

ANALYZE USER PATTERN AND DERIVE NEEDS OF BLUETOOTH LOCATION TRACKER

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ABSTRACT

This study focuses on rapidly growing internet of Things(IoT) products, especially Bluetooth embedded location tracker. We used Bluetooth locator to figure out the needs of people who need it, and to analyze their usage patterns if they are already using it. Based on the results, we generated Affinity Diagram and Per sonar to derive the practical requirements of users who use the location tracker. The requirement tells you the location of your first item to prevent it from being lost. Second, when the baby is out of sight of the parents of infants or companion animals, it can be confirmed through smart phone application. Third, if the smartphone is lost, it informs the loss of the smartphone by an alarm. Fourth, it provides design and color that can reveal personality. We propose a prototype of application interface design that works with location tracker through created person.

Keywords: *Bluetooth Location Tracker, UX Design, Affinity Diagram, Persona, Chipolo*

1. INTRODUCTION

Recently, a lot of personalized Internet of Things (IoT) products linked to smartphones are being launched. Especially in today's complex, Bluetooth location tracker is becoming a new idea product. This is because it reflects the needs of modern people to protect their young children, companion animals, and other personal belongings. To compensate for the disadvantages of GPS, which is widely used for obtaining location information outdoors, using Bluetooth, which spreads in various fields along with the spread of smartphones, it is possible to calculate and estimate the position of the terminal without using GPS information [1]. The location tracker is mostly in the form of a chip, which has built-in Bluetooth for location tracking. It is designed to carry a child or companion animal in the form of a necklace, and parents can check their location from time to time through a dedicated smartphone app. Even if it is a thing, it attaches this chip to the thing and informs the location of the thing.

Therefore, this study focuses on the rapidly increasing number of IoT products, especially the built-in Bluetooth location tracker, to see why this product has been growing in recent years and which features it has. Users also have some needs and want to propose the necessary application design in terms of user experience design to use this location tracker.

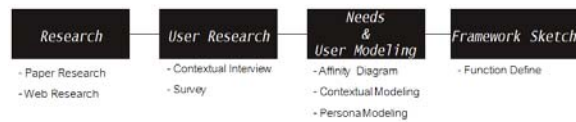


Figure 1: Research Process

We used Bluetooth locator to figure out the needs of people who need it, and to analyze their usage patterns if they are already using it.

Firstly, literature survey was conducted to establish direction through survey on wearable products and Bluetooth location tracker application, and trends of wearable device market and service consumption market trend were examined.

Second, in-depth interviews were conducted for user surveys. Based on the results, we generated Affinity Diagram and persona, and derived the practical requirements of users who use the location tracker.

Third, we proposed a prototype of application interface design that is linked with the location tracker through the created persona.

2. RELATED WORKS

2.1 Internet of Things(IoT)

The Internet of Things (IoT) is a system in which intelligent objects are connected to the

Internet to communicate with people and objects (physical or virtual), objects and objects through networks, and intelligent services. It is expected to be the core of a hyper-connected society that integrates with smart devices, cloud, and big data technology to open and share [2]. The Internet Encyclopedia defines the technology of connecting the Internet (IoT) to the Internet by incorporating sensors and communication functions into various objects. That is, it is an artificial intelligence technology in which objects connected to the Internet exchange data, analyze it by itself, provide information learned to the user, or remotely control the user. Here, things become various embedded systems such as household appliances, mobile equipment, and wearable computers. Things that connect to the Internet need to be connected to the Internet with a unique IP that can identify themselves, and sensors can be embedded for data acquisition from external environments [3].

The Internet of things is derived from existing technologies such as ubiquitous and NFC. M2M (Machine to Machine). It is, an early Internet technology, was used for traffic cards, barcodes, and ATM devices based on the inter-device communication system using sensors (RFID, etc.) [4]. Internet market and technology trends, However, recently, due to the development of communication technology and the universalization of personal terminals, the Internet has developed into a web of things that connect people, things, things and things wherever the network is connected [5].

2.2 Device Product Trends Using Internet

2-2.1 Domestic trends

Robotics start-up Luxrobo has developed a product that can be assembled and assembled like LEGO, the Internet of Things (IoT) used in everyday life and robotic devices. Previously released Internet products were released only in the form of finished products like smart robot cleaners, but the Mody products developed by Lux Robo are 10-inch coin size with unique functions such as power button, microphone, Bluetooth and motor. It is characterized by one set of spare parts. In other words, it is advantageous that only a part of necessary function is selected and assembled like Lego, so that users can apply various products desired as shown in Figure 2. For example, if you want to activate the light by voice recognition,

attach the motor part to the light switch and connect the microphone part. Then, whenever the sound is heard, the motor is turned on and the light switch is turned on [6].



Figure 2: Figure of Luxrobo (The Daum news, 2016.11.06)

SK Telecom provides Smart Farm service, a greenhouse management system that can remotely control the temperature, humidity, water supply, drainage and feed supply inside the greenhouse in Seogwipo and Kyungbuk Sungju areas as shown in Figure 3. [7]

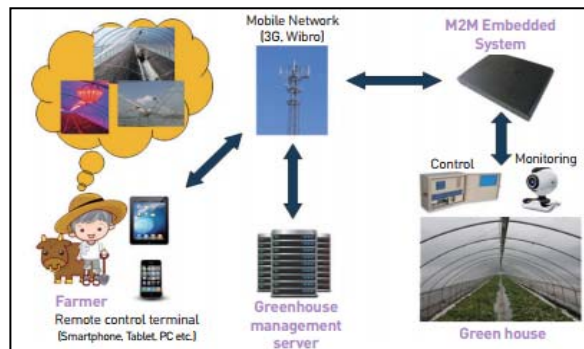


Figure 3: SKT Smart Farm Service

2-2.2 Overseas trends

Qualcomm presented 'Connected Smart Home', the future of home through the development of 'Alljoyn', an Internet platform for objects. This platform enables smart phones and tablets to control home lighting, TV, clocks and speakers. [8]

The American company Smartduvet's "Breeze" can sleep at different temperatures from one partner to another in a single bed. You can set the optimum temperature and sleeping time by using the dedicated app. You can also preheat or cool the bed for the best sleep. [9]

BuddyGuard's "FLARE" as shown in Figure 4 is a home security system that implements all the solutions on one device. First of all, this product uses artificial intelligence to monitor what happens to your home 24 hours a day.



Figure 4: FLARE

A key feature of this product is that when the owner comes in with face recognition, the lens automatically closes for personal protection. The main feature is to replace the backup battery by itself when the battery is low, and automatically connect to the 4G when the WiFi is disconnected. FLARE will alert you to an alarm of 80 decibels if it detects that you are an unidentified person after face recognition. This product is a representative product of home security using artificial intelligence [10]

intelliPLUG is a product that can control all household appliances such as home coffee maker, lava lamp, hygrometer, iron kettle and charger by phone. In other words, it is a plug that can control home electric appliances or lamps of home by phone. Simply plug it into a wall socket and you can turn the connected device on and off. Amazon Alexa integration. UL certification, new features Automatic Upgrade Download the app and connect it to intelliPLUG. [11]

FIXO is a round disk shaped smart device. Basically, it has various functions such as radio, music, currency, health care, various information including clock role. It can also perform a wide variety of tasks like a computer. It is a big advantage that you can check various information of daily life at a glance, and you can listen to music with high quality. It can be operated as a smart home accessory because it can be controlled remotely by linking with mobile device. The 24cm diameter FIXO is a round touchscreen, consisting of an HD camera, a 2-inch stereo speaker and three widescreen wide-screen buttons. [12]

The gate guide as shown in Figure 5 developed by Gate Labs is a smart keypad lock that includes all the benefits of existing smart locks such as video camera, two-way audio, motion detection, electronic key, remote on / off, pin on off. You can issue a temporary key to a friend or guest, or you can check in real time who is at the door. [13]

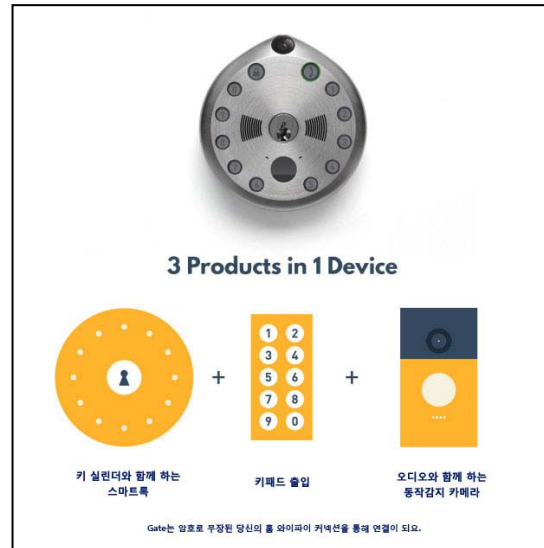


Figure 5: The gate guide developed by Gate Labs

"Sensibo," an Internet that gives intelligence to old-style air conditioners, changes the air conditioner smartly and saves energy. This product is an IoT product that can control the air conditioner anywhere. It can be controlled the air conditioner at one end of its hand at home as well as other countries.

If you plug in the Sensibo power and download the app and pair it up, the installation is complete and you can monitor and change the air conditioner immediately with the intuitive app. But Sensibo basically functions like a remote control of an air conditioner. Therefore, the central air cleaning system does not have a remote control, and therefore the Sensibo does not work. Likewise, smart devices such as Nest's thermostats cannot operate the air conditioner wirelessly. [14] So far, it has been looked at trends in the device market related to the Internet of things. In the future, IOT will include remote control, monitoring and sensing functions based on the Internet connection, from simple products to complex devices.

2-1.3 Location tracker

In the previous section, we introduced various products using the Internet of things. Next, I would like to introduce a location tracker that can use GPS, Bluetooth, or Internet IoT technology to find lost items. Typical products include Zeaplus Nut, Tile, TrackR Bravo, Chipolo, and link and ICookie in Korea.

Chipolo, designed and developed by two start-up companies, Geartronik and Nollie Apps, is a round sensor connected to a smartphone. It uses Bluetooth 4.0 and works like a simple tracker. You can download apps from the App Store or Google Play and connect your device to one or more Chipolo trackers.

If the tracker goes out of range, a notification will be sent to the phone, and if the user does not notice it, the application will show the last known GPS location on the map as it falls into the range of the missing item. If your smartphone is missing, shake Chipolo and your phone will start ringing. [15]

It has a circular shape like a coin, it contains a mercury battery battery, and it also has a function to make a sound alarm so you can find things easily. It reflects the idea of putting locatable tags on important items such as keys and bags, and it is an object-oriented internet product that can track the location of lost items through smartphone apps. The replaceable battery lasts for six months and the Geofence tells when Chipolo is out of range. There is also a temperature sensor which indicates whether the item is indoors or outdoors. [16]

Zeaplus Nut is also a product of Zeaplus Smart Band, which has the advantage that it is relatively inexpensive compared to other similar products. Nut Smart Tracker is a gravel-like device that can be attached to a key chain and is a product of Beijing Zizai Technology Co, LTD. It is used to track and locate lost devices and keys and is available in a variety of colors. It is very light and thin, easy to carry, communicates with devices via Bluetooth 4.0, and is compatible with iPhone 6/6 + and Android 4.2+ devices. [17]

If you attach the tile to the desired item, you can trace it through the smartphone app. It can also beep. Tiles are also implemented in Bluetooth 4.0, not GPS technology. If the location of a tile is too far away, the tile's cloud-based platform community can be used to track that item through other app users' locations. It also has a waterproof function. It

is the thinnest Bluetooth tracker in the world, just as thin as two credit cards. It can be put in a hard part such as a wallet, a wallet, and a passport. [18]

Table 1: Location tracker

Overseas	Zeaplus Nut	Gravel-like device that can be attached to the grommet It is very light and thin, easy to carry, communicates with devices via Bluetooth 4.0, and is compatible with iPhone 6/6 + and Android 4.2+ devices.
	Tile	If you attach it to the desired item, you can trace it through the smartphone app. It can also beep. Tiles are also implemented in Bluetooth 4.0, not GPS technology. If the location of a tile is too far away, the tile's cloud-based platform community can be used to track that item through other app users' locations.
	TrackR Bravo	The TrackR Bravo is in the form of a small coin, and can be attached like a magnet.
	Chipolo	Chipolo is a Bluetooth-supported item finder with an Android or iPhone app that lets you find items up to 200 feet away. Replaceable batteries last for six months. Geofence tells you when Chipolo is out of range. There is also a temperature sensor that indicates Power: CR2025 (replaceable). Use for about 6 months App support: iOS / Android
	LAPA	Very long signal transmission distance of about 60m Notification Size: 90 decibels Power: CR1632 battery (about 1 year use) Waterproof LCD: LED alarm Communication: Bluetooth 4.0 App support: iOS / Android
	MYNT	Not only stylish and slim design, but also easy to use apps, self-contained remote control. Waterproof for life, Coin battery for about 1 year (Replacement is very easy) US startup Slightech has developed a product
	LINK	Crowd GPS, even if you do not have to be next to me, you can see your location Extreme battery efficiency Simple design
Domestic	ICookie	Because you can call cookies from smartphone apps or call smartphones from cookies Bluetooth transceiver to help prevent loss Size: 31.2 * 7.9mm Communication: Bluetooth 4.0 Communication distance: about 60m Power: CR2032 (replaceable). Use for about 1 year App support: iOS / Android

The TrackR Bravo is in the form of a small coin, and can be attached like a magnet. You can beep through the smartphone app and track your location on the map. The battery can be used for one year. [19]

In Korea, there is 'LINK' which is a tag type location tracker using Bluetooth BLE 4.0. The front / back design, which is made up of buttons and status LEDs in a small size that is a little bigger than a 500-yen coin, is easy to carry anywhere. On the front, there is a status LED and an SOS button. The SOS button is used to trigger notifications from the connected 'FAMY' app when you are at risk or need help. 'FAMY' is an app that links a smartphone with a link. LINK supports crowd GPS functionality through the FAMY app. Crowd GPS (Crowd GPS) is a method that uses the Crowd function instead of the general GPS module to search for the neighboring LINKs, as opposed to the method commonly used in smartphones or navigation systems.

First, the location tracker for loss prevention is small and light in size and weight. Long battery life, easy to use apps, and a wide variety of applications. <https://www.spacosa.co.kr>

iCookie is also a product of domestic small business. It is very similar to the LINK product. The first function is notification function. Cookie and voice / sound (smartphone) are notified when cookie and smartphone are separated from each other a second time. Signal display function Bluetooth signal (sensitivity) - Search for a smartphone in a cookie - Press and hold the 'call button' for 2 seconds - Search for a cookie on your smartphone - Cookie list or details Touch 'Call' on the screen Fourth, the latest location information of the smartphone can be checked in the app by using the recent location information display, so it can be easily found through map when the cookie is lost (location confirmation using GPS of smartphone) [20] A variety of location trackers have been looked at. Although most products have small differences, their performance and appearance are similar. The biggest difference is whether it is a GPS system that locates by satellite or a Bluetooth system that locates by the signal of a mobile phone. Bluetooth has a disadvantage in that the range is short, but the monthly fee is free. The GPS system has a fee for use.

3. USER TEST

We often lose the valuable items such as wallets, umbrellas, car keys, pets, or even children in our daily lives. Therefore, the service that helps users to track their location is as touching as one line of light. However, in reality, whether it is necessary for Korean users to feel the need for these services or not. We wanted to find out how to improve their location tracking service.

First of all, the subjects were selected from three users who have used the location tracker and four who have not used it before.

The interview period was from May 02, 2017 to May 09, one week.

3.1. In-Depth Interview

Q. How many times a day do you forget or find your cell phone or other frequently used things?

A. 1-2 times. You may leave your cell phone or charger when you are ready to go out and get ready for work.

B. I do not find it when I put it in a place that I do not usually put about 3 times.

C. About 2-3 times, when I get up late and are late for class, I have something to take and I do not find it.

Q. How did you cope when you usually forget the location of mobile phones and other frequently used items?

A. Earphones, if you do not have an extra earphone to replace, you can buy a new one or get it through a friend.

B. There is no special way to cope, but keep looking until you keep track of your memories.

C. If you cannot find it, bring something that can replace it. If you have a cell phone, ask your acquaintance to call and locate your cell phone.

Q. How do I keep my cell phone and other frequently used things in order?

- A. The wallets, cell phones, earphones, and other items you collect when you go out, are put on your desk.
- B. Always place your mobile phone on a charger next to your bed, and place frequently used items near the most copper lines.
- C. Keep your cell phone near your bed, and keep your favorite items in your basket.
- Q. Was there any inconvenience related to the location of things while managing cell phones and other frequently used things?
- A. Sometimes when I use things, I leave them there and forget them. Whenever this happens, I have a hard time.
- B. In the case of mobile phones, it is not inconvenient for the place to be set, but other things are not always fixed in position, so it is always necessary to search repeatedly.
- C. Sometimes I do not even think about things, but when I have to take care of it, I am afraid that it will happen if I put it in a place that is obvious to the eye, or if I make hasty preparations.
- Q. Have you ever felt uncomfortable in your life when you cannot find a cell phone or other frequently used things?
- A. I have felt uncomfortable with my mobile phone. When I overslept, I suddenly got out of my cell phone and I was worried that I was in urgent or important communication all day.
- B. When the appointment time is approaching, I was so uncomfortable when I could not find the things I needed to take.
- C. If I cannot find my cell phone, I cannot go outside. I feel uncomfortable because I cannot do anything because I am uneasy until I find it. It contains everything from mobile cards, transportation cards and contacts to mobile phones.
- Q. Do you know what Bluetooth Tracker is?
- A. I have used a lot of Bluetooth products, but the tracker is new.
- B. Until I did this interview, I did not know.
- C. Yes, I was originally interested in Bluetooth related products, but when I was living in the US, I came across my friend's recommendation and YouTube review content.
- Q. If I use 'Bluetooth Tracker', how do I use it?
- A. It seems to be attached to wallets and earphones.
- B. Something that is always less important than a cell phone like a cell phone, but it seems to be used on occasionally used objects.
- C. It seems to be used by attaching it to key, wallet, auxiliary battery, external hard disk etc. which I often lose.
- Q. Do you think you need a variety of Bluetooth Tracker designs?
- A. It would be better if the shape varies depending on the object to be attached. For example, it would be good if the wallet is a card type, and a cell phone is a smart ring.
- B. I do not think it's really strange, but I think it would be better if the design is varied.
- C. Yes, if you do 'Attachment' anyway, it will appear as an appearance, but I think it would be nice if you can.
- Q. If I use Bluetooth Tracker, do I have a requirement for the product?
- A. I like functionality and fancy ratio more than design. If it is easy to use, and the price is cheap, you are willing to try it out.
- B. I would like to present various designs and colors rather than a consistent design.
- C. Once you have answered "above," I'd like to have it. It's like a props. I attach it to the things I use often, but if it is not pretty, I do not want to use it.

3.2. Survey

From June 10th to June 17th, 2017, researcher conducted the survey on 60 college students for one week. The results of the questionnaire of 58 people excluding 2 that did not answer sincerely are as follows.

Table 2: Survey Results

Q1: How often do you lose a cell phone or something in a day?

	Number of People	%
Less than 1 time	8	15%
1-3 times	38	61%
More than 4 times	8	15%
I do not know	4	7%

Q2: Where do you usually keep your cell phones or frequently used things?

	Number of People	%
Around the bed	39	62%
Around the entrance	8	15%
Around the desk	3	7%
Etc	8	15%

Q3: Have you ever felt uncomfortable in your life if you did not find a cell phone or other frequently used item?

	Number of People	%
Have	54	92%
None	0	0%
I do not know	4	7%

Q4: Do you know what 'Bluetooth Tracker' is?

	Number of People	%
Have	15	23%
None	40	69%
I do not know	3	7%

Q5: If you have a chance to use Bluetooth Tracker, would you use it?

	Number of People	%
Use	49	84%
Not Use		0%
I do not know	9	15%

The results of the survey are shown in <table2>.

Experience not finding things well-The frequency of experiences that users have not found despite the

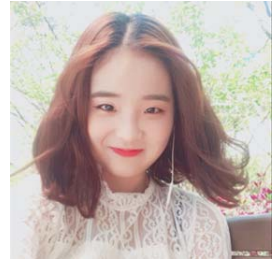
presence of possession in their self-awareness in daily life is high.

The inconvenience of not finding things-The frequency of users experiencing these inconveniences due to the loss of necessary items is quite high.

Recognition of Bluetooth Tracker-The majority of people in Korea do not know yet. However, users' expectation rate of the service is very high.

3-3. Persona

Table 3: Main Persona

<p>Name: Kim Jeong-yeon Age: 37 years Keywords: bumpy personality, busy working mom</p>	
Goal to achieve	
<ul style="list-style-type: none"> - I want to find things quickly and easily when I find things normally. - It's a messy personality. I want you to let me know if I get out of the way. - I want to know the location of missing items and get an alarm. <p>I want to be able to find out what I am when I mix it with the children's things</p>	
Needs	
<ul style="list-style-type: none"> - If there is a missing item, alarm function - Various designs to reflect individual personality - Easy-to-use products without charging - Easy and fast usage - Products that can be used across multiple objects - Products of various colors 	
Main concern	
<ul style="list-style-type: none"> - Location Tracker - Fast positioning of mobile objects 	

Persona is a virtual person who is designed to represent various user types within a population that can use a product or service. It is a resource for establishing user research and marketing strategies in various fields such as service planning, product development, and interaction design development. Persona is a practice-centric methodology first introduced in Alan Cooper's book 'The Inmates Are Running the Asylum', Interaction Designer and Software Development Specialist. [21] In this study, we gathered behavior patterns and characteristics of actual users through in - depth interviews, synthesized the results, and completed the virtual character Persona through existing data research.

<Table3> shows the requirements and goals that users expect of Bluetooth Tracker. First of all, users want to find things quickly and easily when they go

out, and they want someone to tell them when they get out. We also wanted to know the location of the missing items and get an alarm.

I wanted to be able to easily identify what my stuff was when I was mixing it with other things from different people.

4. RESEARCH RESULTS

In order to improve the application design of Chipolo which is a Bluetooth location tracker, we first conducted a user survey, and based on the results, completed the persona and extracted user requirements.

The extracted requirements are as follows.

First, if there is a missing item, it notifies the user through an alarm or the like. Second, I would like a variety of designs that can reflect individual personality. Third, I hope it will be easy to use and easy to use without charging. Fourth, I hope it is a product that can be used in various objects or people or animals.

4.1. Design Result

4.1.1. UX concept

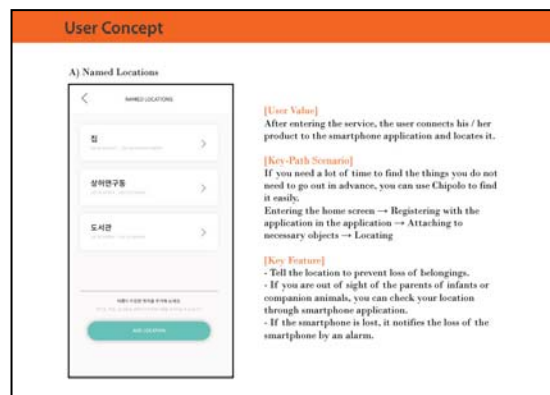


Figure 6 UX Concept

<Figure 6> is the final UX Concept of Chipolo product service. The goal of the service here is to provide an intuitive service so that you can quickly and easily find the things you need when you go out. The details are as follows.

▪User Value

After entering the service, the user connects his / her product to the smartphone application and locates it.

▪Key-Path Scenario

If you need a lot of time to find the things you do not need to go out in advance, you can use Chipolo to find it easily.

Entering the home screen → Registering with the application in the application → Attaching to necessary objects → Locating

▪Key Feature

<Figure 7> shows the New Chipolo's Application Wireframe. Structure is very simple like original Chipolo's Application. <Figure 8> shows the New Chipolo's Application main screens.

- In order to prevent the loss of belongings, we informed its position. In the existing application, we could see only one chipolo on one page, but the new design can check all chipolos which we own at once.

- In the existing application, the login page does not appear directly but the setup page is displayed. In the new design, the login page shows the number of the chipolo you have and the number of connected devices.

- If you are out of sight of the parents of infants or companion animals, you can check your location through smartphone application. In the newly proposed design, you can see all the chipolo I have on My chipolo page and check the position where they exist.

- If the smartphone is lost, it notifies the loss of the smartphone by an alarm.

- Provides design and color to reveal your personality. Thus, the application was able to directly select and specify the color of the chipolo to maintain the consistency of the product and the application.

- the photographs were replaced with simple illustrations, and they were modified to intuitive design. In addition, logout is possible on the personal information screen and it is designed to be able to set

the tracker on the map screen.

4.1.2. Key screens

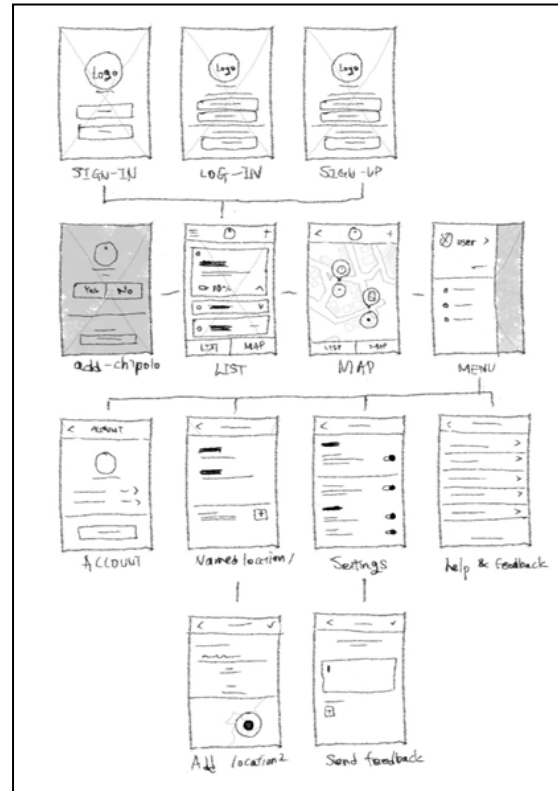


Figure 7 'New Chipolo' application Wireframe (Konkuk University Lee, Injae's works)

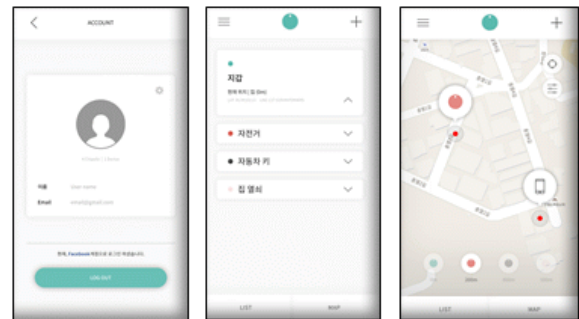


Figure 8 'New Chipolo' application main screens (Konkuk University Lee, Injae's works)

5. CONCLUSION

Modern people spend a lot of time looking for 'something' in their busy daily routine. Therefore, providing intuitive services to find

things quickly and easily is essential for modern people's better lifestyle.

In this study, we conducted a case study on the Bluetooth location tracker which helps the literature survey on the rapidly developing IOT service and the location of the goods easily. In addition, the criteria and direction for the survey were set up and in - depth interviews were conducted according to the criteria to identify the needs of users.

Based on the collected data, the user survey showed that the main user wanted a shape that was appropriate for the object to be attached, convenient usability, low price, and various colors.

Researcher created a prototype for the chipolo application by embodying UX Concepts and service modeling based on the representative requirements that were examined through user research. The original design, it was so complicated that it was hard to recognize how to use. Therefore, the photographs were replaced with simple illustrations, and they were modified to intuitive design. In addition, logout is possible on the personal information screen and it is designed to be able to set the tracker on the map screen.

As a follow-up research, it is expected that the usability of the user mobile application proposed in this study can be applied to verify the usability of the design.

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