Power Theft Smart Detection System

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Abstract: *Bypassing or hooking are the two main strategies used to steal power. The home current distribution is therefore done indirectly from the electric pole to an intermediate distributor box and then to the individual residences in order to identify it, a method (current measurement and comparison) is recommended. Periodically, the current in the distributor box is measured, and using a GSM/GPRS module, each house's current is sent to the server database. Similar to this, each home's electric metre is built to measure current value and regularly send it to the server database using GSM/GPRS module. A user-friendly mobile application is used to save the users' information in the database at the time of electric metre installation. This information includes the address, latitude, longitude, and a photo of the user's home or region using mobile GPS. If we find even a little variation between the current numbers after successfully comparing those from the electric metre and distributor box in the server, then the theft has been discovered. Finally, the user's information, including the area's address and photo, is exchanged with the approved mobile application. The region of the theft is also displayed on Google maps using the latitude and longitude. Therefore, the necessary actions are done..*

Keywords: Energy Metre, Power Usage, and Arduino UNO

I. INTRODUCTION

Electricity theft is the illegal act of stealing electricity. According to a research, power theft costs the globe $89,3 billion per year. India ($16.2 billion) and Brazil ($10.5 billion) suffered the most losses, followed by Russia ($5.1 billion) [1]. In certain states, transmission and distribution losses surpass 50%, and overall national losses hover around23% [2]. The integrated steel factories demand a significant quantity of power. Apart from captive power and blowing stations, it is estimated that a power plant with a capacity of around 25,000 MW must be developed to satisfy this need [3]. With the aid of our prototype, we can catch the theft and perhaps conserve as much power as possible that can be used in steel mills.

II. OBJECTIVE AND BRIEF WORKFLOW

Distribution losses (overall: 30%) and electricity theft have been experimented with in the power distribution industry. In order to reduce power theft by bypassing or hooking, we are recommending a web-based mobile application that will alert users to electricity theft that is occurring in a specific location. The primary goals of this effort are,

1. To create a system that is both affordable and effective for detecting power theft without using any human resources.
2. To provide a web-based mobile application for the electrical board's authorised authorities so they can keep track of all thefts, where they occur, and how to get there.
3. To create an online bill payment system and regularly keep track of the total number of electric units utilised by users in the server database.
4. To create a global website that would keep track of theft analytics and the likely areas that would be targeted for theft using multi-color graphs and visual representations, making it easier to analyse thefts and able to forecast future thefts.

Both the hardware and software components of this solution require work. The customised electric metre and distributor box are examples of the hardware, and the creation of a website and a mobile application is an example of software. It is necessary to learn fundamental components such the digital electric metre, gsm module, acs712 module, microcontroller,

And ADC as well as how they function in order to design the hardware first. Next, it is necessary to construct the short circuit diagrams for the electric metre and the distributor box (shown in fig. 1). The hardware design and PCB design of the aforementioned components should then be taken into account. Now, according to our customised or circuit diagram, all of the component PCB designs must be combined into a single PCB design. The PCB design of the distributor box will be customised to include a GSM module and several acs712 modules that must be linked to a microcontroller. The acs712 module has to be connected in series with a live wire. The circuits of the commercial electric metre, the acs712 module at the input side, and a gSm module will all be included on the PCB design of the customised electric metre, and they will all share the same microcontroller. The customised electric meter's required functionality will be programmed into the microcontroller. In order to provide the GSM module and microcontroller from the available ac current, the analogue to digital conversion circuit needs also be added into the PCB design. The aforementioned PCB designs may be created using PCB design software, and any potential flaws must be simulated using a simulation programme. The PCB design will be manufactured on the PCB board following a successful simulation. The aforementioned work will be completed under the supervision of a manufacturer, vendor, or lab that offers instruction and enables PCB design, fabrication, licencing, and production linked to electric metres.
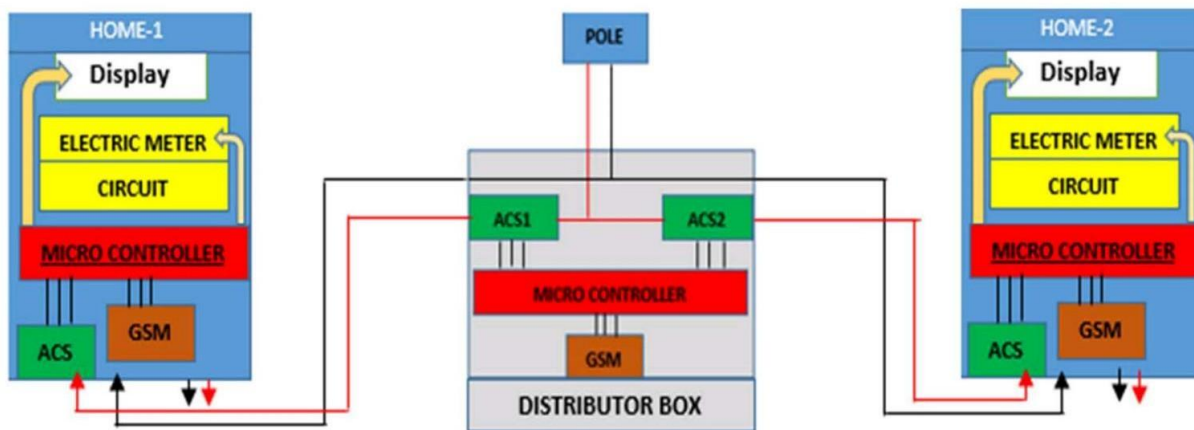

Fig. 1. Architecture of the proposed system

For the software component, an international website will be created using web development for all users for the payment system and analytics of theft, and an android-based web-based mobile app will be created for the authorised authorities who are in charge of detecting theft. A key part of the whole system is played by the database and server side programming. The mobile app will be created in a way that will enable the server to regularly receive current values from the gsm module, compare them, and display the region of theft with the user's information that is being stolen and instructions in google maps. So, open source software may be used to construct the software component.

The system's originality is described below.

1. This solution operates under the theory of parallel current division. This makes it more effective.
2. This answer demonstrates the precise location of the area being stolen along with a picture of it.
3. The analysis of past thefts can be used to forecast potential thefts em designin the future.
4. In cases of power theft, it may also enable the supervisor to turn off the power to a location.

The solution makes use of a gsm sim800 module that can send the measured current's value to the server via gprs.

III. DETAILED SYSTEM DESIGN

The theft of electricity was discovered using the current division rule. This rule states that a parallel circuit functions as a current divider because the voltage is constant across all of the branches while the current is divided among them. The current across the circuit impedance is calculated using the current division formula.

We link an acs712 current sensing module to the house's installed metre as well as the distribution box. An arduino UNO is used as a microcontroller to which the electricity from the acs712 is supplied. After the arduino is connected to the GSM-GPS module, the data from both sides is then delivered to the approved database.

The data are so compared, and if the discrepancy exceeds the specified threshold, power theft is discovered. Our solution requires the following hardware and software:

- Arduino uno;
- Current sensing module (acs 712);gsm (sim 800);
- Gps module;
- Database (using my sql)

3.1 Arduino Uno

The open-source electronics prototyping platform arduino [4] is built on adaptable, user-friendly hardware and software. The cad and pcb design are free to use because arduino is an open source project. Several other arduino boards, including the arduino uno, arduino nano, arduino mini, and arduino mega, are readily accessible on the market (both original and copied).
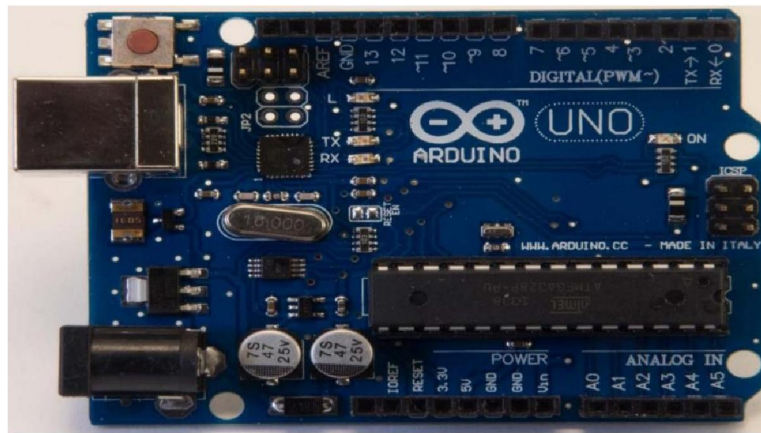

Fig. 2. Arduino Uno R3

Due to the following requirements, we specially chose this board (fig. 2) for our study.

- 6 ports for analogue input
- Connector for power input.
- 14 digital i/o ports, including 6 pwm connections, plus a 4 standard usb interface for   power,   data,   and programming.
- Female in headers
- The most often used board has one hardware serial port (uart).
- Most popular board. Ideal for starters.

3.2 Current Sensing Module (ACS 712)

The acs712 current sensor, as seen in fig. 3, is available online and is made to work well with microcontrollers like the arduino. Based on the allegro acs712elc chip, these sensors. The full scale values for these current sensors are 5a, 20a, and 30a.
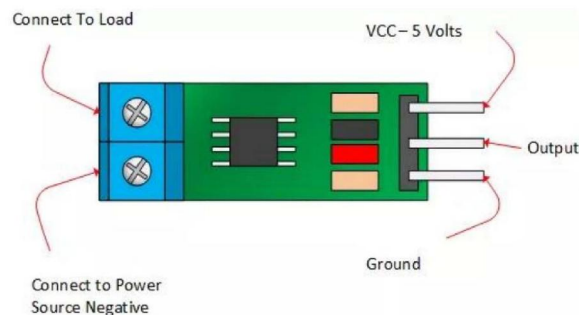

Fig. 3. Pin configuration of ACS 712

3.3 GSM (SIM 800)

Fig. 4 GSM module (sim 800)

Sim800 is a quad-band gsm/gprs module that operates on the gsm 850mhz, egsm 900mhz, dcs 1800mhz, and pcs 1900mhz frequencies. With a compact configuration of 24*24*3mm, sim800 can suit nearly all the space requirements in customers' applications, such as m2m, smart phones, pdas, and other devices. Sim800 features gprs multi-slot class 12/class 10(optional) and supports the gprs coding schemes cs-1, cs-2, cs-3, and cs-4.

3.4 GPS Module

A GPS navigation device (fig. 5) that can receive data from satellites is required in order to determine the device's geographic location. The gadget may provide directions and display the location on a map using the appropriate software. The sim800 offers all hardware connections between the module and customers' boards and contains 68 smt pads.

Therefore, we must do the following preparations in order to discover this: prior to installing the metre, we will utilise a gps module to record the latitude and longitude of each pole and dwelling. Arrangements and connections at the distributor box

The live wires from the poles must be fed block by block into a distributor box.

The distributor box has the capacity to distribute power among the residences in a specific neighbourhood. As a result, a distributor box will be set up later for a collection of homes.

Therefore, using the acs712 module, the ac current is measured in the distributor box independently for each dwelling, and the microcontroller is then given this current's magnitude.

The measured current value is transferred using the gsm/gprs module and updated into the database table holding the user-id at a regular desired interval in a server side database that is being maintained (referring timestamps).
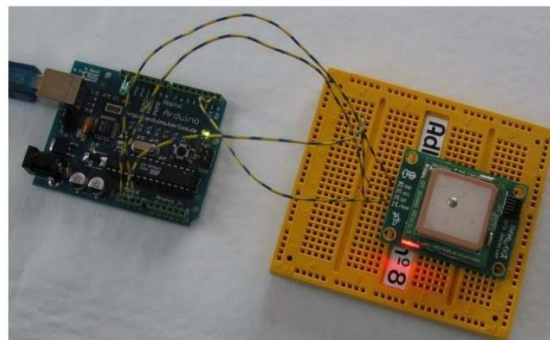

Fig. 5 GPS module

Google map API/Google street view

1. The database's theft table now contains the precise location of the theft.
2. Consequently, the satellite receives the position from the database via satellite communication.
3. Now that the stolen location has been identified using the gps of that spot, the satellite is configured to capture an image of the scene.

Mobile application

1. A mobile application has been created to provide authorised individuals access to the theft site and to take the necessary action.
2. This programme has direct access to the theft table database.
3. The position and unique id of the electric metre are provided together with the satellite's photographs directly to this application.

IV. CONCLUSION

This technique lessens the significant power and financial losses brought on by customer power theft. According to this idea, power theft may be efficiently reduced by identifying the locations where it happens and alerting the authorities. Electric metres will be equipped with the suggested system, which will be concealed so that as soon as the current difference exceeds a certain threshold, an email and automated message with the location and a picture of the affected region are sent to the appropriate authorities.

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