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Application Development for Environmental Campaign Certification

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ABSTRACT

This study demonstrates the harmful impact that drugs have when they are dumped on the ground or flushed down the drain since they contaminate soil, water, and even the environment. However, many people are ignorant of the environmental effects of "disposing of" unused medications. So, this research aims to provide a simpler method to reduce this environmental pollution using the mobile applications..

1. INTRODUCTION

● 1.1 What is medical waste?

Medication that has been wasted is a medication that cannot be utilized at home or in other settings because it has passed its expiration date, has degraded, or has been spoiled. Drugs in an unusable form are referred to as "waste drugs" and are included in the category of "disused drugs" that are not used in typical families, etc. Waste medications are, in theory, considered hazardous wastes* and are collected through a separate collection box before being burned.* Among home wastes, those that might harm human health and the environment by spreading illness or harming the body include waste insecticides, waste fluorescent lights, waste pharmaceuticals, and wastes containing mercury (Korea Consumer Agency, 2020).

● 1.2 Relationship between medical waste and the environment

When leftover medications are discarded, they can pollute the land and water, disrupt the ecology, expose people to antibiotics continuously, and cause the spread of germs that are resistant to many drugs(Korea Consumer Agency, 2020).

When low doses of synthetic estrogen (17-Ethylnylestradiol), a component of the contraceptive, were released into the lake over an extended period of time, the fish were unable to reproduce properly and went extinct. According to ongoing research, contaminated pharmaceuticals have a harmful impact on the ecosystem. For example, river pollution has been linked to changes in fish behavior.

The National Academy of Environmental Sciences has also experimented more than three times during the 2000s to demonstrate the effects that result from the disposal. The researchers found a variety of medications, along with antibiotics and analgesics for pain caused by inflammation. In certain instances, bad bacteria perished, good bacteria didn't reproduce, and bacteria developed antibiotic resistance. They stated that the pharmaceuticals we unintentionally discard have the potential to have a substantial negative impact on humans and the entire environment if we continue to disregard these signs.

The British daily newspaper The Guardian published a headline in 2017 that said, "If antibiotics are ineffective, super germs grow and infect people, which might cause 10 million fatalities by 2050."

The "recovery and treatment pilot project for waste pharmaceuticals at home" has grown rapidly since 2009, according to data. However, some local governments now recommend disposing of leftover medications in volume-based trash bags following the change to the "Volume-volume Waste Fee System Fee Enforcement Guidelines" in 2015, which led to a decrease in the number of leftover medications.

When leftover medications are dumped, the environment and the soil and water are polluted. Multidrug-resistant bacteria might spread as a result of disruption and ongoing antibiotic exposure, directly endangering human health. When synthetic estrogen is put into a lake, it stops fish from reproducing after being exposed to it (Korea Consumer Agency, 2020).

In the waters of Korea's four major rivers—the Han River, Yalu River, Nakdong River, and Tuman River—cimetidine (an antacid) was found at an average concentration of 1.163 ppb, according to Cheon Bu-sun (2014). The 0.22 parts per billion validated in other nations is five times lower than this amount. In addition, near the Han River sewage treatment facility, diclofenac (an antipyretic and analgesic) was discovered at a concentration of 9.87 ppb. Once more, this rate is eight times higher than the 1.2 ppb maximum recorded quantity in other areas.

The environment suffers when pharmaceuticals are introduced into the environment. Antibiotics can disturb the entire ecology, even in low quantities, by changing the food chain or the seaweed colony structure. Diclofenac exposure caused severe renal failure in bald eagles, reducing their population by up to 85%, according to one study. It is also hazardous to invertebrates and algae(Korea Consumer Agency, 2020).

The fact that it immediately has a detrimental effect on people's health is the most important problem here. The tissues of animals and plants absorb biological and chemical medications that are released into the environment and left behind in the soil or sediment, and as a result, they eventually return to the human body in the form of food. In this situation, even very little dosages can be dangerous, especially for infants, expectant mothers, the elderly, and those with weakened immune systems(Korea Consumer Agency, 2020).

2. PROBLEMS

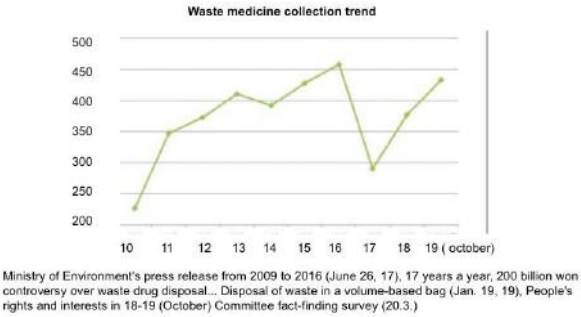
● 2.1 Waste medicine collection and treatment status

Waste medications gathered from pharmacies, such as those used at home, are taken to and kept there until being incinerated(Korea Consumer Agency, 2020).

Table 1. Waste drug collection progress (Source: Korea Consumer Agency, 2020)

For each local government, including pharmacies, pharmacies, public health facilities, local governments, pharmaceutical businesses, and drug distributors, the topic of transit and storage of waste medications is varied, and in some cases it is not clearly defined

(Collection Status) The quantity of leftover medications that had been collected as of October 2019 was 433,480 kg, up from 2010 but remaining steady since the middle of the year(Korea Consumer Agency, 2020).



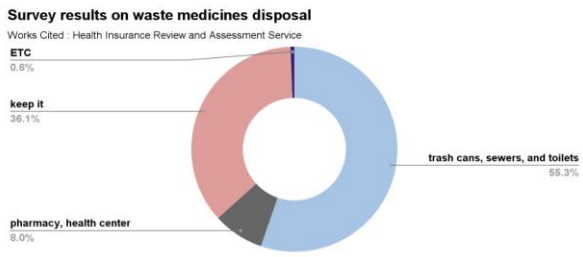
Graph 1. Waste medicine collection trend

After the "Home Waste Medicine Collection and Treatment Pilot Project" in 2009, it showed a steady rise, but after the "Volume-volume Waste Fee Implementation Guidelines" revision in 2015, some local governments gave instructions to dispose of the waste medications in the volume-based waste bags, the amount collected fell. assumed to be three). All leftover medications gathered from pharmacies and public health facilities are burned. They are handled like domestic garbage and may be landfilled if they are disposed of in a volume-based bag, nevertheless. As of 2018, 20,361 tons of household garbage were disposed of in volume-based bags, of which 4,008 tons were landfilled and 12,163 tons were burned (59.3 percent). The components of the waste medicines may thus flow directly into the soil environment through leachate or into the aquatic environment through groundwater in the event of disposing of waste medications at home in volume-based bags (Korea Consumer Agency, 2020).

2.2 Public awareness of waste medicines

The percentage of returning to pharmacies, public health facilities, etc. (8.0 percent) was substantially lower than the rate of disposing of leftover

medications in the trash can, sewer, or toilet (55.2 percent), according to survey data from the Health Insurance Corporation Review and Assessment Service in 2018. Additionally, just 25.9 percent of the population "knows" how to properly dispose of insoluble medications, and the majority of people (74.1 percent) do not know it well, suggesting that it will be challenging to boost the collection rate (Korea Consumer Agency, 2020).



Graph 2. Survey results on waste medicines disposal

This shows that there had been no change in how waste drug treatment was seen and used compared to the findings of a comparable prior survey from 2010(Korea Consumer Agency, 2020).

2.3 Collecting Problems

1. Problems of Offer pharmacies and public health facilities waste medicine collecting bins, and encourage them to attach notes

The collecting box is put in a visible location, and a notice is displayed asking people to dispose of their used medications through pharmacies and public health facilities. However, as a consequence of this survey, only 17 (14.2%) of the 120 pharmacies examined had waste drug collection boxes, and only 6 (5.0%) had information boards. As a result, customers returned waste pharmaceuticals via pharmacies. It was almost impossible to complete. Additionally, only 4 (33.3 percent) of the 12 public health centers had a collection box, and only one (8.3 percent) had a notice board, making it challenging for customers to dispose of expired medications at home through public health centers. As a result, improvements are required. Additionally, there aren't any pharmacies that sell over-the-counter medications and offer advice on how to dispose of unneeded medications, so there isn't enough exposure regarding gathering unused medication. In order to distribute and maintain a waste medicine collection box and information board in pharmacies and public health facilities, it is necessary for the relevant local government and relevant ministries to create these items. They should also strengthen the policy requiring pharmacists to provide medication guidance and raise awareness of the collection of waste medicines(Korea Consumer Agency, 2020).

Problems of Enhancing standard ordinance draft preparation, collecting, and implementation assessment and management

Even though ordinances have been passed, the collection cycle, transport, storage, and incineration entities are not specified, and there are instances where the contents of collection box installation, pharmacist medication guidance, and notice board posting are not specified. Currently, the collection and disposal of waste medicines come under the scope of local governments, and for such management, standards must be prepared through the "Ordinance on the Management of Unused Medicines." Local governments are required under the "Guidelines for Management of Hazardous Wastes in Living Areas" to submit an annual report to the Ministry of Environment detailing how hazardous wastes are managed in everyday life. However, whether or not to collect each household's hazardous garbage individually and the collection methods must be disclosed when reporting performance(Korea Consumer Agency, 2020).

3. CURRENT SOLUTIONS

3.1 Current solutions that they are offering

1.By making waste medicine collecting boxes and informational boards, local governments, and capable ministries distributed and kept in pharmacies and public health facilities(Korea Consumer Agency, 2020).

2.Create a strategy to increase awareness of and public support for collecting used medication(Korea Consumer Agency, 2020).

3.Standard draft creation for the Ordinance on the Management of Dissolved Drugs and Ordinance Enactment Making Plans for the Growth of Local Governments(Korea Consumer Agency, 2020)

4.Evaluation and management of collection and treatment implementation in addition, such as individual waste medication performance reports(Korea Consumer Agency, 2020)

3.1.1 Their plans

1. Recommendation from the government (local government, Ministry of the Environment, Ministry of Health and Welfare), Distributing waste medicine collection boxes and information boards to pharmacies and public health centers by local governments and relevant ministries, Preparing a standard draft of "Ordinance on the Management of Insoluble Drugs" and planning to increase the number of local governments passing ordinances Complementary evaluation and management of collection(Korea Consumer Agency, 2020).

2. Providing website content with customer information, such as media coverage and consumer era(Korea Consumer Agency, 2020)

3.2 Domestic System: Domestic laws and ordinances

According to the enforcement rule article 14 waste management act, household wastes that pose a threat to human health and the environment are recognized as "hazardous wastes in the living system," and the head of the local government is required to develop and implement a treatment plan and evaluate its effectiveness. In addition, the guidelines for hazardous waste management established by the Ministry of Environment stipulate the details of waste drug discharge and collection.

The following refers to the disposal and collection of pharmaceutical waste. Home medication disposal is free, however, pharmacies and public health clinics will charge a fee (including health and medical centers; hereinafter the same shall apply) Discharge to public health offices or health clinics - If the waste drugs generated by business activities, such as drug wholesalers, qualify as household waste, they must be disposed of through the household waste drug collection and treatment system; however, discharge and fees are imposed and collected according to local ordinances (Korea Consumer Agency, 2020).

Posting notices or affixing notice boards at pharmacies, etc. discharging locations to dispose of waste medicines generated at home to pharmacies, public health centers, health centers, or health clinics - In pharmacies, public health centers, public health offices, or health clinics that collect waste drugs, the waste drug collection box is placed in a conspicuous and easily accessible location. The medical waste that is disposed of from the pharmacy, they have to be collected at least once a month and have to be delivered to an incineration facility. Local governments are now responsible for the collection and handling of discarded pharmaceuticals. The "Ordinance on the Management of Unused Medicines, etc." has been passed by several municipal governments. It provides information on the cycle, etc(Korea Consumer Agency, 2020).

3.3 Overseas Countries Medical Waste System

3.3.1 EU

In accordance with the 2001 "Guidelines for Human Medicines11"), certain warnings for disposing of leftover pharmaceuticals, etc., must be printed on the outside packaging, and member states are required to establish an adequate collecting mechanism for unused drugs, etc.

Guideline	Article	Description
	Article 11	Specific Precautions for Disposal of Disposable Medicines or Wastes Derived from

		Pharmaceutical Substances
2004 / 27 / EC	Article 54	The summary of product characteristics should include the following information: Disposal of wastes derived from insoluble drugs or pharmaceuticals Specific Precautions and References to Appropriate Collection Systems
	Article 127b	Member States should ensure that appropriate collection systems are in place for unused or expired medicinal products.

Table 2 . Articles related to waste medicines in the EU 「Guidelines for Drugs for Human Use」

3.3.2 France

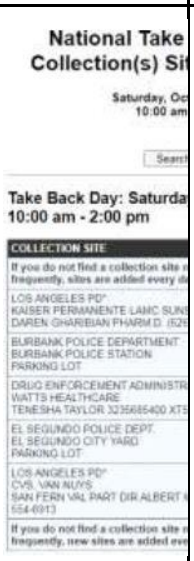
The Public Health Act of 2009 created the legal framework for the recall of unused medications from pharmacies, which was made mandatory in 2007. Through the 'Cyclamed' initiative, the entire nation actively participates in the collecting of unused medications; thus, eight out of ten individuals return unused medicines to pharmacies. In the same year, 376 tons were collected in Korea, and an average of 7.3 grams per person was returned, indicating a significant difference. Cyclamed is operated with the assistance of 18 million euros donated by the multinational pharmaceutical corporation Sanofi as of 2016(Korea Consumer Agency, 2020).

Picture 1. France pharmacy which shows how they use Cyclamed box

3.3.3 United States of America

The Waste Drug Discharge Act15) authorized pharmacists and the DEA (U.S. Drug Enforcement Administration) to collect unwanted pharmaceuticals in 2010. The DEA announces the national take-back day on its website, and when you enter your address, the site directs you to the nearest collection point so that you can drop off your

medications on the designated day. Additionally, pharmacies, hospitals, and legal facilities are designated as collection points, so returns are possible at any time(Korea Consumer Agency, 2020).

Collection date information	Collection location information	Mail-back Program Guide
		

Picture 2 . USA's collection data information

Picture 3. USA's collection location information

Picture 4. USA's Mail-back Program Guide

3.3.4 Canada

Certain provinces in Canada have a producer-responsibility waste medication collecting system in compliance with provincial law16). The "Medication Return Program" is administered by the non-profit group HPSA (Health Products Stewardship Association) with the help of pharmaceutical corporations(Korea Consumer Agency, 2020).

Picture 5. Canada medical waste collection box

3.3.5 Switzerland

In Switzerland, the Environmental Conservation Act is the cornerstone of environmental legislation (USG). This legislation controls environmental issues such as water quality, soil, and garbage. In addition to this Act, the Water Resources Conservation Act and Chemicals Act govern relevant industries, however, the majority of the specifics are specified in the Environmental Conservation Act's Enforcement Decree or Enforcement Regulations. As such, the Swiss Environmental Conservation Act extends to the whole environmental sphere, and its punishment measures are very stringent, penalizing all purposeful and careless illegal offenses. (Han, 2021) Article 74 of the Federal Constitution of Switzerland declares, "The Federation enacts laws to protect humans and their natural environment from damage or harm." Such danger or damage must be avoided. The polluter is responsible for the price of preventing or eradicating such damage or injury. The states are responsible for the execution of federal rules unless the Federation is required to do so by federal law. In addition, Article 120 of the German Federal Constitution states: "Humans and their environment shall be protected from the exploitation and abuse of genetic technology." The Federation regulates the reproduction and use of the animal, plant, and other creatures' genetic material. To this purpose, it is necessary to consider not only the dignity of living things, but also the safety of humans, animals, and the environment, and to maintain the genetic variety of plant and animal species."

4. PROPOSAL: COLLECTING UNUSED MEDICINE USING MOBILE APPLICATION:

I am trying to find a way to reduce medical waste using the mobile application through this paper. First, I would like to research the mobile application and follow the trend of the mobile applications and then suggest an app called " aXepill".

4.1. Mobile app

4.1. 1 The advantages of using mobile app

Recent figures indicate that around 13 percent of patents issued by software-related firms in the U.S.87 percent of patents awarded by typical manufacturing enterprises are reportedly given to startups. Manufacturers are conducting an increasing amount of research on software convergence. Therefore, it is currently impossible to separate manufacturing from software. Software is reportedly the primary component that impacts the competitiveness of the industrial business (Norton, 2006) . Also, connecting to the mobile application will allow more people to access the service because this is the most popular way for people to access it through their mobile phones and the most logical way to use the platform effectively is by creating a smartphone app.

In contrast to most other industries, the software industry has endured COVID-19 relatively well. While stay-at-home limitations and company closures have decimated industries that rely on physical services and in-person clients (such as hospitality, arts, and tourism), technology companies appear to have emerged largely unharmed from the crisis. As a result of the coronavirus boosting our daily screen time by a third and accelerating businesses' adoption of digital technology by several years, the events of the pandemic have improved the performance of various segments of the software sector (MarketFinance,2021). First, the productivity of remote working has increased. More than half of respondents to a study conducted by ASG Technologies stated that the COVID-19 criteria enhanced their attention to DevOps activities (a set of practices that combine software development and IT operations). In contrast, 52.3% indicated that it boosted their cloud migration progress (the process of moving data to a cloud computing environment). These figures align with the larger trend toward increasing productivity in other industries, where production is said to be up 47%, CRM activity is up 176%, and phone conversations are up 230%.

In addition, the demand for services has increased. Despite a decline in demand for the majority of essential service providers into 2020, data and software developer positions have continued to expand. According to research by Randstad, a recruiting and employment service, data and software development roles surged by 1% and 8% during the first few months of the epidemic.

Moreover., digital spending has increased. According to a recent Institute of Financial Studies (IFS) report, 70 percent of UK firms elected to increase or maintain expenditures in digital technology over the previous year, while just 19 percent intended to reduce tech spending. The survey also reveals that 52 percent of enterprises have increased their digital expenditures in response to COVID-19's macroeconomic disruption.

Furthermore, A further unanticipated effect of the COVID-19 pandemic was the expansion of digital health technology. Digital solutions have aided the healthcare system in innumerable ways, from hospitals utilizing software to give patients with contact-free healthcare services to private enterprises developing AI apps to alleviate some of the responsibilities associated with healthcare (MarketFinance,2021).

4.1.2 Case study of mobile app service

Smartphones are hybrid devices that combine the functionality of digital mobile phones and personal digital assistants. Smartphones can access the wireless Internet regardless of time or location, and as new functionalities are introduced, it is bringing about significant changes for individuals, businesses, and society. Mobile apps, which are applications installed on smartphones or personal digital assistants (PDA), include schedule management and address book management programs, multimedia playback programs, alarm functions, calculators, games, Internet access services, music playback functions., navigation, and office applications (Park et al., 2012).

In the early phases, mobile app technology and security, UX/UI, supplied services, and intent to use are becoming key concerns as a result of the rapid proliferation of smartphones. The research on the technology and security of mobile apps comprises a study on the elements that increase the privacy protection of mobile apps from the perspective of users and developers, as well as a study on the construction of an EFL/ESL cognitive framework for mobile apps. Users with a high drive to pursue media material and frequent access place a premium on the application's utility, whereas consumers with strong managerial usefulness, entertainment, and time-passing needs place a premium on the application's usability when creating an attitude toward it. considered a factor. As a result, it appears that the availability of constant access influences the desire to use a mobile application, with enjoyment, interest, and mobility also playing a crucial role.

4.1.3 Government and local governments' mobile app service provision status

As of 2012, local governments and public institutions, including central administrative agencies, supplied a total of 393 public app services, including civil complaints 24 and the Sangsang proposal. Local governments typically have a large number of apps in the categories of culture and travel, whereas government agencies have a large number of applications in policy information and economy-related subjects. Guidelines for app-accessibility have been published. The purpose of this guideline is to increase accessibility for information-vulnerable groups such as the disabled. It consists of a list of points to be observed and recommendations to be followed when designing an app.As the mobile environment evolves, the government and public institutions have made efforts to develop and distribute public apps that provide public services in a convenient manner. However, the majority of applications are designed to provide simple information, and there are few apps that handle civil complaints. In addition, with the exception of a few apps, a substantial number of public apps have not yet been activated, and duplicated content exists. The purpose of this study is to identify the issues with these public app services from the perspectives of providers, developers, and users, and to provide remedies based on this information.

4.2 Suggestions for an App

We found out that the route to access the proper way of medical waste is complicated and people lack social awareness of medical waste disposal. So we are trying to develop an app that eliminates the process of delivering to the pharmacy, raises social awareness toward medical waste disposal, reduces environmental pollution, and creates an easy route for people to access.

4.2.1 The medical disposal app, "aXepill"

Axepill is a mobile application for customers who wish to "properly dispose of" medical waste through locating health centers or medical facilities that provide the proper accommodations for medicine disposal. The aXepill planned to create an app that tells the location of public health clinics to solve this problem and dispose of medical waste properly. People can discover venues to dispose of medication trash more readily if they are informed about the location of health clinics. The aXepill anticipates a reduction in water contamination when pharmaceuticals are properly disposed of.

The aXepill was developed using Android Studio. Android Studio was first announced at the Google I/O Conference in 2013 and is a software-integrated development environment (IDE). Gradle, a build automation system utilized by Android Studio, facilitates the synchronization of library versions as Android Studio continues to add libraries and projects. In addition, multiple types of emulators can be controlled, and the layout editor makes it simple to develop user interfaces (User Interface). The developed application uses the GPS function of the smartphone to determine the user's current position and the camera function of the smartphone to take a picture that visually depicts the current concerns and problems of village civil affairs. The written complaint-related information and photo data are maintained in the database of the server.

*4. 2. 2 Target Customers*In general, to effectively dispose of waste medicines, the waste drugs must be received by pharmacies, public health centers, pharmacists, and pharmaceutical companies. Our app specifically targets people who deal with medical waste daily: people who work at hospitals, medical facilities, funeral homes, and veterinary clinics. It allows users to raise awareness of the hazardous effects of medical wastes and their potential to cause environmental degradation. Thus, it encourages users to dispose of medical waste properly and efficiently by offering them a service that allows them to send medical waste to the nearest healthcare center in their local area.

4.2.3 Market analysis

The aXepill eliminates the process of delivering to the pharmacy. In pharmacies, odorous waste medicines and unsightly storage due to liquid medicine bursting are often concerns. Pharmacies are additionally burdened with collecting waste medicines because of the number of waste medicines. Pharmacists are engaging because it is required, but they believe there should be no labor or obligation on their shoulders. According to the Korean Pharmaceutical Association, without burdening pharmacies, it should be feasible to collect and incinerate household waste medicines gathered at pharmacies.

The fundamental issue here is the people's lack of social awareness toward medical waste disposal. According to a Health Insurance Review and Assessment Service survey, 55.2% of respondents answered that they dispose of medicines through trash cans, sewers, and toilets. People's awareness of how they confront this environmental issue is a severe issue. In the fifth section of our app, which is INFORMATION, they can learn basic information. For the essential information, they can learn about the definitions and types of medical waste. In addition, there will be articles and tips on how to reduce medical waste and how it is essential to dispose of the waste properly in the nearby healthcare facility. Statistics on this page will highlight how our app has contributed to reducing medical waste.

The aXepill will be successful because biomedical waste has posed significant challenges to the world, and this app will generate less pollution, especially for hospitals, dispensaries, and testing laboratories. It would be way much easier to deal with biomedical waste.

4.2.4 Competitor Analysis

The mobile application developed by Andhra Pradesh's state pollution control is one of our competitors. It is a mobile app for effective management and scientific disposal of biomedical waste from Covid-19 hospitals and quarantine centers. The similarities that aXepill and APPCB have are the target market. Both apps target hospitals that require the disposal of tons of biomedical waste. However, technically, this app only has a function that prescribes detailed guidelines. Unlike APPCB, our app has six functions (mentioned above). In addition, our app provides a simple route for people to access by directly delivering the medical waste to the nearest public health center through a detailed map. Moreover, aXepill enables friendly and interactive live chat in case the users need guidance on proper disposal protocols of waste products. Users of the app can also write reviews and rate our app on various app stores and be engaged as a part of the community by uploading photos that encourage the trend of proper medical waste disposal methods.

The aXepill is unique as it calculates the amount of waste generated by each user or household to set a threshold for the number of wastes produced by each user. Photos taken during waste disposition can be uploaded to the system, featuring a real-time online education and communication platform for discussing waste sorting.

The app also covers safety procedures for handling medical waste, for example, medical waste policies and user responsibilities. aXepill specifically focuses on people who must manage medical waste and thus, manage medical waste by preventing it from harming neighbors, patients, and the public.

4.2.5 App design

The aXepill app name was made by combining two words, "axe "and "pill." Axe means the abrupt removal of something, and pill means medicine. As two words are combined, this eventually means removing the medicine.

Picture 6. Logo of aXepill

4.2.6 Hex colors

#9DF63F - green stands for environment

#4F6FFE-- blue stands for the sea that is getting polluted due to the disposal waste

#FFFFFF- this color represents the medicine

4.2. 7 The functions of the app

AXepill's app is divided into six sections after the user logins into its account:

SEND	Users send the medical waste in either of the two ways they prefer. Direct delivery to a nearby public healthcare center and submit the form to provide they did or registered in a group. second method
MAP	● Provides a map to find the nearest public healthcare center ● Users can click or zoom on a specific desired location to receive basic information such as office hours, phone number, website link, and more.
MY PAGE	● Users check their current activity points and guidelines on how the activity points are earned.
VOLUNTEER	● Can register for volunteer activity ● The app outlines each activity's detailed data and locations
INFORMATION	● Users can learn basic information and check out notifications in the community ● Can learn about the definitions and types of medical waste that exist and are consumed frequently
ABOUT US	● Displays the company's mission statement, FAQ, and contact points.

Through the above services, users will be able to preserve the environment by utilizing this app.

5. CONCLUSION

As biomedical waste has posed significant challenges to the world, various nations exhibit varying approaches to reducing medical waste. Since South Korea has the following shortcomings, South Korea should develop more mobile applications that can offer solutions to the following problems which will be helpful to save millions of animals and humans worldwide.

Further developed mobile app locations will help to generate less pollution, especially for hospitals, dispensaries, and testing laboratories. It would be way much easier to deal with biomedical waste.

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