An Automated Fraud Elimination Via Electrical Signal Monitoring And Recording Device (AFEESMR)

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Abstract
An Automated Fraud Electrical Signal Monitoring and Recording device was designed and constructed using all required electronic components. The device achieved the evaluation and monitoring of the time power was supplied through the public supply (Electricity) and the supply through the alternative power generator automatically via the indication of an on/off(0/1) states on the monitoring device for a specified period of time. The compilation and computation of the results over a certain time frame characterized signal strength which was used to checkmate the accuracy of an estimated electricity billing system, which is a common practice in this part of the nation by electricity distribution companies. The result from our investigation in a particular household in a specific month through the electrical signal monitoring and recording device reveals that, the electricity bills send by the distribution company was outrageously estimated and fraudulent. As customers are made to pay for power they never use, this is also corruption. We opinion that the general acceptability of this device will help to reduce corruption in the public power sector as well as theft and fraudulent activities in large organizations that are using both electricity and alternative power generating system backups. In this specific nation where corruption is seen to be endemic, its reduction in the power sector will go a long way to foster national development and sustainable economy as well as improving the standard of living of the populace.

Keywords: alternative power generators, outrageous fraud elimination, signal monitoring, recording device.

INTRODUCTION
The demand for electricity keeps increasing daily because of the ever growing human population, industrialization and the rapid development in Science and Technology. The high demand and consumption rate has led to the increase in electricity bills and tariffs. In a bid to find solution to this ugly development, various methods of generating electricity have been adopted and more research is being carried out on how clean energy can be generated and distributed to customers at an affordable cost.

Due to the vital nature of electricity to the society, power generating companies have capitalized on this to exploit and give consumers monthly high electricity bills. Nigeria has a peculiar case where most consumers are without electricity supply for many hours, days or months but rather rewarded monthly with outrageous electricity bills. In most cases large industries and parastatals like the University of Calabar and individual households are given estimated bills which most at times are very outrageous; this is one major area that this project is meant to address.

As a result of the epileptic power situation in Nigeria many industries depend on backup power generators to meet their electricity demand. This backup generator uses either fuel or diesel as the working liquid. Most companies or industries spend lot of funds purchasing this working liquid (fuel or diesel) for their generators without keeping accurate record of the daily consumption rate. This leads to fraud in the system whereby fuel can be taken illegally from the storage without being noticed.

This project was designed to electronically monitor and record the total time of on and off state of power supply to individual households, thereby over riding outrageous estimated billing systems. This will also help to reduce illegal premium motor spirit (PMS) and diesel siphoning, theft and any fraudulent act.

LITERATURE REVIEW
Fraudulent activities has been discovered in different Fields, Institutions and Sectors (Computer Networks, Communication, Power, Finance and Banking) etc, and as cankerworm, it is destructive and worrisome that scientist and researchers are on their toes to nip the activities of these fraudsters. Kochava employed real-time Global Fraud Blacklist & Fraud Console a very powerful suite of preventative tools to eliminate fraudulent activity from network traffic (Fraud and Global, 2018), when fraud was discovered to be evident in most of their app traffic. Forensiq a sophisticated ad fraud detection methods was employed to identified invalid traffic from
sophisticated botnets, maliciously loaded ads, data center traffic, click farms, proxies, hijacked devices, malicious ad injectors, and more (Forensiq 2018). This ad fraud detection methods identify malicious activity thereby allowing the elimination of bad actors in order to optimize digital spend towards higher quality traffic. Sutisoft uses AP Automation to Eliminate Fraud by improving internal control over their accounting departments (AP Automation 2018). Threat Metrix identified the exponential growth of mobile transaction and the use of networked devices to shop, bank or access social networks. Nonetheless, Threat Metrix detected mobile fraud to be subsequently increasing in the same upward trajectory as criminals exploit the vulnerabilities of mobile applications. This also shows a unique set of risks. To protect against this mobile fraud and attacks a lightweight software development kit (SDK) for Google Android and Apple iOS mobile devices called Threat Metrix Solution for Protecting Native Mobile Applications was proposed and introduced.

This SDK as illustrated (Threat Metrix 2018) can be integrated within mobile applications, to deliver strong device identification, as well as detect any breaches to the host application while evaluating the overall security posture of the device. In the power sector so many fraudulent activities have been discovered over time as shown in most scientific publications. Electricity consumer dishonesty is a problem faced by all power utilities. Finding efficient measurements for detecting fraudulent electricity consumption has been an active research area in recent years and several solutions have been and is still been proposed, among several includes the introduction of smart meters to stop electricity theft (Pitrus 2018). Robert and Anna proposed power energy consumption cyber security in smart metering low voltage network (Czechowski and Kosek, 2016).

The works discussed how technical issues can prove useful in designing increasingly refined security measures and ways to detect electricity theft. (Saurabh et al, 2015) proposed an alternative problem formulation to find a distribution of compromised meter measurements that maximizes the quantity of stolen electricity subject to the constraint that individual meter measurements will be undetected with high probability. (Faithpraise et al, 2018) illustrated the change of attitude towards handing the supplied of electric energy distributed as a major therapy to improve energy efficiency and reduce non-technical loses. (Nagi et al, 2010) proposed solutions on NTL detection of electricity theft and abnormalities for large power consumers. Whereas all the research surveyed as enlisted in this articles dwells in theft elimination, none has focus on fraud elimination in the power sector as demonstrated in the fields of computer networks, communications, finance and banking. So the major contribution of this article settles on fraud elimination in the power sector technically to drive sustainable development on any nation’s economy.

The primary objectives of this research are:
- To evaluate the time power was supplied via public supply and generator automatically
- To Checkmate the accuracy of an estimated electricity bills.
- Reduction of theft and fraudulent activities in large organizations that are using both electricity and alternative power generating system backups.
- To reduced corruption in the public power sector.
- Foster the goal of development and economy sustainability

**MATERIALS / METHODOLOGY**

**The Automated Fraud Electrical Signal Monitoring and Recording device** consists of a real time clock (RTC) module, liquid crystal display and a memory card reader all interfaced with an Atmega 328P microcontroller which is the major device that coordinates all the actions of other devices. There are two major inputs into the microcontroller unit (MCU) which are from the power sources that are monitored. Once there is a change in the state of any of the inputs the microcontroller gets the time from the RTC and saves it on a memory card via the Secure Digital (SD) card module. The time that this change occurred is also displayed on the LCD to enable the user to be aware of the action that is taken place. The system continues to log in data for several days, weeks and months for easy information retrieval from the memory card over an interface monitor as illustrated in Fig. 1

![Fig.1. Block diagram of Electrical signal monitoring and recording device](image)

**METHODOLOGY**

The project is divided into different modules all of which are put together for the system to perform the desired task.
Microcontroller Unit
Clocking System
Power supply unit
Liquid Crystal Display
SD Card Module
Real Time Clock
Microcontroller Programming

MICROCONTROLLER UNIT
A microcontroller is a small computer manufactured on a single integrated circuit which comprises of a microprocessor (CPU), random access memory (RAM), input and output ports, analog to digital converters etc. which is used to run a dedicated program to carry out specific tasks. Microcontrollers are applied in many areas like in household appliances (microwaves, washing machines, television etc.), computer peripherals (printers, scanners and mouse) automotive and aerospace industry, industrial automation etc. Microcontrollers come in different shapes, sizes and structure depending on what they are designed for and some common manufacturers of microcontrollers are Microchip Technology (PIC), Intel, and Atmel (AVR).

For this project the microcontroller used was an Atmega 328P and an Arduino board was used in the programming. Figure 1.2 shows the pin out of the Atmega 328P IC.

**Specifications of Atmega328**
- Flash Memory .......... 32 kilobytes
- EEPROM ................. 1 kilobytes
- RAM ...................... 2 kilobytes
- No. of input/output ports ... 23
- Operating Frequency ...... 16 MHz

Clocking System
The Atmega328P has an internal oscillator but it has a very low accuracy and is easily affected by changes in temperature around the microcontroller. In order to get an accurate clocking pulse a 16MHz pierce crystal oscillator was used combined with two 22pF capacitors connected in parallel that serve as the load capacitance for driving the crystal oscillator. At this frequency the microcontroller is able to communicate properly with the SD card module and the RTC with minimal error.
Power Supply Unit

The power logging device is meant to run 24 hours, to accomplish this, a battery source was used in the design to enable the system run permanently in order not to be affected by any change in power supply. The microcontroller, LCD and SD card module all require a recommended 5VDC supply voltage. To achieve this a 9V battery is connected to 5V voltage regulator (LM7805) in order to drop the 9V supply voltage to the recommended 5VDC which can be used to power the system properly.

LM7805 Voltage Regulator

To avoid voltage fluctuations from the supply voltage, a voltage regulator IC is used. The LM780 is a 5V voltage regulator IC which is used to ensure that the microcontroller and all other modules interfaced with it receive a steady supply of 5VDC irrespective of the change in the supply voltage.

Liquid Crystal Display (1602a)

A 16×2 LCD is interfaced with the microcontroller in order to give the user a feel of what is going on at the background by displaying the date and time of the last change in power supply. The LCD has 16 terminals of which 8 are data pins ranging from D0 to D7. It can be operated in 4-bits or 8-bits mode. In 4-bit mode 4 data ports (D4-D7) are used while all data ports are used in 8-bits mode. For this project the LCD is used in 4-bit mode in order to save the number of digital pins used on the microcontroller. Table 1.1 shows the functions of the different ports of the microcontroller.

Table 1.1: Pin Out of LCD Module

<table>
<thead>
<tr>
<th>PIN NO</th>
<th>NAME</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VSS</td>
<td>0V</td>
</tr>
<tr>
<td>2</td>
<td>VDD</td>
<td>+5V Power Supply</td>
</tr>
<tr>
<td>3</td>
<td>V0</td>
<td>Contrast</td>
</tr>
<tr>
<td>4</td>
<td>RS</td>
<td>Register Select</td>
</tr>
<tr>
<td>5</td>
<td>RW</td>
<td>Read or Write</td>
</tr>
<tr>
<td>6</td>
<td>E</td>
<td>Enable</td>
</tr>
<tr>
<td>7</td>
<td>D0</td>
<td>Data Pin</td>
</tr>
<tr>
<td>8</td>
<td>D1</td>
<td>Data Pin</td>
</tr>
<tr>
<td>9</td>
<td>D2</td>
<td>Data Pin</td>
</tr>
<tr>
<td>10</td>
<td>D3</td>
<td>Data Pin</td>
</tr>
<tr>
<td>11</td>
<td>D4</td>
<td>Data Pin</td>
</tr>
<tr>
<td>12</td>
<td>D5</td>
<td>Data Pin</td>
</tr>
<tr>
<td>13</td>
<td>D6</td>
<td>Data Pin</td>
</tr>
<tr>
<td>14</td>
<td>D7</td>
<td>Data Pin</td>
</tr>
<tr>
<td>15</td>
<td>A</td>
<td>+5V Backlight</td>
</tr>
<tr>
<td>16</td>
<td>K</td>
<td>0V Backlight</td>
</tr>
</tbody>
</table>

Real Time Clock (Ds1302)

Time is very essential in power monitoring, therefore a Real time clock module was interfaced with the microcontroller. As the name implies the RTC feeds the microcontroller with the correct time and without this module the microcontroller cannot determine accurately any time there is change of state in the power signal and the data recorded on the memory card will be meaningless. The RTC module is made up of a DS1302 IC, 32.768KHz crystal oscillator and a lithium battery to keep the IC powered all the time.

DS1302 INTEGRATED CIRCUIT

The DS1302 trickle-charge timekeeping chip contains a real-time clock/calendar and 31 bytes of static RAM. It communicates with a microprocessor via a simple serial interface. The real-time clock/calendar provides seconds, minutes, hours, day, date, month, and year information. The end of the month date is automatically adjusted for months with not fewer than 31 days, including corrections for leap year. The clock operates in either the 24-hour or 12-hour format with an AM/PM indicator.
**SD CARD MODULE**
The Microcontroller has a memory that can be used to store data but this memory is limited and in order to increase the size of the memory an SD card Module is interfaced with the microcontroller. With this a larger external memory can be introduced and data can be written to or read from it. Communication between the microcontroller and SD card module is serial and the protocol used is the serial peripheral interface (SPI). The SD card Module has 6 major terminals which are shown in Table 1.2.

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCC</td>
<td>5V Supply</td>
</tr>
<tr>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>CS</td>
<td>Chip select</td>
</tr>
<tr>
<td>MOSI</td>
<td>Master Out Slave In</td>
</tr>
<tr>
<td>MISO</td>
<td>Master In Slave Out</td>
</tr>
<tr>
<td>SCK</td>
<td>Serial Clock</td>
</tr>
</tbody>
</table>

*Table 1.2: SD Card Module Terminals*

**Microcontroller Programming**
The code was written using the Arduino IDE software which was then compiled and uploaded to the the Atmega 328P IC using the Arduino Uno board shown in Fig. 1.8.

![Arduino Uno Board](image)

**RESULT ANALYSIS**
To create an engine model, the thermodynamic processes of the engine performance must be known.

![Average time covered](image)

**CONCLUSION**
It would be inferred that keeping record of actual utilization of electrical signal time-of-use is vital especially with the discrepancy in electric power distributed and their exorbitant tariff for individual households in Nigeria and University of Calabar in particular. The development of this project has been carried out according to specification. The implementation of the data log in system was achieved. As well as interfacing of the data logger to the computer, using USB communication, to ensure accurate data recording. In the early part of this report, the background technologies outlined how this
project would be developed. The central part of this report was concerned with how these technologies were implemented in achieving the laid down objectives and goals. The overall goal was to develop a device that is dedicated to tracking the actual time-of-use of electric power distributed to households over a period of time in order to reduce fraud and corruption that is endemic in the power sector.

**RECOMMENDATIONS**

This write up should serve as an eye opener to any subsequent research on the improvement of the electrical signal measurement device. An application of this work is highly recommended to monitor and record environmental data such as temperature, weather condition etc. further research on this device should include:

- Data collected via SMS to the phone of the research fellow making the information available on the move.
- Proper electrical signal monitoring and recording software can be developed to process the data.
- Wireless communication can be integrated to establish communication between the host computer, the electrical signal monitoring and recording device and the distribution company. This would involve using Radio Packet Controllers (RPC) which can both transmit and receive data over wireless communication link. One of the controllers would be connected to the USB port of the host computer and the other would be on the electrical signal monitoring and recording board. This means that the Logger application would still communicate to the USB port of the host computer without a bus linkage.
- A software which automatically will convert the binary digit into its graphical signal for onward real time billing estimation according to real time load consumption.
- A graphical quantitative graph converter should also be incorporated for automated interpretation and comparison of the bills issued by the power sector.

**REFERENCES**


