J-INTECH (Journal of Information and Technology)
Terakreditasi Kemendikbud SK No. 204/E/KPT/2022
E-ISSN: 2580-720X || P-ISSN: 2303-1425

Creating Easy Tender App for Tender Process Procurement Division at PT. United Tractors

Farhan Ryanda Imran[1], R Wisnu Prio Pamungkas [2]

[1,2]Informatika, Universitas Bhayangkara Jakarta Raya, Jl. Raya Perjuangan No. 81 Marga Mulya, Bekasi Utara, Jawa Barat, 17143 Indonesia

***Correspondence Email :**
202010225255@mhs.ubharajaya.ac.id

Abstract

In the ongoing era of digital transformation, the use of information technology has become essential in digitizing business processes across various sectors, including the tender process for procuring goods and services. Manual tender processes often face several challenges, such as being time-consuming, prone to human errors, and inefficient. In the Procurement and Investment Function Division 1 of PT. United Tractors, the tender process for optional safety device items is still conducted manually, creating complexity and consuming a significant amount of time. This research proposes the development of an Android-based application, named Easy Tender, to automate most stages of the tender process. The application is designed to include features such as participant registration, tender participant confirmation, automatic winner determination based on the lowest price and set deadlines, and sorting ranking in the tender recap using the Bubble Sort algorithm. Additionally, the application provides ease of digitalized negotiation and allows real-time monitoring of the tender process. With the development of Easy Tender, it is expected that the Procurement and Investment Function Division 1 of PT. United Tractors can digitize their tender processes, making the tender process more efficient, time-saving, and reducing the risk of human errors. This application is also expected to enhance accountability in determining the winner based on the lowest price. Therefore, this research holds high urgency in efforts to improve operational efficiency and the application of information technology in the business world.
Keyword : Accountability; Android; Automation; Bubble Sort Algorithm; Tender Process

1. Introduction

In the era of digital transformation, the use of information technology has become essential in digitizing business processes, including the procurement tender process. The traditional manual tender process is fraught with challenges such as time consumption, human errors, and inefficiencies. These issues can significantly hinder the effectiveness and accuracy of tender operations.

At PT. United Tractors, specifically in the Procurement and Investment Function Division 1, the procurement process for optional safety devices is still conducted manually. This involves multiple stages, including negotiations through instant messaging applications, registration and confirmation of tender participants, winner determination via email, and recapitulation using spreadsheets. Such methods are not only labor-intensive but also prone to errors, especially in the critical stage of winner determination, which requires manual comparison of bid prices.

The manual tender process at PT. United Tractors is complex and time-consuming. The reliance on various manual methods increases the risk of human errors, delays, and inefficiencies. These challenges make it difficult to ensure a transparent and accountable tender process, especially when determining the winning bid.

To address these issues, the researcher proposes the development of an Android-based application called Easy Tender. This application aims to automate most stages of the tender process, including participant registration

and confirmation, automatic winner determination based on the lowest price and deadlines, and tender recapitulation using the Bubble Sort algorithm. The proposed solution is supported by previous research that highlights the effectiveness of digital systems in improving operational efficiency and accuracy in tender processes. By digitizing the tender process, Easy Tender is expected to make the procurement process in the Procurement and Investment Function Division 1 at PT. United Tractors more efficient, time-saving, and less prone to human errors, while also enhancing accountability in winner determination.

2. Research Methodology

In this research, the methods used are Rapid Application Development (RAD) and the Bubble Sort algorithm. These methods are combined to leverage the strengths of each in addressing different aspects of the problem. RAD is applied to accelerate system development through active user participation in the development process. This approach is conducted rapidly, iteratively, and focuses on creating several prototypes that eventually evolve into the final system (Alhafis, Saputera, & Andilala, 2023; Charlitos & Adam, 2023), the Bubble Sort algorithm is utilized to perform comparisons from the last element to the first element, resulting in an ascending ordered array (R. W. Arifin & Setiyadi, 2020).

The combination of RAD and Bubble Sort addresses both the need for efficient system development and the specific requirement of sorting bid prices in the tender process. RAD ensures that the application is developed quickly with ongoing feedback from users, while the Bubble Sort algorithm provides a straightforward method for sorting bids to determine the lowest price efficiently. The stages in this research are as follows:

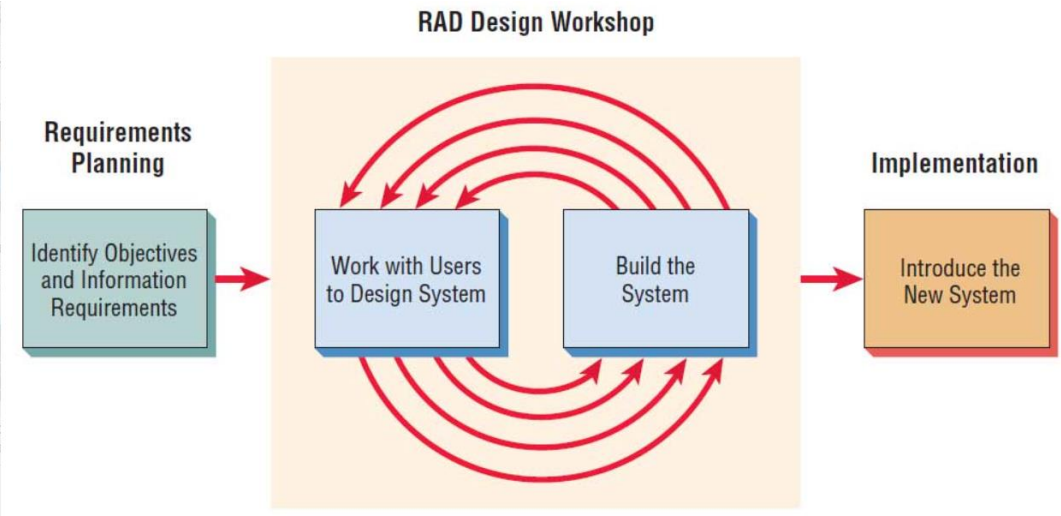

Figure 1. Rapid Application Development (RAD) Design Workshop

In this research, the researcher used several data collection methods focused on gathering the necessary information for the development of the Easy Tender application. Here are the data collection methods used. This involved the writer's direct observation and monitoring of all tender and procurement-related processes within the Procurement & Investment Function 1 Division of PT. United Tractors. Through this observation, the writer sought to gain a deep understanding of how the processes were carried out, identify potential obstacles that might arise, and look for opportunities to digitize manual management processes through the implementation of the Easy Tender application. This observation took place during the writer's internship period, from February 16, 2023, to June 30, 2023.

The interview method was used to gain a deeper understanding of the needs of users and stakeholders related to the Easy Tender application. The writer conducted interviews with several parties such as the Department Head of Procurement Function 1, Procurement Staff, and other relevant parties. These interviews helped identify desired features, problems to be solved, and expectations for the application.

Literature review was conducted to gather relevant information about technology, best practices, and similar applications that could serve as references in the development of the Easy Tender application. The writer also gathered data from theoretical and practical sources that support the development of this application.

The selection of the Bubble Sort algorithm for sorting the tender prices was based on several factors. First, the Bubble Sort algorithm is straightforward to implement and understand, making it suitable for educational purposes or scenarios where simplicity is preferred over efficiency. Second, the dataset for this simulation is small, consisting of only five prices. In such cases, the overhead of more complex sorting algorithms may outweigh their performance benefits. Third, the Bubble Sort algorithm has a relatively stable performance with small datasets(Rizki Saputra, Andryana, & Sholihati, 2021), making it a reasonable choice for this scenario. The algorithm analysis and data simulation in this research involve the use of the Bubble Sort algorithm to sort five prices: 1,000,000; 1,300,000; 1,250,000; 950,000; and 1,100,000. The Bubble Sort algorithm is used to sort the prices from smallest to largest through iterative and repetitive comparisons. Each iteration ensures that the smaller prices are moved to their correct positions until all prices are correctly sorted(Panggabean, Htb, Perina, Toro, & Syahputra, 2023).

Table 1. Tender Price Data Simulation

Price-1	Price-2	Price -3	Price -4	Price -5
1,000,000	1,300,000	1,250,000	950,000	1,100,000

Analysis of the Use of the Bubble Sort Algorithm in Kotlin with a Data Simulation of Prices Sorted from Smallest to Largest Can Be Seen in the Following Flowchart.

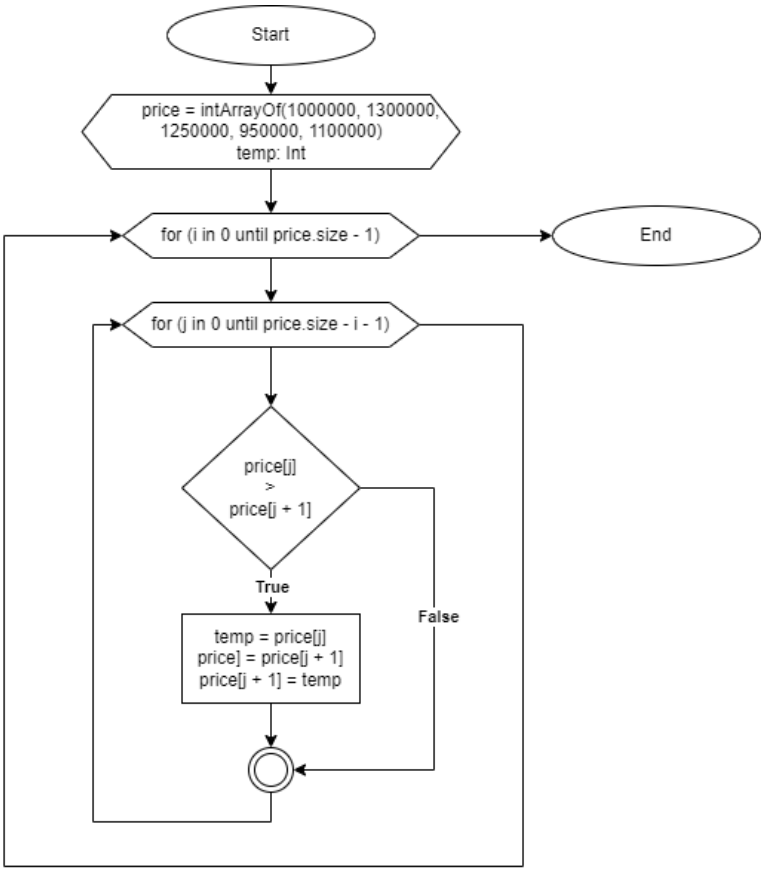

Figure 2. Bubble Sort Algorithm with Sample Data Simulation

The simulation of price comparison and the iteration process of the Bubble Sort algorithm is performed on the provided price data set. This algorithm works by comparing prices one by one, swapping their positions if necessary, until all prices are sorted from the smallest to the largest(R. W. Arifin & Setiyadi, 2020).

Table 2. Bubble Sort algorithm data simulation iteration

Iteration Step	Price 1	Price 2	Price 3	Price 4	Price 5
Iteration1	Rp1,000,000	Rp1,300,000	Rp1,250,000	Rp950,000	Rp1,100,000
Iteration 2	Rp1,000,000	Rp1,250,000	Rp1,100,000	Rp950,000	Rp1,300,000
Iteration 3	Rp1,000,000	Rp1,100,000	Rp950,000	Rp1,250,000	Rp1,300,000
Iteration 4	Rp1,000,000	Rp950,000	Rp1,100,000	Rp1,250,000	Rp1,300,000
Iteration 5	Rp950,000	Rp1,000,000	Rp1,100,000	Rp1,250,000	Rp1,300,000

The analysis of the current system is an important aspect in understanding how the system operates in identifying and evaluating various problems, obstacles, and needs that must be considered in this research(Mersita, Darwis, & Surahman, 2022).

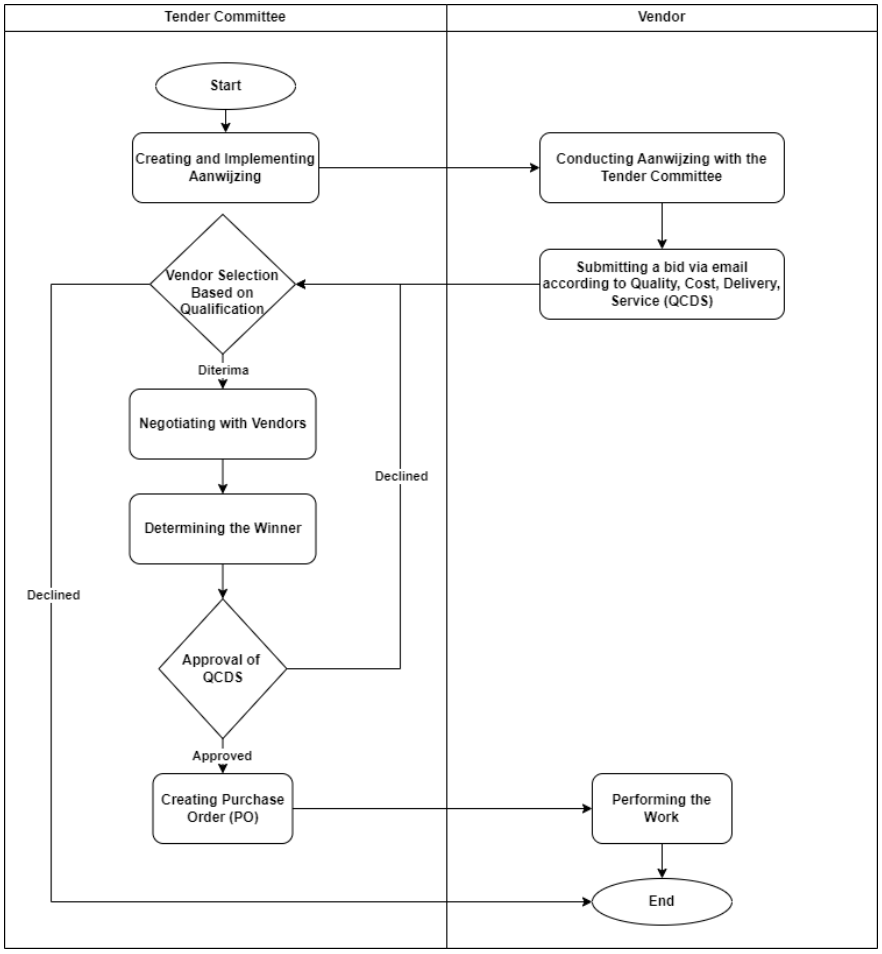

Figure 3. Current System Activity Diagram

After analyzing the collected data, the author proposes the Easy Tender system to improve the tender process in Procurement & Investment Function Division 1 at PT United Tractors. One method that can be used to analyze problems in the current system and to propose solutions is the Bubble Sort algorithm(Anwardi, Anggi, Misra, Tengku, & Ekie, 2020). This proposal includes the development of the Easy Tender application for automating the tender process and steps to improve the effectiveness of the current system.

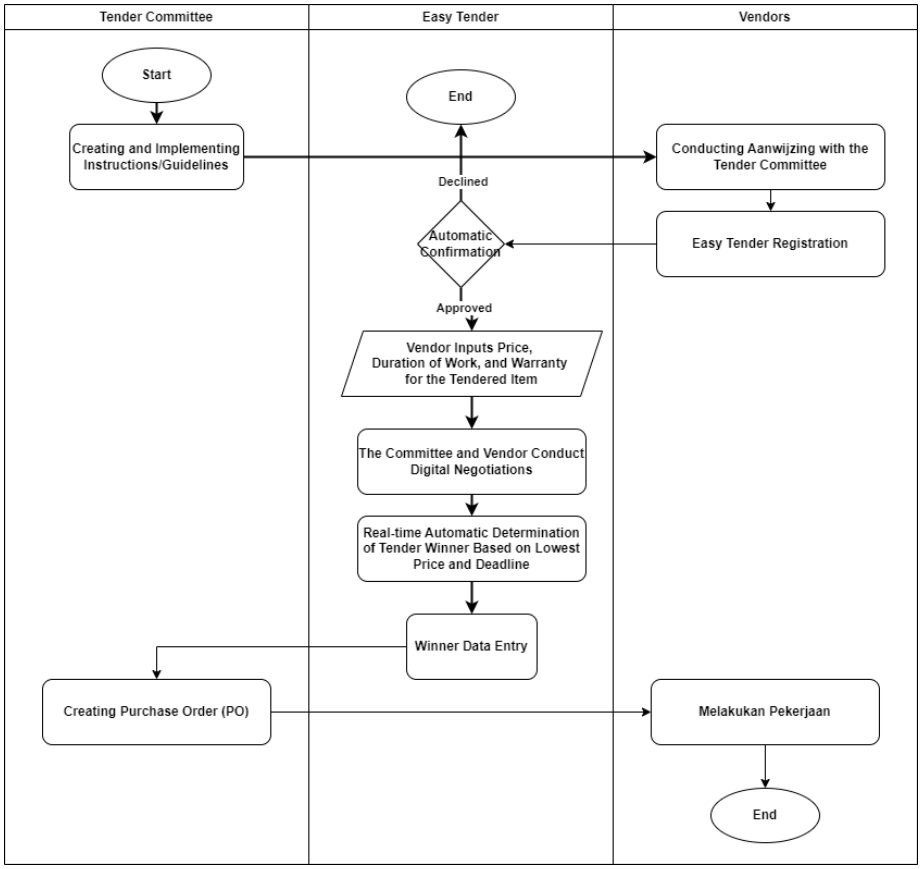

Figure 4. Proposed System Analysis

The Tender Committee (PIN) and Vendors can register or log into their respective accounts. Vendors must verify via email after registration. After logging in, vendors fill out a form with the required information. The Tender Committee can set the deadline for the goods to be offered in the tender process. This application allows the Committee and Vendors to view the list of goods offered, participating participants, and to make bids on prices, duration of work, and guarantees. Users can also negotiate and monitor the winning tender.

3. Results

The Tender Committee (PIN) and Vendors can register or log into their accounts. Vendors must verify via email after registration. After logging in, vendors fill out the required form. The Tender Committee sets the deadline for the goods to be offered in the tender process. This application allows the Committee and Vendors to view the list of goods and tender participants, make bids on prices, duration of work, guarantees, and negotiate. Users can also monitor the winning tender.

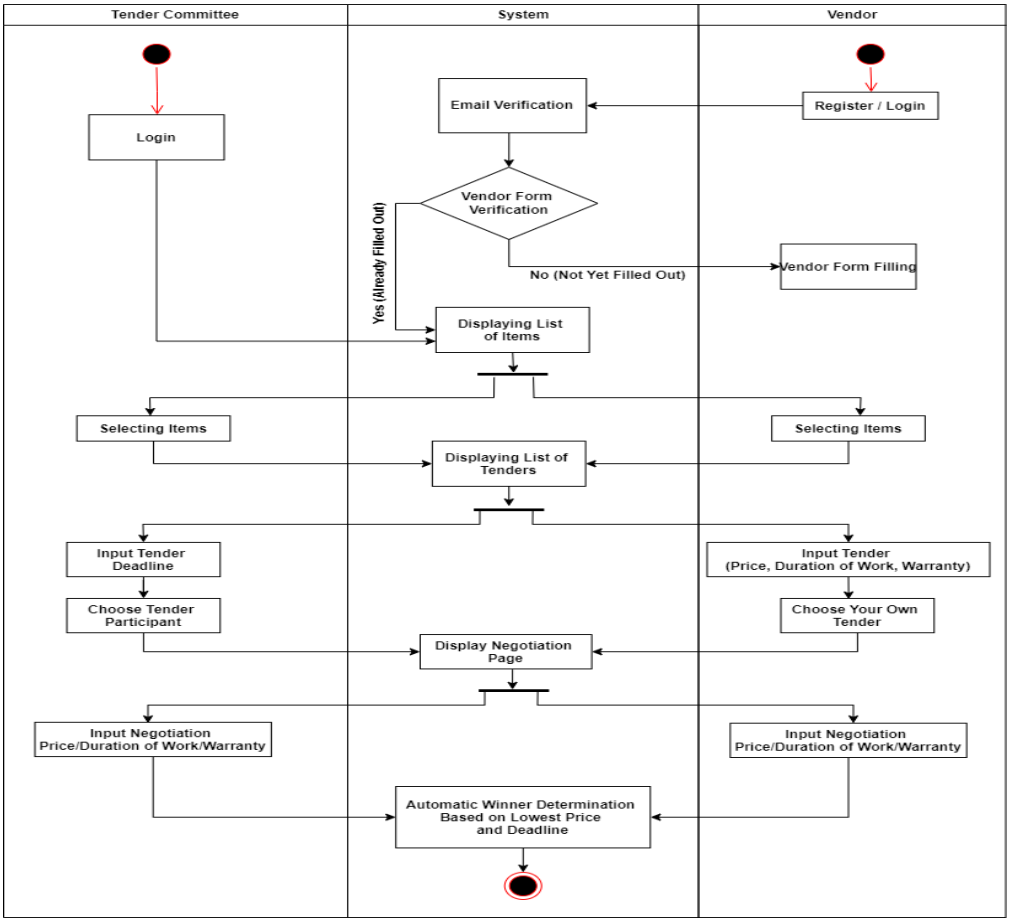

Figure 5. Easy Tender Application Flow

4. Discussion

The implementation of the Firebase real-time database in the development of the Easy Tender application for real-time recapitulation and negotiation in this application is as follows :

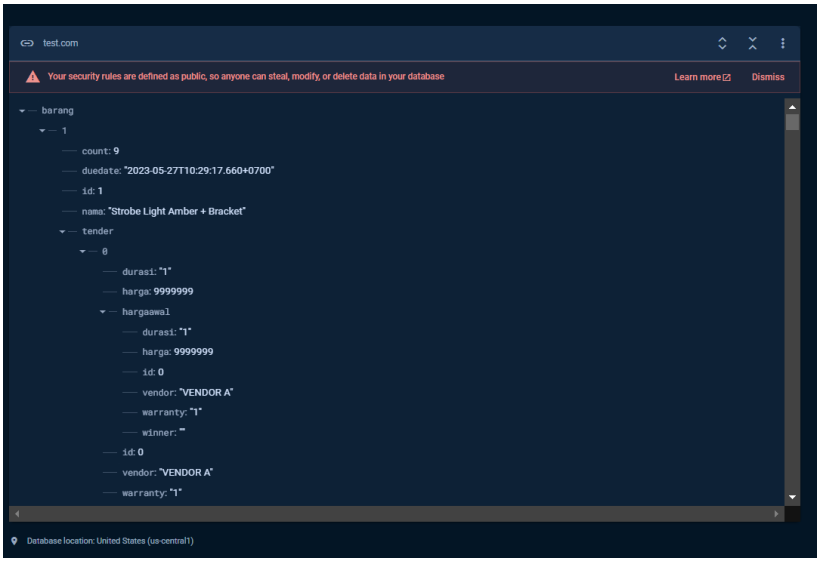

Figure 6. Data retrieval using the Firebase real-time database

The implementation of data retrieval in the Easy Tender application uses the Firebase real-time database with a Not Only SQL (NoSQL) approach. However, the following example shows data retrieval that does not conform to the structure or paradigm of NoSQL in the goods database table(Andrianto & Munandar, 2022).

The implementation of authentication pages in Easy Tender manages user authentication and provides access based on authorization. This page ensures data security and provides an efficient user experience. Users register by filling out a form (username, email, password, password confirmation). After registering, users must verify their email. Users click the verification link sent to their email. Without verification, users cannot log in.

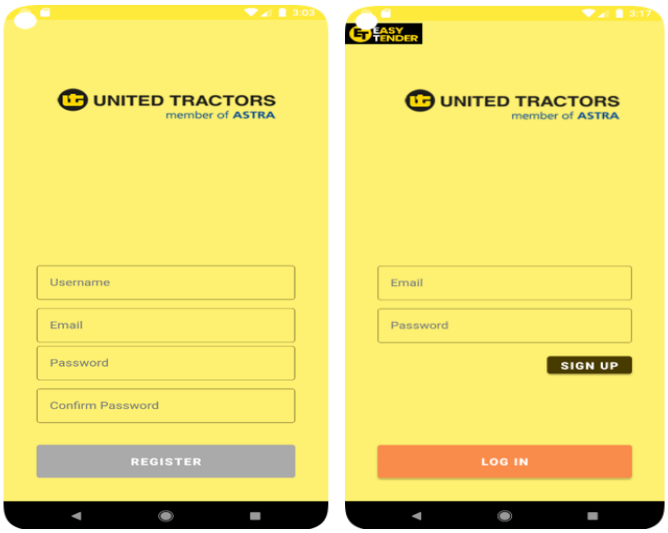

Figure 7. Register and Login Pages

This page is used to fill out the vendor form with information such as vendor name, address, phone number, email, sales name, NIB (Nomor Induk Berusaha), and owned goods. After filling out the form and submitting it, the system will validate whether the vendor is eligible to participate in the tender. If eligible, the vendor is directed to the goods registration page. If not, the vendor is redirected to the rejection page.

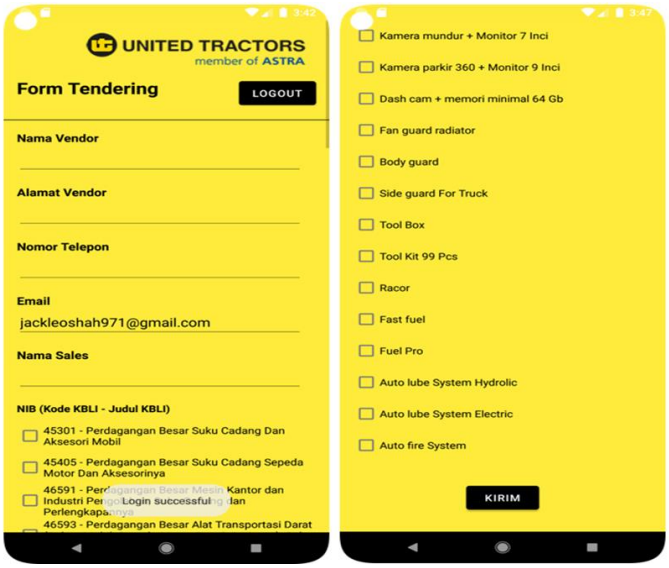

Figure 8. Vendor Form Page

The Goods List page in the Easy Tender application functions to load a list of goods to be offered in the tender process. On this page, Vendors can view the list of goods and notifications regarding updates that occur in the tender process in the Easy Tender application. From the Tender Committee's perspective, they can add new goods, edit goods information, and delete irrelevant goods, as well as view new notifications in the notification bell available at the top of the page. The purpose of this page is to facilitate Vendors and the Tender Committee in viewing the goods to be offered in the tender process.

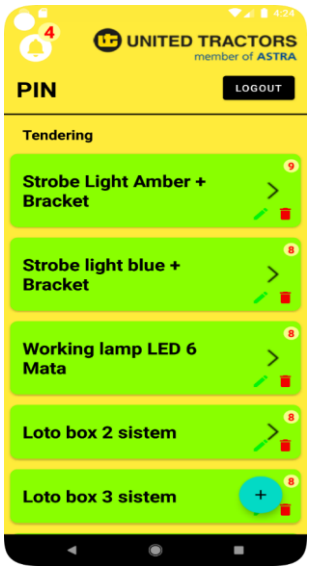

Figure 9. Goods List Page

Figure 10. Page for Editing and Adding Goods

Figure 11. Notification Page

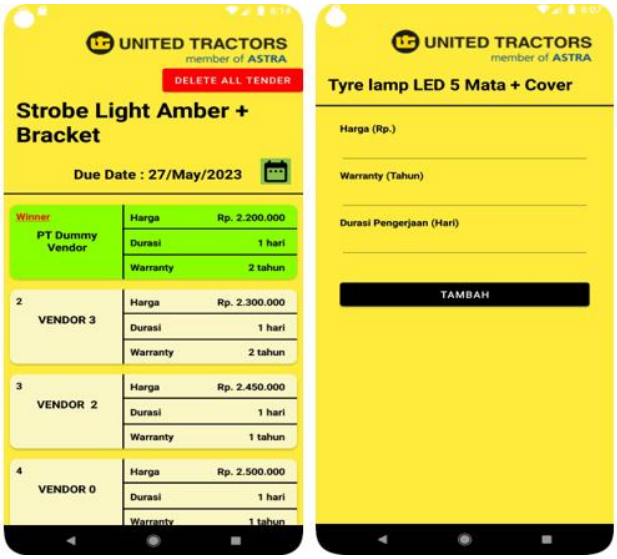

Figure 12. Goods Bidding List Page and Add Bidding

This page facilitates users in viewing the list of bidders and making bids in the tender process. It displays detailed information such as vendor name, price, warranty, duration of work, and information on the winning bid. Users can check and make bids on goods being tendered. This page makes it easy for users to add bids to the tender process. There is a form for inputting data such as price, duration of work, and warranty. Users fill

out the form with details and accuracy to submit their bids, ensuring ease in participating in the bidding process.

This page facilitates users in viewing the list of bidders and making bids in the tender process. It displays detailed information such as vendor name, price, warranty, duration of work, and information on the winning bid. Users can check and make bids on goods being tendered. This page makes it easy for users to add bids to the tender process. There is a form for inputting data such as price, duration of work, and warranty. Users fill out the form with details and accuracy to submit their bids, ensuring ease in participating in the bidding process.

This page facilitates negotiation between Vendors and the Tender Committee regarding the price, duration of work, and warranty of goods. Users can view negotiation history, respond to offers, and negotiate directly through the platform using the Firebase real-time database.

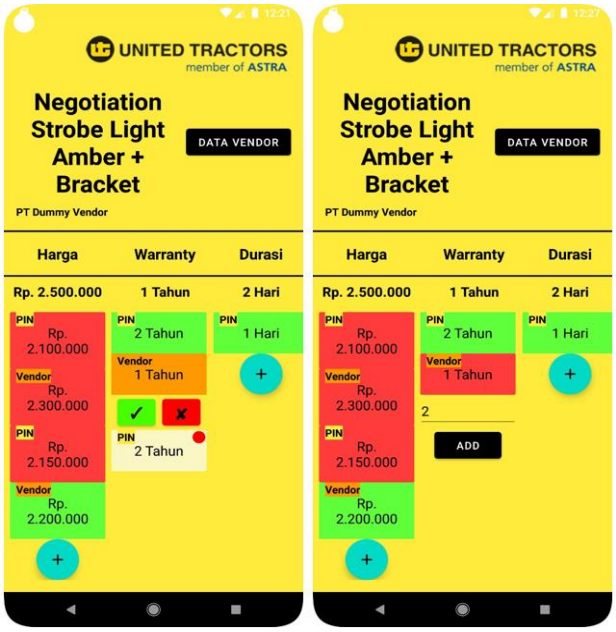

Figure 13. Tender Negotiation Page

In the Easy Tender application, the Bubble Sort algorithm is used to determine the winning bid based on the lowest price. This algorithm sorts the list of bids from lowest to highest price after all bids have been received and verified. Bubble Sort was chosen for its simplicity and efficiency for a moderate amount of data(N. Arifin, Fauziah, & Nurhayati, 2022). With this algorithm, the application can automatically determine the winning bid quickly and efficiently, improving the efficiency of the tender process. Below is an example table of a simulation sample for 8 tender participants with prices, duration of work, and warranty for Strobe Light Amber + Bracket goods.

Table 3. Participant Data with Prices for Strobe Light Amber + Bracket Goods

Participant	PT Dummy Vendor (Rp) (juta)	VENDOR 0 (Rp) (juta)	VENDOR 1 (Rp) (juta)	VENDOR 2(Rp) (juta)	VENDOR 3(Rp) (juta)	VENDOR 5(Rp) (juta)	VENDOR 6(Rp) (juta)	VENDOR 7(Rp) (juta)
Price	2,2	2,5	2,5	2,45	2,3	2,5	2,5	2,6

From the 8 price data for Strobe Light Amber + Bracket goods, sorting in ascending order using the Bubble Sort algorithm results in 7 iterations. This sorting process can be seen in the following table.

Table 4. Iteration Process of Price Data with Bubble Sort Algorithm for Strobe Light Amber + Bracket Goods

Iteration	**0** (Rp) (juta)	**1** (Rp) (juta)	**2** (Rp) (juta)	**3** (Rp) (juta)	**4** (Rp) (juta)	**5** (Rp) (juta)	**6** (Rp) (juta)	**7** (Rp) (juta)
Start	2,2	2,5	2,5	2,45	2,3	2,5	2,5	2,6
1	2,2	2,5	2,5	2,45	.2,3	2,5	2,5	2,6
2	2,2	2,45	2,5	2,5	2,3	2,5	2,5	2,6
3	2,2	2,45	2,5	2,5	2,3	2,5	2,5	2,6
4	2,2	2,3	2,45	2,5	2,5	2,5	2,5	2,6
5	2,2	2,3	2,45	2,5	2,5	2,5	2,5	2,6
6	2,2	2,3	2,45	2,5	2,5	2,5	2,5	2,6
7	2,2	2,3	2,45	2,5	2,5	2,5	2,5	2,6

From these iterations, it can be concluded that the Bubble Sort algorithm successfully sorts the price data for Strobe Light Amber + Bracket goods in ascending order. Each iteration shifts the values so that the smallest value is in the correct position. The sorting process is done by swapping the positions of two elements if the previous element is larger than the next element. After the 7th iteration, the data is sorted from lowest to highest price.

5. Conclusion

The research on the use of the Bubble Sort algorithm in the Easy Tender system at the Procurement & Investment Function Division 1 of PT United Tractors has achieved its objectives. The implementation of the Bubble Sort algorithm successfully sorts the list of price bids in ascending order, enabling the application to determine the tender winner automatically and efficiently.For further research, it is recommended to expand the Easy Tender application's scope to include other types of tenders beyond optional safety devices for heavy equipment. Additionally, the application should be developed to be accessible through various platforms, not limited to Android, to increase its usability and reach. Furthermore, establishing clear Standard Operating Procedures (SOPs) for the application's use would enhance its efficiency, consistency, and accuracy in managing tender processes.

Reference

Alhafis, A. N., Saputera, S. A., & Andilala. (2023). *Implementasi Rapid Application Development Dalam Membangun Sistem Pendaftaran Nikah Secara Online*. *19*(2), 299–307.

Andrianto, R., & Munandar, M. H. (2022). Aplikasi E-Commerce Penjualan Pakaian Berbasis Android Menggunakan Firebase Realtime Database. *Journal Computer Science and Information Technology (Jcoint)*, *3*(1), 20–29.

Anwardi, Anggi, R., Misra, H., Tengku, N., & Ekie, G. P. (2020). Analisis PIECES dan Pengaruh Perancangan Website Fikri Karya Gemilang Terhadap Sistem Promosi Menggunakan Model Waterfall. *Jurnal Rekayasa Sistem & Industri (JRSI)*, *7*(1), 57–65.

Arifin, N., Fauziah, & Nurhayati. (2022). Kombinasi Algoritma Sequential Searching dan Bubble Sort Pada Manajemen Laboratorium. *Jurnal Sains Komputer & Informatika (J-SAKTI*, *6*(1), 294–306.

Arifin, R. W., & Setiyadi, D. (2020). Algoritma Metode Pengurutan Bubble Sort dan Quick Sort Dalam Bahasa PemrArifin, R. W., & Setiyadi, D. (2020). Algoritma Metode Pengurutan Bubble Sort dan Quick Sort Dalam Bahasa Pemrograman C++. Information System for Educators and Professionals, 4(2), 17. *Information System for Educators and Professionals*, *4*(2), 178–187.

Charlitos, R., & Adam, S. (2023). *J-INTECH (Journal of Information and Technology) Aplikasi Penyesuaian Stock Sebagai Pendukung Proses Audit Pada Perusahaan Manufaktur dengan Metode RAD*. (204).

Mersita, R., Darwis, D., & Surahman, A. (2022). Sistem Informasi Pembayaran SPP pada Sekolah di Kecamatan Gedung Tataan dengan Metode Extreme Programming. *Jurnal Ilmiah Sistem Informasi Akuntansi*, *2*(2), 45–53. https://doi.org/10.33365/jimasia.v2i2.1872

Panggabean, A. B., Htb, R. R., Perina, I., Toro, Y. L., & Syahputra, A. (2023). Implementasi Algoritma Bubble Sort pada Sistem Pelayanan Perpustakaan Menggunakan Laravel. *Sudo Jurnal Teknik Informatika*, *2*(1), 19–27. https://doi.org/10.56211/sudo.v2i1.185

Rizki Saputra, D. Y., Andryana, S., & Sholihati, I. D. (2021). Analisis Perbandingan Algoritma Bubble Sort Dan Selection Sort Pada Sistem Pendukung Keputusan Pemilihan Tempat Kost Berbasis Ios (Iphone Operating System). *JIPI (Jurnal Ilmiah Penelitian Dan Pembelajaran Informatika)*, *6*(2), 318–324. https://doi.org/10.29100/jipi.v6i2.2015