Sales and Inventory Tracking System for Anuradha Jewellers Negombo

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A dissertation submitted for the Degree of Master of Information Technology

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UCSC

Declaration

The thesis is my original work and has not been submitted previously for a degree at this or any other university/institute.

To the best of my knowledge it does not contain any material published or written by another person, except as acknowledged in the text.

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This is to certify that this thesis is based on the work of

Mr./Ms.

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Supervisor Name:

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Abstract

Anuradha Jewellers are Negombo based renowned jewellery manufacturer and seller. For last four decades they have managed to gain the trust of many people in the area making their business very successful. It is always challenging task to keep ahead of competition in world of business, and when it comes to Jewellery industry it is more difficult especially since customers always looking for best quality, latest and unique design for cheaper/competitive price. To makes things further difficult rising cost of gold due to various uncontrollable reasons have added further burden to the industry.

Presently client maintain records manually, making client spending unnecessary time processing and maintaining data rather than spending time to improve his business. Client has recognized the importance of automating the business process. Proposed system will enable client to minimize the use physical document, remove some of the manual processes in the business, enforce better access control and enhance the reporting.

Organizations always search for ways that helps to control and tack their business with ease. Computerized systems enable to track the business process with ease. Computerized systems also can streamline the business process with proper controls and methodologies.

The proposed system will cover all the issues that were discovered during system analysis stage. It is strongly believed that the proposed system will solve majority of the issues faced by the client. Proposed system will convert manual unstructured process by the client into more structured, industry standardized automated process, which client will be able to operate efficiently. Proposed system will also provide better control of access for the information safeguarding business critical information.

Open source tools have evolved into innovative and more user friendly during recent past. Therefor open source tolls have become more and more famous than ever. Freely available and widely circulated learning material have become the reason for the popularity for open source system development tools. Since anyone can access to these freely available tools, technology and learning materials it's considered as the best way forward for the project.

This dissertation demonstrate in detail, methodologies used during system development life cycle, existing and proposed system, tools used to develop the new system etc.

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Thank you

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Abbreviations

☐ **Client** - is the Owner/s of Anuradha Jewellers.

☐ **Customer/s**- is/are people interact/does business with client.

☐ **UCSC**- University of Colombo School of Computing.

☐ **JCS**-Jewellery Computer System is computerized application that was developed to track business of jewellery vendors.

☐ **RAD-** Rapid application development**.** RAD is a concept that was born out of frustration with the waterfall software design approach which too often resulted in products that were out of date or inefficient by the time they were actually released. The term was inspired by James Martin, who worked with colleagues to develop a new method called Rapid Iterative Production Prototyping (RIPP). In 1991, this approach became the premise of the book Rapid Application Development.

☐ **CLI**- Command-Line Interface is a user interface to a computer's operating system or an application in which the user responds to a visual prompt by typing in a command on a specified line, receives a response back from the system, and then enters another command, and so forth. The MS-DOS Prompt application in a Windows operating system is an example of the provision of a command line interface. Today, most users prefer the graphical user interface (GUI) offered by Windows, Mac OS, BeOS, and others. Typically, most of today's UNIX-based systems offer both a command line interface and a graphical user interface.

☐ **CGI**- Common Gateway Interface, In computing, CGI offers a standard protocol for web servers to execute programs that execute like Console applications (also called Command-line interface programs) running on a server that generates web pages dynamically. Such programs are known as CGI scripts or simply as CGIs. The specifics of how the script is executed by the server are determined by the server. In the common case, a CGI script essentially executes at the time a request is made and generates HTML.

☐ **IDE** - An integrated development environment is a software suite that consolidates the basic tools developers need to write and test software. Typically, an IDE contains a code editor, a compiler or interpreter and a debugger that the developer accesses through a single graphical user interface (GUI). An IDE may be a standalone application, or it may be included as part of one or more existing and compatible applications.

☐ **SQL**- stands for Structured Query Language - SQL lets you access and manipulate databases, it is an ANSI (American National Standards Institute) standard. SQL can execute queries against a database, retrieve data from a database, insert records in to a database, update records in a database, delete records from a database, and create new databases, new tables in a database, create stored procedures in a database, create views in a database and also SQL can set permissions on tables, procedures, and views.

- **WPF** -Windows Presentation Foundation provides a unified framework for building applications and high-fidelity experiences in Windows that blend application UI, documents, and media content. WPF offers developers 2D and 3D graphics support, hardware-accelerated effects, scalability to different form factors, and interactive data visualization.

- **WinForms**- Multi-Level Hierarchies on Rows and Columns, Grouping, Fixed Hierarchies and Fixed Items, Data-Bound and Unbound modes, Sorting, Filtering, Editors, Pivot Tables and more.

- **ASP.NET-**is a free web framework for building great Web sites and Web applications using HTML, CSS and JavaScript. You can also create Web APIs, mobile sites, use real- time technologies like Web Sockets and more

- **Universal Windows Platform** - is a platform-homogeneous application architecture created by Microsoft and first introduced in Windows 10. The purpose of this software platform is to help develop universal apps that run on both Windows 10 and Windows 10Mobile without the need to be re-written for each. It supports Windows app development using C++, C#, VB.NET, or XAML. The API is implemented in C++, and supported in C++, VB.NET, C#, F# and JavaScript

- **Win32**- Alternatively referred to as the Windows API and WinAPI, Win32 is the main set of Microsoft Windows APIs used for developing 32-bit applications.

- **RDBMS**- Relational Database Management System is basically used to store data.

Client Specific Abbreviations

- **LR**-Ladies Ring
- **BR**-Baby Ring
- **NECBACK**-Neckless Back Chain
- **BAN**-Bangles
- **BRL**-Bracelet
- **CH**-Chain
- **CRO**-Cross
- **DES**-Tussle
- **GP**-Gypsy
- **BGP**-Barrel Gypsy
- **GR**-Gents Ring
- **KR**-Ear Ring
- **LR**-Ladies Ring
- **MN**-Money
- **NEC**-Neckless
- **PAN**
- **PP**-Pendant
- **SP**-SP Chain
- **SURA**
- **WR**-Ladies Wedding Ring

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1. Introduction

1.1 Customer

Anuradha Jewellers (will be referred as "client" in future) is one of the leading and renowned jewellery manufacture and seller in Negombo. With experience of more than 3 decades they have gained customer's trust for quality 22 carat gold jewelleries. They are also famous for their support and after sales service for the products that they sell.

Entrepreneur Mr. Nimal Yahathugoda initiated from a bank loan to start a small jewellery shop in early 1980s, he was able uphold his business to become one of the renowned jewellers in the area. Today they manufacture and supply jewelleries to many other jewellery sellers in the area. At present his son Mr. Sanjaya Yahathugoda has given the task to strengthen the business which he has been able to add more value to the business.

Since the family run business and the extra care and friendly nature of Yahathugoda family and their employees, people visit them. They take extra care for their customers in order to provide better service, with rare and attractive designs and competitive prices and innovative services and advanced technologies that they have given them edge over competitors.

There are experienced designers that provide unique designs that match the customer, Customer can sit with the designer and design jewelleries as they prefer. Also there are catalogues with latest designs from famous designers from all over world if anyone would opted to go for.

Their craftsmen are the best in the industry, with decades of experience with ability to make flawless jewelleries according to customer requirement with 100% satisfaction. These craftsman are capable of crafting very delicate designs.

Client operates in very attractive location, designed to make customers relaxed and enjoy with vast collection of jewelleries on display. Customers visiting are very well treated even if they do not buy from them, But Anuradha jewellers have so much to offer customers could not resist their designed and craftsmanship.

Client provide un-matched service for their customers. When customer buy a product from them for rest of the lifetime they provide various services (polishing, curing, etc.) on the product, if customer wants to go for newer design by selling old jewellery item, Client provided better rete which is more than the actual market for their own product that customer return.

1.2 Industry

Jewellery industry is very sensitive to various socio-economic and political factors, price of gold have become rapidly changing due to those reasons which have become very difficult to predict even for experienced business mind.

Due to political tension between countries some governments prefer to invest and buy gold instead of stable currencies like USD or Euro etc. Therefore value of gold rises. Since this will affect their economy and value of currency goes down countries like US sell their gold reserves or request friendly governments to issue more gold to the market, so the price of gold goes down. Due to tension between countries price of gold have become more and more unstable in recent past. Therefore businesses take extra care when purchasing and stocking raw gold.

Rapidly changing prices affect their sales also customers are reluctant to purchase gold jewelleries due to rapidly varying prices. People purchase jewelleries not only to ware, but also to pawn or sell during time of financial issues, therefore people have also become extra careful when purchasing jewelleries.

There are periods of the year where business run high and low, usually during months of April, May & December amount of transactions are considerably higher than other months.

Industry thrives with huge competition, some competitors are experienced more than half a decade. But no matter how experience you are, there is enough of market share to grab with correct attitude and approach.

New comers always trying to provide better attractive service to customers with very attractive prices. Therefore making the customers happy and satisfied in the best thing to do remain in the industry, by doing so they need to build good relationship with customers. Quality of the items, latest designs, customer care, after sales service are some of the generics that customer would expect. Therefore building trust and looking forward for a long term relationship if very important.

Apart from rivalry jewellery industry is interconnected in many other ways, they maintain common price per sovereign of gold. And some hold specialized equipment (special equipment that can measure purity of gold for example), where they provide services to other vendors.

1.3 Motivation

Jewellery industry involves very artistic and professional craftsmanship which bring prestige for an individual and for centuries people are involved with gold jewelleries and evolved timely manner, changing rapidly with new cultural and younger generations mind-set. But for centuries process of jeweller manufacturing did not change much until last decade till machines capable of crafting more accurate very miniature complex designs were done, which was almost impossible task to be done by a human unless very talented experienced craftsman.

With technological advancement business process also started to evolve, Business started to change the gear from manual to computerized system in order to make the processes more scientifically systematic, improved, effective and efficient. Computerized system make the business to function with ease, save cost, made the process easier to manage, convenient, quicker, ease of recovery, systematic business process, easy to track and monitor the business.

Client is planning to computerize possible features that could ease the burden on employees and save time. Also computerizing the process will enable the client to stream line and standardize the processes as well which will enable him better customer services and get a very good idea about the state of the business.

The most problematic areas are tallying of cash book, stock verification, order tracking, invoice tracking and customer tracking, with introduction of the computerized system I believe client should be able to function efficiently.

Client is believed to have customer base of more than 20,000, and for his regular customers client wants to introduce special promotions to attract more customers but identifying such customers. Also when there is need to get contact details of credit customers or customers who have their orders ready employees need to search through physical documents find the information.

Maintaining stock has also become difficult task and lot of anomalies need to corrected which is very time consuming process. Especially daily stock verification process is very time consuming task most of the times frustrating task at the end of the day, where if something goes wrong whole process needs to be redone. Like so it is expected to reduce manual, time consuming processes, which will be definite cost save for the client.

Since there are no automated/computerized method client spend lot of time on tracking business transactions and record maintenance. Due to legal and other requirements client need to maintain past business transaction records with his safely for future reference. Therefore extra effort needed to be spent to keeping records safe and restrict accessibility to authorized staff.

With introduction of the computerized system, manual functions like invoicing will be done by the system. Stock levels and other relevant details will be updated automatically therefore there will be no need to spend time on updating relevant other records. System access control will done using user name, password and user access levels, therefore client can decide who is going to see/do alterations/updates on data captured data. Also type of work done by each user will be maintain to track user activities if required.

Proper backup and security features need to be introduce the data and system. Special attention will be given to data transmission to preventing information fallen into unwanted people. Data encryption, secure data transmission will need to be implemented.

1.4 Approach

In order to understand flow of business observations, interviews and document inspection will be done. Based on clients requirements system development methodology is selected. Basically Microsoft Visual C# Express/Community and Microsoft SQL Express, which are free tools available will be used for system development. Application will be windows based. System will be installed in computers locally. Application will access online database hosted in cloud server.

To make the system safe and secure user access levels and access control will be implemented to prevent unwanted people accessing information that are not intended to. Data encryption methodologies will be implemented while transmitting data in between the database and the application.

Testing will be carried out prior to correct coding errors, actual data will be feed into the system. After clearing coding errors system will be installed in 2 personnel computers and testing will be carried to, Parallel run of manual and automated system will be done for one month time to check errors in the system.

System maintenance and additional features will be added in order to cater for customer requirement.

1.5 Flow of business

Customer visit the shop in anticipation to purchase jewellery item. Employees ask from customer what type of jewellery item that customer want and the price range. Depending the requirement employee shows customer existing range of items, weight of the item and price. If customer wants to buy that item competitive price will be offered, if customer is regular buyer special price will be offered. Customer can pay by cash, credit card, Cheque, raw gold etc. Hand written bill is issued to the customer to certify the transaction. For regular customers credit facility will also be available. If customer is not happy with the collection or looking for specific design when is not available at the moment design is done according to customer need or they can select particular design from catalogues. In such case order will be placed, when placing an order design of the item, weight, data of delivery, estimated price will be recorded in the order bill. Sometimes customer may pay portion of the total cost therefore it will record as advance, some customers may have gold if so it is weighted and recorded in the same bill and value of gold will be deducted from final bill. Some customers will return their old jewelleries for new accordingly price will be calculated for those items and final bill will be prepared accordingly.

As soon as the order is accepted gold craftsman will be assigned to the job, he will be given 20% more than the estimated weight of the jewellery and date will be given to complete the work and that date is at least 3-4 prior to the date that of the order details. Amount of gold given to the particular craftsman will be recorded in "gold box" If gem stone work or polishing need to be done they will ask gold craftsman to complete the work earlier than that. Same procedure will follow when client wants to top up the stock of the shop, where items that moves regularly. Weight of the jewellery item and weight of remaining gold will be weighted and recorded in "gold book" When the craftsman hand over the finished item. Finished item is kept in the order box until it taken into the stock

at the end of the day. Item in gold box could also sell if customer want to buy it (without been taken into stock). If the item is for an order client will check the data which order is supposed to deliver and if there is enough time to craft same item, if this is possible they will sell the item. Else order will be placed and same previous process will take place.

Apart from craftsman jewelleries are purchased from other jewellers. Even though everyone is competing for higher market share, there are interconnections between jewellers.

At end of each day items in the gold box is weighted, categorized and tagged with these information and added to the stock. Then the staff do physical stock verification. Cash collected is counted and tally with the cash book and advanced received.

1.6 Objectives

Main objectives of this project are as follows;

1. Streamline the business process.
2. Minimize manual paper work.
3. Access control for business critical information.
4. Tracking of invoices, orders, stock etc. with ease.
5. Minimize manual work carried out.
6. Real time reporting.
7. Reduce workload.

1.7 Scope of the project

Project focus on to develop web based software tool to systemize manual processes carried out by the client, hence enabling client to provide better service to customers.

Invoice

When a customer visit the shop and wants to buy an item/s which is already available in stock or customer who previously order item/s which were not available during that time and now ordered item/s ready to collect.

Order

When item/s required by the customer is not available in the stock or when client need to increase the stock in the shop order is raised. Details such as items details weight of the item, date that the items should be ready for collection are recorded.

Work Order

Work order is where items which are requested by order/s are assigned to craftsman in-order to craft item/s. Craftsman will be informed regarding the weight of the item design, date when the item should be finished and return. Depending on the weight of the item, gold will be allocated to the craftsman.

Work Order Return

Work order return is when the craftsman send finished item/s to shop. Item/s is checked if it is carrying correct weight, design and also through quality check is carried out. If client is satisfied will be accepted as finish work.

GRN

GRN is raised to add finished item/s to the stock. Item is weighted tagged with a unique item code, item category and will be added to the inventory of the shop.

Stakeholders

Stake holders are categorised as "Customers", "Craftsman", "Employees", "Other". This categorization is done according to the requirement of the client. Stakeholder's full name, NIC/Passport no, date of birth, address and contact details are captured.

1.8 Outline of dissertation

This dissertation comprise with six chapters describing steps carried out during each stage of the system development life cycle.

CHAPTER 02 – BACKGROUND/ LITERATURE REVIEW

This chapter of the dissertation describes background and business needs, and review of similar systems available and system development technologies that are in practice.

CHAPTER 03 – ANALYSIS AND DESIGN/ METHODOLOGY

Analysis and Design chapter describes client requirements which are expected to accomplish through the computerized system. Techniques that are used to gather requirements and System design based on user requirements are described in this chapter. Functional and non-functional requirements are pointed out and illustrated at the abstract level.

CHAPTER 04 – IMPLEMENTATION

This chapter describe how the requirement captured on previous chapter is converted into computerized application. Here tools and methodologies which are used to develop the system are described and screenshots are used to illustrate the system.

CHAPTER 05 – USER EVALUATION AND TESTING

This section depicts the testing strategies. Test plan and test cases are used to evaluate the overall system to ensure the system is functioning as expected.

CHAPTER 06 – CONCLUSION AND FUTURE WORK

This chapter of the thesis describes the summary of achievements, future enhancements That are expected to carry out in future.

2. Background/Literature Review

2.1 Background

Anuradha Jewellers are famous for their craftsmanship, quality, and value for the money, friendly efficient service for more than three decades, among the customers. They offer unconditional service for jewellery items and various types of other services for their customers.

When customer comes to purchase an item client introduce them with items that will match perfectly according to need of the customer. If customer is not satisfied with available items they can go through various design catalogues or they can request for the support of experienced designer to design what exactly they need.

If customer opted to purchase from available stock, particular item/s is weighted and competitive price will be offered. And if customer agree item/s will be invoiced and payment will be done by customer. If customer want new item/s to be crafted order will be placed. Order will carry details such as type of item/s, weight, date of delivery. During the time of the order only estimated cost can be calculated since final weight can only be known after finished item arrives at the shop, but there will not be major variation of the weight since client have through knowledge of his range of products.

Employees of Anuradha Jewellers have to manage lot of manual data and preform stock calculation, balancing of cash book and credit etc. manually. Those are very time consuming and sensitive duties which they have to pay lots of attention and needed to be carefully carried out in order to minimize errors that could occur. Client and staff have to spend considerable amount of time to perform such manual operations therefore client is sending considerable amount of money for his staff.

Apart for the burden of carrying out manual functions client has to maintain his physical documents for future requirements (Ex: - Financial audits by Inland Revenue Department etc.). And client has to spend lot of time to process reports that he is legally bound to produce to various government entities. Therefore client need to keep records safely (to safeguard documents damaged by insects, water or other possible methods) without been damaged, and he has to spend money for safe storage of these physical documents.

Another problem that the client is faced with is enforcing access control for physical documents which contain business critical data. It is very difficult task to keep unwanted individuals from accessing them. And Physical access control is very costly task and therefore client have realized the need for alternative solutions for all these matters.

Taking all above matters into his consideration client has opted support from computerized system, in order streamline his business processes where he plan to standardize his operations, and automate manual tasks such as stock varication, reporting (cash book, credit book and other financial reports that the client requires to produce for government entities etc.), backup of business critical information.

2.1 Systems available

2.12 Jewellery Computer System (JCS) [1]

JCS is a famous computerized system used by jewellery vendors worldwide (http://www.jcssoft.com). JCS runs on all current Windows operating systems including Windows 10. JCS can create your own inventory categories, vendor codes, and departments to suit your needs. They are willing to make changes to the software promptly as needed by clients. System can be purchased in modules according to the need of the client.

Functionality:

- Barcode inventory tracking (RFID inventory tracking optional)
- Track Memo inventory and Consignment inventory
- Assign basic items to be sure you always have them on hand
- Fast Seller Reports and Purchase Order function
- Return/Adjust tracking
- Retail and discount price tracking
- Serial number field for watches
- Assemble/breakdown capability with miscellaneous costs added too
- Physical Inventory processing either through barcode scanning or RFID Scanning

Pricing

Single store, single user starter program costs $1,495. All modules except picture taking capability. Single store with up to three workstations costs $4,700 for a single store. Additional workstations cost $400 each. Each additional store costs $3,500.

Enterprise version is an additional $1,500. It includes a task manager, loose diamond distribution report, diamond guarantee module, and special analysis reports.

RFID inventory tracking hardware from Track Tech costs $3,000. One-time RFID integration fee is $1,000. Reusable RFID chips are $.50 cents each.

Modules included in standard version are: Inventory control, Sales processing, Layaway tracking, Accounts Receivable(A/R) (add finance charges, allow for minimum payments, create statements, aging reports), Repair tracking,(including texting and/or emailing when job is ready), Special Order tracking, Purchase orders, extensive CRM module, Staff Management, Time Clock, Appraisals, and pictures of items in inventory and repairs.

Instalment A/R module includes credit bureau reporting, contract printing, and ability to schedule monthly credit card payments. Refinancing or add-on sales too. Contact JCS for pricing of this custom module.

One year of support and updates are included. Continued support and updates cost 15% of the software price or $550, whichever is greater.

2.13 The Edge [2]

The Edge (http://theedgeforjewelers.com) retail jewellery store management system was built from the ground up as a solution for independent retail jewellers. It is arguably the easiest yet most technically advanced industry software product available. Currently installed in over 3,000 jewellery stores, The Edge is a truly modern Windows program built on Microsoft's .NET platform, and is compatible with Windows 8, Windows 7 and Windows XP both 32-bit and 64-bit versions. In addition, The Edge has achieved Microsoft Gold Certified Partner status, which allows us to access numerous benefits only available to preferred members of the Microsoft development community. We utilize these insider benefits to develop even more sophisticated jewellery retail software.

"The 2013 Big Survey" in INSTORE Magazine showed The Edge to be the clear market leader with five times the number of users as the number two software provider – and more than all other systems combined.

Our mission is to help independent retail jewellers become more profitable through the use of appropriate technologies and business methods. Let's profit together.

Features

- Pickup Alert
  This bright green button says that there are four items that can be picked up because they are ready (i.e. an appraisal or repair is finished or a special order has arrived). Clicking this button will enable the user to choose which items to deliver at this time.
- Why-In?
  This indicates what brought the customer into the store. In this case it is indicating they brought their 2013 Birthday Card in for the special offer it contained. Why-In is a great way to determine what advertising and media is working to attract customers to your store.
- Name & Address
  The name and address block contains pertinent information about the customer. You can see in the example that The Edge is reminding the user to obtain the customer's email address and also showing a couple of important dates in the customer's life. Note: The system can be set to show these events always or for just a period of time when they are relevant (i.e. three weeks before and after the event). The numbers at the bottom of the block represent the number of purchases, the dollar amount of those purchases, the number of service transactions, the total dollars spent with the store and the date they became a customer. This data is valuable for marketing and can come in handy at POS to know how valuable the customer has been to the store.
- Note Alert
  The bright green button signals that there is a note on this customer's record. Clicking the button reveals the note(s). The user can add new notes or modify existing notes as well as change customer contact info from this button.
- Sale Line
  This is a standard sale line. Scanning the barcode on the jewellery tag would create this line. If need be, four different discount methods (a percentage, a straight dollar amount, an adjusted price at retail or adjusted after tax in which case the appropriate recalculation of the tax is performed) are possible in the price block on the right of the line. Note the item menu button is green. It is signalling the user that this item has been pre-appraised and they can print the appraisal right now at time of purchase.

☐ Repair Take-in
A repair intake of an Amethyst Ring to be sized. The image was capture during take-in by integrated software. See repair envelope below.

☐ Layaway
A layaway of this diamond pendant. You can see the amount of deposit required in the tender box at the bottom of the screen. A layaway originates like any sale; just scan the barcode then click the layaway button while on that line in the POS screen. It is that easy.

☐ Special Order
A special order line. This line is a result of the user filling in the special order form that pops up for this purpose. When a special order item is received into inventory, The Edge identifies the customer to the entry person and the item is connected to that customer.

☐ Payment
To illustrate how easy it is to take payment, three methods have been used here, some cash, some by a check and the remainder by credit card.

- **Pricing**

  Basic version (Single Store, Single Workstation) – US $4600.
  Enterprise version (Single Store, Three Workstations) – US $5700.

2.2 Available technologies and tools

2.2.1 Visual Studio Express 2017[3]

Develop by Microsoft as integrated development environment which used to develop computer programmes and web sites, web applications and mobile applications is very popular object oriented system/software development tool. Visual studio includes tools such as code editor, integrated debugger, code profiler GUI development environment etc. which has become reasons for popularity of this tool.

Visual Studio supports 36 different programming languages and allows the code editor and debugger to support nearly any programming language and language specific services. Built-in languages include C, C++, C++/CLI, Visual Basic .NET, C#, etc.

Visual studio is very convenient tool to work with but to only licence version will enable the full capabilities of this tool.

2.2.2 PHP[4][5]

PHP could help to build simple, dynamic web applications. PHP is a general-purpose scripting language that is especially suited to server-side web development, in which case PHP generally runs on a web server. Any PHP code in a requested file is executed by the PHP runtime, usually to create dynamic web page content or dynamic images used on websites or elsewhere. It can also be used for command-line scripting and client-side graphical user interface (GUI) applications. PHP can be deployed on most web servers, many operating systems and platforms, and can be used with many relational database management systems (RDBMS). Most web hosting providers support PHP for use by their clients. It is available free of charge, and the PHP Group provides the complete source code for users to build, customize and extend for their own use.

Originally designed to create dynamic web pages, PHP now focuses mainly on server-side scripting, and it is similar to other server-side scripting languages that provide dynamic content from a web server to a client, such as Microsoft's ASP.NET, Sun Microsystems' Java Server Pages. PHP has also attracted the development of many software frameworks that provide building blocks and a design structure to promote rapid application development (RAD).

2.2.3 Microsoft SQL Server [6]

Microsoft SQL Server is a relational database management system (RDBMS) that supports a wide variety of transaction processing, business intelligence and analytics applications. SQL Server supports ANSI SQL, the standard SQL language. But SQL Server also contains T-SQL, Microsoft's own SQL implementation. SQL Server Management Studio is SQL Server's main interface tool, and it supports 32-bit and 64-bit environments.

SQL Server is offered in several editions with different feature set and pricing options to meet a variety of user needs, including the following:

Enterprise: Designed for large enterprises with complex data requirements, data warehousing and Web-enabled databases. Has all the features of SQL Server, and its license pricing is the most expensive.
Standard: Targeted toward small and medium organizations. Also supports e-commerce and data warehousing.
Workgroup: For small organizations. No size or user limits and may be used as the backend database for small Web servers or branch offices.
Express: Free for distribution. Has the fewest number of features and limits database size (10GB) and users. May be used as a replacement for an Access database.

The advanced security features supported in all editions of Microsoft SQL Server, Encryption: which lets user update encrypted data without having to decrypt it first. Row-level security: which enables data access to be controlled at the row level in database tables.
Dynamic data masking: which automatically hides elements of sensitive data from users without full access privileges.

2.24 MySQL [7]

The MySQL software delivers a very fast, multi-threaded, multi-user, and robust SQL database server. MySQL Server is intended for mission- critical, heavy-load production systems as well as for embedding into mass-deployed software. Oracle is a registered trademark of Oracle Corporation and/or its affiliates. MySQL is a trademark of Oracle Corporation.

The MySQL software is Dual Licensed. Users can choose to use the MySQL software as an Open Source product under the terms of the GNU General Public License [8] or can purchase a standard commercial license from Oracle. You can visit this link to look into further information on this subject (http://www.mysql.com/company/legal/licensing/).

- ☐ Written in C and C++ programming languages.
- ☐ Tested with a broad range of different compilers.
- ☐ Works on many different platforms.
- ☐ Uses multi-layered server design with independent modules.
- ☐ Designed to be fully multi-threaded using kernel threads, to easily use multiple CPUs if they are available.
- ☐ provides transactional and no transactional storage engines.
- ☐ Use very fast B-tree disk tables (MyISAM) with index compression.
- ☐ Designed to make it relatively easy to add other storage engines. This is useful if you want to provide an SQL interface for an in-house database.
- ☐ Use very fast thread-based memory allocation system.
- ☐ Execute very fast joins using an optimized nested-loop join.
- ☐ Implements in-memory hash tables, which are used as temporary tables.
- ☐ Implements SQL functions using a highly optimized class library that should be as fast as possible. Usually there is no memory allocation at all after query initialization.
- ☐ Provide server as a separate program for use in a client/server networked environment, and as a library that can be embedded (linked) into standalone applications. Such applications can be used in isolation or in environments where no network is available.

3. Analysis and Design methodologies

3.1 Analysis

System analysis very important stage of system development, unless the problem is identified correctly, correct solutions could not be developed. Therefore applying the correct methodologies is very important. Without accurate data been collected, developing the correct system will be impossible.

During the system analysis information that is mandatory to identify the problem domain is captured. Sometimes client will not provide accurate information unwillingly or willingly therefore various methods needed to be adopted to extract necessary information accurately.

Another important task during the analysis stage is verification on gathered information. Different individuals could have different perspective on the way the business is functioning, sometimes it may not be the most accurate way the things could be explained. Therefore it is mandatory that the information captured verified by more than single source.

Methods used to capture information;

Observation

Observation is one of the methods that is utilized to capture valuable data regarding how client's business behave, during observation analysis how the business function is observed, Observation is very good tool to capture business functionality very accurately.

During the initial stage observation was done to get better idea about flow of business, how things happen in the shop. Observation is helpful to get clear understanding on how the business is functioning. And to plan future activities such as to prepare to for interviews (what are the questions that will be asked, from which person this question need to be asked etc.) All the aspect of the business was observed. Duties carried out but each individual was observed.

Interview

On second stage interviews were carried out. Interview enables to find out tasks carried out by each individual. All the stake holders were interviewed including customers of the client. After the initial interview all captured information was documented and second round of interview was carried out to clear out grey areas. It is also recognized that educational background of employees. It is very important aspect when designing the user interfaces.

Reference: Annexure I Interview Transcripts with client and staff (Page 40)

Document inspection

Documents and reports (historical data) were inspected to get clear idea about type of data that needed to be captured. It is very important get a clear idea about what data to be captured and what are they used for later when analysing the captured data. During inspection of documents type of reports that the client require is discussed. Also what

data need to appear in the report and from where that information need to be captured for report.

Further to that several discussions was done on how the development and implementation will be carried out and brief on client type of changes going to occur and how it will benefit his business process and enhance out puts of employees.

Most important aspect of system analysis is to capture information accurately with minimum stress to stake holders.

3.2 Objectives

- Computerize possible manual process.
- Standardize process and procedures.
- Track transactions by employees.
- Reduce workload of employees.
- Automated report generation.
- Reduce operational costs.
- Eliminate Redundant processes.
- Improve the security of information.
- Backup and disaster recovery.

3.3 Findings

Clients' Expectation

- Increase efficiency of the organization with minimal increase of the number of employees enabling present employees to handle assigned work load effectively.
- Quicker and effective service to the customers.
- Proper maintenance of business critical information records and effective disaster recovery methods.
- Security for the information, access control.
- Automated report generation (Daily and periodical reports).
- Minimize manual operations to fullest possible.
- Proper backup and disaster recovery.

Employee's Expectation

- Eliminate redundant processes.
- Easy to operate.
- Easy to enter information.
- System generated reports.

Customer expectations

☐ Faster and efficient service.
☐ Faster and efficient feedback from employees.
☐ More reliability in order tracking.
☐ Proper invoice with correct details.

Gold Book

When an order is given to a craftsman to do a jewellery item client keep a record of the amount of gold that is given to particular craftsman. The gold book keeps track of the movement of gold and customer order details. It is very important that client keep track of this since once the customer place the order, those items should go immediately to craftsman, and Client verbally inform design, number of units and date which he need the item back to the craftsman. If these records are not properly maintained and monitored client will not be able to deliver ordered items to customers on promised date. And will not be able to track amount of gold that are with each craftsman.

☐ Name- Name of the craftsman that gold is given to no other identification are kept to uniquely identify one person from another.
☐ Date- Date which the order is given.
☐ Item-Description of the item
☐ NoU-Number of units from the item that need to be crafted
☐ Out-Amount of Gold given
☐ Rate- Rate that will be paid for craftsman recorded in LKR
☐ In- Weight of the items crafted (Amount of gold came in as jewellery item back from
☐ Craftsman and raw gold
☐ Wastage- Amount of gold that could not be recovered

Order Box

It contain jewellery items, there could be finished items also there could be items that came from gold craftsman which requires to be sent to polishing craftsman or to fix gem stones to gem craftsman.

Jewellery items that are crafted are kept in the order box until they are weighted, tagged and added to stock at end of each day or it will be sold if a customer(1) would like to purchase particular item from the order box. Sometimes such sold item could be done for an order from another customer in such case client will check the date the item/s needed to be delivered to customer, If there is enough time to prepare another item order new is given to craftsman immediately, Else the client will request customer(1) to place an order.

Stock

Stock is an important aspect of the business process, without the stock business will not properly function. Therefore it is very important to maintain stock records accurately. Stock is list of items that are in the shop. All the items in the shop should be in the stock, except for the items that arrived with in the day by different craftsman. There are several details that is recorded in order to make the process easier to the client.

Prior to any item is weighted, Details of the item is written in a tag and attached with the item. And those details are recorded in a sheet manually.

All the items are categorized according to below list,

- LR-Ladies Ring
- BR-Baby Ring
- NECBACK-Neckless Back Chain
- BAN-Bangles
- BRL-Bracelet
- CH-Chain
- CRO-Cross
- DES-Tussle
- GP-Gypsy
- . BGP-Barrel Gypsy
- GR-Gents Ring
- KR-Ear Ring
- LR-Ladies Ring
- MN-Money
- NEC-Neckless
- PAN
- PP-Pendant
- SP-SP Chain
- SURA-
- WR-Ladies Wedding Ring

At end of the each day staff to physical stock verification is carried out in order to make sure that all the records tally correctly.

Cash Book

Cash transactions occurred during the day is recorded in cash book, Transactions that could appear in cash book could be
- Customer paying cash for jewellery item.
- Cash given to someone/for some work.
- Cash given by another jewellery shop.
- Jewelleries are sold to another jewellery shop on cash.
- Cash loan given to a person/Staff member.

Credit Book

Credit transactions that occur is recorded in Credit Book. Transaction are,
- Customer buy jewellery on credit.
- Jewelleries are sold to another jewellery shop on credit basis.
- Customer pay for item but not the full invoice amount.

Order Book

Order Book is where all the details about orders are recorded here, Orders could come from customer or another jewellery shop. When the order is placed type of the item, design, weight of the item, date of delivery is recorded and estimated price is given, the actual price of the item could only be calculated after actual item is crafted, when calculating the cost of the item price of gold sovereign on the date order was placed is taken.

3.4 Areas Covered

3.4.1 Inventory control

Inventory control is also about knowing where all stock is and ensuring everything is accounted for at any given time. An inventory control system or a computerized inventory system is a process for managing and locating objects or materials. Many shops now use stock control systems. The term "stock control system" can be used to include various aspects of controlling the amount of stock on the shelves and in the stockroom and how reordering happens.

Typical features of stock control software include:
- Ensuring that the products in shop is in just the right quantity.
- Recognizing when a customer has bought a product.
- Automatically reordering stock at the appropriate time.
- Automatically producing management information reports that could be used for decision making. These might detail what has sold, how quickly and at what price, for example. Reports could be used to predict when to stock up on extra products, for example, during April, May, November & December or to make decisions about special offers, discontinuing products and so on. Sending reordering information to the client/employee (popup reorder notifications) will be generated by the system automatically upon given instructions.

Modern inventory control systems often rely upon barcodes and radio-frequency identification (RFID) tags to provide automatic identification of inventory objects. Inventory objects could include any kind of physical asset: merchandise, consumables, fixed assets, circulating tools, library books, or capital equipment. To record an inventory transaction, the system uses a barcode scanner or RFID reader to automatically identify the inventory object, and then collects additional information from the operators via fixed terminals, or mobile computers. The new trend in inventory management is to label inventory and assets with QR Code, and use smart-phones to keep track of inventory count and movement. These new systems are especially useful for clients operations, where an employee needs to record inventory transaction or look up inventory stock in the field, away from the computers and hand-held scanners. Client is looking forward to expand the capabilities like this in future.

Processes that need to be available are
- Add/Create item categories.
- Add/Create new item.
- GRN generation.
- Stock update.
- Stock reports.
- Update stock levels upon sale.

3.4.2 Sales

Software records each sale when it happens, so your inventory records are always up-to-date. When customer purchase an item client issue customer an invoice as proof to his purchase An invoice, bill is a commercial document issued by a seller to a buyer, relating to a sale transaction and indicating the products, quantities, and agreed prices for products the seller had provided the buyer.

System have the ability to pick up or capture customer details from and to database. Invoice will allow multiple methods for settlement, Invoice could be categorized as cash invoice, credit or order invoice. Even though it is called an cash invoice customer have the option to pay using various methods (Cash, credit card, by gold (gold could be raw gold or old jewellery item) etc.). Credit invoice is created when customer have full or part from the total amount to settle. Order invoice is where customer place an order for jewellery item(s), Sometime customer could pay portion from the estimated amount by cash, credit card or by gold (gold could be raw gold or old jewellery item), unlike other invoices order bill have date of delivery where it is supposed to be collected by the customer.

Invoice may contain:
- A unique reference number
- Date of the invoice
- Name and contact details of the seller
- Name and contact details of the buyer
- Date that the goods to be delivered (Order bills)
- Description of the product(s)
- Number of item(s)
- Unit price(s) of the product(s)
- Total amount charged
- Payment

Other important aspect of this module is reports. There reports enable client to track sales details with ease. It is important that client to have a pictures of days sales activities, These reports will be very important, at the end of the day when tallying all records, Reports and actual figures must depict same information.

3.4.3 Purchasing

Client could purchase raw gold as well as finished items, This module will help client to track such transaction. It is here where details about craftsman, other jewellery manufacturers are captured and recorded. Various details are kept reordered about craftsman/suppliers including
- Name & Address
- Contact details
- Amount of gold with supplier/Craftsman
- Date of Delivery

Purchasing will need to update stock levels in the system, Stock levels will increase upon a purchase. Therefore purchasing is very important aspect of the business function. Functions like invoices could not be created unless stocks are updated via purchasing. There are information that client need to track and generate reports from this module. These reports will play important role in the business.

3.4.4 Customer management

With the manual operations client did not had records about his client base. With introduction of the computerized system client will be able to capture all information related to customers,

Details that will be captured:
- Name of Customer
- Address
- Contact details
- Date of Birth

3.5 Issues of current process

1. Huge amount of time required to process data at end of each day on manual data entry and during the report preparation.
   Solution: Computerized system will automatically generate reports and any given time in matter of seconds, So huge amount of time spent of such tasks could be saved.

2. Loss of data and amount of space used to keep physical documents
   Solution: Schedules backups of database and system software could be put in place. Therefore disaster recovery should be an issue. With introduction of computerized system, need for the manual documentation will eliminate.

3. Tracking of records (inventory, order details, customer records, previous invoice details, etc.) is very time consuming and create confusions among employees and sometimes with customers.
   Solution: With computerized system any details can be located within matter of seconds.

4. Security of the information and unauthorized alterations
   Solution: User authentication will be carried out prior to access the system without username and password no one can logon to the system. Data encryption methodologies will be used when transferring data.

3.6 Work Flow
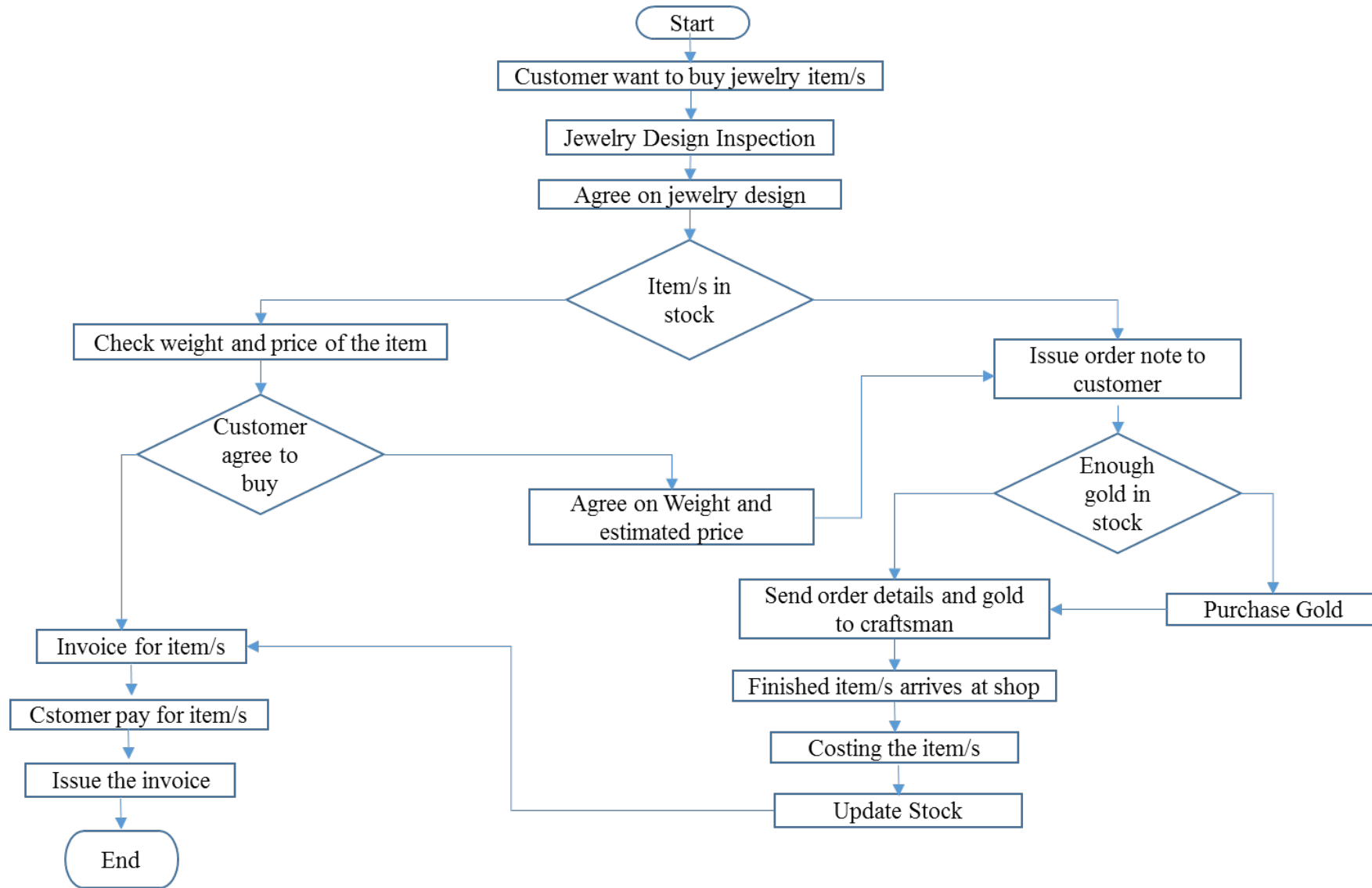
Figure 3.1 - Work Flow

3.7 ER Diagram
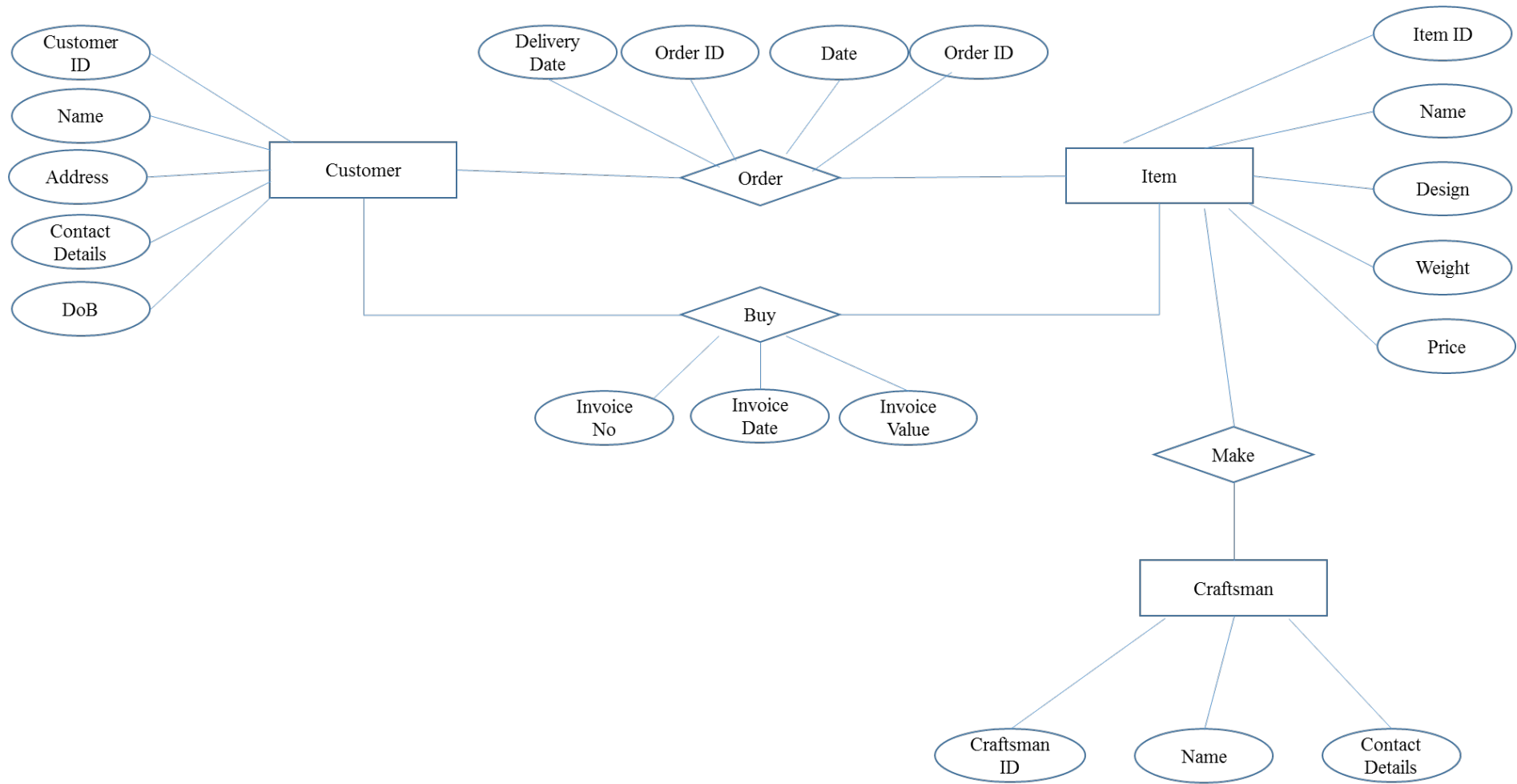
Figure 3.2 - ER Diagram

3.8 Use Case
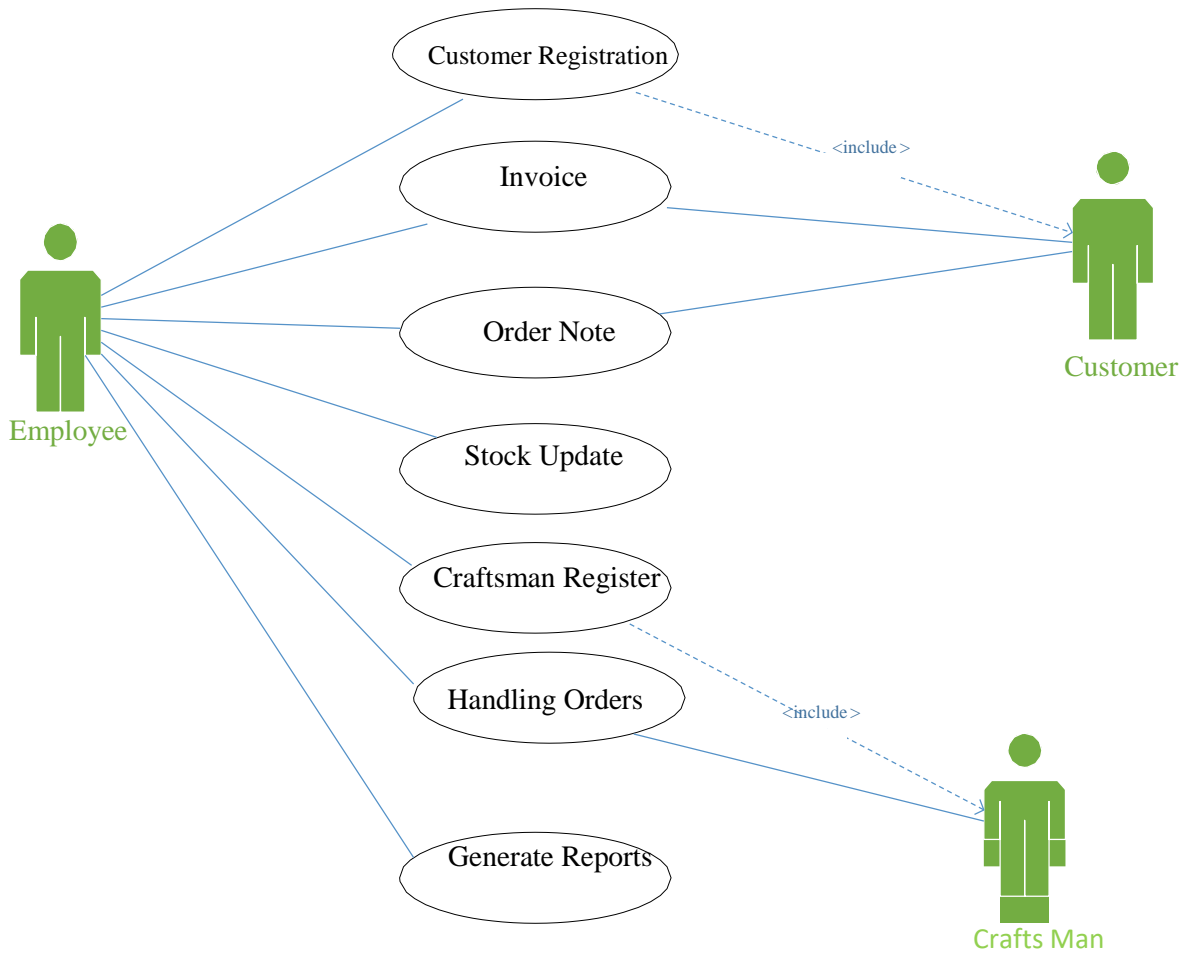
Figure 3.3 - Use Case diagram for Proposed System

3.8.1 Use Case: Customer Registration
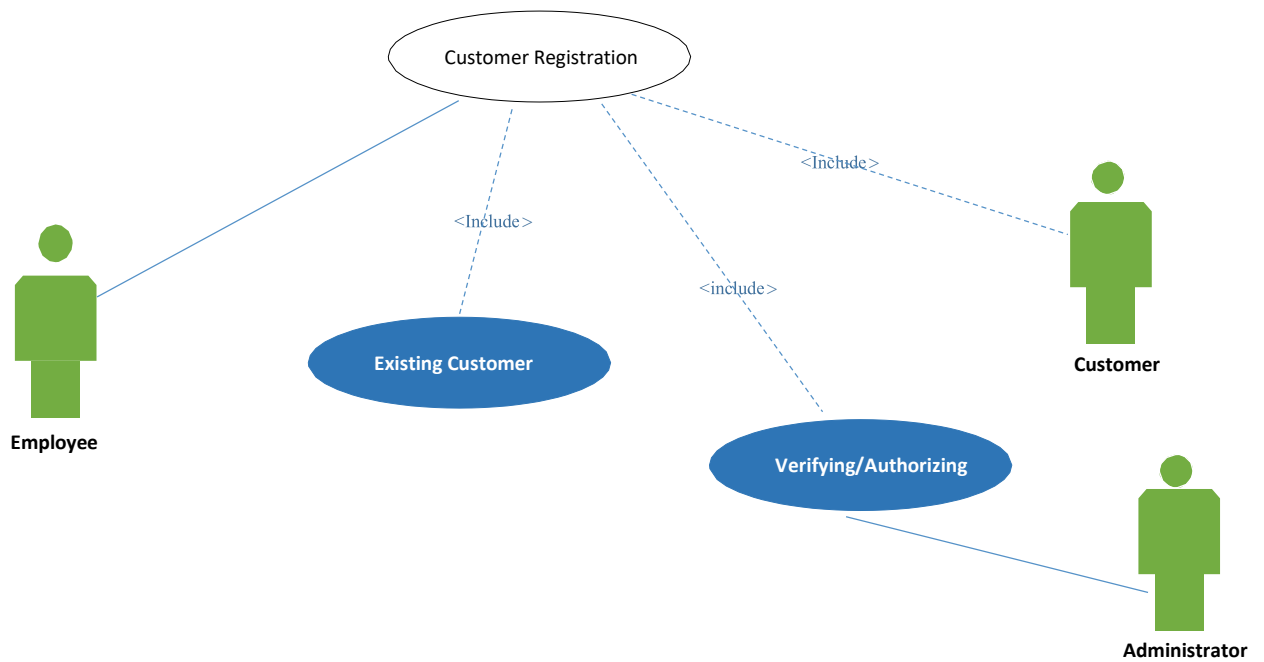
Figure 3.4 - Use Case: Customer Registration

Use Case	Customer Registration
User	Employee
Other Participators	Customer, Administrator
Description	Registering details of the customers into the system.
Details	Customer details are recorded prior to invoicing during the 1st visit of the customer, If the customer details are already in the system user can search for his record. Customer Name, Address, Phone Number, Contact Details, DoB are recorded.

Table 3.1 - Use Case: Customer Registration

3.8.2 Use Case: Invoicing
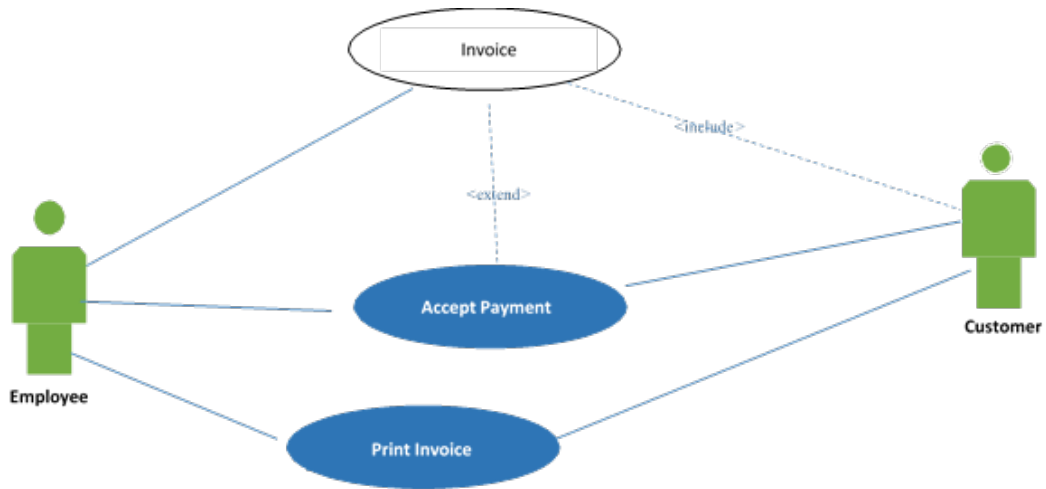
Figure 3.5 - Use Case: Invoicing

Use Case	Invoicing
User	Employee
Other Participators	Customer
Description	Issuing of invoice for the purchase by the customer
Details	Point where the sale of item will end, Customer details will be picked from customer table, Item details are entered, optionally discount could be provided and several settling methods will be available (Cash payment, credit cards, Part payment by raw god or old jewelleries, etc.)

Table 3.2 - Use Case: Invoicing

3.8.3 Use Case: Order Note
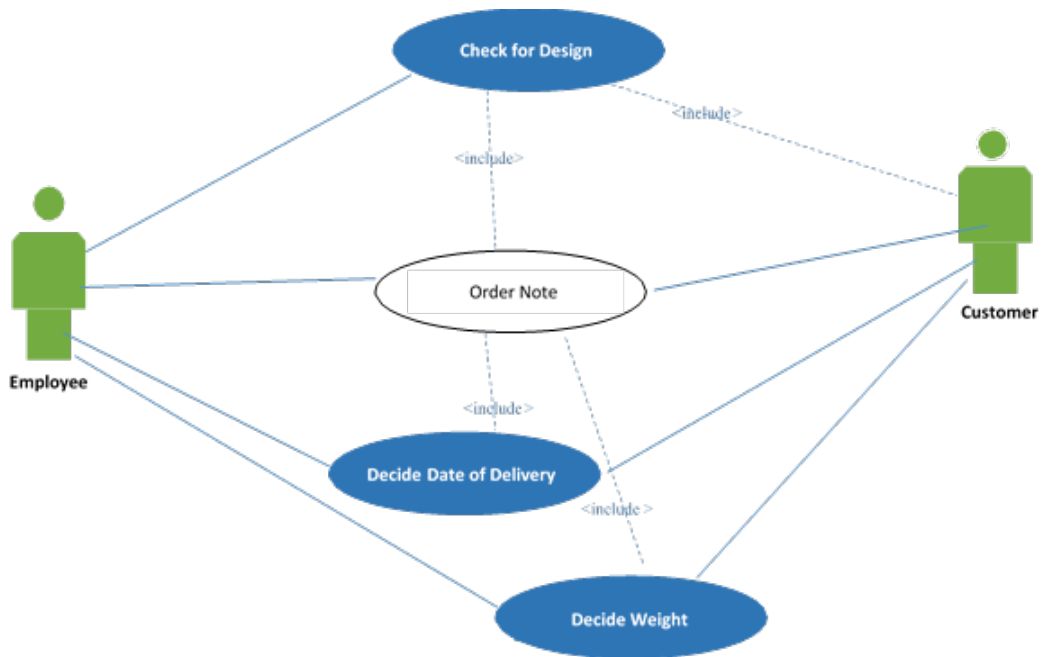
Figure 3.6 - Use Case: Order Note

Use Case	Order Note
User	Employee
Other Participators	Customer
Description	Customer wants to craft item specific size, weight and design as they prefer.
Details	When customer wants to craft item according to their own specifications, Order note will be issues to customer indicating all details.

Table 3.3 - Use Case: Order Note

3.8.4 Use Case: Stock Update
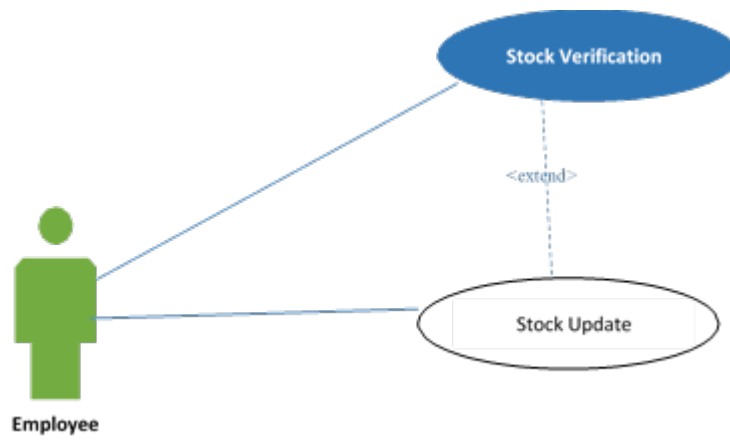
Figure 3.7 - Use Case: Stock Update

Use Case	Stock Update
User	Employee
Other Participators	
Description	Update stock levels
Details	When the Invoice is raised stock levels are reduced and when GRN is issued stock level will rise.

Table 3.4 - Use Case: Stock Update

3.8.5 Use Case: Craftsman Registration
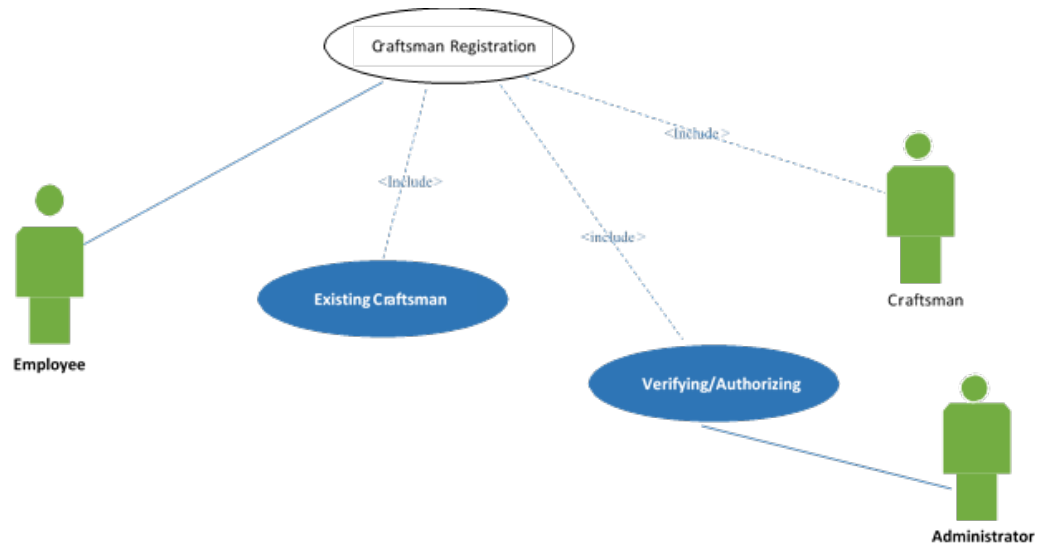
Figure 3.8 - Use Case: Craftsman Registration

Use Case	Craftsman Registration
User	Employee
Other Participators	Craftsman, Administrator
Description	Register details of craftsman
Details	Name, Address, Contact details, and other important details are captured.

Table 3.5 - Use Case: Craftsman Registration

3.8.6 Use Case: Order Handling
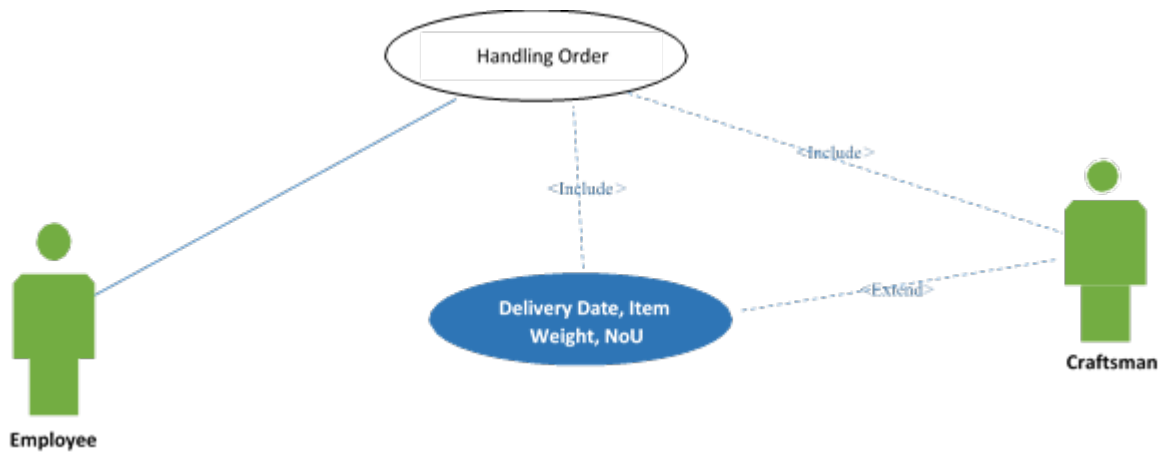
Use Case	Handling Order
User	Employee
Other Participators	Craftsman
Description	Specifications of the items are handed over to craftsman
Details	Weight of the item, design size, number of items and other necessary details will be given to craftsman to carry out work

Table 3.6 - Use Case: Order Handling

3.8.7 Use Case: Generate Reports

Figure 3.10 - Use Case: Generate Reports

Use Case	Generate Reports
User	Employee
Other Participators	
Description	Periodical reports that is essential will be generated
Details	Daily-Cash book, credit book, Gold Book Monthly-Stock Level, Sales, Debtors

Table 3.7 - Use Case: Generate Reports

3.9 Sequence Diagram

Figure 3.11 - Sequence Diagram

4. Implementation

4.1 Reasons for selecting PHP over other web development languages

Why Choose PHP Over Other Web Development Languages? Developers can opt from many scripting languages while developing web applications. Some of the programming languages that developers or programmers utilize in common are CGI, Perl, ASP and PHP. Conversely, PHP has definite benefits the reason for which it has become the most accepted web development language. IT firms ranging from medium sized to big are using PHP for creating multiple types of web applications. One can realize the competence of the language from the fact that huge applications like Facebook utilize PHP. Web developers having knowledge and experience in PHP are in soaring demand in the current times. Developers are choosing PHP over the other languages due to the subsequent reasons. Easy to Learn and Uncomplicated the language is quite easier to understand than many other programming languages. This is because the language has resemblance with languages like Java and C. Even if you know only HTML, learning PHP would be quite easy for you. The language is perfect for beginners since it is easy to understand and clear. Flexibility PHP offers a higher level of flexibility as compared to languages like ASP. NET in addition the language is open source software you can use any text editor to write the code. Some of the common text editors which you can utilize are Notepad, TeXShop, WordPad so on and so forth. Alternatively, while using ASP. NET, you have to utilize Microsoft Visual Studio for creating the code. PHP is also not OS specific and quite portable as it runs well on operating systems like Windows, UNIX and Linux OS. Dynamic the language creates dynamic websites which refresh automatically. If you use PHP for developing a website, you do not need to make any alterations or updates manually for refreshing it. Web Integration The language has created more than thirty percent of the applications present in the internet. The PHP language processor integrates with various systems like Pusher. Nearly every business is using the language including large corporations, government, hospitals and banks.

Frameworks you can find a great number of PHP frameworks. These frameworks help you to take out a mixture of tasks using PHP. You can perform tasks like code reuse, session management and finding database libraries easily using PHP frameworks. A popular PHP framework is Slim. Support In addition the support and documentation for PHP is quite easy. The support forums which aid the language are completely free. You can find many blogs and forums online to help you if you face any coding issues. You can also find support through social media among all scripting languages the user base of PHP is huge. This is one of the causes behind such a huge support community of the language. Easy to Resolve Challenges Web developers face programming challenges very often. In case of PHP, you can easily find the issues and fix them. In case of other languages it takes quite an effort to fix those problems. Object Oriented Programming the PHP language is competent of calling Windows and Java COM objects. You can also create custom classes which other classes can have access to from custom classes. This increases the effectiveness of the language. These

are the major benefits of PHP over other scripting languages. Above and beyond, the language is an open source and free. Applications developed using PHP are very rapid and have a high level of security. All these factors have made the language highly well-liked in the word of web development.

4.2 MySQL

Here are some of MySQL's finer points. Each of the attributes discussed below can be used to describe other products, but put together, these features make MySQL an interesting and unique piece of software.

It's fast
MySQL is undeniably quick. It is a true multi-threaded database server that excels at retrieving information. MySQL was originally designed for the purpose of querying information at an amazingly fast pace.

This design introduced some disadvantages that made MySQL a poor choice for some people. A database is used for two basic actions: inserting/modifying data and querying (requesting information) from existing data. The creators of MySQL opted for an architecture that sacrificed some speed in the insert/modifying process to gain speed during queries. So if you were developing a database application in 1999 and you foresaw your application dealing with a lot of inserting and modifying of data, MySQL would have been a poor choice. However, MySQL now offers many configuration options that give you the choice of extreme speed in queries at times when heavy inserts are not expected, or you can opt for options that work better while inserting/modifying data.

Just how fast is MySQL compared to the competition? It's very, very difficult to say. Benchmarking of database servers is very tricky business. The only real way to gauge comparative speed is to do a straight-up comparison with another product using the same hardware and the same code. So without giving numbers, which are easily disputable, I'll say what is generally believed: MySQL is fast, and you'll just have to believe that.

It's relatively easy to use
If you work in a Fortune 1000 business, there's an excellent chance that at many places in your organization, some developers are using a recent version of Oracle. You can be sure that the person in charge of the database went through extensive training and/or went to school to learn how to properly maintain this large and very complex database system.

MySQL doesn't offer much of the power of Oracle, but if you don't need all of the features Oracle offers and most don't), you'll find it far, far easier to get your database and related applications up and running with MySQL. In fact, I believe that this book and the online manual may be all that you need to be a very competent user and administrator of MySQL.

It's widely used

MySQL is growing in popularity. If you're looking to develop a MySQL-powered Web site, you'll have little difficulty finding an ISP that supports MySQL. Additionally, when you run into problems, you will be able to go to one of the many MySQL support forums to get expert troubleshooting advice.

It's open source

MySQL is an open-source product released under the GPL (GNU Public License). At this point, many independent developers work on the code without any monetary compensation because they get great satisfaction from their efforts. In addition, at least two companies (MySQL AB and NuSphere) offer commercial support for MySQL.

With open-source software, the base code is available to any who wants to see and alter it. So if you happen to be a sophisticated C programmer, you are welcome to add your own enhancements.

If you go the open-source route with MySQL, you will find many products that complement your MySQL database server. A Web server and scripting language are used to create dynamic sites. In the open-source space, Apache is a well-known and well-respected Web server. As far as scripting languages go, Perl and PHP are two very popular open-source languages that are often used with MySQL. When combined, these open-source developer tools make for a powerful development environment. This is especially true of Web-based applications.

4.3 Minimum Hardware/System requirement.

User Computers
  Processor: Single physical CPU, but multiple cores allowable
  Random Access Memory (RAM): 1 GB

Hosting Plans
  Domain
  24/7 Technical Support
  Bandwidth for 5 concurrent users
  Periodical Backups

4.4 PHP MVC Model

4.4.1 Controllers

Controller represents the classes connecting the model and the view, and is used to communicate between classes in the model and view. Controllers respond to user actions (clicking on a link, submitting a form etc.). Controllers are classes that extend the Core\Controller class.

Controllers are stored in the App/Controllers folder. A sample Home controller included. Controller classes need to be in the App/Controllers namespace. You can add subdirectories to organize your controllers, so when adding a route for these controllers you need to specify the namespace.

Controller classes contain methods that are the actions. To create an action, add the Action suffix to the method name. For example Controller "Person" will be called when user select the "stakeholder" option from main menu and within the controller it will request "person" view to load where user will be displayed with graphical form containing labels, text/text boxes etc.

Figure 4.1 - Screen Shot: Person Controller

4.4.2 Models

Model represents the underlying, logical structure of data in a software application and the high-level class associated with it. This object model does not contain any information about the user interface.

Models are used to get and store data in your application. They know nothing about how this data is to be presented in the views. Models extend the Core\Model class and use PDO to access the database. They're stored in the App/Models folder.

All the data requirement for the Person view is provided by the "Person_Model", it interact with the MySQL database and extract the data that the view require.
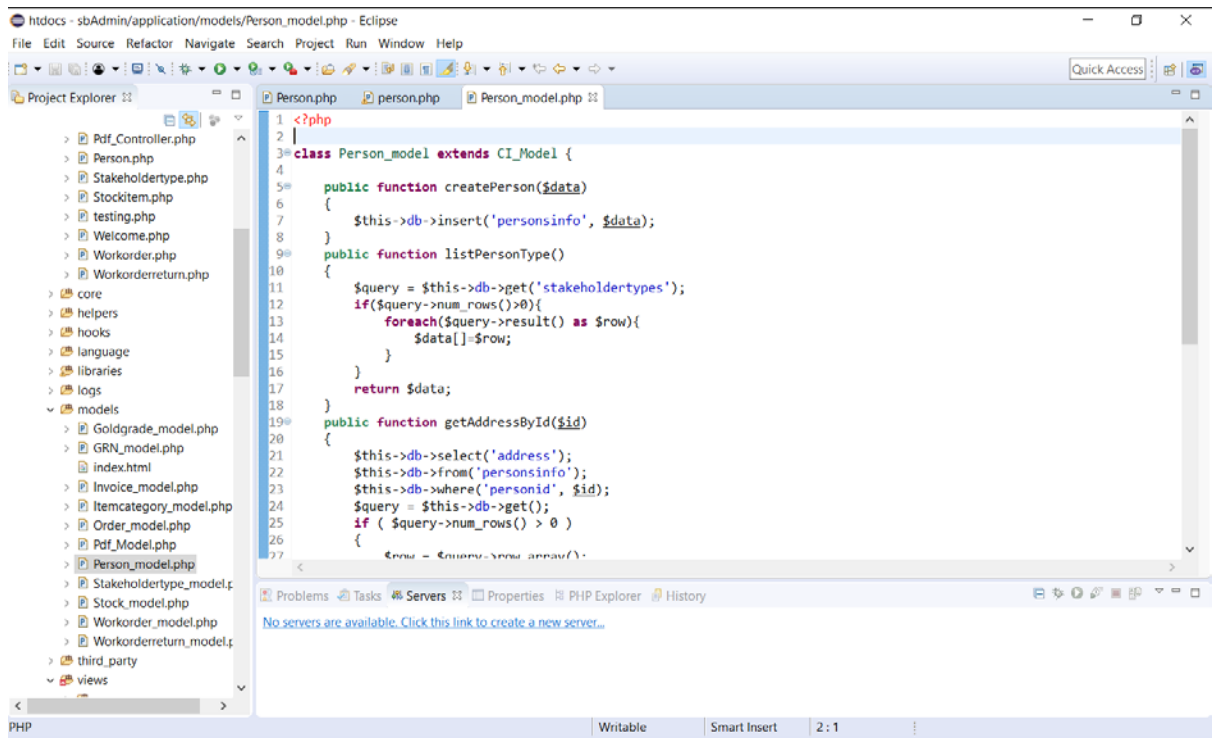
Figure 4.2 - Screen Shot: Person Model

4.4.3 Views

View is a collection of classes representing the elements in the user interface (all of the things the user can see and respond to on the screen, such as buttons, display boxes, and so forth).Views are used to display information (normally HTML). View files go in the App/Views folder. Views can be in one of two formats: standard PHP, but with just enough PHP to show the data. No database access or anything like that should occur in a view file. You can render a standard PHP view in a controller, optionally passing in variables.
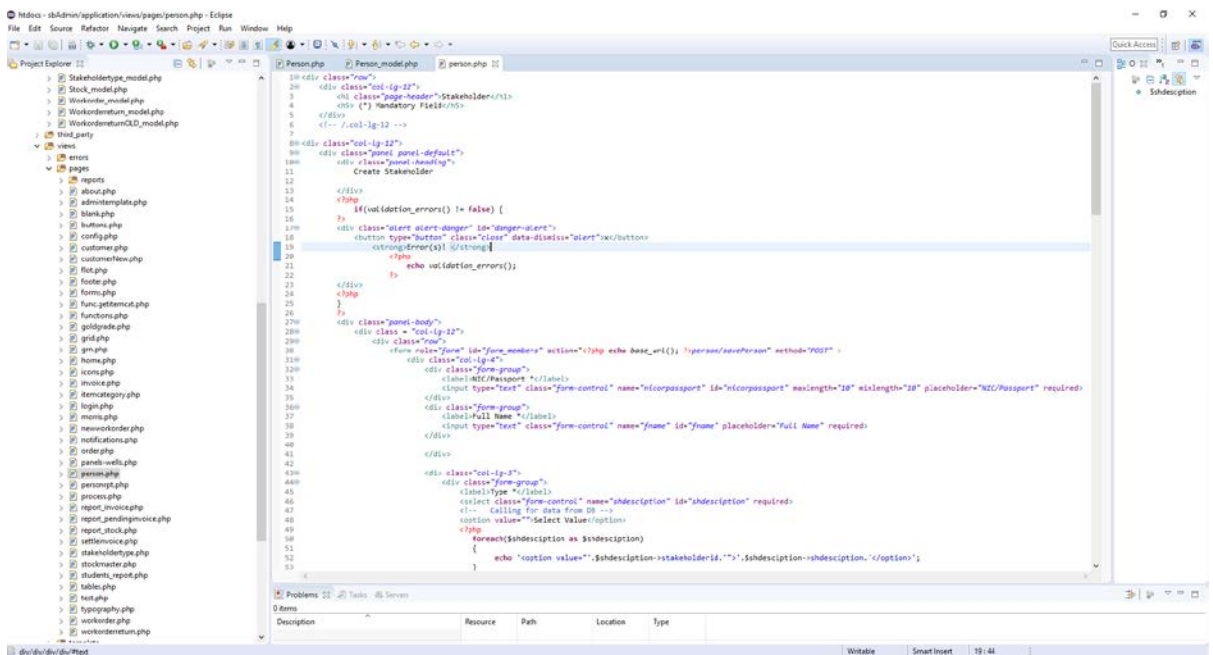
Figure 4.3 - Screen Shot: Person View

4.5 Screen Shots

Figure 4.4 - Screen Shot: Stakeholder

Stakeholder could be any person involved with business transaction. Client want to record primary information like Name, NIC/Passport No, DoB, Address, Telephone Number and Email.

Figure 4.5 - Screen Shot: Stakeholder Type

Stakeholders are categorized into different categories, this form is used to create categories as customer prefer. Stakeholders are categorized as pre client's preference. Categories are created using this form.

Stock Item

Figure 4.6 - Screen Shot: Stock Item

Data related to a stock item is captured by this form. All the date that are requited in relation to a stock item are captured by this form

Figure 4.7 - Screen Shot: Item Category

Stock item is categorized according to industry standards. (see stock under page-20) Client make you of this form to create categories as required.

Invoice

Invoice Number	Invoice Number
Invoice Date	2018/Apr/01
Order No	Order No
Name of Customer	Susitha ▼
Address of Customer	.
Last Name of Customer	.N/A

Add Row Delete Row

	Item Name	Gold Weight	No of Unit(s)	Rate	Value
☐ 1					

Total

Discount	**VAT**	**NBT**	**Invoice Total**
Discount	VAT	NBT	Invoice Total

Settlement

Cash Payment	**Card Payment**	**Cheque Payment**	**Other Payments**
Cash Payment	Card Payment	Cheque Payment	Other Payments

Balance
Invoice Balance

Submit Data Reset Form

Figure 4.8 - Screen Shot: Invoice

Invoice is issued to customer when item/s purchased. Data is recalled from Stakeholder table, Stock table.

Figure 4.9 - Screen Shot: Order Form

Order is raised when customer want to have design that client does not have in his stock or when the particular item/s are out of stock.

Figure 4.10 - Screen Shot: Work Order

Work order is where items in the order is allocated to a craftsman.

Return Work Order

Figure 4.11 - Screen Shot: Return Work Order

When craftsman deliver item/s to the client its recorded using Return Work Order form.

5. Test Strategy

5.1 Test Objectives

The objective of the test is to verify that the functionality of the application, works according to the specifications. The test will execute and verify the every aspects of the application by detecting errors in the application and fix them enabling client to achieve expected outputs described on initial chapters of this document.

5.2 Test Assumptions

Key Assumptions

- Production like data required and be available in the system prior to start of Functional Testing

General

- Exploratory Testing would be carried out once the build is ready for testing
- All the defects to be appropriately documented in details for later correction
- All necessary inputs required during Test design and execution will be supported by client.
- Client will review all Test cases prepared prior to start of Test execution
- The system will be treated as a black box; if the information shows correctly online and in the reports, it will be assumed that the database is working properly.

Functional Testing
- During Functional testing, testing team will use preloaded data which is available on the system at the time of execution

UAT

- UAT test execution will be performed by end users.

5.3 Test Principles

- Testing will be focused on meeting the business objectives, cost efficiency, and quality.
- Testing processes will be well defined, yet flexible, with the ability to change as needed.
- Testing activities will build upon previous stages to avoid redundancy or duplication of effort.
- Testing environment and data will emulate a production environment as much as possible.
- Testing will be a repeatable, quantifiable, and measurable activity.

Data Approach

- In functional testing, application will contain pre-loaded test data and which is used for testing activities.

5.4 Scope and Levels of Testing

5.4.1 Exploratory

PURPOSE: the purpose of this test is to make sure critical defects are removed before the parallel run which will be carried out by client and staff.

SCOPE: Every module of the application

TESTERS: client and staff members under guidance of the developer.

METHOD: this exploratory testing is carried out in the application without any test scripts and documentation

5.4.2 Functional Test

PURPOSE: Functional testing will be performed to check the functions of application. The functional testing is carried out by feeding the input and validates the output (Reports etc.) from the application.

TESTERS: client and staff members under guidance of the developer

METHOD: The test will be performed according to Functional scripts.

TEST ACCEPTANCE CRITERIA
1. Approved Functional Specification document, Use case documents must be available prior to start of Test design phase.
2. Test cases approved prior to start of Test execution
3. Development completed, unit tested with pass status and results shared with client.
4. Test environment with application installed, configured and ready to use state

READINESS
Development completed & unit tested
Application deployed and system ready for testing on Test environment
Production like data is available to test all functionalities.
Defect fixes planned based on Defect triage (Unit Testing) and evaluation criteria.

5.4.3 User Acceptance Test (UAT)

PURPOSE: this test focuses on validating the business logic. It allows the end users to complete one final review of the system prior to deployment.

TESTERS: the UAT is performed by the end users.

METHOD: Since the business users are the most indicated to provide input around business needs and how the system adapts to them, it may happen that the users do some validation not contained in the scripts. Test team write the UAT test cases based on the inputs from End users.

TIMING: After all other levels of testing (Exploratory and Functional) are done. Only after this test is completed the product can be released.

PRIOR to UAT
- Business Requirements must be available
- Application Code should be fully developed
- System Testing should be completed
- No Show stoppers, or High or Medium defects in the System
- Only Cosmetic errors are acceptable before UAT
- Regression Testing should be completed with no major defects
- All the reported defects should be fixed and tested
- UAT Environment must be ready

5.4.4 UAT Results Analysis
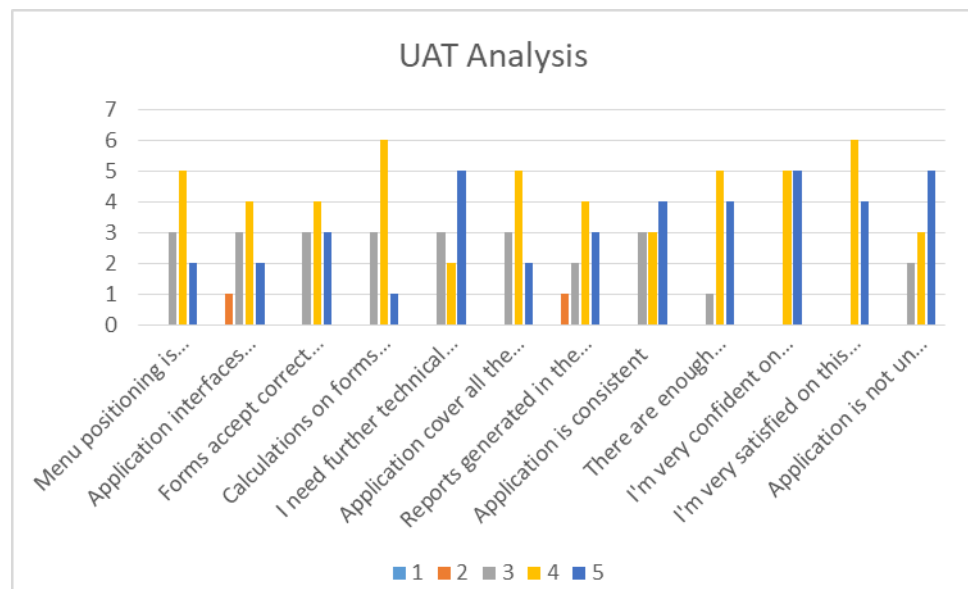
Figure 5.1 - UAT Analysis Bar Chart

It could be agreed that the satisfactory level of the users on functionality and aesthetics has been achieved.
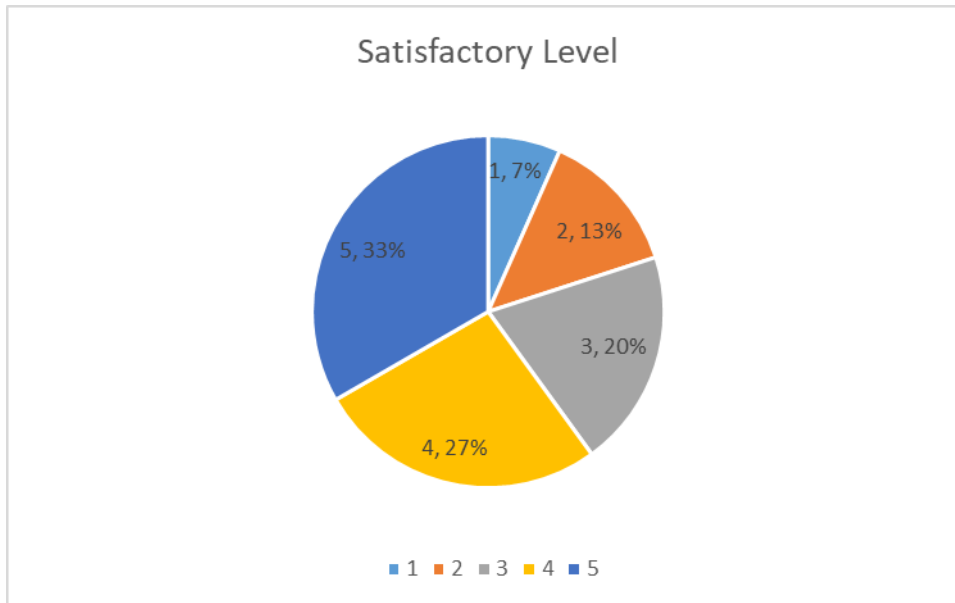
Figure 5.2 - UAT Analysis Pie Chart

System users have shown their willingness to use this system and it can be concluded that users confident over the system.

5.4.5 System test plan and outputs

A test case is a document, which has a set of test data, preconditions, expected results and post conditions developed for a particular test scenario in order to verify compliance against a specific requirement. Test case acts as the starting point for the test execution and after applying a set of input values, the application has a definitive outcome and leave the system at some end point or also known as execution post condition. (Refer Annexure V).

6. Conclusion and Future Work

6.1 Conclusion

Client has come across to the stage where he have to focus more on introducing more innovative was to provide solutions to his customers. Due to the manual system client have to spend lot of time to track his business rather than focusing on development of the business.

Proposed system will provide client a trusted companion to track his business and streamline the processes in this business. Also control the information flow preventing unauthorized people from accessing the data.

I believe that the solution will provided client the freedom that he was looking forward to enabling client to focus more on expanding and providing innovative solutions for his clients more effectively and efficiently.

6.2 Future Work

This system was developed with very limited time period, therefore only client's basic requirements are fulfilled. Many different adaptations, tests, and experiments have been left for the future due to lack of time. Future work concerns deeper analysis of particular mechanisms, new proposals to try different methods.

- Introduce Radio Frequency Barcoding tracking system.
- Develop Pawning module.
- Online Sales module.

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Annexure I

<u>**Interview Transcripts with client and staff**</u>

Interview with Mr.Sanjaya Yahathugoda

Explaining the flow of the business,

Customer come in to the shop looking for jewellery item/s, some people what to buy from existing stock, there are two places where jewelleries are kept. Firstly the stock, where most of the items are recorded in. Items in the stock are weighted, tagged with item code and weight. All these details are recorded in a excel document. Secondly the Order Box where items crafted are kept, Also jewellery items that are given in as exchange for another also kept. Some of the items in the Order Box could be work in progress (WIP). WIP items could be items that are finished by gold craftsman and pending gem stone work or need polishing to be done. Sometimes customer could buy from either of these places.

If the customer wants to get a design as pre their preference, they can choose any design from available albums or they can get help from designers of Anuradha jewellers or their own design. Order will be placed with the design and the estimated weight and price of the item and date of delivery. And an order invoice will be issued to the customer.

For order invoice or cash invoice there are several methods of payment, some customers exchange old jewelleries or raw gold which are checked for purity of gold and weight and price will be offered for the item, If customer is willing to accept it they can pay rest be paid by cash, cheque, credit card etc. Sometimes customers may request for credit. In such case according to the relationship/mutual understanding with the customer, jewelleries will be sold as credit.

Sometimes customer may want to buy item that are done as per an order, in such case client will check the date the item is due to be collected by the customer if there are enough time to another item to be crafted if so customer can purchase the item else order will be placed.

When the stock level comes to certain point or when customer order an item to be crafted design details are sent to the craftsman with the weight of the item and date to handover crafted items. Amount of gold given to the craftsman are recorded against their name for tracking purposes.

Apart from the individual craftsman some items are purchased from other vendors. Also some customers come to sell raw gold that they have same procedures are followed in these occasions.

All cash that come in and goes out are recorded in cash book. Cash could come in as payment for jewellery, loan taken by some person, cash that given by a person/vendor/jewellery business owner (which that person owe for item that he bought or took as loan) to be given to another person (whom could fallen into one of same categories as mention previously). Money could

go out in many forms. As pavement for things that needed for business to function (stationaries, utility bill payment, etc.), as payment for jewelleries or gold purchased etc.

Other than the regular customers they sell items to other jewellery shops also, these could be bulk sale or single item. And client also buy items from other jewellery sellers.

Interview with Mr.Sunil Santha

- Manual system difficult to track.
- Anyone can misuse information, document.
- No way to track misuses.
- Have to spend lots of time to track details.
- Stock tallying at end of day takes very long time and effort.

Interview with Mr.Ashoka Jayasinghe

- Difficult to determine stock levels.
- Difficult to track orders.
- Difficulties in calculating amount of gold with craftsman.
- Difficult to track order details.
- Difficult track credit details.

Annexure II (Blank Invoice)

Figure 9.1 – Manual Invoice (Blank)

Annexure III (Written Invoice-Credit)

Figure 10.1 - Credit Invoice

Annexure IV (Order Bill)

Figure 11.1 - Order Note

Annexure V (Test Plan)

Test Cases

S/N	Scenario	Test Step	Expected Result
Access Control			
1.1		correct user name and wrong password used	Display Error saying "Invalid credentials used check you have used correct user name and password"
1.2		Wrong user name and correct password used	Display Error saying "Invalid credentials used check you have used correct user name and password"
1.3	Logging to system.	Wrong user name and password used	Display Error saying "Invalid credentials used check you have used correct user name and password"
1.4		Correct user name and password used	User needs to be directed to main screen
1.5		Either user name or password or both fields are empty	Display Error saying "Neither fields cannot be empty"
1.6	Logging to system.	Log off button press	User redirected to log in screen
Adding of new person to the system			
2.1		Numeric character used in either "First Name" , "Last Name"	Error will be given upon submitting and redirected to same form.
2.2	Checking correct type of data is used in fields	Non numerical character in ZIP code, Telephone and Mobile number fields	Error will be given upon submitting and redirected to same form.
2.3		E-Mail filed with incorrect format	Error will be given upon submitting and redirected to same form.
2.4	Mandatory data availability	First Name, Last Name, Gender, DoB, Type, Address, City are mandatory fields, test carried out with either one or more field kept blank	Error will be given upon submitting and redirected to same form.
Adding Gold Grade			
3.1	Checking correct type of data is used in fields	Both Gold grade and Gold purity fields with non-numerical characters	Error will be given upon submitting and redirected to same form.
3.2		Both Gold grade and Gold purity fields with numerical characters	Data tables need to be updated accordingly.

S/N	Scenario	Test Step	Expected Result
3.3	Fields kept blank	Test either or both Gold grade or/and Gold purity fields blank or not	Error will be given upon submitting and redirected to same form.
Adding Item Category			
4.1	Checking correct type of data is used in fields	Fields Item category and Category description with numerical values	Error will be given upon submitting and redirected to same form.
4.2		Fields Item category and Category description with alphabetical characters	Data tables need to be updated accordingly.
4.3	Fields kept blank	Test either or both Item category or/and Category Description fields blank or not	Error will be given upon submitting and redirected to same form.
Adding new stock item			
5.1	Checking correct type of data is used in fields	Item name filed with numerical values	Error will be given upon submitting and redirected to same form.
5.2		Allor either filed(s) under "Gold/Stone Details" and "cost details" with Alphabetical characters	Error will be given upon submitting and redirected to same form.
5.3	Mandatory data availability	Item Code, Item Category, Item Name, Gold Grade, Weight of item, Gold weight and Labour cost are mandatory fields, test carried with either one or more field kept blank	Error will be given upon submitting and redirected to same form.
Invoicing			
6.1	Checking correct type of data is used in fields	Gold Weight, No of units, Discount, Cash Payment, Card Payment, Cheque Payment fields must contain numerical values	Error will be given upon submitting and redirected to same form.
6.2		Check values in Invoice value, cash Payment, Card Payment, Cheque Payment, Balance	Invoice value should be equal to cash Payment + Card Payment+ Cheque Payment + Balance
6.3	Availability of Data in mandatory fields	Mandatory fields are Item Name, Gold Weight, No of units, value, if one or any of these fields are not available	Error will be given upon submitting and redirected to same form.
6.4	loading order data from Database	select the order no and check correct data is loaded	when order no is selected details of customer need to be populated
6.5	Accuracy of system calculated values	Values in Item Cost, NBT, VAT, Invoice value, Balance fields are system calculated	According to no of items and their value system should generate correct values and

S/N	Scenario	Test Step	Expected Result
			display it in corresponding field.
Generate Order			
7.1	Checking correct type of data is used in fields	Check Gold Weight, No of units, Discount, Cash Payment, Card Payment, Cheque Payment fields contain correct values	Gold Weight, No of units, Discount, Cash Payment, Card Payment, Cheque Payment fields must contain numerical values
7.2	Mandatory data availability	Customer Name, Address, Date of Delivery, Item Name, weight and gold grade no of units are mandatory fields Testing the form with any of the filed without data and save	Error will be given upon submitting and redirected to same form.
7.3	Save data in DB	If all filed are correctly filled	Data tables need to be updated accordingly.
Issue Work Order			
8.1	Mandatory data availability	check either one or more out of Order no, Name of the crafts man, Item Name weight gold grade no of Units and delivery date columns are empty or not	Error will be given upon submitting and redirected to same form.
8.2	Data from database loading	select order and craftsman	Data from database need to populate said fields upon selecting appropriate option
8.3	Correct figure is shown in Gold required field	check values in weight, no of units and gold requirement fields	Gold requirement =sum of (Weight* No of units)
Order Receive			
9.1	Loading work order data from database	search and select the work order no	When a work order is selected appropriate fields will be populated
Data Saving			
10.1	Writing data	Check each form when submit button is pressed data in the form need to saved	Data should be written to correct table
Information in Reports			
11.1	Accuracy of reports	Check each reports with manual transactions	Reports need to be tally with manual reports

Table 0.1 - Test Cases

Test Output

S/N	Scenario	Test Step	Expected Result	Pass/Fail
Access Control				
1.1		correct user name and wrong password used	Display Error saying "Invalid credentials used check you have used correct user name and password"	PASS
1.2		Wrong user name and correct password used	Display Error saying "Invalid credentials used check you have used correct user name and password"	PASS
1.3	Logging to system.	Wrong user name and password used	Display Error saying "Invalid credentials used check you have used correct user name and password"	PASS
1.4		Correct user name and password used	User needs to be directed to main screen	PASS
1.5		Either user name or password or both fields are empty	Display Error saying "Neither fields cannot be empty"	PASS
1.6	Logging to system.	Log off button press	User redirected to log in screen	PASS
Adding of new person to the system				
2.1		Numeric character used in either "First Name" , "Last Name"	Error will be given upon submitting and redirected to same form.	PASS
2.2	Checking correct type of data is used in fields	Non numerical character in ZIP code, Telephone and Mobile number fields	Error will be given upon submitting and redirected to same form.	PASS
2.3		E-Mail filed with incorrect format	Error will be given upon submitting and redirected to same form.	PASS
2.4	Mandatory data availability	First Name, Last Name, Gender, DoB, Type, Address, City are mandatory fields, test carried out with either one or more field kept blank	Error will be given upon submitting and redirected to same form.	PASS
Adding Gold Grade				
3.1	Checking correct type of data is used in fields	Both Gold grade and Gold purity fields with non-numerical characters	Error will be given upon submitting and redirected to same form.	PASS
3.2		Both Gold grade and Gold purity fields with numerical characters	Data tables need to update accordingly.	PASS
3.3	Fields kept blank	Test either or both Gold grade or/and Gold purity fields blank or not	Error will be given upon submitting and redirected to same form.	PASS
Adding Item Category				
4.1	Checking	Fields Item category and	Error will be given upon submitting	

S/N	Scenario	Test Step	Expected Result	Pass/Fail
	correct type of data is used in fields	Category description with numerical values	and redirected to same form.	PASS
4.2		Fields Item category and Category description with alphabetical characters	Data tables need to e updated accordingly.	PASS
4.3	Fields kept blank	Test either or both Item category or/and Category Description fields blank or not	Error will be given upon submitting and redirected to same form.	PASS
Adding new stock item				
5.1	Checking correct type of data is used in fields	Item name filed with numerical values	Error will be given upon submitting and redirected to same form.	PASS
5.2		Allor either filed(s) under "Gold/Stone Details" and "cost details" with Alphabetical characters	Error will be given upon submitting and redirected to same form.	PASS
5.3	Mandatory data availability	Item Code, Item Category, Item Name, Gold Grade, Weight of item, Gold weight and Labor cost are mandatory fields, test carried with either one or more field kept blank	Error will be given upon submitting and redirected to same form.	PASS
Invoicing				
6.1	Checking correct type of data is used in fields	Gold Weight, No of units, Discount, Cash Payment, Card Payment, Cheque Payment fields must contain numerical values	Error will be given upon submitting and redirected to same form.	PASS
6.2		Check values in Invoice value, cash Payment, Card Payment, Cheque Payment, Balance	Invoice value should be equal to cash Payment + Card Payment+ Cheque Payment + Balance	PASS
6.3	Availability of Data in mandatory fields	Mandatory fields are Item Name, Gold Weight, No of units, value, if one or any of these fields are not available	Error will be given upon submitting and redirected to same form.	PASS
6.4	loading order data from Database	select the order no and check correct data is loaded	when order no is selected details of customer need to be populated	PASS
6.5	Accuracy of system calculated	Values in Item Cost, NBT, VAT, Invoice value, Balance fields are	According to no of items and their value system should generate correct values and display it in corresponding	PASS

S/N	Scenario	Test Step	Expected Result	Pass/Fail
	values	system calculated	field.	
Generate Order				
7.1	Checking correct type of data is used in fields	Check Gold Weight, No of units, Discount, Cash Payment, Card Payment, Cheque Payment fields contain correct values	Gold Weight, No of units, Discount, Cash Payment, Card Payment, Cheque Payment fields must contain numerical values	PASS
7.2	Mandatory data availability	Customer Name, Address, Date of Delivery, Item Name, weight and gold grade no of units are mandatory fields Testing the form with any of the filed without data and save	Error will be given upon submitting and redirected to same form.	PASS
7.3	Save data in DB	If all filed are correctly filled	Data tables need to be updated accordingly.	PASS
Issue Work Order				
8.1	Mandatory data availability	check either one or more out of Order no, Name of the crafts man, Item Name weight gold grade no of Units and delivery date columns are empty or not	Error will be given upon submitting and redirected to same form.	PASS
8.2	Data from database loading	select order and craftsman	Data from database need to populate said fields upon selecting appropriate option	PASS
8.3	Correct figure is shown in Gold required field	check values in weight, no of units and gold requirement fields	Gold requirement =sum of (Weight* No of units)	PASS
Order Receive				
9.1	Loading work order data from database	search and select the work order no	When a work order is selected appropriate fields will be populated	PASS
Data Saving				
10.1	Writing data	Check each form when submit button is pressed data in the form need to saved	Data should be written to correct table	PASS
Information in Reports				
11.1	Accuracy of reports	Check each reports with manual transactions	Reports need to be tally with manual reports	PASS

Table 0.2 - Test Outputs

Annexure VI (User Acceptance Testing (UAT))

(1) Name (Optional): ………………………………………………………………………

(2) Date: ………………

* Please rate your opinion with 1 to 5 as per below rating

☹ Strongly Disgree - 1 ☹ Disagree - 2 😐 Neither Agree nor Disagree - 3 🙂 Agree - 4 😊 Strongly Agree -5

		1	2	3	4	5
1.0	Menu positioning is appropriate					
2.0	Application interfaces are user friendly					
2.1	Mention where you need further assistance					
3.0	Forms accept correct types/ranges of data					
3.1	Mention where you need further assistance					
4.0	Calculations on forms are accurate					
4.1	Mention where you need further assistance					
5.0	I need further technical advice to use the system					
5.1	Mention where you need further assistance					
6.0	Application cover all the functionality that I need					
6.1	Mention where you need further assistance					
7.0	Reports generated in the system are accurate					
	Mention where you need further assistance					
8.0	Application is consistent					
9.0	There are enough guidance provided to use each form					
9.1	Mention where you need further assistance					
10.0	I'm very confident on this application					
11.0	I'm very satisfied on this application					
12.0	Application is not un necessarily complex					

Figure 0.1 - UAT Format

Annexure VII (UAT Feedback)

Respondent: Jayani Madushika an Employee

(1) Name (Optional): ..... කසුනි මධුෂිකා ....

(2) Date: 10/06/2018

* Please rate your opinion with 1 to 5 as per below rating

☹ Strongly Disgree - 1 😐 Disagree - 2 😐 Neither Agree nor Disagree - 3 🙂 Agree - 4 😊 Strongly Agree -5

Table 1: UAT

		1	2	3	4	5
1.0	Menu positioning is appropriate				✓	
2.0	Application interfaces are user friendly				✓	
2.1	Mention where you need further assistance					
3.0	Forms accept correct types/ranges of data			✓		
3.1	Mention where you need further assistance					
4.0	Calculations on forms are accurate				✓	
4.1	Mention where you need further assistance					
5.0	I need further technical advice to use the system				✓	
5.1	Mention where you need further assistance					
6.0	Application cover all the functionality that I need				✓	
6.1	Mention where you need further assistance					
7.0	Reports generated in the system are accurate				✓	
	Mention where you need further assistance					
8.0	Application is consistent					✓
9.0	There are enough guidance provided to use each form					✓
9.1	Mention where you need further assistance					
10.	I'm very confident on this application					✓
11.	I'm very satisfied on this application			✓		
12.	Application is not un necessarily complex					✓

Figure 0.1 - UAT Feedback by Jayani Madhushika

Respondent: Maheshika Karunarathne an Employee

(1) Name (Optional): .... (handwritten) ....

(2) Date: 10 - 06 - 2018

* Please rate your opinion with 1 to 5 as per below rating

☹ Strongly Disgree - 1　☹ Disagree - 2　☺ Neither Agree nor Disagree - 3　☺ Agree - 4　☺ Strongly Agree - 5

Table 1: UAT

		1	2	3	4	5
1.0	Menu positioning is appropriate				X	
2.0	Application interfaces are user friendly				X	
2.1	Mention where you need further assistance					
3.0	Forms accept correct types/ranges of data				X	
3.1	Mention where you need further assistance					
4.0	Calculations on forms are accurate				X	
4.1	Mention where you need further assistance					
5.0	I need further technical advice to use the system					X
5.1	Mention where you need further assistance					
6.0	Application cover all the functionality that I need				X	
6.1	Mention where you need further assistance					
7.0	Reports generated in the system are accurate				X	
	Mention where you need further assistance					
8.0	Application is consistent			X		
9.0	There are enough guidance provided to use each form					
9.1	Mention where you need further assistance					
10.	I'm very confident on this application				X	
11.	I'm very satisfied on this application				X	
12.	Application is not un necessarily complex				X	

Figure 0.2 - UAT Feedback by Maheshika Karunarathne

Respondent: Sunil Santha Shop Manager

(1) Name (Optional): ....

(2) Date: .10./.06/.208....

* Please rate your opinion with 1 to 5 as per below rating

☹ Strongly Disagree - 1 ☹ Disagree - 2 ☺ Neither Agree nor Disagree - 3 ☺ Agree - 4 ☺ Strongly Agree - 5

Table 1: UAT

		1	2	3	4	5
1.0	Menu positioning is appropriate					✓
2.0	Application interfaces are user friendly				✓	
2.1	Mention where you need further assistance					
3.0	Forms accept correct types/ranges of data				✓	
3.1	Mention where you need further assistance					
4.0	Calculations on forms are accurate					✓
4.1	Mention where you need further assistance					
5.0	I need further technical advice to use the system					✓
5.1	Mention where you need further assistance					
6.0	Application cover all the functionality that I need				✓	
6.1	Mention where you need further assistance					
7.0	Reports generated in the system are accurate					✓
	Mention where you need further assistance					
8.0	Application is consistent					✓
9.0	There are enough guidance provided to use each form					✓
9.1	Mention where you need further assistance					
10.	I'm very confident on this application				✓	
11.	I'm very satisfied on this application					✓
12.	Application is not un necessarily complex				✓	

Figure 0.3- UAT Feedback by Sunil Santha

-----END-----