The Development of A Web Application for Tracking Medical Cannabis Products

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Abstracts: This research aims to develop a web application for tracking medical cannabis product information, designed and developed according to the System Development Life Cycle (SDLC) process. The study was conducted in the province of Buriram, Thailand, and the sample group was selected through purposive sampling, consisting of 30 individuals from Play La Ploen Community Enterprise, representing cannabis cultivators and medical cannabis product processors. Data was collected through in-depth interviews to gather database design and system development requirements. The tools used for system development were PHP, HTML, CSS, JavaScript, Bootstrap, Visual Studio Code, and XAMPP, with MySQL used as the database management system. The effectiveness of the information system was evaluated using a 5-point Likert scale questionnaire developed based on the PIECES framework. The research findings indicate that the medical cannabis product tracking system is functional, as users are able to scan the QR code on the packaging to obtain comprehensive and complete information about the product.

Keywords: Information system, Medical cannabis products, Supply chain management, Tracking system, Web application.

1. INTRODUCTION

Cannabis is a plant that thrives in warm climates and contains compounds that affect the nervous system, particularly in the leaves and flowering buds. When consumed, it can induce euphoria and anxiety [1]. The cultivation of cannabis plants has a long history, and it has been found that its fibers and extracts can be utilized for medicinal purposes. The cannabinoids found in cannabis that have been extracted for medical use consist of two types, namely Tetrahydrocannabinol (THC) and Cannabidiol (CBD). The benefits of using cannabinoids in medicine have been found that the compound THC can reduce symptoms of nausea, vomiting, and pain. On the other hand, the compound CBD can reduce pain and control seizures [2,3]. Currently, the World Health Organization classifies THC as a Schedule I substance due to its high potential for illicit purposes, although it has medical benefits. Conversely, CBD is not considered a substance of abuse; therefore, cannabis is still considered a Schedule I substance. [4]

The Thai Ministry of Public Health has established a Medical Cannabis Service Plan with the aim of increasing healthcare opportunities for patients suffering from severe, chronic, or unresponsive illnesses who do not respond to current Western or Thai medical treatments. Consequently, this has led to a push for legalizing cannabis cultivation. In 2019, the National Farmers Council proposed the cultivation of cannabis for medical purposes, with a pilot program to be implemented in four provinces across different regions, including Lampang in the Northern region, Buriram in the Northeastern region, Kanchanaburi in the Central region, and Surat Thani in the Southern region. The cultivation of cannabis is only permitted using organic farming methods and must be delivered to the Department of Thai Traditional and Alternative Medicine [5]. While Thailand is in the process of developing legislation regarding the medical use of cannabis [6], the cultivation of cannabis still poses certain risks to society's physical and mental health in some respects. Therefore, the cultivation, production, and usage must be strictly controlled by the public health authorities and in accordance with the principles of relevant laws and ministerial regulations, as stated in the Narcotics Act (2019) only [7,8,9,10] in order to instill confidence in stakeholders that the product is genuinely safe for use.

The researchers thus applied the concept of supply chain management in developing a web application for tracking medical cannabis products. The study was conducted in the leading province of the northeastern region of

Thailand, linking all activities from importation, cultivation, harvesting, production, processing, and distribution, to enable stakeholders to efficiently access and review backward data on medical cannabis products.

2. LITERATURE REVIEW

According to Section 26/2(1) of the Narcotics Act (No. 7), B.E. 2562 [11]

"No person shall produce, import, export narcotics of category 5, except in the case of necessity for the benefit of the government, medical treatment, patient care, research and development studies, including agriculture, commerce, science, or Industries for medical purposes, and have obtained a license from the licensing authority with the approval of the committee."

Therefore, all information from farmers who grow cannabis plants to the point of processing into medical products, including the remaining parts of the cannabis plant that must be destroyed, must be licensed and reported according to the strict guidelines of the Ministry of Public Health. The process of medical cannabis production must adhere to quality control regulations set by the government, starting from the cultivation stage to the final product [9,12]. The activities involved in this process include several sectors, such as the provincial public health office, which imports cannabis strains and distributes them to registered farmers; the farmers who are responsible for planting, harvesting, and destroying the cannabis plants; and the factories that are responsible for processing and manufacturing cannabis products, which are then sent to hospitals.

The development of a web application for tracking medical cannabis products aims to collect data on all activities throughout, allowing stakeholders to track product information via QR code and view corresponding details. Therefore, the researchers have adopted the concept of supply chain management as a framework for designing and developing systems, Due to supply chain management, collaboration between organizations is facilitated, enabling close monitoring of work processes [13,14,15,16,17]. It utilizes existing resources efficiently, reduces system-wide costs [13,18], and enables effective inventory management, effectively meeting customer demands [19,20]. This approach is beneficial and suitable for medical cannabis products [8,12,21]. Additionally, the information system plays a crucial role in providing visibility into the overall system operations [15,22,23]

The development of a system begins with studying a functional architecture model, physical architecture, and communication architecture in developing an agricultural logistics data system, based on the idea of Chaimae [24]. The study found that the appropriate architecture can support efficient supply chain management activities. This is consistent with the findings of Garay-Rondero et al. [25], who found that the use of ICT has a direct positive impact on the efficiency of supply chain management. In addition to providing convenience, efficiency in accessing data, and increasing flexibility in operations, ICT can also reduce operating costs. Furthermore, the application of the concept of supply chain management to information systems helps stakeholders to accurately verify information in the supply chain and produce reliable reports while maintaining a high level of security in usage [26,27]. This is consistent with the findings of Gupta et al. [18] and Dubey et al. [28,29], which suggest that information systems have a positive relationship with high-level supply chain management, allowing for flexible and adaptable management practices that ultimately lead to successful supply chain operations.

2.1. Objectives

1. To study the operation of the medical cannabis product tracking system
2. To design and develop a system for tracking medical cannabis products
3. To evaluate the effectiveness of the medical cannabis product tracking system

3. METHODOLOGY

3.1. MATERIALS

3.1.1 The tools used for data collection were in-depth interviews with tools verified by experts through the use of IOC values.

3.1.2 The tools utilized in the development of the information system include PHP, HTML, CSS, JavaScript, Bootstrap, Visual Studio Code, and XAMPP. In addition, MySQL is utilized as the database management system.

3.1.3 The research tool used was a Likert Scale questionnaire consisting of five options to assess the effectiveness of the information system. The statistical analysis was performed in percentage.

4.2 Methods

The researchers conducted a study to develop a system for tracking medical cannabis products, following the process of the System Development Life Cycle (SDLC) [30]. The research activities were divided into three phases based on the research objectives, as shown in Table 1.

Table 1. Research Methods

Phase	Activities
Phase 1: study the operation of the medical cannabis product tracking system.	Preliminary Investigation
Phase 2: Design and develop a system for tracking medical cannabis products.	Planning
	Defining
	Designing
	Building & Test
Phase 3: Evaluation of the effectiveness of the medical cannabis product tracking system.	Deployment

From Table 1, the research methods are as follows:

Phase 1: The preliminary investigation was conducted to study the operation of the medical cannabis product tracking system. This involved engaging with stakeholders' representatives to identify the relationships between relevant organizations, activities, data, and resources within the medical cannabis product supply chain. The outcome of this phase is the context of the tracking system for medical cannabis products.

Phase 2: A system for tracking medical cannabis products has been designed and developed as follows:

First: Planning activities consist of system development planning, which includes defining the scope of work, schedule, and resource allocation to ensure the project's success. The system's functions are devised using a decomposition diagram depicting a work breakdown.

Second: Defining activities involves the requirements for gathering and analyzing a medical cannabis product tracking system. This was done through in-depth interviews with key informants. The outcome of this activity is a logical model consisting of an Entity Relationship Diagram and application architecture, which will be used for designing the subsequent information system.

Third: Designing involves selecting appropriate tools for system development, including pHp,

HTML, CSS, JavaScript, Bootstrap, Visual Studio Code, and XAMPP. The database management system used is MySQL, which is an open-source and freeware solution. Additionally, the user interface is designed in this phase.

Fourth: Developers are responsible for creating the database, writing the program, and verifying the system.

Phase 3: Evaluation of the effectiveness of the medical cannabis product tracking system through deployment activities. This includes system installation, usability testing, and performance evaluation. The sample group was selected using purposive sampling and comprised 30 individuals from the Play La Ploen Community Enterprise in Buriram province, Thailand, consisting of a pioneering group of farmers and producers of medical cannabis products in the northeastern region of Thailand. The research tool used was an Information System Performance Evaluation questionnaire.

The assessment was developed using the PIECES Framework, which consists of six indicators: performance, information, economics, control, efficiency, and service [31]. Each indicator has key variables that influence the success of policy implementation, as follows:

1. Performance: The use of information systems is expected to result in increased productivity and a high possibility of benefiting the improvement of the efficiency of the control and tracking system for medical cannabis products.
2. Information: The development of the system based on management and user requirements will reflect the system's credibility, accuracy of the information, ability to provide information services, and responsiveness to information needs.
3. Economics: The role of information systems will create value for each business unit in the medical cannabis supply chain. The new system will develop cooperation between business units from the beginning to the end without limitations in terms of distance and time.
4. Control: Information systems will assist each business unit in reducing risks associated with traditional operational practices and creating best practices for management in new formats.
5. Efficiency: The information system will effectively reduce operating costs in terms of both budget and time.
6. Service: Various long and complicated processes in the government system will be simplified by integrating different steps into the information systems, allowing for faster and more efficient work. The results of the system performance evaluation have led the researchers to refine the system to meet user requirements and install it for actual use.

4. RESULT AND DISCUSSION

The study results on the operations of the medical cannabis product tracking system reveal that the process of controlling and tracking cannabis product activities consists of four steps, as follows: 1) importing cannabis strains and distributing them to registered and authorized farmers by the provincial health office; 2) cultivating and harvesting the product by farmers; 3) processing into medical products by the Play La Ploen Community Enterprise; and 4) utilization in medical facilities by the Khu Mueang Hospital, Buriram Province, as shown in Figure 1.

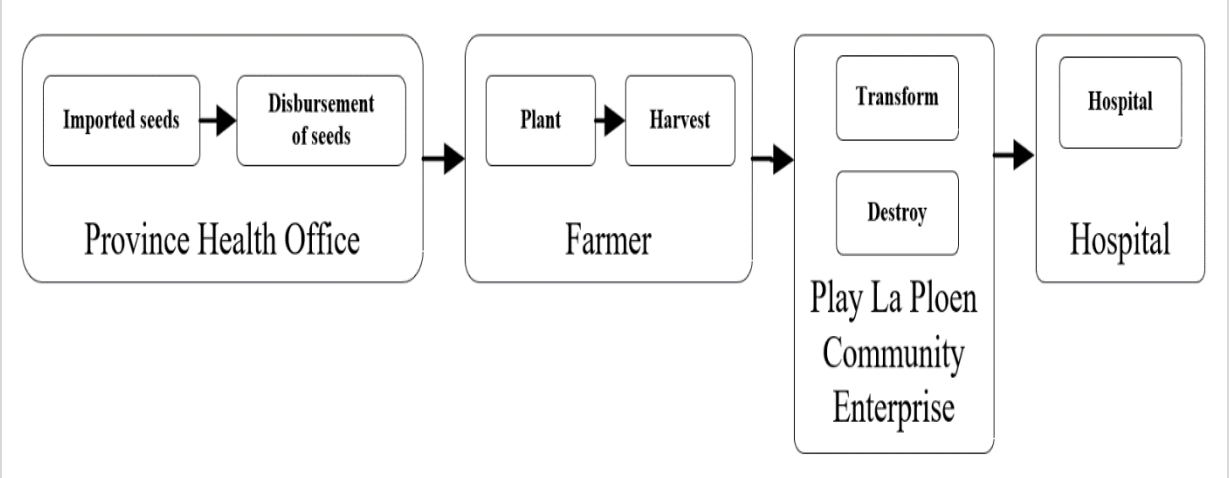

Figure 1. Context of Tracking System for Medical Cannabis Products.
Source: Survey (2022).

The results of the design and development of the medical cannabis product tracking system. Based on the planning activities, the functions of the tracking system for cannabis products can be defined as shown in Figure 2.

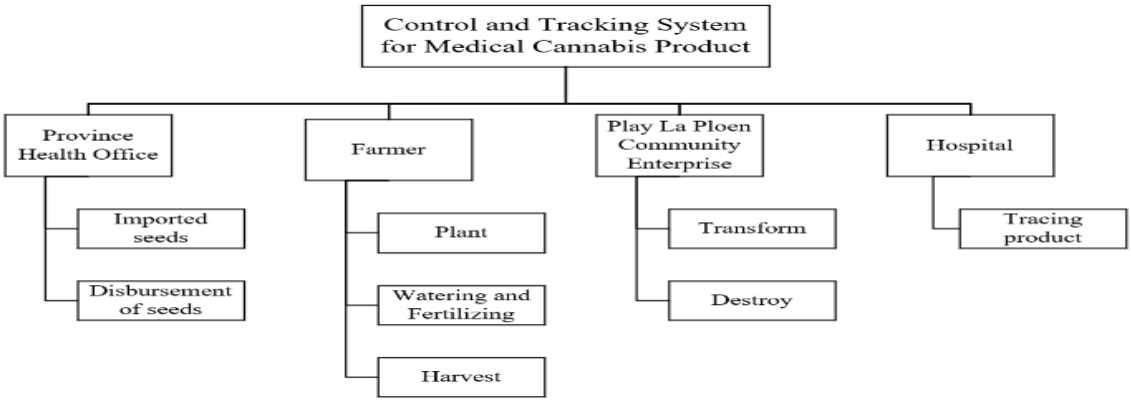

Figure 2. Decomposition Diagram of Tracking System for Medical Cannabis Product

Based on Figure 2, the system functions are designed according to the roles and responsibilities of each unit, as follows:

Province Health Office is responsible for importing cannabis seeds and processing requests for cannabis seed acquisition from farmers.

The farmer is responsible for dispensing cannabis seeds, cultivating cannabis plants, watering and fertilizing them, as well as harvesting the cannabis yield.

Play La Ploen Community Enterprise is responsible for processing cannabis products into medical products.

The hospital is capable of safely examining medical cannabis products and administering them to patients.

The researchers utilized stakeholder requirements to design a data model for the creation of a database for the tracking system, as depicted in Figure 3.

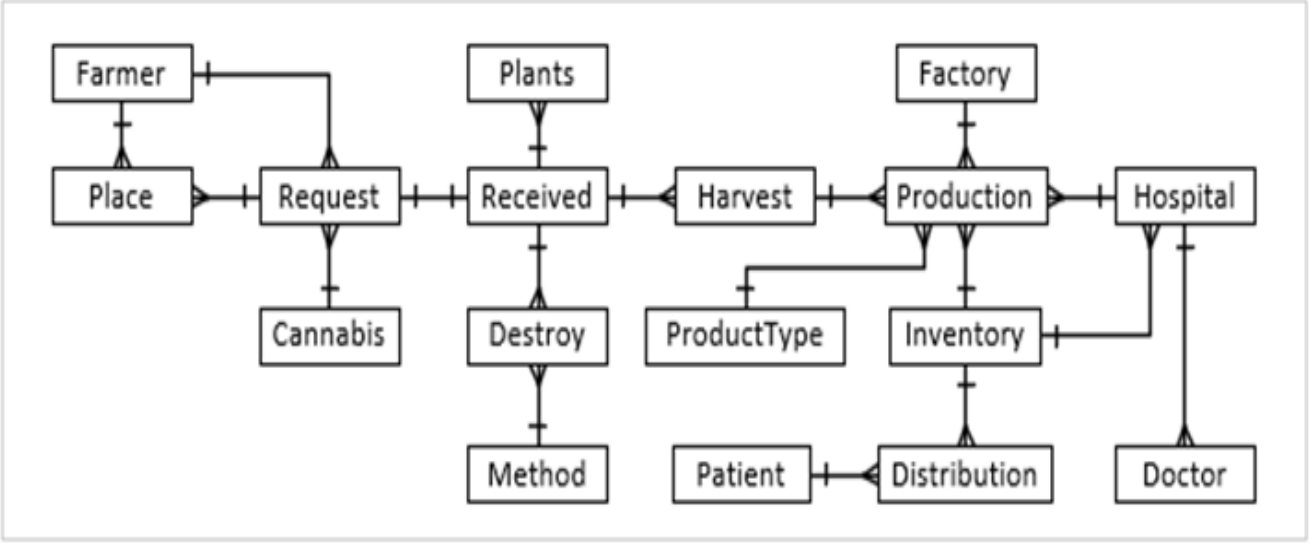

Figure 3. Entity Relationship Diagram (ERD) of Tracking System for Medical Cannabis Product.

Based on the ERD in Figure 3, the database will store information about farmers, cultivation locations, cultivation permit applications, cannabis strains, receiving and distributing of cannabis strains, cultivation processes, harvesting, destruction, processing into products, production facilities, inventory, and delivery of medical cannabis products to hospitals. Afterward, the application architecture was designed.

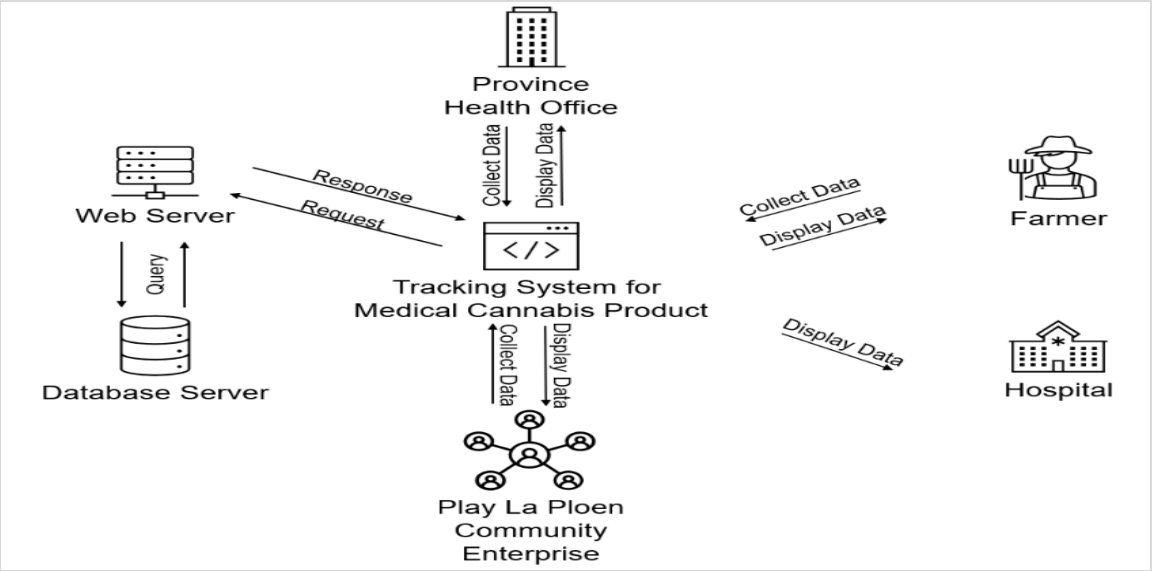

Figure 4. Application Architecture.

From Figure 4, the Medical Cannabis Product Tracking System was developed using web architecture design concepts. Users including the Province Health Office, farmers, Play La Ploen Community Enterprise, and hospitals can access the developed application via a web browser. The web server is responsible for sending and receiving data using the HTTP protocol, while a database server stores data related to the medical cannabis product tracking system.

The medical cannabis product tracking system, which has been customized to meet the stakeholders' needs, will be a web application under the domain name http://cnb.bru.ac.th. It consists of user interfaces for four user roles, including:

1. The Province Health Office can manage data related to the import of cannabis seeds and the requests for cannabis seeds from farmers, as illustrated in Figure 5

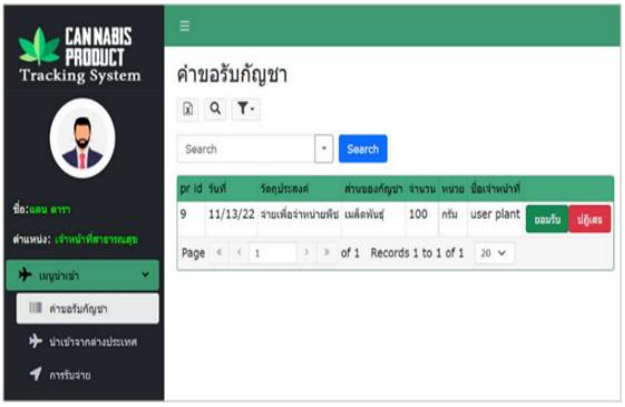

Figure 5. Function for The Province Health Office
Source: http://cnb.bru.ac.th

2. Farmers are able to manage data related to cultivation activities, from the distribution of cannabis seeds, planting, watering, and fertilization, to the harvesting process, as depicted in Figure 6.

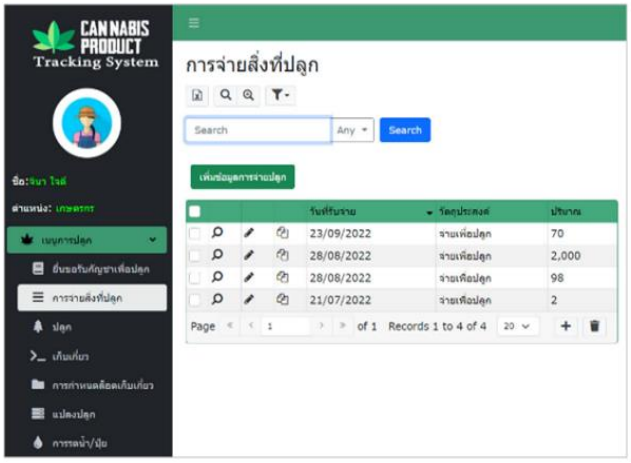

Figure 6. Function for Farmers
Source: http://cnb.bru.ac.th

3. Play La Ploen Community Enterprise can manage data related to product processing and generate QR codes for traceability purposes, allowing for backward data checking, as shown in Figure 7.

Figure 7. Function for Play La Ploen Community Enterprise

Source: http://cnb.bru.ac.th

4. The hospital will be able to track medical cannabis product information using a QR code displayed on the product. The result will display information about the cannabis strains, farmers, plots, planting date, harvest date, processing date, processing place, and lots of products, as illustrated in Figure 8.

Figure 8. Output for Tracking Medical Cannabis Products via QR Code
Source: http://cnb.bru.ac.th

The evaluation results of the medical cannabis product tracking system across 6 dimensions, as presented in Figure 9.

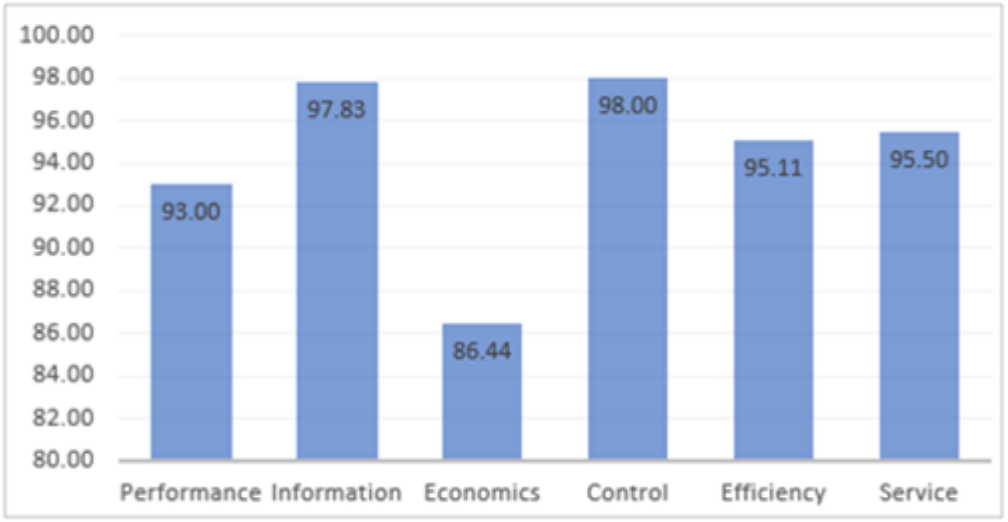

Figure 9. Evaluation Result of Tracking System for Medical Cannabis Product
Source: Survey (2022)

The survey results showed that stakeholders have the highest opinion on the efficiency of control aspects. The system is functioning well, the data security is high. The information aspect received a slightly lower opinion because the information is accurate, complete, and meets the requirements. The aspect that received the least opinion is economics, with stakeholders reasoning that the operational costs do not differ significantly from the old system, but there is a noticeable improvement in processing speed. Additionally, stakeholders suggested that survival rate data for growing cannabis should be collected to use in future cultivation planning.

5. CONCLUSION

In accordance with the regulations set forth by the Department of Medical Services, and the Ministry of Public Health, which still categorizes cannabis as a controlled substance with a potential for abuse, it is only permissible for medical use under strict control. In light of this, the researchers designed and developed an information system using the SDLC process by gathering requirements from stakeholders, designing the database, and developing a web application that enables the verification of medical cannabis product information through QR codes. After completion of the system development, stakeholders were invited to test and evaluate its effectiveness, and based on the results and feedback received, the system was improved to meet the desired user requirements. In actual use, each stakeholder role has access rights and data access restrictions that align with their respective responsibilities, ensuring the security of the data. Therefore, this provides confidence that the medical cannabis products with data recorded under the tracking system are reliable and can be safely used for medical purposes. This is because the tracking medical cannabis product system stores all activities related to medical cannabis products to report to the Department of Medical Services, Ministry of Public Health.

6. RECOMMENDATION

It is recommended to develop a mobile application as a tracking system for medical cannabis products to provide convenience for users, as the trend suggests that internet users will increasingly become mobile users in the future.

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