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Inventory Management System Olahan Hasrat Sdn. Bhd. Using Mobile Application

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Abstract: The Inventory Management System (IMS) is commonly used in industry today to improve the productivity of item movement. In order to have a proper business that involves with large amount of goods or items, a strong fundamental need to be worked behind the scene which can affect a company rate of work and budget. The conventional IMS approach included a lot of paperwork, such as spreadsheet and order list, which would be more difficult to handle as storage increases. The inventory management system can be computerized to further improve the productivity of IMS. The case study involved in this project is Olahan Hasrat company which is a mechanical and electrical contractor. The goal of this project is to build an IMS software which can store a large amount of item data. The main component of this system is to track the inventory that is going in and out from the warehouse. Other than that, this mobile application can calculate expenses and see the report of monthly spending. In addition, the system can also compare prices between suppliers with the latest price of the goods from online shops. In order to develop the software, the methodology of the project is approached by using prototyping model. The system is built using Java language and Firebase as the platform for database. The program will then be tested using user acceptance with questionnaires is given after they tested the system. This paper focuses on developing IMS with mobile application for Small to Medium Enterprise (SME) and the use of engineering companies in the field.

Keywords: Inventory Management System, Mobile Application, Prototyping Model.

1. Introduction

As businesses are evolving day by day, today the world has become more competitive and has called for a prompt, up-to-date technology adoption that can cope in difficult times. Businesses and companies are also affected by this development. Hence this project proposes the concept of managing inventory management system to help companies to improve the integration of cross-border business activities. Inventory management is a systematic approach to the purchase, storage and distribution of inventories, both raw materials and finished goods (products) [1]. In order to automate management, an inventory management system is used as a method for controlling the level of inventory and the availability of goods.

In Olahan Hasrat Sdn. Bhd., All the inventory tracking is carried out by hand and is truly time consuming. The inventory management is one of the most critical aspects of any business organizations. The causes of the failure of inventory management operations are due to the lack of awareness or knowledge of the existence of demand [2]. The main purpose of this paper is to propose a conceptual model with variety of methods to make Inventory Management more flexible in terms of timing of handling the tracking, paperless and more competitive in the global market. The objectives of this study are:

- Analyze the existing system and determine the most effective software development tool for the design of the inventory management system.
- To design and develop a low-cost inventory management system that is user friendly.
- To test and verify the inventory management system software.

The scope of the project is important in determining the direction of the project. The scope of the project is the main guideline in developing this application. The following project scope is determined to ensure that project objectives are achieved:

- The system will be used in the field of mechanical, electrical and civil engineering to organize the storage of items and goods and manage and oversees the flow of data and finances of the company.
- The system will be used by the manager of Olahan Hasrat as the administrator (Admin).
- This system will be developed using mobile application.

The followings are the output from project results:

- The system can be login by user.

- User is able to insert all sorts of expenses such as for transportation, tools, Personal Protective Equipment (PPE), rents, shopping and others.

- User can track down their inventory and date of purchase in the warehouse so they can manage the inventory on hand, counting and handling it to prevent untracked material lost, excessive buying of the same item.

- The system should be able to search item online from online shopping to track price from suppliers so user is able to track the price comparison between suppliers to choose which supplier is the most affordable to buy their item and reduce unnecessary spending.

- The system should be able to create a report from previous expenses to alert user the performance of the company and enable user to predict for future the quantity of item needed for certain category of project.

- Implement a paperless environmental principle in the filing system.

The rest of the paper is organized as follows: Section II describes the literature review of this project. Section III presents the methodology to develop this application. Section IV presents the discussion part and section V shows the conclusion of this project.

2.0   Literature Review

The study of the case background, the problem-solving process and the technologies used to establish a new system are part of the literary review. Case studies for this project is inventory management. The objective of the literature review is to identify and evaluate needs and situations for the implementation of the new system to address the current system's weakness. References are often made to contrast with current structures. In general, sales are transactions between two parties where the consumer receives products (tangible or intangible), services or properties in exchange for money [3]. Thus, the mechanism allows each party to give up something in exchange for something of value

to them. Aside from sales, inventory means raw materials, work-in-process materials and final products, goods that are deemed to be part of the properties of a company that are ready for a sale [4]. This explains why a company needs an inventory available to make sales to the client in return for money that produces income.

For every firm, the requirement for effective management is highly important. Managers have created and deployed several current strategies to solve this problem. It allows a management to boost capital productivity by decreasing material cost, preventing long-term blocking of significant working capital and improves turnover of capital [5]. The dependable flow of businesses to help minimize the impact of unexpected disruptions plays a key role in the efficient inventory control model and urgency logistical system [6].

There are two types of challenges that companies face in maintaining inventory levels that are high or low in inventories. On the one hand, maintaining a high amount of inventory for a lengthy period of time is typically not good for business because of the costs of inventory storage, unsustainability and spoilage. On the other hand, the low amount of stock is not good either, as the company could also face the possibility of losing future revenue and potential profit growth. Problems with inventory control often led to records and physical counts that ultimately lead to higher inventory values than preferred [7]. In an attempt to solve inventory problems, the answer lies in effective inventory management. Generally speaking, companies are widely using decision-making support technologies and applications for individual decision makers, work groups and online stakeholders [8]. Good inventory management performance involves carrying adequate inventory, while simultaneously reducing its expiry, to guarantee 100% availability [9, 10]. In Olahan Hasrat Sdn. Bhd., All the inventory tracking is carried out by hand and is truly time consuming. The inventory management is one of the most critical aspects of any business organizations. The causes of the failure of inventory management operations are due to the lack of awareness or knowledge of the existence of demand [2].

As the advantages of converting to a modern inventory management system have been clearly shown by many businesses, it is time for Olahan Hasrat to start applying it in their business to see the differences between them. A study entitled 5 reasons to upgrade your inventory management system to mobile,'[11] few advantages were described as follows:

1. Force Effectiveness

Retail warehouses need mobile devices that are both durable enough to endure the physical demands of day-to-day operations and flexible enough to meet modern requirements. Advanced mobile devices running current Operation System (OS), such as Samsung phones and tablets running Android, make it easy for users to switch between scanning and communication to improve productivity.

2. Inventory management improving the Return On Investment (ROI)

With their fast processors and high-resolution cameras, powerful, smartphones and tablets can now equal and often surpass the performance of dedicated scanning devices. Not only can these machines deliver more functionality and versatility than conventional scanners, they do so at a lower price point. This is good news for retailers as they strive to adapt to new warehouse demands with limited resources and support a fast ROI from mobile innovations.

3. Secured data

Fully supported operating systems are only one layer of an effective security plan to defend against increasing attacks on retail systems. Other key elements include defensive system security integrated into both hardware and software layers and advanced authentication, such as face

recognition and fingerprint verification, which allows employees to easily log in and get to work while providing better security than password-based systems.

4. Inventory management increases cash flow

Purchasing the correct product in the right amount to satisfy customer demands and at the same time removing the slow-moving, redundant inventory leads to improved cash flow and potentially increased incomes.

5. Inventory management improves decision-making

Competitive market analytics across all areas of businesses is possible with quick, reliable data collection. Not just that, problems and incidents integrated with the infrastructure make it easier to recognize and address issues actively.

2.1   Study of existing system: Inventory Management- BoxHero application

Inventory Management-BoxHero application is a multi-platform application that can be accessed through Android and in iPhone Operating System (iOS) operating system [12]. The app is free to purchase in Google Play Store and Apple App Store but you will have to pay for business plan with 30 days free trial. If you wish not to continue the subscription, you will be switched to a single plan which is free but lesser services. Figure 1 shows the interface of the application. Inventory Management-BoxHero application offers the activity of tracking and monitors inventory in history, any stock in and out and remaining stocks. Other than that, this application also can remind the user with alarm notification about low stock reminder.
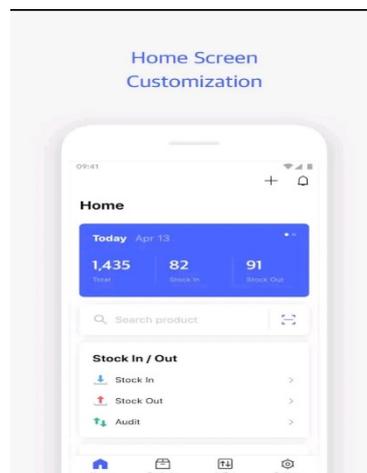
Figure 1: home screen interface for tracking inventory

2.2   Study of existing system: Stock and Inventory Management System application

The Stock and Inventory Management System application is built by Magnetic Lab. The platform application can only be accessed through the Android operating system [13]. The application is free to purchase by downloading it using Google Play Store and it is really popular among business entrepreneurs. Figure 2 shows the system interface. Stock and Inventory Management System application allows user to manage product and inventory by managing product details, add, update and delete. They also provided QR and barcode scanner for reading product code. Search and filter utilities are available for easily search products and filter transactions to reduce time-consuming on scrolling the data.
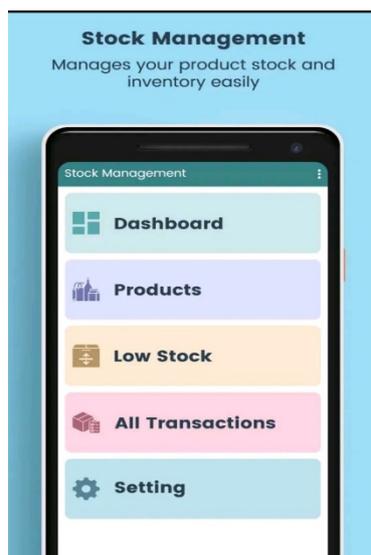
Figure 2: the interface for inventory tracking in this application

2.3   Comparison with the Existing Systems

Comparative features like registering, log-in, inventory tracking and monitoring have been used in standard modules with all of the application with the system. This demonstrates by this analogy that all the application and device must be logged in as a user with a username and password.

Table 1 shows the system comparison between other applications and the proposed system. From this comparison, it shows that the addition in features such as price comparison, expenses tracker and the search engine is improved from the other applications. Inventory Management System Olahan Hasrat Sdn. Bhd. improves the other system by adding the module of price comparison so they can track the supply pricing between suppliers to reduce unnecessary spending and avoid loss. The search engine is also improved to ease users when searching for a product, item and title of a project by typing the keywords. An expenses tracker module also has been upgraded to make Admin track the overall expenses from many categories so they can foresee which category is spending the most. Supposedly it can help manager gain more achievement and success in the inventory management.

Table 1: System Comparison

Features/system	Inventory Management- BoxHero application	Stock and Inventory Management System application	Inventory Management System Olahan Hasrat Sdn. Bhd.
Register/log in/ log out	√ user id and password	√ user id and password	√ user id and password
Inventory tracking	√	√	√
Expense tracker	√	X	√
Price comparing	X	X	√ track supply pricing to compare the supply pricing between suppliers

Table 2: (cont.)

|			
Search engine	X	√	√ to ease them searching product, item and title of project by key-in keywords.
Project report	√	√	√ to monitor the total spending in months by each category, with the details such as percentage given in pie chart.

3.0 Methodology

In this section, the methodology used to develop the project will be discussed in detail. Inventory Management System Olahan Hasrat is an application developed for the manager in Olahan Hasrat Sdn. Bhd.. The methodology that has been chosen to develop this application is the prototyping model. The way this project is approached is through the Object-Oriented Development approach, which will first analyze the problems instead of creating a prototype in the specification process necessity. In prototyping model, the main phases are requirements gathering, quick design, build prototype, user evaluation, refining prototype and lastly implementing and maintenance. Firstly, requirements gathering is an activity and necessary to discuss with stakeholder to determine the problems faced and propose a solution to all of the problems found [8]. Several problems related to the existing system is identified. The difficulty in managing inventory in the warehouse of Olahan Hasrat is done manually. In addition, the method of searching, retrieval of information and analysis in the current system is complex and time consuming due to inefficient work development. In the quick design phase, the system design will be created according to the suitability of the system requirements that have been identified. With this, the hardware and software system requirements can be clearly defined. Object oriented approach is used in this phase. Next, by the system design feedback, the system was first developed in a small software called a unit and implemented into the next process by using Android Studio which is Java language. This process includes understanding the results of the analysis and the design through the creation of the software code. With the user's evaluation of the current system, there will be refining prototype which is to improve the system's design and also functionality. Last but not least, is the implementation and maintenance of the system to make sure it works perfectly from time to time.

3.1 System Analysis

Systems analysis is the method of analyzing systems for the detection of parameters and procedures. System analysis is a problem-solving methodology that improves the system and assures that all modules of the system operate properly to fulfil the needs of the customer. The requirement is collected by interviewing the manager of Olahan Hasrat Sdn. Bhd. Regarding current situation and improvement they needed to the system since the manager is going to be the user of the developed system. From the requirements collected, a Unified Modeling Language (UML) diagrams are used in documenting the system analysis in this review.

Figure 3 shows the use case diagram of the whole system. This system is provided for one user only. He is acted as Admin for the system. There are five main functions in this system as shown in Figure 3.
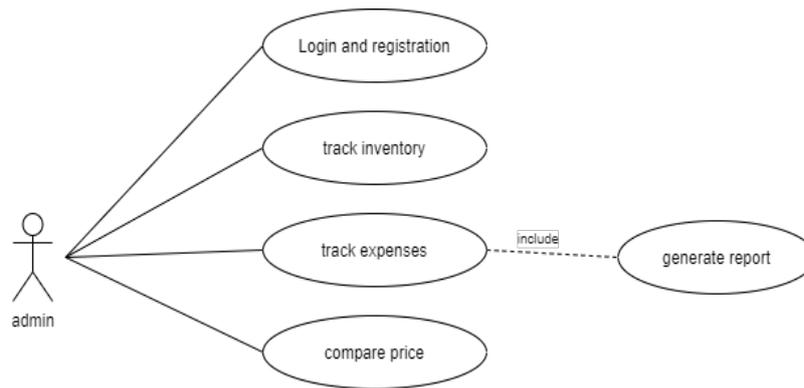
Figure 3: use case diagram of the Inventory management System

3.2   System Design

Figure 4 shows the class diagram for inventory tracking. In the inventory tracking, user can manage the inventory by viewing, add or delete item. They should scan the item's barcode to add the item into the inventory, inserting the item description such as product brand, date and many more. To delete item whether because of wrong input or the item is already used, user also need to scan the barcode by using the camera scanner provided in the app. There is also search engine to ease user to search for the item to reduce time consuming. In track expenses, user can input their expenses throughout any circumstance with varieties of categories such as for tools, transportation, PPE, shopping, rent and others. By the total of expenses, a report will be generated by showing a pie chart of total expenses with percentages by each category. In comparing prices, user can input the product name, and the system will search the products from online shopping platform such as Shopee, Lazada and Carousell then it will show the cheapest price for the product searched from each platform.
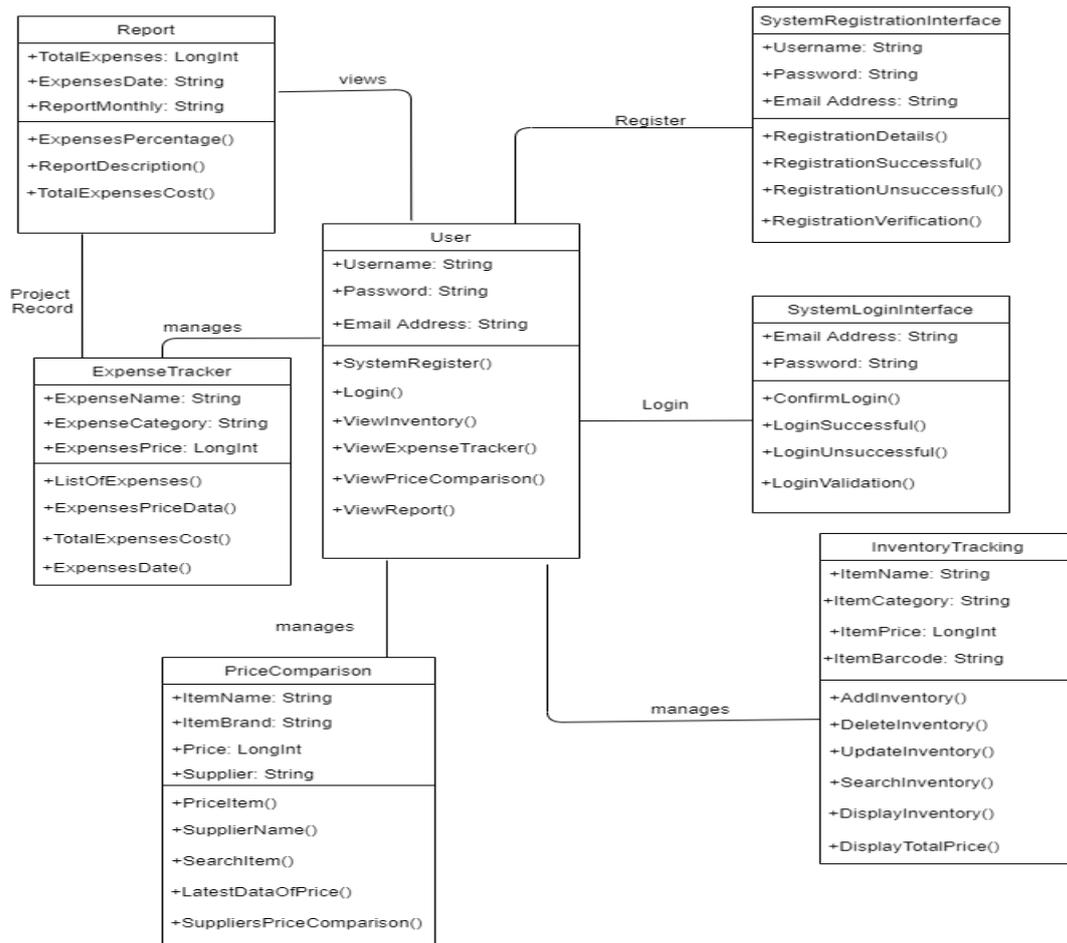
Figure 4: class diagram for inventory tracking

4. 0   Result and Discussion

In this section, it is about implementing the system design and developing it into the real system. Coding of Inventory Management System Olahan Hasrat is involved. In the design phase, several modules of the system will be designed and transformed into a program to be executed. The user interface is drawn using Draw.io application and developed using Android Studio by using Java language. Figure 5 shows the code segment of register module while figure 6 displays the registry interface. Users need to type their username, e-mail address and password if they do not have an account. If the user already has an account, the user must log in before accessing the main interface and all the information is saved in the database.

```java
public class Register extends AppCompatActivity {
    EditText mUsername, mEmail, mPassword;
    Button mRegisterbtn;
    TextView mLoginbtn;
    FirebaseAuth fAuth;
    ProgressBar progressBar;
    String userID;

    private static final String TAG = "TAG";
    private FirebaseFirestore fstore;

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_register);
```

Figure 5: Registration code segment
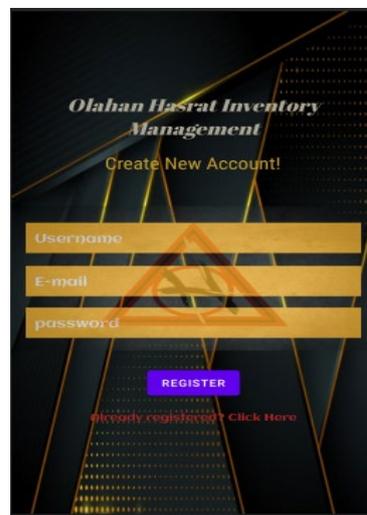
Figure 6: interface for registration

Figure 7 shows the segment code for login activity while figure 8 shows the interface for the login segment if the user already has an account.

```java
public class Login extends AppCompatActivity {
    EditText mEmail, mPassword;
    Button mLoginBtn;
    TextView mCreateBtn, forgotTextLink;
    ProgressBar progressBar2;
    FirebaseAuth fAuth;

    @Override
    protected void onCreate (Bundle savedInstanceState) {

        super.onCreate(savedInstanceState);
```

Figure 7: Login Segment Code

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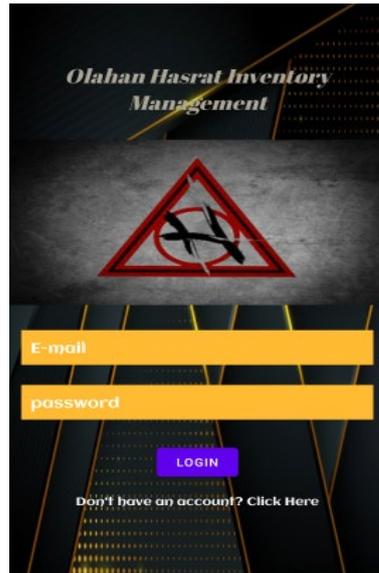
Figure 8: interface design for login

Figure 9 shows the segment code of inventory management while figure 10 shows the interface of the inventory management. There are 4 segments in this part which is to add, delete, view product and view the total list of inventories with price inside the inventory. User can reduce time just by scanning the barcode or Quick Response (QR) code to add, search and delete product.

```java
public class MainActivity extends AppCompatActivity {
    private FirebaseAuth fAuth;

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main);
        fAuth = FirebaseAuth.getInstance();

        FirebaseUser fuser = fAuth.getCurrentUser();
        if (fuser != null) {
            finish();
            startActivity(new Intent( packageContext: this, dashboardActivity.class));

        }
    }
}
```

Figure 9: Inventory Management Segment code
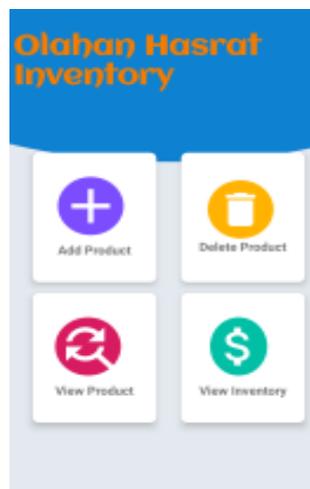
Figure 10: Inventory Management interface

Figure 11 shows the expense tracker source code while figure 12 shows the interface of the page.. This module is for user to calculate the expenses of every spending with categories so user can track and monitor the flow of the company's money. They can also put description in every detail that they want to put to make user clearer of what is the detail of any expenses.

```java
public class AddExpenseActivity extends AppCompatActivity implements View.OnClickListener{
    TextView expNameField,expAmountField;
    Spinner expCategoryField;
    Button addBtn, cancelBtn;
    int catValue = -1;
    DatabaseReference ref;
    DatabaseReference expensesRef;
    private FirebaseAuth mAuth;

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_add_expense);
        ref = FirebaseDatabase.getInstance().getReference();
        mAuth = FirebaseAuth.getInstance();
        getSupportActionBar().setTitle("");
```

Figure 11: Expense tracker source code

Figure 12: Interface for track expenses

Figure 13 shows the code segment of the price comparer while figure 14 shows the interface of a product price comparison activity. This module is for user to compare the price between suppliers for the same product.

```java
public class Search extends AppCompatActivity{
    static EditText editSearch;
    ImageButton voiceSearch;
    ImageButton barcodeSearch;
    static String shopeeUrl;
    static String LazadaUrl;

    private static final int RECOGNIZER_RESULT=1;
    static ArrayList<Recent>  recentSearch=new ArrayList<~>();
    static ArrayList<Recent>  databaseProducts=new ArrayList<~>();

    RecyclerView recyclerView;
    GridLayoutManager gridLayoutManager;
    RecentAdapter recentAdapter;

    private FirebaseAnalytics mFirebaseAnalytics;
```

**Figure 13: Price comparing source code**
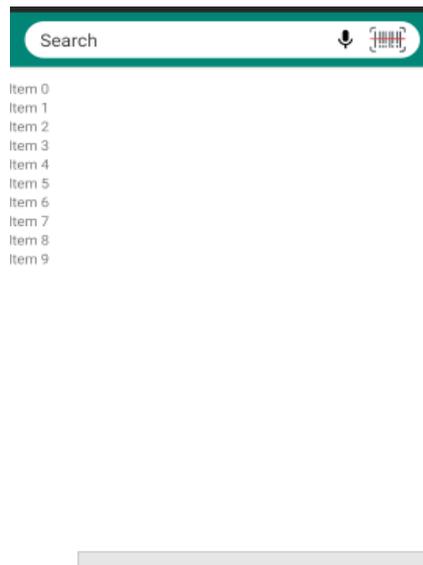
Figure 14: Interface for Price comparison

Test cases are used in this functional testing as a tool or way to test the system's functionality and whether they fulfil the expectations shown. Functional testing is a way to verify that the application has all necessary features, as defined in its functional specifications. This test case is created based on the modules and application utilization. This test is done after the software has been developed. The target users are briefly explained on how the program operates and how the interface interacts. The users' comments such as software interface issues, functionality problem, command structure and entry problems have been collected. The questionnaires have been released to 7 respondents which are the owner and employees of Olahan Hasrat. The questionnaire is separated into two parts A and B. Part A raises the question of the functionality of the system and Part B of the system's usability and design. Scale 1-4 is used as a poor-to-excellent scale in Part A, while merely yes or no is utilized in part B. Figure 14 and figure 15 shows the graphical data for both part of the user acceptance testing. The test questionnaire is shown in appendix A.
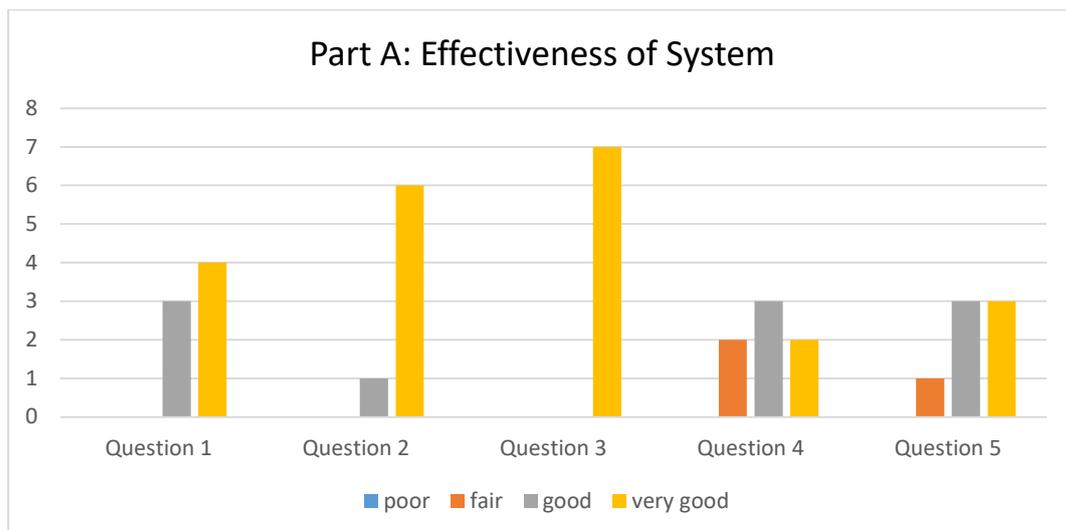
Figure 15: Part A
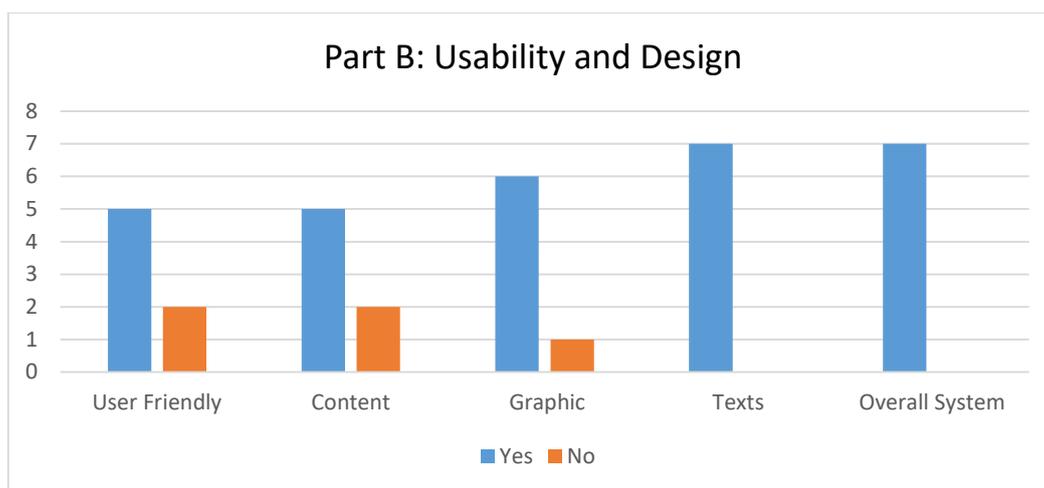
Figure 16: Part B

The questionnaire is separated into two parts A and B. Part A raises the question of the functionality of the system and Part B of the system's usability and design. Scale 1-4 is used as a poor to very good scale in Part A, while merely yes or no is utilized in part B. From the results, users are overall satisfied with the usability and design of the application while the effectiveness of the systems can be improved more in the future.

5. Conclusion

Olahan Hasrat Inventory Management System is an application developed in a mobile version. This application can help users manage their time better and help managers track the flow of their inventory. In general, the outcomes for the system should achieve the genuine goals for Olahan Hasrat with the time given for the development of the system. The system works effectively and may assist the user track the inventory and save time on it. Overall, with the time given to develop a system, results taken for the system manages to fulfil the real objectives for Olahan Hasrat. The system is well functioning and can help the user to track their inventory and save time through this system. The future tracking procedure is supposed to be more effective, more secure and better during inventory and expenses tracking, which is used before using Microsoft Excel.

A lot of challenges have been faced during the application development process. The application is being developed in native ways at the beginning of this project. However, due to a lack of expertise in Java programming, this project is slowly developed and many sources needed to learn independently from available sources. In the future, the Olahan Hasrat Inventory Management System can be enhanced or upgraded to a better application with more full features. Users will then use it to enhance their inventory management. In conclusion, the Inventory Management System Olahan Hasrat has achieved the objectives outlined at the beginning of its development planning. Even though the system has accomplished all its goals, this system also needed more refinement, so that it could really help the inventory management manager to save time and money.

Acknowledgement

Appendix A

OLAHAN HASRAT INVENTORY MANAGER SYSTEM TESTING FORM

**Notes: This System Testing Form is provided for feedback system users to find out the extent to which the capabilities of the system are developed. This form has 2 parts, namely Part A and Part B. Please answer all questions.

Please tick (/) the appropriate evaluation box.

PART A:

1	Poor
2	Fair
3	Good
4	Very good

No.	Description	1	2	3	4
1.	The system meets the needs of company managers				
2.	The system helps in tracking inventory				
3.	The calculations in this system are correct				
4.	The system can provide useful information to users				
5.	The system can track company's direct and indirect cost spending.				

PART B:

Please tick (/) the yes or no answer.

No.	Question	Valuation	
	SYSTEM CONTENT	**YES**	**NO**
1.	Interesting content delivery		
2.	The instructions are easy to understand		
3.	The system assists in recording and monitoring information to user.		
	USER FRIENDLY		
1.	The system is easy to use		
	TEXT		
1.	The text used is clear and easy to read		
2.	The text used is appropriate.		
3.	The words used are easy to understand.		
	GRAPHICS		
1.	Appropriate background.		
2.	The color used is appropriate		
3.	Attractive interface design.		
	OVERALL SYSTEM EVALUATION		
1.	This system is easy to use		
2.	this system has no errors		
3.	The information from the database is as match as displayed into the system.		

Comments/suggestions:

Signature:

Date:

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