

ELECTRICAL POWER USAGE ALERT SYSTEM

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ABSTRACT

Presently, we are living in a world where electricity has become an important part of our daily life. the purpose of this device is to alert the person about how much power is being consumed. For example, in summer we use the air conditioner but we don't come to know how much power is consumed until the monthly bill is generated. When the bill is generated, we get shocked by the amount.

It is to help people prevent the excess use of electricity. We know that nowadays the weather is unpredictable, sometimes too hot or too cold or too humid due to rains. Every time it's an extreme situation. When it is too hot, people tend to more usage of air conditioner and then when the bill is given, they get shocked seeing a huge amount. The problem is when it's too hot, we tend to make excess usage of electricity. We make excess use of electricity when there are functions or marriages at home.

Thus, we have come up with the idea of creating a device which can alert the person about the power used. The final outcome will be a message generated by using the GSM modem. Wastage of electricity can be prevented in a situation like mentioned above. Our device has two modes of operation and can be switched from one to another by the user, by sending a message. This makes our device user-friendly and more flexible to use. We also are demonstrating another feature in which we are showing two current connection lines which can be controlled separately through an SMS, which helps the user to save power more efficiently.

KEYWORDS: ARDUINO UNO, GSM, OPTOISOLATOR, STEP-DOWN TRANSFORMER.

1. INTRODUCTION

The primary function of this product is that it converts the energy consumed into the currency and alerts the user according to the limit set by him/her. The device helps a person to control the usage of electricity. The situations based on which this project was developed was seeing how people get shocked on seeing their electricity bill at the end of the month and face problems in paying it before time. This problem is mostly seen in the middle class and in youngsters owning their own house who use electricity allot but later find it difficult to pay it. Seeing such incidents, we thought why don't we make a device which alerts the person when the limit set is 75% of the limit is used and then a second alert when 100% of the limit is used. The alert goes to mobile through a message using a GPS modem. If we consider a normal 1.5-ton (2 star) air conditioner, it consumes around 5000 watts per hour. 1000watts = 1KWh which means a 1.5ton air conditioner consumes 5 KWh (KILOWATT HOUR). One unit of electricity costs around Rs.6.5/- (approx.)

This device has additional features like:

- It has two modes of function:

- 1.Normal mode: this mode sends alert at 50%, 75%, 100% of the consumption of the limit.

2. Daily mode: in this the user gets the alert of the amount of power used at the end of each day, hence named as the daily mode.

The daily mode can be activated by sending a message from the authorized number and the user can switch to normal mode by sending a message.

- The device gives the user flexibility to switch on and switch off lights and fans which are represented by three bulbs in the prototype and these are considered as one line of connection and other important home appliances like refrigerator or air-conditioners are represented as a fan with a separate line of connection. So, if the user wants only the refrigerator or air-conditioner to work he can switch off the fans and lights connection by sending a message. The control is given to the user which is an advantage.

2. LITERATURE SURVEY

There was an article published in International Research Journal of Engineering and Technology (IRJET) regarding a similar product with not much difference, but we have tried to see that our product differs from the one published. The aim of implementing the product might be the same but the way it works differs. We feel our product is more efficient because of the different features included when compared to the one existing. It's an advantage of having more than one function.

Their conclusion was:

Thus, the Electrical Power Usage Alert System is used to alert the user regarding his everyday consumption of electricity. This helps in saving electricity and also keeping the electricity bills under limits. A small module consisting of the ARDUINO board, ESP8266 and GSM can be installed with energy meter to make the electricity consumption smarter.

3. SYSTEM DESCRIPTION

The system is explained with the help of an architecture and module description.

3.1 HARDWARE REQUIREMENTS

3.1.1 ARDUINO UNO

Arduino Uno is an open-source microcontroller which is easy to use to develop devices that can communicate with other devices to improve the day-to-day activities of people. Arduino provides microcontroller kits which are inexpensive. It consists of 6 analog inputs, 14 digital input/output pins, a USB connection, a power jack, a 16MHz resonator, a 2kB RAM and a reset button.

The ATmega328P microcontroller provides us with UART TTL serial communication which is possible by using the digital pin 0 and pin 1 which are Rx and Tx respectively.



Figure 1: Arduino Uno

3.1.2 GSM MODEM

GSM is an abbreviation for Global System for Mobile communication originally from Group Special Mobile. GSM operates a number of different carrier frequencies), with 2G GSM networks operating in the 900 MHz or 1800 MHz bands.



Figure 2: GSM Modem

The structure of a GSM network has a number of discrete sections. They are:

- The Base Station Subsystem.
- The Network and Switching Subsystem. This is sometimes also just called the core network.
- The GPRS Core.
- The Operations support system (OSS) for maintenance of the network.

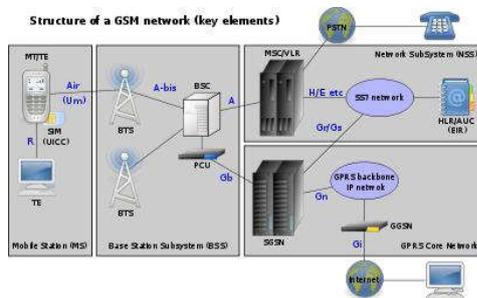


Figure 3: Structure of a GSM Network

3.1.3 OPTOISOLATOR

An Opto-isolator is also known as Opto-coupler is a semiconductor device. It uses a short optical transmission path to transfer an electrical signal between circuits or elements of a circuit while keeping them electrically isolated from each other.

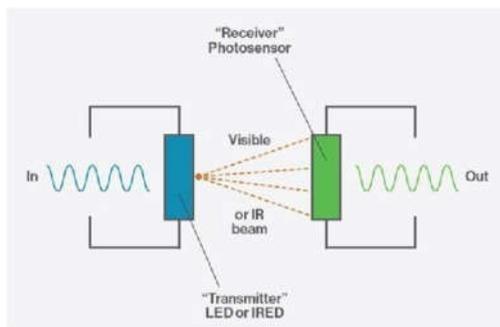


Figure 4: opto-isolator

This component is used in a wide variety of communications, control and monitoring systems which use light to prevent

electrical high voltage from affecting a lower power system receiving a signal.

3.1.3 STEP-DOWN TRANSFORMER

A Step-down Transformer is a type of transformer, which converts a high voltage at the primary side to a low voltage at the secondary side.

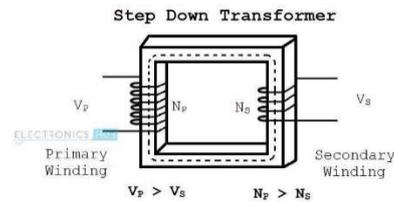


Figure 5: Step-down Transformer

3.2 ARCHITECTURE OF THE DEVICE

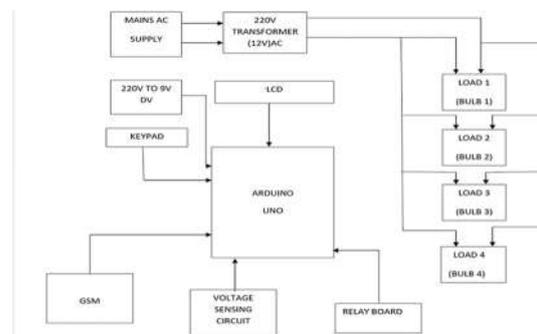


Figure 6: Architecture diagram

4. WORKING OF THE SYSTEM

- We first switch on the power supply of the model
- We see a display on the LCD.
- The next step is to press and hold the power button of the GSM modem for a second or two.

- We will see that a blue light appears which keeps blinking once in two or three seconds.
- The LCD will display options for setting the limit for the user. To set the limit it will ask the user to press #
- Then the device starts reading the power consumed and this is displayed on the LCD.
- The reading is taken continuously and when 75% of the limit is reached it sends a message to the user.
- The message is sent to the number of the sim placed in the GSM modem.
- After sending, the device keeps comparing the reading and the limit and send a message to the user when 100% of the limit is used.
- To switch on the bulbs, the user sends a message “1” and gets an acknowledgement as “bulbs on”. similarly, to switch off the bulbs the user sends a message “2” and get an acknowledgement “bulbs off”.
- To switch on the fan, the user sends “3” and gets a message as “fan on” and to switch off the fan the user sends “4” and gets a message as “fan off”.
- To switch mode to daily mode from normal mode the user sends a message “5” and gets an acknowledgement as “DM activated” and to switch to normal mode from daily mode the user sends “6” as a message and receives “DM deactivated”.

5. CONCLUSION

We presented the design and implementation of an Electrical Power Usage Alert System based on technology using a cellular phone, to send an SMS (Short Message Service) to the user. The proposed system combines two commonly used technologies namely, Global System for Mobile (GSM) Arduino Technology. This indeed is an easy, practical, inexpensive and yet very effective way of transmitting information to the user.

In the future government of our country might want a solution to control the usage of electricity and this can be a good idea to implement. Any further changes also can be made depending on the outcome needed, but a person might need to brainstorm to make practical and appropriate changes keeping in mind about the advantages and disadvantages.

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