RETISUSUN : RETAIL POINT-OF-SALE AND INVENTORY SYSTEM

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DECLARATION

I hereby declare that the material in this thesis is my own except for quotations, equations, summaries and references, which have been duly acknowledged.

25 JUNE 2025

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ABSTRACT

An integrated point-of-sale (POS) and inventory management system, ReTiSusun was created to solve the frequent yet crucial problems that small and micro retail enterprises encounter, especially those brought on by human error, poor restocking choices, and a lack of easily accessible sales data. Frequent stockouts, overstocking, and lost profit opportunities are the results of traditional systems, particularly in Malaysia, which frequently rely on antiquated or non-integrated platforms that need manual inventory changes and offer minimal analytical help. These inefficiencies highlight the need for a system that is specifically designed for small-scale operations and is lightweight, clever, and easy to use.

The actual repercussions of inventory mismanagement, such as lost revenues from understocking or wasted money invested in overstocked items, serve as the project's driving force. When deciding whether to replenish, many small business owners still rely on their own discretion or static spreadsheets, which can result in expensive errors. Furthermore, their capacity to make data-driven judgments is restricted by their inability to access past sales and restocking data. In order to minimize human mistake, decrease manual workload, and offer precise, useful insights into inventory control and sales activities, ReTiSusun was developed.

The project's goals are to create a system that enables business owners to effectively manage their inventory, automate sales transactions, produce insightful business reports, and make informed recommendations about how much to refill based on past trends. Additionally, ReTiSusun wants to offer barcode scanning, receipt printing, and user access management while keeping a short learning curve appropriate for non-technical users.

The Waterfall Software Development Life Cycle (SDLC) model is used in this project because it provides a methodical and systematic approach that is perfect for projects with well-defined requirements. The.NET framework, C#, WinForms for the desktop point-of-sale interface, and SQL Server for the backend database are used in the development of the system. A Restocking Suggestion Engine, Purchase Orders, Inventory, Sales Transactions, Restocking, and User Management are among the modules. Because each module is modular and maintainable, it can be scaled or enhanced in the future as needed.

A fully functional desktop-based point-of-sale and inventory system that greatly enhances small business users' everyday operations is the anticipated result. It will assist data-informed decision-making, automate repetitive processes like restocking, give real-time visibility into inventory levels, and lessen human error in stock management. Furthermore, by providing contemporary features like stock synchronization, role-based access, and restock prediction, the system is anticipated to surpass conventional non-integrated solutions like IRS POS, which is widely utilized in Malaysia, while still being usable by companies with little infrastructure or technical know-how.

In the end, ReTiSusun helps small businesses succeed in a cutthroat retail climate by bridging the gap between smart inventory management and simplicity.

ABSTRAK

RetiSusun : Inventori Runcit dan Tempat Jualan

Sistem pengurusan pusat jualan (POS) dan inventori bersepadu, ReTiSusun dicipta untuk menyelesaikan masalah yang kerap tetapi penting yang dihadapi oleh perusahaan runcit kecil dan mikro, terutamanya yang disebabkan oleh kesilapan manusia, pilihan penyimpanan semula yang lemah dan kekurangan data jualan yang mudah diakses. Kehabisan stok yang kerap, lebihan stok dan peluang keuntungan yang hilang adalah hasil daripada sistem tradisional, khususnya di Malaysia, yang kerap bergantung pada platform kuno atau tidak bersepadu yang memerlukan perubahan inventori manual dan menawarkan bantuan analisis yang minimum. Ketidakcekapan ini menyerlahkan keperluan untuk sistem yang direka khusus untuk operasi berskala kecil dan ringan, bijak dan mudah digunakan.

Kesan sebenar salah urus inventori, seperti kehilangan hasil daripada kurang stok atau wang terbuang yang dilaburkan dalam item yang terlebih stok, berfungsi sebagai penggerak projek. Apabila memutuskan sama ada untuk mengisi semula, ramai pemilik perniagaan kecil masih bergantung pada budi bicara mereka sendiri atau hamparan statik, yang boleh mengakibatkan ralat yang mahal. Tambahan pula, kapasiti mereka untuk membuat pertimbangan berasaskan data dihadkan oleh ketidakupayaan mereka untuk mengakses data jualan dan penyimpanan semula yang lalu. Untuk meminimumkan kesilapan manusia, mengurangkan beban kerja manual, dan menawarkan cerapan berguna yang tepat tentang kawalan inventori dan aktiviti jualan, ReTiSusun telah dibangunkan.

Matlamat projek adalah untuk mencipta sistem yang membolehkan pemilik perniagaan mengurus inventori mereka dengan berkesan, mengautomasikan urus niaga jualan, menghasilkan laporan perniagaan yang berwawasan dan membuat pengesyoran termaklum tentang jumlah yang perlu diisi semula berdasarkan arah aliran masa lalu. Selain itu, ReTiSusun ingin menawarkan pengimbasan kod bar, pencetakan resit dan pengurusan akses pengguna sambil mengekalkan keluk pembelajaran pendek yang sesuai untuk pengguna bukan teknikal.

Model Waterfall Software Development Life Cycle (SDLC) digunakan dalam projek ini kerana ia menyediakan pendekatan berkaedah dan sistematik yang sesuai untuk projek dengan keperluan yang jelas. Rangka kerja.NET, C#, WinForms untuk antara muka tempat jualan desktop dan SQL Server untuk pangkalan data bahagian belakang digunakan dalam pembangunan sistem. Enjin Cadangan Penyimpanan Semula, Pesanan Belian, Inventori, Transaksi Jualan, Penyimpanan Semula dan Pengurusan Pengguna adalah antara modul. Oleh kerana setiap modul adalah modular dan boleh diselenggara, ia boleh ditingkatkan atau dipertingkatkan pada masa hadapan mengikut keperluan.

Sistem tempat jualan dan inventori berasaskan desktop berfungsi sepenuhnya yang meningkatkan operasi harian pengguna perniagaan kecil adalah hasil yang dijangkakan. Ia akan membantu membuat keputusan berdasarkan data, mengautomasikan proses berulang seperti penyimpanan semula, memberikan keterlihatan masa nyata ke dalam tahap inventori dan mengurangkan kesilapan manusia dalam pengurusan stok. Tambahan pula, dengan menyediakan ciri kontemporari seperti penyegerakan saham, akses berasaskan peranan dan

ramalan stok semula, sistem itu dijangka mengatasi penyelesaian tidak bersepadu konvensional seperti IRS POS, yang digunakan secara meluas di Malaysia, sementara masih boleh digunakan oleh syarikat yang mempunyai sedikit infrastruktur atau pengetahuan teknikal.

Akhirnya, ReTiSusun membantu perniagaan kecil berjaya dalam iklim runcit yang kejam dengan merapatkan jurang antara pengurusan inventori pintar dan kesederhanaan.

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CHAPTER 1
INTRODUCTION

1.1 Introduction

Keeping the right number of items on the shelves in an inventory-critical business is essential. The massive amount of unsold items means hoarding up cash, or otherwise, losing sales that is profitable until the next restock arrives.This is especially critical for smaller businesses, where most of them are either hoarding too much items, or don't have enough in their inventory. Small businesses struggle to find the balance between sales output and inventory needs. This properly explains the nature of inventory system where the goal is to manage number of items, restocking, alerts, and especially recognizing patterns in sales that can lead to better restocking numbers.

Inventory and Point-of-Sale system should go in a rhythm. The main concept is that every single item that is bought, must be updated in the inventory to avoid data inaccuracy. The system must also process payments efficiently, manage sales and keep track of inventory and customer data. Modern systems provide better insights into their sales trend, customer habit, which allows smaller businesses to make informed decisions in their tasks such as restocking.

Integration between the two systems is crucial, which means that customer data and sales trend definitely contributes to the inventory system's tasks such as stock counting, restock amounts, restock trends, alerts and other important tasks. This kind of operation is more preferable by bigger corporations, where even a small percentage of loss can contribute to so many disadvantages, in which most of the time for smaller businesses, can kill their business.

1.2 Problem Background

Humans are prone to make errors when doing repetitive tasks, which is what inventory management is. Although this may sound like a minor problem considering the technologies that we have achieved in these days, human error accounts for 70% of data loss, hardware failure and data corruption in small businesses. This is a shockingly high number that so many small business owners miss, a number which can surely determine the future of their business. Not to mention the reliance of 'own experiences' rather than using meaningful data to make decisions in business operations, which only 33% of shop owners avoid by using a systemic inventory management and point-of-sales systems.

Expiring stocks are very critical for businesses. These stocks can either be sold for profit, or dumped in the garbage because it's expired. The latter means a big loss for the company, which means putting the business in serious risk if it keeps happening. Without a system that constantly reminds the business of it's expiry date, businesses risk losing profit and taking a lot of loss. The fact that 67% businesses uses unsystematic or mixed system for their inventory worsens the stock mishap situation in smaller businesses.

Smaller businesses do not have access to business critical data such as local area demand, making them vulnerable to making restock decisions that might lead to a lot of stock mishap. Without these data, they can't make an informed decision on every restock. This further worsen their situation when they could've only bought things that the people of local area really buys. Furthermore, it increases the risk of data inaccuracy in restocking too.

1.3 Project Statements

The three primary challenges with unsystematic and mixed inventory and point-of-sale (PoS) systems are human errors, poor visibility to expiring items, and the inaccuracy during restocking. For small shop owners, these issues relate to significant operational inefficiencies.

Human errors in inventory systems cause huge problems to businesses such as data loss, hardware failure and data corruption. Such mistakes can result in inaccurate stock counts, leading to lost sales or overstocking, which can strain the business. The users need a system that minimizes manual data entry that minimizes human effort to lessen human errors.

To add more, businesses risk losing profits if their restock is inaccurate and uninformed. If more items, or less items, are restocked than it has to be, they miss on more profits. These businesses need a feature that helps them to accurately estimate their restock rather than relying on their personal experience.

Lastly, expiring items may not be as visible to business owners. These items will waste their resources in the end, putting their business in a tight financial position.

1.4 Project Objectives

RetiSusun aims to overcome the challenges of small retail or convenience business owners by directly addressing the challenges that were discovered. To overcome those challenges, these objectives are crucial and has been chosen :

- To gather requirements that are essential to the project such as business tasks, business data requirements, business technical accessibility, efficiency, cost structure, business limitations and existing solutions.
- To develop an integrated inventory and Point-of-Sale (PoS) system that allows users to choose their own services using React Native and .NET MAUI.
- To evaluate the accessibility, usability, and overall impact of the project on businesses through user testing and feedback analysis.

1.5 Project Scope

In the context of RetiSusun project, the project scope covers 3 types of users : customer, user (business owner) and supplier. The modules of RetiSusun are as such :

Module	User	Description	CRUD
User Management	Business	User can manage their business information on their profile.	CRUD
	Supplier	User can manage their business information on their profile.	

Inventory	Business	Allow user to view all the items in their inventory, and manipulate business-critical information such as price.	CRUD
	Supplier	Allow user to manipulate the list on their listing in the catalog.	
Purchase Order	Business	Allow user to buy restock items from the catalog of suppliers.	CRUD
	Supplier	Allow user to receive and update purchase orders by businesses.	
Restocking	Business	Allow user to update their inventory whenever the restock arrives.	CRUD
Sales Transaction	Business	Allow user to execute sale transaction of items.	CRUD
	Customer	Allow user to buy items from the business store or catalog.	
Reporting	Business	Allow business to store and retrieve their transaction data.	CRUD
	Customer	Allow user to receive transactional receipts.	
Restocking Suggestion	Business	Allow business to estimate the number of restock needed for each item.	CRUD
Settings and Report	Business	Allow business to customize their application environment.	CRUD
	Supplier	Allow user to customize their application environment.	

Table 1.0 : RetiSusun Project Scope

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

2.2 Introduction to RetiSusun

RetiSusun offers integration between its Point-of-Sale (POS) and inventory system that streamlines business management to reduce data inaccuracy, poor visibility to expiring products and amount inaccuracy during restocking. Other than basic restocking, RetiSusun aims to offer restock estimation and access to past sales data to provide meaningful numbers that can be used to increase data accuracy and business efficiency.

2.2.1 Impact of Retisusun on Data Inaccuracy

RetiSusun includes robust Point-of-Sale and inventory features that minimize manual labour on business tasks such as stock counts, mis-scans and check-out errors. RetiSusun will include features such as barcode scanning, inventory synchronization and batch import validation. These features are crucial in minimizing human effort thus translates to better data accuracy during business tasks.

2.2.2 Impact of RetiSusun on Poor Visibility to Expiring Products

RetiSusun includes alerts features to remind the business owner to their expiring products. Expiring products translates to bad restocking estimation, which in the end will waste their precious resources, time and storage space. This alert will remind the owner of their expiring product, and will also be included in the restock estimation calculation later on during their next restocking. This can directly minimize the business owner from wasting resources from restocking items that won’t sell much, and instead suggest them items to focus on their business that actually sell.

2.2.3 Impact on Amount Inaccuracy During Restocking

RetiSusun includes intelligent restocking in its list of features. This allows business owners to better understand and decide the amount of items they should restock on their shelves using past sales data. This accuracy also helps them to reduce manual data handling, which translates a lot to data inaccuracy. In the end, it will help business owners directly to restock sustainably and provide a better guide than their own experience.

2.4 reviewing existing apps

2.4.1 Xilnex POS

a. Features and Functions

Xilnex has comprehensive features, providing a wide range of features including inventory management, sales tracking, customer relationship management and marketing tools. This makes Xilnex a great choice for shops that offer benefits to regular customers and keep track of customer behaviours.

Xilnex also offers a scalable business model to its users. Its software allows customization to fit the needs of businesses of all sizes. This makes Xilnex a good software for growing businesses that plans for growth, without paying a costly investment.

Xilnex also offers robust reporting that offers detailed reports to help businesses analyse their performance. This is a must for all inventory and point-of-sale system, in which they executed effectively.

Finally, Xilnex offers integration capabilities, allowing it to integrate with various hardware and software solutions. This is a very good quality to have, especially when analytics is involved. This feature makes Xilnex an attractive solution to medium and large corporations due to their trade volume.

b. User Interface and User Experience of Xilnex

Synchronization is completed.
Redirecting to dashboard...

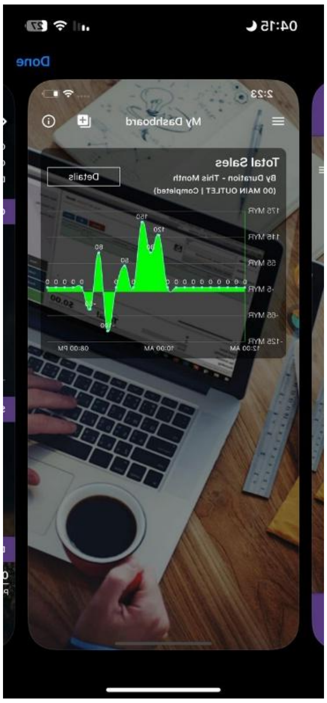
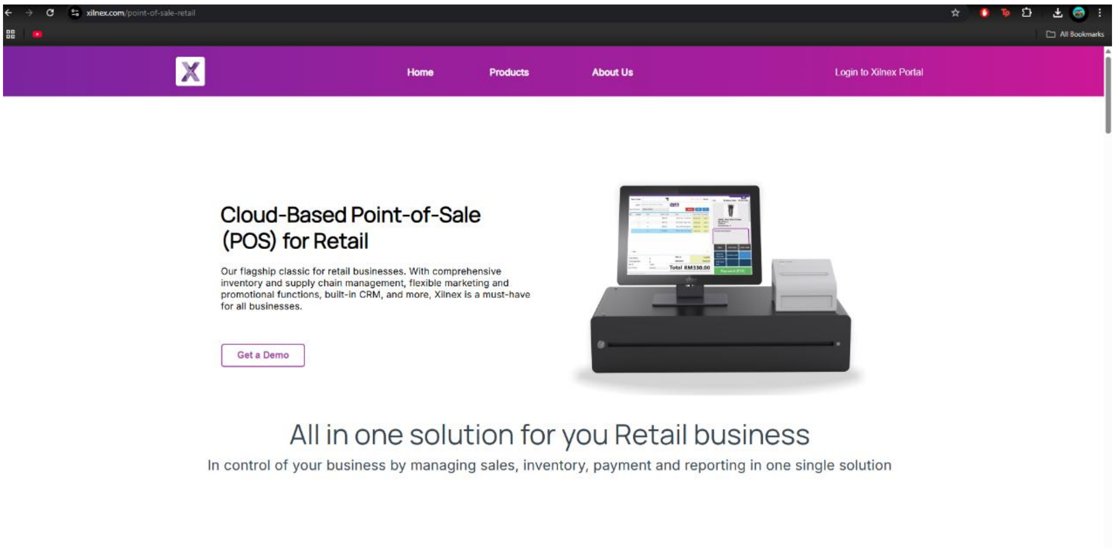


Figure 1.0 : Xilnex Mobile App

Figure 1.1 : Xilnex Mobile App Feature



Cloud-Based Point-of-Sale (POS) for Retail

Our flagship classic for retail businesses. With comprehensive inventory and supply chain management, flexible marketing and promotional functions, built-in CRM, and more, Xilnex is a must-have for all businesses.

All in one solution for you Retail business

In control of your business by managing sales, inventory, payment and reporting in one single solution

Figure 1.2 : Xilnex Products

2.4.2 Slurp! POS

a. Features and Functions

Slurp! Offers user-friendly interface for business owners, allowing them to easily use and navigate around the software environment, even for staffs with limited technical skills. This reduces the resources needed to be spent on staff training and the time needed to set up the business environment.

Its real-time inventory management system allows businesses to track inventory levels and prevent stockouts using stock level thresholds warning and multi-outlet support. This supports businesses to manage their inventory well.

Slurp! Has mobile ordering features allowing customers to order and pay directly to the business through their mobile devices. This reduces dependency on third-party softwares to do the ordering, or makes the process more efficient when integration is needed.

Lastly, its integration with delivery is seamless due to its Getorders platform, allowing its businesses to manage online orders. The operation uses real-time synchronization to ensure order updates and menu changes are synced in real-time, ensuring consistency and accuracy of customer orders.

b. User Interface and User Experience of Slurp! POS

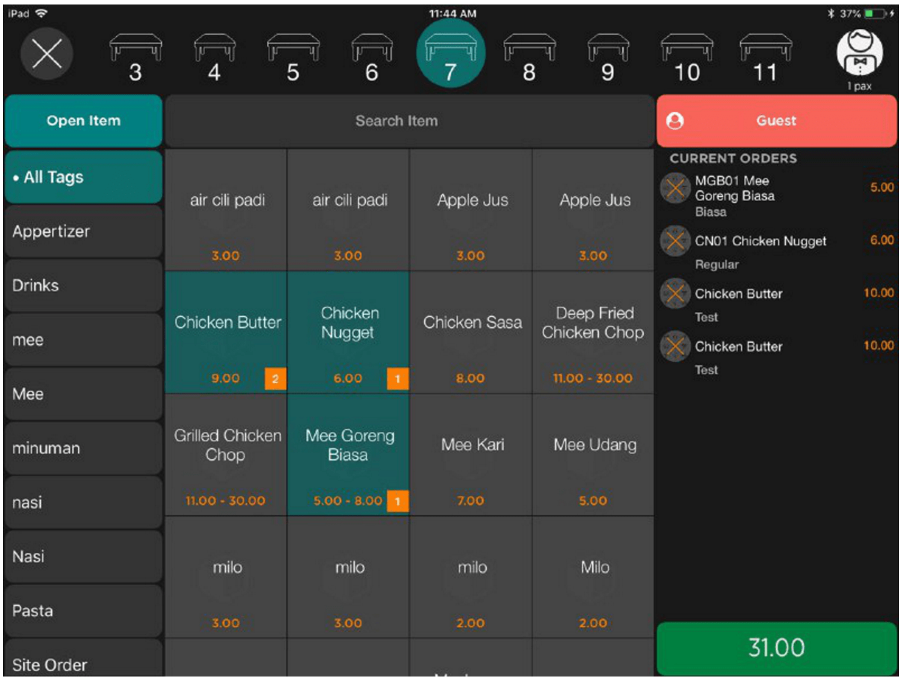
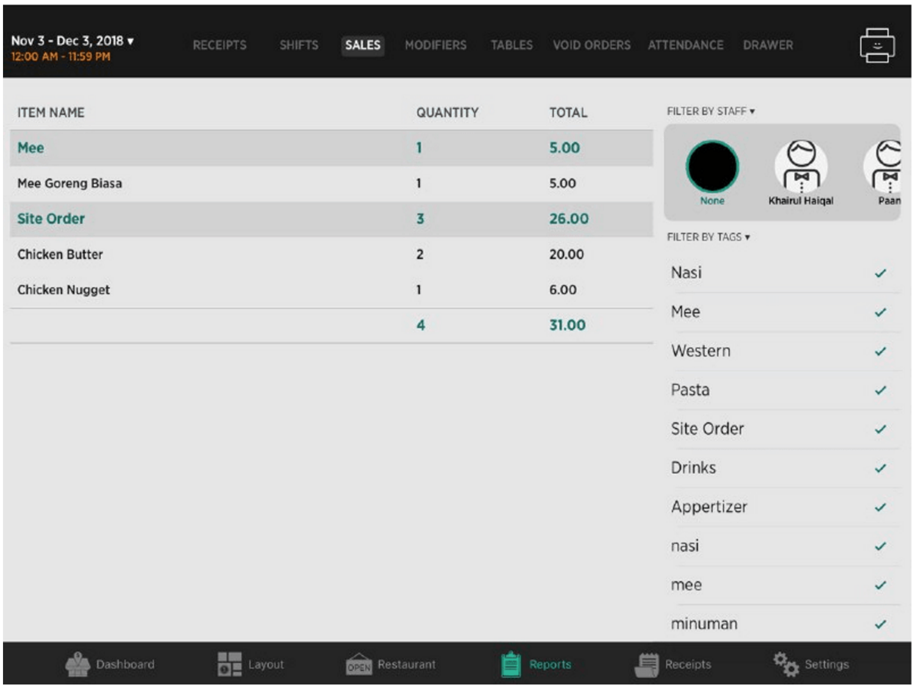


Figure 2.0 : Slurp! POS UI



Nov 3 - Dec 3, 2018 ▾
12:00 AM - 11:59 PM

ITEM NAME	QUANTITY	TOTAL
Mee	1	5.00
Mee Goreng Biasa	1	5.00
Site Order	3	26.00
Chicken Butter	2	20.00
Chicken Nugget	1	6.00
	4	31.00

FILTER BY STAFF ▾

None Khairul Haiqal Paan

FILTER BY TAGS ▾

Nasi	✓
Mee	✓
Western	✓
Pasta	✓
Site Order	✓
Drinks	✓
Appertizer	✓
nasi	✓
mee	✓
minuman	✓

Figure 2.1 : Slurp! POS Sales & Inventory Tracking

2.4.3 BIG POS

a. Features and Functions

BIG POS also offers user-friendly interface, making the platform easy to use. This reduces the resources needed to train staff and does not require the staff to have good technical skills. In the consideration of implementing of such system, it is a good thing to have as it will save cost in the long run.

BIG POS's pricing isn't as stated in its name, in fact it is relatively cheap compared to other existing solutions. BIG POS offers competitive pricing plans for businesses of different sizes. This allows business of any scale to subscribe, and use the features that they only need without paying excessively for features they may not need.

One of BIG POS's best features is its integrations with various hardware and software solutions such as delivery services and online ordering. This is always a good feature as it increases revenue for the business.

b. User Interface and User Experience of BIG POS

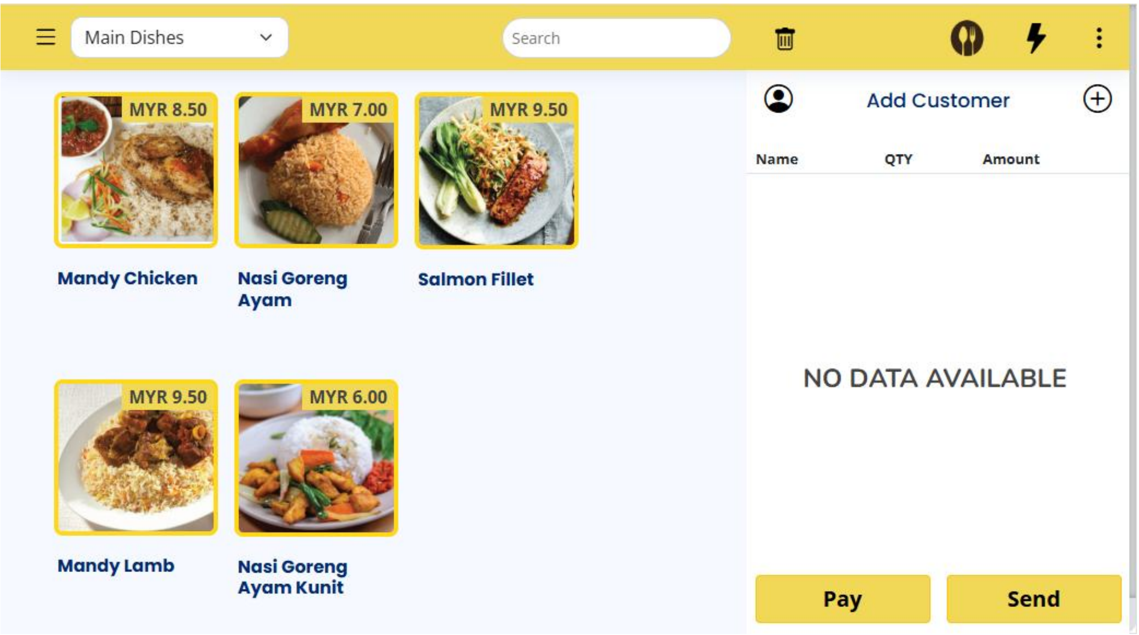
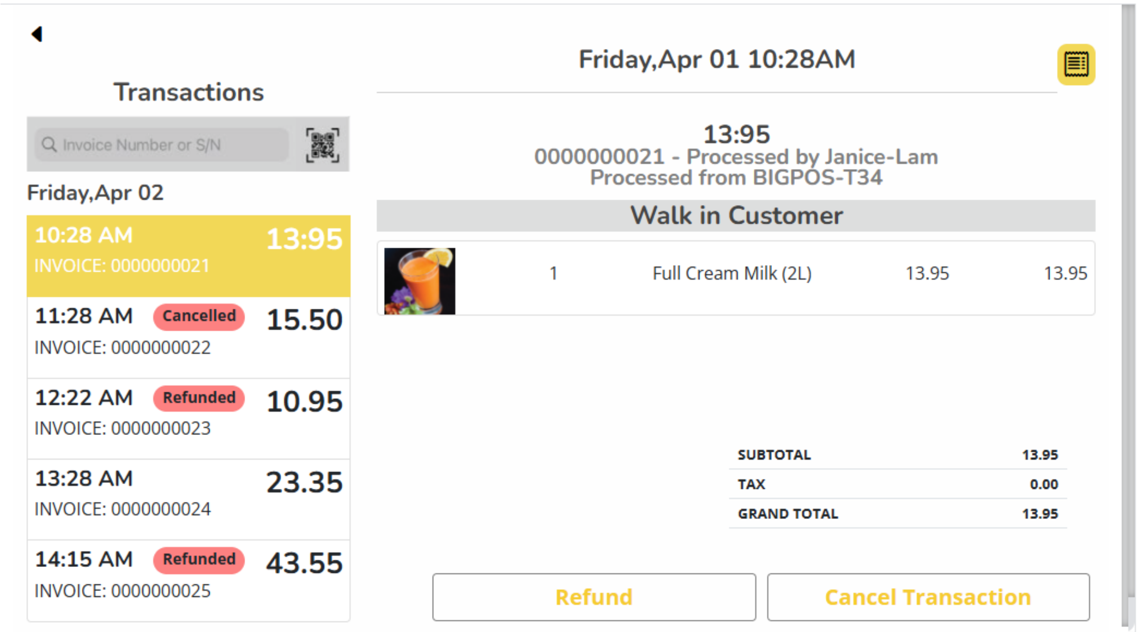


Figure 3.0 : BIG POS UI



Friday,Apr 02

10:28 AM INVOICE: 0000000021	13:95
11:28 AM Cancelled INVOICE: 0000000022	15.50
12:22 AM Refunded INVOICE: 0000000023	10.95
13:28 AM INVOICE: 0000000024	23.35
14:15 AM Refunded INVOICE: 0000000025	43.55

Friday,Apr 01 10:28AM

13:95
0000000021 - Processed by Janice-Lam
Processed from BIGPOS-T34

Walk in Customer

1	Full Cream Milk (2L)	13.95	13.95

SUBTOTAL	13.95
TAX	0.00
GRAND TOTAL	13.95

Figure 3.1 : BIG POS Transaction UI

2.4.4 Smart-ACC POS

a. Features and Functions

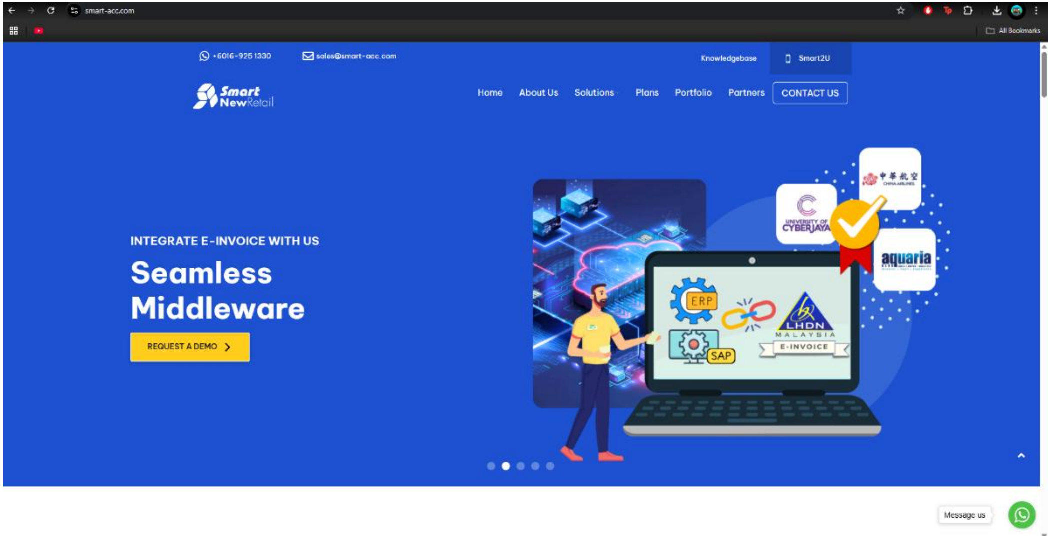
This software solution offers comprehensive features, providing a wide range of features that helps businesses manage their operations. The operations include basic operations such as sales, inventory, stock management and others.

In accordance to other similar systems that offer scalability opportunities, Smart-ACC offers customization that fits the needs of businesses of any size, allowing business growth while using the same system setup.

Integration capabilities are also included such as mobile ordering, online ordering and deliveries. This helps businesses to simplify and streamline their operations to increase business efficiency, thus increasing revenue.

This system also offers robust reporting for its sales and inventory, providing detailed reports to help businesses analyse their business performance in all scopes that they need. This also allow business owners to plan their growth and operations.

b. User Interface and User Experience of Smart-ACC POS

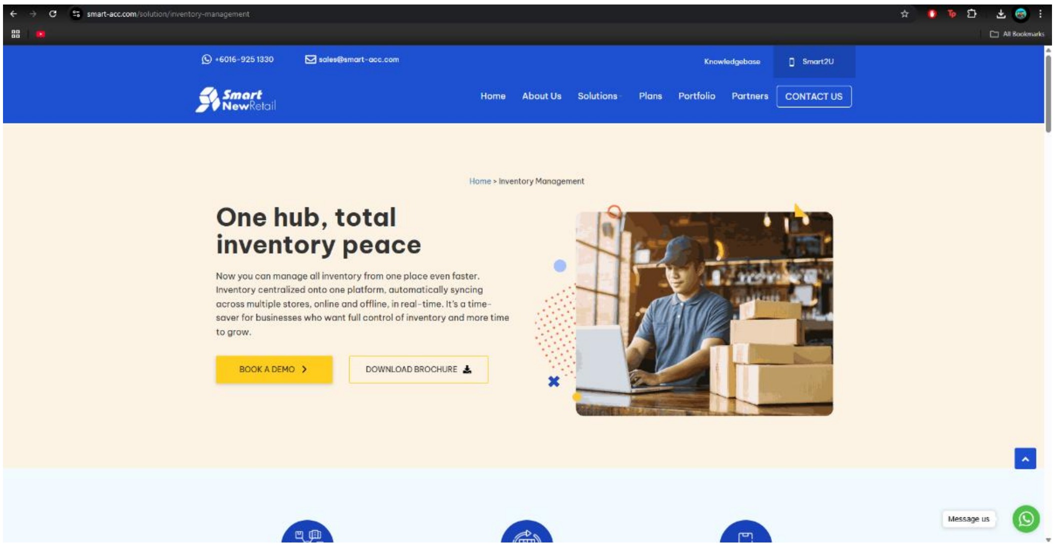


INTEGRATE E-INVOICE WITH US

Seamless Middleware

REQUEST A DEMO

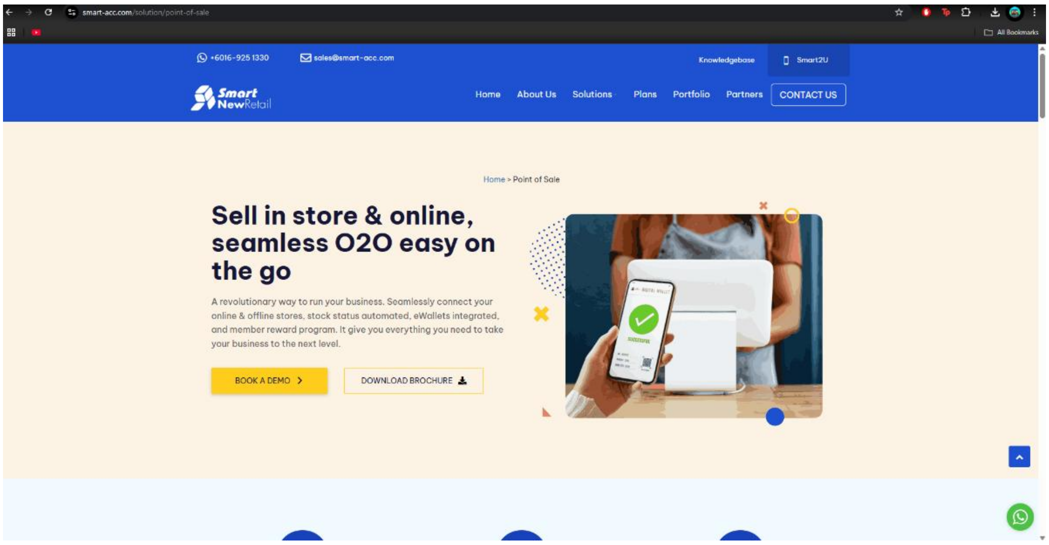
Figure 4.0 : Smart-ACC Homepage



One hub, total inventory peace

Now you can manage all inventory from one place even faster. Inventory centralized onto one platform, automatically syncing across multiple stores, online and offline, in real-time. It's a time-saver for businesses who want full control of inventory and more time to grow.

Figure 4.1 : Smart-ACC Inventory System



Sell in store & online, seamless O2O easy on the go

A revolutionary way to run your business. Seamlessly connect your online & offline stores, stock status automated, eWallets integrated, and member reward program. It give you everything you need to take your business to the next level.

Figure 4.2 : Smart-ACC POS System

2.4.5 StoreHub

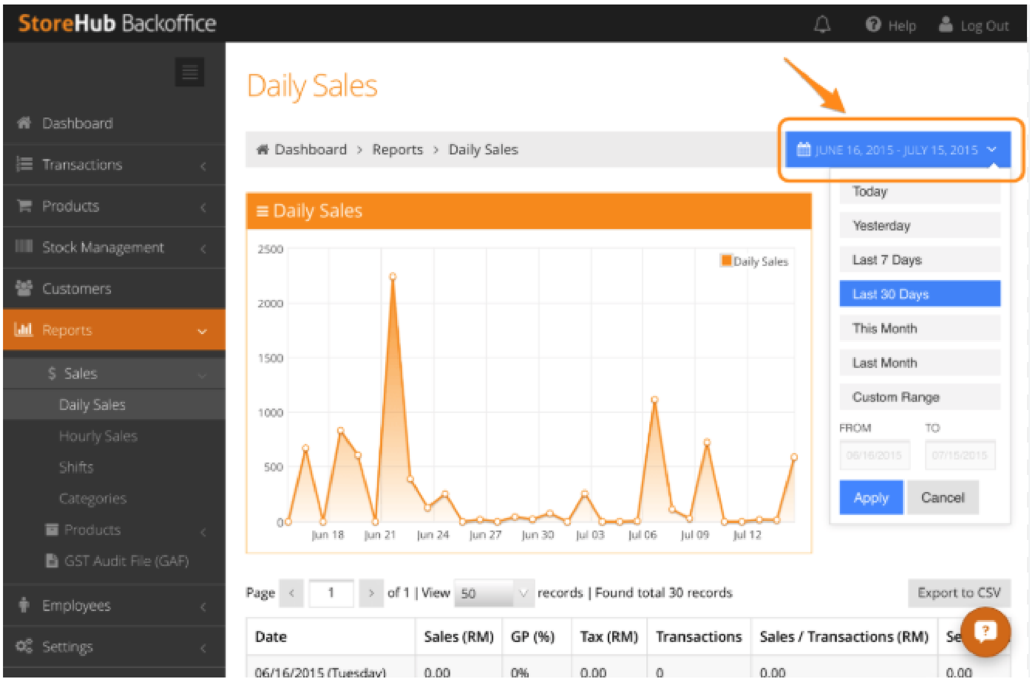
a. Features and Functions

This software offers a cloud-based system so that users can access their business data at any time. This allows users to access the data although they are not physically at the business location, and execute business tasks remotely.

Comprehensive features are also available such as inventory management, sales tracking, employee management and customer loyalty program. This allow business owners to better manage their business and customer interests due to the features being closely developed to each other, providing meaningful data for business planning.

Integrations with other essential services such as payment gateways, delivery services and online ordering are offered to ensure a better pool of customers. This will increase the revenue of the business owners, while maintaining a good customer experience.

b. User Interface and User Experience of StoreHub



Daily Sales

Dashboard › Reports › Daily Sales

JUNE 16, 2015 - JULY 15, 2015

FROM 06/16/2015 TO 07/15/2015

Page 1 of 1 | View 50 records | Found total 30 records

Date	Sales (RM)	GP (%)	Tax (RM)	Transactions	Sales / Transactions (RM)	Se
06/16/2015 (Tuesday)	0.00	0%	0.00	0	0.00	0.00

Figure 5.0 : StoreHub Reports

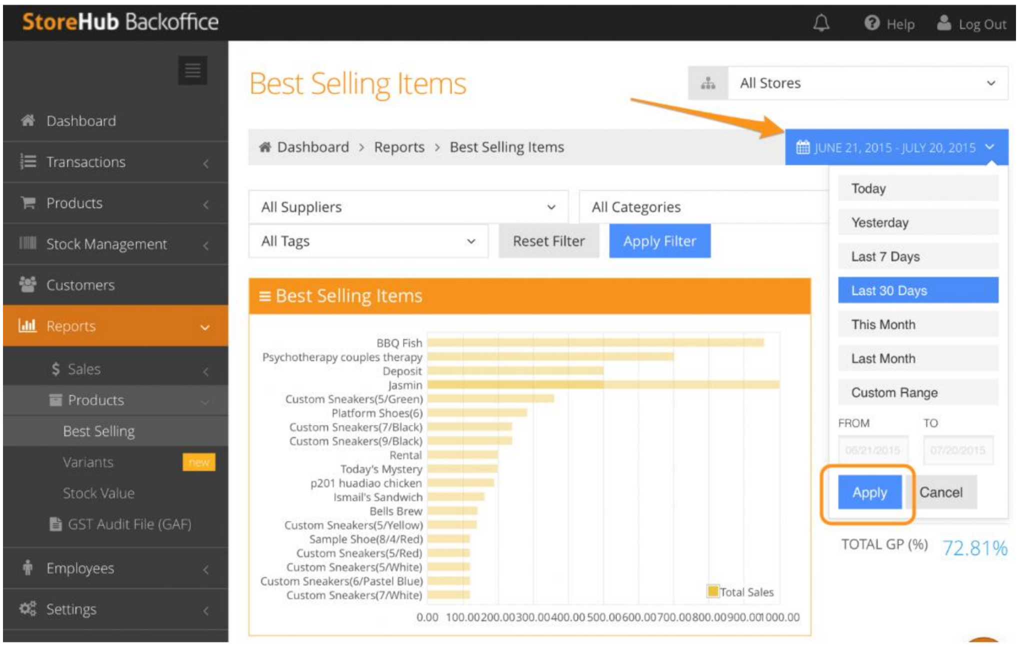


Figure 5.1 : StoreHub Item Performance

2.4.6 Comparison between Existing Apps

Features	Xilnex POS	Slurp! POS	BIG POS	Smart-ACC POS	StoreHub	RetiSusun
Comprehensive Features	✓			✓	✓	✓
Robust Reporting	✓		✓	✓	✓	✓
Cost-Effective		✓	✓			✓
Minimal Training		✓	✓			✓
Restock Estimation						✓
Loyalty Program	✓				✓	✓

Table 2.0 : Competitor Review Grid

2.5 Summary

Many Point-of-Sale system such as Xilnex, Slurp!, BIG POS, Smart-ACC and StoreHub have been developed and has helped retail businesses with their inventory and sales management. These systems offer a wide range of features that includes sales tracking, loyalty programs, robust reporting and even integration with other platforms to extend their features further. However, many of these systems were developed for larger corporations, which the features may be too overwhelming or practically useless for smaller businesses such as convenience store or small retailers. RetiSusun, on the other hand, is tailored specifically for smaller businesses that appreciates simplicity, affordability, maintainability and usability. RetiSusun has been planned to target pain points of smaller businesses such as stock miscounts, checkout errors and inaccurate restocking. RetiSusun also offers a feature that many of these systems don’t have, which is restock estimation features which will help them a lot considering they do not have enough resources or capital to have such data on their hand. This feature gives RetiSusun a good advantage against the other advanced solutions which gives businesses opportunity to make informed decisions in their business tasks. This combination of functionality will be a more suitable and aforable solution for small-scale enterprises compared to larger platforms.

CHAPTER 3

METHODOLOGY

3.1 Introduction

3.2 Development Methodology

Adopting the Waterfall model for the ReTiSusun project would be a suitable approach, especially considering the need for a structured and sequential development process. Waterfall is a linear development methodology that emphasizes completing one phase before moving on to the next, making it easier to plan, schedule, and document the entire development cycle. Each phase—Requirements, Design, Implementation, Testing, Deployment, and Maintenance—is clearly defined, allowing the team to have a strong sense of direction throughout the project timeline.

Waterfall encourages thorough documentation and planning, which is important in ReTiSusun due to the complexities expected in its system architecture and flowchart. Since ReTiSusun integrates various components such as MySQL Database, coding practices typically used by students, API usage, and the .NET framework, having a detailed design before implementation helps minimize confusion during development.

ReTiSusun's nature as an inventory management system also benefits from the Waterfall model’s clarity. Since the core features and functionalities are already outlined early on, ReTiSusun can establish a strong foundation before any coding starts. This is especially useful given the comparison with existing proprietary software like Xilnex and BIG POS, where changes mid-development are often restricted. With Waterfall, once requirements are gathered and signed off, the team can proceed without worrying about continuous changes, maintaining stability and consistency.

While the Waterfall model does not emphasize frequent stakeholder involvement like Agile, it ensures that all expectations are clearly captured at the beginning of the project, which is beneficial when dealing with stakeholders who may not be available for continuous feedback. This makes Waterfall a practical model for ReTiSusun’s development lifecycle, where structured phases can ensure quality output and timely delivery.

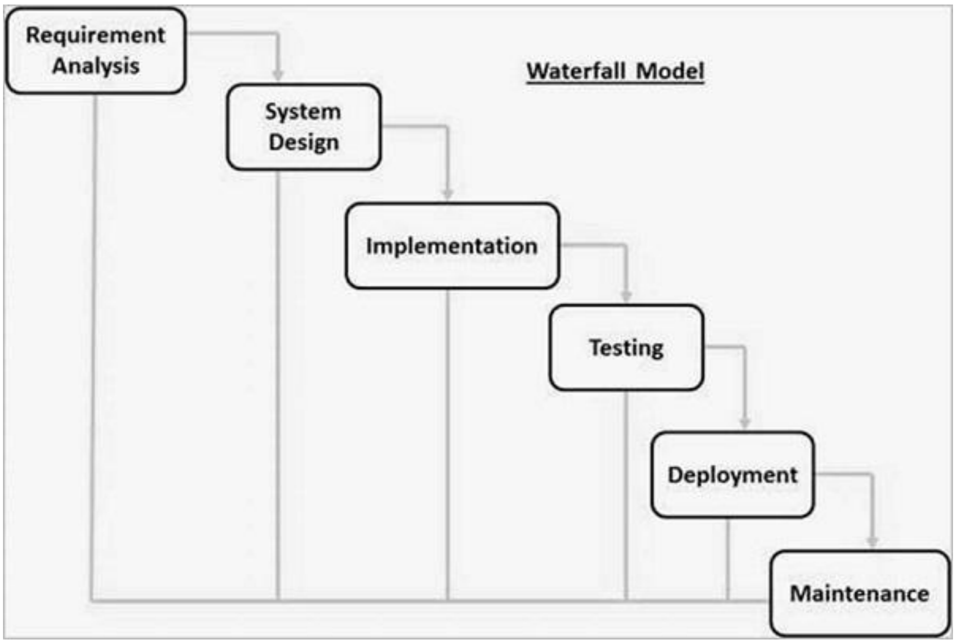


Figure 6.0 : Waterfall Development Life Cycle

3.3 Waterfall Methodology

3.3.1 Requirement Analysis Phase

a. Week 1

- **Identify Project Scope and Objectives**

This phase is about understanding what the RetiSusun system is meant to do and setting clear limits on what the system will cover. It helps us stay focused on the right goals and avoid doing more than what's needed for this project.

The first method used in this phase is brainstorming and doing a literature review. Brainstorming helps generate ideas based on the needs of small retail businesses, especially how they manage stock and sales. The literature review supports this by helping us learn from previous research and other existing systems. Together, these methods help us figure out what the project should include and what goals we should set.

We are also reviewing current Inventory and Point-of-Sale systems to understand how they work and what features they offer. By doing this, we can decide what approach works best for our project and spot any problems or missing features in those systems. This helps us plan a better system that fits our users' needs.

Another method we're using is the SMART Goal Framework. This means we want our goals to be Specific, Measurable, Achievable, Relevant, and Time-bound.

Following this method keeps our objectives clear and helps us track progress more easily as we build the system.

Lastly, we plan to gather resources from websites of existing solutions. These sites show what features other systems have, what they're good at, and where they might not perform well. This also helps us understand how small retailers actually run their daily operations and what kind of technology they need. For example, we can get the existing solutions website from :

- Slurp! - https://getslurp.com/
- BIG POS - https://bigpos.com/
- Smart-ACC - https://www.smart-acc.com/

We can also find more helpful resources from online documentation like the ASP.NET Docs and Flutter Dev Docs. These sites offer a lot of useful information that can guide us during the development of the RetiSusun system. They include step-by-step tutorials, examples, and explanations that show how the frameworks work. By studying these materials, we can learn about the right methods and tools to use while building the system. These resources also give us a better understanding of common development practices and can help solve problems we might face along the way.

- **Identifying Stakeholders**

This phase is focused on identifying the people who will be affected by the RetiSusun system, who will use it, or who can influence how it is developed. This helps us understand who we need to consider throughout the project to make sure their needs are met.

The first step in this phase is to list out all the stakeholders involved in the project in a document called the Stakeholder Identification List. This list helps us figure out how many people are involved, what their roles might be in the future, and how important they are to the success of the project. Knowing this early on helps with planning and decision-making.

At this early stage, we plan to include stakeholders who are directly connected to the goal of the project. For example, owners of small retail shops or convenience stores are the main target users for our system because their business size and technical needs match what RetiSusun is designed for. We also include a university supervisor, who will guide and monitor our progress. In addition, a project examiner is needed to assess the final system when it's done.

To better understand their needs, we plan to interview shop owners, university supervisors, and also retail business employees. These interviews will give us more details about their roles and expectations.

b. Week 2 to Week 5

- **Conduct Stakeholder Interviews**
  In this part, we collect detailed insights on user needs, expectations and features for RetiSusun from the interviewee that we have contacted.

  The method used for this interview is a Semi-Structured Interview. This method is carried out by using a mix of prepared and follow-up questions in order to achieve flexibility during discussions due to the nature of variety in the development of RetiSusun. Questions included inventory practices, challenges and the desired improvements by the interviewee. We use resources such as interview script and notes for this. In order to get the best insight, we decided to interview 2 small shop owner and 1 employee of theirs.

- **Existing Solution Review**
  In this phase, we have reviewed existing solutions such as Xilnex, Slurp!, BIG POS, Smart-ACC and StoreHub.

  The purpose of this review is to get the technical requirements for RetiSusun in terms of features, the non-functional requirements needed for it and cost estimation. We use free demo of their software and reviewed their business site in order to gain those information. We then compiled the review in the Final Year Project report in order to document the result for the use of documents finalizing.

c. Week 6 to Week 7

- **Finalize Requirement Documents**
  In this phase, we finalize the requirements that has been gathered from the interviews and existing solution review.

  One of the method that has been used is Competitor Review Grid. We have used some features and advantages to compare RetiSusun to other existing solutions. We have compared RetiSusun with the existing solutions on 6 fields : Comprehensive Features, Robust Reporting, Cost-Effectiveness, Minmal training Requirement, Restock Estimation Feature and Loyalty Program. These are all the most critical fields that is needed in POS and inventory system that is tailored for small business owners.

  The other method that has been used is Requirement Analysis on the answer that has been given by the interviewee. The resources we use include Canva and Microsoft Word. Their responds has been analyzed and extracted, and translated into functional and non-functional requirements for this project.

d. Week 8 to Week 9

- **Approval on Requirements**
  On this phase, we have obtained an approval of the requirements from our Final Year Project supervisor after the review.

  This approval on the requirements means that we can proceed with the development of RetiSusun based on the gathered and approved requirements. The resources used on this part includes Microsoft Word.

- **Entity-Relationship Diagram**
  Based on the project scope and the functional requirements that has been gathered, we have proceeded to draw the Entity-Relationship Diagram. The software that has been used for this includes Visual Paradigm.This ERD is extremely crucial in the development of modules and database in RetiSusun.

- **Data Flow Diagram**
  Based on the project scope and functional requirements, the Data Flow Diagram (DFD) Level-0 and Level-1 has been graphed. These 2 DFD diagrams are also crucial in the development of RetiSusun in the development of its features and requirements. The resources that has been used for this diagram includes Canva, Visual Paradigm and draw.io.

3.3.2 System Design Phase

e. Week 10 to Week 13

- **Develop System Architecture**
  This part was used to design an architecture using ASP.NET which provides web-based access. The architecture uses the Three-Tier Architecture that is common in .NET Applications. The Presentation Layer uses ASP.NET MVC for web UI. The Business Logic Layer handles application rules, validation and processing. The Data Access Layer interacts with SQL Server or local database. The resources that has been chosen that will be used in later development is Visual Studio 2022 and Draw.io.

- **Develop UI/UX Prototype**
  This phase is to design an interactive, and responsive UI for RetiSusun which provides optimal experience on the desktop browser. Responsive wireframes and interactable pages has been developed by using Windows Form in Visual Studio 2022, which allows flexibility during later development when integrating the backend logics. This design prioritize desktop layouts, with media queries.

- **Develop Database Schema (ERD)**
  This phase implements a normalized relational schema of SQL Server, designed to support inventory tracking, POS transactions and basic business operations. The resources that has been used for this is Visual Paradigm.

f. Week 14

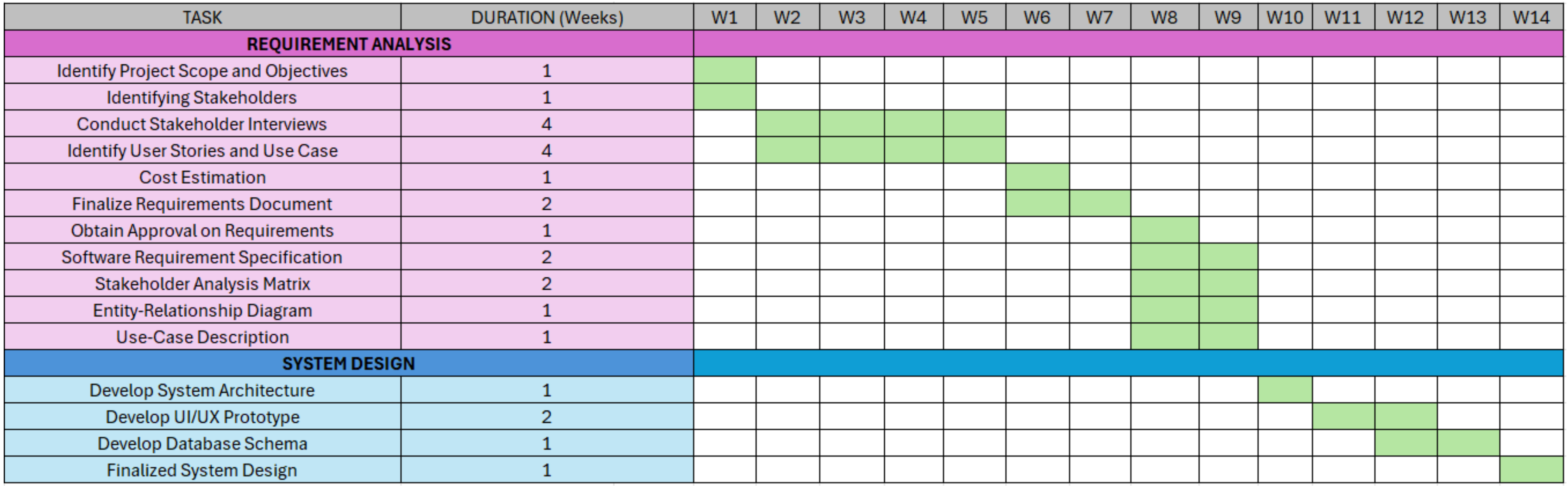
In this week, the system designed has been finalized and peer reviewed. The UI prototype using Windows Form has also been finished, ready to be used for presentation and reviewed by university supervisor and Final Year Project examiners.

3.4 Hardware and Software Requirements

Component		Technology	Description
Hardware		Windows 10/11 (64 bit)	Required to run Visual Studio 2022 and .NET Framework-based applications.
		8GB RAM (minimum)	Esures smooth multitasking during developent and testing.
		Intel i5 or equivalent	For compiling and running .NET applications.
		30GB of free disk space	For Visual Studio, SQL Server, development kits and others.
Software	Frontend	Blazor (WebAssembly)	Interactive and reusable web UI components.
		Windows Forms (.NET)	For desktop POS interface
	Backend	ASP.NET Core MVC	Manages routing, logic and integration between UI and data layers.
		C# (.NET 6 or later)	Primary backend language.
		Entity Framework Core	ORM to map relational data from SQL server to C# objects.
	Database	Microsoft SQL Server Express	Free and lightweight database server for managing overall data for RetiSusun.

Table 3.0 : Hardware and Software Requirements of RetiSusun

3.5 Gantt chart



TASK	DURATION (Weeks)	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14
REQUIREMENT ANALYSIS															
Identify Project Scope and Objectives	1	🟩													
Identifying Stakeholders	1	🟩													
Conduct Stakeholder Interviews	4		🟩	🟩	🟩	🟩									
Identify User Stories and Use Case	4		🟩	🟩	🟩	🟩									
Cost Estimation	1						🟩								
Finalize Requirements Document	2						🟩	🟩							
Obtain Approval on Requirements	1								🟩						
Software Requirement Specification	2								🟩	🟩					
Stakeholder Analysis Matrix	2								🟩	🟩					
Entity-Relationship Diagram	1								🟩	🟩					
Use-Case Description	1								🟩	🟩					
SYSTEM DESIGN															
Develop System Architecture	1										🟩				
Develop UI/UX Prototype	2											🟩	🟩		
Develop Database Schema	1												🟩	🟩	
Finalized System Design	1														🟩

Figure 7.0 : GANTT Chart of RetiSusun Development

3.7 Summary

RetiSusun uses the Waterfall Model as its development approach, which is an ideal approach due to its planning, scheduling and documentation in the earlier phase for the entirety of the development. The phases are broken down to 2 so far : Requirement Analysis and System Design.

The requirement analysis phase started by defining the scope and objectives of the project, which involves brainstorming, literature review and applying the SMART Goal Framework. Stakeholders, which has been interviewed using a semi-structured interview has been done on some local convenience store owners and their employee. Existing solutions such as Xilnex, Slurp!, BIG POS, Smart-ACC and StoreHub has been reviewed for the purpose of gathering the functional and non-functional requirements. Finalization of requirements has been done by using a Competitor Review Grid and analyzing the interviewees responses, which provides a clear view on the functional and non-functional requirements of RetiSusun. Approval was then acquired, then we created the Entity-Relationship Diagram and the Data Flow Diagram Level-0 and Level-1.

The system design phase explains RetiSusun’s Three-Tier Architecture using ASP.NET. A UI/UX Prototype has also been developed sing Windows Forms. A normalized relational database schema has also been created.

CHAPTER 4

SYSTEM ANALYSIS DESIGN

4.1 Introduction

RetiSusun system designs emphasizes more on usability, maintainability and ease of use rather than aesthetics. The system has to perform under stress, without having too many breakdowns and always have the data accuracy that is expected of it. The design is critical to minimize human effort, and that it exploits the concept of visual hierarchy at its fullest to ensure business efficiency.

RetiSusun must also offer features that are comprehensive, which means it has to cover business tasks from every single aspect including restocking, user management, loyalty program and others. Without these critical features, RetiSusun will fail to solve the problem it wants to solve.

4.2 System Analysis Design

4.2.1 System Requirement Gathering

4.2.2 Interview

In order to achieve the comprehensive requirements, we have interviewed **Rosminah Binti Langku, a manager at Amjied Ali Khan Enterprise**.

The main purpose that we have interviewed is to gather functional and non-functional requirements that is critical to RetiSusun. The input that has been received from Mrs. Rosminah was expected to be very helpful and insightful in identifying pain points of smaller business owners.

It must come to the attention of this matter that she agreed to be interviewed under the condition :

1. Her contact information to not be used in any documentation, unless it is critical for the Faculty deems it necessary.
2. She had the right to not answer any question that she deems critical to her business, therefore can’t be shared.

3. She had the right to not be recorded while doing the interview due to personal reasons.

She was interviewed on Friday, 25th April 2025 at 7:00 p.m. on the platform Google Meet. The interview was 1 hour 37 minutes long.

4.2.3 Questionnaire

Question Type	Question	Answer
Business Background	Can you briefly describe your business?	We sell electronics, telecommunication devices, carpet, clothes and others. Our store is on lower level shop lot, and we currently have 2 employees.
	How many products (on average) do you sell or manage in your store?	Typically on a good month, we should have around 800 in stocks. On worse days, it can be as low as 600.
	How do you currently track sales and inventory?	We have a POS and inventory system.
Existing System	What is the current Point-of-Sale system and inventory software that you're using?	It's called IRS POS, I've been using it for at least 10 years. When I got it, I paid around RM1,500 to get the whole package, software and hardware.
	What features do you like or dislike about your current system?	I like that it's maintainable, and I don't have to pay any more money for it. It never breaks down.
	What are the problems you face with sales and inventory with the current system?	Always restocking and stock update, because we need to do it manually, and most of the time me don't even know what item was missing, all we know is the amount of money lost.
	How do you handle stock management, like restocking or stock alerts?	It doesn't have any alert, and stock management is very basic. All I can do is key in some items when the restock arrives, and update the stock at the end of the week when I have the time to.
Functional Requirements	If we were to develop a new PoS and inventory system, what features would you like?	Definitely include inventory synchronization so that lost items are accounted for.
	Explain the need of sales report generation.	Mainly daily report, and monthly report so that I can file taxes better.

	Explain the need of low stock alert.	If an item is low on stock, make sure to have notifications.
	Explain the need of restocking.	Restocking is pretty basic, make sure to have basic stock entry feature.
	Explain the need of new items analysis.	It sure is good to have what items sell and what don't. I expect to have a catalog that has that feature.
	Explain the need of existing items analysis.	I expect the feature should show how the existing items perform, make sure to have value as well so that I can know in what way the items perform.
	Explain the need of barcode scanning.	Barcode is useful too. Every item has its own barcode, and the barcode of the same item is always the same. It's important for inventory and sales.
	Explain the need of manage customer data.	We don't have that, but it would be nice if we can know who the regular customers are so that we can offer better deals.
	Explain the need of discounts or promotions.	Discount is just adding a reduction after the actual price, usually that has a barcode as well. Preferably since this is a small operation, there should be a button that can add the discount.
	Explain the need of restock estimation.	It would definitely save us some time and spend our money on restock efficiently. It would be nice too if I can know how long a stock order is going to last.
	Explain the need of point-of-sale.	It's the most essential. It needs to scan item accurately, and efficiently, otherwise it's going to slow down operation. Our staff don't have to key in the barcode, which is a save for us.

	Do you need support of multi-user access?	Currently, no. Maybe in the future if I need another manager to do the managerial tasks for me.
Non-Functional Requirements	How important is speed and responsiveness in a system for your business?	Not so much about speed, but responsiveness and maintainability are must.
	Do you prefer a system that works offline, online or both?	Preferably both, and make sure there's no syncing problem when it goes offline.
	What level of data security or backup do you expect?	We don't expect much, because it's a small store anyway. So, as long as our money doesn't get digitally robbed, it should be fine.
	Would you prefer a web-based system, a mobile app, or both?	Web-based, but having it on mobile app is a good thing to have. Most business tasks are done on-site. If there is a mobile app for it, it's a good thing that I might try.
	How user friendly should the system be? (simple interface vs feature rich)	A bit of both, our current POS design is messy, but it works fine.
Devices and Platform	Do you use any devices like tablets, smartphones or PCs in your store?	Just the device the POS company gave us after we bought it.
	What operating system do you primarily use? (Windows, MacOS, Android, iOS)	I'm not sure about the POS we're using now, but I think it's Windows. I'm more familiar on Windows.
	Would you prefer using the system on a personal device or a dedicated shop device?	Preferably dedicated shop device, but I don't want to spend too much money on it.
Cost, Training and Support	Would you be comfortable with a pay-per-use model, subscription or a one-time payment system?	Having cash on hand for a one-time payment seems quite hard. I only had money like that in the early business years. I would prefer subscription with low price.

	How much training do you think you or your staff would need to use the new system?	Hopefully not too much, which is why I expect a lot of features but not too much of a hassle to learn. I hope they can familiarize themselves with it in a week.
	What kind of customer support do you expect? (WhatsApp support, in-app help)	WhatsApp would be nice, I can get direct help. Maybe in-app FAQ would also help.

Table 4.0 : Interview Questions and Reponses

4.2.4 User Requirements

4.2.4.1 Functional Requirements

Module	ID	Description
User Management Module	UM_001	System allows registration with unique username and password.
	UM_002	System allows users to reset their password.
	UM_003	The system can restrict access to modules based on user roles.
	UM_004	System allows user to update information (name, contact etc.)
Inventory Module	IM_001	System allows user to add new items with name, brand, category, barcode, unit and cost.
	IM_002	System allows user to view all inventory items with filters.
	IM_003	System allows editing and deleting items.
	IM_004	System shows real-time stock quantity and status.
	IM_005	System records and displays historical stock changes.
	IM_006	System allows product grouping.

Purchase Order	PO_001	System allows user to create purchase order, select items and suppliers.
	PO_002	System will auto-fill supplier info when selected.
	PO_003	System can generate purchase order numbers automatically.
	PO_004	System can track order status : Draft, Sent, Received, Cancelled.
	PO_005	System will calculate order total based on item quantity and price.
Restocking Module	RT_001	System allows user to add new stock for inventory item.
	RT_002	System automatically validates restock quantities.
	RT_003	System allows manual stock entry.
	RT_004	System tracks restock history by item and date.
	RT_005	System allows barcode scanning
Sales Transaction Module	ST_001	System allows items to be scanned.
	ST_002	System displays a cart list, quantities and discount.
	ST_003	System allows multiple payment method (cash, debit etc.)
	ST_004	System shall update item from inventory right after every transaction.
	ST_005	System shall provide receipts after transactions.
	ST_006	System supports discounts and promotions.
	ST_007	System allows cart clearing or item removal before checkout.

	ST_008	System will log all sales in the sales history.
Reporting Module	RP_001	System generates sales report filtered by date range and user.
	RP_002	System allows user to view, print or export all reports.
	RP_003	System generates End-of-Day (EOD) reports.
	RP_004	System shall track top-selling products.
	RP_005	System allow downloading reports in pdf file.
	RP_006	System protect report access by user roles.
Restocking Suggestion Module	RS_001	System must analyze past sales data to estimate restock quantity per item.
	RS_002	System allow threshold configuration when items should be suggested.
	RS_003	System displays item quantities with their expiry dates.
	RS_004	System excludes discontinued items.
Settings and Report Module	SP_001	System allows users to update business information.
	SP_002	System allows logo customization.
	SP_003	System allows adding tax settings and rounding rules.
	SP_004	System allows user to send feedback or issue reports.
	SP_005	System allows backup of data.

Table 4.1 : Functional Requirements of RetiSusun

4.2.4.2 Non-Functional Requirements

Non-Functional Requirements	**Definition**	**Scope**
Reliability	System shall be operational at least 99% of the time without crashes or data loss.	Robust exception handling, validating all inputs and outputs and do testing using simulated usage.
Performance	System will respond to user action and/or barcode scan within 1 second.	Optimize database queries, use in-memory cache.
Data Integrity	Transactions and stock updates are stored with 100% accuracy.	Use database constraints (primary, foreign keys)
Maintainability	System structures uses modular layers (UI, logic, data).	Follow MVC architecture and apply separation of concerns.

Table 4.2 : Non-Functional Requirements of RetiSusun

4.3 System Design

4.3.1 Context Diagram

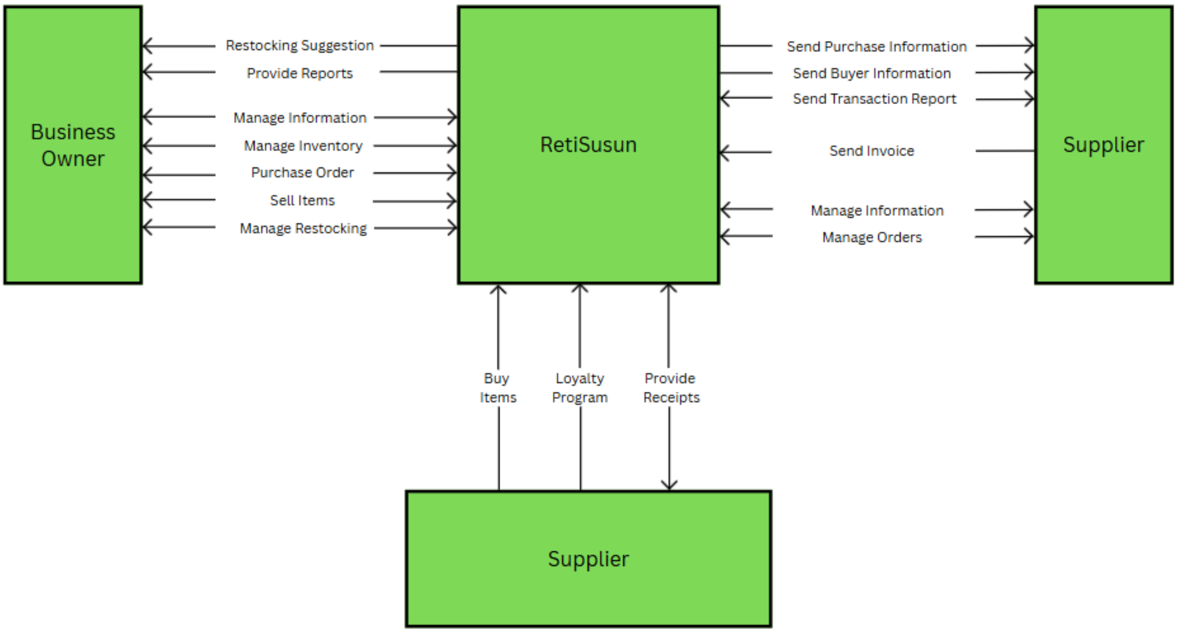


Figure 8.0 : RetiSusun Context Diagram

4.3.2 Data Flow Diagram (DFD) Level-0

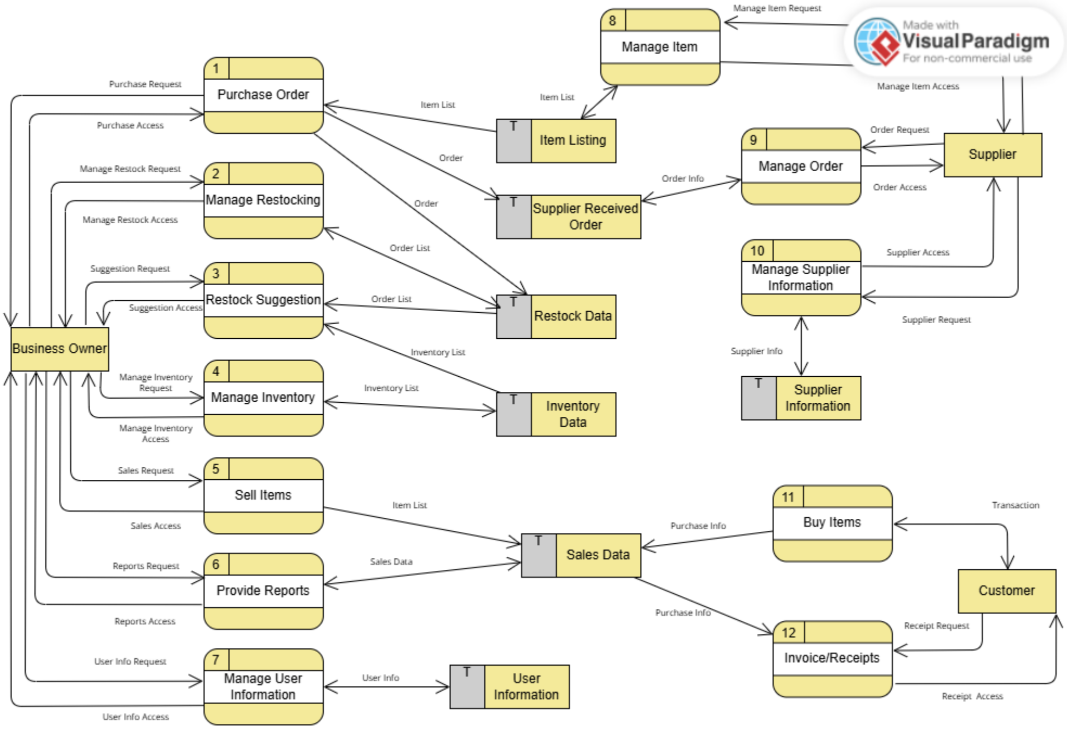


Figure 8.1 : RetiSusun DFD Level-0

4.3.3 Data Flow Diagram (DFD) Level-1

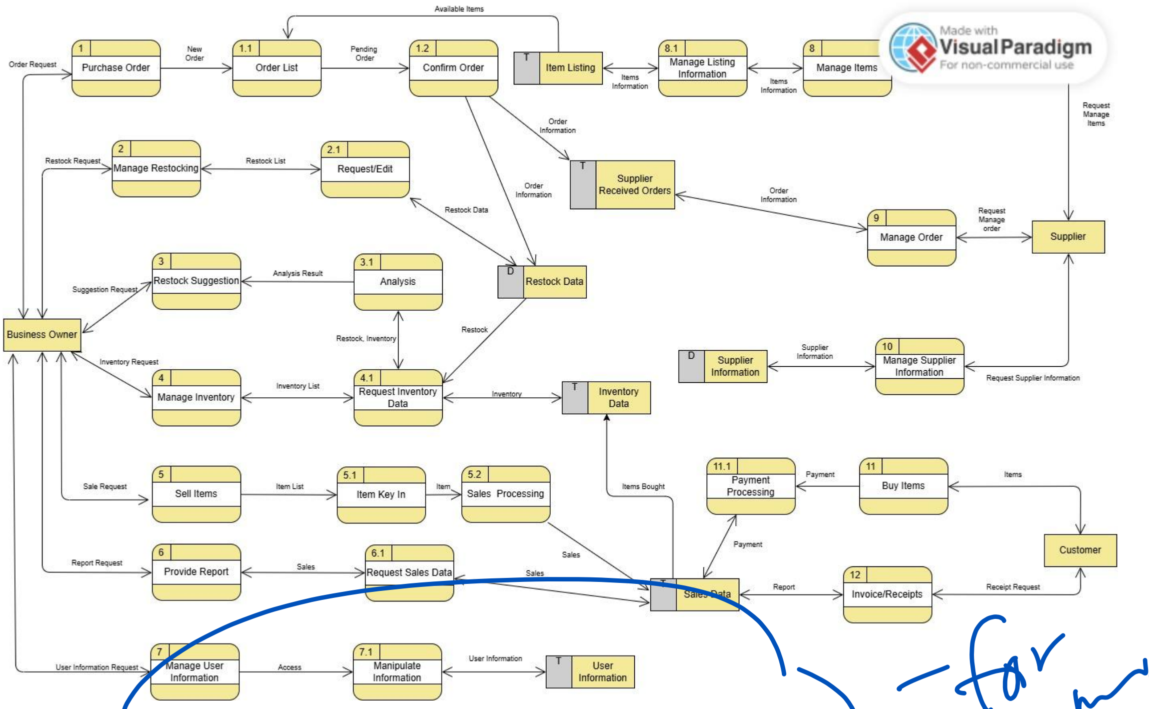
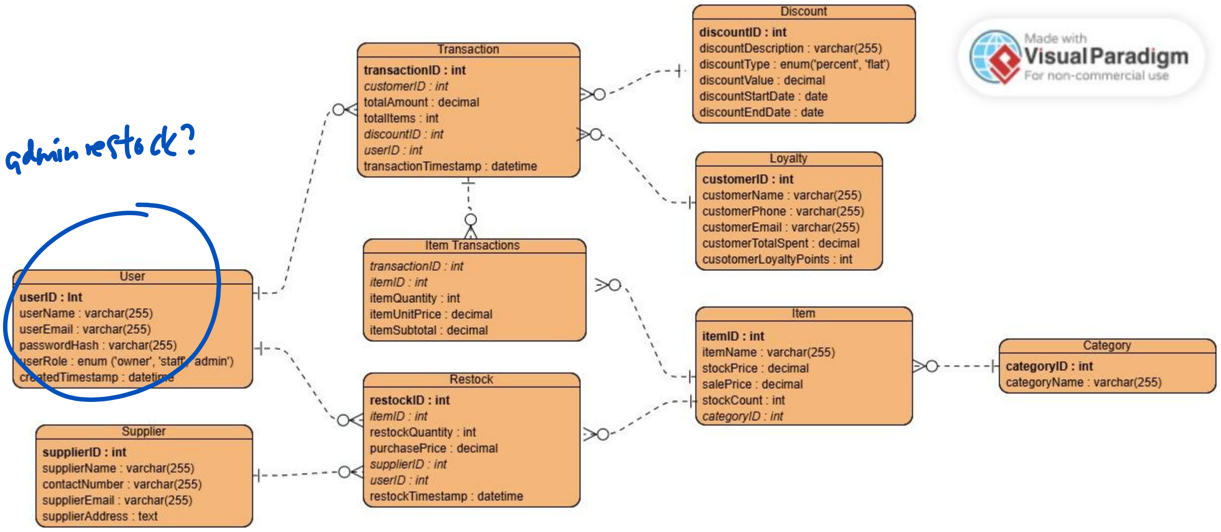


Figure 8.2 : RetiSusun DFD Level-1

— for each module

4.3.4 Database Design

4.3.4.1 Entity-Relationship Diagram



admin restock?

Figure 8.3 : RetiSusun Entity-Relationship Diagram

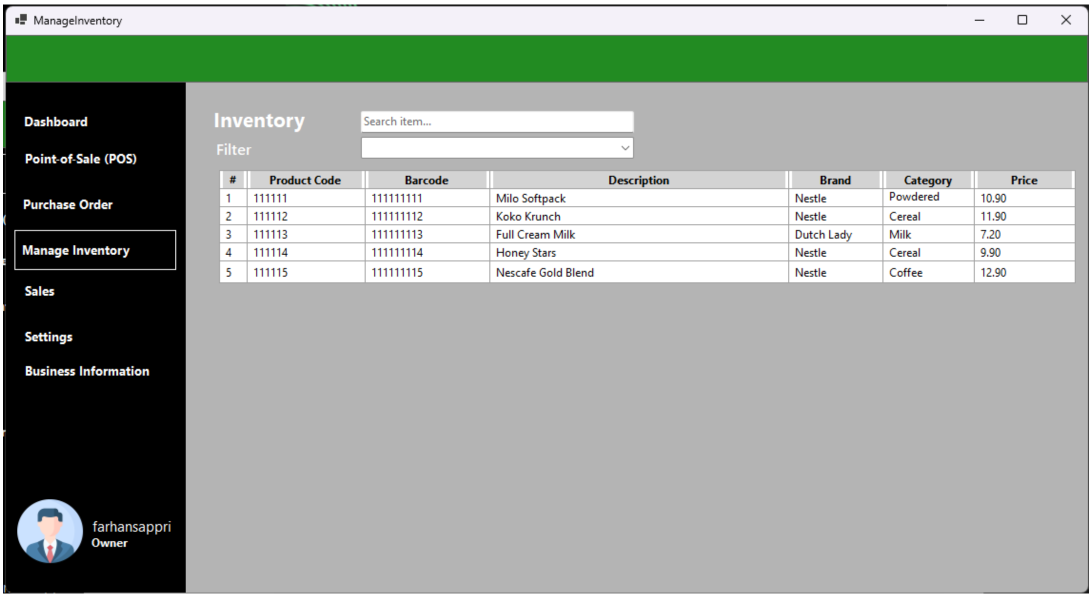
4.3.4.2 Data Dictionary

Field Name	Data Type	Field Size	Constraints
userID	Integer	10	Primary Key
userName	Varchar	255	Not null
userEmail	varchar	255	Not null
passwordHash	varchar	255	Not null
userRole	Enum('owner','staff','admin')	9	Not null
createdTimestamp	datetime	19	Not null
supplierID	Integer	10	Primary key
supplierName	varchar	255	Not null
contactNumber	varchar	255	Not null
supplierEmail	Varchar	2552	Not null
supplierAddress	text	-	Not null
transactionID	Integer	10	Primary Key
customerID	Integer	10	Foreign key, Primary Key
totalAmount	decimal	10	Not null
totalItems	Integer	10	Not null
discountID	Integer	10	Foreign key, Primary key
userID	Integer	10	Foreign key
transactionTimestamp	datetime	19	Not null
transactionID	Integer	10	Primary key
itemQuantity	Integer	10	Not null
itemUnitPrice	Decimal	10	Not null
itemSubtotal	decimal	10	Not null

itemID	integer	10	Foreign key, Primary Key
restockID	Integer	10	Primary key
restockQuantity	Integer	10	Not null
purchasePrice	Decimal	10	Not null
supplierID	Integer	10	Foreign key
restockTimestamp	datetime	19	Not null
discountDescription	Varchar	255	Not null
discountType	Enum('percent','flat')	-	Not null
discountValue	Decimal		Not null
discountStartDate	Date	19	Not null
discountEndDate	date	19	Not null
customerName	Varchar	255	Not null
customerPhone	Varchar	255	Not null
customerEmail	Varchar	255	Not null
customerTotalSpent	Decimal	10	Not null
customerLoyaltyPoints	integer	10	Not null
itemName	Varchar	255	Not null
stockPrice	Decimal	10	Not null
salePrice	Decimal	10	Not null
stockCount	Integer	10	Not null
categoryID	Varchar	255	Primary key, foreign key
categoryName	varchar	255	Not null

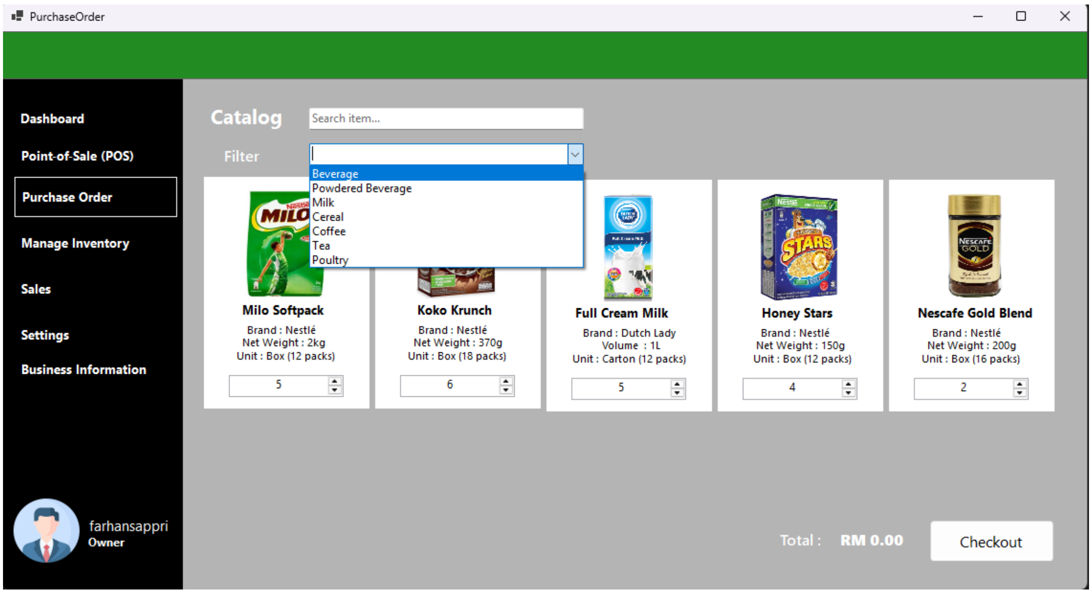
Table 5.0 : RetiSusun Data Dictionary

4.4 Interface Design



#	Product Code	Barcode	Description	Brand	Category	Price
1	111111	111111111	Milo Softpack	Nestle	Powdered	10.90
2	111112	111111112	Koko Krunch	Nestle	Cereal	11.90
3	111113	111111113	Full Cream Milk	Dutch Lady	Milk	7.20
4	111114	111111114	Honey Stars	Nestle	Cereal	9.90
5	111115	111111115	Nescafe Gold Blend	Nestle	Coffee	12.90

Figure 9.0 : RetiSusun Manage Inventory



Milo Softpack
Brand : Nestlé
Net Weight : 2kg
Unit : Box (12 packs)
5

Koko Krunch
Brand : Nestlé
Net Weight : 370g
Unit : Box (18 packs)
6

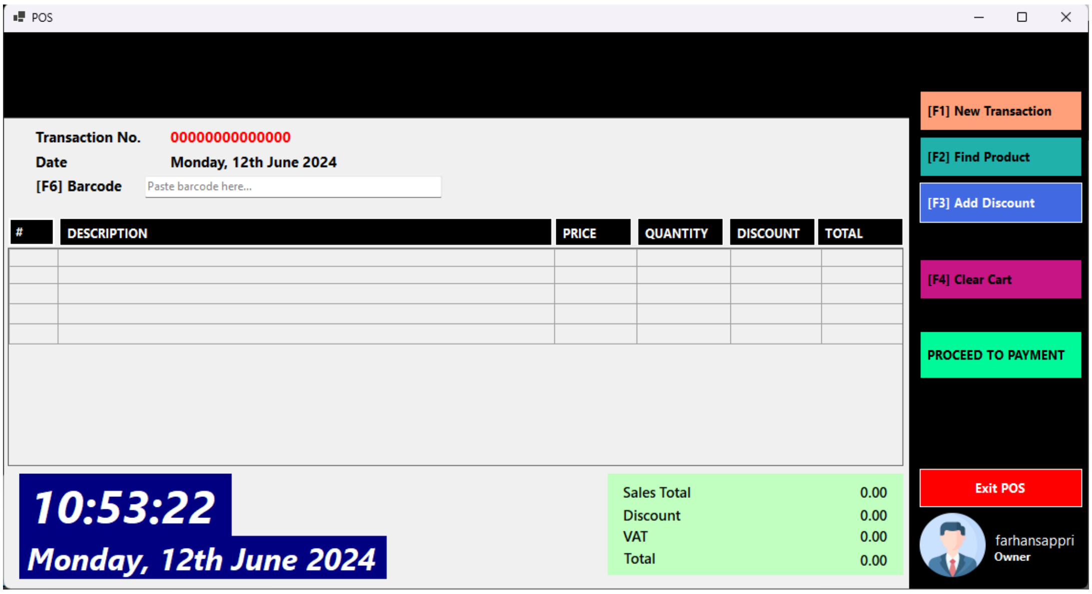
Full Cream Milk
Brand : Dutch Lady
Volume : 1L
Unit : Carton (12 packs)
5

Honey Stars
Brand : Nestlé
Net Weight : 150g
Unit : Box (12 packs)
4

Nescafe Gold Blend
Brand : Nestlé
Net Weight : 200g
Unit : Box (16 packs)
2

Total : RM 0.00

Figure 9.1 : RetiSusun Purchase Order



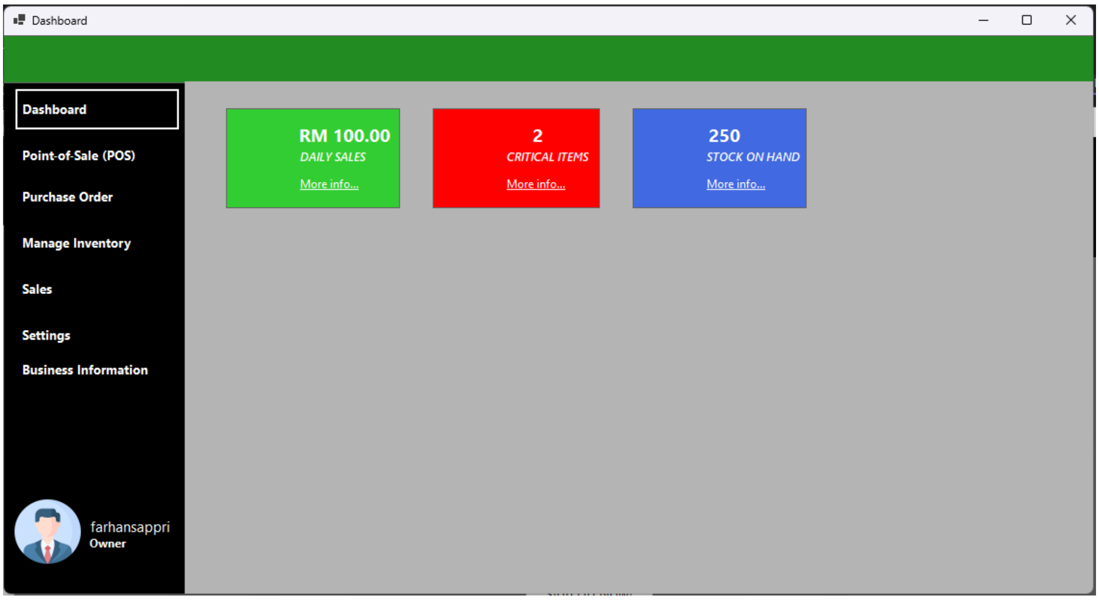
Transaction No. 00000000000000
Date Monday, 12th June 2024
[F6] Barcode

#	DESCRIPTION	PRICE	QUANTITY	DISCOUNT	TOTAL

10:53:22
Monday, 12th June 2024

Sales Total	0.00
Discount	0.00
VAT	0.00
Total	0.00

Figure 9.2 : RetiSusun POS

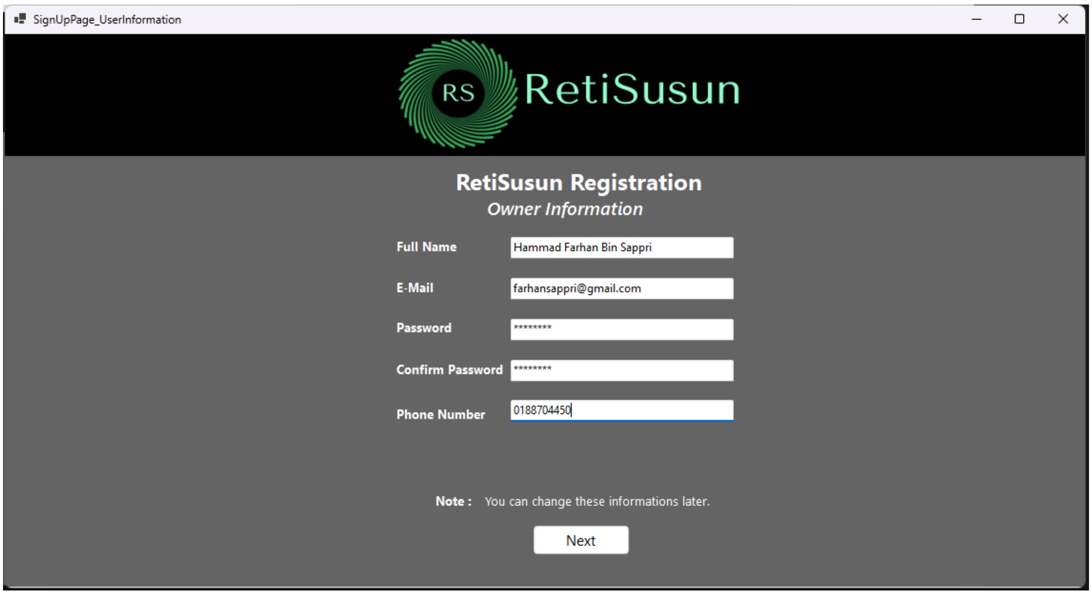


RM 100.00
DAILY SALES
More info...

2
CRITICAL ITEMS
More info...

250
STOCK ON HAND
More info...

Figure 9.3 : RetiSusun Dashboard

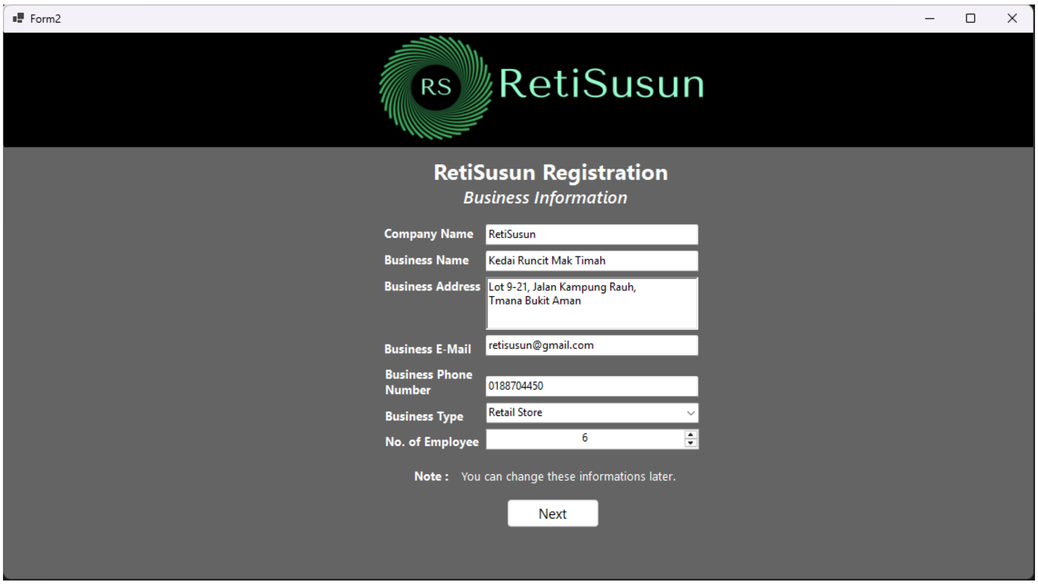


RetiSusun Registration
Owner Information

Full Name	Hammad Farhan Bin Sappri
E-Mail	farhansappri@gmail.com
Password	********
Confirm Password	********
Phone Number	0188704450

Note : You can change these informations later.

Figure 9.4 : RetiSusun Owner Information (Registration)



RetiSusun Registration

Business Information

Company Name: RetiSusun

Business Name: Kedai Runcit Mak Timah

Business Address: Lot 9-21, Jalan Kampung Rauh,
Tmana Bukit Aman

Business E-Mail: retisusun@gmail.com

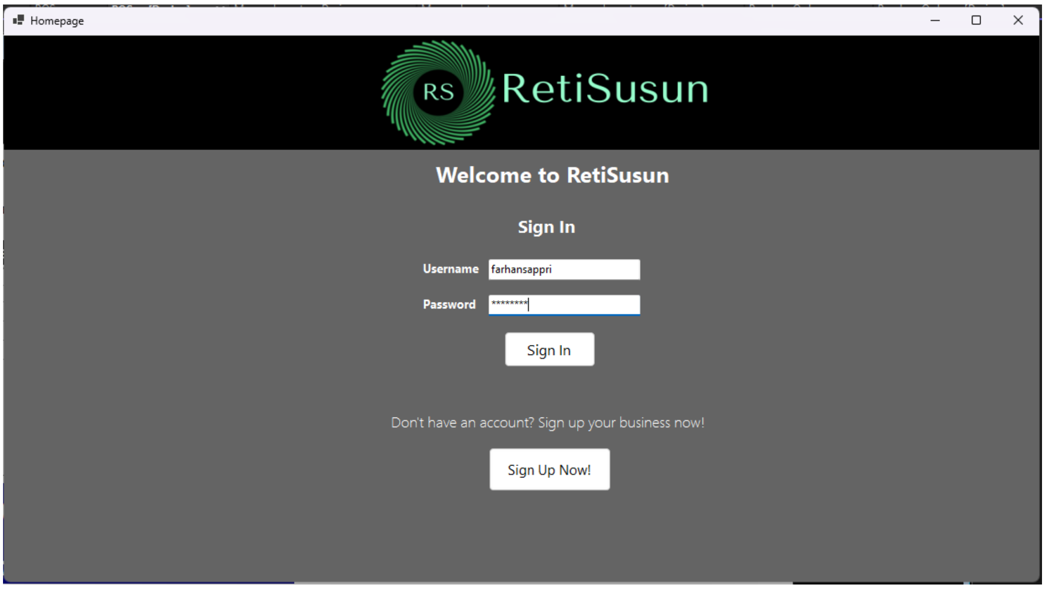
Business Phone Number: 0188704450

Business Type: Retail Store

No. of Employee: 6

Note : You can change these informations later.

Figure 9.5 : RetiSusun Business Information (Registration)



Welcome to RetiSusun

Sign In

Username: farhansappri

Password: ********

Don't have an account? Sign up your business now!

Figure 9.6 : RetiSusun Login Page

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APPENDIX

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