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# Home Automation System for Paralyzed Individuals Using Voice Recognition

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## Abstract

This study describes the design of a low-cost voice recognition-based home automation system that allows physically disabled individuals with paraplegia or quadriplegia (who are unable to move their limbs but are able to speak and listen) to control a variety of household appliances and raise their bed using voice commands based on their comfort and needs. A voice recognition module, an Arduino Uno microcontroller, a relay circuit, and an adjustable bed make up the suggested system. Before the speech recognition module can be used to recognize commands, it must be trained. When the voice instruction is successfully recognized, the Arduino uses the relay circuit to drive the appropriate load. Depending on the user's comfort and requirements, the bed elevation can be adjusted in three different ways. Additionally, the voice recognition module's accuracy is evaluated under various circumstances. The functions of the suggested system are validated by the experimental results. The findings demonstrate that the system can effectively support individuals with physical disabilities without the need for outside assistance.

*Index Terms*— Home automation system, voice recognition module V3, Arduino Uno, adjustable bed motorized jack, and those with physical disabilities.

## I. INTRODUCTION

Because of their extensive operational capabilities and ease of use, home automation systems are becoming more and more popular every day. Home automation systems become easier to use and more intuitive when speech recognition technology is incorporated. While home automation systems can be very helpful for those with physical disabilities, some people need them to meet their needs and be comfortable.

Numerous studies and advancements have been made in the field of home automation systems. The Microsoft speech API on a PC is used by the voice recognition-based home automation system [1] to identify voice commands. To regulate the various electrical equipment, these commands are sent to the controller via the RF transceiver. This method is more costly and challenging to manage due to the usage of computers.

[2] suggested an intelligent home navigation system for the elderly and disabled that makes use of a wheelchair, an Arduino controller, a voice recognition module (SR-07) for speech recognition, and a navigation module. Without requiring the help of a third party, the Arduino moves the wheelchair in accordance with the command it gets from the voice recognition module. The voice recognition-based home automation system [3] employs a Zigbee module with a controller for wireless device control and Lab VIEW for speech recognition. The use of the computer, which raises the system's cost, is the system's limitation [1] [3].

suggested a home automation system that includes a microcontroller and relay module for controlling appliances, such as turning lights on and off, and a DSP processor for voice recognition. By using a Zigbee wireless module, the additional wiring needed for signal transmission is eliminated.

[4] Developed a home automation system for elderly and physically disabled individuals that can operate household appliances using voice commands or a mobile remote control. The Android application does the voice recognition, which is then transferred to the controller for device control.

The home automation system [6] suggested two methods for controlling household appliances: voice commands and timers. Virtual Basics 6.0 is used to construct the software environment on the PC, and PC parallel ports are used to control the devices.

proposed a Bluetooth-based home automation system that includes a remote controller that is interfaced with a microprocessor and a Bluetooth module to enable wireless appliance control. When a key on the remote controller is pressed, the controller uses a Bluetooth module to communicate the command to the receiver, which then takes the appropriate action.

The suggested solution employs a PC to translate speech commands into text, which is then sent to a cellular network via a mobile phone, another mobile phone receives the text message, the microcontroller reads the command, and the appropriate control action is performed.

suggested a method that allows items to be controlled from a great distance. Voice commands from the user are translated into symbols and transmitted via a WI-FI network to the server PC. The voice recognition software on the PC was created using Microsoft VisualBasic.net. The matching device is switched on or off when the command is acknowledged and the information is sent to the control circuit via the PC parallel port.

proposed an automation system for the industry based on speech recognition that employs the HM2007 voice recognition module for the voice recognition function, which offers

In the industry, maintenance engineers and people with disabilities can simply and pleasantly operate the loads.

#### I. SYSTEM OVERVIEW

[8] An integrated system that runs entirely on voice commands, the voice recognition-based home automation system helps the elderly and those with physical disabilities by making their lives easier. Fig. 1 displays the functional block diagram of the suggested system.

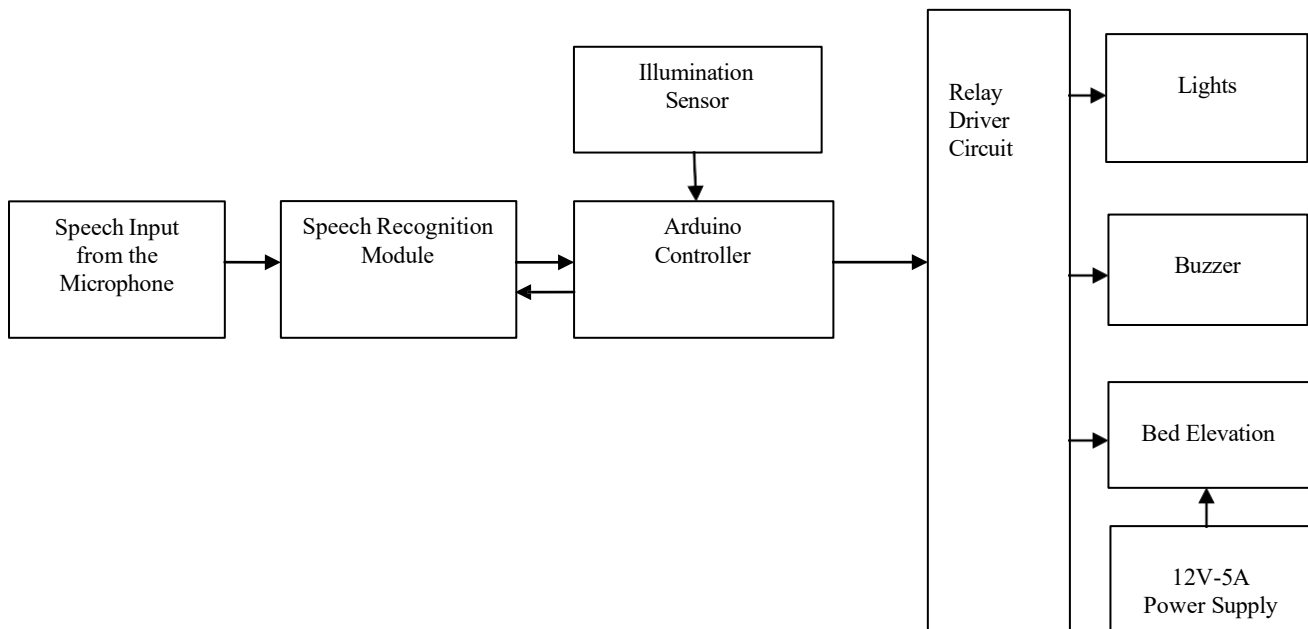


Fig. 1 Block Diagram of Voice Recognition Based Home Automation System

The voice recognition module receives the speech input from the microphone and compares the speech signal with the trained voice samples that have been previously saved. When a spoken command is successfully recognized, the Arduino microcontroller activates the appropriate electrical device, such as turning on lights or utilizing a relay module to modify the bed elevation. After processing the data from the illumination sensor, the Arduino controller automatically turns off the lights to conserve energy based on a predetermined point value. When a disabled person calls for aid or requires someone's support, the buzzer sounds.

### I. HARDWARE IMPLIMENTATION

[9] This section describes the hardware implementation of the suggested system, which is depicted in Fig. 1.

#### A. Voice Recognition and Microphone Module

A straightforward collar-style microphone with a 3.5 mm connection is utilized to transmit speech commands to the voice recognition module. The voice recognition procedure uses the Elechouse voice recognition module v3, as seen in Fig. 2. Prior to it, the voice recognition module must be trained.

can be put to actually recognize the voice commands. The speech input from the microphone is given to the voice recognition module and there, the input speech is compared to the voice instructions that have already been learned; if they match, a control circuit is used to take action. Up to 80 commands, each lasting 1500 milliseconds, can be stored in the speech recognition module v3.library, and only seven of the eighty commands are able to be fed into the recognizer for the recognition procedure. As a result, only seven commands can be used at once, and clearing the recognizer is required before adding more commands. The General Input Pins and Serial Port can be controlled in two different ways by the module. When a voice command was acknowledged, the board's general output pins could produce a variety of waves. Under optimal conditions, the module's recognition accuracy is 99%.

Fig. 2 Voice Recognition Module v3

#### A. Arduino Uno

B. The Arduino Uno microcontroller serves as the controller for the suggested system depicted in Figure 3. With the Arduino platform, professionals and students may easily and affordably design devices that use sensors and actuators to interact with their surroundings. Arduino comes with a basic integrated development environment (IDE) that runs on a PC and enables users to build C or C++ applications for Arduino. The ATmega 328 serves as the foundation for the Arduino microcontroller. It includes six analog inputs and fourteen digital input/output pins, six of which can be utilized as PWM outputs. The Arduinio has a clock speed of 16 MHz and operates at 5V D.C.



Fig. 3 Arduino Uno Mircontroller

#### C. Light Sensor

D. In order to save energy, the system uses a light-dependent resistor to sense the amount of light in the room and turns off the lights when there is enough daylight to see everything.

E. *Buzzer*

F. The buzzer is one of the primary indicators of the system that is intended to notify guardians to check on the impaired person and provide the required care when the buzzer sounds. The patient can use voice commands to activate the buzzer for assistance if they need it.

G. *Relay Circuit*

H. Relays are used with the Arduino to control home appliances. As seen in Fig. 4, the system uses 5V-5 pin relays. The relay stays in its typical closed state.

I. Due to electromagnetic induction, the relay switches from a normally closed to a typically open state when its coils are energized. The home automation system makes use of relays in their usually open state (N.O.). The buzzer, lighting sensor, and relay are incorporated on the general-purpose PCB in Fig.

J. 4. 5V is needed for the relay circuit in the home automation system, and 12V 5A is needed for the motor of the jack that raises the bed. The Arduino board alone can provide the 5V supply need, but a separate supply circuit is required for the 12V 5A supply. Here, a 15-0-15 V center tap



Fig. 4 Relay Circuit, Buzzer and Illumination Sensor

transformer is utilized. A bridge rectifier comes next.

A circuit that transforms AC into DC is utilized. Since the D.C. after conversion is not ripple free, ripple free capacitors  $C1 = 3300\mu\text{F}$  and  $C2 = 0.33\mu\text{F}$  are utilized. The LM338K voltage regulator, which produces a regulated voltage of 12V and a constant current of 5A, is used to control the voltage. The output voltage ripples are eliminated by the capacitor  $C3 = 100\mu\text{F}$ , and the circuit is protected when the capacitor  $C3$  discharges by the diode  $D3$ . The circuit schematic for a 12V, 5A power supply is shown in Figure 5, and the embedded circuit for a PCB power supply is shown in Figure 6. The entire electronic circuit assembly of the voice recognition-based home automation system is depicted in Fig. 7.

K. *Buzzer* The buzzer is one of the primary indicators of the system that is intended to notify guardians to check on the impaired person and provide the required care when the buzzer sounds. The patient can use voice

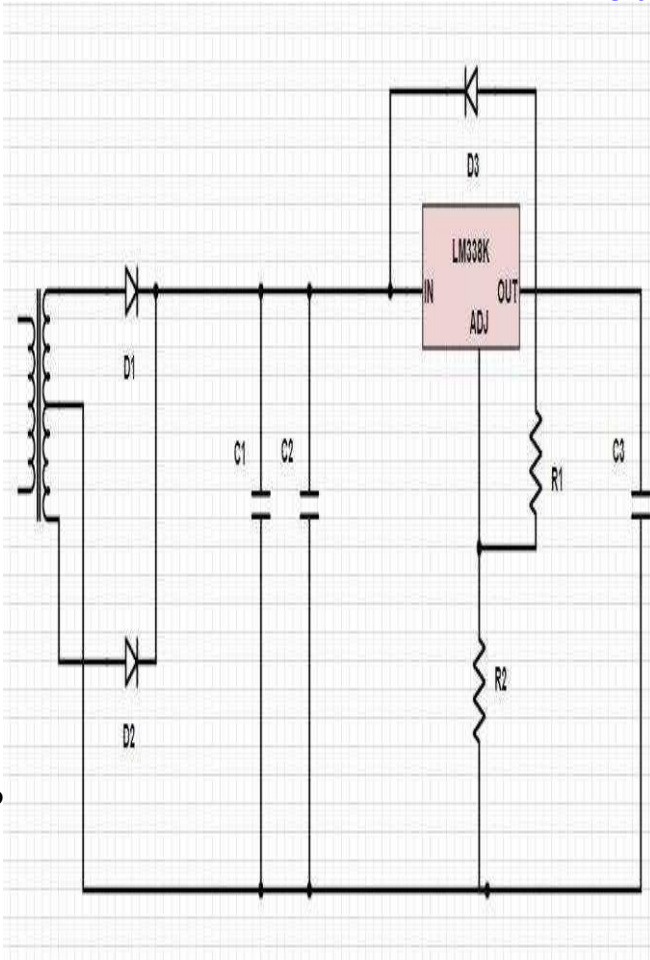


Fig. 5 12V, 5A Power Supply Circuit Diagram

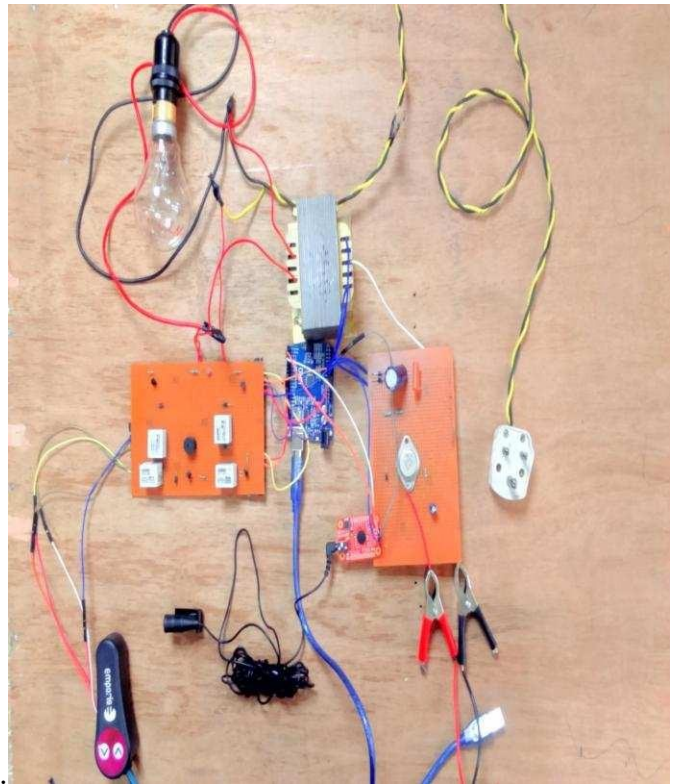


Fig. 7 Complete Assembly of the Electronics Circuit

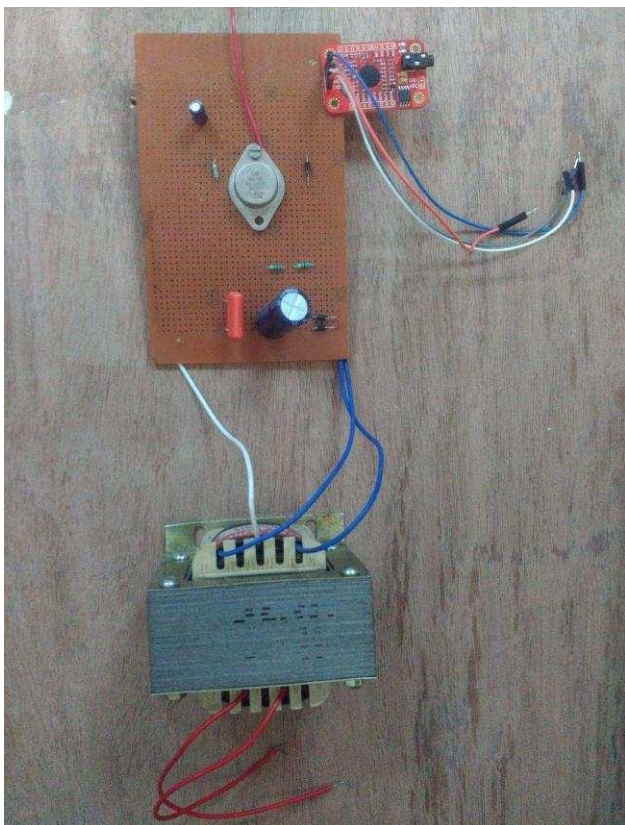


Fig. 6 12V, 5A Power Supply

*M. Bed Modelling and Elevation Control Mechanism*

N. A motorized jack and the bed are employed in a home automation project. The bed can be raised or lowered using the motorized jack. A hardwood bed is modeled here, which takes less time and money to construct than commercial beds that use a metal chassis. The bed is six feet long overall, of which 2.5 feet can be moved with the aid of connectors, while the other 3.5 feet remain fixed. The bed measures two feet in both width and height. A box-like structure sits beneath the bed's movable portion, and a motorized jack is installed on top of it to raise or lower the bed's movable portion. The electronics for the home automation system are located inside the box structure, as seen in Fig. 8. The Emporis Motorized Jack can raise up to 1500 kg of weight and runs on 12V dc with a maximum current of 10A. The jack's lifting range is between 12 and 35 cm, or around one foot long. Additionally, the jack incorporates limit switches that, when a specified height is reached or the jack is lowered to a specific point, halt the motor. Relays regulate the motor's direction, which is used by the jack to raise the bed and lower it back to the ground. The jack's motor is a 12V dc motor. A per



Fig. 8 Adjustable Bed



Fig. 9 Bed Elevation with the Person Sleeping on the Bed

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Flashhouse Voice Recognition V3 Module "train" sample.
-----
Usage:
-----
COMMAND      FORME      EXEMPLE      Comment
-----
train        train (c) (c) ...   train 0 2 45   Train records
load         load (c) (c) ...   load 0 51 2 0  Load records
clear        clear           clear         remove all records in Recorder
record       record / record (c) (c) ... record / record 0 70  Check record train status
vr           vr             vr           Check recorder status
getsig       getsig (c)       getsig 0      Get signature of record (c)
sigtrain     sigtrain (c) (sig) sigtrain 0 1230  Train one record(s) with signature (sig)
settings     settings         settings      Check current system settings
help         help            help         print this message
-----
sigtrain 0 vhelp
-----
Record: 0   Speed now
Record: 0   Speed again
Record: 0   Can't be reached
Record: 1   Speed now
Record: 1   Speed again
Record: 1   Can't be reached
Record: 0   Speed now
Record: 1   Speed again
Record: 0   Success
Success: 1
Record: 0   Trained
SIG: vhelp
```

I. SOFTWARE IMPLEMENTATION

The Arduino controller is used for the software implementation portion of the voice recognition-based home automation system. It includes speech recognition module training. Before the speech recognition module can be used for recognition, it must be trained using voice commands. After loading the voice recognition module training program onto the Arduino, the voice instructions are used to train the device. Figure 10 illustrates how the Arduino IDE is used to train the voice recognition module. The Arduino IDE's C++ language is used to write the home automation system's primary programming. When a voice command is successfully recognized, the appropriate control action is performed. Fig 10 Voice Recognition Module Training using Arduino

## II. RESULTS AND DISCUSSIONS

[10] This project's primary goal is to model an adjustable bed that can change its elevation in response to user voice requests and create a voice recognition-based home automation system for managing appliances. When a disabled person needs assistance, the Arduino recognizes the voice command and uses it to switch the relay and alter the direction of the motor. As a result, the jack raises or lowers the bed, turns off the lights, and sounds the buzzer. When there is enough natural light to look around, the illumination sensor automatically switches off the lights. Three elevation positions are available on the adjustable bed: sitting, resting, and sleeping. As illustrated in Figure 11, the sleeping posture is when the bed is 180 degrees above the floor. This position allows the person to sleep easily. A person can rest easily in the rest position, which is depicted in Fig. 12, where the bed is raised 150 degrees above the floor. As seen in Fig. 13, the person is virtually in a sitting position when the bed elevation is roughly equal to 135 degrees. The current that the motor draws when raising or lowering the bed at various weights is displayed in Table 1. The comparison graph between the motor's current draw at various weights is shown in Fig. 14. According to the comparative graph, the motor consumes more current as the jack lifts heavier weights, but it essentially stays constant when the bed is lowered. When the jack is opening, the motor's no load current is 1.050 Amperes, and when the jack is closing, it is 0.710 Amperes. The list of commands and their respective functions are displayed in Table 2.



Fig. 11 Bed Elevation in Sleeping Mode



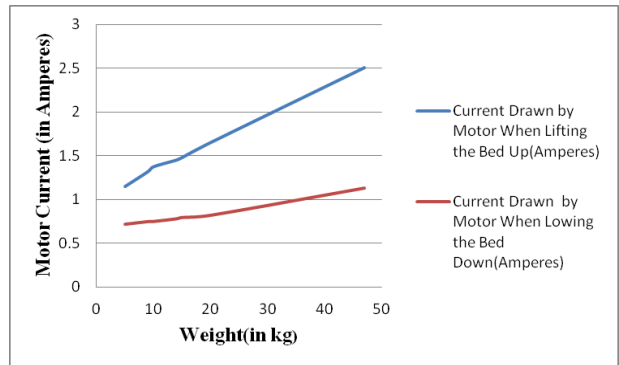
**Fig. 12** Bed Elevation in Rest Mode



**Fig. 13** Bed Elevation in Sitting Mode

TABLE 1  
 CURRENT DRAWN BY THE MOTOR WHILE LIFTING BED UP OR  
 LOWERING DOWN AT DIFFERENT WEIGHTS

Sr. No.	Weight( Kilo Grams)	Current Drawn by Motor When Lifting the Bed Up(Amperes)	Current Drawn by Motor When Lowing the Bed Down(Amperes)
1	5	1.150	0.718
2	9	1.319	0.748
3	10	1.375	0.750
4	14	1.451	0.780
5	15	1.480	0.795
6	20	1.650	0.820
7	47	2.503	1.130



		1	2	3	4	5
1	On	1	1	1	1	1

7	Sleep	0	1	0	1	1	3
8	Rest	0	1	0	1	1	3
9	Up	1	1	0	1	0	3

Sr. No.	Voice Command			Function performed
21	ControlOn	1	1	Load the control and of commands to recognizer
2	Control			Load the all devices to be controlled by controller.
3	Off	1	1	
3	Off	0	1	Turn off all devices
4	lights			Turn on the lights
5	Dark			Turn off the lights
56	DarkBed	1	1	Connect the supply to the bed motor and load the commands to
6	Bed	0	1	1 control the bed elevation into recognizer
77	SleepSleep	1	1	Set the bed elevation to 180 degree with respect to the stationary part of bed
8	Rest	1	0	
8	Rest			Set the bed elevation to 150 degree with respect to the stationary part of bed
9	Up	1	1	
9	Up			Set the bed elevation to 135 degree with respect to the stationary part of bed

Fig.14 Current Drawn by the Motor While Lifting Bed Up or Lowering Down at Different Weights

TABLE 2  
VOICE COMMANDS AND THEIR FUNCTIONS

The test results for the trails are displayed in Tables 3 and 4.

carried out on the voice recognition module to assess its accuracy in both quiet and noisy environments. For every command in the table, a total of five trials are run. The speech recognition module accurately recognizes the spoken command in five out of five tries. In silent conditions, the voice recognition module's accuracy rate is 80%.

TABLE 3 RESULTS IN SILENT CONDITION TABLE 4 RESULTS IN NOISY CONDITION

Sr. No.	Voice commands	Experimental Trials					Total Responses
		1	2	3	4	5	
1	On	1	0	1	1	1	4
2	Control	0	1	0	0	1	2
3	Off	1	0	0	1	1	3
4	lights	0	1	0	1	1	3
5	Dark	1	0	1	0	1	3
6	Bed	0	1	0	1	0	2

Only three of the five trials under the noisy condition were successfully identified, meaning that the voice recognition module's accuracy under noisy conditions is 60%.

I. CONCLUSION

[11] The voice-activated home automation system was developed and put into use. The method was specifically created for older individuals and those who suffer from paralysis. Instead of constructing a mechanical base with linear actuators, which has been shown to be very cost-effective, a hardwood adjustable bed equipped with a motorized jack is modeled. Three elevation positions are available on the

adjustable bed: sleep, rest, and sitting. The user can select their preferred position simply using voice instructions. Voice commands make it simple to communicate with the system in order to automate tasks and manage electrical devices, and they also remove the need for remote controllers and other electronic devices. Disabled people can use a buzzer to alert their guardians when they need assistance. When there is sufficient sunlight to view objects around, the illumination sensor automatically switches down the lights. Additionally, a time delay is incorporated so that, in order to save energy, lights and other devices will automatically turn off if the user forgets to do so.

[1] RESOURCES

- [1] In the August 2013 issue of the International Journal of Science and Research (IJSR), T. Kirinumar and B. Bhavani's article, "A Sustainable Automated System for Elderly People Using Voice ecognition and Touch Screen Technology," vol.2.[2] Rajesh Khanna Megalingam, Ramesh Nammily Nair, and Sai Manoj Prakhya, "Automated Voice based Home Navigation System for the Elderly and the Physically Challenged," International Conference on Advanced Communication Technology, Seoul, pp. 603-608, February 2011. [3] "Control of Electrical Appliances through Voice Commands," by Arthi J.E. and M. Jagadeeswari, IOSR Journal of Electrical and Electronics Engineering, vol. 9, pp. 13–18, February 2014. [4] Gooneshwaree Hurry, Sawan Kumar Gopy, Parameshachari B D, and Tulsirai T. Gopaul, "A Study on Smart Home Control System through Speech," International Journal of Computer Applications, vol. 69, pp. 30-39, May 2013.
- [2] [2] "Voice Control of Home Appliances using Android," by Norhafizah bt Aripin and M. B. Othman, for the International Conference on Electric Power, Electronic, Communication, Control, and Informatic Systems, Malang, August 2014, pp. 142-146. [3]. "A System for Smart-Home Control of Appliances Based on Timer and Speech Interaction," by S. M. Anamul Haque, S. M. Kamruzzaman, and Md. Ashraful Islam1, in Proceedings of the 4th International Conference on Electrical Engineering & 2nd Annual Paper Meet 26-28 , pp. 128-131, January, 2006.
- [3] Jia-Ren Chang Chien, Cheng-Chi Tai, "The Information Home Appliance Control System—A Bluetooth Universal Type Remote Controller," in Proceedings of the 2004 IEEE. International Networking, Sensing & Control. Taipei, Taiwan, vol. 1, pp. 399-400, March 21-23. 2004
- [4] N.P.Jawarkar, Vasif Ahmed and R.D. Thakare., "Remote Control using Mobile through Spoken Commands," in IEEE - International Consortium of Stem Cell Networks (ICSCN) 2007. 22-24, pp.622-625, 2007
- [5] Mardiana B., Hazura H., Fauziyah S., Zahariah M., Hanim A.R., Noor Shahida M.K., "Homes Appliances Controlled Using Speech Recognition in Wireless Network Environment," ICCTDInternational Conference on Computer Technology and Development, vol. 2, pp.285- 288, 2009
- [6] A.K.Gnanasekar, and P.Jayavelu, "Voice Based Wireless Industrial Automation with Enhanced Feedback System", in Proceedings of the International. Conference on Advances in Computer, Electronics and Electrical Engineering, pp. 51-55, 2012.
- [7] Faisal Baig, Saira Beg, and Muhammad Fahad Khan., "Controlling Home Appliances Remotely through Voice Command", International Journal of Computer Applications, vol. 48, June 2012.
- [8] Applications, vol. 48, June 2012.