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Enhancing Smart Home Interfaces through Natural Voice Recognition

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ABSTRACT: The objective of home automation is to establish a convenient and high-quality lifestyle. The idea of "intelligent homes" is rooted in progress across domains like artificial intelligence and linguistic computing. In this regard, language comprehension technology plays a vital role, acting as a link between human expression and automated system responses. NLP users have the ability to control or command devices in their homes, regardless of their disabilities. The specific commands or requests may differ from the preset options. One of the areas where artificial intelligence (AI) is commonly applied is natural language processing (NLP). Our project aims to provide users with a hand free voice system that goes beyond simply controlling appliances, offering a wide range of functionalities. The user issues a command using speech to the mobile device, which then translates the message and sends the relevant command to the designated appliance. The main goal is to develop a voice-controlled system that can manage all household services and applications, while also learning the user's preferences through machine learning algorithms.

KEYWORDS: NLP (Natural Language Processing), IOT (Internet of things), AI (Artificial Intelligence).

I. INTRODUCTION

The method of entering a residence without any help is referred to as home automation. This enables individuals to fulfill a physical or mental limitation that restricts their requirements. Many individuals, particularly the elderly, have a strong aversion to depending on others to accomplish their daily activities. In addition to individuals with physical disabilities, the program also caters to those with other types of impairments. As a result of this technology, these individuals will be able to live. Voice assistants utilize natural processing language (NLP), speech synthesis, and voice recognition technologies to assist users. For Internet of things (IOT) devices that lack touch functionality, a voice interface becomes essential. In addition to smartphones, voice assistants are also becoming increasingly popular.

Smart speakers, which are devices equipped with a speaker and microphone, are becoming more integrated into our daily lives. Due to the limitations of current systems and the advancements in IOT technology, the proposed solution relies on IOT as a bridge between users and household equipment. It possesses characteristics similar to those of a digital assistant. The objective of this project is to develop a system that integrates internet of things (IOT) technology with natural language processing (NLP) techniques, allowing users to control their household appliances and gadgets through voice commands.

The technologies currently employed in this industry are significantly less advanced than what we are proposing. Most of the smart home automation systems available today are limited to basic functions such as controlling lights and appliances. A wide range of products are available in the market that aim to simplify these common tasks, utilizing various technologies such as Wi-Fi, NFC (near-field communication), and Global system for mobile Communication. Nevertheless, whether they are implemented or recommended, these current systems frequently require complex connections with household appliances. Some systems depend on sending commands through a mobile device, while others necessitate pressing a button at a designated location.

II. LITERATURE SURVEY

The industry and the academic community have collaborated to achieve success. In perfect harmony, they are working together to make significant progress in the field of smart home automation systems. Several prominent technology companies, such as Apple, Amazon, and Google, have been actively involved in developing consumer products that

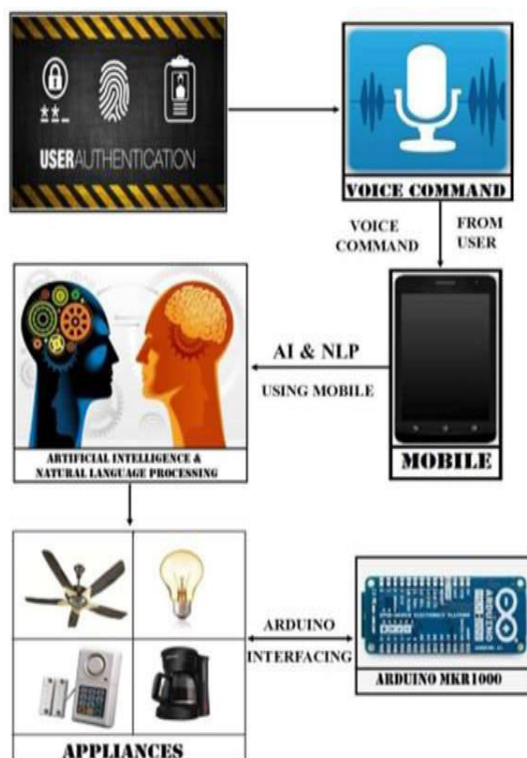
cater to the needs of the general public. Throughout this year, several of these devices have been introduced to the market, such as amazon echo,, Apple home kit, and Google home. Never the less, none of these systems aspire to have omnipresence or incorporate artificial intelligence to anticipate the user commands. In the past year (2015), there have been significant advancements in this field, prompting both companies and academic institutions to strive for further progress. Some home automation systems propose relying solely on wireless sensors and disregarding any another options. These systems employ basic technology, such as html web pages, to facilitate communication between the Arduino boards. They have also mentioned the possibility of using a mobile platform, but it would not enhance the proposed system, instead, it would make the implementation more complicated. The heavy reliance on wireless sensors could potentially result in inaccurate outcomes.

Alternative smart home system use of Arduino boards are the sole solution. These systems can be easily replaced by zigbee , raspberry pi, or any other programmable board, as their functionalities remain unchanged. These systems heavily rely on mobile devices as their primary control interface, limiting the flexibility to modify this setup. This is a worry for the user, as mobile devices are typically carried with them wherever they go, rather than being stationary in the house. They do not endorse voice commands from the user. [1]: The proposed system includes a voice recognition module, an Ardino uno microcontroller, a relay circuit, and a bed that can be modified. The voice recognition unit requires prior training to accurately recognize and respond to commands. Unfortunately, all of the listed features are only available for adjustable beds. The suggested idea is overly familiar and lacks proper design principles. [3]: It is common for multiple appliances within the same range to interpret the commands given to a specific device, leading to unintended actions. They do not employ natural language processing and artificial intelligence to comprehend the user's intentions. [5]: Most of home automation system rely solely on GSM technology for their implementation. Despite their impressive remote capabilities, the overhead of operating it in a small home environment is significant. The boards are challenging to meet the requirements of GSM technology, resulting in a significant increase in implementation costs.

III.PROPOSED SYSTEM

Our initiative aim is to offer the most seamless and user-friendly experience possible. An effective method to communicate with household devices by using spoken words in a manner that is easily understood by humans. We aim to simplify the application process by eliminating the need to navigate through multiple screens using voice commands. The project's based on natural language processing creates a bonding between our system and the users. Primarily, the user is authenticated by entering the specified username and password on their mobile device. The user issues a voice command to the mobile device, which translates the message and sends the relevant command to the designated appliance. Rephrase The mobile device understands the user's voice command through natural language processing. The mobile device serves as a central hub, it determines which appliance needs to perform a specific operation in order to meet as per the user's request. The main control hub can be a desktop application, web application, or a smart phone application, as all the data transferred can be processed by the cloud. The Arduino boards are connected to the appliances and programmed in a manner that allows them to react to mobile inputs. Our project streamlines the operation of all household appliances, resulting in a significant decrease in power consumption caused by unnecessary use or wastage of the appliances' services.

Architecture Diagram:



IV. IMPLEMENTATION

The aim is to provide the easiest and most easy way to interact with home appliances through spoken instructions in natural language. We plan to eliminate the need for navigating through multiple application screens by enabling control with single voice instructions by user. The natural language system in our system creates a more personal and user friendly connection for the user. Initially, the user is authenticated by entering a username and password on their mobile device. Once authenticated, the user issues a voice command, which is interpreted by the device and translated into the appropriate action for the specified appliance. The mobile device serves as a central hub, determining which appliance needs to perform the requested operation. This central hub can be a desktop application, web application, or smartphone app, with all data being processed in the cloud. However, for user convenience and enhanced mobility, we will be using a smartphone in this project. Home automation is one of the rapidly expanding industries that can change the daily life of people. Certain home automation system are designed those with special needs like the elderly and the bedridden people. The proposed System function can be integrated as a single portable unit and allows one to wirelessly control lights, fans, bed, television sets, and turn ON or OFF any appliance that is plugged into a wall outlet, get the outputs of different sensors and take decision accordingly. The system is light weight and designed in a way that is easy to install, Setup, run, and maintain. The problem lies with the situation of the elderly or bedridden people, who cannot usually help themselves to move around, and might require external assistance. People who live alone might also need a helping hand at home. Therefore a voice controlled home automation system is designed, so that the users can finished certain tasks by just the use of their voice commands, furthermore the system is designed to have a hand-held device so that the user can easily speak their commands, otherwise they would have to walk over to the microphone to speak. This project can quality of life for bedridden patients and older people as their voice command can trigger the control section that adjust their BED positions. It can also operate house hold appliances like, fan, AC and TV, based on the command. The motor used is a DC geared motor to lift the home/hospital bed and incline it to a desired angle.

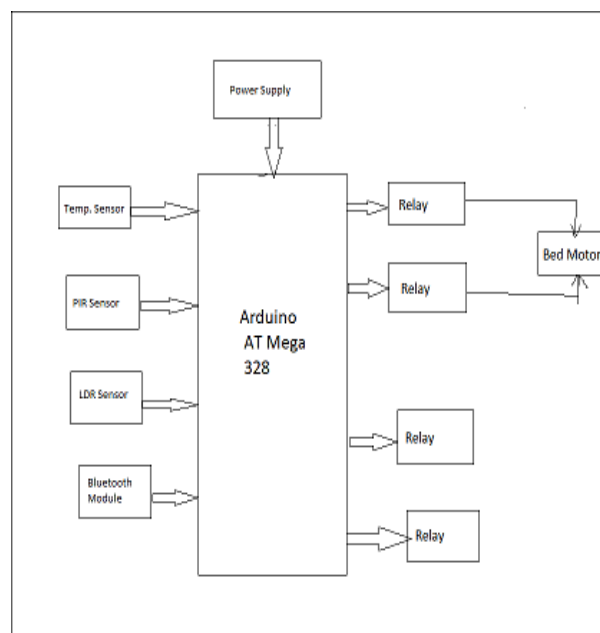
Voice Input: Describe the process of capturing voice commands through the mobile device or smart speaker, including any pre-processing steps like noise reduction or voice activity detection.

NLP Processing: Provide an overview of how the system interprets the user’s spoken commands, including steps like tokenization, parsing, and intent recognition.

Command Execution: Detail how the interpreted command is translated into an actionable task and sent to the appropriate smart home device for execution.

Feedback Loop: Explain the process by which the system collects data on user interactions and uses this information to improve its understanding of user preferences and behaviors over time.

Fig:1Block Diagram



The Block diagram consist of main bed control through voice. The main part of the system is to control bed which totally works on command. The instruction provides to the system are implemented through programming. Total 2 commands has being used they are either Bed up or Bed down head side. Only one command can work at a time. The use of android phone in the system to capture the voice i.e. to give the input commands. The Bluetooth of android system is connected to Bluetooth module what even the command has being recorded it will send to Bluetooth and then Bluetooth will transmit it to microcontroller. This is a switch which is available nearby patients’ bed. If air is needed simply says FAN ON and FAN OFF.If we want to turn on then use Light ON and Light OFF light will be ON automatically. This voice recognition system will transmit the data to the microcontroller enabling the motor driver circuit pins and entering into the desired mode of operation of the driver circuit and then the motor driver circuit will send the signal to the motor terminal to rotate in the specific direction.

V. HARDWARE IMPLEMENTATION

Implementing a virtual assistance smart home control system using AI & IOT and a relay driver is a practical and versatile approach. The relay driver acts as an intermediate between the AI & IOT and the devices you need to control, allowing you to switch them on or off based on voice commands. Here's a step- Connect to virtual assistant to services like weather APIs, news feeds, or smart home devices. Implementing home control with AI & IOT involves connecting various sensors, appliances, and other components with the AI & IOT to control and monitor different views of home environment. AI & IOT plays a key role in managing appliances and the it is connected to mains without use of any other external systems. Here is the hardware implementation of activated assistant for smart home control as shown below:

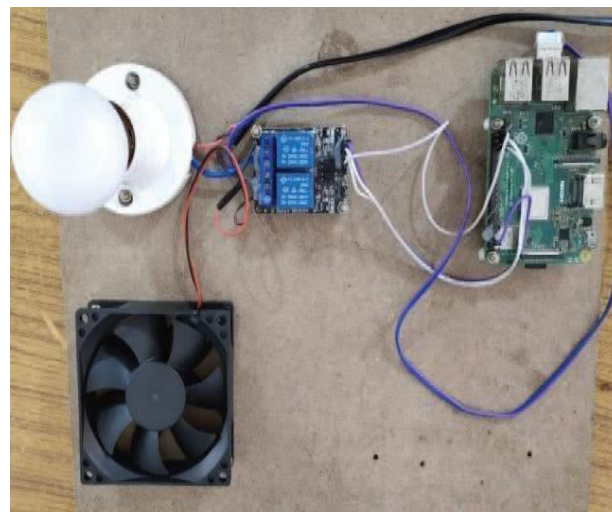
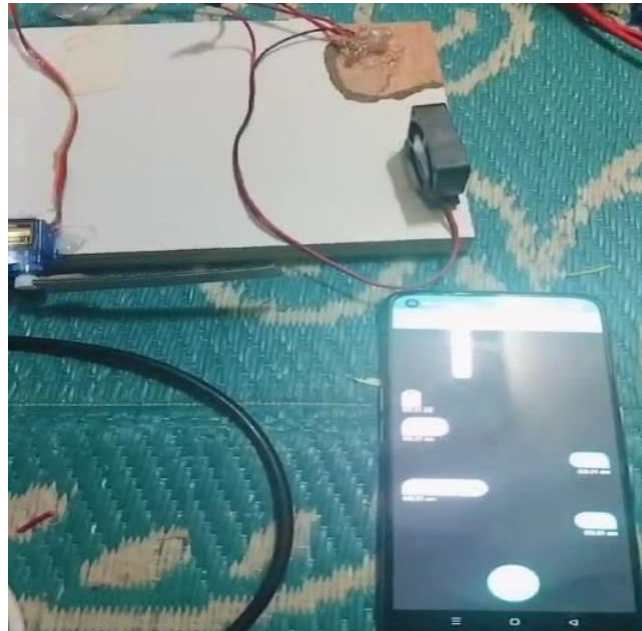
Fig:2 Hardware Implementation

Figure 2 shows the hardware implementation of voice assistance based smart home control system, it connects to light, fan using relay and a speaker for output. It can implement by using following steps: Step 1: Start the power supply. Step 2: Initialize system, Bluetooth module. Step 3: Pair mobile Bluetooth with the system Bluetooth module (HC-05). Step 4: In module mode, when Bluetooth module receive the voice command from the user then according to I/P command respective action take place Bed positions like upward and downward. Fan ON , Fan OFF also, Light On and Light OFF.

VI.SOFTWARE IMPLEMENTATION

Slave default Baud rate: 9600 Data bits: 8. Stop bit: 1. No parity pin I12 and F 11 can be connected to red and blue led separately. When master and slave are paired, red and blue led blinks 1time/2s in interval, while disconnected only blue led blinks 2times/s. Auto-connect to the last device on power as default. c. Permit pairing device to connect as default. d. Auto pairing as default. e. Auto-reconnect in 30 min when disconnected as a result of beyond the range of connection. To control the microcontroller, embedded C (Arduino IDE Tool) logic is used to control the motors

simultaneously. To design the mechanical bed, Fusion 360, Solid works and Auto- CAD are used. To simulate the electronic components, Proteus are used. To train the voice commands using Bluetooth module (HC- 05), Access port and UNO are used.

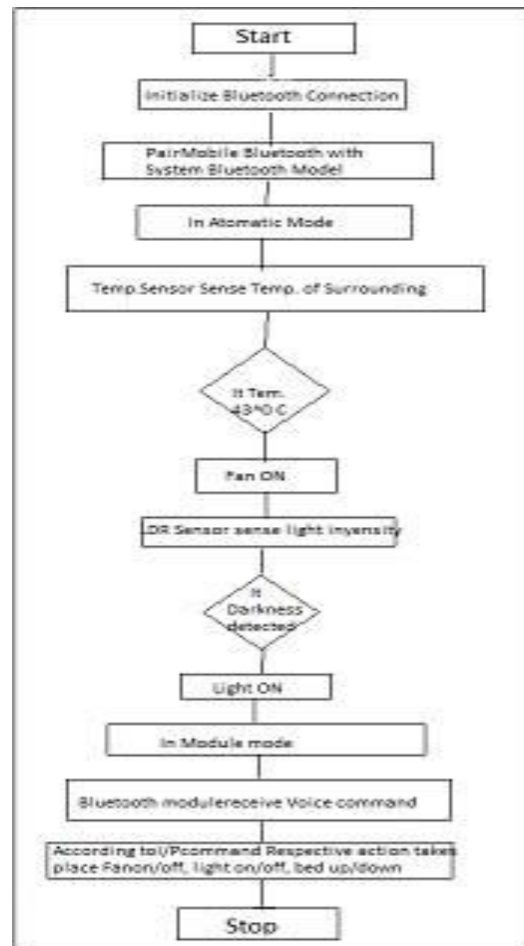


Fig:3 Flowchart

VII.CONCLUSION

The majority of current home automation system used a specific set of commands or procedures in order to interact with their home appliances. These complicated procedures distance the users away from the technology. To resolve existing challenges our projects address the solution proposes voice commands to controlling home appliances. These voice commands which are processed by Natural language processing helps the users to build a better connection with the technology and encourages them to use it more. It also eradicates the mundane task of operating home appliances manually.

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