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Working of Home Appliances Using Android Mobile Phone via Bluetooth

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ABSTRACT

This paper presents the overall design of Home Automation System (HAS) with low cost and wireless remote control. This system is designed to assist and provide support in order to fulfill the needs of elderly and disabled in home. Also, the smart home concept in the system improves the standard living at home. The main control system implements wireless Bluetooth technology to provide remote access from PC/laptop or smart phone. The design remains the existing electrical switches and provides more safety control on the switches with low voltage activating method. The switches status is synchronized in all the control system whereby every user interface indicates the real time existing switches status. The system intended to control electrical appliances and devices in house with relatively low cost design, user-friendly interface and ease of installation.

I. INTRODUCTION

The "Home Automation" concept has existed from a long time. The terms "Smart Home", "Intelligent Home" followed and has been used to guide the concept of networking appliances and devices in the home. Home automation Systems (HASs) represents a vast research opportunity in directing new fields in engineering, architecture and computing technology. HASs becoming famous nowadays and enter quickly in this emerging era. However, end users, especially the disabled and elderly due to their cost and complexity, do not accept these systems.

Due to the advancement of wireless technology behavior there are different of connections are introduced such as GSM, WIFI, ZIGBEE, and Bluetooth. Each of the connection has its own specifications and applications. Among the four popular wireless connections that usually implemented in HAS project, Bluetooth is being selected with its suitable capability. Bluetooth with its globally available frequencies of 2400Hz is able to provide connectivity up to 100 meters at speed of up to 3Mbps depending on the Bluetooth device class.

A home automation system (HAS) provides the integration among all of the electrical and electronic devices in a home aqnd other commercial purposes. The techniques used in home automation systems include controlling of electronic and electrical devices, such as home entertainment systems, security systems, air conditioners, lawn watering systems, domestic robots, cleaning system etc., The devices in the house may be connected to a home network to gain the access of those devices and may also allow remote access through internet. As information technology has been integrated with the home appliances and systems, they are able to communicate in an integrated manner which results in energy saving and safety benefits..

II. SYSTEM OVERVIEW

Fig 1 illustrates the overall controlling function of the system. The system is installed beside the conventional electrical switches on the wall. The Bluetooth wireless connection enabled the system communicates with graphical

user interface (GUI) on PC/laptop or portable devices without cable. The target home appliances are controlled by the system Main Control Board.

In order to improve the standard living in home, this system provides three different categories of physical control methods to the Main Control circuit. The first physical control method is by pressing on the modified Low Voltage Activating Switches. The conventional high voltages switches will be subsituted by the modified 5 Volt push buttons as the activating switches. The second and third control methods are performed as wireless remote control to the appliances. The second control method is by pressing on Window GUI on PC/laptop by using mouse or touch pad. This method provides facility to the computer user to control over the domestic appliances without approaching toThe low voltage switch reduces the risk of dangerous electrical shock by wet hand. the switches on the wall. Third control method is done by Android GUI installed in mobile Phone. The user can easily touch on the screen of the phone to control the home appliances. This portable method is able to assist the disabled people who have problem with locomotion difficulty.In these three methods listed above we are using the third method to show output.

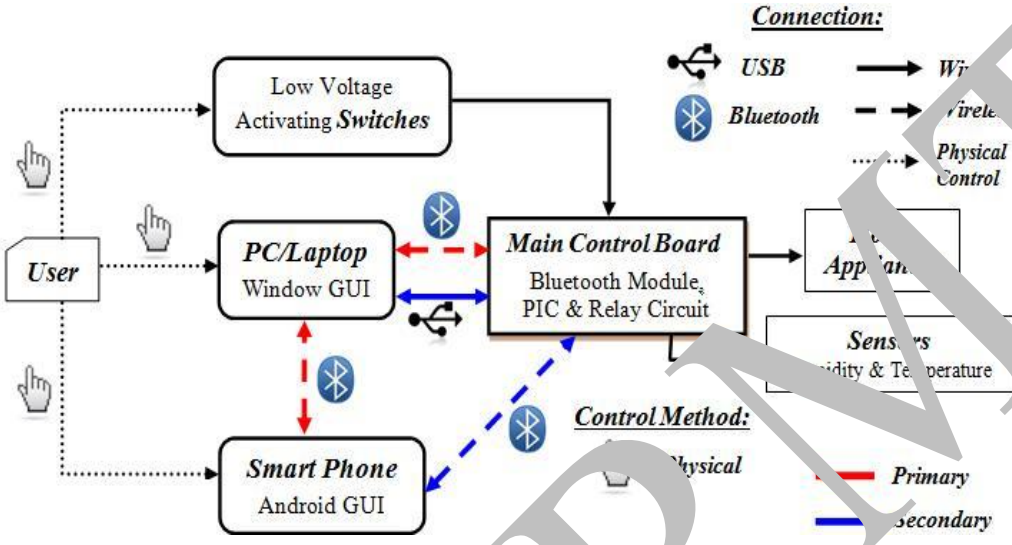

Fig 1. Functional Block Diagram of the System

III. HARDWARE DESIGN

This section mainly enlights about the hardware construction of main control board. Fig 2 depicts the hardware block diagram in the main control board. PIC Microcontroller, PIC16F877A is selected due to its weak price, broad range of application, high quality and easy availability; it is an ideal solution in applications such as: the control of different processes in industry, machine control devices, measurement of different values etc. Some of its main features are listed below..

- Operating frequency 0-20 MHz
- Power suppl 2.0-5.5V
  - Consumption: 220uA (2.0V, 4MHz), 11uA (2.0 V, 32 KHz) 50nA (stand-by mode)
- Power-Saving Sleep Mode
- Brown-out Reset (BOR) with software control option
- 35 input/output pins
  - High current source/sink for direct LED drive

software and individually programmable pull-up resistor

- Interrupt-on-Change pin

- 8K ROM memory in FLASH technology
  - Chip can be reprogrammed up to 100.000 times
- In-Circuit Serial Programming Option
  - Chip can be programmed even embedded in the target device
- 256 bytes EEPROM memory
  - Data can be written more than 1.000.000 times
- 368 bytes RAM memory
- A/D converter:
  - 14-channels
  - 10-bit resolution

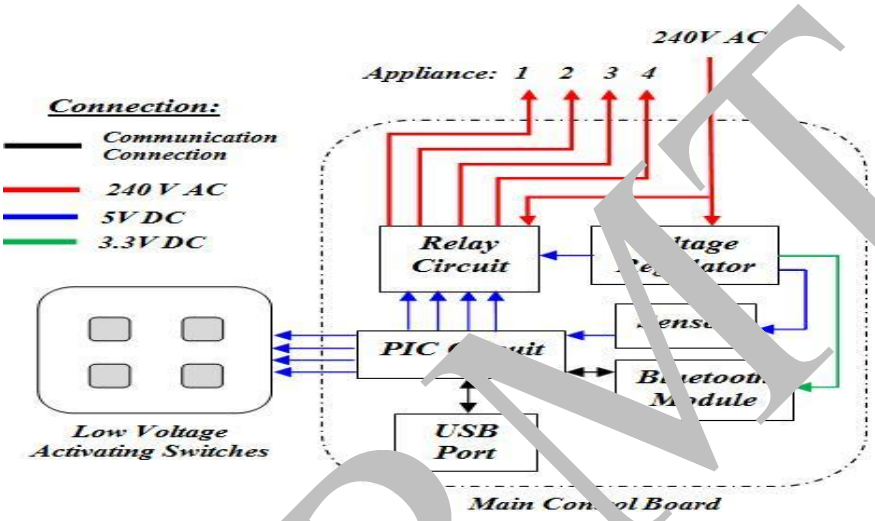

Fig 2. Main Control Board Hardware Block Diagram

The electrical current is directly attached to the main control board whereby it separates the regulator and relay circuit. The voltage regulator is created by common reliable regulator circuit which consists of transformer, rectifier and regulator. 5V and 3.3V DC output is regulated in order to satisfy the voltage needs of the specific components in the main control board. Moreover, the low voltage activating switches will replace by the existing switches.

The installation of the system must be made easy in direction to make it simple and less complex. The system is installed directly to the room wall like our main circuit. The installation of this system reduces the complex wiring reinstallation and overhead wiring on the wall.

The existing switch connection is connected and controlled by the relay circuit inside main control circuit. Furthermore, multiple control boards can be installed in house.

With these simple and low cost devices, the main control board is constructed in pretty small size but still performs the strong functions and features of the system.

IV. SOFTWARE DESIGN

Software design section includes the main functions of the system designed in the PIC microcontroller and GUIs Android application. Fig 3 illustrates the process of the Low Activating Switches in the system. The switches detection function is performed by the microcontroller, PIC. The activating switches are designed by push buttons. Any input switch is pressed; it will interrupt the main function loop of the PIC. Then, the PIC will activate the relay and toggle the current appliance's switch status. At the moment, PIC also informs the change of switch status to all the GUIs that connected to the main board.

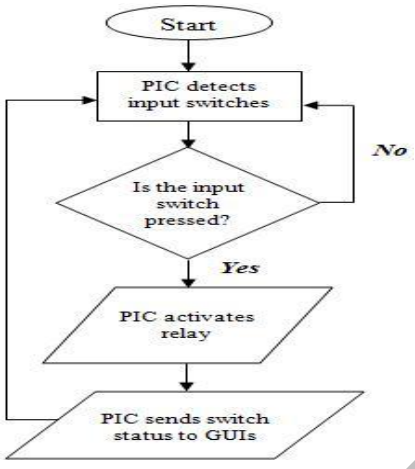

Fig 3. Low Voltage Activating Switches Process

Android GUI is designed by an user-friendly interface. The four devices indicated the appliances status that connected to the system. User can simply click on the buttons assigned to particular devices to turn on/off the appliance. Control board „Connect" button is performed to establish connection to main control board by Bluetooth to the Bluetooth Modem and then to establish connection between Bluetooth Modem to Android GUI. When the both connections are established, Bluetooth Modem acts as the server between main board and phone. All the data received from main board will be forwarded to the phone. Also, the data sent from phone will be forwarded to main board.

Fig 4. Android GUI

The application is designed in Android version 2.2 with API level 8. The application is designed in low API level so that the devices with higher version are compatible with it. Android GUI tested on smart phone with Version 4.4 . The interface is very simple to use, user can easily touch on the icon to turn on/off the appliances after connected to the Bluetooth modem to the main control board. In this Android GUI Keys (A,B,C,D) are assigned to turn on the devices while the Keys (E,F,G,H) are assigned to turn of the device. The central key is used to turn off the main board supply.

Figs 6 illustrate the interface of Android GUI selecting Bluetooth device. User can connect directly to main control board) or connect to PC/laptop (PROZ) by Bluetooth connection.

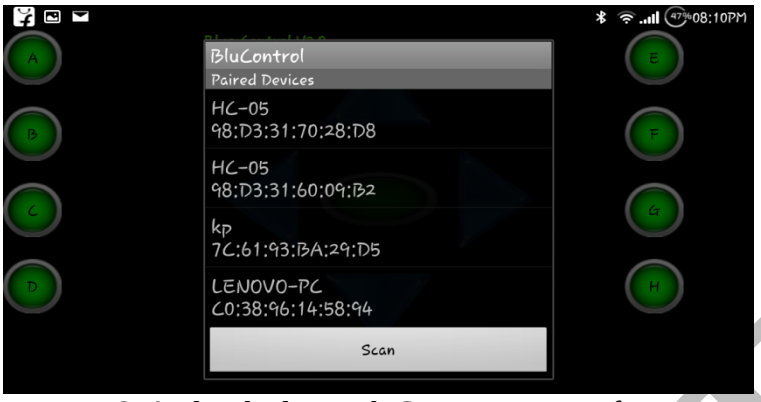

Fig 6. Android Bluetooth Connecting Interface

V. CONCLUSION

In conclusion, this low cost system is designed to improve the standard living in home. The remote control function by smart phone provides help and assistance especially to disabled and elderly. In order to provide safety protection to the user, a low voltage activating switches is replaced current electrical switches. Moreover, implementation of wireless Bluetooth connection in control board allows the system install in more simple way. The control board is directly installed beside the electrical switches whereby the switching connection is controlled by relay.

For future work, the Window GUI will be implemented with speech recognition voice control. The android GUI will be implemented as a remote Bluetooth microphone to the Window GUI. All the voice signal inputs to the smart phone will be transmitted to the Window GUI for signal processing. Also, the push buttons implemented in low voltage activating switches will be replaced by capacitive sensing switches. All the future work is expected without spend extra cost, even one cent from the current system.

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