

IoT Based Room Automation and Control of Wheel Chair using Google Assistant for Disabled Patients

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Abstract- The Progression in technology is an epitome people with a physical among the Disabled people. Individualistic manoeuvre is an optimal difficult problem for a disabled person; thus, it limits the Activities of them. The implementation of Internet of things (IoT) in the field of Automation is in concern of Researches. Individualistic Movement and other activity without the help of Care-takers is a challenge for physical abnormal people. In this paper a smart Automation technology is introduced to overcome this problem. The designed technology includes an astute way of operating and controlling the wheel chair and also to control the electronic and electrical thing over Wi-Fi. The Automation technology helps the physically abnormal people to move from one place to another without the help of caretaker. In this paper a voice command technique is used to control the wheelchair, electrical and electronic item in the room. The voice command technique is achieved by Google Assistant and the received data is given to the microcontroller. The microcontroller Commands the movement of the wheel chair and other automated things which are connected. The Technology in this paper control of the wheel chair by the voice command of the user through Esp8266 Module and move accordingly. The astute home controlling systems in this paper also helps physical abnormal people to control their electrical devices such as AC, heater, oven, television (TV), lights, and fans using voice commands and without moving to Switch on or Switch off electrical items. The predominant benefit of the proposed system is that it benefits the physically disable people to have their individualistic Movement and functionalise the things around them by themself.

Keywords: *IoT, Google Assistant, Cloud, Home Electrical System, Wheelchair, ESP8266 Module.*

I. INTRODUCTION

A huge number of people become limping due to accidents and other spinal diseases every year. Hence Individualistic movement for these challenge. Controlling a physically operated wheelchair will be a much hard chore however it has turned out to be deliberate for people with dainty disability. Manual operation of electrical and electronic items in a room is also a difficult problem for disabled people. The activity for disabled people achieved with the help of caretakers is also a concern. So An Astute wheelchair with automated self-control will be a practically technical sound solution for this problem.

Efficient and optimal technology for wheelchair Automation is Voice command technology which is achieved over Google Assistant. The major parameters focused on this technology are room automation which controls the electrical systems in the room and controlling of the wheelchair. The Internet of things connects the parameters in this described technology and achieved by Wi-Fi module. The interfacing of voice will be the upcoming age of interfacing technology after the touch screen-based system [1]. Subsequently, the interfacing is based on voice; the result must resemble people communicating with individual people. Consequently, a combined framework component was required. For example, Natural Language Processing (NLP), Dialog Manager (DM), Knowledge Database (KDb), Automated Speech Recognition (ASR), Natural Language Generator (NLG), and Text-to-Speech combination (TTS) [2] [3]. Based on Natural Language Processing (NLP), there is no need for creators to think of a technique to convert human language into information because Google Assistant has API (Application

Programming Interface) that will transform it automatically or modified by developers and strongly supports Google Assistant SDK [4]. This feature helps developers to concentrate on the application developing process than language conversing process.

The usage of voice-based virtual assistants to control Internet of Things (IoT) devices that are established individually are not combined with Google Assistant [5] or use the Google Speech Recognition API alone and have their specific NLP [6]. An astute home is a new idea of a household. A smart home provides luxury, security, energy-conservation that is potential for the house at any time [7] [8]. The Internet of Things (IoT) is comprised of three parts: sensor, network and application usage. Numerous communication technologies can be employed to carry out the connection of devices to IoT [9].

After the introduction of IoT Technology, astute household research and development became popular for the past few days. IoT-based Astute Home is an application that could ease human activities to control multiple devices, such as electronic and electrical equipment, via internet connections. Apart from various wireless technologies, that could help to connect from remote areas to develop the intellect of the home environment. Enlightened IoT networks are being framed to meet human needs to fulfil the connections with other things. IoT technology is applied to precipitate innovative ideas and momentous growth for astute homes to improve the living standards [10]. An astute gesture-controlled wheelchair that operates rather than the joystick input to control a wheelchair by an in-built gesture function of a mobile phone and touch sensor. [11] Also, a hand gestured based wheelchair that can be controlled with the help of a gesture recognition system [12].

This paper proposes an automation technology that helps the physically disabled people to shift from one place to another using voice command and the proposed system also helps to control the smart home system. The voice command is achieved by Google Assistant.

In Section II, the Related Work of the proposed system is scribbled. The voice control technique by Google assistant, controlling of smart home systems and the controlling of wheelchair System Architecture is presented in Section 3. In Section IV, the proposed system is explained with block diagram and flowchart. In section V, the proposed framework is assessed by implementing the prototypes and other relative experiments. Finally, in Section VI the conclusion is stated.

II. RELATED WORK

Some research has undergone under Google assistant for smart room electrical and electronic systems. On a style, that aids the voice activation system for physically disabled folks by incorporating manual operation. Arduino microcontroller and voice recognition are wont to support the movement of the chair. The chair doesn't answer associate degree incorrect speech command. Looking on the direction given through voice and gesture, the Arduino controls the chair directions [13]. Also, the practices of voice-based virtual assistants to govern the Internet of Things (IoT) devices that are established separately are not connected with Google Assistant [5]. The Internet of Things (IoT) involves three parts: sensor, network, and application practice. Several communication technologies can be working to carry out the connection of devices to IoT [9]. The patient will operate the chair victimization voice commands and also the location of the patient are often derived victimization GPS module within the chair that tracks and sends the knowledge to a smartphone application (app) via the base of operations. Voice module V3 is employed to record the patient's voice and acknowledge that voice to follow the directions of the patient. [14]

Monitoring energy from star and energy meter with facilitates of the Arduino controller and residential automation is completed by IoT with the Esp8266 LAN module. This module is employed for managing each of the data and watching the energy state of the patron facet. [15]. A smart gesture-controlled wheelchair that functions moderately than the joystick input to govern a wheelchair by an in-built gesture function of a mobile phone and touch sensor [11]. Through mobile application as associate degree computer program that has convenience for the user(s) to be ready to manage the house appliance remotely by various tasks, voice command and graphical computer program. The computer program employs the Google help for voice command atmosphere whereas the graphical computer program is developed Blynk App [16]. system that uses good plugs, good cameras, good power strips, and a digital assistant like Amazon Alexa, Google Home, Google Assistant, Apple Siri, or Microsoft Cortana to capture voice commands, from someone with physical disabilities, spoken during a way more natural thanks to management normal home electrical appliances so as to show them on or off, with least elbow grease Smart home management systems facilitate disabled folks to regulate their home electrical devices like tv (TV), lights, and fans victimization solely voice commands while not moving to show on The voice recognition of electrical instrumentation is the victimization of the Google Assistant's application on smart phones [18].

III. SYSTEM ARCHITECTURE

The proposed system is designed to control the wheel chair and home electrical system by voice command for the disabled people to move freely and take care of them by themselves without the support of others. Voice recognition with correct pronunciation will help the Google Assistant to process the system in Fig(1). The process and function of each segment is described.

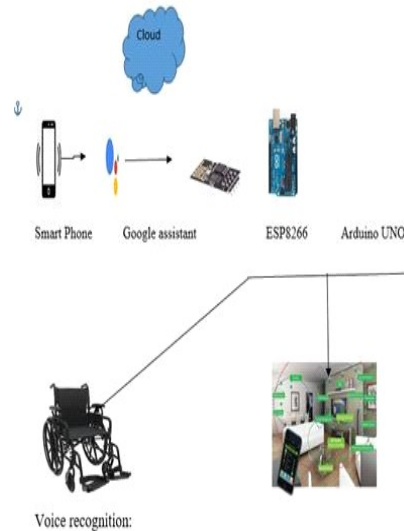


Fig.1 Architecture

Voice Recognition

Voice management could be a form of voice recognition technology that allows devices like good phones, Bluetooth devices, and other residential voice tools to grasp spoken words and be controlled through easy voice commands and responses. This eliminates the necessity for users to perform a lot of ancient management tasks, like pressing buttons and other manual operation.

The voice recognition on electrical instrumentality is the exploitation of voice commands application on the smartphone. The digital sound process is controlled by associate degree application to recognize the detected voice commands, that area unit is typically called Voice Recognition. This technology works by capturing the human voice and that is recreated into a digital format in order to get translated into a system. Then the system can compare the input data that has been in the form of a digital format with voice information that has been set. The designs employed in this analysis use a wireless sound system that controls electrical appliances like TV, lights, and fans. The operation of this voice management is based on a controller which helps to activate and deactivate electrical instrumentality by replacing the button operate with voice commands through wireless electronic equipment and the web. The event of voice control exploitation of the Google Assistant Application might become a future home reference that anywhere we tend to move solely with voice commands will activate and deactivate home electrical instrumentality though it's somewhere different within the house. Google Assistant may be a virtual assistant application supported by computing technology, which was developed by Google, principally accessible on mobile devices and other home devices. Almost all humanoid smartphones have a feature Google Assistant Application. If not, we tend to might get onto on the Google Play Store to put in the appliance. Google Play Store may be a free application and open supply to put in anything's of application for humanoid smartphone.

Arduino uno

The Arduino Uno is an open-source microcontroller based on a Microchip ATmega328P. The Arduino can be programmed using an Arduino IDE platform which is based on C programming language. It is flexible, compact and easy to handle the device with many processing capabilities. The Arduino can be powered directly by

the computer by using USB cable, or it can be powered using an AC-to-DC adapter or a battery. This controller has 2KB SRAM, 32KB of flash memory, 1KB of EEPROM, 16 MHz frequency crystal oscillator and Reset pin, also this Arduino controller has a total of 28 pins in which 14 digital pins, 6 analog pins and 8 control pins.

Wi-Fi module

An ESP8266 is a low-cost Wi-Fi enabled system on chip module, has high features which makes it an ideal module for IoT applications. This ESP8266 Wi-Fi Module has 8 pins, and which compatible to 3.3V logic level only. This ESP8266 module communicates with the microcontroller by using set of AT commands. The Microcontroller communicates with ESP8266 module using UART with a specified Baud rate.

L298N Motor driver module

A L298N Motor Driver Module is a high- power motor driver module which is used for driving DC and Stepper Motors. This L298N Module can able to control up to 4 DC motors, or 2 DC motors with speed and spinning direction of DC motors. The spinning direction of the DC motors can be controlled by changing polarity of its input voltage, which use an H-Bridge technique, and this H-Bridge circuit contains four switches with the motor at the centre to form an H-like arrangement.

• PROPOSED FRAMEWORK

The automatic control of wheelchair and astute Home electrical system support the disabled to control the wheel chair to move forward, backward, right and left with the correct pronunciation accepted by the Google Assistant controlled by the microcontroller. The working is explained in the block Diagram Fig (2).

A.BLOCK DIAGRAM

Astute controlling of wheel chair and home electrical system helps the disabled to move independently and to take care of them by themselves. The system works when it receives the OK GOOGLE Comment from the Android mobile. The digital data is transferred through the ESP8266 module to the controller via cloud. The data is first initialised in the cloud, Fig (2) when the source gives the command the controller checks the data with the controller and if the data co-relates the concerned operation is carried out. If the data co-relates with the command of the wheel chair the ESP8266 module of the wheel chair is operated. If the data co-relates with the command of the Astute electrical system the ESP8266 module of the electrical system is operated. The voice command using Google assistant act as a switch to control the home electrical appliance and wheel chair for the disabled person.

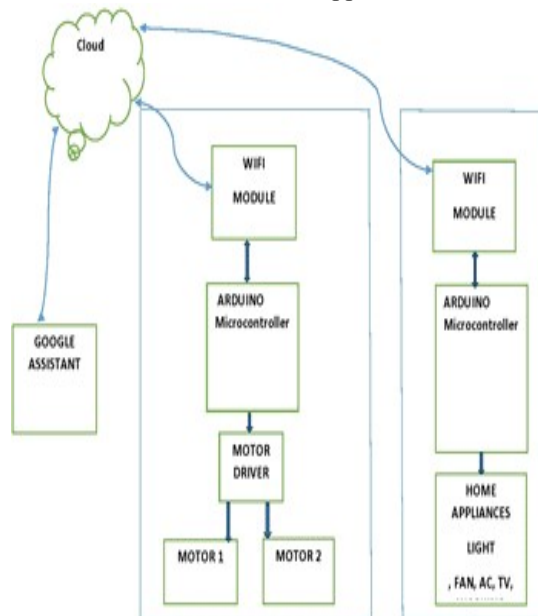


Fig: 2 Block Diagram

From previous researches on the IoT electrical Home control system, there are four sorts of areas for applied for Short Message Service (SMS), Telegram, Blynk Apps, and net. Once the user uses the application to regulate home electrical instrumentation within the home and wheel chair inside the home, the user must sort the text message in advance to send the command whereas the Google Assistant application is an IOT of straightforward. As result of voice commands, the users get a lot of convenience compared to mistreatment text. Users solely send voice commands to the Google Assistant Application and therefore the system can mechanically show the text messages that we tend to aforementioned before. It means users don't need to sort text messages once more. Some, as a result, are types of the applying for IoT good home system, as shown in Table (1).

B. FLOW DIAGRAM

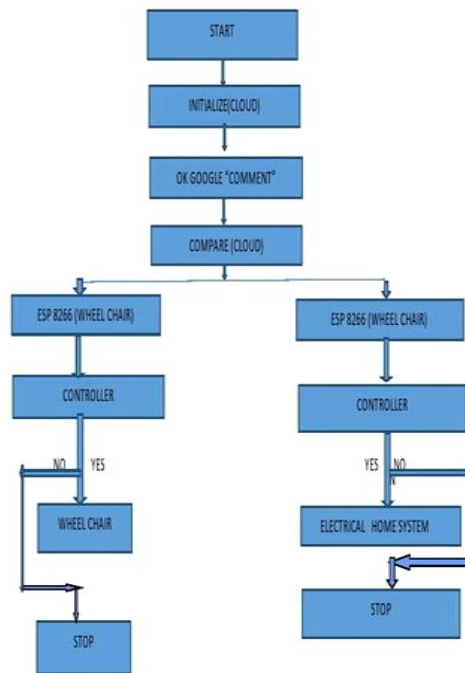


Fig: 3 Flowchart

The flowchart explains steps of overall program flow for Activating and Deactivating the wheelchair and Electrical Equipment Control System Using Google Assistant in Fig(3).

- When starting, it executes the program process initiation.
- The program runs with the Microcontroller of Arduino UNO with ESP8266 in the standby mode position waiting for messages from the user.
- If the Microcontroller with the ESP8266 is not connected to the internet, it will return to the standby mode position, and it check the Internet Connection.
- If the Microcontroller with the ESP8266 is connected to the internet, it is ready to receive the next command message.
- After that next, open and run the Google Assistant application.
- If the voice command message from the user's voice pronunciation is correct, that saying OK GOOGLE TURN ON "WHEELCHAIR", and OK GOOGLE TURN ON "ELECTRICAL

EQUIPMENT”, that on the Google Assistant application, then the message becomes the keyword to TURN ON the WHEELCHAIR and ELECTRICAL EQUIPMENT, such as light, fan, ac and washing machine, etc. Then ACTIVATE “WHEELCHAIR” and “ELECTRICAL EQUIPMENT”

- Next, if the voice command message from the user's voice pronunciation is correct, saying OK GOOGLE TURN OFF “WHEELCHAIR”, and OK GOOGLE TURN OFF “ELECTRICAL EQUIPMENT” on the Google Assistant application, then the message becomes the keyword to TURN OFF the WHEELCHAIR and ELECTRICAL EQUIPMENT. Then DEACTIVATE “ELECTRICAL EQUIPMENT”
- If the voice command message from the user's voice pronunciation is not correct on the Google Assistant application, then the message will be rejected, could not activate it. So, check the pronunciation.
- The end, it is finished.

• TESTING AND IMPLEMENTATION

After the development of the device is complete, successive step is to examine, take a look at and make the device live. This stage aims to check the general perform and performance of the device. Real active experiments were carried out.

• *Voice Command Test*

This Examination aims to see the pronunciation and clearness of the voices. Voice Pronunciation ought to be correct and accurate. Once act of the disabled is registered to Smartphone through Google Assistant Application and reflected to the cloud. If the voice pronunciation is incorrect and precise, the Google Assistant Application co-relates with the cloud and gives the information to the controller. The controller makes the device to work accordingly. Further if the pronunciation of the

• *Control Test*

As a part of practical examine the controller receives the voice command and operates accordingly. When the disabled person gives the voice, the voice pass through the ESP8266 module to the cloud and the cloud compares the command with the previously stored data and makes the wheel chair and home electrical system act accordingly. The practical experiments were carried out and the wheel chair and home electrical system acted accordingly and shown in Fig (4.a) and Fig (4.b)



Fig:4.a & b Practical test

• CONCLUSION

In this paper we have designed an astute way of controlling the wheel chair and home electrical system. This proposed design makes the Disabled people to move freely without the support of others and operate the electrical home system by themselves. The voice command is processed through Google Assistant. When the Google Assistant receives the correct pronunciation, the process gets activated. This system will be an easy solution for the disabled people because the process is in a flow of the usual talk with précised pronunciation. Google Assistant helps the disables to control the wheel chair to move forward, backward, right and left, and also to Switch the ON and OFF the electrical home systems. Further this system can be controlled by interfacing with brain for future Research.

REFERENCES

- [1] Weigelt and W. F. Tichy, "Poster: ProNat: An Agent-Based System Design for Programming in Spoken Natural Language," 2015 IEEE/ACM 37th IEEE International Conference on Software Engineering, Florence, 2015, pp. 819-820.
- [2] S. Mischie, L. Mățiu-Iovan and G. Gășpăresc, "Implementation of Google Assistant on Raspberry Pi," 2018 International Symposium on Electronics and Telecommunications (ISETC), Timisoara, 2018, pp. 1-4.
- [3] R. Posevkin and I. Bessmertny, "Translation of natural language queries to structured data sources," 2015 9th International Conference on Application of Information and Communication Technologies (AICT), Rostov on Don, 2015, pp. 57-59.
- [4] D. Sheppard, N. Felker and J. Schmalzel, "Development of Voice Commands in Digital Signage for Improved Indoor Navigation Using Google Assistant SDK," 2019 IEEE Sensors Applications Symposium (SAS), Sophia Antipolis, France, 2019, pp. 1-5.
- [5] X. Han and M. A. Rashid, "Gesture and voice control of Internet of Things," 2016 IEEE 11th Conference on Industrial Electronics and Applications (ICIEA), Hefei, 2016, pp. 1791-1795.
- [6] S. Khattar, A. Sachdeva, R. Kumar and R. Gupta, "Smart Home With Virtual Assistant Using Raspberry Pi," 2019 9th International Conference on Cloud Computing, Data Science & Engineering (Confluence), Noida, India, 2019, pp. 576-579.
- [7] K. Guravaiah and R. L. Velusamy, "Prototype of Home Monitoring Device Using Internet of Things and River Formation DynamicsBased Multi-Hop Routing Protocol (RFDHM)," IEEE Transactions on Consumer Electronics, vol. 65, no. 3, pp. 329-338, 2019.
- [8] X. Li, R. Lu, X. Liang, X. Shen, J. Chen, and X. Lin, "Smart community: an internet of things application," IEEE Communications Magazine, vol. 49, no. 11, pp. 68-75, 2011.
- [9] A. Al-Fuqaha, M. Guizani, M. Mohammadi, M. Aledhari, and M. Ayyash, "Internet of Things: A Survey on Enabling Technologies, Protocols, and Applications," IEEE Communications Surveys & Tutorials, vol. 17, no. 4, pp. 2347-2376, 2015.
- [10] D. Pavithra and R. Balakrishnan, "IoT based monitoring and control system for home automation," in 2015 Global Conference on Communication Technologies (GCCT), 2015, pp. 169-173.
- [11] A New Design Approach for Gesture Controlled Smart Wheelchair Utilizing Microcontroller.
- [12] G. Soni, V. Poddar, Y. Sahu and P. Suryawanshi, "Hand Gesture Recognition Based Wheel Chair Direction Control Using AVRMicrocontroller", *International Journal of Advanced Research in Computer and Communication Engineering*, vol. 5, no. 3, pp. 344-348, 2016.
- [13] Ms. Cynthia Joseph, Aswin S and Sanjeev Prasad J "Voice and Gesture Controlled Wheelchair", Proceedings of the Third International Conference on Computing Methodologies and Communication (ICCMC 2019) IEEE Xplore Part Number: CFP19K25-ART; ISBN: 978-1-5386-7808-4.
- [14] Nasrin Aktar , Israt Jahan and Bijoya Lala "Voice Recognition based intelligent Wheelchair and GPS Tracking System", 2019 International Conference on Electrical, Computer and Communication Engineering (ECCE), 7-9 February, 2019.
- [15] U.Ramani, S.Sathiesh kumar, T.Santhoshkumar and M.Thilagaraj, "IoT Based Energy Management for Smart Home", 978-1-7281-2414-8/19/\$31.00 c 2019 IEEE. Poonphon Suesaowaluk , "Home Automation System Based Mobile Application", 2020 the 2nd World Symposium on Artificial Intelligence.
- [16] Progress Mtshali and Freedom Khubisa, "A Smart Home Appliance Control System for Physically Disabled People", 2019 Conference on Information Communications Technology and Society (ICTAS).
- [17] Haris Isyanto, Ajib Setyo Arifin and Muhammad Suryanegara, "Design and Implementation of IoT-Based Smart Home Voice Commands for disabled people using Google Assistant", 2020 International Conference on Smart Technology and Applications (ICoSTA).
- [18] C.Nagarajan and M.Madheswaran - 'Experimental verification and stability state space analysis of CLL-T Series Parallel Resonant Converter' - Journal of ELECTRICAL ENGINEERING, Vol.63 (6), pp.365-372, Dec.2012.
- [19] C.Nagarajan and M.Madheswaran - 'Performance Analysis of LCL-T Resonant Converter with Fuzzy/PID Using State Space Analysis'- Springer, Electrical Engineering, Vol.93 (3), pp.167-178, September 2011.
- [20] C.Nagarajan and M.Madheswaran - 'Stability Analysis of Series Parallel Resonant Converter with Fuzzy Logic Controller Using State Space Techniques'- Taylor & Francis, Electric Power Components and Systems, Vol.39 (8), pp.780-793, May 2011.
- [21] C.Nagarajan and M.Madheswaran - 'Experimental Study and steady state stability analysis of CLL-T Series Parallel Resonant Converter with Fuzzy controller using State Space Analysis'- Iranian Journal of Electrical & Electronic Engineering, Vol.8 (3), pp.259-267, September 2012.
- [22] Nagarajan C., Neelakrishnan G., Akila P., Fathima U., Sneha S. "Performance Analysis and Implementation of 89C51 Controller Based Solar Tracking System with Boost Converter" Journal of VLSI Design Tools & Technology. 2022; 12(2): 34-41p.
- [23] C. Nagarajan, G.Neelakrishnan, R. Janani, S.Maithili, G. Ramya "Investigation on Fault Analysis for Power Transformers Using Adaptive Differential Relay" Asian Journal of Electrical Science, Vol.11 No.1, pp: 1-8, 2022.
- [24] G.Neelakrishnan, K.Anandhakumar, A.Prathap, S.Prakash "Performance Estimation of cascaded h-bridge MLI for HEV using SVPWM" Suraj Punj Journal for Multidisciplinary Research, 2021, Volume 11, Issue 4, pp:750-756
- [25] G.Neelakrishnan, S.N.Pruthika, P.T.Shalini, S.Soniya, "Perfromance Investigation of T-Source Inverter fed with Solar Cell" Suraj Punj Journal for Multidisciplinary Research, 2021, Volume 11, Issue 4, pp:744-749
- [26] C.Nagarajan and M.Madheswaran, "Analysis and Simulation of LCL Series Resonant Full Bridge Converter Using PWM Technique with Load Independent Operation" has been presented in ICTES'08, a IEEE / IET International Conference organized by M.G.R.University, Chennai.Vol.no.1, pp.190-195, Dec.2007
- [27] M Suganthi, N Ramesh, "Treatment of water using natural zeolite as membrane filter", Journal of Environmental Protection and Ecology, Volume 23, Issue 2, pp: 520-530,2022
- [28] M Suganthi, N Ramesh, CT Sivakumar, K Vidhya, "Physiochemical Analysis of Ground Water used for Domestic needs in the Area of Perundurai in Erode District", International Research Journal of Multidisciplinary Technovation, pp: 630-635, 2019