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"Digital Transformation and Sustainable Business: Challenges and Opportunities for Higher Education Research and Development"

Mobile Information System Design for Agricultural Commodity Prices in Simalungun

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Abstract

The agricultural sector is one of the important sectors in the Indonesian economy. However, the availability of data and information on agricultural commodity prices is not yet available in real time and easily for farmers, the community and others. In Simalungun Regency, agricultural product price information is still distributed manually and unevenly. Research was conducted to overcome the problem by building a mobile-based agricultural commodity price information system that can be easily accessed by users based on the Android platform. This system was developed using the waterfall method, which includes the Requirements Analysis, System Design, Implementation and Testing phases. The test results show that this system can display commodity price data in real time and is user friendly, making it easier for users to access price data in this area. The implementation of this system is expected to increase the efficiency of price information distribution, encourage data transparency, and enable better decision making for all parties.

Keywords : *Information system, Agricultural commodity prices, Android, Waterfall, Real-time*

Introduction

In this era, technological developments have experienced very significant progress towards everyone's living environment. Technological advances in this digital era have caused extraordinary transformations in various aspects of life, including agriculture. The design of an agricultural commodity price information system in Simalungun Regency is one of the sophisticated solutions for the Simalungun Regency government. This application is designed to help facilitate the government in finding information on agricultural commodity prices and to accelerate access and be easy to use by stakeholders in the agricultural sector. Simalungun Regency is one of the regencies in North Sumatra province which has an area of 4372 km². Based on the Ministry of Home Affairs in 2024, the population of Simalungun Regency was 1,022,570 people with a density of 237 people/km². Where 38.46% of the population works in the agricultural sector in 2024. Agriculture in Simalungun Regency is not only the key to the local economy, but also plays a major role in the growth of micro, small and medium enterprises (MSMEs) rooted in agricultural products. During 2020, Simalungun Regency produced, among others, 336,332 tons of rice, 234,977 tons of corn, and 213,319 tons of cassava. However, this agricultural region which has mainstay commodities, such as Cabbage, Rice and Chili, still faces limited access to information in the agricultural sector which hinders the optimization of production and marketing potential.

Agriculture in a broad sense is the cultivation of natural resources such as land and plants to harvest food, raw materials for business, and other commodities that are beneficial to humans. Business relies heavily on fast

and accurate commodity price data so that farmers will know when to sell at the optimal strategy. Agriculture is an integral part of the global economy, and governments often face challenges in finding information on agricultural commodity prices.
A mobile-based agricultural commodity price information system is a solution that has emerged to overcome this problem. This application allows the government to interact with connected parties more effectively and efficiently in the process of disseminating information in the agricultural sector, which in the future will become a sophisticated agricultural commodity information system that is connected to the internet and can be accessed anywhere so that the government can easily find out relevant information about commodity prices. With this application, the government and related parties can easily enter information and get information without having to come to the physical market.

Literature Review

The development of information technology has accelerated the digitalization of various sectors, including the agricultural sector. In the context of managing and disseminating price information on agricultural commodities, the development of a suitable information system plays an important role in increasing transparency, efficiency, and data availability, especially for farmers in rural areas such as Simalungun Regency.
According to Laudon and Laudon (2020), an information system is the integration of information technology and human activities used to support operational and decision-making processes. In the agricultural sector, this system plays an important role in providing accurate data to support farmers and other stakeholders in decision-making. Rahman and Wahyuni (2017) demonstrated that an Android-based food price information system can help local governments control inflation by providing centralized, publicly accessible price data. The use of mobile platforms also enables rapid and widespread dissemination of price information.
At the national level, the Indonesian Ministry of Agriculture (2023) launched the National Food Price Application to provide online data on major commodity prices in various regions of Indonesia. However, the application did not fully address local needs, such as in Simalungun District. Therefore, a locally anchored information system is important to provide more context-appropriate solutions. Pangestu and Saian (2022) also developed a web-based vegetable price monitoring system in Getasan District, which was shown to improve decision-making and price transparency for farmers and market participants. Based on these findings, the development of a mobile agricultural commodity price information system in Simalungun District is a strategic step. This initiative not only aligns with technological advancements but also meets local needs for fast, accurate, and reliable access to price information.

Methods

This research uses a software engineering approach with the waterfall systems development model. This model was chosen because of its widespread use in developing systems that have clear requirements and workflows from the outset. The waterfall principle is a sequential and systematic approach that facilitates documentation and control of each phase and is therefore very suitable for the development of mobile information system applications.The waterfall model was chosen because this project has functional and non- functional requirements that can be fully defined at an early stage. Furthermore, this model supports a structured workflow from analysis to testing, thus minimizing the risk of inconsistencies in system development. This method is also suitable for systems that do not require many changes during the development process.

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1. Data Collection Techniques
   Three techniques are used to collect data, namely:
   a. Observations The author made direct observations of the activities related to the medical device distribution system.
   b. To obtain comprehensive information, the author used a question-and-answer interview method on all activities related to the sale of medical devices.
   c. The purpose of the following literature review is to collect data and to investigate and search for the necessary information relevant to the preparation of the report.
2. System Development Techniques
   The waterfall method consists of the following phases:
   a. Requirements Analysis
      The purpose of this phase is to determine user and system requirements. Data will be collected through:
      - Interviews with staff from the Simalungun Regency Agricultural Service and several local farmers.
      - Direct observation of the current commodity price information distribution process.
      - Document study of previous price reports and systems. The output of this phase is a system requirements document (Software Requirements Specification/SRS) that includes key features such as real-time price display, commodity search, market location, and price history.
   b. System Design
      In this phase, the system architecture and user interface are designed. The design components include:

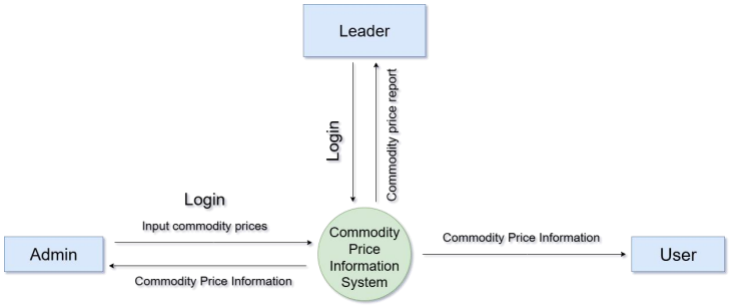

Figure 1. *Data Flow Diagram* Level 0

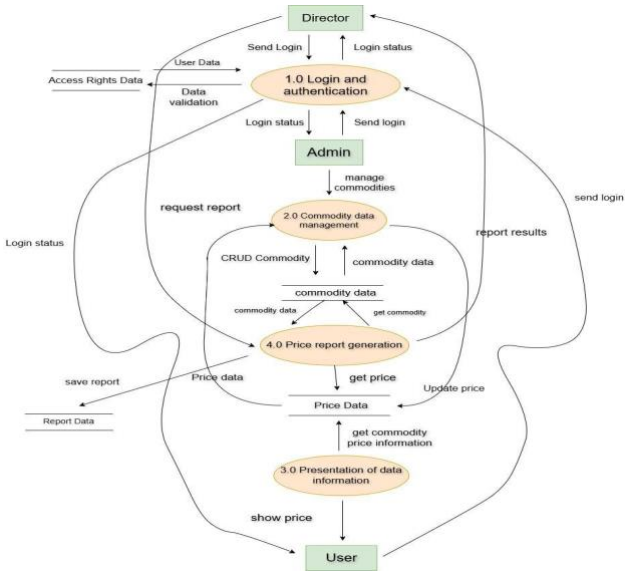

Figure 2. *Data Flow Diagram* Level 1

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c. Implementation
The system will be developed as an Android application and will use:
- Programming language: PHP (backend) and JavaScript
- Framework: Android Studio
- Database: MySQL

All system modules will be implemented based on the approved design documents.

d. Testing
Testing was conducted using User Acceptance Testing (UAT) with farmers and Ministry of Agriculture employees as end users.The test results show that the system can display commodity price data in real time and that the user interface is easy to use.

e. Implementation and Evaluation
The software may undergo changes after delivery to the user. Changes can occur because errors occur and are not detected during testing, or because the software needs to be adapted to a new environment. The support or maintenance phase can repeat the development process from the specification analysis phase to new software changes.

Results and Discussion

In this chapter, the architecture, implementation and system analysis will be explained in detail. The following is a display of the information system interface on an Android device:

Figure 3. Homepage & Prices list

The testing phase is a crucial step in ensuring the system's functionality, reliability, and user satisfaction. This study incorporated three types of testing: White Box Testing, Black Box Testing, and User Acceptance Testing (UAT) to comprehensively evaluate the mobile-based agricultural commodity price information system.

1. White Box Testing

White box testing (structural testing) involves verifying the internal logic and structure of the application. It ensures the correctness of the system's code and data flows.

Table 1. White Box Testing

No	Test Case	Purpose	Result
1	Validate commodity price retrieval algorithm	Ensure correct SQL queries fetch real-time prices	Passed
2	Check user authentication flow	Verify admin and user access levels	Passed
3	Test data update operations	Ensure admin updates are reflected in the database	Passed

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No	Test Case	Purpose	Result
		correctly	
4	Review conditional statements and loops	Confirm all logical branches behave as expected	Passed
5	Unit testing of modules (login, search, report)	Validate individual module functionality	Passed

2. Black Box Testing

Black box testing (functional testing) examines the system's functionality without considering its internal code. It focuses on the input-output behavior and user experience.

Table 2. Black Box Testing

No	Test Scenario	Expected Result	Actual Result	Status
1	User logs in with valid credentials	User is redirected to home screen	Works as expected	Passed
2	User enters invalid credentials	Error message is displayed	Works as expected	Passed
3	Admin updates commodity price	Price data updates and displays in real time	Works as expected	Passed
4	User searches for unavailable commodity	"No data found" message is displayed	Works as expected	Passed
5	Generate PDF report for selected date range	PDF report generated with correct data	Works as expected	Passed

3. User Acceptance Testing (UAT)

User Acceptance Testing (UAT) was performed to validate the system's ability to meet user requirements in real-world scenarios. Farmers and Ministry of Agriculture staff tested the system to ensure it is user-friendly and functional in their daily operations.

Table 3. UAT Testing

No	Test Scenario	Expected Result	Actual Result	Status
1	Farmer searches for commodity prices	Correct real-time prices displayed	Prices displayed correctly	Passed
2	Admin updates commodity price data	Updated prices reflected instantly on the user interface	Updates applied in real time	Passed
3	Generate PDF report for selected commodities	Report generated with accurate data	Report generated successfully	Passed
4	Farmer navigates through application menus	Application menus are intuitive and responsive	Navigation is user-friendly	Passed
5	Application performance under normal usage	App performs without crashes or delays	Smooth performance	Passed

This structured testing approach ensured that the system was reliable, secure, and ready for deployment in Simalungun Regency.

Conclusion

This research successfully established a mobile-based agricultural commodity price information system for Simalungun Regency. It aims to improve access and dissemination of agricultural commodity price information for farmers and other stakeholders quickly, accurately, and in real time. This information system is based on user-friendly mobile interface technology and supports data updates by the administrator. Based on the results of all the system's main functions, such as information search and data updates, it can be concluded that this information system has worked well. Although it is working well, there are several aspects that can still befurther developed, such as:

1. Add historical data-based price prediction features and trend analysis
2. Develop an offline version
3. Add a field sales representative form

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