# An Efficient Web Based Home Appliance Control System

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## Abstract

In this paper an efficient web based home appliance control system (WBHACS) is proposed for the peoples who stay out of home maximum of the time for their offices, business and for other reasons. They always remain tensed whether their homes are secured in their absence or either anyone trying to break the security of their homes. The working peoples can avail this WBHACS conveniently from any part of the world. If any stranger tries to break the security of the home and get into the home, the owner is uncomfortable with that and then the proposed WBHACS can be availed. In emergency the stranger can be identified with the close circuit camera integrated with the system. In addition, if the owners seek for external help like police station or from relatives then it is possible to do with the WBHACS. There is an emergency alarm system also included along with the proposed model to alert the neighbors. It uses the Wi-Fi system to monitor the home appliances via home personal computer from a distance. For successfully implement this proposed model in experimental setup, we use PIC 16F877A, IR-TSOP modules and Image capture module. The Visual basic is used for making attractive graphical user interface (GUI). In order to program on the PIC we use micro C as a programming language.

## Keywords

Home Appliance Control, Wi-Fi, GUI, Internet Based Control

## I. Introduction

In general most of crime is happen absence of the owner of the house. So owner cannot identify the criminal and fail to trace or stop. So there need an automatic system which will detect the break in security and also capable of identifying the suspect. The system also needs to be able to automatically detect those electrical appliances which are on even absence of the owner in a house.

Now a day's the security of personal home is a prime concern for them who have to leave their homes empty for day long or month for their offices, business or vacation trips. Being outside the home they always tensed about thieves or criminals attack on their homes and being in confusion that are the doors or windows open or closed. Studies have shown that attack by a criminal in empty house or elderly people is increasing. So we propose a Web Based Home Appliance Control System (WBHACS) which will help the peoples to know about the condition of their homes. If someone stranger tries to break the security of their homes, the system alerts the police or the authorized peoples. The image capture module will help to identify the strangers. If owner wants, he can check the status of the doors and windows whether it is open or closed. By this method, the owner of the house can take immediate action to protect his home from any kind of threat. The owner also can change the status of the all electronics home appliances using the proposed model. Using this model a user can significantly reduce his monthly electric bill by optimizing the system utilization and controlling the electronic home appliances while leaving the home for job or business.

The remainder of the paper is organized as follows. Section II describes the related works, and Section III presents the proposed Web Based Home Appliance Control. A detail experimental environment is presented in Section IV. Section V concludes the paper.

## II. Related Works

A number of research works have done on this area. For examples, using Dual Tone Multiple Frequencies (DTMF), a home appliances monitoring system is discussed in [1]. In another paper, home appliances remote control system is proposed using Bluetooth [2]. Remote control of home appliances using mobile communication network has been discussed in [3]. Another low cost GPRS based home security system, is discussed in [4], which does not mention about its low cost at implementation level. It informs the theft attempt to a property management person and only through SMS. A home automation system in which only SMS is sent for emergency is shown in [5]. An emotional computing system is described in [6], which does not describe about its implementation. A ZIGBEE network for remote monitoring of home appliances is presented in [7]. A common remotely monitoring system is proposed to perform multiple surveillance system [8]. Michael discussed about the detail of system architecture and design of the home M2M gateway [9]. Zhang et al. designed a model for home intelligent electronic assistant system based on embedded module of 3C44B0X [10]. Muller et al. addressed a problem by introducing an assistance system that allows for the easy and almost automatic issuing and distribution of valid X.509 certificates to new devices [11]. This proposed model is effective not only in a single home but also for the multiple homes. Behera et at. proposed a real time surveillance system detects and tracks the objects in motion and provides automatic warning in case of suspicious activities such as unidentified object and restricted zone monitoring [12].

## III. Proposed Web Based Home Appliance Control

This section is presented detail about the proposed WBHACS. According to this proposed model, all electrical appliances in home will be connected with a home PC and the status of the appliances can be controlled by using this PC. The Graphical user interface of the project will continuously shows the status of home appliances including doors and windows of the home. This home PC can be controlled using Internet from outside the home. A block diagram of proposed web based home appliance control is presented in fig. 1.

### A. Image Capture Module

Image Capture module consists of a close circuit camera and an interface to a new technology named Wi-Fi direct module. This module automatically activates when any object appears in front of it and it captures the image of the object. The captured image is provided to a wireless image transmission module, which transfers the image to the home PC. After that the captured image is saved in the memory of the home PC.
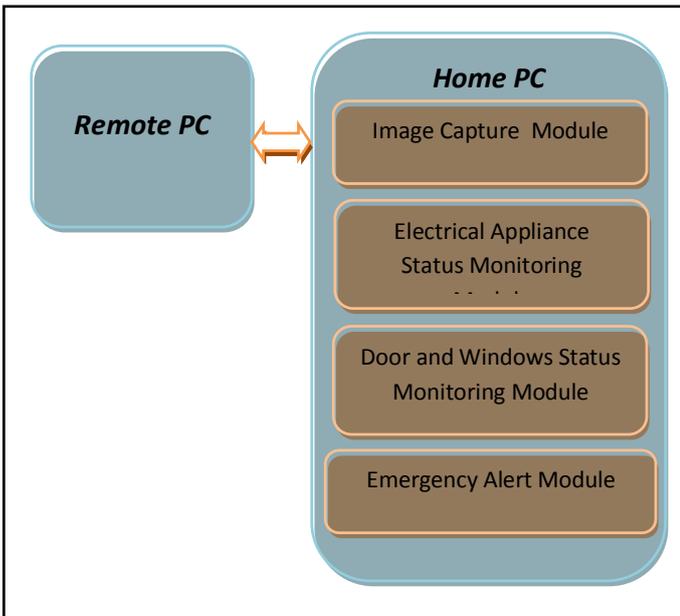
Fig. 1: A Block Diagram of Proposed Web Based Home Appliance Control

## B. Wireless Image Transfer Module

This module uses Wi-Fi technology to transfer the digital image to the home PC, and then the transferred image is saved in PC memory. The image of stranger outside the home can be captured using closed circuit camera and then the captured image is transferred to home PC using a Wi-Fi module. Furthermore, this captured image will help in recognizing the threat. A detail procedure of a wireless image capture module is illustrated in fig. 2.
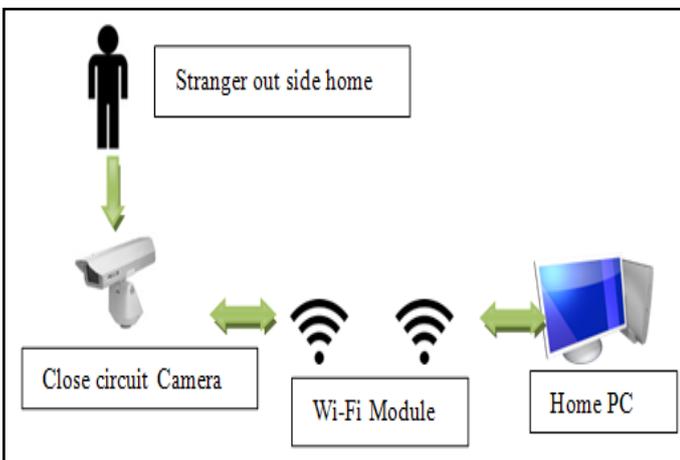


Fig. 2: A Detail Overview of a Scenario of Wireless Image Transfer Module

## C. Door and Window's Status Monitoring Module

To sense the status of the doors and windows, whether these are open or closed, we have used IR-TSOP. If the any door or window is open then it works as an obstacle to the IR and thus they will get reflection and IR-TSOP receives this reflected signal. This will help a user to monitor the condition of the doors and windows. An arrangement of this module in a house is illustrated in fig. 3.

## D. Wireless Module

In this proposed system, the transmitter module is a 4-pin module and uses 2-12 volt dc power. There is a RF receiver module which is capable of receiving data within 100 meter in ideal condition. The received data by RF receiver is fed into decoder Integrated

Circuit (IC) which converts the serial data as parallel data and feeds as an input to the microcontroller PIC 16F877A [13].
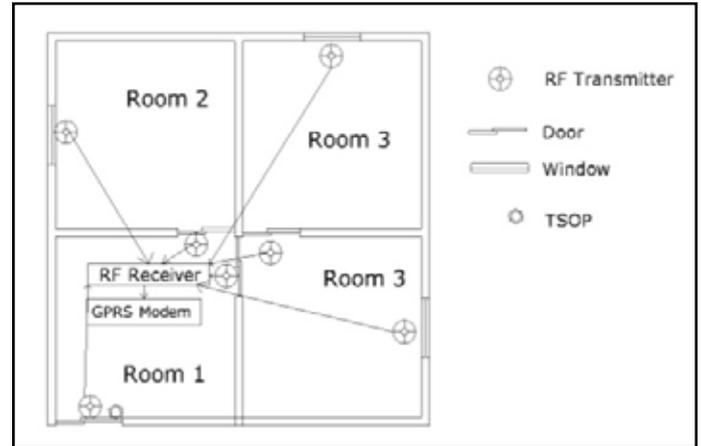


Fig. 3: Arrangement of Identifying Break in Security

## E. Emergency Alert Module

The received signal from RF receiver is fed into microcontroller PIC16F877A which is a product manufactured by the Microchip. This microcontroller has two functions. Firstly, it activates the emergency security alarm at home to alert the home and neighbors about the security threat and secondly, it activates a GPRS modem. The GPRS modem is interfaced with the microcontroller via a MAX232 IC manufactured by Maxim [14-15]. In addition, a GPRS modem Webcam multiband 900E 1800 is used. It uses the Attention (AT) command for its functioning. A pre-programmed voice command is also loaded here and when the call is placed to police station the voice command starts executing. In addition, there is an option of sending SMS.

## F. Graphical User Interface

In order to build an attractive Graphical User Interface (GUI) in our proposal we used the Visual basic [16] tool. The GUI in this system helps in controlling the appliance of home visually and it also help users to see the status of the home appliances. If a person unmindfully leaves any appliance in the home during the period of leaving home for office or business, from work place or any remote place he/she can control these appliances. Any apparatus may turn on or turn off by clicking a button of the GUI. If any apparatus is turned on then the will show the text turn off, and vice-versa. This method confirms the best use of electrical power in home and decrease the un-mindful wastage of electrical power. A snapshot of the GUI for monitoring appliances is shown in fig. 4.



Fig. 4: A Snapshot of the GUI for Monitoring Appliances

## G. Home PC and Remote PC Connection Module

In order to control the home appliances in our proposed system we use a PC with which all electrical control appliances will be interfaced via the PIC microcontroller [17]. To monitor the home PC from the remote areas, in home PC we have used computer to computer interfacing software named Team Viewer [18], which helps to take control over home PC from a remote PC. It is secure software to take control over home PC because it uses user authentication to access the home PC. A GUI team viewer with the Home PC and Remote PC connection is demonstrated in fig. 5.
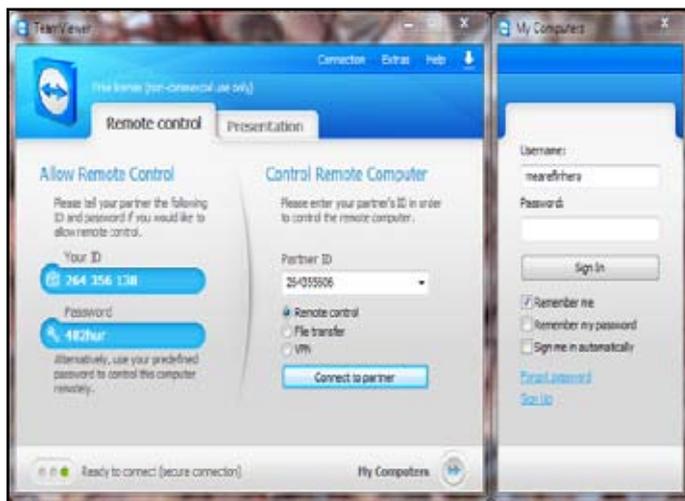


Fig. 5: A GUI of Team Viewer with Home PC and Remote PC Connection

## IV. Experimental Environment

A detail of overview of the experimental environment is presented in this section. The Figure 6 shows the hardware configuration for the RF receiver. If there any change in data line of the transmitters which are placed on the doors and the windows, it automatically can detect by the receiver.



Fig. 6: The Hardware Configuration of the RF Receiver

A GPRS modem is controlled by using AT commands. A blinking red light on the modem indicated that the modem is correctly connected using the serial port. The GPRS modem supports in placing calls to the police station and also sends the SMS to the desired number. The fig. 7 shows a virtual terminal for AT command of a receiver.



Fig. 7: Virtual Terminal for AT Command of a Receiver

Table 1: Transmission Voltage Versus Reception Range

| Transmitter Voltage (V) | Reception Range (meter) |
|---|---|
| 2.6 | 26 |
| 4.2 | 38 |
| 7 | 54 |
| 8 | 68 |
| 9 | 71 |
| 12 | 101 |

The transmitter voltage has a range of 2 to 12 volts. Fig. 8 shows the range of reception for various transmitter voltages. This fig. is drawn using the MATLAB simulator. All statistical data for the fig. 8 is presented in Table 1.
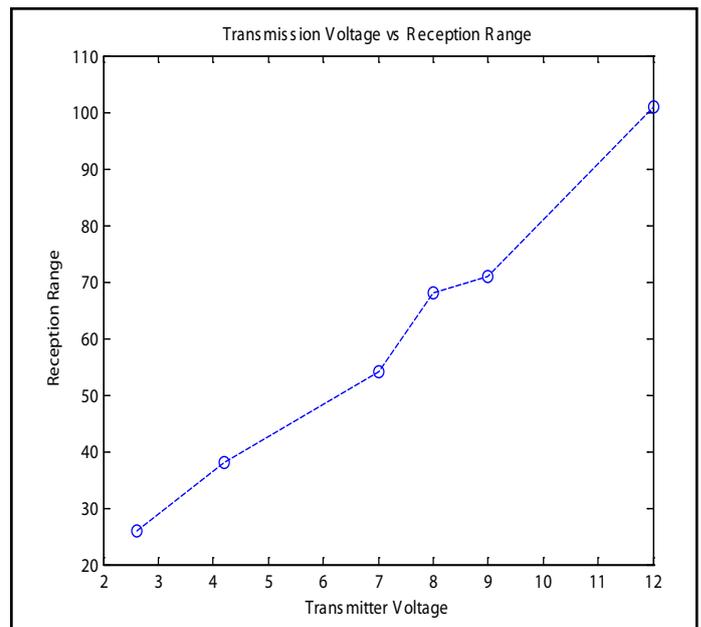


Fig. 8. Transmission Voltage Versus Reception Range

The doors and windows are open and closed by clicking in the GUI button as the doors and windows are interfaced with the PC. An interface circuit is made using numerous stepper motors to control the doors and windows. A complete circuit diagram with interface circuits is illustrated in fig. 9.
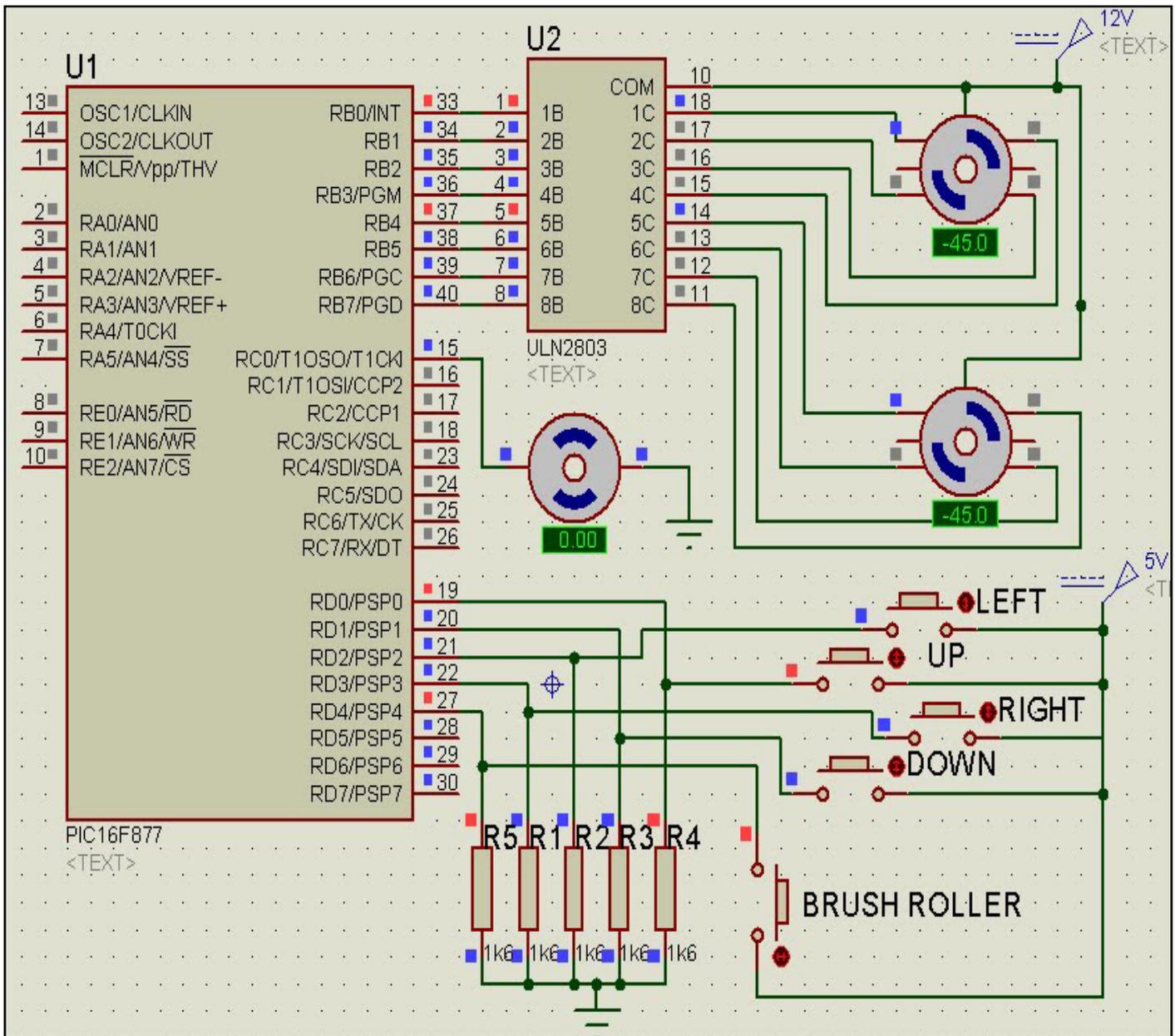
Fig. 9: A Complete Diagram With Interface Circuit to Control the Door and Window Using PIC

## V. Conclusion

In this paper, a web based appliance control system is proposed and briefly discuss above detail procedure to deploy it at home. This system is effective for the users who stay most of the time outside their homes and anxious about the robbery or theft. This system helps to monitor continuously the home appliances and also helps in automatic alert against security threat and takes immediate action to inform police or neighbors about the unwanted situation. As it can deploy using the commonly used electronic devices; therefore, it is an easy and cost effective system. In this proposed model, everything is happening within a short time by clicking on the GUI buttons and this system occupies less equipment arrangement. Using this system, a user can inform the unwanted situation to the police station or any registered authority by phone call or SMS. The image of the person who is trying to break the security of the home also can forward to the police station or any related agency using the existing Wi-Fi technology. Therefore, with the help of this system a user can stay always tension free about the security of his/her home appliance.

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