A Sustainable Automated System for Elderly People Using Voice Recognition and Touch Screen Technology

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Abstract: ***Home Automation industry is growing rapidly; this is fuelled by the need to provide supporting systems for the elderly and the disabled, especially those who live alone. Home automation systems must comply with the household standards and convenience of usage. This paper details the overall design of a wireless home automation system built to control lights and other electrical appliances at home or office using voice commands and touch screen responses. The system has been tested and verified. The verification tests include voice recognition response test, touch screen response test and indoor ZigBee communication test. A touch of symbol on touch screen, can control the home appliances using Zigbee technology. Home devices can be operated remotely. It can be used at home, industry, hotels, shopping malls and process control systems. This system is mainly implemented for multi disabled persons using voice recognition and touch screen technology.***

Keywords: Touch screen, voice recognition, Home automation system, ZigBee communication.

1. Introduction

The demography of the world population shows a trend that the elderly population is increasing rapidly as a result of the increase of the average life expectancy of people. Caring for and supporting this growing population is a concern for governments and nations around the globe. Home automation is one of the major growing industries that can change the way people live. Some of these home automation systems target those seeking luxury and sophisticated home automation platforms; others target those with special needs like the elderly and the disabled.

There have been several commercial and research projects on smart homes and voice recognition systems. The system is a 7-inchtouch screen that can wirelessly be connected to security alarms and other home appliances. The home automation through this system requires holding and interacting with a large panel which constraints the physical movements of the user [7-8].

Voice recognition based wireless Home automation system [1] can control home appliances by voice commands but it has larger hardware for just controlling ON/OFF status of home appliances and it can't regulate home appliances. Another popular commercially available system for home automation is from Home Automated Living (HAL) [2]. HAL software taps the power of an existing PC to control the home. It provides speech command interface. A big advantage of this system is that it can send commands all over the house using the existing highway of electrical wires inside the home's walls. HAL is easy and inexpensive to install. However, most of these products sold in the market are heavily priced and often require significant home make over.

The aim of the reported Wireless Home Automation System (WHAS) is to provide those with special needs with a system that can respond to voice commands and control the on/off status of electrical devices, such as lamps, fans, television etc, in the home [1]. The system should be reasonably cheap, easy to configure, and easy to run. By touching symbols in touch screen, control of home appliances can be done using Zigbee technology [5].Overall view of this paper is implementing home automation system using voice recognition technology and touch screen technology. It is a cost effective and sustainable system for home automation. The effective utilization of home appliances can be improved by combining both the technologies. They may be more secure to use. Failure in one technology may be identified using other technology. So, problem solving is much simpler. Section 2 provides the system design. The hardware design is detailed in section 3 while the software design is detailed in section 4.The results are discussed in section 5.

2. System Overview

The Wireless Home Automation System (WHAS) is an integrated system to facilitate elderly and disabled people with an easy-to-use home automation system that can be fully operated based on speech commands and touch screen responses. The system is constructed in a way that is easy to install, configure, run, and maintain. The functional blocks of the overall system are shown in Figure 1.

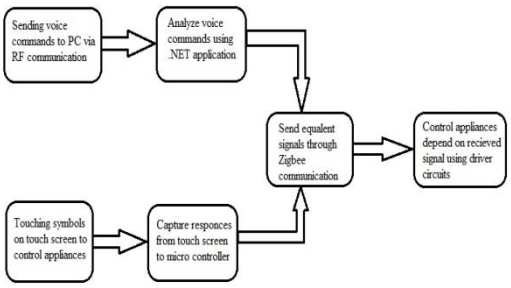

Figure 1: Functional flow of system

3. Hardware Design

The system consists of three modules:

- Voice Recognition Module (PC based).
- Touch screen Module.
- Appliance Control Module.

3.1 Voice Recognition Module

The voice is captured using a microphone. The data is then compressed and sent serially through RF transmitter. At the receiving end, data is received through RF receiver and passed to the computer through the sound card. A Visual Basic Application program, running on the PC, uses Microsoft Speech API library for the voice recognition. Upon recognition of the commands, control characters are sent wirelessly to the specified appliance address. Consequently, appliances can be turned ON or OFF depending on the control characters received.

3.2 Touch Screen Module

Upon touching symbols on touch screen, the respective data is captured by the touch module. The touch screen module monitor the response of the touch screen, if a touch be on the screen, the module sends the command to the touch screen controller, read the touch point data(x/y coordinates) and send the message to the central microcontroller for analysis [8]. The microcontroller transmits the respective characters serially to the appliance control module through Zigbee network.

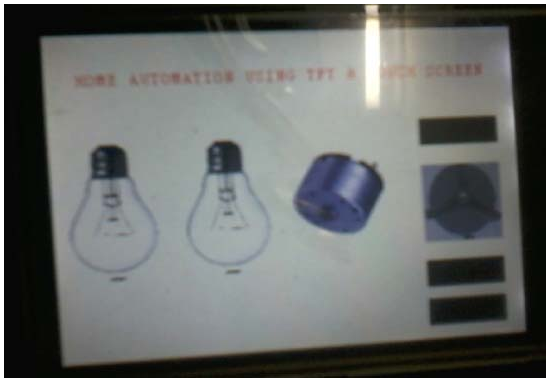

Figure 2: Touch Screen Module

Touch screen modules have TFT LCD which displays the symbols of appliances. A touch of the symbol on touch screen changes the status of appliance; that is the appliance is turned ON / OFF.

3.3 Appliance Control Module

Once the control commands are recognized, the control characters are sent to the specified appliance address through ZigBee communication protocol. Each appliance that has to be controlled has a relay controlling circuit.

Figure 3: Appliance Control Module

4. Software Design

The voice recognition application implements Microsoft speech API. The application compares incoming speech with an obtainable predefined dictionary. The Microsoft speech API run time environment relies on two main engines: Automatic Speech Recognition (ASR engine) and Text To Speech (TTS engine). ASR implements the Fast Fourier Transform (FFT) to compute the spectrum of the fingerprint data [7]. Comparing the fingerprint with an existing database returns a string of the text being spoken. This string is represented by a control character that gets sent to the corresponding appliance's address. Control characters corresponding to the recognized commands are then sent serially from the central controller module to the appliance control modules that are connected to the home appliances. By the start of voice recognition application a window can be as shown in figure 4. To start application press "Enable speech" button which enables application to receive voice signals.The application is ready to receive voice signals. Received voice signal is shown in "Hypothesis". Recognized signal is shown in "Recognition". According to the recognized signal equivalent control characters are sent through serial communication.

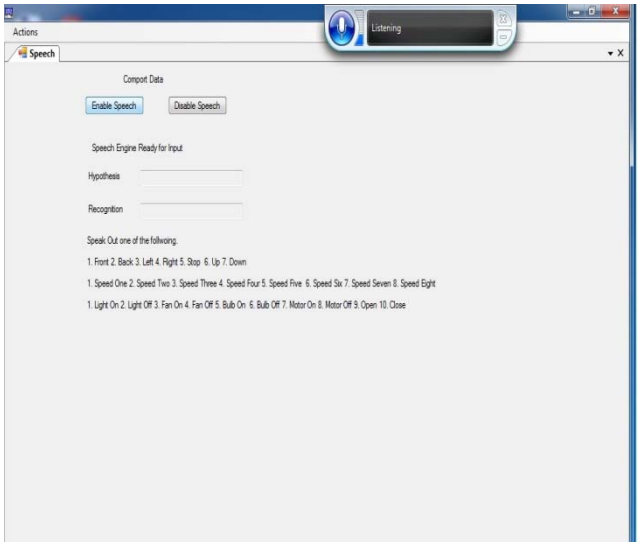

Figure 4: Voice Recognition Application

5. Results

"A Sustainable Automated System For Elderly People Using Voice Recognition Technology" was designed such that the devices can be used by elderly people and multi-disabled persons.

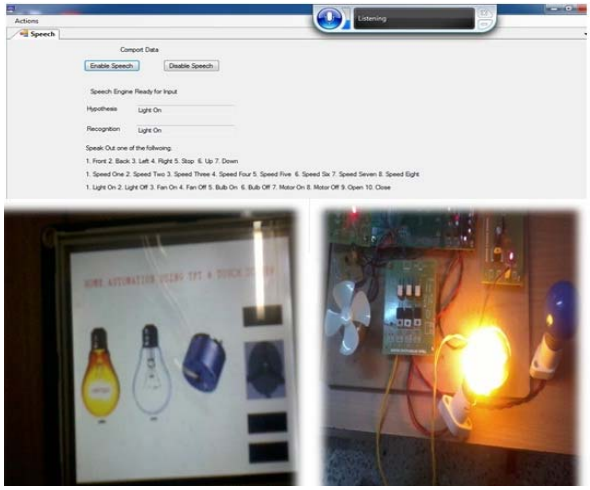

Figure 5: Test Results

When we say light on, the voice recognition application receives signals through RF. Received data is shown in hypothesis and recognized data is shown in recognition. If both the data are matched, correct results can be obtained as shown in the figure 5. To regulate speed of home appliances we can use touch screen. Based on the selection of the stage, the appliance can be controlled to run at that speed.

6. Conclusion

A home automation system based on voice recognition and touch screen technologies was built and implemented. The system is targeted at elderly and disabled people. The prototype developed can control electrical devices in a home or office. The system implements Automatic Speech Recognition engines through Microsoft speech APIs. The system implemented touch screen technology using TFT touch screen. The system implements the wireless network using ZigBee RF modules for their efficiency and low power consumption. The preliminary test results are promising.

7. Future Work

- Extend with timer control. It can control appliances by user defined time.
- Implement security with password protection.
- Adding images to voice recognition system.
- Adding confirmation commands to the voice recognition system.
- Integrating variable control functions to improve the system versatility such as providing control commands other than ON/OFF commands. For example “Increase Temperature”, “Dim Lights” etc.
- Integration of GSM or mobile server to operate from a distance.
- Design and integration of an online home control panel.

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