

# Smart Home for Elderly and Disabled People

Abhishek Mishra<sup>\*</sup>, Aditya Naik<sup>\*\*</sup>, UtkarshaNaik<sup>\*\*\*</sup>,  
RutvikNanavati<sup>\*\*\*\*</sup>, Prof. RuchiChouhan<sup>\*\*\*\*\*</sup>

<sup>\*</sup>(Department of Electronics & Telecommunication, Mumbai University, Malad (W) – 400095, Maharashtra,  
[abhishekamitmishra396@gmail.com](mailto:abhishekamitmishra396@gmail.com))

<sup>\*\*</sup>(Department of Electronics & Telecommunication, Mumbai University, Malad (W) – 400095, Maharashtra,  
[adityanaik6461@gmail.com](mailto:adityanaik6461@gmail.com))

<sup>\*\*\*</sup>(Department of Electronics & Telecommunication, Mumbai University, Malad (W) – 400095, Maharashtra,  
[utkarshan99@gmail.com](mailto:utkarshan99@gmail.com))

<sup>\*\*\*\*</sup>(Department of Electronics & Telecommunication, Mumbai University, Malad (W) – 400095, Maharashtra,  
[nanavativrutvik1@gmail.com](mailto:nanavativrutvik1@gmail.com))

<sup>\*\*\*\*\*</sup>(Department of Electronics & Telecommunication, Mumbai University, Malad (W) – 400095, Maharashtra,  
[ruchimehta.chauhan@gmail.com](mailto:ruchimehta.chauhan@gmail.com))

\*\*\*\*\*

## Abstract:

Smart homes are homes with technologically advanced systems to enable domestic task automation, easier communication, and higher security. As an enabler of health and well-being enhancement, smart homes have been geared to accommodate people with special needs, especially elder people. This paper examines the concept of “smart home” in a technologically driven society and its multi-functional contribution to the enhancement of elder people’s lives. Elderly, handicapped patients, and people with disabilities who have problems with locomotion difficulty can benefit from proposed smart home to totally operate, with high performance, all appliances and devices from anywhere in the house. The smart home will be necessary in modern era. Smart home is the digital connectivity among different appliances. Here we show the potential of ZigBee through the design and implementation of smart home system. It provides remote access to the user for the monitoring and controlling purpose. With remote access we provide gesture based control for home appliances.

**Keywords-** ZigBee, Smart Home, Remote access, Gesture control.

\*\*\*\*\*

## I. INTRODUCTION

The analysis of the world population shows a trend that the elderly population across worldwide is increasing rapidly, because of the increase of the average life expectancy of the people. Therefore, to take care and support this growing population is a concern for governments and nations around the globe. Secondly, in past few years many innovative technologies such as Internet, Wi-Fi, Bluetooth have fully developed and widely supported by the market. In the current years, embedded systems with microcontrollers are being utilized in most of the electronic gadgets to the market, which focuses on appropriate possibility for smart control. This technology approaches a new and thrilling opportunities to increase the connectivity of the devices within the home for the purpose of Smart home. Through the integration of relevant technologies for elder people, Smart home systems

can be properly designed for the purpose of offering residents comfort and security.

According to the survey in 2011, 35% of people of age 65+ had some type of disability and some of them require assistance to meet important personal needs. Elderly prefer living independently in their own home which promote the feelings of competency. From economic point of view, the cost of living at home with smart monitoring appliances is less expensive and more beneficial than attending medical centers and being supervised by nurses. Hence, the implementation of smart home systems with remote monitor controls will reduce the expense of personal aid assistance at home.

Smart Home is the system, which enables us to make our home smarter and easy to use. The technology controls the devices, which are connected with it. This system enables the person with disabilities and elderly people to sit at a place and

control appliances remotely. The technology has specific application in field of IOT where despite technology advancement & increase growth in the field, smart home systems is not easy to use for all and installation of smart home system is still costly and labor-intensive task. Smart home systems are used to those finding luxury and sophisticated homes. In the rapid growth of enormous volume of new gadgets, the main challenge involves to control the gadgets by a single system in a compact and a smart way. Therefore, Our Smart home is a smart solution that automatically controls the appliance.

It firstly uses remote control which eliminates the use of traditional switches. Other way is gesture control which is very useful for person with disability that involves understanding and recognition of hand movements by their interaction with device. The goal of the Smart Home System is to give for elderly and disabled people with a system that can offer remote control and gesture control. Using this they can on/off the status of electrical devices, such as ac, bulb etc in the home. This project recreates the new definition for smart home system with no internet connectivity and with secure, feasible and flexible approaches.

## II. LITERATURE SURVEY

Smitha M, et.al, [1] "Hand gesture-based home Automation for Visually Challenged People." They have constructed a device for blind people to support them to handle the household appliances. They have utilized accelerometer which is used to feel the accelerations of a hand. The gesture templates were saved in a master controller at the receiver end. The received gesture and the hand gesture were analyzed and then compared by the templates. If the corresponding gestures were matched with the templates, stored then accordingly home appliances were controlled.

Bilal Ghazal et.al, [2] "Home automation for elderly and handicapped people using XBEE" which is expertized for existing houses despite of its eligibility to be broadened to new houses. The main concept was that the elderly and disable people, are living at home most of the time. Since the targeted users are constantly living in their dwelling, the web server mode and the GSM mode are not sufficient while the conventional bluetooth system that operates at 10 m may not discover all the domicile area. The idea behind this project is to use wireless communication using zigbee receiver that achieves the total control between the remote-control tool and the master main hub. The master control board is depend on microcontroller interfaced with zigbee receiver module to make sure overall communication between the remote control and its basic unit. The microcontroller pins are attached to relays and sensors

where the demanded on/off functionality depends on configuration performed corresponding to the conditions mentioned by input sensors.

Rathnayake et.al, [3] discuss the HIC (Human Computer Interaction) technology which reduces the gap between the human and computer. This system is an aid for physically challenged including people with speaking and hearing disabilities. The home appliances are controlled through voice and gesture commands which are sensed by Kinect motion sensor. In the proposed paper, voice and gesture recognition are one of the special consideration and HCI technology is the easiest way of communicating or interacting with hardware systems.

Bulbul Bhaskar et.al, [4] "Smart Home Automation System Using AVR Microcontroller" displays smart home system using AVR microcontroller. The system incorporates with sensors, master controller and bluetooth module to provide automation capability towards different household works. An AVR microcontroller offers better performance and high flexibility for controlling various appliances.

D. Chaitanya et al, [5], presented "Home appliances Control Based on Hand Motion Gesture" which proposed the system for virtual switch Control to remove the need to look into the handheld remote and to search for a specific key for specific function. Thresholding algorithm is used for hand gesture recognition purpose. The accelerometer sensors are used to sense the gesture of hand using ARM based control unit. To indicate output LED's are used. This system was designed to control a device based on free air hand gesture motion technology. It uses the hand gesture pad, which works on the principle of e-field distortion. ARM7 based microcontroller is used for data analysis and RF communication is used for communicating gestures from pad to the device. Embedded C programming is used for the application.

## III. METHODOLOGY

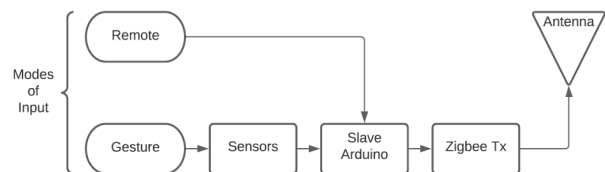


Fig. 1 Block Diagram of Remote Control Unit

This block diagram describes the **Remote-control unit** of our project. There are two input methods, which are used to interact with appliances.

**A. Remote (2\*3 Keypad Matrix)**

The signal from keypad matrix is communicated with slave Microcontroller via five digital channels, which are connected to d3, d4, d5, d6 and d7 i.e., pin number 6,7,8,9 and 10 respectively to the same.

According to signal received, Microcontroller while following the code detects which key is pressed among 6 of them, then value corresponding to that key is communicated further to TX pin of Microcontroller.





The ZigBee Module (R configured) Receives the data via TX Pin i.e., Pin no. 1 of Microcontroller. Further it is transmitted via Antenna to Main Hub.

**B. Gesture Module**

The gesture sensor detects the gesture made and communicate to microcontroller via Two Analog Pins, one of which is SDA (Serial Data) and other is SCL (Serial Clock). The INT (Interrupt Pin) of Gesture module is Active low and is connected to D2 i.e., Pin no 5 of microcontroller. Then the detected gesture is received and according to the program, the value corresponding to a particular gesture is further communicated to TX pin of Microcontroller. The ZigBee Module (R configured) Receives the data via TX Pin i.e., Pin no. 1 of Microcontroller. Further, it is transmitted via Antenna to Main Hub.

In this TABLE1, gestures definition were added to confirm the user the correct capture of each gesture. It determines the system's ability to read and identify the complexity of gesture while doing such gestures.

TABLE 1

GESTURE	DESCRIPTION	APPLIANCE
	Vertical anticlockwise	APPLIANCE 1
	Vertical clockwise	APPLIANCE 2
	Horizontal anticlockwise	APPLIANCE 3
	Horizontal clockwise	APPLIANCE 4

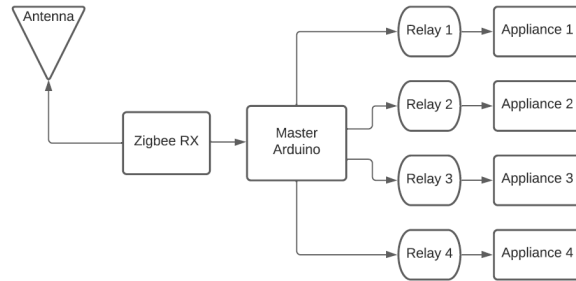


Fig. 2 Block Diagram of Main Hub

This Block Diagram describes the **Main Hub** of our project. The Main Hub is the responsible component for over all performance of our project. The receiving antenna receives data and transmit it to ZigBee module (C configuration) the data received is decoded and send further to Rx pin i.e., pin no. 2 of Microcontroller. The Microcontroller takes up received data as input and according to the program burned in it, Generates an output. The Output is actually the digital command given to relays by microcontroller. According to received command any of the 4 relays are switched on/off and simultaneously appliances.

**IV. RESULTS**

The system was tested with active participation of 10 participant. The results of the testing are as follow for gesture control system with four diffrent gesture first gesture Vertical anti clock wise was tested first the efficiency of this gesture is up to 85 percentile second gesture Vertical clockwise was tested second this gesture has efficiency up to 80 percentile and respectively.

Horizontal anti clockwise gesture has 90 percentile efficiency and horizontal clockwise has 80 percentile efficiency. this testing faced some issues like the gestures are not recognized immediately so we have to repeat the process and do gesture with more perfection and second input method which is remote control was tested too the overall efficiency of remote is up to 95 percentile as the efficiency shown above overall this all gestures and remote can used easily and all have reliable readings.

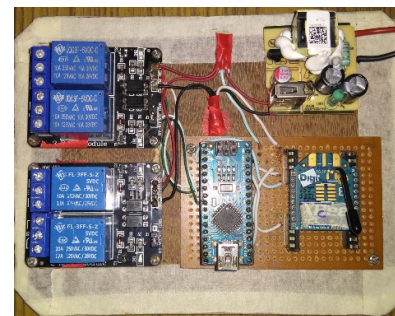


Fig. 3 Main hub

This figure 3 Shows main hub of our smart home system.

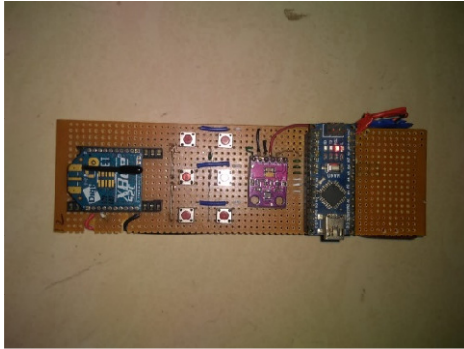


Fig. 4 Remote module (2x3 keypad matrix)

Above Fig. 4 shows keypad remote module and gesture sensor module which we have used to control home appliances.

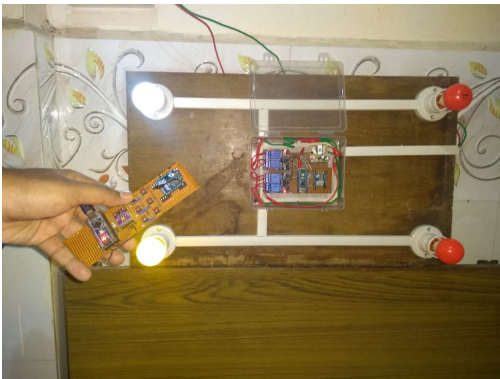


Fig. 5 Result

Above Fig 5 shows final demonstration of smart home system.

## V. ADVANTAGES

- The inefficiency of operation by conventional wall switches can be overcome.
- Gesture control will give easy access to appliances, specially for people in wheel chair

## VI. DISADVANTAGES

- Some gestures was not recognized immediately with some participants.
- Remote control needs more functions to be added in it.

## VII. FUTURE SCOPE

In future, we want to increase gesture library to customize the system according to user profile. So that we can use this project on larger scale. We want to expand the application on industrial level where we thought of fully automated industry warehouse. With the advancement in the system like by adding voice control system to this system, it can be utilized to replace current existing technology as it runs with minimum internet connectivity which prove to be cost and energy efficient.

## VIII. CONCLUSION

Smart Home has recently attracted significant research accordingly mechanisms and techniques have been suggested. In this paper, we have presented the effectiveness of our investigation through focusing on reducing usage of internet and reducing usage of power and additional cost in the process of installing home automation by using zigbee technology. The goal of our project was achieved by designing a useful and fully functional real world product, which efficiently translates the gestures using APDS 9960 gesture sensor to electrical signal that can control home appliances. Besides the gesture control system, it consists of remote control system including voice recognition feature to automate home appliances, which provides secure communication and more profit.

## REFERENCES

- [1] Smitha. M, Ayesha Rumana, Sutha.P, "Hand Gesture Based Home Automation For Visually Challenged," International journal of innovations in engineering research and technology, Volume 2, Issue 4, Apr-2018.
- [2] S. Bilal Ghazal and Khaled khatib, "Smart Home Automation System for Elderly and Handicapped People using Xbee", International Journal of Smart Home, Vol.9, No.4 (2015), pp. 203-210.
- [3] K. A. S. V. Rathnayake, W. K. I. L. Wanniarachchi, and W. H. K. P. Nanavakkara, "Human Computer Interaction System for Impaired People by using Kinect Motion Sensor: Voice and Gesture Integrated Smart Home," in 2018 Second International Conference on Inventive Communication and Computational Technologies (ICICCT), 2018, pp. 531-536.
- [4] Bulbul Bhaskar and R. Swarnalatha, "Smart Home Automation System Using AVR Microcontroller", International Journal of Advanced Technology in Engineering and Science, Volume No.03, Issue No. 02, pp. 234-342, February 2015.
- [5] D. Chaitanya, Y. Aruna Suhasini and G. Nag Arjun, "Home Appliances Control Based on Hand Motion Gesture", International Journal of Emerging Technologies in Engineering Research (IJETER) Volume 5, Issue 11, November (2017).
- [6] Raafat Aburukba, A.R.Al-Ali, Nourhan Kandil, Diala AbuDamis, "Configurable Zigbee based Smart Home Appliances Control System for people with multiple disabilities" IEEE Transactions on Consumer Electronics, Vol.56, pp.1222-1229, 2015.
- [7] B. Hameed. Design & implementation of smart house control using LabVIEW. International journal of soft computing and engineering, (2012) January, Vol. 1, Issue 6, pp. 98-106.
- [8] K. Dutta, P. Rai, and V. Shekhe.r. "Microcontroller based voice activated wireless automation system." International journal of electrical, electronics & communication engineering, (2012), Vol. 2,

No. 8, pp. 642-649.

- [9] M. Mazidi, R. McKinley, and D. Causey, PIC microcontroller and embedded systems, 1st ed, Prentice Hall (2007).
- [10] Y.Usha Devi 1, II M.Tech., “Wireless Home Automation System Using ZigBee”, International Journal of Scientific & Engineering Research Volume 3, Issue 8, August-2012 ISSN 2229-5518
- [11] [Cited 8th Dec 2020]: <https://microcontrollerslab.com/zigbee-interfacingarduino/>
- [12] [Cited 20<sup>th</sup> Dec 2020]: <https://www.mepits.com/project/299/embedded-projects/zigbee-arduino-interfacing>