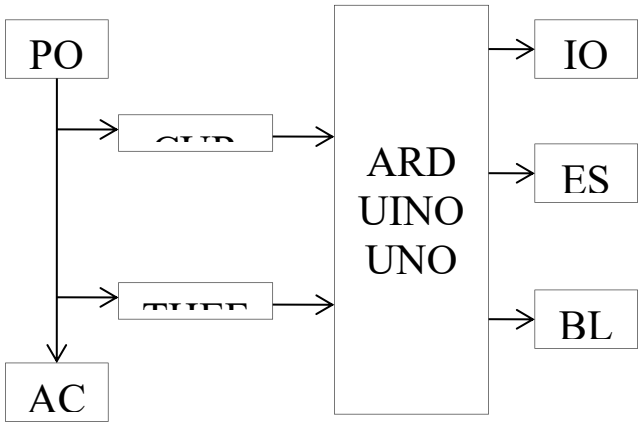

Fig.1 Block Diagram of Power Theft Detection using IoT

IV. HARDWARE USED

A. *Arduino Uno*

The Arduino Uno is an open-source microcontroller board that runs on the ATmega328 microprocessor. It has six analogue inputs, fourteen digital input/output pins, a 16MHz crystal oscillator, a USB port, a power jack, an ICSP header, and a reset button. It comes with everything you need to support the microcontroller; however, it must be connected to a computer by USB cable or powered by a battery to work. Uno, unlike all previous boards, does not use the FTDI USB-to-serial driver chip. Instead, the Atmega8U2 has been configured to function as a USB-to-serial converter.

The name "Uno" comes from the Italian word "uno," which means "one." It was chosen to represent the imminent release of Arduino 1.0. The Arduino Uno and version 1.0 are quickly becoming the industry standard. When compared to prior generations, the Uno is the most recent in a line of USB Arduino boards, and hence the Arduino platform's reference model.

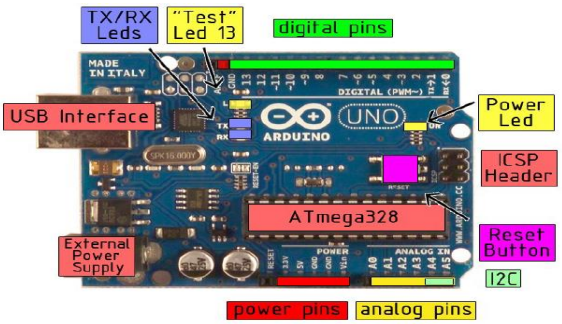

Fig.2 Arduino UNO Board

B. *Esp8266 Wi-Fi Module*

The ESP8266 Wi-Fi Module is a stand-alone Wi-Fi networking solution with an integrated TCP/IP protocol stack that can provide access to our Wi-Fi network to any microcontroller. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor.

The ESP8266 can be controlled from your local Wi-Fi network or from the internet. The ESP-01 module has GPIO (General Purpose Input Output) pins that can be programmed to turn an LED or a relay ON/OFF using internet. This module can be programmed using an Arduino/USB-to-TTL (Transistor to Transistor Logic) converter through the serial pins (RX,TX).

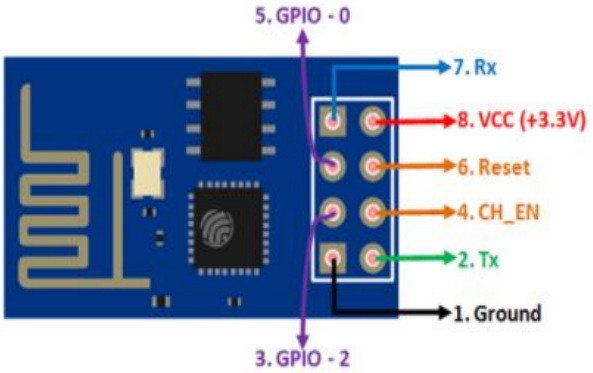

Fig.3 ESP8266 Pinout

C. *Current Sensor(ACS712)*

A current sensor is a device that sense and converts current flowing in the circuit to an easily measured output voltage, which is proportional to the current through the measured path. When a current flows in a circuit, voltage drop occurs. ACS712 Current Sensor is the sensor which can be used to measure and calculate the amount of current applied to the conductor without affecting the performance of the system. ACS712 Current Sensor is a fully integrated and Hall-effect based linear sensor IC. The ACS712 is very accurate. It is a little noisy and it is also very sensitive for magnetic fields caused by wires, transformers.

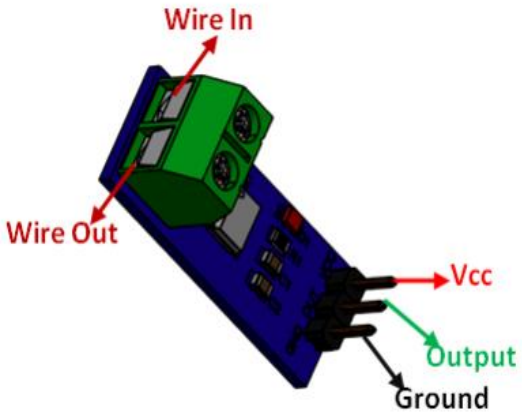

Fig.4 ACS712 Current Sensor Pinout

D. LCD with I2C Module

The term LCD stands for liquid crystal display. It is one type of electronic display module used in a great range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These displays are especially preferred for multi-segment light-emitting diodes and seven segments. The principle benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc.

Inter-integrated Circuit (I2C) is a two-wire short distance communication protocol. Multiple slave devices can be used in the same two wires with one or more master controllers. How does the master identifies which slave does the data to be sent. In I2C, the external devices have an I2C address for different devices like LCD Backpack, OLED Display, etc. By using the address the data is transmit to the specific device connected on the same I2C Bus. The message is divided into two frames and sent serially via the I2C Bus. The first frame contains the address of the message, once the address matches with any device on I2C bus, that device will transmit acknowledge (ACK) signal to the master controller. After receiving the acknowledgment the data bits are sent from the slave. By this method an I2C bus works.

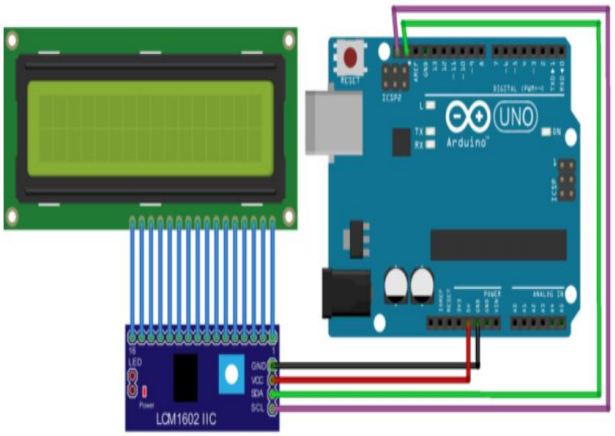

Fig.5 LCD with I2C module

V. SOFTWARE USED

A. Arduino Software

The major text editing programme used for Arduino programming is the Arduino Integrated Development Environment (IDE). It is here that the programme will type up the code before uploading it to the Ardunio board that needs to be programmed. The Arduino code is referred to as sketches, and the Ardunio code is referred to as Ardunio code.

The Arduino code is written in C++ and contains a number of specific methods and functions that will be discussed later. C++ is a computer language that is easy to understand. A 'sketch' is created and then processed and compiled into machine language.

A class is a collection of functions and variables that are grouped together in one location in software programming. Each class contains a function Object() [native code] function that is used to generate a new instance of the class. Declare a class instance in order to access the class's functions.

1) *Setup():* A setup method is required in every Arduino sketch.

a. Pin functionality using the pinMode()

b. Pins in their first state

c. Set up the classes

d. Set variables to their default values

e. Logic in the code

2) *Loop():* The loop function is required for every Arduino sketch, and it is the main function that executes once setup() is complete. It repeats itself in a loop, as the name implies. Our circuit's main logic is described by the loop.

Fig.6 Arduino Software

B. Blynk Software:

Blynk was created with the Internet of Things in mind. It can control hardware from anywhere, display sensor data, save and visualize data, and do a variety of other tasks. The platform is made up of three primary components:

- Blynk App - It enables us to develop stunning user interfaces for our projects by utilizing the many widgets available.
- Blynk Server - The Blynk Server is in charge of all communications between the Smartphone and the hardware. Blynk Cloud can be used, or our own Blynk server can be run locally. It's an open-source project that can handle thousands of devices with ease.
- Blynk Libraries - These libraries enable communication with the server and process all incoming and outgoing commands on all popular hardware platforms.

Consider this scenario: Every time a Button (widget) in the Blynk app is pressed, a message is sent to the Blynk Cloud, where it miraculously finds its way to our hardware.

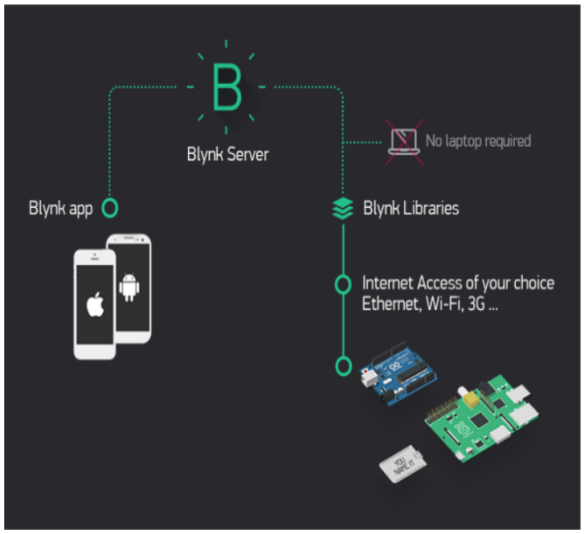

Fig.7 Overview of Blynk Software

VI. WORKING PRINCIPLE

In the society it was seen lot of people doing illegal power theft like unauthorized tapings from lines during functions and meter bypassing etc. these led us to do something to stop power theft as much as possible that is why "power theft detection" is chosen as a main project. IoT is the recently evolving technology. Energy, particularly electricity, is a key input for accelerating economic growth. The theft of electricity is a criminal offence and power utilities are losing billions of rupees in this account.

The circuit consists of AC supply, Switches, Arduino UNO, LCD, ESP8266 module, Current Sensors and two bulbs. Meters cannot be used for high currents so current sensing is done by current sensors. Two current sensors are used, one is connected at load side to measure the current through load and other sensor is connected at supply terminals to measure the current supplied by source.

The main component in this circuit is Arduino controller. It receives current signal from two current sensors. Then it compares those two current magnitudes by the conditional operator. Since there is no theft load, the two current sensors show almost the same values. Here the system is in healthy condition.

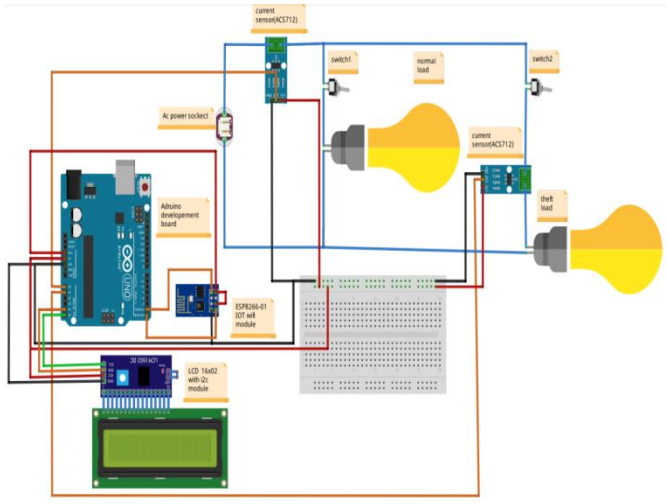

Fig.8 Schematic Diagram of Power Theft Detection using IoT

The Arduino cannot access current signal. So interface of the current sensors is possible by means of voltage only. Here current signal is converted into voltage signal. It can be converted with the help of current sensor. Current sensor converts the current signal into electrical signal and passing that voltage signal to Arduino. The secondary of the current sensors is connected to the respective bulbs. If the variation in current values is more than the specified value, that means the condition is violated. Then a notification is send to the mobile through blynk app. If any tapping is done, i.e. power theft is happened. Then two current sensors show different values. The source current is more than the actual load current. If there is any deviation more than the specified value then controller sends the signal to LCD and Internet of things. IoT is used for sending notification in blynk app and also it has facility to get a mail when power was theft, to the officials through internet. LCD is used for the purpose of display. It shows the message that “theft detected” and also the amount of current that is deviated. The ESP module allows an Arduino board to connect to the internet, so that the people in the substation can know the information about the power theft through internet and allowing them to take appropriate action against the offenders.

VII. ADVANTAGES

- This system would provide a simple way to detect an electrical power theft without any human interface wirelessly via Internet.
- Maximize the profit margin of power utility company.
- Security is automated.

VIII. DISADVANTAGES

- Requires internet facility.

IX. CONCLUSIONS AND FUTURE SCOPE

Since power theft is one of the major problems that is taking place in the present scenario an effective method to protect the power theft is required. Arduino UNO based electricity theft identification and control frameworks were proposed in this project. The framework would give a straightforward method to recognize a power theft condition with no human interface. By using the simple devices like microcontroller, current sensors and internet of things the model is implemented.

Further this technique can be employed in single mobile and affordable systems using microcontroller . This system reduces human labor and saves electricity making the system more efficient for power saving management. This is a potable model which is used to determine power theft and disconnection of unpaid bills. Due to day by day increase in the technology by using the same model we can also implement the following in the software part.

- Over load notification can be added in the software part.
- Short circuit notification can be implemented.

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