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COMMERCIALISED DURIAN PLANTATION: DEVELOPMENT AND DESIGN OF WEB AND MOBILE APPLICATION

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ABSTRACT

Durian farmers face many challenges in managing their plantations efficiently and effectively. These challenges include unpredictable weather patterns, labour shortages, pest and disease outbreaks, market fluctuations, and the complexity of managing farm operations. The commercialisation of durian plantations represents a significant shift in the agricultural landscape, driven by increasing demand for this prized tropical fruit. This project focuses on developing and designing a comprehensive web and mobile application explicitly tailored for commercialised durian plantations in Malaysia. Employing the Rapid Application Development (RAD) approach, the project encompasses four main phases: analysis, rapid design, prototyping, testing, and deployment. By leveraging digital technology, the application aims to address these challenges by streamlining various aspects of durian plantation management, including crop monitoring, inventory management, pest and disease tracking, and yield forecasting. Through user-friendly interfaces and intuitive functionalities, the application seeks to empower durian growers with actionable insights and decision-making tools to navigate these challenges and enhance their operations' productivity, efficiency, and sustainability. An evaluation component was conducted to assess the usability and effectiveness of the application in real-world plantation settings. Overall, the response to the evaluation indicated that both applications are valuable and easy to use, justifying their integration into durian plantation management practices. The significance of this project lies in its potential to revolutionise durian plantation management practices, contributing to the broader goals of sustainable agriculture and economic development in the durian industry. Findings from the project evaluation will inform future

directions for refinement and expansion of the application, ensuring its continued relevance and impact in supporting the growth and competitiveness of commercialised durian plantations.

Keywords: Durian cultivation, Commercialisation, Agricultural technology plantation management, durian information system

INTRODUCTION

Durian, native to Southeast Asia, holds the moniker "King of Fruits." Scientifically named Durio zibethinus, it thrives primarily in Malaysia, Thailand, Indonesia, and the Philippines. Recognisable for its intense aroma, large size, and tough, thorn-covered shell, durian is a staple in the region. Southeast Asian countries like Malaysia provide ideal conditions for durian cultivation, with temperatures ranging from 27°C to 35°C and annual rainfall between 1800 mm to 4000 mm, favouring its growth in tropical climates (Rasad, 2020). Cultivating durians is a meticulous endeavour, requiring careful consideration of numerous factors to produce marketable fruit suitable for commercialisation. However, farmers often face challenges in managing durian plantations, as manual cultivation management lacks efficiency. Additionally, the absence of a systematic information system among farmers can result in poorly maintained plantations and unmarketable durian fruits. Moreover, a lack of knowledge in disease and pest control, soil preparation, and drainage systems further complicates cultivation efforts.

The commercialisation of durian plantations in Malaysia represents a significant shift in the durian industry landscape. Historically, durian cultivation in Malaysia was largely subsistence-based, with small-scale farmers growing durian primarily for local consumption (Baharum et al., 2019). However, increasing demand, coupled with advancements in agricultural technology and infrastructure, has led to the establishment of large-scale durian plantations aimed at meeting both domestic and international markets (Abdullah et al., 2020). The growing popularity of durian has prompted a surge in research exploring market trends and consumer preferences. Studies have identified factors influencing durian purchasing decisions, including fruit quality, variety, price, and convenience (Lim & Yacob, 2018). Additionally, according to Roslan et al. (2021), consumer preferences vary across different demographic segments, highlighting the importance of targeted marketing strategies and product differentiation in the commercialised durian industry.

However, technology is crucial in modern durian plantation management, facilitating efficiency, productivity, and sustainability. Web and mobile applications have emerged as valuable tools for durian growers, offering real-time monitoring of plantation conditions, inventory management, pest and disease tracking, and yield forecasting (Mohd Radzuan et al., 2022). These applications empower farmers with data-driven insights and decision-making capabilities, ultimately enhancing farm management practices. This project tackles these obstacles by customising web-based and mobile applications to meet durian farmers' requirements. These applications provide pertinent information and support for durian cultivation, facilitating streamlined plantation management and increased productivity. Through this initiative, the project seeks to alleviate the challenges encountered by durian farmers and foster the sustainable development of the durian industry. The envisioned web-based and mobile applications are poised to benefit durian farmers significantly by facilitating the growth and maintenance of durian trees through systematic plantation management. Particularly advantageous for farmers with sizable staff, this system synchronises data across multiple devices, ensuring seamless access to vital plantation information. Tasks, tree condition reports, and production details can be effortlessly accessed on various devices, mitigating challenges such as disorganised task

scheduling and inaccurate production data. By leveraging these benefits, the system holds the potential to address critical challenges faced by farmers, thereby enhancing efficiency and productivity in durian cultivation.

To tackle the challenges, the project endeavours to aid durian farmers across Malaysia by establishing a mobile and web-based application as the central network. To achieve this, the project has been structured into three main objectives: (1). Identify the requirements for the Commercialised Durian Plantation Information System, (2). Develop the prototype of the Commercialised Durian Plantation Information System and (3). Evaluate the usability of the Commercialised Durian Plantation Information System. By pursuing these objectives, the project aims to offer comprehensive support to durian farmers, thereby improving their cultivation practices and ultimately advancing the durian industry in Malaysia. Despite the promising prospects of commercialised durian plantations, several other challenges persist. Climate change, land scarcity, labour shortages, and pest infestations threaten durian cultivation (Environment Asia, 2020). Moreover, ensuring sustainable practices and maintaining product quality remains paramount for durian growers. However, these challenges also present opportunities for innovation and collaboration within the industry, driving the development of novel technologies and practices to address emerging issues.

BACKGROUND AND RELATED STUDIES

Plantation or orchard management is a process of management that includes all the stages involved in transforming a piece of land into a productive and profitable crop (Upson, 2021). Figure 1 shows the stages involved in orchard management. The process begins before the trees are planted. The plantation farmer needs to determine certain aspects, such as goals, work plans and priorities related to the plantation, before planting a seed on the land. These aspects are crucial for the growth of any trees to produce marketable fruits, nevertheless durian fruits. After identifying the factors above, the tree saplings are planted according to the work plan.

The second stage takes place during tree growth and is tree care. This includes fertilising and applying pesticides to the crop. It also includes determining the necessary action or steps to deal with a diseased tree and having a disaster plan, such as fires, droughts, or floods. It is crucial to address the possible issues as soon as the problem is identified, as it has a higher chance of saving and repairing the tree. The last stage in plantation management is harvesting. When the trees can bear mature fruit, harvesting and selling the production occur at this stage. The harvesting process includes hiring a group of workers, keeping account of the amount of fruit collected, and finally finding markets for the product. During this stage, necessary data such as the fruit size and weight, age of the tree, and type of fruit are recorded, as the data can provide an overview of what to improve for the future harvest.

Figure 1

Plantation Management Phases

An information system is a collection of interconnected components for collecting, storing, and processing data, as well as supplying information, knowledge, and digital products (Zwass, 2020) Information systems are used by businesses and other organisations to conduct and administer their business operations. The same is true for durian plantations. Information systems play a massive role in each stage of plantation management, mainly in the harvesting stage. Therefore, a systematic information system is essential for durian cultivation as the yield condition depends on the steps taken for each stage. With the advancement of technologies, the commercialisation of durian plantations has emerged as a critical trend in the Malaysian agricultural sector, reflecting the growing recognition of durian as a lucrative cash crop. Large-scale durian plantations have proliferated nationwide, particularly in regions with favourable climatic conditions and soil quality for durian cultivation. This shift towards commercialisation has been facilitated by various factors, including advancements in agricultural technology, improved infrastructure, and strategic marketing initiatives aimed at capitalising on the global appeal of durian (Abdullah et al., 2021). With the rise of commercialised durian plantations, there has been a growing emphasis on leveraging digital technologies to enhance farm management practices, streamline operations, and optimise yields. Web and mobile applications have emerged as valuable tools for durian growers, offering functionalities such as real-time monitoring of plantation conditions, inventory management, pest and disease control, and direct consumer engagement.

Related Studies

A few Studies were conducted on the existing system for durian plantation management. Five studies related to durian digital technologies are compared, as written in Table 1.

Table 1

Previous Studies Related to Durian and Digital Technologies

Related Study	Result	Suggestion	Authors
Factors Influencing the Adoption of Digital Technologies in Durian Plantations: A Case Study in Malaysia	Explores factors driving the adoption of digital technologies, including web and mobile applications, in durian plantations in Malaysia.	Investigates perceived benefits, challenges, and adoption barriers faced by durian growers in integrating digital tools into farm management practices.	Abdullah, et al., (2021)

Consumer Preferences and Purchasing Behavior in the Malaysian Durian Market: Implications for Web and Mobile Application Design	Examines consumer preferences and purchasing behaviour in the Malaysian durian market.	This paper discusses implications for the design of web and mobile applications aimed at enhancing the durian shopping experience based on consumer preferences and behaviour.	Lim and Yacob (2019)
Technological Innovations in Durian Plantation Management: Opportunities and Challenges for Sustainable Agriculture	Provides a comprehensive review of technological innovations in durian plantation management.	Evaluate the potential benefits of technologies for enhancing productivity, sustainability, and profitability in durian cultivation while addressing challenges growers face.	Mohd Radzuan et al., (2020)
Transformation of Traditional Durian Orchard into Commercial Durian Orchard in Pahang, Malaysia	Explores the process and challenges of transforming traditional durian orchards into commercial ventures in Pahang, Malaysia.	Identifies key factors influencing successful transition and offers insights for farmers considering commercialising durian cultivation.	Baharum et al. (2019)
Marketing Strategies of Fresh Durians among Tourists in Penang, Malaysia	Investigates marketing strategies employed by durian sellers targeting tourists in Penang, Malaysia.	Provides insights into effective marketing tactics, product presentation, and customer engagement strategies for durian sellers in tourist destinations.	Roslan et al., (2018)

Instead, this study found that two (2) commercial information systems developed for the durian industries, Durian Plantation Management (PMMP) and E-Soft Durian Plantation System, are software solutions designed to assist in managing durian plantations. However, they differ in several aspects: PMMP is a comprehensive system for managing various aspects of durian plantation operations. It offers crop monitoring, inventory management, financial tracking, and labour

management functionalities. PMMP is designed to cater to the needs of durian plantations of various sizes, from small-scale operations to more significant commercial ventures. On the other hand, the E-Soft Durian Plantation System is a specialised software solution tailored explicitly for durian plantation management. It focuses on specific tasks related to durian cultivation, such as crop monitoring, inventory management, and possibly labour tracking. This system may offer fewer features than PMMP but provides a more focused and specialised approach to durian plantation management.

Both systems may integrate with IoT devices and sensors to collect real-time data on environmental conditions, soil moisture levels, and plant health. They may also offer mobile accessibility through companion mobile applications, allowing users to access essential features and data anywhere. While PMMP may provide a broader range of functionalities and scalability options, the E-Soft Durian Plantation System offers a more specialised and potentially streamlined approach explicitly tailored for durian cultivation. The choice between the two systems would depend on factors such as the size and specific requirements of the durian plantation, as well as the preferences of the users.

Regarding limitations, both PMMP and E-Soft Durian Plantation System may have limitations in terms of customisation options. Users may find it challenging to tailor the software to their needs or integrate custom features essential for their durian plantation management processes. While PMMP and E-Soft Durian Plantation System offer valuable tools for durian plantation management, they may have limitations regarding customisation, scalability, compatibility, data analysis, user interface, cost, and mobile accessibility. Durian growers should carefully evaluate these limitations and consider their specific requirements before selecting a software solution for their plantation management needs.

We aim to develop a user-friendly application tailored specifically for small and medium durian orchard farmers. Recognising farmers' diverse needs and constraints in managing their orchards, we aim to create an intuitive and accessible platform that simplifies essential tasks and streamlines operations. By prioritising ease of use and accessibility, we aim to empower durian farmers of all skill levels to effectively utilise digital tools for managing their orchards, optimising resource allocation, and enhancing productivity. Through close collaboration with farmers and continuous feedback gathering, we are committed to developing a solution that meets the unique needs of small and medium durian orchard farmers, ultimately contributing to the sustainability and success of their operations.

METHODOLOGY OF STUDY

Rapid Application Development (RAD) was adopted as the project management process in completing this project. A form of the agile methodology development process, RAD emphasises rapid prototyping and iterations. It allows developers to quickly make several iterations and updates to a program without starting from the beginning of the development schedule for each update [OBJ] . This method was chosen as the project management process because the project was completed within a short period, which was 28 weeks.

Figure 2

Rapid Analysis Design (RAD) Phases
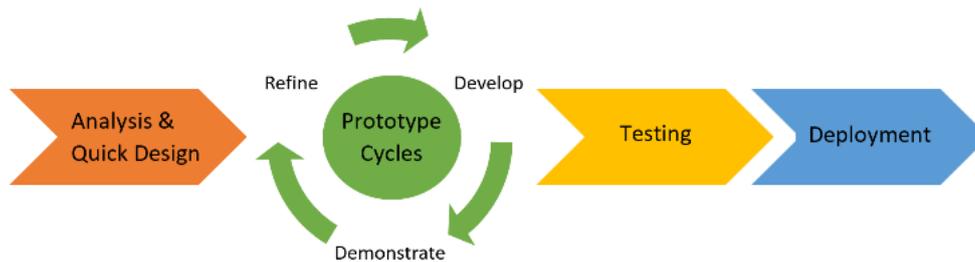
In the first phase, analysis and quick design were done by gathering the necessary information to obtain an overview of the programme needed to solve the problems. The information-gathering process consisted of reviewing articles and researching the durian domain. Necessary information on the process of durian cultivation, which includes preparation of soil, drainage system, fertilisation system and harvesting, was collected for a better understanding of the domain. In addition, this project was constructed to compare the existing applications during this phase. When there is sufficient information, analysis defines the objectives, scope, timelines, and expectations.

The second phase is the prototype cycle, where this project carries out three steps: to develop, demonstrate, and refine the prototypes. During this phase, this project developed prototypes of the applications based on the requirements obtained from the clients and the research conducted on similar applications. The requirements were obtained through questionnaires that collect data on the current system used by the clients and the situation or problem faced by the clients in durian cultivation. Then, the prototypes were shown to the clients to determine the suitability of the application in durian cultivation. When the project was in line with the client's requirements, the project proceeded with the refinement process. Updates and changes on the prototype issued by the clients were considered and used to improve the product. This project converted the prototypes about the updates to a working product during this phase. To develop the working product, this project used HTML, PHP, CSS, and SQL languages for the web-based application and Java language for the mobile-based application.

This project tested the application using pilot and field testing in the testing phase. Testing was conducted to ensure every function worked smoothly and met the client's requirements. Five people were handpicked for pilot testing, including three males and two females, who were selected to test both applications. The participants were selected from a group of conveniently available people, including friends and family. On the other hand, durian farmers or fruit farmers were contacted to conduct field testing. During this phase, the participants were allowed to propose new ideas, alterations, or updates to the working application. Subsequently, both tests were implemented, and the updates presented during the process were used to make necessary changes to the application.

In the last phase, this project deployed the finalised application to the client using a web host selected, 000WebHost, and FileZilla to upload the related files on a remote server for the web-based application. The coding files for the mobile-based application were transformed into an APK file shared through the Google Drive folder link. This phase consisted of constructing documentation on the user manual, including screenshots and descriptions for functions featured in the application, which was aimed to assist the user in navigating the application. Final changes were also made while checking the system for bugs during this phase.

DESIGN DEVELOPMENT

The system developed is divided into two systems: web-based applications and mobile-based applications. Both applications are interrelated with each other and share the same database. Each plantation system can only be accessed by the farmers of the plantation, both the owner and the workers. People outside of the plantation, including other durian farmers, cannot access the plantation system except for their plantation system if they have registered with the system developer. The system also requires a primary internet connection as both applications will be connected to the web server. Storage is also required for mobile-based applications as it takes up a relatively small amount of device storage when installed. This system assumes that the user is familiar with a web-based application and mobile-based application interface and with handling and interacting with computer and mobile device hardware such as keyboard, mouse, and touch screen. Since the web-based application requires a web browser to be accessed, it is assumed that the user has an internet browser installed on the computer.

The Requirements of the Commercialised Durian Plantation Information System (CDPIS)

The CDPIS requirements were obtained using three methods: (1) interviewing selected durian farmers and (2) analysing the documents and existing durian management plantation system. The interview was informal on a durian farmer using the Phone Interview method. The durian farmer mentioned was contacted through an acquaintance. Open-ended questions were asked during the interview, mainly about the difficulties faced in managing durian plantations and the functions expected for the system. The farmer's responses were recorded and analysed to obtain the requirements. Besides, the documents and existing systems related to this project were analysed. The documents or articles were found by searching related keywords, such as "durian farming system", "farming app", and "farming management system" on the Google search engine. The documents were examined to determine the system application requirements that could aid the farmer in durian plantation management.

The functional requirements for the CDPIS web-based application consist of six significant requirements, namely "login account", "manage plantation", "schedule task", "manage report", "view production", and "generate QR", as rendered in Table 2. In comparison, the CDPIS mobile app consists of three significant requirements, namely "login account", "list task", and "scan QR", as rendered in Table 3. As for the non-functional requirements, the CDPIS web-based application consists of three significant requirements, namely "secure system", "performance system", and "design website", as rendered in Table 4, while the CDPIS mobile app consists of two significant requirements namely "secure system" and "design app" as rendered in Table 5. M indicates the priority of the requirements for both applications – mandatory requirements (something the system must do), D – desirable requirements (something the system preferably should do) and O – optional requirements (something the system may do).

Table 2

Functional Requirements for Web-based Application

No.	Requirements ID	Requirements Description	Priority
1	**CDPIS01**	**Login Account**	
	CDPIS01_01	Existing users can log in to their account with the	M

		correct username and password	
	CDPIS01_02	New users can register by contacting the developer via email	M
	CDPIS01_03	The system will display an error message if users enter the wrong username and password.	O
2	**CDPIS02**	**Manage Plantation**	
	CDPIS02_01	The system should display the records of the tree background	M
	CDPIS02_02	The system should display records of fruit background	M
	CDPIS02_03	The system should allow users to add records of tree background	D
	CDPIS02_04	The system should allow users to remove records of tree background	D
	CDPIS02_05	The system should allow users to add records of fruit background	D
	CDPIS02_06	The system should allow users to remove records of fruit background	D
	CDPIS02_07	The system should allow users to edit records of tree background	O
	CDPIS02_08	The system should allow users to edit records of fruit background	O
	CDPIS02_09	The system should display an error message if there is an empty field when the user saves the records.	O
	CDPIS02_10	The system should display an error message if the ID entered to add a record exist in the database.	O
3	**CDPIS03**	**Schedule Task**	
	CDPIS03_01	The system should display the task list	M

	CDPIS03_02	The system should sync the system task list with the app task list	M
	CDPIS03_03	The system should allow users to add tasks to the task list	D
	CDPIS03_04	The system should allow users to remove tasks from the task list	D
	CDPIS03_05	The system should allow users to edit tasks in the task list	O
	CDPIS03_06	The system should display an error message if there is an empty field when the user saves the task.	O
4	**CDPIS04**	**Manage Report**	
	CDPIS04_01	The system should display all reports made through the app	M
	CDPIS04_02	The system should allow users to remove reports	D
	CDPIS04_03	The system should allow users to edit reports	O
	CDPIS04_04	The system should display an error message if there is an empty field when the user saves the report.	O
6	**CDPIS05**	**View Production**	
	CDPIS05_01	The system should display all records of good fruits from the app	M
	CDPIS05_02	The system should display all records of rotten fruits from the app	M
7	**CDPIS06**	**Generate QR**	
	CDPIS06_01	The system should generate unique QR codes for trees	M
	CDPIS06_02	The system should generate unique QR codes for fruits	M

CDPIS06_03		The system should allow the user to display the existing QR code.	D
CDPIS06_04		The system should display an error message if the ID entered to generate QR does not exist in the database.	O

Table 3

Functional Requirements for Mobile-based Application

No.	Requirement ID	Requirements Description	Priority
1	**CDPIS07**	**Login Account**	
	CDPIS07_01	Users can log in to their account with the correct username and password	M
	CDPIS07_02	The app will display an error message if users enter the wrong username and password.	O
2	**CDPIS08**	**List Task**	
	CDPIS08_01	The app should display the list of tasks from the scheduling system	M
	CDPIS08_02	The app should allow the user to checkboxes in the list of tasks	D
	CDPIS08_03	The app should allow the user to uncheck boxes in the list of tasks	D
3	**CDPIS09**	**Scan QR**	
	CDPIS09_01	The app should allow users to scan the QR codes from trees and fruits	M
	CDPIS09_02	The app should display the tree details after scanning the tree's QR code	D
	CDPIS09_03	The app should display an option to add a report for tree inspection after scanning the tree QR code.	D
	CDPIS09_04	The app should display the fruit detail function after scanning the fruit QR code.	D
	CDPIS09_05	The app should display an option to select the fruit's condition after scanning the QR code.	D
	CDPIS09_06	The app should allow users to key in reports after selecting Add Report.	O
	CDPIS09_07	The app should allow users to select the option good for fruit condition after selecting harvest fruit.	O

CDPIS09_08		The app should allow users to select the option bad for fruit condition after selecting harvest fruit.	O
CDPIS09_09		The system should display an error message if there is an empty field when the user saves the report.	O

Table 4

Non-Functional Requirements for Web-based Application

No.	Requirement ID	Requirements Description	Priority
1	**CDPIS10**	**Secure System**	
	CDPIS10_01	Only the owner and workers of the plantation can access the system	M
	CDPIS10_02	Password must be the length of more than eight digits	M
	CDPIS10_03	Password must contain characters and numbers	M
	CDPIS10_04	The owner is creating a user ID	M
	CDPIS10_05	The account for workers is created under the owner ID	M
2	**CDPIS11**	**Performance System**	
	CDPIS11_01	If the system breaks, it will return to the last position before it crashes.	D
3	**CDPIS12**	**Design Website**	
	CDPIS12_01	The system theme is minimalist	D
	CDPIS12_02	The system font must be easy to read	D

Table 5

Non-Functional Requirements for Mobile-based Application

No.	Requirement ID	Requirements Description	Priority
1	**CDPIS13**	**Secure System**	
	CDPIS13_01	Only the owner and workers of the plantation can access the app	M
	CDPIS13_02	Password must have a length of more than eight digits	M
	CDPIS13_03	Password must contain characters and numbers	M
2	**CDPIS14**	**Design App**	
	CDPIS14_01	The app theme is minimalist	D
	CDPIS14_02	The app font must be easy to read	D

The requirements in Tables 3,4 and 5 were visualised and modelled using the proper modelling methods and tools. The requirements were visualised and modelled using this project's Unified Modelling Language (UML). Two behavioural diagrams, namely use case and activity diagrams, as well as a class diagram that illustrates the app's structural components, were employed in this study. StarUML was used to create the mentioned diagrams. Figures 3 and 4 represent the use case diagram of the system, which describes the interactions between the use cases and the actor of the application. The use cases are the primary functional requirements for each application. The use case of "Manage Plantation" for web-based applications enables the user to conduct sub-functions such as "Manage Tree" and "Manage Fruit". The use case diagram is elaborated to highlight the app's dynamic behaviour. As a result, the interactions involved when using the system are depicted in an activity diagram. The class diagram, as shown in Figure 5, depicts the structural components of the system in durian plantation information management.

Figure 3

Web-based Application Use Case Diagram

Figure 4

Mobile-based Application Use Case Diagram

Figure 5

Class Diagram of CDPIS
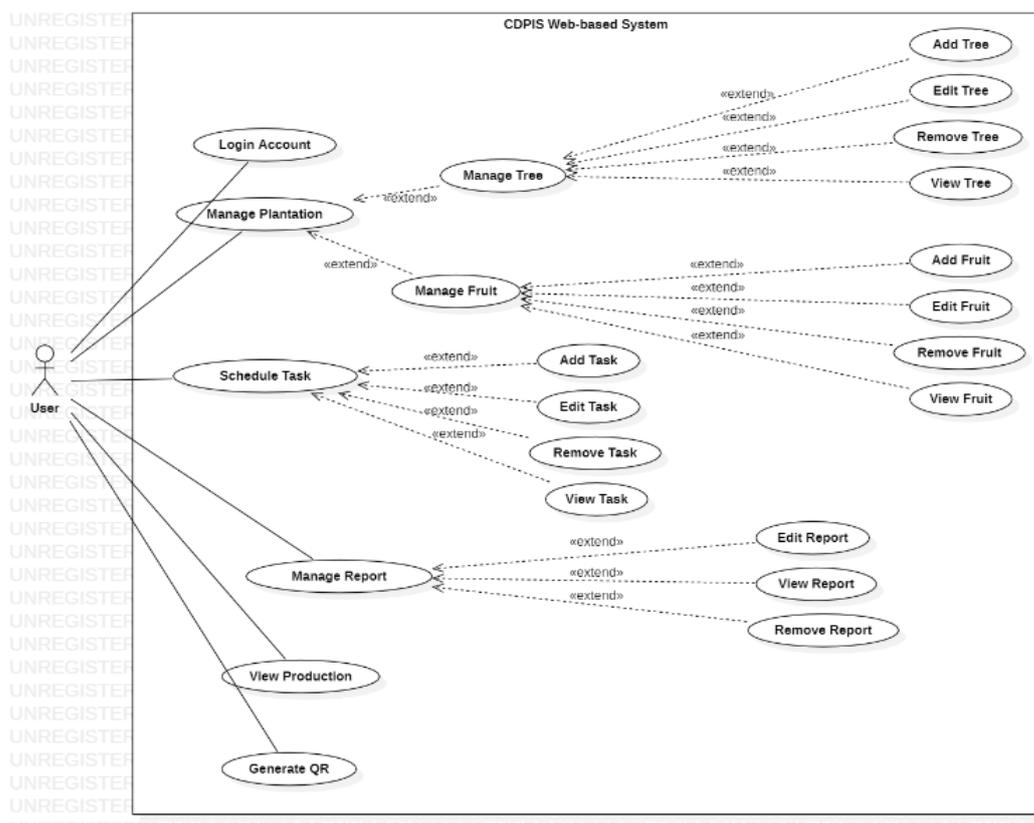
THE PROTOTYPE DEVELOPMENT OF CDPIS

CDPIS, an integrated system for durian plantation management that consists of web-based and mobile-based applications, was developed as a prototype. It encapsulates the requirements outlined in the preceding section. Software prototyping is a standard method of displaying software requirements so that users can provide additional feedback and suggestions based on their interactions with the prototype. Visual Code Studio was the tool used to develop the web-based prototype, which is the CDPIS website, while Android Studio was used to develop the mobile-based prototype, the CDPIS mobile app. Both applications are interconnected with a database server developed using PHPMyAdmin. The development of the website prototype was also made possible using the XAMPP Control Panel. Figures 6 and 7 show the screenshots of the selected interfaces for the CDPIS website, while Figure 8 shows the screenshots for the CDPIS mobile app.

Figure 6

Login Account Page (Web-based Application)
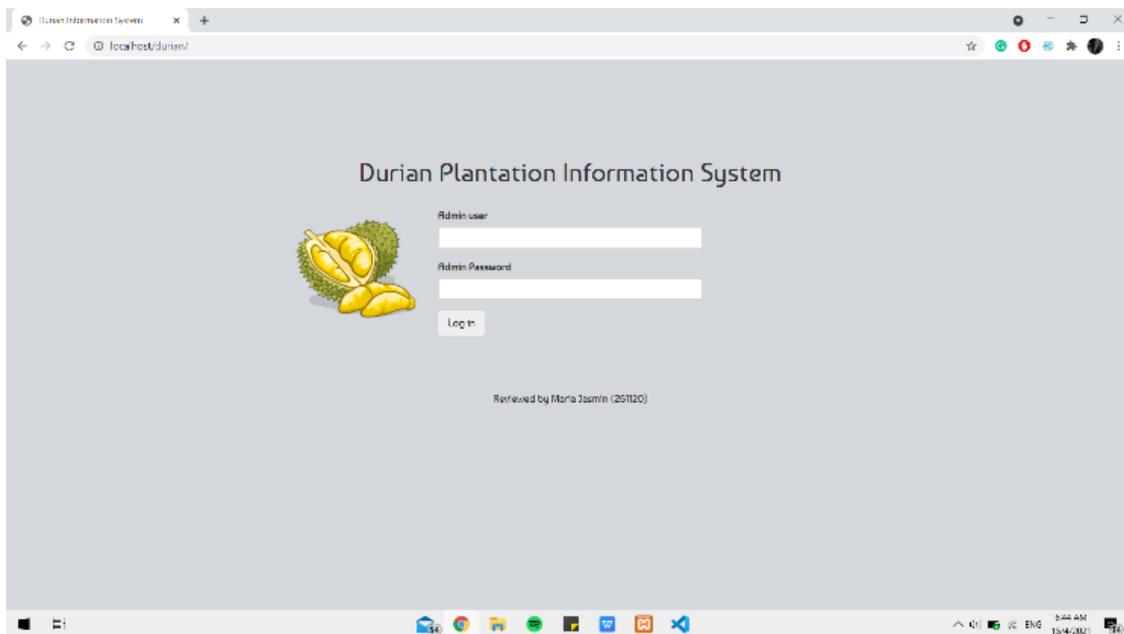
Figure 7

Manage Plantation and View Production Page (Web-based Application)
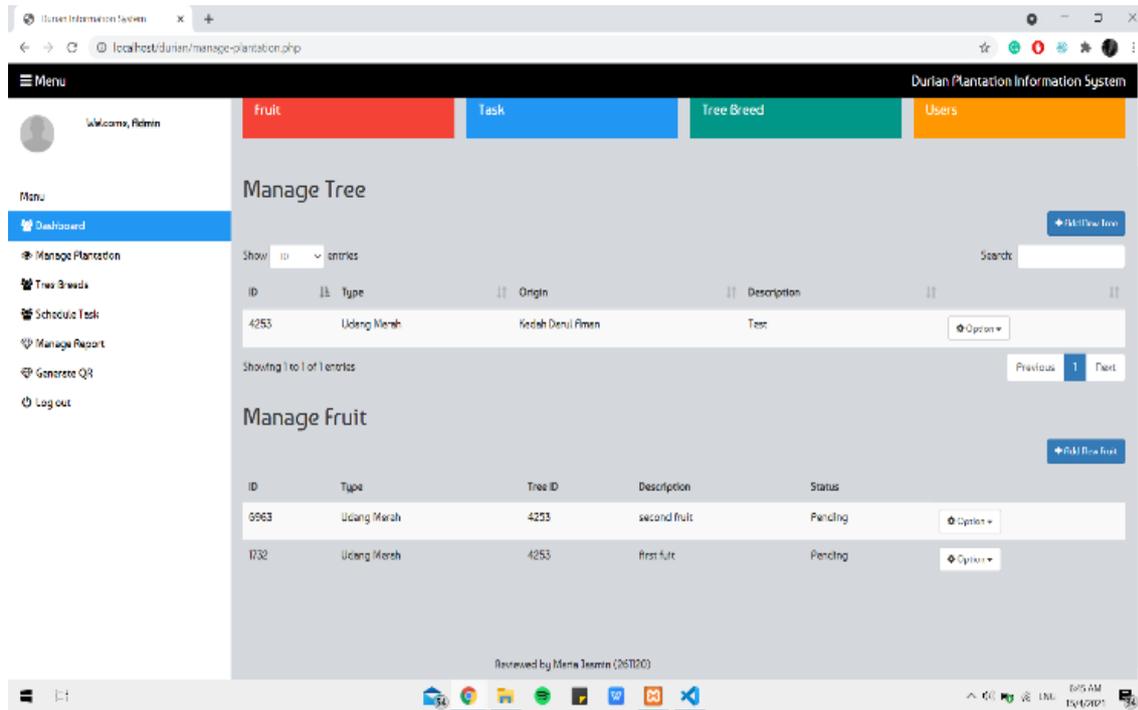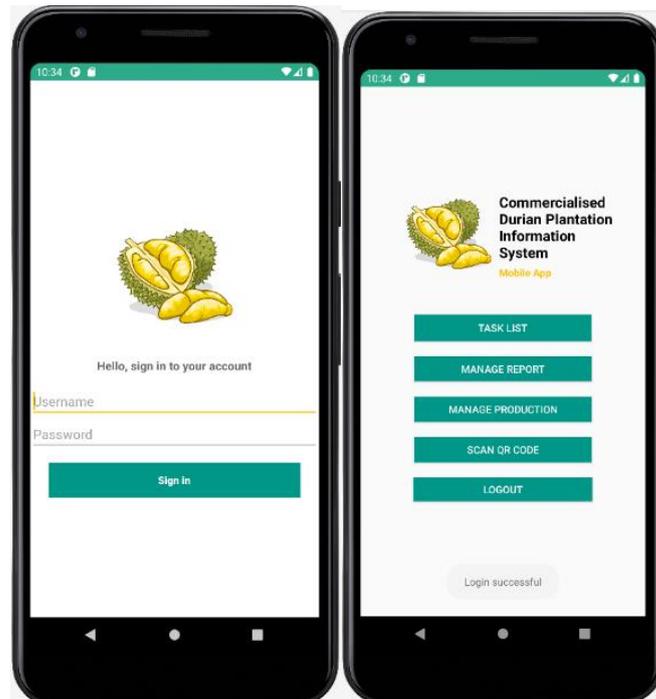

Figure 8

Login Account and Main Page (Mobile-based Application)

EVALUATION AND RESULT

The Evaluation Settings

Due to the current situation and the pandemic, the testing was conducted unmoderated and remotely. A usability evaluation was conducted to determine the ease of use of the applications' design and development among the representative users who participated in the field testing. Usability testing is one type of evaluation, which includes developing a test plan, gathering participants, and analysing the result in the field-testing report.

The target population for this project is durian farmers and people interested in durian cultivation. To evaluate the system, a sampling technique was used to select the participants. The technique adopted was a combination of quota and convenience techniques from the non-probability sampling category. Quota is a sampling technique in which the participants were chosen according to traits. The traits mentioned are gender, age, and knowledge of computers and technologies. The convenience method was also used, in which the participants were chosen from a group of people who were the easiest to contact or to reach. For field testing, a handful of durian farmers were personally contacted. However, only two durian farmers were willing to conduct the evaluation anonymously. To obtain more participants, the convenience method was applied by reaching out to the participants through social media platforms such as WhatsApp and Facebook. The total number of participants for the whole system is unclear, as the field testing was taken anonymously. Some participants may partake in the evaluation for both applications if not one. Therefore, the number of participants was counted according to the number of records in the post-task questionnaires for each category, which is the type of application.

The instrument used for this evaluation is a Word document. The document contains the instructions on how to conduct the system testing and evaluation, the credentials to log into the system, the link to the Google Form for the post-task questionnaires, and the link to the system, which includes the website link and Google Drive link to download the Android application package (APK). The post-task questionnaire consisted of 21 questions in 4 sections. Section A asked for the participants' demographic information; Section B asked about the type of application reviewed by the participants; Section C asked for the participants' opinions and experiences on the applications; and Section D asked for the participants' thoughts on the application in terms of suggestions for improvements or the general thought. Section C comprises 13 questions on a five-point Likert scale where one represents strongly disagree, and five represents strongly agree. The participants performed the following step-by-step procedure for the evaluation: (1) read the instructions, (2) access the system for each application, (3) conduct the task on the applications as stated in the experiment procedure, and (3) answer the post-task questionnaire.

The Participants' Demographic Information
Web-based Application

Based on the analysis conducted on the participants' demographic information for web-based application testing, it was found that most participants, 64.7% of 17 participants, were male. Only 17.6% of the participants were male and aged 30 years and below, while the rest were male and aged 31 to 50. The rest were female, with the number evenly distributed for 30 years and below and 31-50 years old. Most participants, which was 47.1%, do farming or Durian farming as a part-time job, with most of the participants venturing into Durian farming for 2 to 4 years as a part-time job. 35.3% of the participants do this job full-time, and most have done it for over six years as a full-time job. 5.9%

of the participants intend to do Durian farming full-time. 17.6% of them have not or may not want to venture into Durian cultivation. As for the type of durian, most participants have cultivated or want to cultivate Musang King as it has the highest frequency, which was 13 records, followed by D24, with 11 frequencies, and D101, with eight frequencies. The least cultivated type of Durian was XO, as only 2 of the participants have cultivated or intended to cultivate this Durian type.

Mobile-based Application

Based on the analysis conducted on the participants' demographic information for mobile-based application testing, it was found that 80% of 16 participants are male, with 40% being male and at the age of 30 years and below. A small number of participants are female, only 20% of the total. Only 2 participants are male and at the age of 51 years and above. Most of the participants, which was 46.7% of them, does farming or Durian farming as a full-time job with most of the participants have been venturing in Durian farming for 2 to 4 years or over six years as a full-time job. 40% of the participants do this job part-time, and most have done it for 2 to 4 years or 4 to 6 years as a part-time job. 6.7% of them have not or may not want to venture into Durian cultivation, while 6.7% have cultivated other fruits or vegetables for less than two years. As for the type of durian, most participants have cultivated or want to cultivate D101, Durian Kampung and Musang King as they have the highest frequency, eight records, followed by Black Thorn and D24, with six as frequency. The least cultivated type of Durian was Red Prawn XO, as only 2 participants have cultivated or intended to cultivate this Durian type.

The Usability of Commercialized Durian Plantation Information System

The questions in Section C of the post-task questionnaire were used to measure the system's task performance, usefulness, ease of use, and satisfaction based on the participants' experience during the testing. Figures 9, 11, and 13 illustrate the percentage of the responses for the web-based application testing, while Figures 10, 12, and 14 illustrate the response for the mobile-based application.

Figure 9

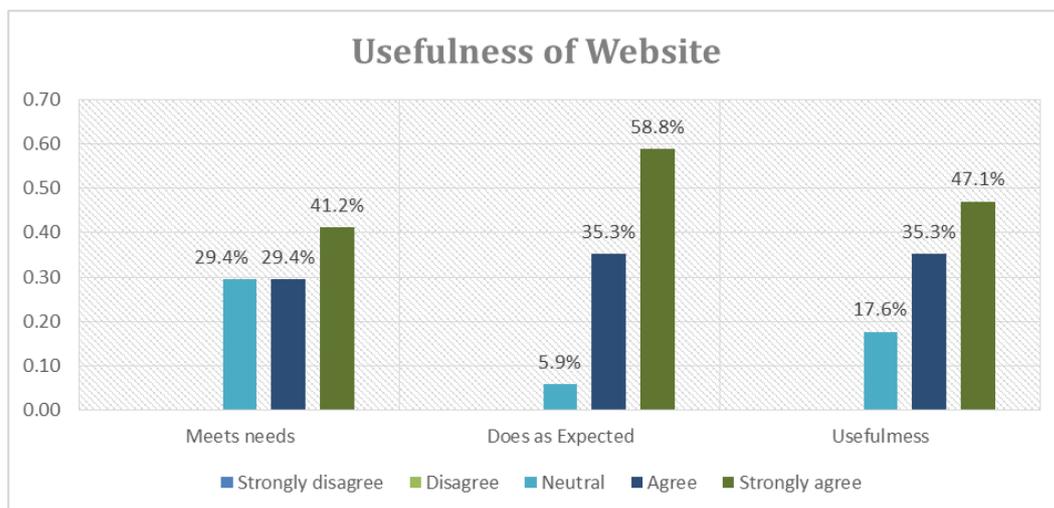*The Usefulness of CDPIS Web-based Application Responses*

Figure 10
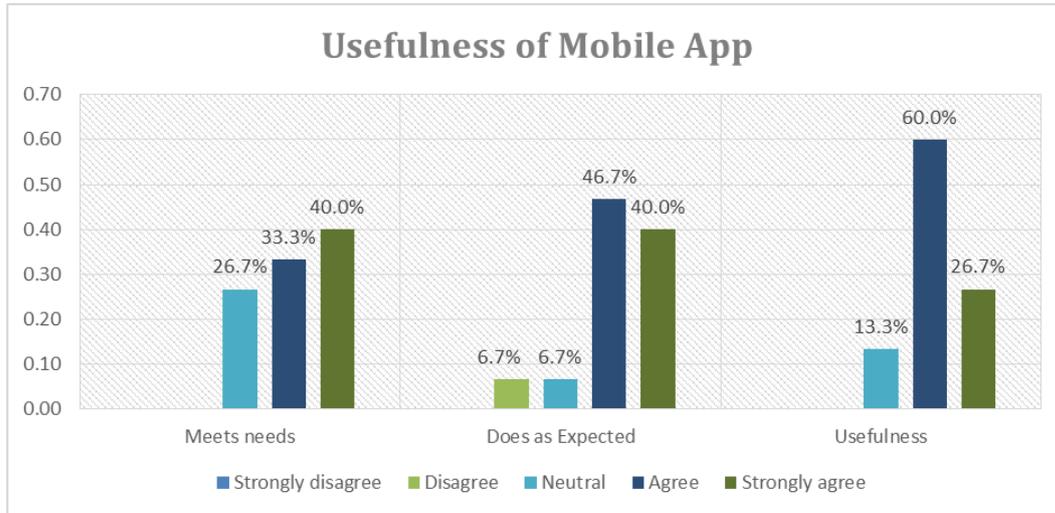
The Usefulness of CDPIS Mobile-based Application Responses

Figure 11

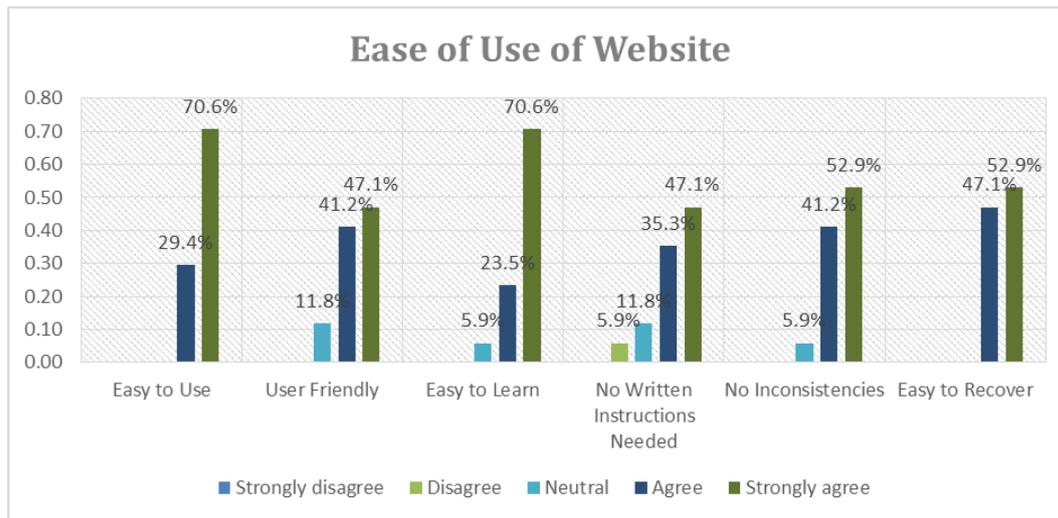*The Ease of Use of CDPIS Web-based Application Responses*

Figure 12

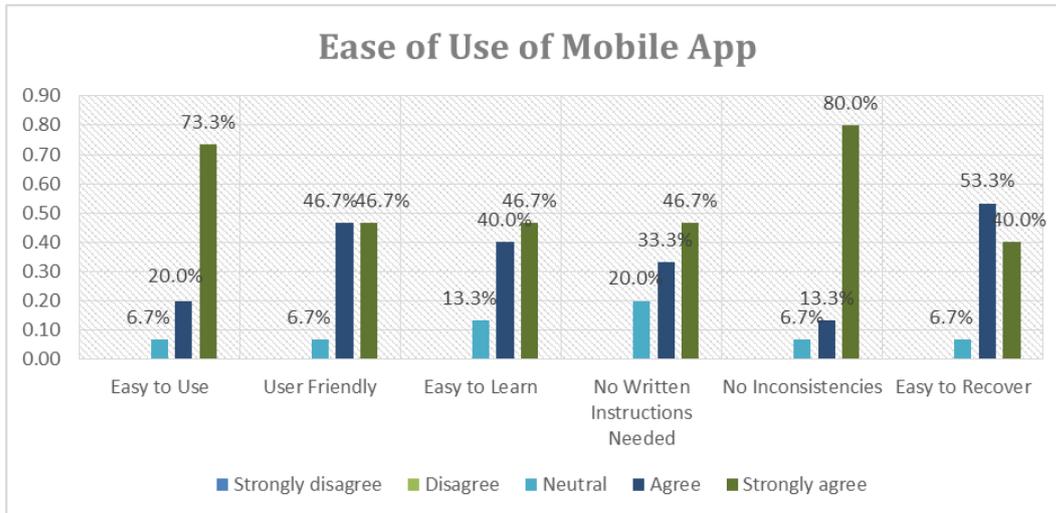*The Ease of Use of CDPIS Mobile-based Application Responses*

Figure 13

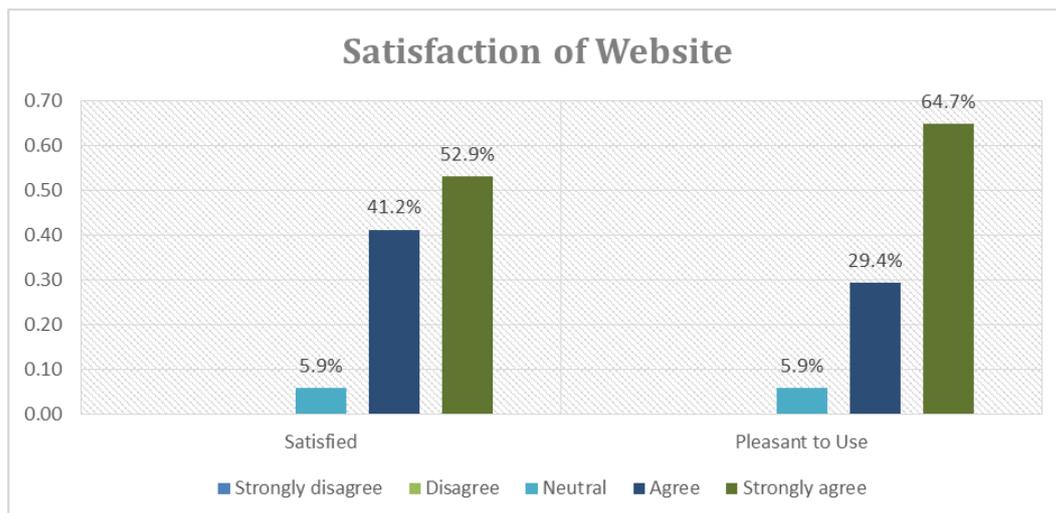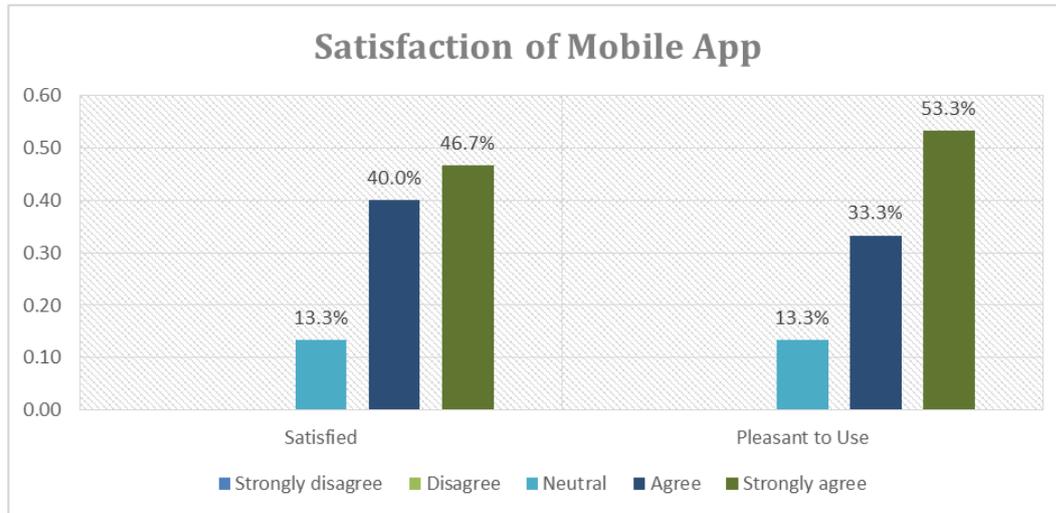*The Satisfaction of CDPIS Web-based Application Responses*

Figure 14

The Satisfaction of CDPIS Mobile-based Application Responses

Analysis of the participants' responses for each application was conducted, and it was found that most participants rated the three-, four-, or five scores for each question. However, a small % of mobile-based application participants, which is 6.7%, rated a score of two for the question "Does as expected" in the usefulness aspect. It was concluded that the mentioned participants did not conduct the testing for the web-based application as the application is the most significant part of the whole system. The participants may find that the mobile-based application's usefulness did not meet their expectations. Apart from that, a small % of web-based application participants, which is 5.9%, rated the two scores for the "No written instructions needed" in the ease-of-use aspect. It was concluded that the application has many functions, making it difficult for the participants to navigate and use it for the first time.

Overall, the evaluation's response indicated that both applications are helpful and easy to use. In addition, the participants rated the applications' functions that assist them in managing durian plantations as satisfactory. Nevertheless, it was discovered that some mobile-based applications faced difficulties using them as the layout of some pages did not fit the aspect ratio of their devices. This problem was mainly reported by the participants who used a smaller ratio of the device than the programmed size.

CONCLUSION AND FUTURE WORKS

Based on the results from the post-task questionnaire and the feedback obtained, some improvement is needed regarding the system's design. The problem is mainly with the layout of the mobile-based application, as it is reported that some pages on the mobile app do not fit the participants' devices' aspect ratio, the participants who use devices with a smaller size ratio than the size set during the development. Overall, the system is ready to be implemented as the feedback given and the analysis conducted to show a positive result from the participants. With a properly written manual on how to use the system, the system can solve the problem statement of the project and thus contribute to the management of the users or farmers' plantations. Many aspects of the CDPIS can be studied to improve

further the provision of the necessary aid in durian plantation management. Currently, the system can only manage and standardise the information about the durian plantation.

In the future, the functionality of the CDPIS can be expanded by adding new functions, such as a tree monitoring system. Through the application of sensors and Artificial Intelligence into the system, this function enables users to virtually monitor their plantation as it can determine the humidity and temperature of the soil, which is essential for the growth of the durian trees. Besides, a function such as an automated scheduling system can help produce a more marketable durian fruit. The function includes step-by-step durian cultivation and guidelines on actions to be taken when the trees are infected with diseases or pests. In conclusion, the commercialisation of durian plantations in Malaysia represents a dynamic and evolving sector within the agriculture industry. Web and mobile applications offer promising avenues for enhancing farm management practices, improving productivity, and meeting the demands of an increasingly discerning consumer base. By leveraging technology and embracing innovation, Malaysian durian growers can position themselves for continued success in the global market while promoting sustainable practices and preserving the rich heritage of durian cultivation.

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REFERENCES

Abdullah, N., Abdullah, R., & Shaharuddin, S. (2021). Factors Affecting the Adoption of Digital Technologies in Durian Plantations: A Case Study in Malaysia. *Journal of Contemporary Issues and Thought*, *11*, 1-10.

Abdullah, N., Abdullah, R., & Shaharuddin, S. (2020). Factors Affecting the Establishment of Musang King Durian Orchards among Agro-Tourism Farms in Malaysia. *Journal of Contemporary Issues and Thought, 11*, 1-10.

ABS Innovations. (2021, July 3). Durian Plantation Management Powered by PMMP. Retrieved from ABS: https://abs.global/abs-innovations/durian-plantation-management/

Baharum, S. N., Che Lah, N. B., & Abdullah, R. (2019). Transformation of traditional durian orchard into commercial durian orchard in Pahang, Malaysia. *Malaysian Journal of Society and Space*, *15*(4), 17-29.

E-Soft. (2014). E-Soft Durian Plantation System. Retrieved from E-Soft - Your Software Provider: http://www.e-soft.com.my/durian.html

Ismail, N., Muhamad, H., & Yusoff, N. (2020). The challenges and potential of durian cultivation in the face of climate change: a case study in Malaysia. *Environment Asia, 13*(2), 179–187.

Lim, A. S. C., & Yacob, M. R. (2018). Marketing Strategies of Fresh Durians among Tourists in Penang, Malaysia. *Journal of Social Sciences and Humanities, 9*(2), 169-180.

Mohd Radzuan, R. B., Ibrahim, Z., & Yaacob, Z. (2022). Durian Production Management: A Review on Current Practices and Technologies. *International Journal of Agricultural and Biological Engineering, 15*(1), 36-

Rasad, H. (2020, November 12). Malaysia Durian Market Guide. Retrieved from Tridge: https://www.tridge.com/guides/durian/MY

Roslan, S., Omar, E. A., & Masron, T. A. (2021). Consumer Preferences for Durian Attributes: Evidence from Malaysia. *Journal of Food Products Marketing, 27(*1), 79-93.

Singh, A. (2019, December 6). What Is Rapid Application Development (RAD). Retrieved from Capterra: https://blog.capterra.com/what-is-rapid-application-development/

Upson, M. (2021, July 3). What is Orchard Management? Retrieved from wisegeek: https://www.wise-geek.com/what-is-orchard-management.htm

Zwass, V. (2020, November 2). Information system. Retrieved from Encyclopaedia Britannica: https://www.britannica.com/topic/information-system/Operational-support-and-enterprise-systems