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語音助理現況與普及性 – 以 Google Assistant 為例

Google Assistant: Case Study of Voice Assistant Adoption

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中文摘要

本文探討了語音助手在台灣市場的使用，並提出相關建議作為相關市場拓展的參考。

語音革命正在發生。由於語音互動的便利性，使用語音助理在在美國、歐洲國家和中國越來越普及，人們習慣透過不同的裝置與語音助理互動，如智慧型手機、智慧型音箱及車載系統等。在所有裝置，最多人使用的是智慧型手機上語音助理。台灣的智慧型手機滲透率高，其中多數人使用 Android 系統，因此，本研究以探討智慧型手機上的 Google Voice Assistant 作為研究案例。

本研究通過 400 份調查問卷收集數據並分析回覆內容，以了解台灣市場中語音助手的當前認知度和使用狀況。分析中包括使用語音助理的原因、使用障礙、使用功能和頻率、障礙改善的影響，以及非用戶障礙和潛在機會的分析。

本研究結果並為語音助手的設計提供了建議，並有望增加語音助理在市場上的使用。

關鍵字：語音助理、智慧型助理、語音助手、語音購物、聲控

ABSTRACT

This paper explores the use of voice assistants in the Taiwan market and suggests relevant recommendations as a reference for relevant market expansion.

Voice revolution is happening. Because of the convenience of language interaction, the use of voice assistants in the United States, European countries and China has become more and more popular, and people are accustomed to interacting with voice assistants through different devices. Among all devices, the largest market share is smartphone-based voice assistants. Taiwan's smartphone penetration rate is high, and most of user use the Android system. Therefore, this study uses Google Voice Assistant as a research case to explore the use of voice assistants on the market.

This study collected data through 400 questionnaires and analyzed the response to understand the current level of awareness and usage of the voice assistants in the Taiwan market. The finding of the study included reasons for using voice assistants, obstacle of use, functions and frequency of use, the impact of obstacle improvement, and analysis of non-user obtacles and potential opportunities.

The results indicate that the study provides some suggestions for the design of voice assistants and is expected to increase the use of voice assistants on the market.

Keywords: Voice Assistant, Siri, Google Assistant, Smartphone-based Assistant, Voice Commerce

Table of Contents

5

LIST OF FIGURES

6

LIST OF TABLES

7

1 Introduction

1.1 Research Background & Motives

Voice is quicker, easier and more convenient than typing, eMarketer indicated that: "Consumers like the natural interaction and convenience of voice.", and "The trend of computer computing is gradually shifting to the voice interface, because the voice technology products are not expensive, and users do not need to type and respond well."

The rapid progress of speech recognition affected the development of voice assistant. Google machine learning dropped the WER (Word Error Rate) from 23% to 8% from 2013 to 2015 on Google Now. The speech recognition achieved 95 % accuracy of human English language in 2017, which is the same as the current threshold for human accuracy.

With the good performance on voice recognition, voice assistants have been widely used on a variety of devices. The smartphone has the biggest usage for voice assistant access. Juniper Research announced that smartphone assistants will be the largest platform by volume because of Google Assistant and Siri. According to a survey by the Pew Research Center (2017), nearly half of United States adults (46%) use voice assistants, and 42% of U.S. adults use voice assistants through smartphones. The usage rate is much more than other devices such as computer or tablet (14%) or stand-alone devices like Amazon Echo or Google Home (8%) which indicate that voice assistant is changing. eMarket also pointed out that voice assistant is on the trends that will shape retail in 2019.

A total of 72.2% of the population own smartphones. Taiwanese mainly access the Internet via mobile phones in Taiwan, and 88.2% of Internet access was through mobile phones in 2018. In terms of market share, 64.5% of smartphone users in Taiwan use the

Android system, which is almost twice that of iOS users (33.7%).

In order to enhance the voice assistants adoption in the potential market with high smartphone penetration, this study will analyze the current market conditions and provide opportunities and suggestions for the future popularity of voice assistants.

Taiwanese can interact with Apple Siri in Chinese since 2014 through iOS devices. With limited functionality, it did not create a wave of voice assistant penetration. Google Assistant launched the Chinese version in October 2018. Being a new entrant, Google Assistant is mainly deployed on Android devices, and can also be used on the iOS system as a standalone app. Therefore, Google Assistant is chosen to be the focus of this research.

1.2 Research Purpose

The purpose of this study is to understand the current state of voice assistant usage, propose recommendations to enhance the adoption of voice assistants on the market and to further the development of future voice assistant system.

The specific objectives were presented below.

1. To understand the presence of voice assistant in the market.

2. To categorize and understand users' motivation and non-users hindrance for the adoption from a bottom-up approach.

3. To use the findings of this study to make suggestions for future voice assistant system development.

1.3 Research Outline

The following body of work is structured in the following sections:

- Section 2 Literature Review: The definition of voice assistant, the current research

status regarding voice assistant adoption, and smartphone usage in Taiwan. A review of the extant literature, to identify the opportunities for this study to contribute knowledge to the literature.
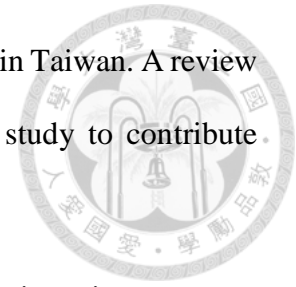
- Section 3 Methodology: This study uses a case study and questionnaire survey to verify voice assistant penetration, understand user experience and non-users' hindrance of voice assistants usage.

- Section 4 Case Study: Introduces Google Assistant including recent development, and comparison with Apple Siri. Analyzes the two major brands of voice assistants based on mobile phones, as a reference and comparison for the following survey in this study.

- Section 5 Survey Results and Analysis: The data was collected through a questionnaire on the internet and a total of 400 valid questionnaires were collected. A bottom-up thematic analysis was carried out to analyze the quantitative survey data.

- Section 6 Recommendation: The result based from relevant research review and analysis of the survey are reported, including voice assistant current penetration, the motivation of adoption, hindrance of non-user and potential use opportunities, by which to reach research purpose.

- Section 7 Conclusions: Summary of the current situation and opportunities based on findings and recommendations which are adopted by Taiwan's voice assistants.

2 Literature Review

The review of literature focused on defining and introducing voice assistant, moreover the other part of the review focused on identifying current user experience of voice assistants from a broader perspective to gain a general idea of user's needs and their interaction with the system.

2.1 Definition of Voice Assistant

Voice Assistant is often confused with several names: Intelligent Personal Assistant, Automated Personal Assistant, Smart Assistant, Virtual Digital Assistants, and Chatbot.

The definition of the voice assistant referred to in this study is mainly based on the definition of Matthew B. Hoy 's literature: "Voice assistants are software agents that can interpret human speech and respond via synthesized voices…", "and are embedded in smartphones or dedicated home speakers. Users can ask their assistant questions, control home automation devices, and media playback via voice, and manage other basic tasks such as email, to-do lists, and calendars with verbal commands."

Voice-activated technologies

The early development in Natural Language Processing (NPL) influenced recent voice recognition. In 1962, IBM demonstrated "ShoeBox" at the IBM Pavilion of the World's Fair in Seattle. It was the forerunner of today's voice recognition systems, which was able to recognize 16 spoken words and the digits from 0 through 9.

In the 1970s, scientists at Carnegie Mellon University created Harpy. It could recognize 1,011 words, which is about the vocabulary of a three-year-old person. The Julie doll which came out in 1987 could recognize a child's voice and respond to it. Apple

began building speech recognition features into its Macintosh computers in 1993. Dragon came out with Dragon Naturally Speaking in 1997, which was the first continuous dictation product and able to understand about 100 words per minute and turn them into text.
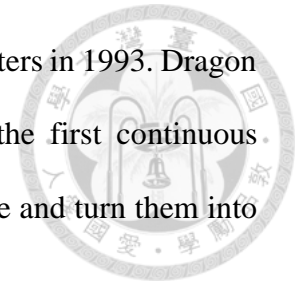
In recent years, voice assistants have begun to develop by leaps and bounds. Apple Siri was released as a standalone app in 2010, bundled into iOS in 2011 and start a modern voice assistant era. Microsoft followed shortly thereafter with Cortana in 2013. Amazon launched Alexa with its Echo-connected home speaker in 2014, and Google's Assistant was announced in 2016 along with its Home speaker and is also embedded in the Google app for Android-based smartphones. (Matthew B. Hoy, 2018) Juniper estimates that 3.25 billion voice assistants are in use in January 2019.

Recent voice assistants are able to create meaningful responses quickly because of the progress in natural language processing. Julia Hirschberg and Christopher D. Manning point out in their 2015 study, that there are four key factors that enable the developments: (1) a vast increase in computing power, (2) the availability of very large amounts of linguistic data, (3) the development of highly successful machine learning (ML) methods, and (4) a much richer understanding of the structure of human language and its deployment in social contexts.

The Process of Voice Assistant Usage

People can use voice assistants through assistant apps or smart speakers that are always listening to wake-up words such as "Hey Siri", "OK Google", "Hey Google" and "Alexa". These devices need to be connected to the Internet, and each interaction is sent back to the central computing system, which analyzes the user's voice commands and provides the appropriate response to the user's request to the assistant.
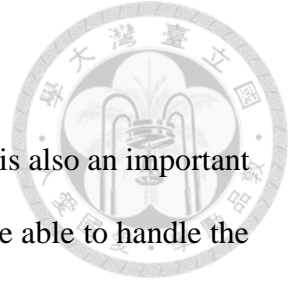
The Features

When it comes to the definition of voice assistants, the function is also an important indicator. The general voice assistant shared some similarities and are able to handle the daily tasks through online search or interaction with other applications:

- send and read text messages, make phone calls, and send and read email messages;

- answer basic informational queries ("What time is it? What's the weather forecast? How many ounces are in a cup?");

- set timers, alarms, and calendar entries;

- set reminders, make lists, and do basic math calculations;

- control media playback from connected services such as Amazon, Google Play, iTunes, Pandora, Netflix, and Spotify;

- control Internet-of-Things-enabled devices such as thermostats, lights, alarms, and locks; and

  tell jokes and stories. (Matthew B. Hoy, 2018)

Voice Assistant Adoption

Juniper Research estimates that 8 billion voice assistants will be in use in 2023 and the growth rate between 2019 and 2023 will be 25.4% (figure 2-1).
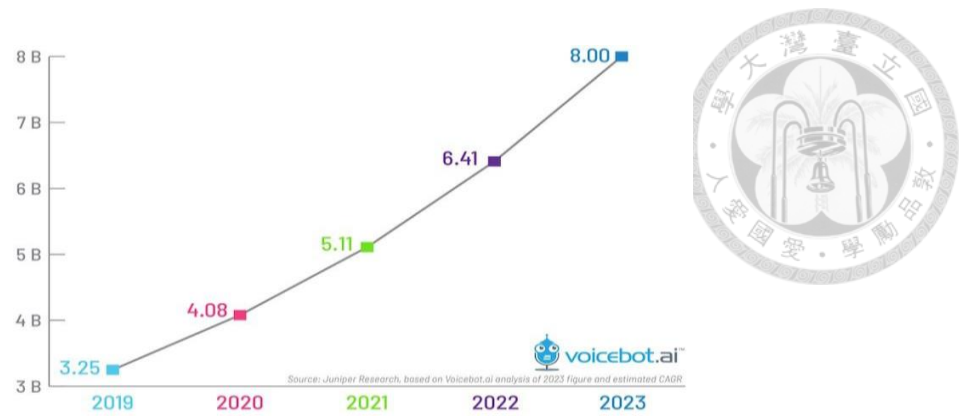
Figure 2-1 Voice Assistant in Use

2.2 Voice Assistant Usage on High Market Penetration Devices and Systems

In the United States, nearly half of adults (46%) use voice assistants. Smartphone users are the majority: 42% of U.S. adults use voice assistants through smartphones, the usage rate is higher than other devices such as computer and tablet (14%) or stand-alone devices like an Amazon Echo or Google Home (8%) (Pew Research Center, 2017).

Another updated marketing survey of United States, United Kingdom, France and Germany indicate that 81% of existing voice assistant users use them (eg, Siri, Cortana, Google Assistant) through smartphones, and 25% of users use voice assistant through smart speakers that they own (Capgemini Digital Transformation Institute, 2018).

In terms of voice assistant systems, Apple iOS and Android have comparable market share in the U.S., but Siri leads in voice adoption on smartphones in this market. 44% of U.S. adults claim they have tried Apple Siri on their smartphones. Compare that to 30% for Google Assistant and 17% for Amazon Alexa (voicebot.ai, 2018).

Features and Frequency

The voice assistant consumer report from voicebot.ai indicated that widespread use of voice interaction started on smartphones and the majority use it on a regular basis. In

voicebot.ai report, 96.5% of smartphone owners at least tried a voice assistant on mobile devices. 61.5% of user use voice assistant monthly and nearly one in four respondent reports using a voice assistant on their smartphone daily (figure 2-2)
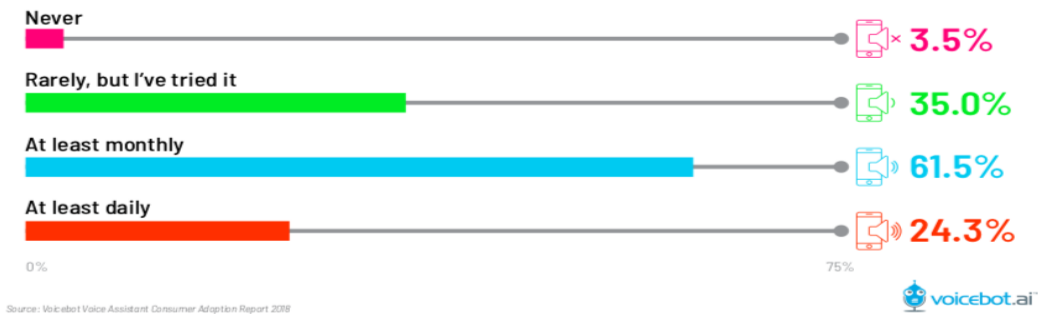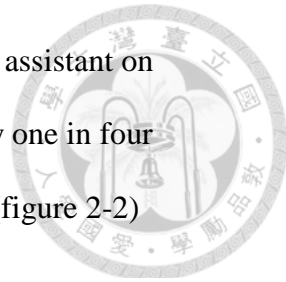

Figure 2-2   Voice Assistant Use Frequency on Smartphones

Users have adopted voice assistant for a variety of functions. 82% of users have used voice assistants for seeking information, and 67% of users have used voice assistant for playing music. The usage has also extended to commerce-related activities which include buying products (e.g. groceries/home care/clothes) and other services like ordering a meal, backing-related transactions, and booking a taxi service (Capgemini Digital Transformation Institute, 2018).

General information search tasks rank well ahead of entertainment when it comes to voice assistant use on smartphones. The top usage is asking questions, more than 50% take advantage of voice search features each month. The next two most common monthly habits involve searching location for either a direction or locating a restaurant. When it comes to productivity tasks, using the voice assistant to initiate communications is most common. Two-thirds of consumers have used a voice assistant to initiate a phone call and 44% do so on a monthly basis. Not far behind at nearly 40% is sending a text by voice (voicebot.ai 2018).

Consumers' expectations of voice on smartphones are getting information and using

the smartphone's function hands-free. Furthermore, the features of commercial activity are also appealing to users.

The OC&C Strategy Consultants report indicates that the market for shopping through voice assistants is rapidly increasing in the US. The voice shopping market has reached $2 billion in 2017 and is expected to grow to $40 billion by 2022, accounting for 6% of all online spending in the US.

Motivation and Hindrance

For voice assistant users, convenience and ability to multi-task are top reasons for preferring voice assistants on smartphones. According to voicebot.ai, what users like about voice assistant on smartphones are being hands free (60%), they can do it while doing other things like driving or cooking (48%), it's more convenient than touch and text (39%), it's faster than touch and text (30%), and it's fun (19%).

What Users Like About Voice Assistants on Smartphones

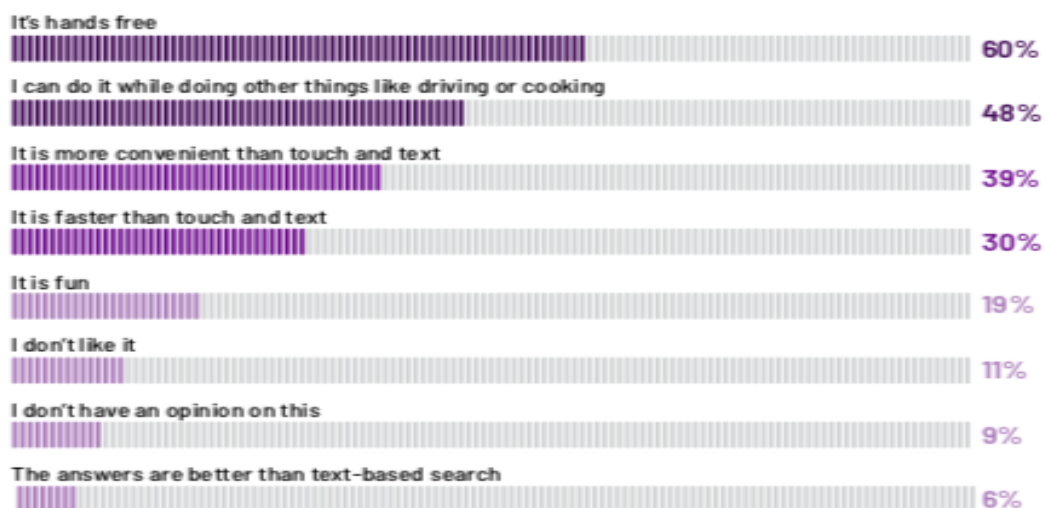|	
It's hands free	60%
I can do it while doing other things like driving or cooking	48%
It is more convenient than touch and text	39%
It is faster than touch and text	30%
It is fun	19%
I don't like it	11%
I don't have an opinion on this	9%
The answers are better than text-based search	6%

Figure 2-3 What user like about voice assistant on smartphones

It is very important to understand the user's need in using the voice assistant. The

2-9

Capgemini report indicates that "understanding user's diction and accent" (81%), "providing relevant recommendation" (75%), and "ability to hold a sensible conversation" are the features that affect user's willingness to use a voice assistant.
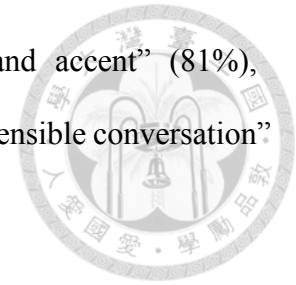
Even in countries with high penetration rates of voice assistants, such as the United States, there are still parts of people who do not use voice assistants. The main reason for not using it is the concern about the security of personal data, and having no incentives.

2.3 Voice Assistant Usage in Taiwan

Voice interaction is also becoming more and more popular in Taiwan. For example, Taiwan High-Speed Rail (THSR) and Facebook launched "Messenger Smart Ticket Purchase". Users can quickly book THSR tickets via voice or text in Facebook messenger without having to visit THSR website or open THSR application.

In order to further understand the use of voice assistants, this part will explain the use of smartphones and voice assistants in Taiwan.

Smartphone and Smartphone-Based Voice Assistant

According to eMarketer＇s estimates(eMarketer, 2016), 78.9% of Taiwan＇s population use smartphones in 2019, the penetration is high in the world. And a local report indicate that a total of 77.3% of Taiwan people access the Internet via smartphones in 2018. In terms of smartphone systems, Android and iOS dominate the use of most smartphone systems on the market. The former has a market share of about 70%, and the latter accounts for about 30% (Mobile phone holders digital opportunity survey, 2018).

In a local study, the use of voice assistant in the smartphone was not high. According to Hsin-Yu Wang and Hsu-Chih Ling, voice assistant users in Taiwan didn't use it frequently. In the study, 40.8% of Siri user and 85.8% of Google Assistant users rarely

used their voice assistant. The users frequently use their assistant for social networking or weather checking.

In terms of the frequency of use of smartphone apps, social networking, information search, and entertainment are the favorite features of smartphone users, with more than half of the users using each feature several times a day. The usage of business activity applications, such as online shopping, hotel reservations, and taxi bookings, are not used as frequently as a routine business, but 46.2% of smartphone users use them at least once a week (Mobile phone holders digital opportunity survey, 2018).

Locally Developed Voice Assistant

With the cooperation of Far East Telecom, China AI company Mobvoi developed Taiwan's first Chinese smart speaker with the annual sales of 20,000 units. The top three functions that Taiwan consumers love are: playing music, seeking information and checking the weather.

Asus launched its first voice speaker (Xiao-Bu) in 2019, the voice assistant system is developed by ASUS's local team. Asus also connects a number of local Taiwanese content providers to provide localized content services such as stock market and streaming music.

Table 2-1 Taiwan Developed Voice Assistant

Brand	FET smart speaker (Ai Chan)	ASUS Smart Speaker (Xiao-Bu)	Chunghua Telecom smart speaker (i Baby)
Debuted	June 2018	January 2019	April 2019

Features	Playing music, seeking information, checking the weather and booking a taxi. Controlling IoT devices (coming soon).	Checking traffic information, listening to music, translating, checking the weather, timers, checking bus times, booking taxis, checking stock market information and Controlling IoT devices.	Playing music, controlling IoT devices, finding a place to eat, checking the weather, checking stock market information.
Language	Mandarin Chinese	Mandarin Chinese	Mandarin Chinese
Developer	Taiwan and China	Taiwan	Taiwan

## 2.4 Product Life-Cycle Theory

Harvard University professor Raymond Vernon proposed Product Life Cycle Theory in 1966. Product life cycle (PLC) is the market life of a product, that is, the whole process of a new product entering the market and being eliminated by the market.

There are five stages in a product's life cycle with respect to the Product Life Cycle Theory: introduction, growth, maturity, saturation, and decline.

The Introduction Stage

At this stage, the new product is introduced to the market, and the customers are not fully informed about the product except for a few customers who are pursuing novelty.

2-12

Almost no one actually purchases the product. The company that developed the original product will invest a lot to promote the product and expand the market demand. At this stage, the profit is low, and there are only a few competitors.
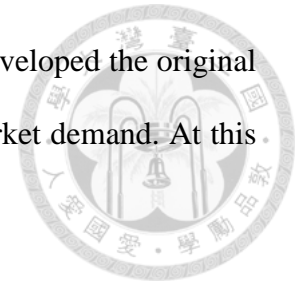
The Growth Stage

When the product enters the growth stage, customers become gradually aware and accept the product. The growing market demand is driving sales and profits. And the increase in demand and sales has led to lower production costs and higher profits. Competitors have entered the market at this stage, creating more competition in the market and leading to lower product prices. One of the marketing strategies is market segmentation, actively exploring new markets and creating new users to facilitate sales expansion.

The Maturity Stage

The product is widely known and start mass production in the most competitive stage with both market demand and sales growth. In order to compete with more competitors with similar products, the original supplier adopts a price reduction strategy to maintain market share and support sales.

The Saturation and Decline Stage

As the market becomes saturated, or as consumers switch to different types of products, product sales and profits begin to decline. The market of the original product starts to shrink. As a result, the original product manufacturing company may stop the production of the product or switch to other lower cost markets.

3 Research Methodology

In order to better understand the feasibility of voice assistants on the market, this study uses case studies to gain insight into Google Assistants and collect feedback from existing and potential users through survey methods to tap market needs and opportunities.

3.1 Questionnaire Design

This study collects and analyzes questionnaire content for users and non-users through several single-choice and multiple-choice questions. The questions regarding voice assistant usage refers to Capgemini's survey of high penetration markets, and the questions were structured using this report. The age range of user and frequency of usage refer to National Development Council's local smartphone usage report.

3.2 Data Sources and Analysis

Self-administered questionnaires were used to collect research data. Data in the survey of this study are conducted online from April 21st to April 28th in 2019. The questionnaires were completed voluntarily by all respondents. During the research period, there were 400 respondents who contributed.

Of the subjects, 64.4% were females, and 85.7% had had a college-level education. The mobile phone brand that the majority use is iPhone (56.4%) and the majority age was between 25 to 44 years (56.4%).

4 Case Study - Google Assistant

4.1 Introduction

Taiwanese people are familiar with Google. According to the StatCounter search engine market share survey in May 2019, Google Search users accounted for 91.3%. However, the voice assistant is a new technology in recent years, so this section will give a more detailed introduction and explanation for the Google Voice Assistant.

History

Google Now is the virtual assistant appeared in Google I/O in 2012 before Google Assistant. It is able to answer questions, provide suggestions, and perform actions through a series of web services. In response to users, Google Now predicts what information they may need based on user past search experience. It received the coveted "Innovation of the Year" award from Popular Science as well in 2012.

Google Assistant is the next generation of Google Now. This artificial intelligence-powered virtual assistant debuted during Google I/O in May 2016 and was estimated be installed on 1 billion devices in January 2019, about 30% of total voice assistant addressable devices worldwide (Juniper Research, 2019). Google Assistant can do a lot of work like Google Now but can do things better, because Google Assistant can engage in two-way conversations by using Google's natural language processing algorithm.

Device

When the Google Assistant was launched, it was only used on Pixel smartphones. Since February 2017, Google Assistant can be executed on other Android devices and released as a standalone app on the iOS system in May 2017. It is currently available for

smartphones, speakers, smart displays, cars, TVs, notebooks, computers, tablets, and wearables.

Language

Google Assistants could only interact in English at the beginning and later opened up for other languages. In October 2018, Google Assistant started to roll out to devices set to use the Chinese (Traditional, Taiwan) language. Now Google Assistant can understand two languages at the same time. Users can communicate with the Assistant in different languages, and it will automatically know which language the user is using and respond accordingly.

Speech Recognition Accuracy

According to a chart from KP internet trends 2017, the correct rate of Google speech recognition has made significant progress in recent years (Figure 4-1).
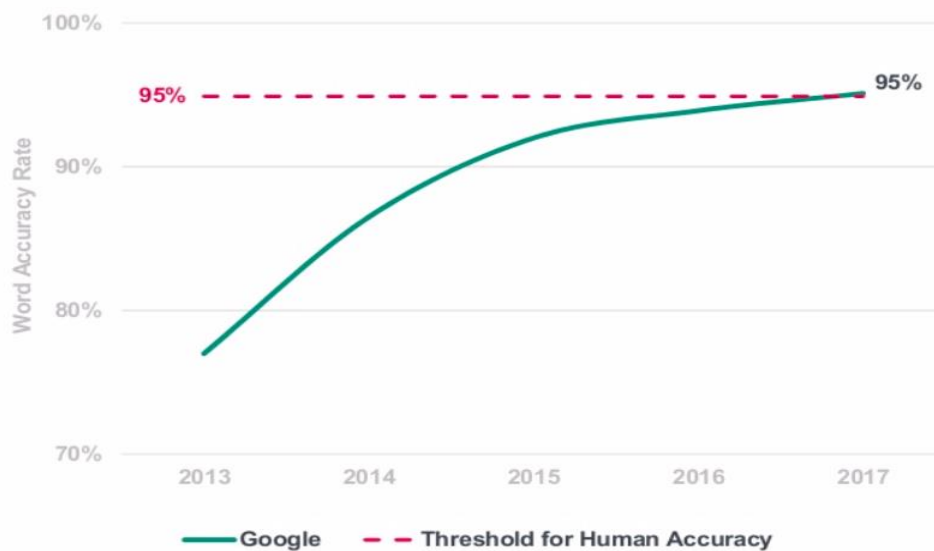

Figure 4-1 Google's speech recognition accuracy

Google announced in Google I/O 2015 that the word error rate WER (Word Error Rate) for Google Now speech recognition dropped from 23% to 8% in two years, which equates to an average annual ERR (error reduction rate) of 41%. Google speech recognition has achieved 95% accuracy in the English language and achieved the current threshold for human accuracy in 2017.

4.2 Updates of the Main Features

To naturally recognize conversations with the user and fulfill the routine task, Google Assistant is continuously developing new features.

Continued Conversation

Google introduced Continued Conversation in 2018, which allows the user to have a natural back-and-forth conversation with Google Assistant without repeating "Hey Google" for each follow-up request.

Multiple Actions

A key part of having a natural conversation is being able to ask about many things at once. With Multiple Actions, Google Assistant is able to understand more complex request. Therefore, user can receive much response from a single complicated question, like "What's the weather like in New York and in Austin?"

Custom Routines

In 2018, Google launched Custom Routines, which allow the user to create their own routine and help the user get multiple things done with a single command. For example, user can create a Custom Routine for family dinner and kick it off by saying "Hey Google, dinner's ready" and the Assistant can turn on your favorite music, turn off the TV, and

broadcast "dinner time!" to everyone in the house.

Google Duplex

Google Duplex was first announced in May 2018 by the company's CEO Sundar Pichai at the Google I / O Developer Conference. Duplex is an extension of Google Assistant, which allows natural conversations by mimicking vocals and can assist with appointments over the phone, such as calling a hair salon to book an appointment, scheduling a restaurant reservation, or calling a business to verify opening hours [19].

Voice Shop at Walmart

Google Assistant user can utilize the "Walmart Voice Orders" feature to voice shop at Walmart. Users can simply say "Google, talk to Walmart" to the Google Assistant, and it would be able to add the product virtually into Walmart shopping cart directly while users are at home or on the go. The feature is now rolling out in the US and will roll to more and more customers. (Walmart, 2019.4)

4.3 Comparison between Apple Siri and Google Assistant

Siri and Google Assistant are the leading smartphone voice assistants in the market. The table below compares the two systems.

Table 4-1 Apple Siri vs. Google Assistant

	Apple Siri	**Google Assistant (on Smartphone)**
Wake Word	Hey Siri	OK Google
debuted	October 2011	May 2016.

4-18
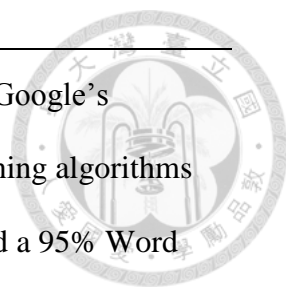
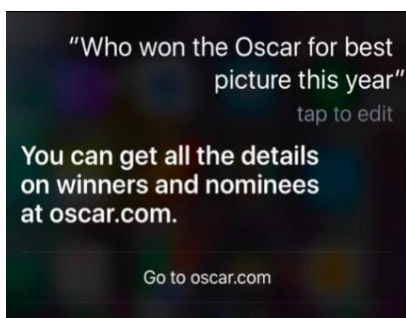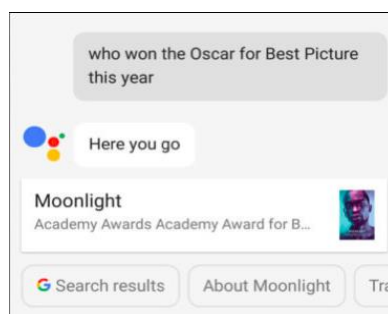|	Siri	Google Assistant
Speech Recognition Capability (in English)	In 2015, Siri has achieved 5% Word Error Rate (WER).	May 2017, Google's machine learning algorithms have achieved a 95% Word Accuracy Rate (WAR)
Answers Attempted [20] (The assistant thinks that it understands the question, and makes an overt effort to provide a response.)	40%	nearly 80%
Correct rate (The precise question asked was answered directly and fully)	80%	over 90%
Chinese version	2014	October 2018
Devices	Siri is available on all Apple devices, including iPhones, MacBooks, iPads, and Apple Watch.	Google Assistant is able to be deployed on Android devices, and was released as a standalone app on the iOS

operating system.

Answers Resources (For example, if the user ask "Who won the Oscar for Best Picture this year?")	Siri may provide sources to answer the user's question, and sometimes it turns to Bing's web-wide search results. Siri suggests visiting oscars.com.	Google Assistant taps into Google search results each and every time when user search, making the response more comprehensive. Google gives the actual answer.
User base	Actively used on over half a billion devices in 2018	Was installed on 1 billion devices in January 2019

4-20

5 Survey Results and Analysis

5.1 Respondents

The survey for voice assistant awareness and usage were conducted online from 21st April to 28th April. At the time the survey was collected, a total of 400 people participated in the online survey. Among the respondents, 330 (82.5%) indicated that they know about voice assistant, of which 250 have used a voice assistant. Thus, a total of 250 participants of users and a total of 80 non-user were used for data analyses in this study.

Table 5-1 Respondents

Demographic and smartphone usage-related characteristics of the study sample (n=400). Values are represented in numbers unless stated otherwise.

e	
der 25	(15.1%)
-34	6 (26.5%)
-44	1 (30.3%)
-54	(15.0%)
-64	(9.3%)
er 65	(4.5%)
nder	
ıle	3 (35.8%)
male	7 (64.3%)

ghest educational degree

:condary school	2.0%)
:chnical or high school	(11.5%)
iiversity	6 (64.0%)
aster or Doctor Degree	(22.5%)
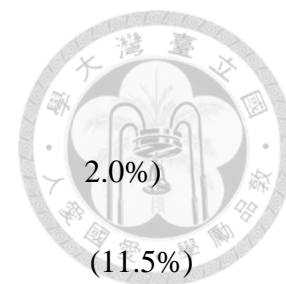
bile phone brand in use

ione	4 (56.0%)
imsung	(12.0%)
'C	(10.5%)
iUS	(5.5%)
'PO	(5.5%)
)NY	(5.0)
VAWEI	(3.0%)
hers (XIAOMI, LG, Google, NOKIA, Ace)	(2.5%)

5.2 Voice Assistant User

The user of the voice assistant has a wide age distribution. In this study, the user's

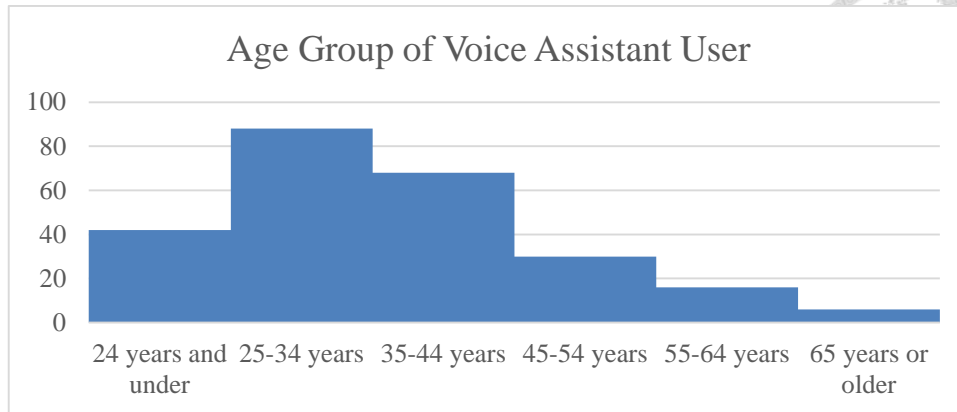age is mainly concentrated in 25-44 years old.

Figure 5-1 Age Group of Voice Assistant User

The devices which use voice assistant:

Most of the users use voice assistant through smartphones, which have gained an installed user base of nearly 3 in 4 users. In terms of systems usage, Apple Siri and Google Assistant shared the most users on the market, 63% of users have used Apple Siri, followed by Google Assistant, which has been used by 29% of users.
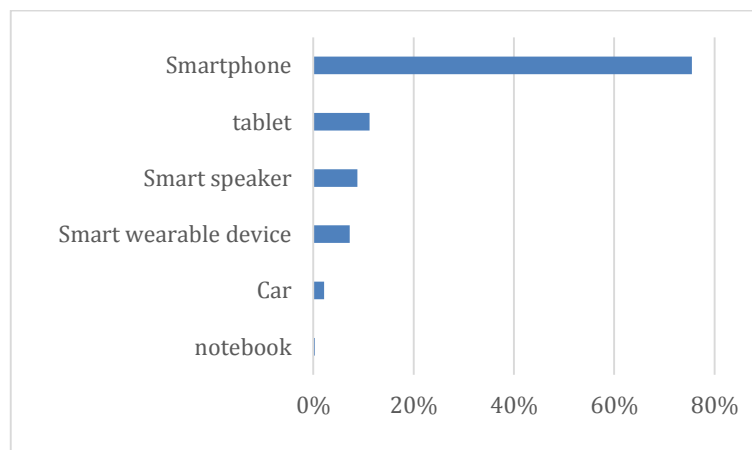

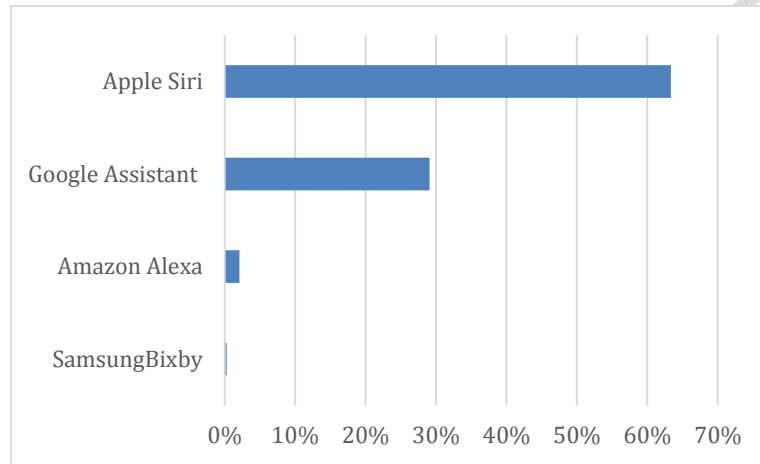Figure 5-2 Device of Using Voice Assistant

Figure 5-3 Voice Assistant System in Use

Obstacles to the user experience affect the willingness and frequency of use. In this study, more than half of voice assistant users think their assistants could be enhanced in the aspect of understanding user's accents and providing personalized services.
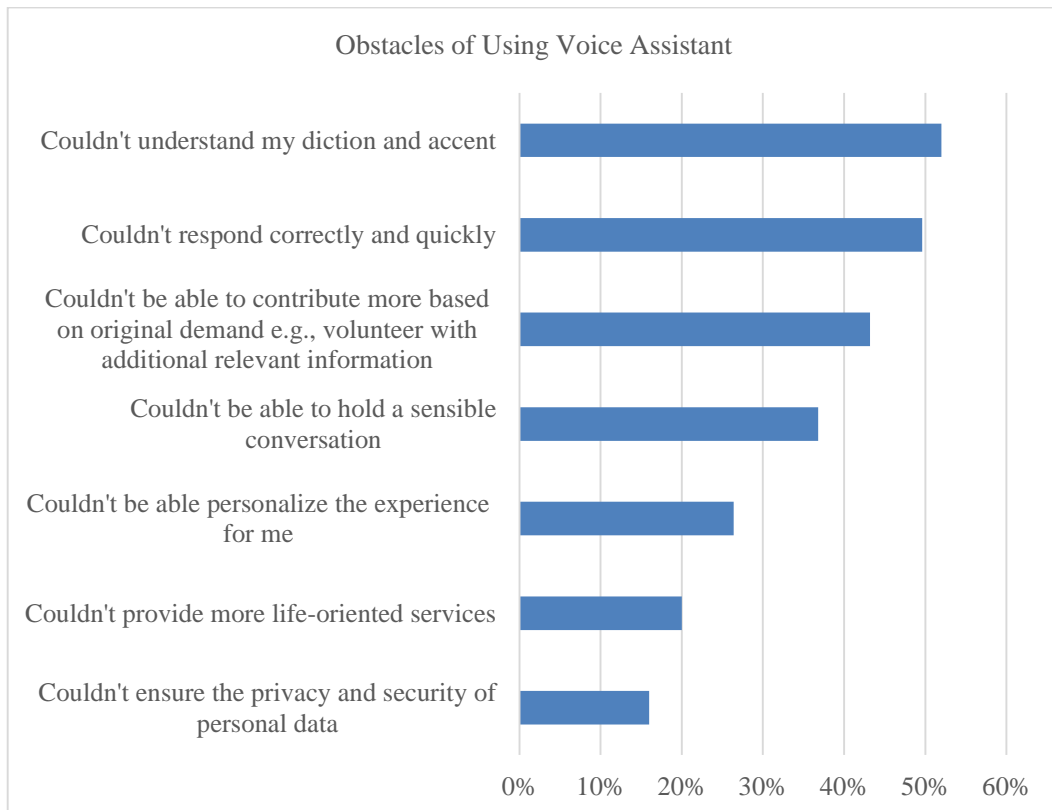

Figure 5-4 Obstacles of Using Voice Assistant

5.3 Google Assistant and Siri User

In order to understand the differences of user experience between two leading systems, this section compares 149 users who have only used Siri with 92 users who have only used Google Assistant.

In terms of frequency of usage, Google Voice Assistant users use their assistants more frequently, and 34% of Google Assistant users interact with their assistants every day, twice as many as Siri users. As Wang and Hsu pointed out in their 2018 study, 40.8% of Siri users rarely use it, and 85.8% of Google Assistant users rarely use it. In this study, Google's user frequency has greatly improved, and only 34% of users rarely use it. In contrast, the ratio of Siri users who rarely use it increased to 55%. Google Assistant users have been more satisfied with the user experience over the past year
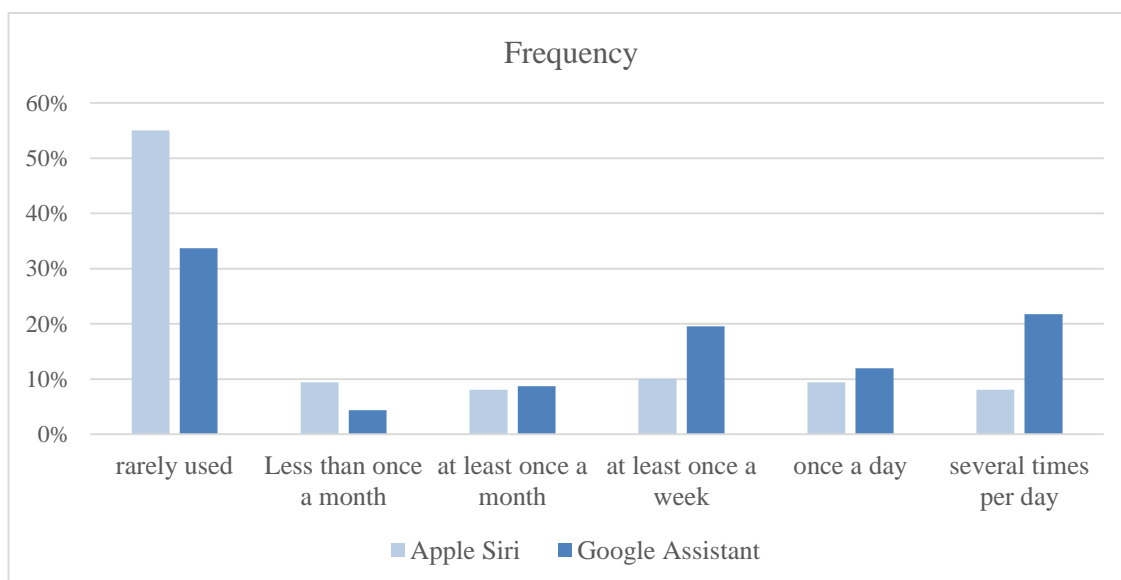

Figure 5-5 Usage Frequency of Apple Siri and Google Assistant

The reason for using the voice assistant is mainly because it is interesting, but users of the Google Assistant are more focused on convenience and multitasking.
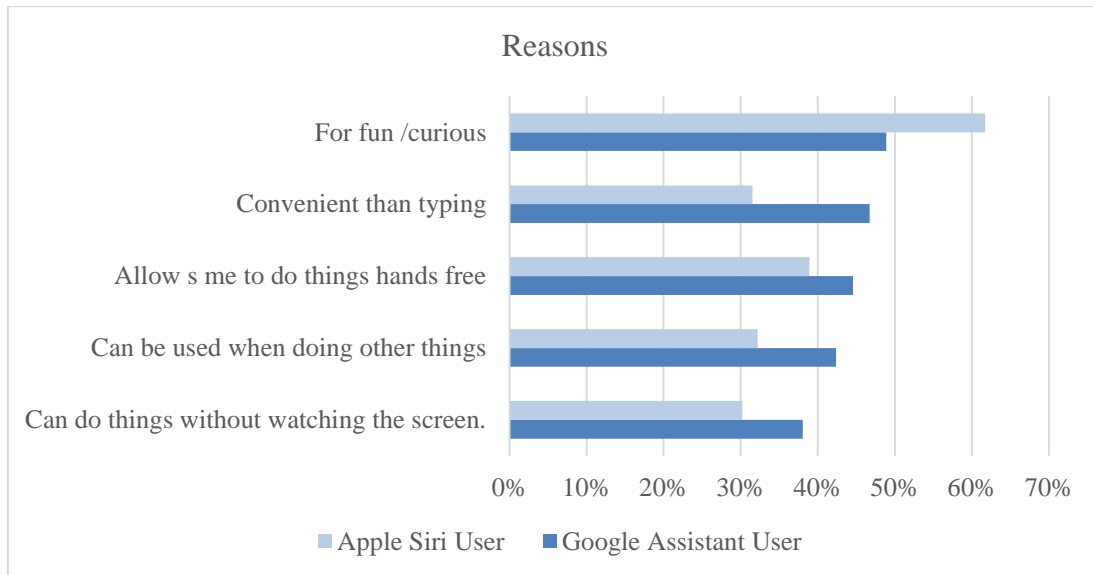

Figure 5-6 Reasons of Adopting Siri and Google Assistant

When the frequency of the usage is focused to "once a day" and "several times a day", every feature of the Google Assistant is used more frequently than Siri. It is most commonly used to confirm the information: 37% of Google Assistant users search for information at least once a day; 25% check the weather and 20% confirm calendars every day. There are also some users who use voice assistant navigation or do research before purchasing products.
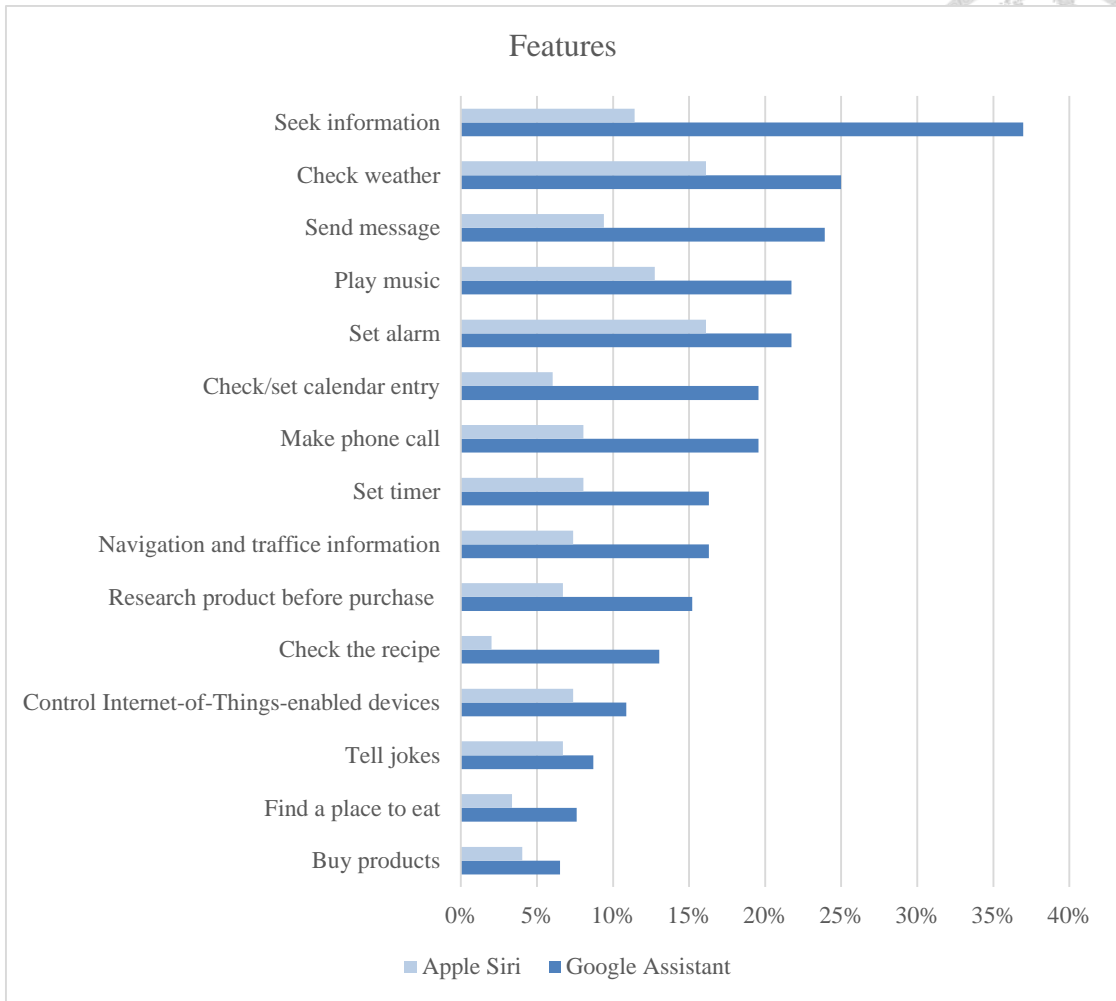
Figure 5-7 Commonly Used Features of Siri and Google Assistant

Although voice assistants have many advantages, current usage is significantly lower than mobile phone applications.

Both Google Assistant and Apple Siri Voice Assistant existing users believe that their voice assistant's understanding of the accent needs to be improved. In addition, according to the experience of the two voice assistant users, the correctness of the answer and the personalized reply content are also expected by the user to be strengthened.

In the two systems, it is obvious that users of Google assistants have a better experience, especially in accent understanding, life-oriented services and data security projects.
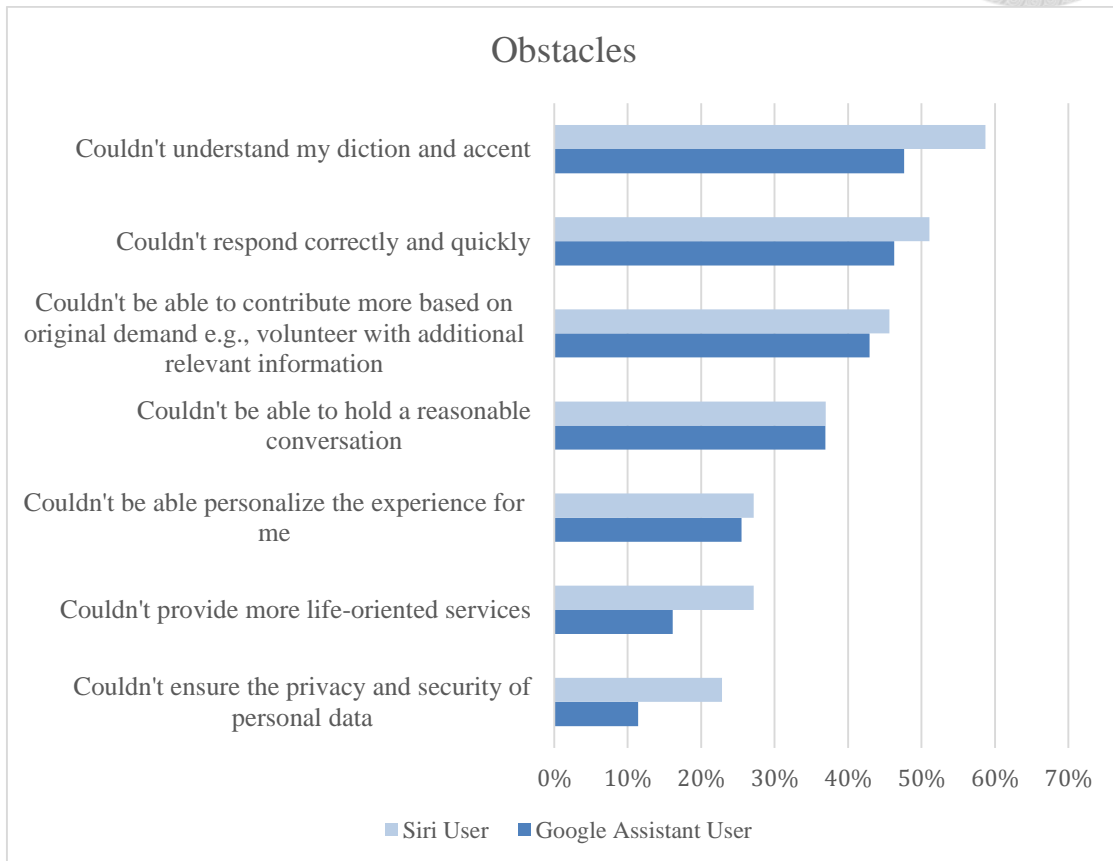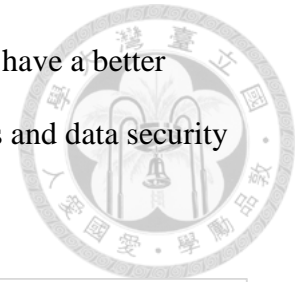

Figure 5-8 Obstacle of Using Siri and Google Assistant (User)

After the hindrances were improved and the frequency of the usage was focused to "once a day" and "several times a day", the daily usage of each feature increased significantly, such as navigation and traffic information (from 16% to 48%), finding a place to eat (from 8% to 36 %), telling jokes (from 9% to 35%), making a phone call (from 20% to 41%), sending messages (from 24% to 43%) and buying products (from 7% to 26%).

Figure 5-9 Google Assistant Frequently Used Features Before and After Improvement

5.4 Non-user

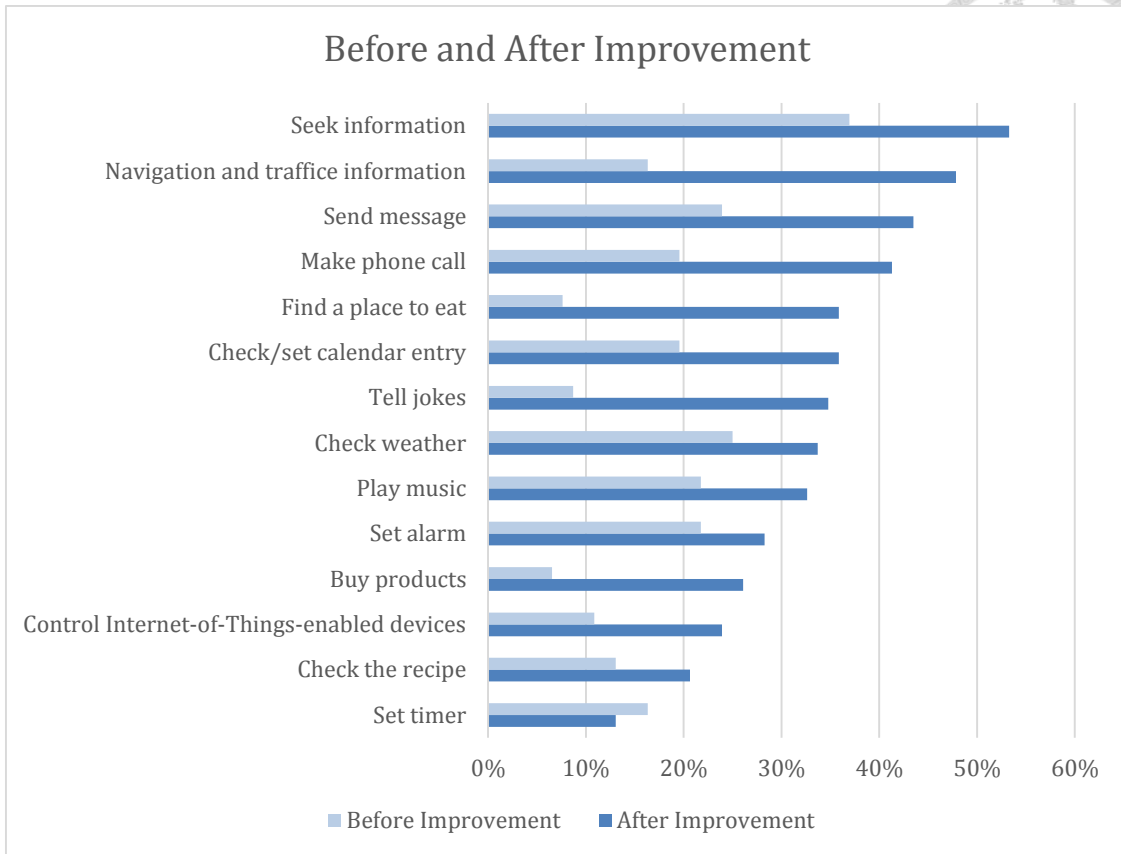Non-users are looking forward to a good conversation experience compared to the user's request for a voice assistant's understanding of the accent. Each of 40% of respondents thinks that reasonable communication and quick and correct response are

the most important. In addition, one-third of non-users pay attention to security issues such as personal data, and this ratio is significantly higher than that of users.
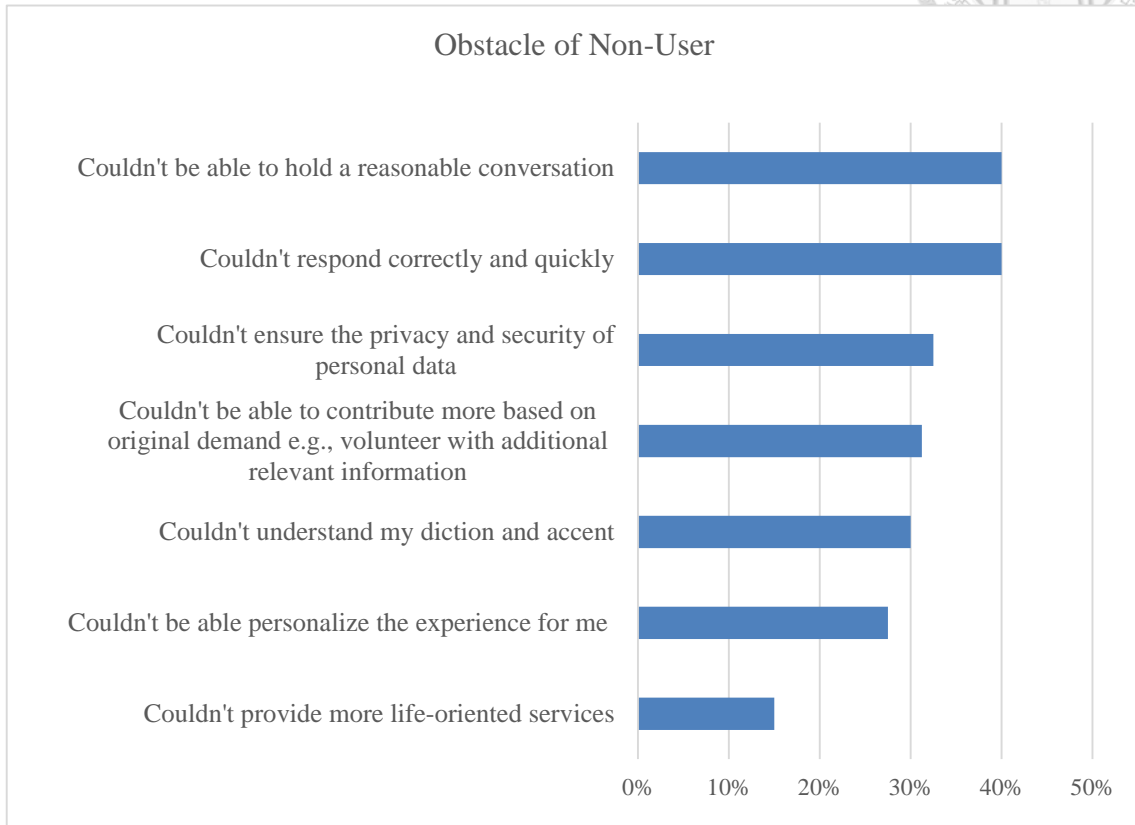
Figure 5-10 Obstacle of Non-User

When the aforementioned obstacles are improved, it may affect the non-users' willingness to adopt a voice assistant. For the fresh users, they are willing to use information-based features such as checking traffic and weather, as well as seeking information through. They are also willing to complete routine work through hands-free voice interaction, such as playing music, making phone calls, and setting alarm clocks and calendars.

In addition, although the proportion of business conduct is low, 35% of current non-users are willing to use the voice assistant to research products before purchasing.

Figure 5-11 Features That Non-users Are Willing to Try

6 Recommendation

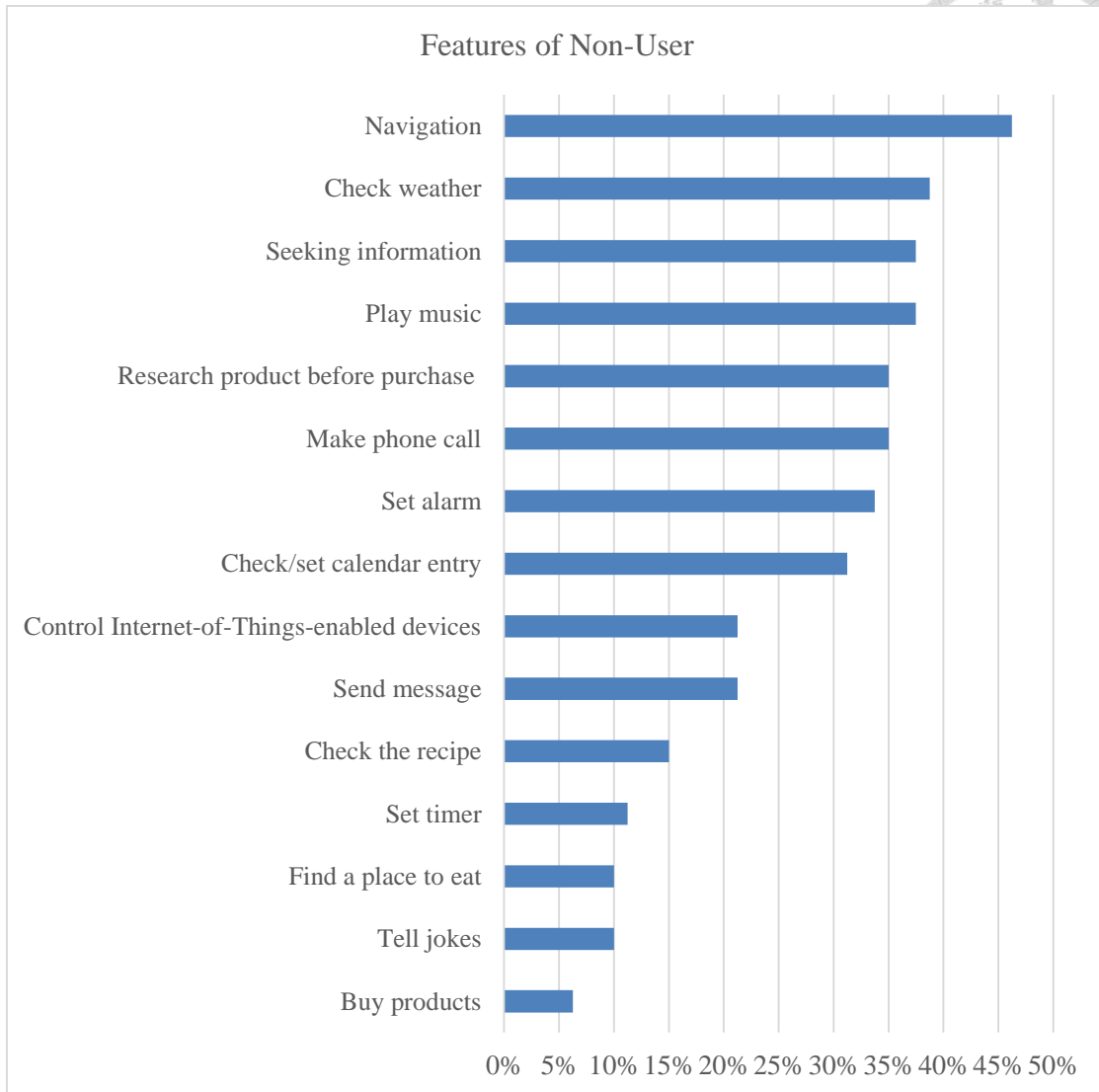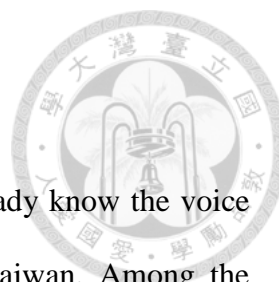According to the results of this study, 82.5% respondents already know the voice assistant, showing that the voice assistant is widely known in Taiwan. Among the respondents, 62.5% have used voice assistants, and the usage frequency of Siri and Google Assistant has increased significantly compared to the 2018 study. In addition, new competitors have joined the market, showing that voice assistants are entering the growth stage in Taiwan.

At the growth stage, competitors enter the market and create more competition in this market. To strengthen the competitive strategy of the product is quite important.

6.1 SWOT Analysis

In order to maintain market growth as much as possible, the main brands of voice assistants must have new product features that meet market demands or create new users through market segments, which in turn can dominate the market. The following will conduct a SWOT analysis for Google Assistant and make corresponding recommendations for the results.

Table 6-1 SWOT Analysis of Google Assistant

Strengths	Weaknesses
● Google has a lot of data: most people in Taiwan use Google Search and rely on the results of Google Search.	● Lack of Chinese speech recognition ability
● Android mobile phone system has a high penetration rate in Taiwan	● Limited function on the market (Unable to make voice shopping or voice booking a restaurant, etc.)

|	
● A higher potential market than Siri (when improved, a higher percentage of people want to use it) ● Google Assistant users are more purposeful than just having fun ● The new features of the various developments of the English version of Google Assistant are also in line with the needs of the Taiwan market.	
Opportunities ● Market awareness and acceptance of voice assistants are getting better and better ● When voice recognition is better, some non-users are also willing to use	**Threats** ● International brands start to provide localized voice services ● The localized voice assistant system begin to enter the market

6.2 Recommendation - Voice Recognition

Based on quantitative survey results of this study, half of the voice assistant users on the market claimed that the assistant could not understand their diction or accent, and could not respond correctly or quickly.

Voice recognition is the foundation of the voice assistant. Users not only expect voice assistants to listen, but also understand their needs, and then provide customized information or services according to their needs. As Julia Hirschberg and Christopher D. Manning indicated that speech cognition requires a large amount of linguistic data

6-33

collection and analysis. Internet users in this market are accustomed to find the information they need through search engines. Google not only has a lot of data but also understands the needs of market users. Combining these two advantages will help Google Assistant understand user needs.
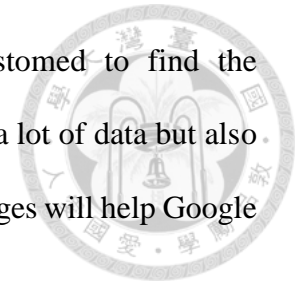
In terms of a richer understanding of the structure of human language and its deployment in a social context, Google is based in English and tends to be weak in Chinese. Google can work with local research institutions to strengthen local language understanding and strengthen localized speech recognition capabilities.

For instance, the Industrial Technology Research Institute voice technology team has been researching DNN (Deep Natural Network) based speech recognition technology since 2014. Two different DNN models were trained for over two years: FNN (Feedback Neural Network) and LSTM (Long and Short Term Memory). Compared with the traditional GMM model (Gaussian hybrid model), ERR reached 39.4% and 57.4%, indicating that the speech recognition rate of domestic R&D has greatly improved. Google can work with the organization to more effectively improve the learning of local language structures.

6.3 Recommendation - Practical Features

To expand the user base, Google Assistants can provide more features or localized information, meet the regular needs of consumers, and build customer trust in the brand.

Voice Commerce

As indicated by the market research of this study, if the obstacles encountered by users are improved, Google Assistant users are willing to use information features (navigation and traffic information), social features (calling and sending messages), and

shopping features (purchasing products). The usage rate of the shopping function has grown from 7% to 26%, which is four times that of the original.

At present, the voice assistants in the market mainly provide content, such as weather information, stock market information, music, and bus information. Furthermore, it also integrates with the local vendor to provide more functions, such as booking a taxi. Compared with the purely content-providing service, voice commerce involves more complicated data exchange and is more technically difficult. Therefore, the smart speaker voice assistant developed in Taiwan at present is unable to provide this function.

In other countries, Google Friends are working with other retailers, such as Walmart and Target, or other shopping platforms related to Google Assistant. In Taiwan, the mobile shopping market continues to grow, and voice assistant users are also showing their expectations for voice shopping. As a result, Google Assistant can also work with Taiwanese retailers to capture the Taiwanese voice shopping market.

Local Information in Need

According to a survey by the Ministry of Communications of Taiwan, 18.1% of Taiwanese people use public transport, among them, 8.8% are bus users. Rail transport user, including railways, THSR, and MRT, accounted for 6.9%, and taxis users accounted for 2.2%.

Because of the strong market demand, the locally developed voice assistant and Facebook have developed and provided the relevant functions of mass transit to meet consumer expectations. Google Assistant can also work with local taxi companies, and THSR to make booking service and provide other public transportation information to enhance users' usage and loyalty through a seamless experience.

7 Conclusion

As Henry Kressel and Norman Winarsky mentioned in their book, "Having to click through multiple stages and screens to perform and execute tasks was just too annoying for most people." The convenience and hands-free features of the voice assistant attracted users to interact with the voice assistant.

According to this study, the following 3 points will support the purpose of this study:

1. The voice assistant awareness is high.

2. Voice assistant users are growing fast.

3. Taiwan Voice Assistant is entering the growth phase of the product life cycle, so it can increase market share by enhancing product features and market segmentation.

The 2 recommendations to increase the adoption of the voice assistant in Taiwan:

1. Improve local voice recognition

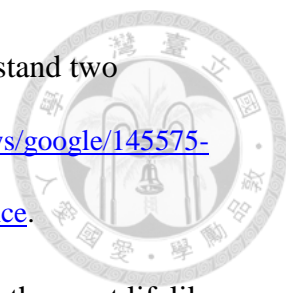2. Enhance practical features including voice commerce and local information in need

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Appendix

Questionnaire For The Respondents (English version)

Section 1 - Voice Assistant Awareness

Voice assistant definition: Voice assistants are used in smart phones, smart phones, and so on. Users can get relevant information from the voice assistant through saying demands or asking questions. The popular voice assistants in the market are Apple Siri, Google Assistant, Amazon Alexa, Cortana, etc.

1. Have you heard of the voice assistant?

    ○ Yes (move on to next section)

    ○ No (move on to section 6)

    Apple Siri and Google Assistant on the smart phone

Section 2 - Voice Assistant Usage

1. Have you used a voice assistant?

   ○ Yes (move on to next section)

   ○ No (move on to section 5)

Section 3 - Voice Assistant Using Experience

1. Which device do you use voice assistants? (multiple choice)

   ○ Smart Speaker

   ○ Smartphone

   ○ Smart wearable device (smart watch, etc.)

   ○ Tablet

   ○ Others: _____

2. What voice assistant have you used? (multiple choice)

   ○ Apple Siri

   ○ Amazon Alexa

   ○ Google Assistant

   ○ Microsoft Cortana

   ○ Others: _____

3. How often do you use voice assistant?

   ○ Several times a day

   ○ Once a day

○ At least once a week

○ At least once a month

○ Less than once a month

○ Rarely used

○ Not used

4. Function and frequency used (randomly determine the order of the functions)

Several times a day

	Several times a day	Once a day	Once a week	At least once a month	Less than once a month	Rarely used	Not used
Set timer							
Check the recipe							
Control Internet-of-Things-enabled devices							
Buy products							
Set alarm							
Play music							
Check weather							
Tell jokes							
Check/set calendar entry							
Find a place to eat							
Make phone call							

Send message							
Navigation and traffice information							
Seek information							
Research product before purchase							
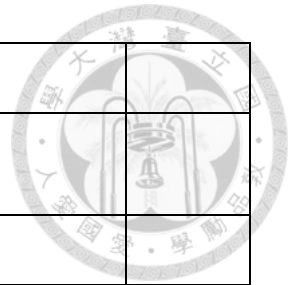
5. Environment when using voice assistant (multiple choice)

   ◯ In your own home

   ◯ In your friend/family member's home

   ◯ On the car

   ◯ In a shop

   ◯ In the workplace

   ◯ In public

6. Social context when using voice assistant (multiple choice)

   ◯ Alone

   ◯ With friends or family members

   ◯ In public Space

7. Reasons for using a voice assistant (multiple choice)

   ◯ For fun /curious

   ◯ Can be used when doing other things (e.g. driving, cooking, holding children)

   ◯ Can do things without watching the screen.

○ Convenient than typing

○ Allow s me to do things hands free

Move to next section

Section 4 - Voice Assistant Adoption Factors (for User)

1. Which of the following reasons are obstacles when you use the voice assistant (multiple choice)

○ Couldn't respond correctly and quickly

○ Couldn't understand my diction and accent

○ Couldn't be able to hold a sensible conversation

○ Couldn't be able personalize the experience for me

○ Couldn't be able to contribute more based on original demand e.g., volunteer with additional relevant information

○ Couldn't ensure the privacy and security of personal data

○ Couldn't provide more life-oriented services

2. If the above conditions improve, which features do you prefer to use more frequently? (Multiple choice)

○ Buy products

○ Tell jokes

○ Find a place to eat

○ Set timer

○ Check the recipe

○ Send message

○ Control Internet-of-Things-enabled devices

○ Check/set calendar entry

○ set alarm

○ Make phone call

○ Research product before purchase

○ Play music

○ Seeking information

○ Check weather

○ Navigation

○ Don't want to use

Move to section 6

Section 5 - Voice Assistant Adoption Factors (for Non-User)

1. Which of the following reasons are obstacles when you use the voice assistant
    (multiple choice)

    ○ Couldn't respond correctly and quickly

    ○ Couldn't understand my diction and accent

    ○ Couldn't be able to hold a sensible conversation

    ○ Couldn't be able personalize the experience for me

    ○ Couldn't be able to contribute more based on original demand e.g., volunteer

    with additional relevant information

○ Couldn't ensure the privacy and security of personal data

○ Couldn't provide more life-oriented services

2. If the above conditions improve, which features do you prefer to use more frequently?

(Multiple choice)

○ Buy products

○ Tell jokes

○ Find a place to eat

○ Set timer

○ Check the recipe

○ Send message

○ Control Internet-of-Things-enabled devices

○ Check/set calendar entry

○ set alarm

○ Make phone call

○ Research product before purchase

○ Play music

○ Seeking information

○ Check weather

○ Navigation

○ Don't want to use

Move to next section

Section 6 – Personal Information

1. Age

   ◯ Under 25

   ◯ 25-34

   ◯ 35-44

   ◯ 45-54

   ◯ 55-64

   ◯ Over 65

2. Gender

   ◯ Male

   ◯ Female

3. Highest educational degree

   ◯ Secondary school

   ◯ Technical or high school

   ◯ University

   ◯ Master or Doctor Degree

4. Mobile phone brand in use

   ◯ iPhone

   ◯ Samsung

   ◯ HTC

○ ASUS

○ OPPO

○ SONY

○ HWAWEI

○ Others: _____