

Home Automation with Power Management

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Abstract

The design and development of a smart controlling for household electrical appliances in real time has been reported in this paper. In home automation system we can control the power supply to the home appliances by simply sending text messages from the android mobile to the raspberry pi3 via telegram application. This project will be useful for physically challenged people. Additionally, the system continuously monitors the power generated in the generating station and compares it with the power consumed by the loads by plotting graph using current sensor and arduino. This comparison is done for indicating abnormal condition and power theft. Using both the systems we can save the energy.

Index Terms: Wireless control and data transmission, Home automation, Energy management, arduino, raspberry pi3, Wireless transceiver HC12 module.

1 INTRODUCTION

The process of controlling various operating equipment, machinery, factory operations, etc., automatically (sometimes remotely) can be termed as automation. Automation is an efficient method to use in every field such that to reduce manpower, energy usage and also for improving the quality and efficiency of any system. There are various emerging automation applications such as home automation system, industrial automation system, automated waste management system and so on. Home automation system is one of the automation systems, which is used for controlling indoor and outdoor lights, air conditioning in the house, to lock or open gates, to control electrical and electronic appliances automatically with the help of various control systems.

There are various types of existing home automation applications such as RF based home automation system, Bluetooth controlled home automation, Arduino based home automation system and so on. The disadvantages of these existing systems are

1. Bluetooth communication has range of 10 to 20 meters and once bluetooth is disconnected the application also disconnects and reconnecting bluetooth is a task. Also Bluetooth connectivity needs high power consumption.
2. In RF based home automation radio communication requires the presence of electricity both at the point of transmission and at the point of reception.
3. GSM uses pulse based burst transmission technology and hence it interferes with certain electronics. Due to this fact airplanes, petrol bunks and hospitals prevent use of GSM based mobile or other gadgets.

This paper focuses on human-friendly technical solutions for monitoring and easy control of household appliances. The inhabitants comfort will be increased and better assistance can be provided. It is foreseen that android mobile phone control system will become more and more ubiquitous at home in the near future and will be very useful in assistive health care particularly for the elderly and disabled people. In the developed system household appliances

are controlled over Internet Of Things (IOT) under WiFi through android applications from any smartphone.

This developed system has the following advantages.

1. Integration of mobile devices with wireless networks, associating mobile devices such as PDAs and smartphones with the automation system become possible everywhere and at any time, as a devices exact physical location is no longer crucial for a connection (as long as the device is in reach of the network).
2. The loss of power can be reduced and manpower requirement is very less when compared to conventional methods.
3. Provides safety from electrical power short circuits while using conventional wall switches to operate loads.
4. Home automation system with automated door locking and security cameras facilitates more security.
5. We can save a lot of time to operate home appliances from anywhere (without wasting time to move from office to home for just unlocking door for family members to enter the home).

2 RELATED WORK

In this section we briefly discuss the existing works about home automation.

Kumar Mandula [4], proposed a mobile based home automation system using IOT which can be used for connecting, controlling and managing intelligent objects which are connected to internet through an IP address.

Cheong P[2], described about a Zigbee-based wireless sensor network node for ultraviolet (UV) detection of flame. The sensor mode is composed of a ZnSSe UV photodetector, a current-sensitive front end including a high-gain current-to-voltage amplifier with 120 dB and logarithm converter, and a transceiver operated at a 2.4-GHz industrial, scientific, and medical band. Erol-Kantarci M[3], stated that Wireless Sensor Networks (WSNs) will play a key role in the extension of a smart grid towards residential premises, and

enable various demand and energy management applications. Efficient demand-supply balance and reducing electricity expenses and carbon emissions.

Nagender Kumar suryadevara[9], developed a smart monitoring and controlling system for household electrical appliances in real time.

Robin goyal[7], proposed a system that provides low cost and flexible home automation and intelligent light control system. Automation provides helps to disabled and normal people too in professional and daily life. This system also provides the remote access facility and we can control all over electronic gadgets.

Soumya S[8], stated that the internet has been connecting people and making life simpler by providing all kinds of information with the click of a button. The author developed Home Automation system based on internet of things. This allows the user to automate all the devices and appliances of home and integrate them to provide seamless control over every aspect of their home.

3 PROPOSED SYSTEM FEATURE

These days with emerging developments in all sectors and growing demands, electricity has become priority for every individual and every organization. The basic procedure for power supply includes power generation, power transmission and power distribution to the destination. Naturally owing to few technical faults, losses may occur due to power dissipation by some devices. This losses may be due to any fault in the transmission line or may be power theft. In developing countries like India, power theft is one of the most prevalent issues which not only cause economic losses but also irregular supply of electricity. It hampers functioning of industries and factories, due to shortage of power supply to them. It causes shortage of power supply to homes. Power management is an integral part of almost every new system design. It enables to keep the power under constraints.

To reduce this we develop antipower theft technique which is shown in fig 1. In this technique, the system continuously monitors the power generated in the generating station and compares it with power consumed by the loads. This comparison is done by plotting

graph using current sensor and arduino. If there is large deviation while comparing abnormal condition is indicated in the power station and the entire system will be shut down for inspection purpose. By this we can reduce power theft and wastage of power.

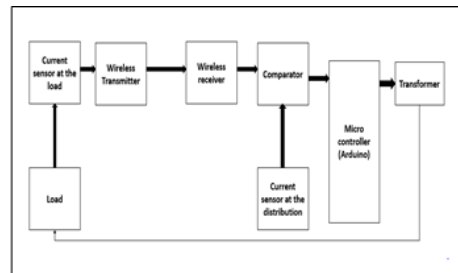
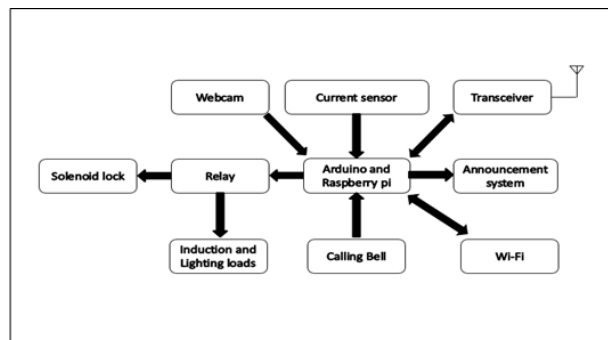


Fig 1. Block diagram for detecting power theft

4 SYSTEM DESIGN AND IMPLEMENTAION



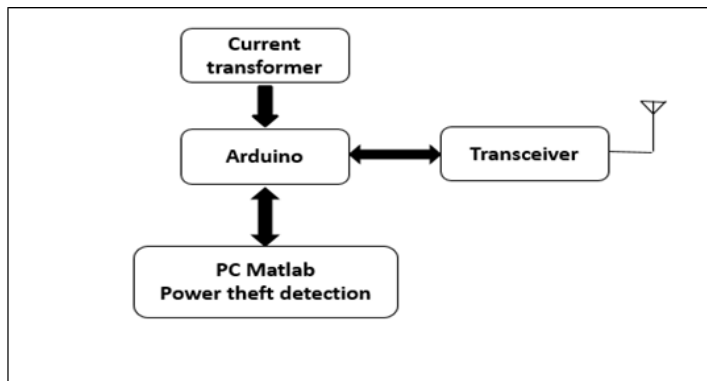


Fig 2. Block diagram of Home Automation with power management

The system consists of Raspberry pi3 processor and relay module to control the power supply to the home appliances. Webcam is used to capture image of a visitor at the entrance. This Webcam and automatic door lock system are used for security purpose. Current sensor and arduino are used for measuring the current consumed by the load and this measured data is sent to the transceiver in the consumer side. Another system is implemented in the power station, this system consists of transceiver, current sensor and arduino which compares the power generated in the generating station and power consumed by the load. If there is large deviation in the comparison abnormal condition is indicated and the entire system will be shut down.

The current drawn by various devices when measured at the utility service entry ranges between 0 to 15 A. This is sensed using a current sensor which works on Hall Effect principle. The current rating of the sensor ranges between 0-30A with an output sensitivity of 185mV/A .The output of the current sensor ranges between 0-5V (Inst) which in turn is fed to the analog input pin of the arduino. The corresponding current value store in the arduino (Ii) is given by the formula

$$I_i = (k * (I_{inst} - V_m) / S_A$$

S_A is the sensitivity of arduino and equals 66mV/A. $V_m = 2.5V$ is the middle sensing voltage. $K=0.0049$ is the stepwise increment for values mapped between 0 to 1023 bits. Thousand such samples

are obtained and the average values is found through the iterative process defined by

$$I_{eq} = I_{eq} + I_i$$

$I_{avg} = I_{eq}t$ is the sum of thousand samples. t is the number of samples, which in this case is 1000.

$$I_{avg} = I_{eq}t$$

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5 SIMULATION AND RESULTS

Fig 3 shows simulation circuit for indicating abnormal condition.

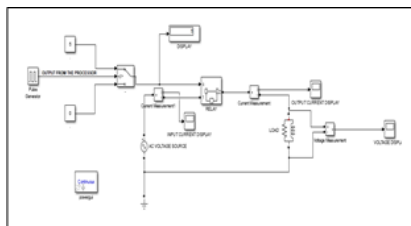


Fig 3. Simulation circuit

The current consumed by the loads are added and subtracted from the source current, if the result is a large value then abnormal condition is indicated. This deviation between the source and the load in the form of graph is shown in fig 4

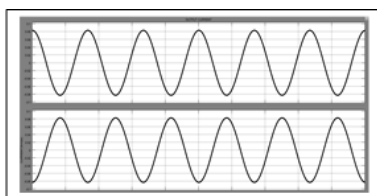


Fig 4. Current waveform during abnormal condition.

If the compared value is zero then it is said to be normal condition (under ideal circumstances) then the resultant graph is shown in fig 5

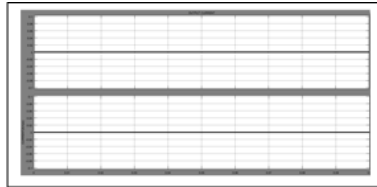


Fig 5. Current waveform during Normal condition

Power can also be saved through Home automation which represented in the form of simulation circuit in the fig 6

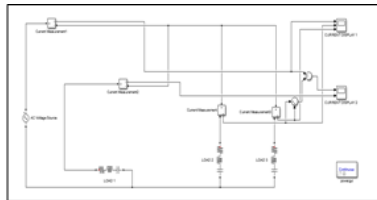


Fig 6. Simulation circuit.

Based on the command given by the user, the processor will control the power supply to the electrical appliances via relay. When the output of the processor is logic high (3.5V) the relay will be energized. For relay energization relay driver circuit is used. Similarly, when the output from the processor is logic low (0) the relay will be de-energized.

The flow of current and voltage to the load (Home Appliances) based on the user command is given in fig.7and 8.

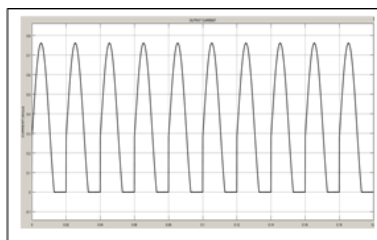


Fig 7. Current waveform.

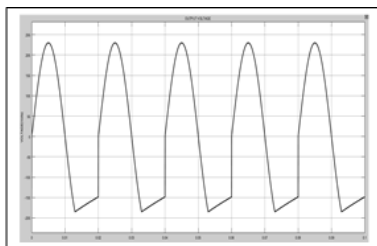


Fig 8. Voltage waveform.

6 CONCLUSION

The home automation using Internet Of Things has been experimentally proven to work satisfactorily by connecting simple appliances to it and the appliances were successfully controlled remotely through internet. The design not only controls the power supply to the home appliances but also measures the current consumed by the load in the consumer and compares it with power generated in the generating station. This comparison is used to indicate abnormal condition and power theft in the transmission line. Thus we can reduce the wastage of power.

7 FUTURE WORK

This system can be expanded by sending messages to the consumer while shutdown for inspection from the power station. In future we can work on prepaid meter which thus allow you to save electricity, which in turn leads to save money. By this you will never get an unexpected, exaggerated electricity bill. Therefore one of the big advantages of prepaid electricity is that it enables you to manage your cash flow and allocate cost properly.

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