

Bangla Voice Recognition Based Home Automation for Elderly and Disabled Patient

Mohammed Arif Hasan Chowdhury¹, Jeenat Sultana²

¹Lecturer, Dept. of Computer Science, Southern University Bangladesh

²Lecturer, Dept. of Computer Science, Southern University Bangladesh

Abstract- Due to the speedy advances of knowledge associated information and communication technology, Voice recognition is an acquainted and accessible conception in today's world. Voice recognition based mostly home automation has long been explored in varied which offers a lot of product and solutions for those that have an interest in an exceptionally easier or manageable lifestyle. The automation focuses on recognition of voice commands and uses low-power ZigBee wireless communication modules together with a microcontroller. Voice recognized Home Automation is a very useful application for the elderly and physically disabled persons, who are not able to do various activities efficiently when they are at home and need one's assistant to perform those tasks. This paper presents a most useful voice recognition system for the elderly and disabled patient in Bangladesh who are unable to do the basic task of operating home electronic appliances like door, fan, light etc. This system is developed by considering local language for elderly and disabled who are only able to speak Bengali language so that the system can recognize the Bengali voice command to operate the home appliances.

Key Words- Voice Recognition, Easy VR, ZigBee, Elderly, Disabled

1. INTRODUCTION

Voice recognition based home appliance is one of the key emergent industries that can amend the way people live. The goal of the reported voice recognized home automation system 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 house. The number of a home accident also increasing in parallel with the rapid increment of elderly and disabled patients in Bangladesh. It is very important to ensure the caring and support of these patients by providing automated home appliance devices. The main aim of Bangla voice recognized home automation for the elderly and disabled patient is to provide local language based voice recognition home to control the on/off status of electrical appliances, such as fan, light, television, call an attendant etc. Since the early 1980s, smart home technology has been explored when the "intelligent building" model was cast-off. The model

anticipated an intelligent implementation of consumer electronic devices, electrical equipment, and security devices. It aimed for the automation of domestic tasks, easy communication, and human-friendly control, as well as safety [1]. Home computerization system has been around for more than a decade and also this is growing technology [2]. Smart home frameworks have caught numerous different advancements up until now and items have been in the market for over a multi-decade. Numerous organizations have entered in this field including Google. Google has declared a driven venture named Android Home [3]. Numerous techniques are available to control the electric home appliances where electronic remote control is the most common one. Voice recognition system or independent sensor systems are also used to control home appliances. [4]. Wireless based home appliances methods has chosen a high force for the last couple of years. It reduces the multifaceted nature identified with the establishment and support contrasted with its wired partner. Bluetooth, Wi-Fi, Easy VR, ZigBee, Radio Frequency Identification (RFID) are the prominent decision for the foundation of such frameworks. A remote system based on smart home frameworks have turned out to be extremely famous as they give comfort, security, and well-being [5].

Voice recognition approach deals with additional user intelligent method in carrying control voice command [6]. Primarily ZigBee based home controlled appliance has been introduced in journal of "ZigBee based voice Controlled Wireless Smart Home System". Zig Bee network receives voice command as input to an ARM9 controller that translates the data into a necessary format to be used in the microcontroller. Finally, the system produces some control characters to switch ON/OFF the home appliances [7]. Speaker-dependent and speaker-independent system are two types of speech recognition system where Speaker-dependent system is designed for a specific speaker that works by learning the unique characteristics of a single person's voice [8]. In the journal of the title "Improved Authentication Using Arduino Based Voice & Iris Recognition Technology", a voice recognition system is proposed to build a security function. The Arduino board as important role integrate with EasyVR Shield [9]. Voice Recognition is a key component of novel home automation solutions. Basically, it is a kind of technology that provides the system to understand the words (not the meanings) given by speech. Controlling an electronic device by voice

provides both easy use and increase in efficiency and productivity. Voice recognition systems also help users do two or more tasks simultaneously while working on computers or other devices [10]. This study aims to design a home automation system that responds to voice commands and allows controlling the on/off status of electrical devices like the lamp, air conditioner, television and door in a house

1.1 System Overview

The voice recognition based home automation system is an incorporated device to hit upon and understand human voice instructions on Bengali voice command as an input to control the electrical appliances wirelessly. The machine that may be completely operated based on voice instructions that are carried out by way of dividing the system into two extraordinary modules which are the transmitter module and receiver module. The transmitter module's essential reason is to just accept human voice because it enters and carry out voice performance technique to perceive the corresponding command control. Then the control signal is transmitted wirelessly at 315 MHZ to the receiver module.

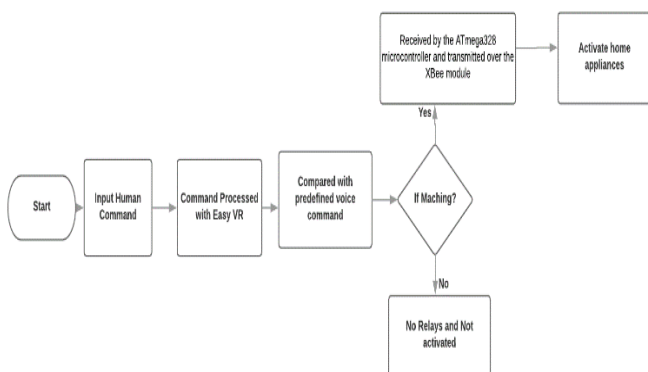


Fig- 1: Flowchart of the system

The framework gets actuated when any the predefined voice command is given. At the point when the user says a specific voice command, it enters the microphone of the Easy VR 2.0 at first and afterward the ATmega328 at the transmitting end gets it. The ATmega328 will transmit a specific command to the ZigBee device at the transmitting end. On permitting the ZigBee, it will send the particular command to the ZigBee device on the desirable end. On the effective substance of the wireless communication, it will inform the ATmega328 microcontroller. Thus, the home appliances can be controlled by expanding or diminishing the speed or turned ON or OFF be contingent on the command are given to it. Figure 2 demonstrates the functional diagram of the system.

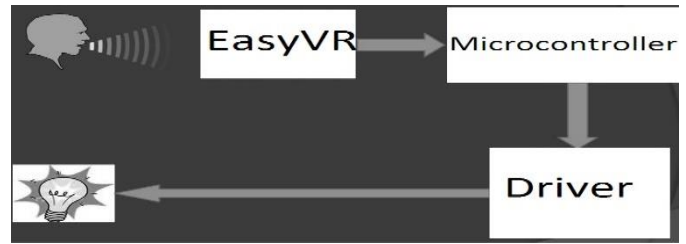


Fig -2: Functional Diagram of the system

1.2 Hardware Design and Implementation

Arduino Uno Microcontroller Card: Arduino, a ready-to-use electronic card, has the main microcontroller, pins to connect control units, and communication ports. The Arduino Uno is a microcontroller board based on the ATmega328. There are 14 digital input/output pins, and 6 of them can be used as a PWM output. Also, it has 6 analog input pins, a 16 MHz crystal oscillator, a USB input, a power input, and reset button. The card consists of the necessary things to support microprocessor [11].



Fig -3: ATmega328 microcontroller

EasyVR Shield 2.0 Voice Recognition Card: EasyVR Shield 2.0 is a voice recognition shield developed for Arduino. It was designed to provide versatile, robust and cost-effective solutions for various voice recognition applications. It is commonly used for voice controlled light switches, locks, curtains or kitchen appliances in home automation solutions [12].

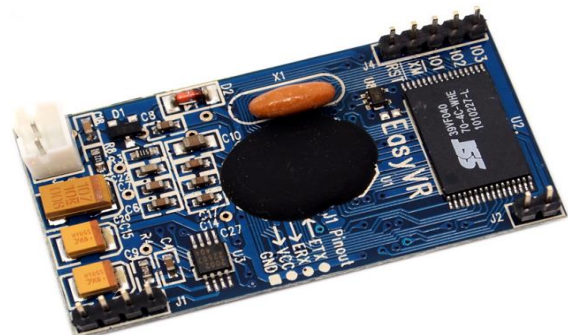


Fig -4: Easy VR Shield

ZigBee: ZigBee, a new standard for wireless communications, enables low cost, low power, short range and low-data-rate wireless multi-hop networking technology standard [13]. It forms a suitable baseline for sensors and control network based upon IEEE 802.15.4. It

is widely accepted because of minimum power use, low-cost, secure, easy-to-install in implementations that are relatively low throughput size data transmitting like distant monitoring, control and distributed processing [13]. Due to its advantages over competitive technologies, ZigBee is a very nice option for wireless voice applications [14]



Fig 5: Zigbee

The system consists of two modules: (i) Handheld Microphone Module with a ZigBee transceiver and Voice Recognition unit (ii) Appliance Control Modules with relay controlling circuits

(i) Handheld microphone module With RF transceiver and a Voice Recognition unit the components of the microphone module is shown in the left side of Figure 3b and the block diagram in Fig. 2. The human voice is captured through the microphone. It is matched with the voice previously recorded in the Easy VR 2.0 as voice recognition unit. If it matches the corresponding character is sent through RF. The voice recognition unit along with Atmega328 constitutes the Speech Recognition System. It is an easy to use programmable speech recognition circuit. Programmable, in the sense that you can train the words (or vocal utterances) you want the circuit to recognize. It allows you to experiment with many facets of speech recognition technology. Fig. 6: Block diagram of a voice-controlled smart home system handheld

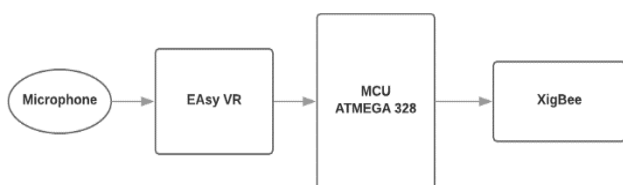


Fig 6: Block diagram of the handheld microphone module

(ii)Appliance control module Once the speech commands is recognized control characters are sent to the specified appliance address through RF communication protocol. Each appliance that has to be controlled has a relay controlling circuit. The block diagram of appliance control module components is shown in Fig. 7: Appliance control module components

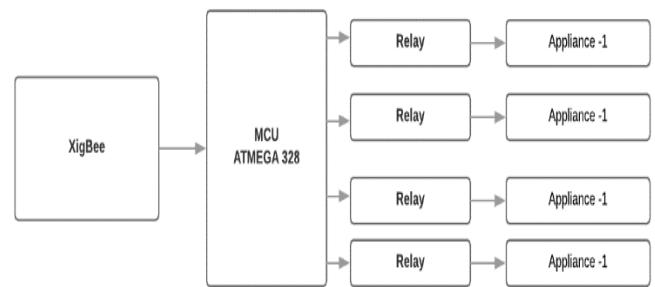


Fig 7: Block diagram of Appliance control module

1.3. Software Design

Easy VR is used to teach the voice commands with its compatible voice recognition software package named “Easy VR Commander”. Also, the voice command is tested to ensure accurate recognition. This is done by speaking it in the microphone and then the command spoken is indicated by the software on the screen. The Easy VR Voice Recognition Unit is a multi-purpose voice recognition module designed to make the voice recognition system robust, cost-effective and versatile. The ZigBee communication protocol is used for an efficient transmission of data from the ZigBee transmitter to the ZigBee receiver.

2. RESULT ANALYSIS AND DISCUSSION

Since the system has been designed for elderly and physically disabled to controlled home appliances by using Bengali command we have considered 6 different commands to control the three individuals devices connected to the system. In this research, the system responds to command of only the 4 authorized persons both male and female. The command is given via throat microphone in both normal and noisy environment. Both English and Bengali voice commands are considered for the justification of the accuracy of the system. The testing was conducted in a medium-sized room to investigate the distance between transmitter and receiver modules in order to confirm the efficiency of the wireless system. 1to 6 meter distances are considered to examine the working accuracy of the system. Participants have been allowed to speak the repetition of same command maximum three times.

There are 12 samples for each command word in Bangla voice command have been spoken by 4 individual participants. A total of 72 sample are considered for measuring the accuracy of Bengali command. Similarly, same sample commands are considered for voice command in English.

Table -1: Result of test Bengali voice command (Normal Environment)

Command	Total No of Command	Accurate	Error
বাতী জালনা	12	10	3
বাতী বন্ধ	12	10	2
দরজা খোল	12	9	3
দরজা বন্ধ	12	10	2
পাখা চালনাও	12	8	4
পাখা বন্ধ	12	10	2

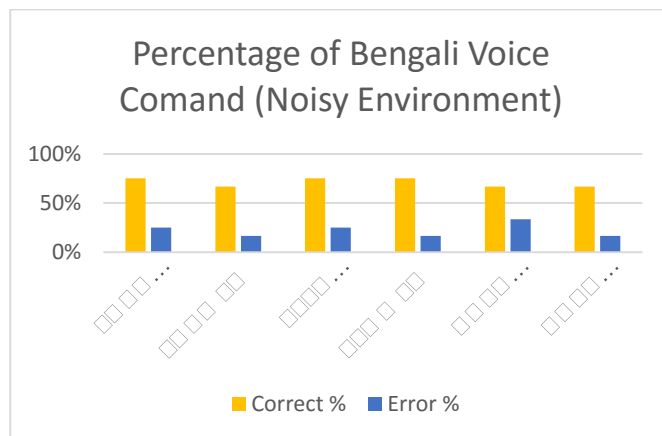


Chart -2: Test result of Bangla voice command (Noisy Environment)

Table 2 and Chart 2 shows the no-shows the result of the success ratio of Bengali voice command in a noisy environment. The result shows that almost 70% of command is accepted by the system in the noisy environment. It is fairly good to observe that the system can run in noisy environments as well.

Table -3 : Result of test English voice command in normal Environment

Command	No of Test	Accurate	Error
Light on	12	10	2
Light off	12	11	1
Door Open	12	10	3
Door Close	12	10	2
Fan Open	12	12	2
Fan Close	12	10	4

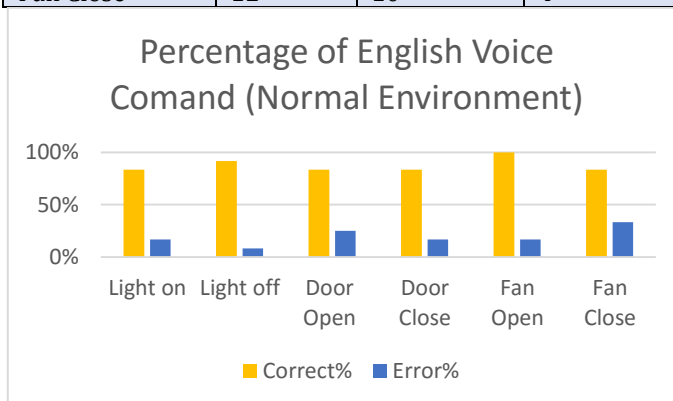


Chart -3: Test result of English voice command (Normal Environment)

The experiments also conducted with English voice command to test the accuracy of English voice command. Table 3 and Chart 3 represents the success and error ratio of given command in English where the environment is considered as in normal. Due to voice accuracy, few commands are failed to recognize in the system but almost 90% voice command is worked properly in the system.

Percentage of Bangla Voice Comand...

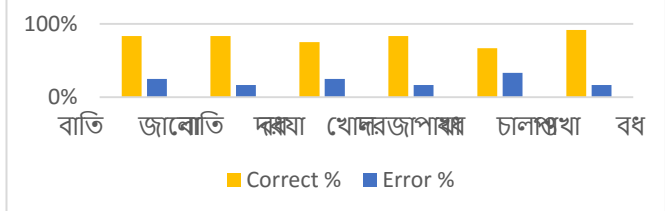


Chart -1: Test result of Bangla voice command (Normal Environment)

The experimental test results in tables -1 shows the no of correct and error of Bangla voice command recognition in a normal environment and Chart 1 shows the percentage of recognition is given the command. The result shows that approximately 80% of Bengali voice command is recognized by the system where the environment is in normal condition.

Table -2: Result of test Bengali voice command (Noisy Environment)

Command	Total No of Command	Accurate	Error
বাতী জালনা	12	9	3
বাতী বন্ধ	12	8	2
দরজা খোল	12	9	3
দরজা বন্ধ	12	9	2
পাখা চালনাও	12	8	4
পাখা বন্ধ	12	8	2

In the relatively noisy environment, the system performance accuracy is nearly 70% which is shown in table-4 and Chart 4.

Table -4: Result of test English voice command in Noisy Environment

Command	No of Test	Accurate	Error
Light on	12	8	4
Light off	12	7	5
Door Open	12	9	3
Door Close	12	9	3
Fan Open	12	8	4
Fan Close	12	10	2

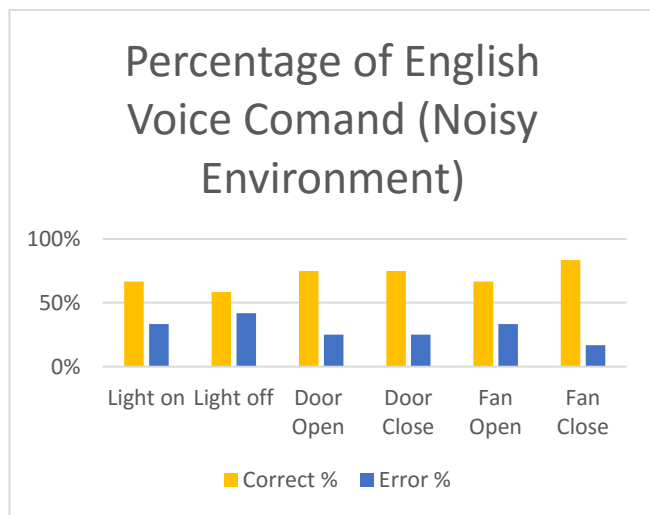


Chart -4: Test result of English voice command (Noisy Environment)

The results show that more than 80% of success rate has been reached in a normal environment and 70% of success rate has been reached in a noisy environment while Bangla voice commands were given to the system. The experimental results show that there is not far difference on presence of accuracy in comparison to Bangla and English voice. The system works in smooth order in a normal environment. The result provides a clear idea to make command with a clear accent as the pre-stored command.

3. CONCLUSIONS

We have examined that home automation is an essential necessity for the elderly and disabled patient in Bangladesh. This study designed and implemented a voiced controlled Zigbee based home automation system for controlling most common electronic appliances are used at home. Zigbee technology has been used in this

system for the wireless communication. The wireless part of the system has been implemented by using especially considering the Bangla voice command for Bangla speaking target people. After the experimental testing of the system, it indicates the need for the professional use of this system at home to care for the elderly and disabled patient. Finally, the system provides an easiest and comfortable solution for the elderly and disabled patient to operate their home appliances with the highest percentage of voice recognition command.

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