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TECHNOLOGY SHIFT TOWARDS INTERNET OF VOICE (IOV) : CONTROL IOT DEVICES WITH SMART VOICE ASSISTANTS

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Abstract

Smartphones have become indispensable for bridging the gap between the online and offline spheres. The internet is used for many purposes, including research, shopping, and even listening to music. Nonetheless, thanks to advancements in speech recognition technology and the Internet of Voice, we now have the option to do online searches by just speaking rather than typing or tapping on our smart devices.Everyday operations like turning on lights, running equipment, searching, asking brief questions, and more are beginning to make use of the internet of speech, not only in cars.Smart technologies have had us in their grip for decades, yet the whole experience has seemed cold and mechanical. Because of the Internet of Voice, our methods of communicating with others via electronic devices have evolved tremendously, compensating for the absence of human interaction.

Keywords : Internet of Voice, IoV, Smart Voice Assistants, Smart Voice Gadgets

Introduction

In 2020, 53 million individuals in the United States will have at least one voice assistant thanks to the explosive rise of voice search. The number of voice assistants has doubled since 2018 (to 25 million), and another 125 percent growth, to 275 million, is expected by 2023. This is a massive increase of 1000% in only 5 years, as reported by Juniper Research.

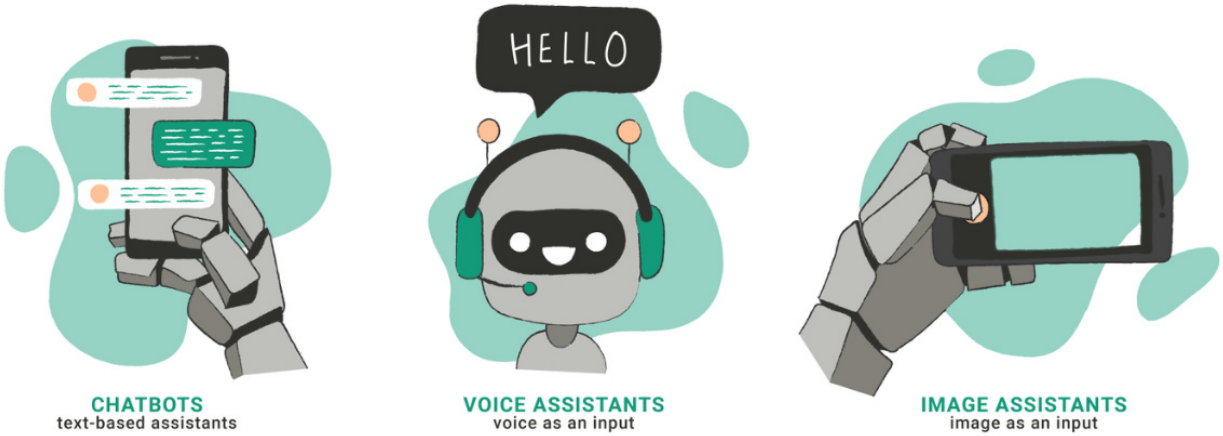

Figure 1 : Virtual Assistants

Inner Aspects of Internet of Voice

The main problem with IoT solutions is that sensors collect data first, then use complicated algorithms to draw conclusions. However, this is a convoluted method of data collection [1].

We need to create gadgets, figure out how to network them, collect data, and then perhaps draw some conclusions. Users must have some level of technical expertise in order to successfully deploy IoT development services and devices. Internet of voice users may pose queries and get timely, insightful replies.

For our cloud infrastructure, we rely heavily on Amazon Web Services (AWS). For starters, we utilise Amazon Cognito to register and authenticate users. With the use of a database stored on Amazon's servers [2], we can associate individual user accounts with unique IDs for individual devices. In the end, the mobile app's core access point is an AWS Lambda function combined with an API Gateway. In order to transmit orders to the RPB or read its current status, the mobile app communicates with the RPB through this cloud infrastructure, where the user registers and logs in with their credentials.

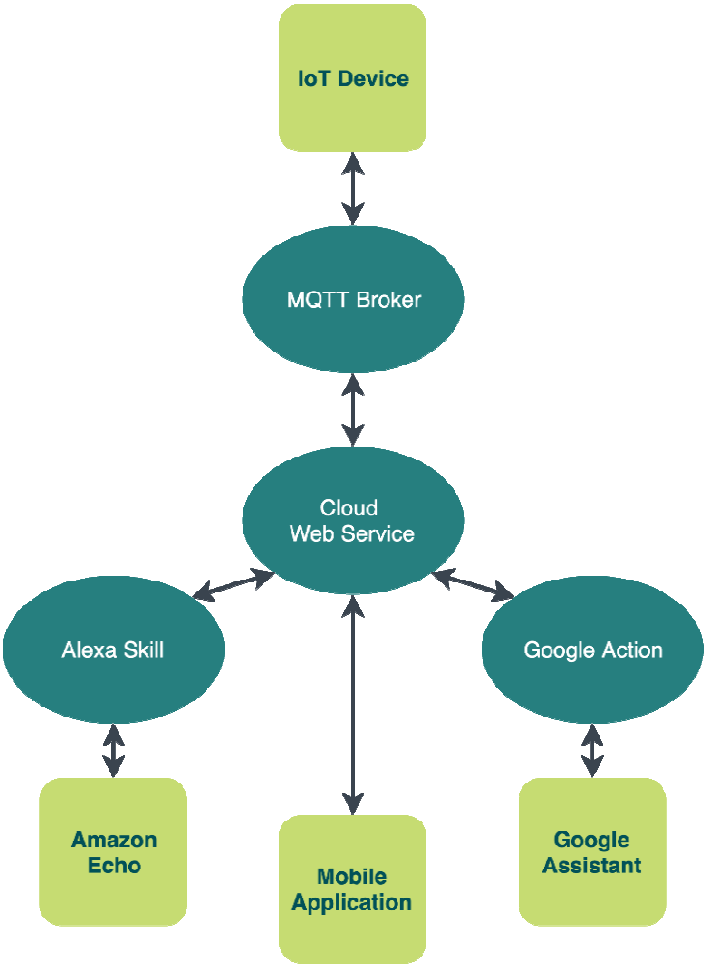

Figure 2 : Integration of MQTT Protocol with Virtual Assistants

We use an effective IoT protocol called MQTT to connect the RPB to the web service. So that it may receive instructions from the web service, the RPB subscribes to a MQTT broker. The phone communicates with the API gateway when the user activates the light switch. The AWS Lambda function receives this and notifies the MQTT broker. As a consequence, the hardware component is alerted to the command and activates the light [3].

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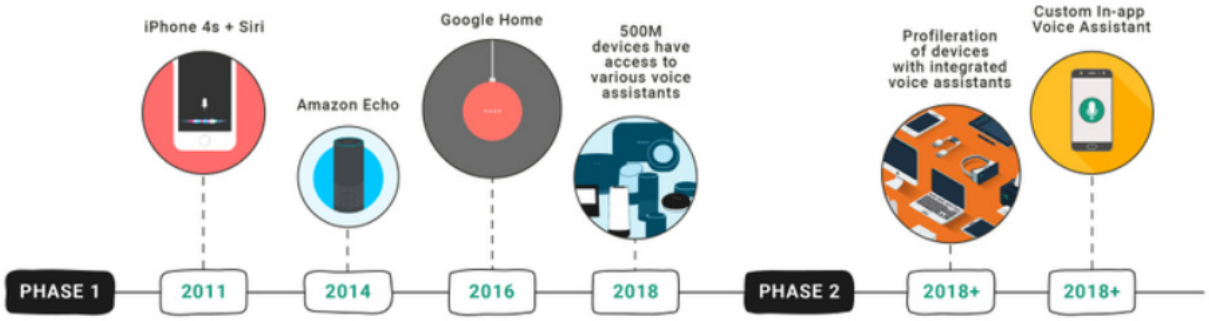

Figure 3 : Timeline in Smart Virtual Assistants

The lack of a more dramatic shift to voice search is unexpected, given the importance of oral communication in our cultures. But products like Google Voice Search and Alexa from Amazon have been crucial in transforming how people see and use voice search [4].

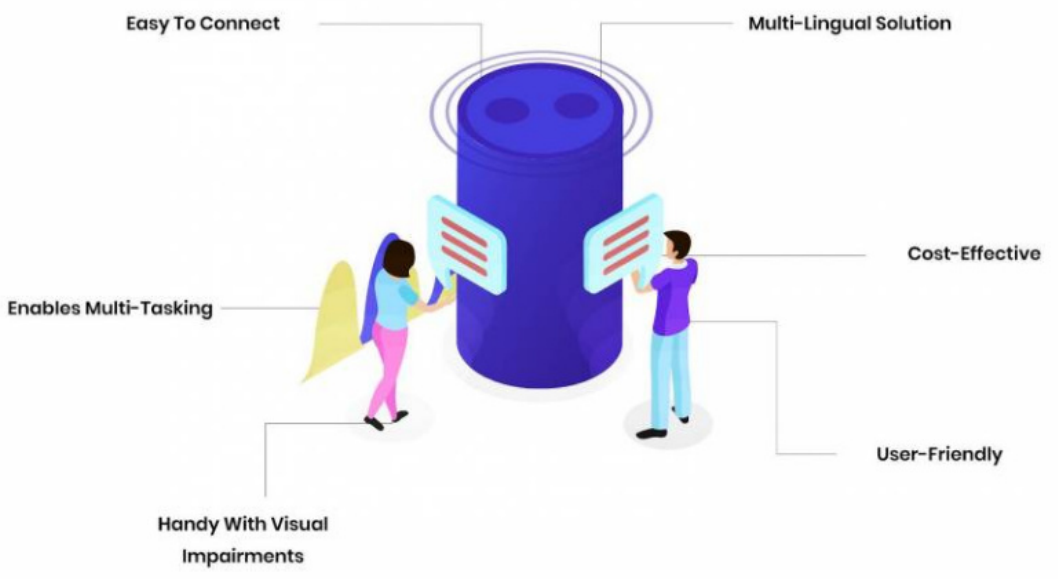

Figure 4 : Key Features in Smart Virtual Assistants

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With voice assistants, we can now talk to the internet rather of having to whip out our phones or touch a button. Until recently, voice search technology was primitive. However, with the rise of natural language processing, stable internet, machine learning, and devices that allow it, people have been able to make the transition from typing to conversing online.

U.S. Smart Speaker Market by Platform
2021, Shipments (000s)

Brand	2021 Shipments	2021 Market Share	2020 Shipments	2020 Market Share	Growth Y/Y
Amazon	21,936	44.1%	45,426	64.7%	-51.7%
Google	20,281	40.8%	19,821	28.2%	2.3%
Apple	7,527	15.1%	4,976	7.1%	51.3%
Total	**49,743**	**100%**	**70,223**	**100%**	**-29.2%**

Source: Omdia © 2022 Omdia

Key Advantages

There are many advantages to using voice search [5], but here are a few of the more important ones:

The fact that we humans are so good at striking up conversations makes it simple for us to establish verbal rapport with computers.While talking to their voice assistants, users may keep working on other activities.Those who have trouble seeing might benefit greatly from using a voice assistant.The price of touch screens and other smart gadgets that rely on touch input may be lowered with the help of voice assistants as well.Because of companies like Google Home and Amazon Alexa's efforts to improve their capabilities in other languages, voice assistants are becoming becoming a viable choice for markets that do not speak English.Voice assistants, which rely on natural language search rather than keywords, reflect this trend.With the help of IoT devices, you may tell your light bulb to switch off by itself or tell your fridge to restock its food supply using your smartphone's shopping app.Reading the news, listening to music, looking up items, requesting directions, and sending short messages are other major

advantages.While the definitions of these phrases may seem similar, they are really extremely distinct. The term "internet of things" is used to describe a network of autonomous, networked objects that exchange data without any human intervention.In contrast, speech and voice commands are used in the internet of voice to gather data and move it across the network.

Connected Technologies and the Future of Speech

Smart gadgets are increasing the interactivity and portability of technology. In reality, companies can quickly and easily create voice-activated apps by riding on the backs of already existing technologies like Amazon's Alexa. By reducing the need to acquire expensive equipment, this method facilitates the widespread adoption of voice-activated IoT in a more timely and cost-effective manner [6].

Back in 2011, when Google first introduced Voice search, it was more of a novelty than a standard service. Nonetheless, advancements in speech recognition technology mean that now more than half of smartphone users interact with their devices using voice technology. Also, over half of all individuals (41%) use voice search often.

Due to the rapid development of both hardware and software for speech technology, smart devices are driving the widespread adoption of the internet of voice throughout the world. Voice search is becoming increasingly portable over the world because to advancements in A.I., machine learning, and natural language recognition.

Every indicator shows that keyboards have a grim future if speech recognition technology continues to advance at its present rate. We may still be linked to our smart gadgets, but the way we interact with them may shift drastically. Even if voice searches wind up becoming the norm, we still may be able to see results on the screen or hear a response. Everyday household items may soon be improved, regardless of whether you use Apple's SIRI or Amazon's Alexa. They may evolve into smarter, more responsive devices that can be controlled by speech [7].

Telephone conversations may now be made over the internet thanks to a technology called VoIP (Voice over Internet Protocol). It's cheap, loaded with features, and totally mobile [8].

The IP address is used by computers and other devices for efficient communication across a network. Plugging the phone into a router enables internet calling. When a call is made utilising VoIP, data is transferred in discrete packets rather than whole voice messages. With the internet, information can be sent to any part of the globe in a matter of seconds.

Phones equipped with VoIP technology can make and receive calls across a LAN. Then, when you dial a phone number, your internet-connected phone communicates with your VoIP service provider to set up a call. Once a link is established, packets of information may be sent and received between the two devices. Digital signals are processed by the VoIP phone before being rendered into audible speech.

Development and Deployment Perspectives

Voice assistants are just pieces of software that can process natural language (NLP). The user may provide a voice command to the app, and the app will then provide an audio response, with the requested information. Voice assistant programmes simplify a wide range of tasks, from playing music and making phone calls to launching apps and turning lights on and off. To this day, the number of people using virtual assistant applications continues to rise, which is a major factor in the industry's meteoric rise [9].

- The user makes an audio request, and the virtual assistant breaks it down into phonemes, the fundamental units of speech.
- With the use of Speech-To-Text technology, these phonemes are transformed into a string representing the request. Additional information about the user, the session, and the session is stored in the JSON file.

- For both the content and the purpose of the request, JSON processing will take place in the cloud.
- The action taken will depend on the motivation behind it. As SSML or a string, it will be included inside a bigger JSON file.
- We'll utilise AI (Text-To-Speech) to handle the reply, and then send it back to you [10].
- The Rise of Voice-Activated Assistants in the Business World and Why They're Taking Over
- The rising popularity of voice assistant apps may be attributed to a number of factors, many of which have piqued the attention of companies in speech recognition app development solutions.

These applications ensure that work flows smoothly and efficiently without any hiccups. The app's straightforward interface makes it suitable for all users, young and old alike. Users may start a discussion with the voice assistant by simply hitting a button.

The developers of voice assistant apps make their products in such a manner that consumers feel a personal connection with their assistance. That gets people excited to start using these tools more often.

Rapid Outcomes

Because of how quickly instructions can be sent, businesses are opting to use virtual assistant app development services. Voice communication facilitates instruction at a much quicker pace than typing or touching. It's simple for customers to receive immediate results by just issuing instructions to Alexa [11].

Fascinating AI has made several important contributions to the field of mobile app development, and this has had a profound effect on the industry as a whole. The novelty of voice-activated digital assistants like Siri, Alexa, and others appeals to both adults and youngsters.

This rise in popularity may be attributed largely to the trend toward speech technology. Even while users may provide directions to search engines by typing them in, most choose to utilise voice commands instead. That's why it's important for companies to invest in skilled app development from industry leaders in the field of voice assistants so they can reach a wide audience [12].

A total of 3.25 billion digital voice assistants were in use at some point in 2019, according to the data. There were then 4.2 billion voice assistants in use by the year 2020. Current projections indicate an increase to 8.4 billion digital voice assistants by 2024. Please see the accompanying image for further information:

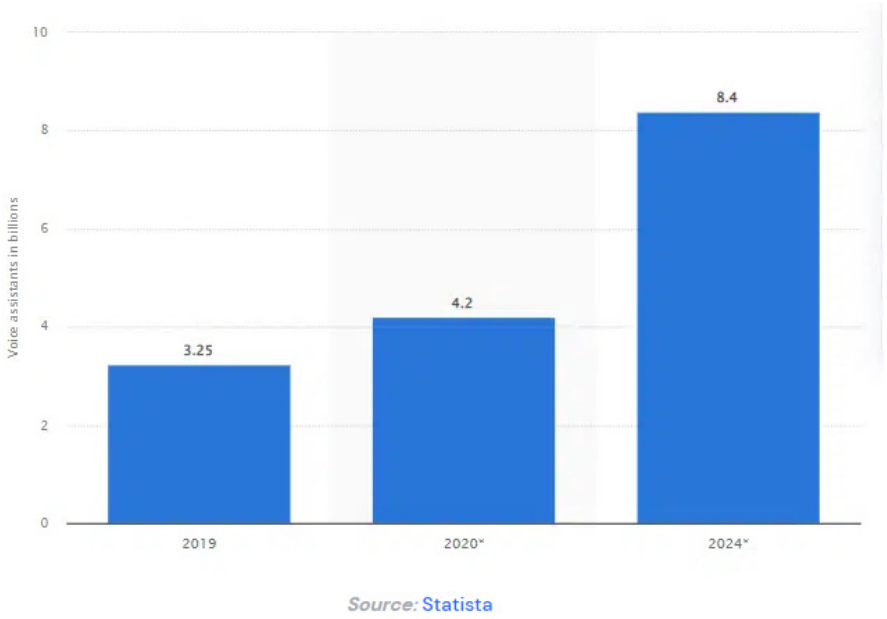

Figure 5 : Diversion of Marketplace and prominence levels in implementation of Virtual Assistants

Key Voice Assistants in Global Marketplace

Voice assistants are thriving in the global digital industry and enjoying explosive growth in popularity. Siri from Apple, Google Assistant, Amazon's Alexa, and others are just a few examples of virtual assistants available. That's why so many companies are also investing in mobile app development services that include voice assistant integration. What follows is a comprehensive breakdown of each of these groups:

Google Assistant has supported the vast majority of Android smartphones used by people throughout the globe, regardless of the lesser number of specialised smart speakers. Google's primary motivation for creating the Assistant was to provide the highest quality user experience possible. Google's virtual assistants are designed to save consumers time and entertain them in the process of becoming an integral part of their everyday lives.

Games and other forms of interaction that are specifically designed for use with Google's platform are fantastic, especially because of the special attention paid to ensuring that they are suitable for children. Canvas, representing its conventional approach, was recently introduced for use in games. Since Google's platform has a more limited directory, it is significantly more strict about the submission of talents.

Apple Siri

It has been reported that Siri has around 375 million monthly users. The widespread availability of Apple products that support this voice assistant has led to its widespread adoption by a sizable population of end users throughout the globe. If you want to build an iOS app that works with a voice assistant, you'll need to hire some serious Swift mobile app developers. If you want a reliable app, you need to hire people with the necessary level of expertise.

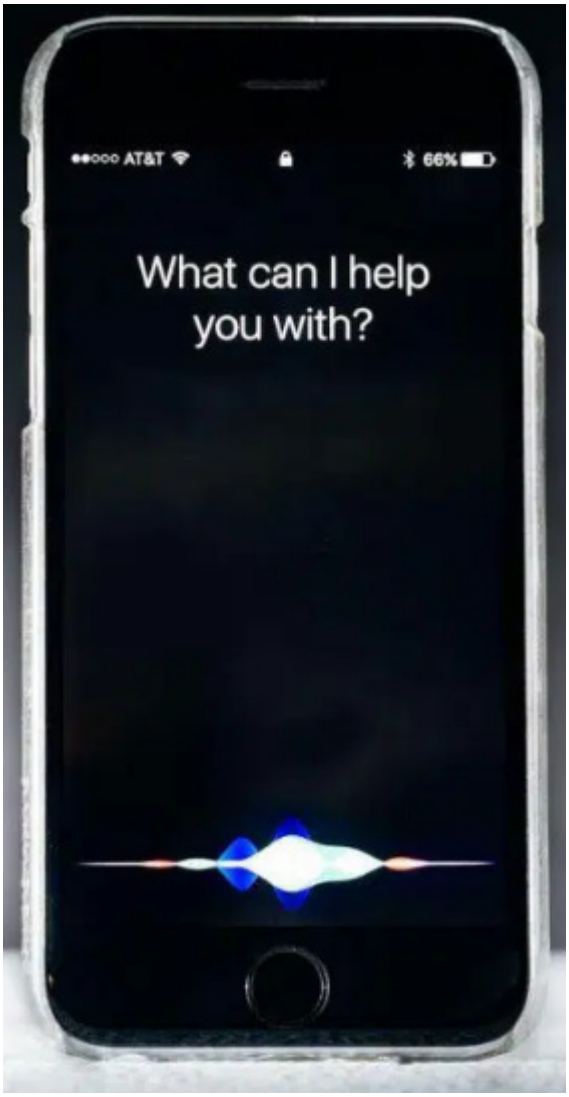

Figure 6 : Apple Siri Virtual Assistants

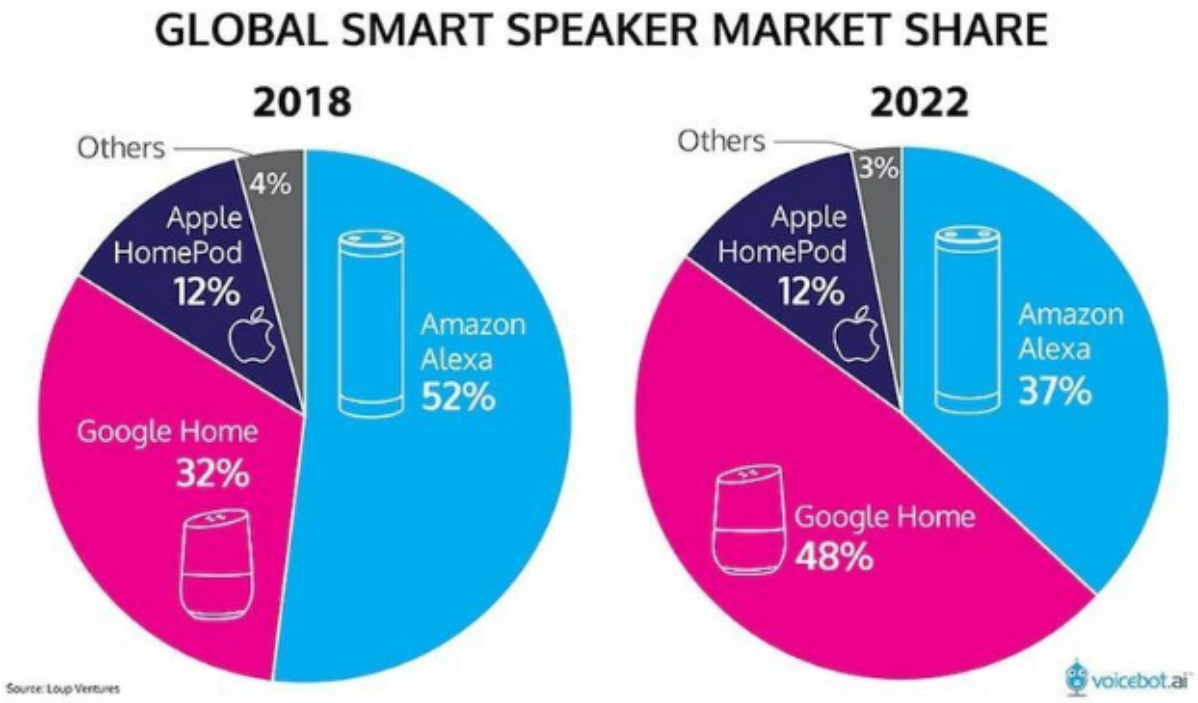

Figure 7 : Market Size Analysis

Amazon Alexa

Amazon's 2019 gadget sales have been reported at over 100 million, with the company's own line of smart speakers and smart displays accounting for the bulk of that total, followed by the company's Fire line of products, streaming media players, and tablets.

Figure 8 : Amazon Alexa

Amazon-specific skill sets are designed to facilitate online shopping. If you're looking for a reliable host to host your e-commerce expansion or subscription business, Amazon is your best bet. There is no required Internet service provider (ISP) for Alexa skills, and it welcomes contributions from anybody for any purpose [13].

Development Aspects

Step One: Formulate a Strategy

This approach utilises APIs and other development tools, together with any existing speech technology, to include into a mobile app. Overall, creating an app on par with Siri or Alexa is really difficult, therefore you'll need the assistance of a professional mobile app development firm. To use this approach, you will require a toolkit to specify the goals as different types of

requests, which will then be sorted into different "domains." Although our emphasis here will be on the three most popular technologies among our audience -

Siri

In the beginning, Siri was not accessible through most third-party apps, but with the arrival of iOS 10, that has drastically changed. At this year's Worldwide Developers Conference (WWDC), it was revealed that Siri may be used to interact with preexisting apps in a variety of domains, including messaging and contacts, audio and video conversations, picture searching, Siri-enabled payments, and the scheduling of fitness-related cars. To facilitate the integration, Apple provides a tailored SiriSDK that includes two frameworks. In the first, you'll find a list of all the many ways the app can help you out, and in the second, you'll get a visual depiction of your data based on the actions you've taken thus far. There is a unique set of activities, or intents, associated with each app category. SiriSDK offers unique classes for these intents that have clear attributes. This picture demonstrates how Siri handles Intents.

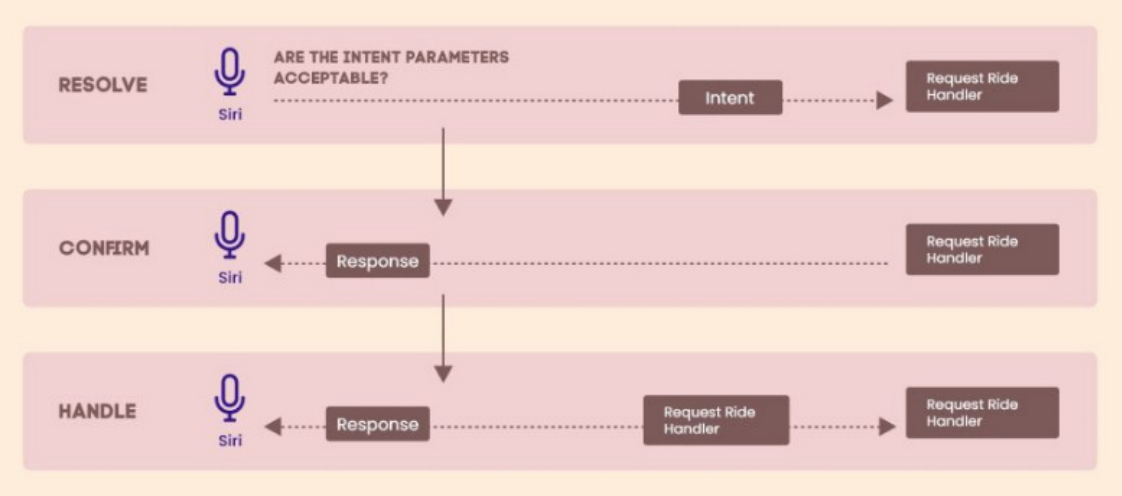

Figure 9 : Intents Processing with Siri

Cortana

If you want to learn how to include voice help into an app, you should look at how Cortana does it. Microsoft's Cortana speech assistant is available in desktop and mobile programmes. Users may adjust the voice command settings without having to initiate a conversation with Cortana. Let's go right into how to send a request to a chosen app. The name of an app may be included in a voice command in one of three simple ways:

When the app's name comes before the spoken instruction, this construction is called a prefix. When the app's name is interposed between the verbal cues, this construction is known as infixal.Suffixal refers to the use of an application's name at the conclusion of a command phrase.Cortana also allows users to activate the programme in the foreground or background using voice commands.

Machines that act as virtual Google assistants

Unlike Apple, which imposes rigid standards on design, Google has always shown its engineers devotion and support. Although the play market is faster than Apple's app store, it still takes some time for apps to be approved before they can be downloaded. Integration with smart assistants is approached more cautiously. Only certain applications, such as Lyft, eBay, Airbnb, and more, are now compatible with Google Assistant. With the use of an exclusive API, these may make their own Now Cards. One must first register their app with Google in order to use the Google Assistant to perform actions inside their app.

One key distinction to keep in mind is how the Google Now assistant differs from traditional voice commands. In contrast to voice actions, which can be integrated with any third-party app through the voice actions API, the Now assistant is limited to a small number of applications.

Integrating Custom Application Programming Interfaces and Artificial Intelligence Tools

You don't have to limit yourself to the aforementioned tools if you want to add voice control to your app. Additionally, developers may use a variety of AI tools and bespoke APIs.

Here are a some of the more well-known ones that you may use as building blocks for your own custom voice assistant:

Jasper

Those who want to develop their own personalised AI helper but don't want any help from other sources will find this tool to be most useful. Jasper is a Python programme that is capable of learning and listening. Active module offers the first capacity, whereas passive module proposes the second. It can do any work at any time. It is able to save you time and effort by continually learning and then presenting you with accurate information.

Melissa

You want to learn how to make an Alexa-like app, right? If you're just starting out in app development and would want to make your own AI assistant app, Melissa is a crucial resource to have on hand. Melissa is modular, so if you want to update or add a certain feature, you can do so without affecting the rest of the algorithm. Melissa can do a wide variety of tasks, like write, talk, upload images, read the news, and listen to music. It supports many platforms (Windows, OS X, and Linux) and is developed in the Python programming language.

Dialogflow

Voice-to-text technologies are supported by the Dialogflow. Voice recognition is used to provide orders and receive responses. Users may choose between a free and a premium version. Cloud-based collaboration is only available in the premium tool, which is the main differentiator between the two editions. So, it's a good fit for folks that value privacy and secrecy above all else when it comes to their data.

API.ai

The API.ai library offers a wide variety of purposes for those interested in learning how to create a voice assistant. This app helps with speech recognition and related tasks by converting spoken instructions into text. The service is similar to others in that it relies on identification and conclusion to function.

The commercial version of API.ai has the added benefit of allowing users to access their own personal cloud while still being available for free to the general public. Any user who values their privacy may thus simply make that choice for themselves. Many different application programming interfaces (APIs) are available on APi.ai, such as those for Android, iOS, Cordova, Windows Phone, Node.js, Python, C#, and Unity.

Wit.ai

Intents and entities are two crucial parts of your app that need to be set up before you can start using Wit.ai. Like Siri, the user's actions are supported by their intent. As such, entities represent the specifics of a user's goal, such as their current location and time. Here, developers are provided with a large pool of pre-made intentions to choose from, eliminating the need for them to create their own. Despite that, anybody may utilise this resource without cost. When working with a Wit.ai-powered virtual assistant app development service, there are some guidelines to adhere to [9].

Wit.ai, like API.ai, provides a wide variety of APIs to programmers working on a variety of platforms. This programme also features a JavaScript plugin, which is useful for front-end developers.

Third Strategy: Necessary Components and Technologies

A cloud infrastructure consisting of additional programming languages is required if you want to create your own AI-powered voice assistant software like Alexa or Siri. Current voice assistant

applications make use of natural language processing and speech recognition technology to further understand and process the words being said. It's important to be well-equipped with the right knowledge and tools before investing in voice recognition app development services. What follows is a list of technologies that might be useful in developing a voice assistant app [14]:

"Speech to Text" or "Voice to Text" technology.

Voice or speech signals are converted into digital data, such as text data, as part of this procedure. This discourse might arrive as a file or a stream. CMU Sphinx may be used to process the data.

TTS (Text to Speech)

It's the inverse of speech-to-text systems, which convert user input (text or pictures) into human voice. To utilise it, a user must first enter a word they are having trouble pronouncing and then click on the "Pronounce" button.

Limiting Noise

The user's speech may be garbled or otherwise inaudible to the voice assistant due to ambient noises such as traffic, electrical equipment, or other people talking. This technology reduces or eliminates distracting background noise to make communication simple. In addition to being a huge help, this function will also provide consumers with a fantastic experience [10].

Automatic Classification and Decision Making

A method of intelligent tagging is employed to decipher the user's inquiry. Say the consumer wants to know where he can spend the weekend. Then, depending on the user's preferences, the system will assign ratings to all of the best hotels and tourist destinations. Integrating this technology is simple, and any iOS or Android mobile app development business that understands how to make a virtual assistant effectively can help you do it.

Voiceprint technology

If you're building your own AI assistant, this is a crucial safety measure to include. The voice assistant uses it to determine who is speaking and whether or not to answer. In this way, speech biometrics protects its users from embarrassing circumstances, such as when Alexa or Siri switches off the lights or lowers the house's temperature while hearing conversations from TV characters.

Talk-to-Text System

The voice and the call out are the two main components. What people hear or see in response to a request is known as the voice interface. Contrast this with callouts, which are what consumers really see when the visualisation is implemented [11].

Compression of Spoken Words

In this case, the app's client side will reformat the audio data into a more compact format before sending it to the server. The goal was to ensure that the software ran smoothly and quickly without any lag time. This method works well with the G.711 protocol.

Important Considerations When Attempting to Make a Siri-Like App,

There are definitely many factors to think about before beginning the process of creating a mobile app. In a similar vein, the following considerations are essential before you launch your virtual assistant software [12].

The First Step Is to Choose the Proper Environment

Before beginning the process of creating a voice assistant app, it is important to learn as much as possible about the current platforms. Choosing the right platforms and services from the many that already exist might be difficult. Create a list of questions such, "What is the best platform to use, and who do you want to use your AI personal assistant to help them with?" if

you want to create a successful AI personal assistant. Then, you may confidently choose the best system for your voice-based app.

The Second Step: Pick the Necessary Options

Your voice assistant app's effectiveness may be greatly improved by including a few key features. Here, you should check over the competition's applications to determine what features users like and incorporate them into your own. The popularity of an app depends in large part on its ability to attract users' attention. It's important to make a calculated decision since it may affect how much it costs to build a voice assistant software [13].

Third, design for actual consumers.

It is important to think about the people who will be using your virtual assistant while you learn the ins and outs of making one. Knowing the target audience and tailoring an AI assistant app to their preferences requires a deep dive into who they are, what they enjoy, what they're searching for, how old they are, and a whole lot more.

Companies who are interested in creating a virtual assistant app naturally want to know how much it will set them back to create something comparable to Siri or Alexa [14]. If you, too, are wondering this, you've landed at the perfect spot to get the info you need. Here, we'll discuss the estimate to develop a voice assistant app and the variables that might affect this number. Some of these elements are:

- The platform chosen as the host for the voice assistant app
- Technologies of choice for creating the app
- Creating Equipment via Design
- Expertise and location of developers
- Due of the app's complexity,

- The ultimate price of the AI assistant app is heavily influenced by the aforementioned parameters. Given this, the average price tag for creating an app comparable to Siri, Alexa, or Google Assistant is between $40,000 and $50,000.

In addition, there are further factors to consider, such as the fact that the expected cost will be lower if you get outsourcing services from the Asian area but will likely be more if you obtain services from European nations.

Everyone is aware of the meteoric rise in popularity of voice assistant applications like Alexa and Siri. Due to their widespread adoption, technologies have quickly become indispensable to modern society. Currently, the timing to enter the voice technology market is prime. The market for intelligent voice assistants is growing rapidly, with new products being introduced regularly.

Now that AI-powered mobile applications are all the rage and everyone wants in on the action, companies are stepping up to the plate. As such, they may get a comprehensive understanding of what it takes to create a voice assistant software that can compete successfully in the market just reading the preceding piece.

Conclusion

Disruptive and holding the promise of lessening our reliance on smartphones, Internet of Voice technology is here to stay. There will be less of a need to tap or touch the phone repeatedly to get a response, which will drastically alter how we interact with our mobile devices. The proliferation of hearable gadgets, cutting-edge Internet of Things development services, and speech recognition software all point to a future where more and more tasks may be performed by speaking to a computer or smartphone.How we interact with voice assistants is being profoundly altered by recent developments in AI and ML.Business organisations are only now starting to grasp the full potential of voice integration as voice has emerged as the pinnacle of the mobile experience. According to a recent study by PwC, those between the ages of 18 and 24 are the most likely to use a voice assistant. However, those between the ages of 25 and 49

are the most likely to make use of a voice assistant.Voice has a lot of room to expand in the future, but many firms are hesitant to adopt a voice strategy due to a shortage of personnel with the necessary abilities. The voice presents a chance to learn about your customers and provide them exceptional service if you're in it for the long haul.

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