Smart Grid Compatible Control of Appliances using Internet Protocol aided by Smart Occupancy Sensor and an Application on a Mobile Platform

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Abstract: I**n this day and age of modern technology, it is only natural that the concept of home automation is fast gaining popularity around the world. Additionally, the problem of conserving energy takes importance in a world of rapidly depleting natural resources. Our project aims to enable control and monitoring of appliances through the internet and additionally help in energy conservation by means of occupancy detection coupled with automatic switch off of appliances. This is also in compliance with the smart grid initiatives being taken in the country.**

**The project uses webcam-based occupancy detection and an Android App as the interface for control of appliances through the internet. A digital wall switch was also designed to replace the traditional arrangement. The main component of the project is the Raspberry Pi Model B, which is used as the control centre.**

Using the Raspberry Pi and webcam decreases both the cost and size of implementing this project, and Android phones are almost ubiquitous. Hence it is possible to bring luxury and energy savings to many users, even in developing countries.

1. Introduction

Home automation is the residential extension of building automation. It is automation of the home, housework or household activity. Home automation may include centralized control of lighting, HVAC (heating, ventilation and air conditioning), appliances, security locks of gates and doors and other systems, to provide improved convenience, comfort, energy efficiency and security. Home automation for the elderly and disabled can provide increased quality of life for persons who might otherwise require caregivers or institutional care.

The popularity of home automation has been increasing greatly in recent years due to much higher affordability and simplicity though Smartphone and tablet connectivity. The concept of the "Internet of Things" has tied in closely with the popularization of home automation.

A home automation system integrates electrical devices in a house with each other. The techniques employed in home automation include those in building automation as well as the control of domestic activities, such as home entertainment systems, houseplant and yard watering, pet feeding, changing the ambiance "scenes" for different events (such as dinners or parties), and the use of domestic robots. Devices may be connected through a computer network to allow control by a personal computer, and may allow remote access from the internet. Through the integration of information technologies with the home environment, systems and appliances are able to communicate in an integrated manner which results in convenience, energy efficiency, and safety benefits.

A smart grid (shown in Fig. 1.1) is an electrical grid that uses information and communications technology to gather and act on information, such as information about the behaviours of suppliers and consumers, in an automated fashion to improve the efficiency, reliability, economics, and sustainability of the production and distribution of electricity.

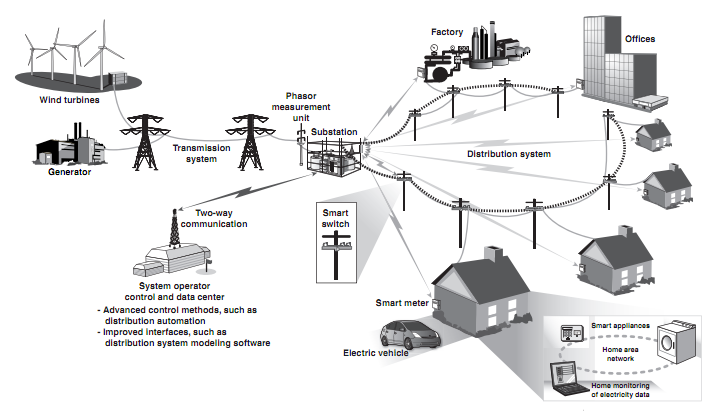


Fig. A pictorial description of a Smart Grid

Control systems for lighting can be used to control household electric bulbs and tubes. Examples include:

* Extinguishing all the lights of the house at a predetermined time and date range as specified by the user.
* Use of motion detectors to automatically e the lights in a room and turn on the lights depending on the presence and absence of people in the room.
* Turning the light on/off with the use of a remote wireless IR device.
* Control the brightness of the lights in the house according to the present ambient light level available or other criteria.
* Change the ambient colour of a room by varying the intensity of the lights or by using Red Green or Blue LEDs (mood control).

1. DESIGN

The design consists of 2 main parts

* Software System
* Hardware System

The block diagram is shown in Fig 2.

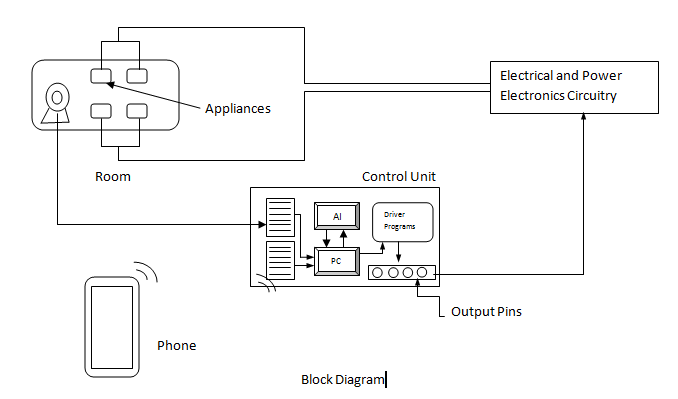


Fig 2. Block Diagram

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Title must be in 24 pt Regular font. Author name must be in 11 pt Regular font. Author affiliation must be in 10 pt Italic. Email address must be in 9 pt Courier Regular font.

TABLE   
Font Sizes for Papers

|  |  |  |  |
| --- | --- | --- | --- |
| Font Size | Appearance (in Time New Roman or Times) | | |
| Regular | Bold | Italic |
| 8 | table caption (in Small Caps),  figure caption,  reference item |  | reference item (partial) |
| 9 | author email address (in Courier),  cell in a table | abstract body | abstract heading (also in Bold) |
| 10 | level-1 heading (in Small Caps),  paragraph |  | level-2 heading,  level-3 heading,  author affiliation |
| 11 | author name |  |  |
| 24 | title |  |  |

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1. Level-1 Heading: A level-1 heading must be in Small Caps, centered and numbered using uppercase Roman numerals. For example, see heading “III. Page Style” of this document. The two level-1 headings which must not be numbered are “Acknowledgment” and “References”.
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Figures and tables must be centered in the column. Large figures and tables may span across both columns. Any table or figure that takes up more than 1 column width must be positioned either at the top or at the bottom of the page.

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gv_figure_4

Fig. A sample line graph using colors which contrast well both on screen and on a black-and-white hardcopy

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Fig. Example of an unacceptable low-resolution image

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Fig. Example of an image with acceptable resolution

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1. Conclusions

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Acknowledgment

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Causal Productions wishes to acknowledge Michael Shell and other contributors for developing and maintaining the IEEE LaTeX style files which have been used in the preparation of this template. To see the list of contributors, please refer to the top of file IEEETran.cls in the IEEE LaTeX distribution.

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