Streamlining Your Living Space: Google Assistant-Powered IoT Home Automation for Modern Living

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Abstract- Advancements in telecommunications, informatics, and electronics have enabled greater comfort and safety within homes. In this paper, we present a study on voice-controlled home automation using the Google Assistant. By leveraging the power of speech recognition technology, this mobile application simplifies the process of controlling home appliances through voice commands, offering a convenient and hands-free way to interact with our living spaces.

Key words- Home Automation, Smart Homes, Internet of Things, Voice recognition, Google Voice Assistant

Introduction

The advancement of technology and modern lifestyle has led to the creation of more convenient working and living spaces. However, for many individuals, especially the elderly and those with health issues, spending most of their time at home cancreate challenges due to the complexity of technologyand the inability to adapt to modern equipment. Consequently, there is a significant social importance in enhancing the sense of safety, comfort, and ease in the home environment. Home automation or smarthome technology is an innovative solution that uses computers, automation, and electronic devices to improve the quality of life by simplifying tasks and enhancing comfort in various home life situations.Typically, a central hub or "gateway" connectscontrolled devices to the system, and users can access the control interface through wall-mounted terminals, tablets, desktop computers, mobile phoneapplications, or a web interface. Home automationoffers a wide range of benefits, including comfort, surveillance, convenience, efficiency, and safety.With the development of electronic and communication technologies, it has become possible to control and monitor all household appliances remotely from a centralized location [1-5]. In today's world, the use of speech recognition algorithms has made voice-controlled appliances increasingly popular in homes. While computers excel at working with structured data like spreadsheets and database tables, humans primarily communicate using words, not tables [6, 7]. This is where Natural Language Processing (NLP) comes into play, as it focuses on the interactions between human languages and computers at the intersection of computer science, artificial intelligence, and computational linguistics. NLP enables computers to analyze, comprehend, and derive meaning fromhuman language in an intelligent and practical way. In essence, NLP is a sub-field of AI that aims tofacilitate computers' understanding and processing of human languages, thereby allowing them to comprehend unstructured text and extract useful data from it [8-11].

Here, we have implemented the system with the help of IoT development board and essential sensor required for collecting the environmentalparameters/status of appliances in home. A voice recognition system is installed in our automation system which voice controlled control over the various components.

System Implementation

a.   Hardware Implementation

Figure-1 illustrates the various components involved in the development of the system. The system relies on NodeMcu, a Wi-Fi board that facilitates communication with the ThingSpeak webpage. NodeMcu receives and

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processes commands sent by ThingSpeak, which obtains data from Google Assistant via IFTTT. The data flow from Google Assistant to NodeMcu is made possible by IFTTT and ThingSpeak, with IFTTT guiding each command in Google Assistant to the appropriate field in ThingSpeak. ThingSpeak then transmits the data tothe NodeMcu board [7- 9].

b.   Software Implementation:

The technologies presented in our project (ThingSpeak & IFTTT) are working as a bridge to enable the communication between the Google Assistant and the NodeMcu microcontroller.

i.   Creation of ThingSpeak webpage:

ThingSpeak is an IoT analytics platform service that allows us to aggregate, visualize and analyze live data streams in the cloud. ThingSpeak provides instant visualizations of data posted by our devices to ThingSpeak. With the ability to execute MATLAB code in ThingSpeak we can perform online analysis and processing of the data as it comes in.
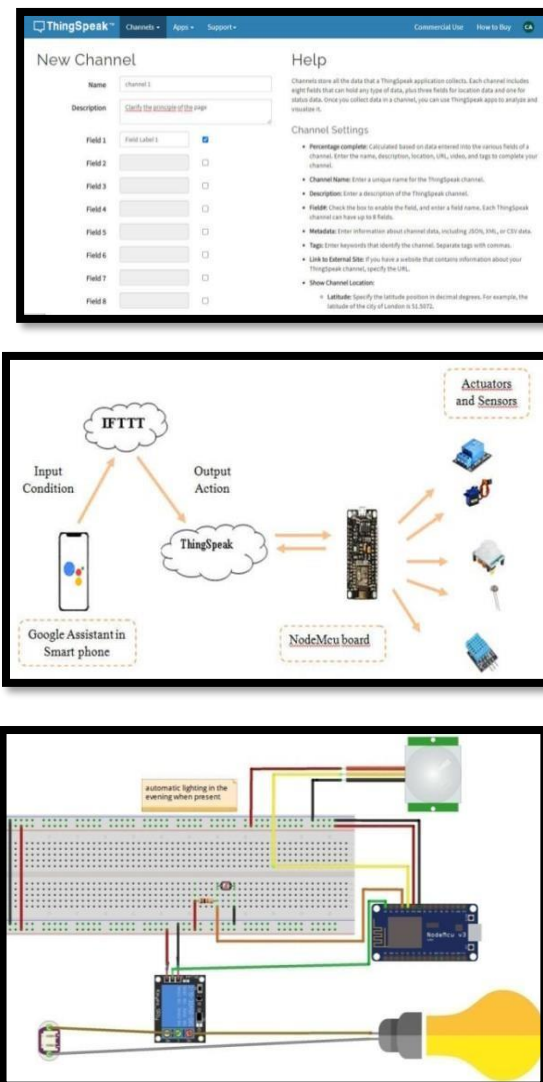

Fig. 1: System components and their logical and physical components arrangement & functioning.

ii.   Structure of ThingSpeak:

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After we have signed up and signed into ThingSpeak, we arrive on the main page of ThingSpeak, this page consists of channels (Fig. 2). Achannel is where ThingSpeak Collect data from a device, from another channel, or from the web.

Fig. 2: The first page of web application on ThingSpeak.

Once logged in to ThingSpeak, the first step is to create a ThingSpeak Channel by selecting "new channel". This will prompt the user to provide a name, description, and other relevant information about the channel in designated fields. Each channel comprises eight fields that can accommodate various types of data, as well as three location fields and
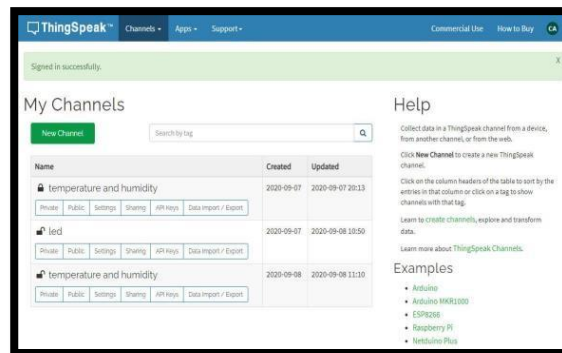
one status field. After creating a ThingSpeak Channel, thenext step involves publishing data to the channel, allowing ThingSpeak to process the data, and then retrieving the data using the intended application [15].

Fig. 3: Created channel page on ThingSpeakplatform.

Once the channel definition is complete, the user can save the channel by clicking "Save channel".Upon saving the channel, a page displays the channel information and relevant details needed to define the channel in the user's system. The ThingSpeak Channel provides various features such as private andpublic views, channel settings, sharing options, API keys, and data import/export capabilities.

The private view is a page that only the user can access, displaying the fields and creation time of the channel. In contrast, the public view allows othersto view the channel. The channel settings enable the user to modify or update the channel information as needed, while the sharing option lets the user choose whether to keep the channel private or share it with the public.

Additionally, the channel provides API keys,which enable the user to write or read data from a private channel. The API keys are automatically generated when creating a new channel. The data import/export feature offers a template file that specifies the correct format for data import. The user should use the field names field1, field2, and so on instead of custom field names as shown in Fig. 3.

The configuration options available in ThingSpeak include:

a.   Adding Visualizations: Users can visualize the characteristics of a channel by using the "addVisualization" function provided in the channel.

b.   Exporting recent data: The "Data Export" button onchannel views allows programmatic access to datafrom the API.

c.   Adding Widgets: Users can display custom visualizations on private and public channel views using configurable widgets, which eliminate the need for writing code.

iii.   Creation of IFTTT account:

IFTTT is a free, web-based service that focuses on creating simple conditional statements, known as applets. It allows users to easily connect various popular services and platforms on the web to trigger automated actions when certain

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events occur. The name "IFTTT" comes from its core functionality,which is based on the principle of "If this, then that". By signing up for a free account, users can enable their apps and devices to work together to accomplishspecific tasks that they couldn't do otherwise. Theworking principle of IFTTT is as follows:

•   Create a free account.

IFTTT plays a crucial role in this process by directly interfacing with Google Assistant to comprehend our voice commands and subsequently write them to a ThingSpeak channel (See Fig. 4). However, beforewe can begin communicating between the three web pages (Google Assistant, IFTTT, and ThingSpeak),we need to follow a few steps to set them up properly [12- 14].

•   Create a Google Assistant account in the mobiledevice.
•   Create an IFTTT account and it should be the sameGoogle assistant account.
•   Create a ThingSpeak account and at least onechannel.
•   Record the write API key from the API Keys tab inour channel view.
•   Click on create in the main page.
•   Choose the applications

To create an applet on IFTTT, we first need to choosetwo applications that we want to connect. We can start by selecting "this" from the main page, which opens up a list of applications we can choose from. Once we have selected an application, we need to set it up by providing the necessary information. Next,we move on to the second step, which is "that". Here, we choose the application we want to communicate with the first one. After completing all the necessary information and saving it, we have successfully created an applet that connects two applications. The process is simple and straightforward.

c. Connection to Google Assistant and ThingSpeak:

Before we can establish a connection between ThingSpeak and Google Assistant, it is essential to create a bridge that enables the transfer of information from Google Assistant to ThingSpeak.


Fig. 4: Say a simple phrase trigger.

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Once we are logged in to IFTTT, we can create an applet that connects Google Assistant and ThingSpeak. The first step is to set up Google Assistant as the trigger in IFTTT by selecting "this" and choosing a trigger while filling in the necessary information. Once the Google Assistant trigger is complete, we can move to the second step, which is "then." In the "then" section, we need to set up an action, and in order to complete our communication, we can choose webhooks. Webhooks are a way for apps to send automated messages or information to other apps. They enable our online accounts to communicate with each other and get notified automatically when something new happens. When we select the Webhooks card, we will need to fill in the Webhooks action fields. This will require a URL, which is a language made up of numbers and letters called an IP address that enables computer networks and servers to communicate with each other.
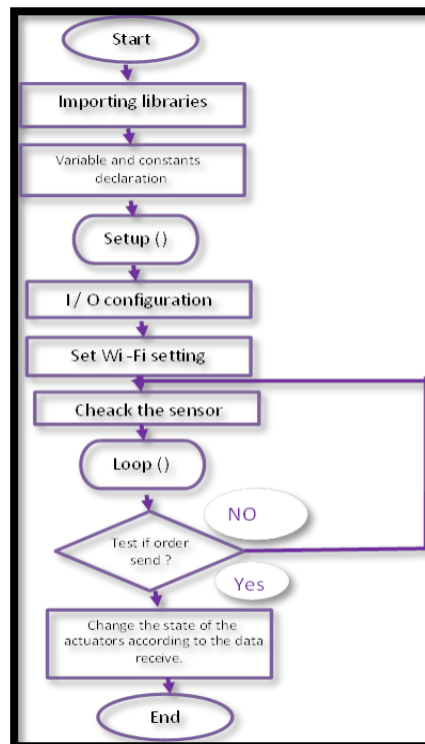
Fig. 5: Google assistant control ThingSpeak flowchart.

The URL used to define the action that the trigger is going to. In our project we define Google assistant as a trigger and ThingSpeak web page as an action. The ThingSpeak URL can define like the following parts:

Part 1: is the domain name which is ThingSpeak in our work.

Part 2: is the API Key, this key is defining the channel we use. We can find the API key in created channel page.

Part 3: is the field number and status. The field is defining the component related in.

Then, we have to fill the URL case in webhook request by the ThingSpeak URL. This step is to define to which channel and field the trigger we had created in Google assistant trigger is going to start.

After completing the applet creation process that establishes the connection between Google Assistant and ThingSpeak, it is necessary to save the applet. Figure 5 provides an organization chart that depicts a step-by-step guide to our working system, which aims to enable microcontrollers to receive voice commands from Google Assistant and use themto control connected home appliances.

Conclusions

Advancements in communicationtechnologies, computing, software, and intelligent systems have revolutionized the

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way people experience comfort and safety in their homes. With the emergence of new services such as energy saving, enhanced security, and improved comfort, homes are becoming smarter and more connected. In this study, we explore the use of the microcontroller NodeMcuto design a home automation system that monitorsand controls various home devices. The system isintegrated with Google Assistant and a web page,allowing users to control their devices using voice commands. This project involves the internet of things and requires modifying Google Assistant, which presented several challenges due to the noveltyand scope of the subject.

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