

Web based Solution for Right Automobile Service Center

**R.M.T.N Rathnayake
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Web based Solution for Right Automobile Service Center

**A dissertation submitted for the Degree of Master of
Information Technology**

**R.M.T.N Rathnayake
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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.

Student Name: Thilina Nuwan Rathnayake

Registration Number: 2014/MIT/052

Index Number: 14550524

Signature:

Date:

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

Mr./Ms.

Under my supervision. The thesis has been prepared according to the format stipulated and is of acceptable standard.

Certified by:

Supervisor Name:

Signature:

Date:

Abstract

Right Automobile and Services is a newly established Automobile Service Center owned by Mr. Ranjan Pathirage. Currently, there are 20 qualified Technicians in the workforce who are undertaking all types of vehicles services.

Right Automobile and Services provides numerous automobile services to the customer's door step. If the customer is busy, he/she can request Right Automobile and Services to visit their home/ location and take their vehicle to the service center and bring the vehicle back after the service is completed. If it is a minor repair, they are capable of providing the service at the customer's location. In addition, a customer can leave the vehicle at the service center.

All these operations are managed manually by the staff and the standard of the procedures are not up to the expectation of the management.

All records are managed using different paper based manual processes and they are not centralized and interconnected. Information is duplicated in many places and maintaining records are problematic and a waste of time as well. Organization is expected to move forward with the new Software based solution targeting best services for their customers and a boost for their sales and productivity.

One of the main problems which identified during the analysis stage is unorganized system process and how it should be interconnected and in-line with future system.

It is expected that the proposed system solution will cover all these analyzed issues and it is strongly believed that the workflow and responsibility sharing mechanism must be included in to this centralized web based solution.

Proposed System will be adapted to simplify the open source features. Basically this is runs on the Code igniter framework by following MVC architecture in PHP and MySQL environment.

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List of Abbreviations

PHP - Hypertext Preprocessor

ERD - Entity Relationship Diagram

UML - Unified Modeling Language

CHAPTER 1: INTRODUCTION

1.1 Brief Introduction to Right Automobile and Services

Right Automobile and Services is a newly established Automobile Service Center owned by Mr. Ranjan Pathirage. Mr. Pathirage is a German Tech Qualified Automobile Expert who's holding more than 10 years of experience in the industry including 5 years in overseas.

At Present, there are 20 qualified Technicians in the workforce who are undertaking all types of vehicles services. There Currently Right Automobile and Service Solution house is located near the Pitakotte junction.

1.2 About Servicing of Motor Vehicles

Servicing of motor vehicles can be categorized in to several packages which involves a series of manual or automated or manual & automated procedures/processes. There are new vehicles and used vehicles. There are service intervals specified for new vehicles as per the manufacturers' service schedule. The completed services of vehicles are recorded in the service book provided by the manufacturer; and for a vehicle which doesn't have a service book will be given a card to paste or hang in the vehicle. A service need of a vehicle is mostly decided by the vehicle owner, not the service Centre. There are some service categories such as full service, body wash only, body wash and interior cleaning, interior cleaning only, Oil change only, grease only, grease and oil change only, minor repairs, major repairs, etc. A detail description is given in item 1.4

1.3 Workflow of Servicing a Vehicle

The most common service is "Full Service" which is a combination of different service categories/items. Service items/categories such as cleaning (exterior and interior), body wash (full, underbody, engine), engine tune-up, cut and polish, tire and battery services. There are separate "service bays" assigned for each or combination of services. Each Service bay furnished with modern equipment.

Combination of these services can be taken as a Full Service but some of the vehicles are in for one or few service items such as Engine Tune-up, brake liners change, oil change only, or body wash only.

Vehicles which arrive at the service center are queued according to the arriving order but sometimes vehicles which are queued only for selected services will be placed out of the queue depending on the availability of slots. Vehicles are forwarded to several service points until all the sub services are completed. There are some services which requires an order of transferring from one service to another such as from exterior cleaning to interior cleaning and then to body wash.

The service Centre has all the materials in stock which are used for vehicle services. The suppliers visit the service station to supply most of the items and they provide those on cash or credit basis. When the stock is reducing, the service Centre should inform the supplier or purchase the goods from outside parties. The service center owner/manager should have a record to maintain the stock level regularly. The commonly used materials are oil filters, brake pads, oil, etc. Sometimes, the materials are brought by the customer. In such cases, only the labour charges and cost of any other materials used will be charged. Customers request different brands depending on the price or brand loyalty.

Final bill is calculated combining all the services, materials used and labour charges; if necessary, discount can be granted on manager's approval.

1.5 Current information Flow

All processes are done manually and the paper works are handled by the supervisor and the cashier. Each service engineer will receive a job card for the jobs assigned. The job card includes the type of work that should be done by the engineer. After the completion of service, the supervisor attaches a paper note with the job card. At the end of each job/service, the paper notes used by the supervisor, job card issued to engineer and the material issued notes are sent to the cashier to prepare the invoice. Discounts will be provided based on the final bill if the service centre owner approves /recommends. At present, there is no requirement to be met to provide any discounts. Hence, discounts can be given by the owner as and when he likes. Once the full payment is done, the vehicle will be released to the customer. The following information flows can be identified.

1. Paper note used by supervisor
2. Job card issued to the engineer
3. Issuing notes by store keeper
4. Discounts recommended by the of owner
5. Material price details and other charges assigned by the supervisor

Income will be calculated daily basis and entered to the log book by the cashier for audit purposes. There is no way to maintain the service details and the detail income figures. The material stock is maintained manually and the store keeper maintains all the records in a book. He has to regularly look at each material to analyze the reordering levels.

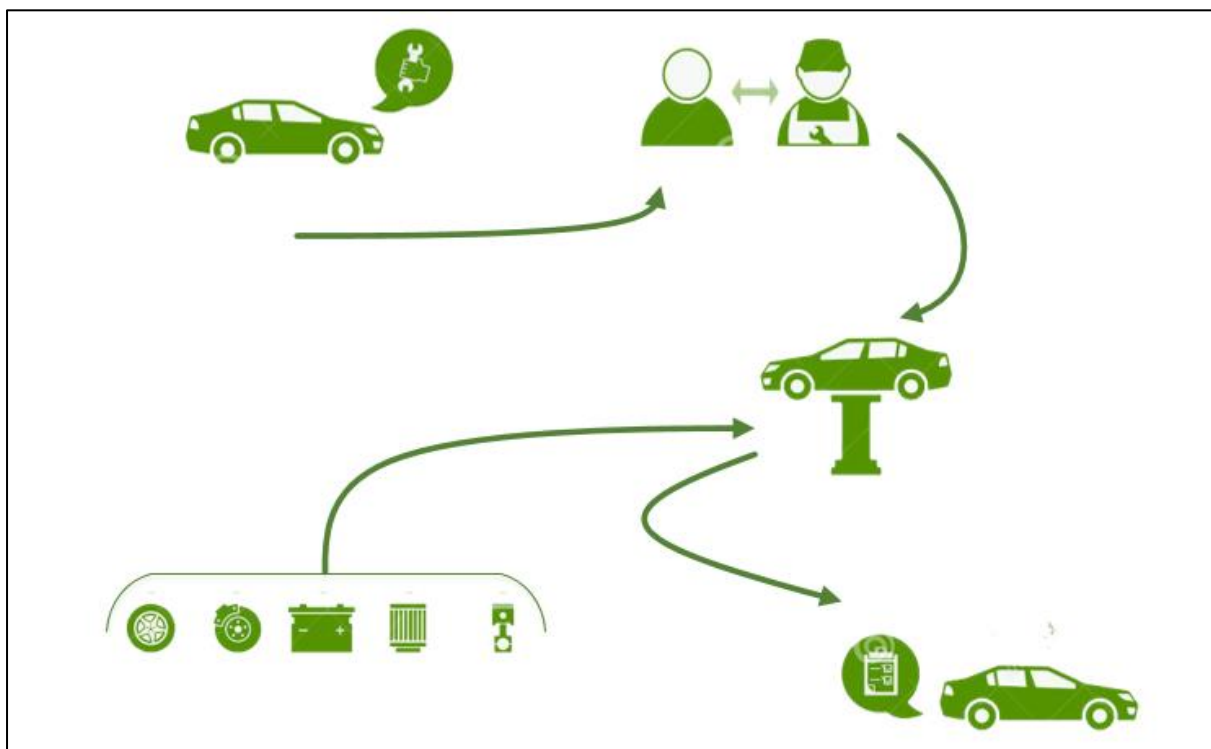


Figure 1 - Current Information Flow

1.6 Objectives

The main objectives of the project can be summarized as follows;

- To align manual operations and maintain an easy record system.
- To expand the client base and enhance client satisfaction level by providing flexible services even at their door step.
- To increase Sales, Performance and Profits
- To manage Resources and avoid unnecessary stock items delay
- To eliminate quality problems of Service Items
- Real time reporting
- To reduce heavy workload for engineers

1.7 Project Scope

This project involves creating a web based software solution to systemize the manual operations which are related to service center operations and also to provide flexible services to the customers via web.

The project scope can be divided into two aspects as;

- a) Customers Services and
- b) Right Auto Operations.

Customer Services

Doorstep Services

Customers can book doorstep services which provides by Right Auto as online services. As an example, a customer can request Right Auto to do the following;

Service the vehicle at the customer's location

When a customer request/book to service the vehicle at their location through the website, an engineer will visit the place and provide the required services.

Right Auto to collect the vehicle from the customer's location

Customers can request/book via website to come and collect their vehicles from a particular location and to deliver it after the service is completed.

Leaving the vehicle at the service premises

Customer can park the vehicle at the service Centre and go. Thereafter, engineers will be taking the vehicle back to customer's location.

Requesting and paying for above mentioned services will be done via the website. Charges will be auto calculated from the system and the payment can be done via website and also at the customers' location after the delivery of the vehicle. The service engineer's details (Name, NIC, Photo, etc.) will be sent through a SMS or an email to the customer for verification purpose. Therefore, Right Auto can assure the security of customers' vehicles. Providing above services will be much convenient for busy customers who have limited time to spend for vehicle service requirements.

Vehicle History/records and other related information

History of the vehicles serviced at Right Auto will be recorded in the system and the customers can view details via website once they logged-in through their user login.

Basic charges for services will also be displayed to customers when they book a particular service through the website. However, the total charge/cost of the service will be calculated by engineers after inspection. The total cost will be informed to a customer via email/SMS.

Discounts provided to a customer by the manager of the Right Auto will be deducted and shown to the customer in the web login. Frequently visiting customers will be provided a fixed discount on condition basis when the bill is calculated. These types of requirements will be managed through the system and displayed to the front end (customer) and to the back end (Right Auto)

Greetings and awareness campaigns

The above will cater all stakeholders a homely feeling where the system will be utilized to send birthday greetings. Email bulk sending will also be catered but the guaranteed delivery of each email message will not be within the scope of the project.

The promotions offered by Right Auto will be notified to the customers via SMS and Emails. As an example, the Right Auto can assign seasonal discounts for all the customers. Once it is fixed to the system, the discount will be automatically deducted from the total bill amount

Right Auto operations

Customer Registration and handling

All customer related information will be captured through the system. The information will be used to forecast sales and expenses. The management will have the ability for on demand reporting where they can drill down from sales to expenses. Furthermore, a mechanism will be included to build up relationships with the clients and remind them of the next service date.

Vehicle Registration and handling

Vehicle information is captured to ascertain the types of vehicles to give discounts & to promote business. The scope will cater in generating a report of frequency based on the vehicle brand to service station.

Registration and handling of Service Items

The inventory management module will be used to store the items in the service center. Items will be serially numbered and the reorder level will be defined per item. The system will check the reorder level and if the reorder level is reached, a user/set of users will be informed via email of the current threshold. It is considered as out of scope to repeatedly inform when the product count is set to zero. The service item cost including the profit margin will be saved in the system and the total price of the items will be taken while invoicing.

Recording Income

System will calculate the total income for the day, profit for the day, number of services done, number of items used, etc. Summary of this information can be filtered as per date range basis. Income received from the customers also will be saved in the system where it can identify the best customers who have paid more to Right Auto.

Job details of the working staff

System will save job records of the engineers and the earnings received to Right Auto. Staff details will be fed to the system. When a member of staff /engineer is assigned to a vehicle/job, his details also can be viewed by the customer. System will provide reports on the basis of job completed by each engineer. Based on the work capacity more than one engineer can be assigned to a job.

Dashboard

Summary of the income, profit, number of services done, items availability, reorder information and standard prices of the services will be displayed on the dashboard for the Right Auto management to take decisions.

1.8 Structure of the Thesis

This thesis includes six main chapters and each chapter describes steps that are carried out to complete the information management system according to the stated goals. Structure of the thesis is as follows.

CHAPTER 02 – BACKGROUND/ LITERATURE REVIEW

This chapter of the thesis describes current business needs, critical review of similar systems available (open source and proprietary) and technologies available and relevant implementation have been discussed.

CHAPTER 03 – ANALYSIS AND DESIGN/ METHODOLOGY

Analysis and Design chapter describes user's requirements which are expected to accomplish through the system, techniques that are used to gather the requirements and System design based on user requirements. Functional and non-functional requirements are pointed out and illustrated at the abstract level. Use case diagrams show how the users interact with the system. UML diagrams are used to design the system behavior and system states. Some of diagrams and screenshots are illustrated in this chapter.

CHAPTER 04 – IMPLEMENTATION

System implementation is the conversion of design specifications into a real world physical system. This chapter describes the way the database and programs are technically implemented.

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. Thus, the unit testing, integration testing, system testing and acceptance testing are shown on this section.

CHAPTER 06 – CONCLUSION AND FUTURE WORK

This chapter of the thesis describes the overall summary of achievements, future enhancements and the conclusion.

CHAPTER 2: BACKGROUND/ LITERATURE REVIEW

2.1 Background

Right Automobile and Services provides any type of automobile services up to the customers door step. If the customer is busy, he/she can request Right Automobile and Services to visit their home/ location and take their vehicle to the service center and bring back home after the service is completed. If it is a minor repair, they are capable of providing the service at the customer's location. In addition to that, the customer can leave the vehicle at the service premises and go, thereafter, Right Automobile technicians will bring the vehicle to the customer's location. The main concern raised by the management is their needness to cater business to the client's door step.

Based on the customers' feedback and the experience of the staff members the management of the Right automobile services has decided to overcome their issues by moving in to a web based new System.

Furthermore, the management feel that the organization lags behind in managing the invoicing of clients where they believe a radical change is needed to uplift the revenue stream. Currently all invoicing is done manually and old records are archived. Through the manual system the management is not able to make key decisions instantly as the sources of information is not readily available for them.

Moreover, Right Automobile Services is not able to quantify the quality of the given services to its customers and the growth of the client base has dropped from 15.6% to 10.2% over a period of 90 days. Surveys prove the root cause for this as the poor operational service quality.

The company also faces an inventory shortage problem as there is no real time monitoring of the stock. There is no reorder mechanism and the stores department is unable to produce a report of inventory items on demand. The management also feel the need of a mobile friendly solution. It is identified that the era of a mobile platform is essential to keep a float with disruptive technologies. The presence in social media is also minute and ordinary awareness campaigns had not yield the potential reach of the targeted audience.

2.2 Similar Systems in Use

There are different types of Vehicle Service Management systems available as commercial products. Most of the available products target the foreign market. In Sri Lanka, -most of the service centres undertake tasks related to services and they are hesitant to handle the minor repairs. In foreign markets, servicing of vehicles is often carried out and vehicle repairs and servicing of vehicles are considered as a single business. Functionality wise it's too complex and the cost incurred for such a product will be high. This chapter describes the advantages and disadvantages of existing similar systems.

Some examples for such software are:

- ELVA DMS - Vehicle Service Management System [1].
- AutoSoftOnline [2].
- Garage Partner [3].

ELVA DMS - Vehicle Service Management System is one of the most popular automotive software commonly used by USA based countries, it provides a desktop based solution for medium type of automotive businesses. ELVA DMS basically depends on Microsoft platform and have been developed using Microsoft Navision ERP [1].

Features in ELVA DMS:

- Financial Management
- Inventory Management
- CRM
- Service Management
- Mobile Device Compatible
- BI
- Service Packages
- Service Scheduling (planning)
- Service History
- Service Work Warranty
- Insurance Financial Management
- External Service Management

CHAPTER 3: ANALYSIS AND DESIGN/ METHODOLOGY

3.1 Introduction

This chapter is discussed the planning the development of information systems through understanding and specifying in detail what a system should do and how the components of the system should be implemented and work together. System analysts solve business problems through analyzing the requirements of information systems and designing such systems by applying analysis and design techniques.

3.2 System Analysis

During the analysis stage, it determines the end-user requirements. Often this is done with the assistance of client focus groups, which provide an explanation of their needs and what their expectations are for the finished product and how it will perform. Data gathering for the system analysis is conducted by interviews, small questionnaires, and observation of staff and inspection of manual documents. Data gathering completed in different methods were very much useful to identify the problems and shortcomings of current processes and to find the ways of optimizing the work processes to define a new system.

3.2.1 Requirement Analysis Methods - Interview

Interviews are selected as a primary tool for requirement analysis stage. At the initial round of Interviews, User groups are identified. Other interviews are conducted according to their job specifications. Intention of these Interviews was to understand different user profiles and to know the tasks which each employee carries out to accomplish their day today goals. These were also helpful to identify how they expect the new system to ease their workload. Organization Processes and bottlenecks are also addressed at this stage.

3.2.2 Identified User Group

During the Requirement analysis following five user groups were identified,

User Group	Primary Task
Vehicle Owner/Customer	Online Booking, Services Request
Manager	Organizing Online Bookings, Manual Bookings
Supervisor	Supervising Service Points
Cashier	Billing
Storekeeper	Managing Store

Table 1- User Groups and their primary task

Customer's Expectation (difficulties faced by the customer)

- Customers have to fill a form in each visit prior to the required service.
- There is no possibility to check past records
- Customer has to spend more time to get the service done
- Due to the handwritten manual bills information is not clear enough to prove to outside/inside parties.
- Inadequate communication from the service centre.eg:.holidays, extended hours etc....
- Promotional details are not communicated in a timely manner.

Management's Expectation

- Increase efficiency of the organization with minimal increase of staff because they believe current staff is capable of handling a better work load if the information flow is properly organized
- Fast processing of vehicle
- Proper maintenance of records about organization's Customers, Vehicles and details about Services performed
- Ability to generate reports on historical data
- Get rid of unorganized paper based record keeping system

- Improve the process of “doors step” services
- Increase/improve the customer base and their attraction by
 - Providing more online services,
 - Promotions through the system,
 - maintenance of customer details, etc.

Supervisor’s Expectation

- Capturing the customer's request on a note paper often gets miscommunicated and ends up in arguments.
- More often supervisors have to reach clients several times to clarify their requirements. Properly organized and detailed system to capture customer requests is needed
- The system which is in place to track the progress of a service job is not productive
- Service supervisor who initiated a job needs to follow the same vehicle until it completes all of its requested services
- Since a single supervisor manages several vehicles at a time, they have to walk around a significant distance within the service station premises of which they will feel as they are very exhausted/uncomfortable.
- A supervisor needs to walk to Cashier counter for each vehicle that completes the service, in order to hand over the service details to cashier.

Scorekeeper’s Expectation

- Store keeper needs to maintain records of issued materials for many vehicles at the same time. With the current hand-written note system it's a very difficult task.
- Storekeeper has to walk to Cashier for each vehicle that completes the service in order to hand over the material details to cashier
- Storekeeper needs to maintain a manual storekeeping system to maintain stocks.
- It is very difficult to identify the re-order levels of each item which will lead to customer dissatisfaction as they will have to purchase items from outside.

Cashier's Feedback

- Cashier has to fill a large invoice by hand for each service
- Cashier has to do the cost calculation manually and double check them to maintain accuracy
- All the details related to cash handling needs to be reentered in log books manually at the end of each day for auditing purposes.
- If a customer or the management needs to know service or billing details of a previous service, cashier needs to go through 100's of records manually just to find the correct record.
- Difficult to calculate discounts, labor costs manually.
- Very difficult in analyzing the income, profit and expenses.

3.2.3 Requirement Analysis Method – Observation

Observation of work carried out in each service point, store and office to determine how the information workflow runs inside the organization. Also workflow was observed in perspective of a customer's arriving to obtain a service by servicing a vehicle at the service station. Other than understanding organization's main business flow these observations helped to understand the alternative workflow that can occur during real life working environment.

3.2.4 Requirement Analysis Method - document Inspection

During document inspection it was clearly visible how hard it is to drill and search for a historical record related to a client or a service of the organization. Other than that this inspection helped to understand the exact information that needs to be captured by the proposed solution

- It's difficult to find historical records of Customers, Vehicles and Services
- Minimum auditing capability
- Records are scattered over several places and are in danger of getting destroyed
- Duplication of records
- Large amount of paper based records are maintained

3.3 Identified Issues of the Current System

Below are the main issues identified after combining all the identified facts and solutions that new system should provide to resolve.

Issue 01

Company wants to gather Customer and vehicle information related to service requests before starting the service job. Customers are compelled to fill forms related to these information and if a customer has services to be done in many of his vehicles, he needs to provide the same information many times and this leads to frustration and customer dissatisfaction.

Solution

Proposed system should allow to gather Customer information and Vehicle information at the same time. Once it is registered in to the system, Vehicle Number can be used as a reference for a Service job. When a customer is registered, a unique customer ID is created and it can be used for pre-booking and viewing past information.

Issue 02

Company Owner wants to promote the Pre-Booking facility as a concept. Doorstep Services is the Core feature of this concept and they are looking to provide followings,

- **Right Auto to collect the vehicle from the customer's location**

Customer request/book via website to come and collect the vehicle from the customer's location and deliver it after serviced.

- **Park the vehicle and go**

Customer can park the vehicle at the service Centre and go Thereafter, Service Centre engineers will deliver the vehicle to the customers' location.

Solution

It's expected to provide the facility to Registered Vehicle owners through the Pre-booking facility.

Issue 03

There are few supervisors working at the service station. When a vehicle arrives for a service, one of the supervisors needs to record the vehicle number on a note paper along with the service requested by the owner. Thereafter the same supervisor follows the vehicle through each service point and records details about the services that are completed. This makes an unnecessary delay when switching a vehicle to another service point since the vehicle has to wait till the relevant supervisor arrive at the service point in order to release the vehicle. If a vehicle has to be handed over to a different supervisor the note should be handed over to a new supervisor for continuation.

Solution

Proposed system should allow any supervisor to start a new job by entering the vehicle number, there after any supervisor can complete and update service at each service point.

Issue 04

Currently when the Storekeeper issues materials for a vehicle, he updates it on a separate note paper with the vehicle number which is similar to the one used by station supervisors. The issue here is that the Storekeeper is unaware of the vehicle number or the requested services of the particular vehicle because those details are only with the supervisor.

Solution

Proposed system should allow the Storekeeper to record material information against service job.

Issue 05

At the completion of a service, both Service Supervisor and Storekeeper have to handover their references to Cashier. This needs to be repeated for each vehicle which enters the service queue. This is a waste of time for both the Supervisor and the Storekeeper.

Solution

Proposed system gets all the details automatically once the service is completed

Issue 06

Cashier has to collect two notes before billing for a completed service, one from the service supervisor and one from the Storekeeper. Then he fills all these details on a pre-printed bill and enters the prices manually by calculating the total and offer the discount (if any). Manual Calculation has a higher risk in busy situations.

Solution

Proposed Solution will calculate the total bill automatically and offer a clearly printed bill as a confirmation about the customer payments. This will eliminate calculation errors.

Issue 07

Currently the manual system of exchanging information is a real bottleneck when expanding the service capacity of the station. Organization doesn't want to increase the staff capacity for such a expand and wants to improve staff productivity.

Solution

Proposed System allows to mark all service related confirm and pending jobs against the staff.

Issue 08

At the moment it's very hard to get information regarding past services for further reference. Current paper records are very difficult to manage and store in the limited space available.

Solution

Proposed system should allow to search historical data easily and accurately.

Issue 09

Due to lack of information gathering it's a very difficult task to communicate special promotions, special offers and offers lasting durations.

Solution

Proposed system should facilitate to provide SMS and Email Communication for its customers

3.4 Operational Feasibility

The main intention of the new system is to identify the manual processes which have become bottlenecks and inefficient for the improvement of the organization; and to propose a new and an appropriate system with reengineered work processes. Therefore, the new system is designed to eliminate the delays of processes and increase efficiency by gaining the maximum use of resources including staff where the operational cost will be minimized.

It was identified that Right Automobile and service's paper based information system is not very organized and not supportive to the staff to handle their day to day operations. The service bay arrangement of the premises is done very well but the operations are not feasible to customers and staff

3.5 Economic Feasibility

The operational cost of the new system is feasible enough to maintain. Operation cost and managing customers will be easy with new initiatives proposed by this system. The customer base will increase due to their enthusiasm for online activities. In addition to that, customers would prefer to get the service of Right Auto due to the ease of getting the work done. The system does not require an additional hardware to operate since it is web based. Misuse of materials will be minimized as it maintains stock records.

3.6 Technical Feasibility

Once implemented, knowledge required is minimal to operate, backup and manage the system. One of the existing support crew can be trained easily to handle the daily operations of the system as it's built using Codeigniter Framework & PHP, bootstrap [4].

The owner of the organization can obtain summarized data figures by logging-in into the system remotely. The technology used by the system is not difficult for a user to handle his work. Customers are provided with a facility to download the mobile application and use whenever necessary. They can refer to their vehicle details as well. Therefore, mobile phone feasibility is also captured at this point.

3.7 Overview

Below main functionalities are handled by the System

- Registering Vehicle Owners
- Registering Vehicles
- Online Service Booking
- Initiating a Service job
- Updating Progress of the Service Job
- Updating Materials Used
- Completing a Service Job
- Calculating and Printing the Invoices
- Closing a Service
- Generating Reports
- Managing past records (Organization and customer wise)
- Stock Management System

Below main Nonfunctional requirements are handled by the System

- looking for Open source platforms
- Easy to operate and access
- Should have good documentation
- Not to depend on any OS or Platform
- Easy maintenance
- High reliability

3.9 User Roles

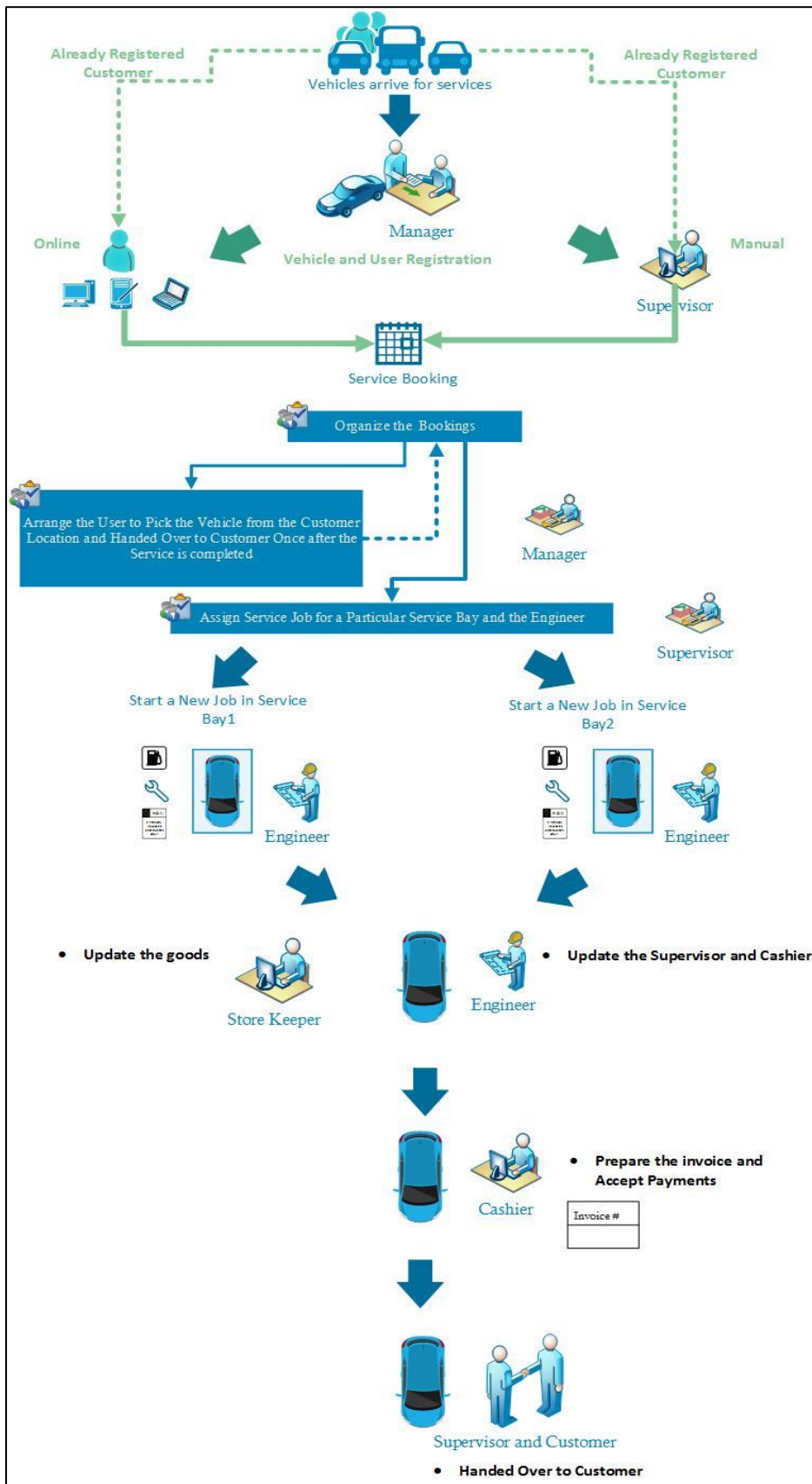


Figure 2 - User Roles and Proposed Work flow

System Administrator

A Super user who performs all of the system functionality. Also has Server Security Permission and MySQL Server

Vehicle Owner

A registered User can use their Online Account to do online bookings, view details of their vehicles' past repair information and raise inquiries.

Manager

The manager can perform all system functions except Administration of the system. Manager has the facility to enroll all vehicle Owners and Vehicles. Also he is responsible for Organizing All Service Request Bookings, Service inquiries etc.

Supervisor

Supervisor can arrange Service tickets and update tasks upon the successful completion of a service. Also a supervisor is responsible for making a job as “completed” after inspecting and handing over the vehicle to a customer. Supervisor has no access to financial details as well.

Storekeeper

Storekeeper is only allowed to update materials issued on service tickets. Also responsible for Managing stores. He can see the history of vehicle service information.

Cashier

Cashier has permission to generate and update bills and offer any discounts if necessary. Also He has the permission to start a new Service job on behalf of the service supervisor. He can view all historical reports including financial data.

	Administrator	Manager	Supervisor	Cashier	Storekeeper	Vehicle Owner
Registrar Vehicle Owner	✓	✓	✓	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Registrar Vehicle	✓	✓	✓	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Online bookings	✓	✓	✓	<input type="checkbox"/>	<input type="checkbox"/>	✓
Online Inquiry	✓	✓	✓	<input type="checkbox"/>	<input type="checkbox"/>	✓
Organize Service Request	✓	✓	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Assign Service Bay and Engineer	✓	✓	✓	✓	<input type="checkbox"/>	<input type="checkbox"/>
Manage Store	✓	✓	<input type="checkbox"/>	✓	✓	<input type="checkbox"/>
Invoicing	✓	✓	<input type="checkbox"/>	✓		<input type="checkbox"/>
View financial Report	✓	✓	<input type="checkbox"/>	✓	<input type="checkbox"/>	<input type="checkbox"/>
View Historical Data	✓	✓	✓	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
System Administrator	✓	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Manage Staff	✓	✓	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Table 2 : Role Permission Matrix

3.10 Systems Analyst modeling tools

The systems analyst uses modeling tools to Focus on important system features while downplaying less important features. Which discuss changes and corrections to the user's requirements with low cost and minimal risk. It is helped to verify that the systems analyst correctly understands the user's environment and has documented it in such a way that the systems designers and programmers can build the system

Three important systems modeling tools are discussed here. A workflow diagram depicts a series of actions that define a job or how work should be done. It also visualizes how tasks will flow between resources, whether they're machines or people and what conditions allow the sequence to move forward, the entity-relationship diagrams which emphasize the data relationships, and the UML diagram which focuses on enabling to specify, visualize, construct and document artifacts of a software.

3.10.1 Use Case Diagram

Use case diagram is used during the analysis phase of a project to identify the system functionality. This describes the interaction of people or external device with the system under design. The Figure 3 shows that high level view of the use cases diagrams.

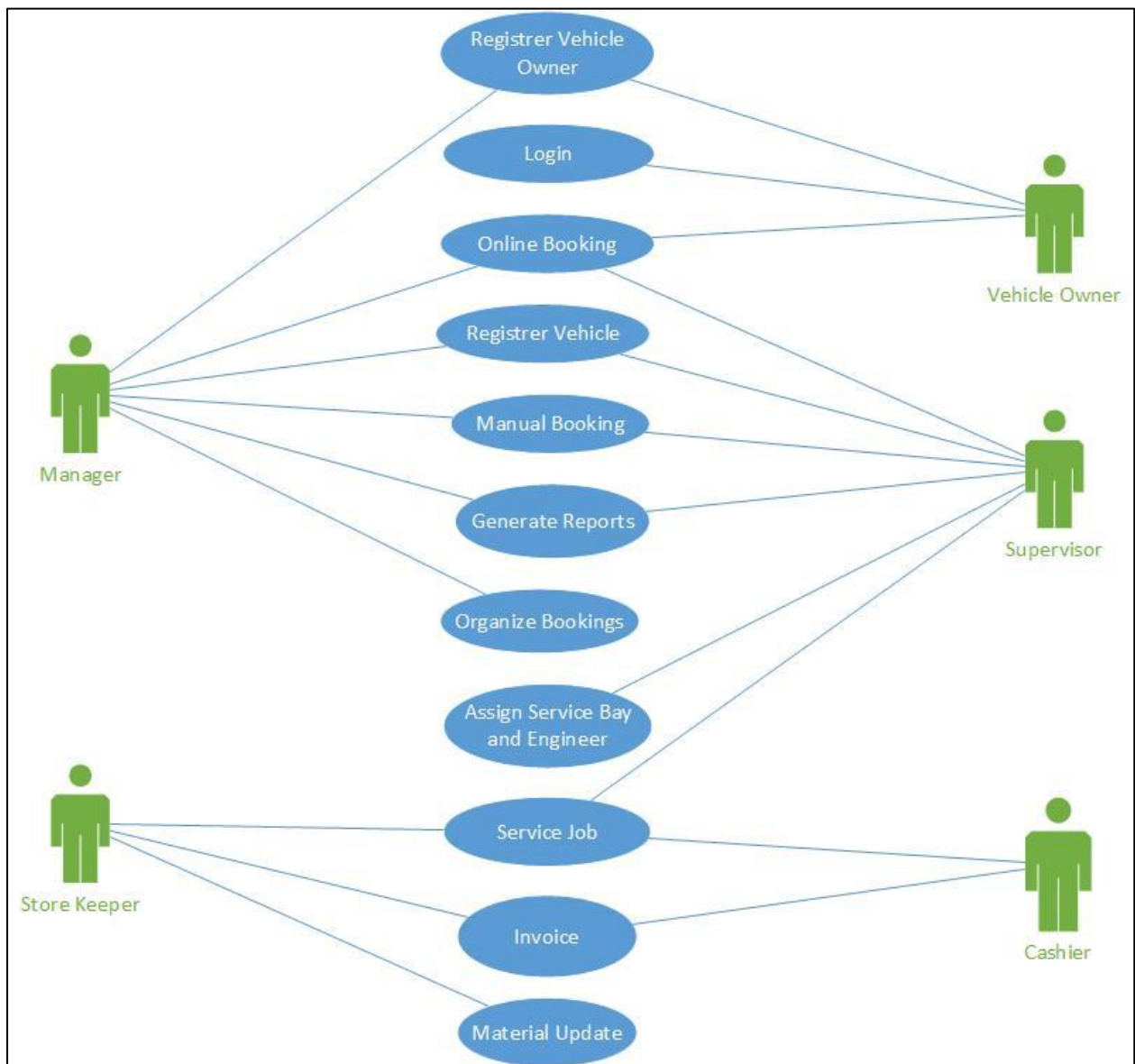


Figure 3 - Use Case Diagram

3.10.1.2 Use Case: Vehicle Owner Registration

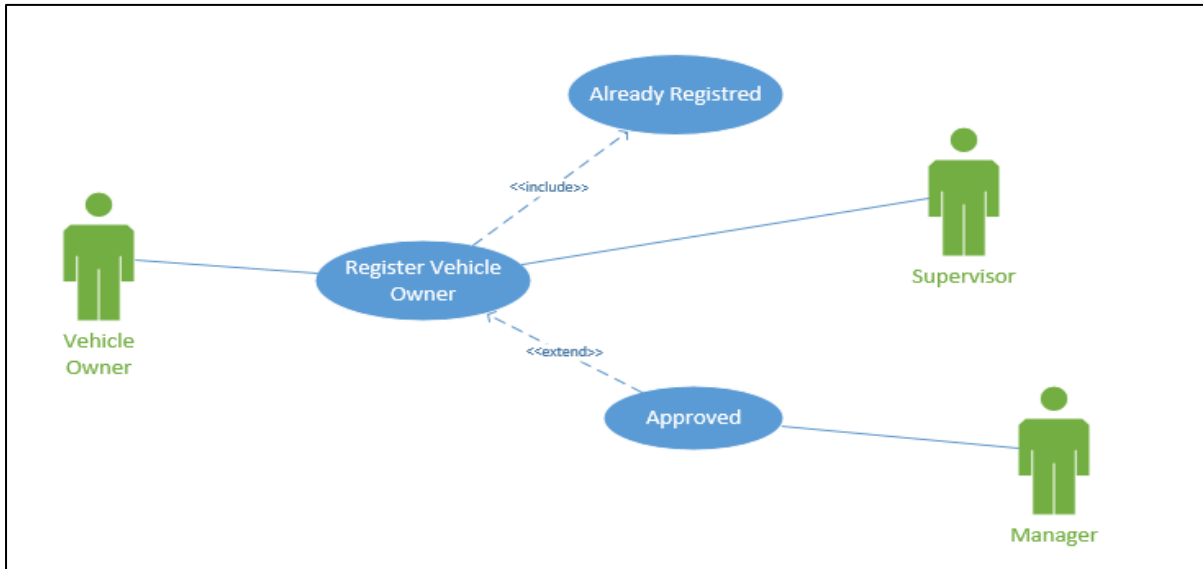


Figure 4 : Use case - Vehicle Owner Registration

Use Case	Vehicle Owner Registration
User Roles	Manager, Supervisor, Vehicle Owner
Description	Register Vehicle Owner information to the system
Details	A First-time Vehicle Owner needs to be registered and a unique user id should be generated. One Person can only be registered to the system and avoid the duplicate. Vehicle owner should provide Name, Contact No, Email Address and NIC for their registration. Manager can only approve the registered vehicle owner information. Vehicle Owner will receive the confirmation email after the successful registration with user credential for a online login.

Table 3 - Register Vehicle Owner

3.10.1.3 Use Case: Vehicle Registration

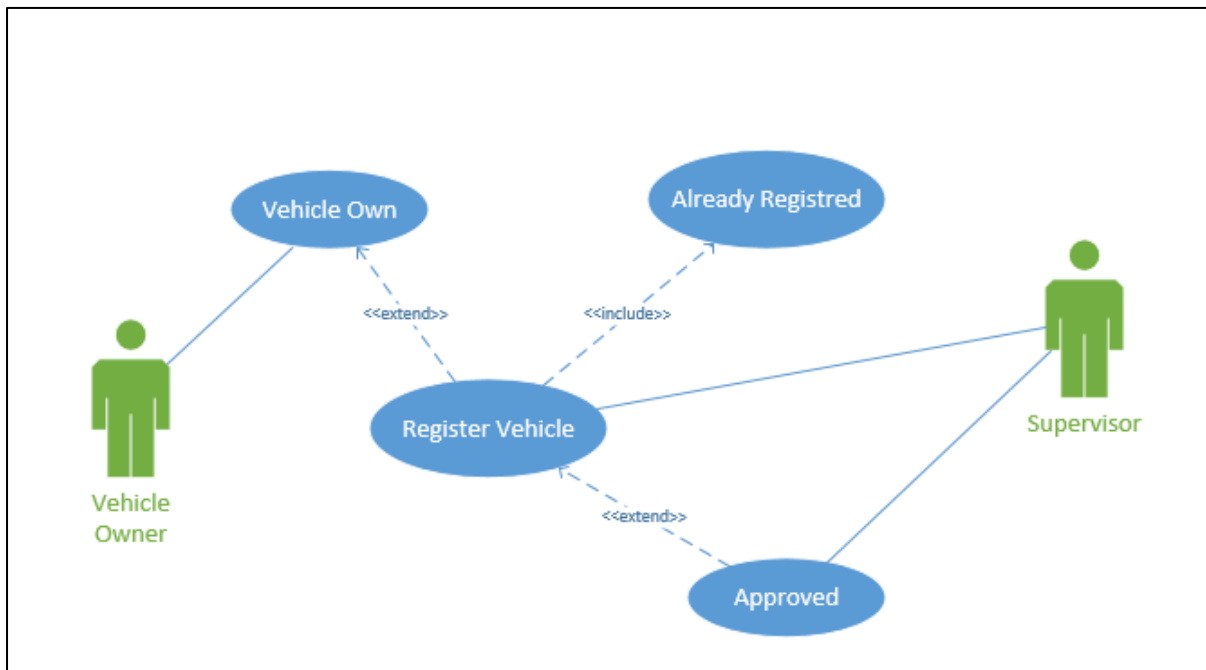


Figure 5 : Use case - Vehicle Registration

Use Case	Vehicle Registration
User Roles	Manager, Supervisor, Vehicle Owner
Description	Registering Vehicle to the system
Details	<p>Vehicle Owner should be available before register the vehicle in the system.</p> <p>Vehicle needs to be registered only once. Many vehicles can be registered under the same vehicle owner. A vehicle can't have two Vehicle owners.</p> <p>Vehicle No, Brand, Type, Model and Production Year information should be provided.</p>

Table 4 - Register Vehicle

3.10.1.4 Use Case: Online Bookings

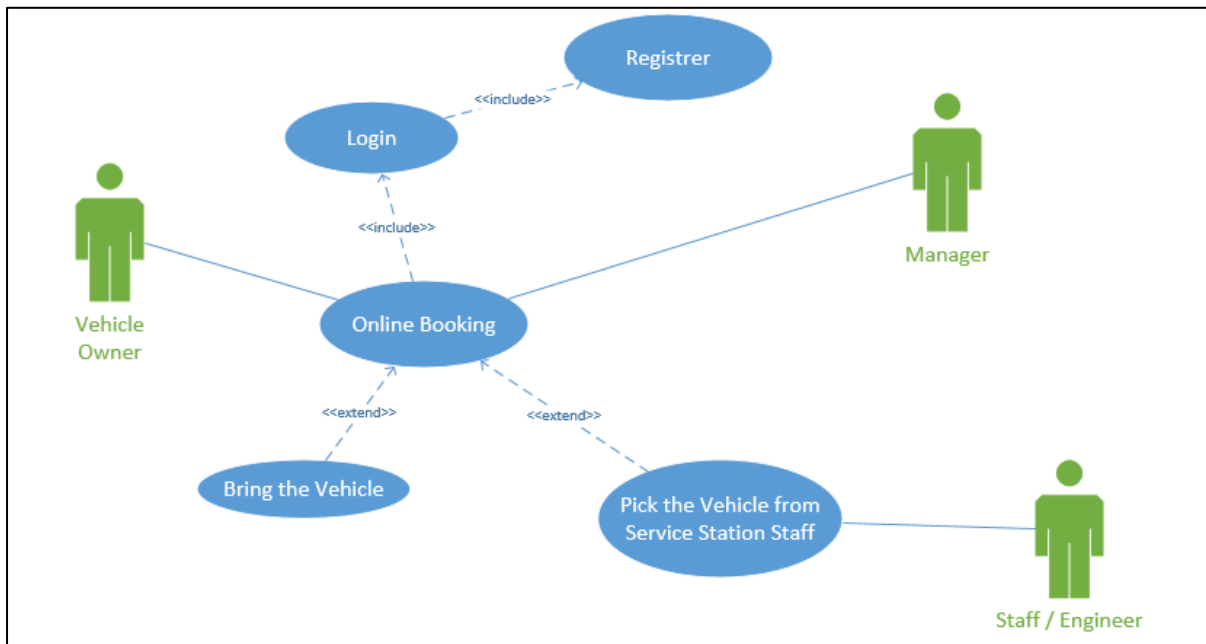


Figure 7 : Use case - Online Bookings

Use Case	Online Booking
User Roles	Manager, Vehicle Owner, Staff / Engineer
Description	Vehicle owner can book the service via Web or Mobile App
Details	Vehicle owner should be registered in the system. There are two options available for online booking. Owner can get the service station man power to pick the vehicle and do the service or the owner can bring the vehicle to the Service Station and done the service.

Table 5 - Online Booking

3.10.1.5 Use Case: Manual Bookings

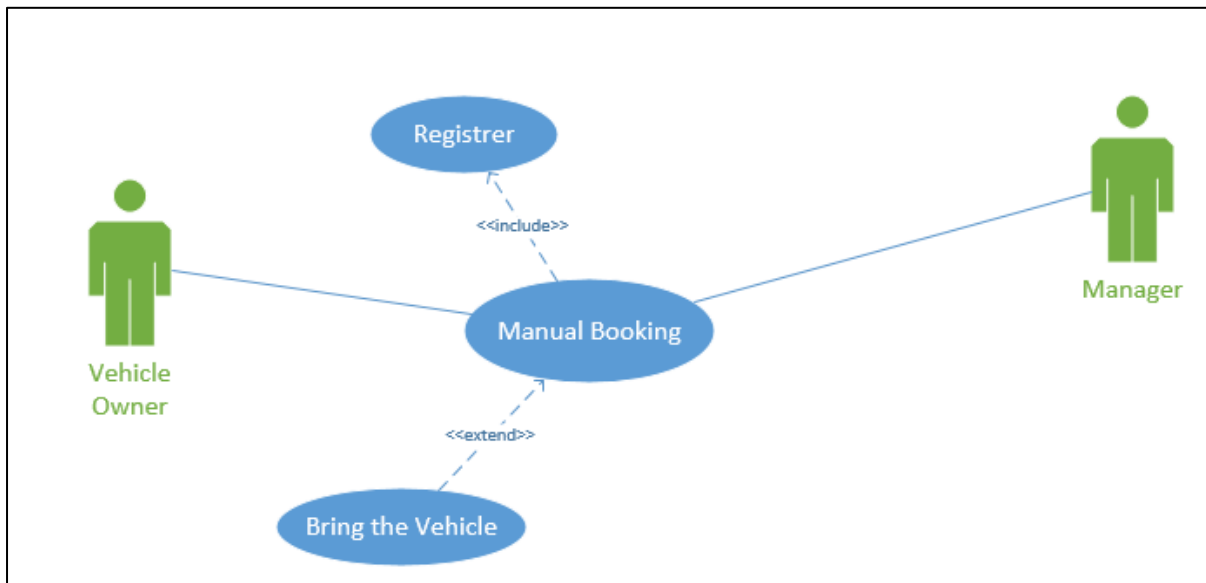


Figure 8 : Use case - Manual Bookings

Use Case	Manual Booking
User Roles	Manager, Vehicle Owner
Description	Vehicle owner must come to the service station and get the services done.
Details	Vehicle owner and Vehicle should be registered in the system. If not it should register before request the Service. Available time slot will be provided based on first come and first serve basis.

Table 6 - Manual Booking

3.10.1.6 Use Case: Organize Service Bookings

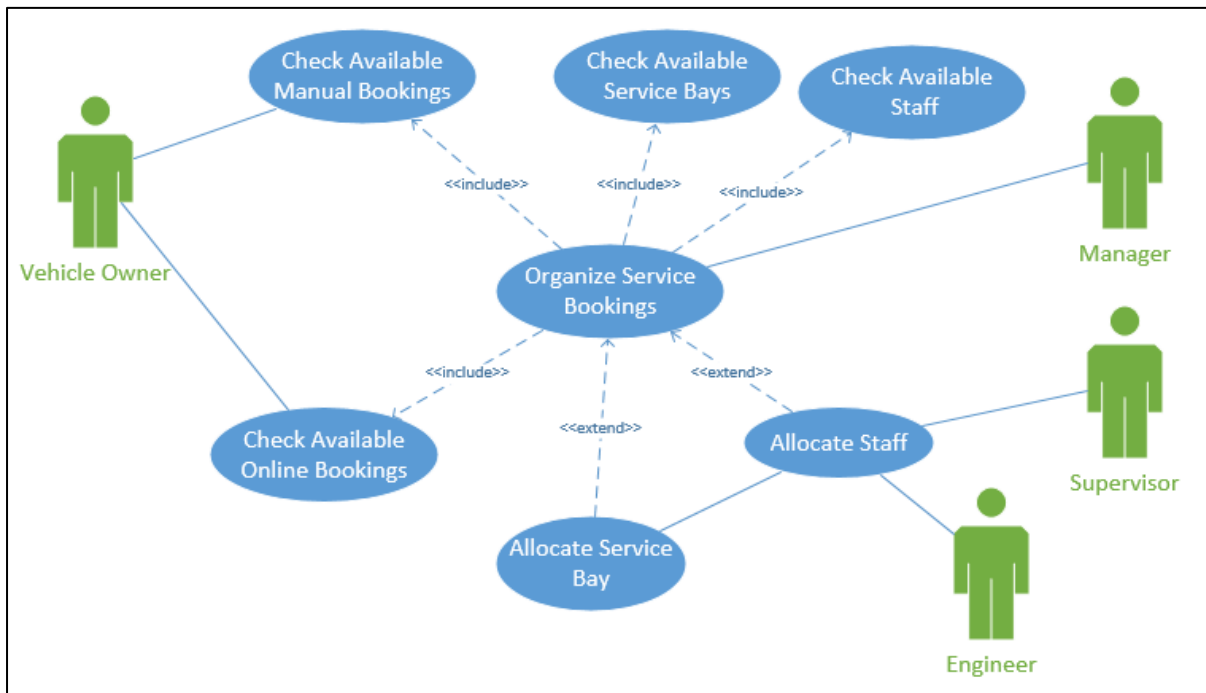


Figure 9 : Use case - Organize Service Bookings

Use Case	Organize the bookings
User Roles	Manager, Supervisor, Engineer, Vehicle Owner
Description	Both Manual and Online Service requests are processed
Details	<p>All Service requests are processed by the Manager</p> <p>Available Service bays and Engineers are allocated for each service request and each service should be monitored by the supervisor.</p> <p>A separate person should be assigned to pick the vehicle from the customer end if they request online booking with service center man power.</p>

Table 7 - Organize the bookings

3.10.1.7 Use Case: Invoice Generation

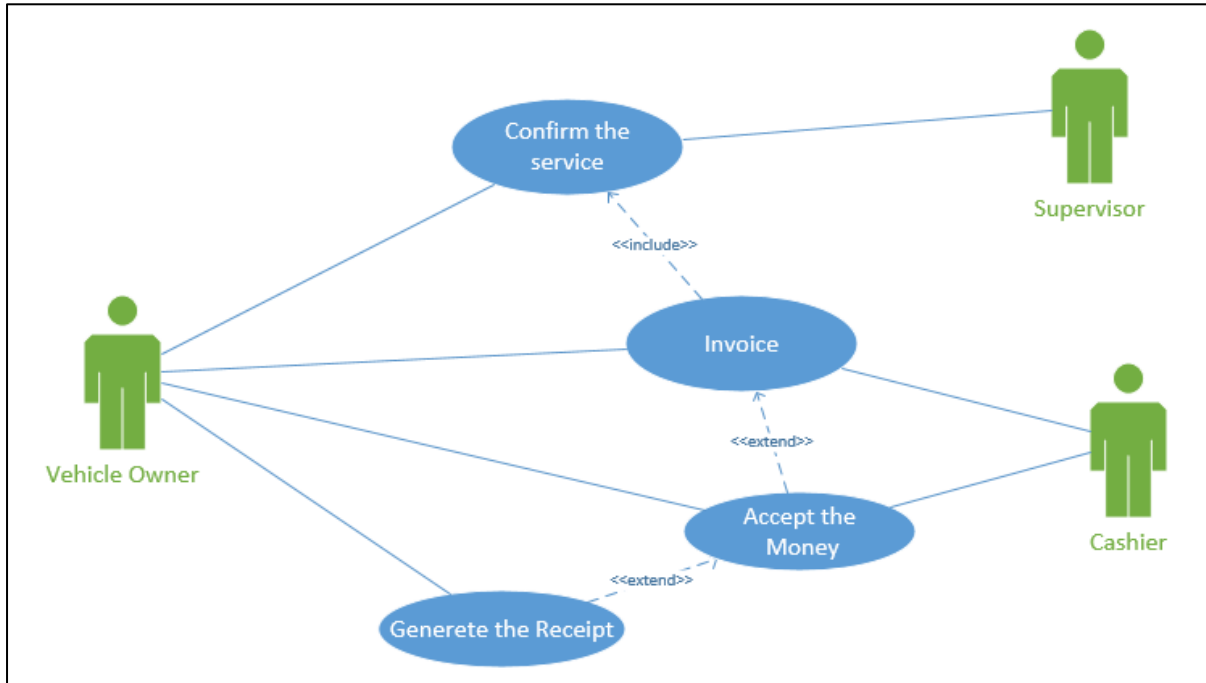


Figure 10 : Use Case: Invoice Generation

Use Case	Invoice
User Roles	Supervisor, Cashier, Vehicle Owner
Description	Invoice generation
Details	<p>Cashier should generate invoices for vehicles which are confirmed by the allocated engineer and Supervisor.</p> <p>Available Service bays and Engineers are allocated for each service request and each service should be monitored by the supervisor.</p> <p>Vehicle owner should pay for the invoice and printed receipt will be given for each success payments. Vehicle owner has facility to view same invoice via online.</p>

Table 8 - Invoice

3.10.1.8 Use Case: Material Request and Update

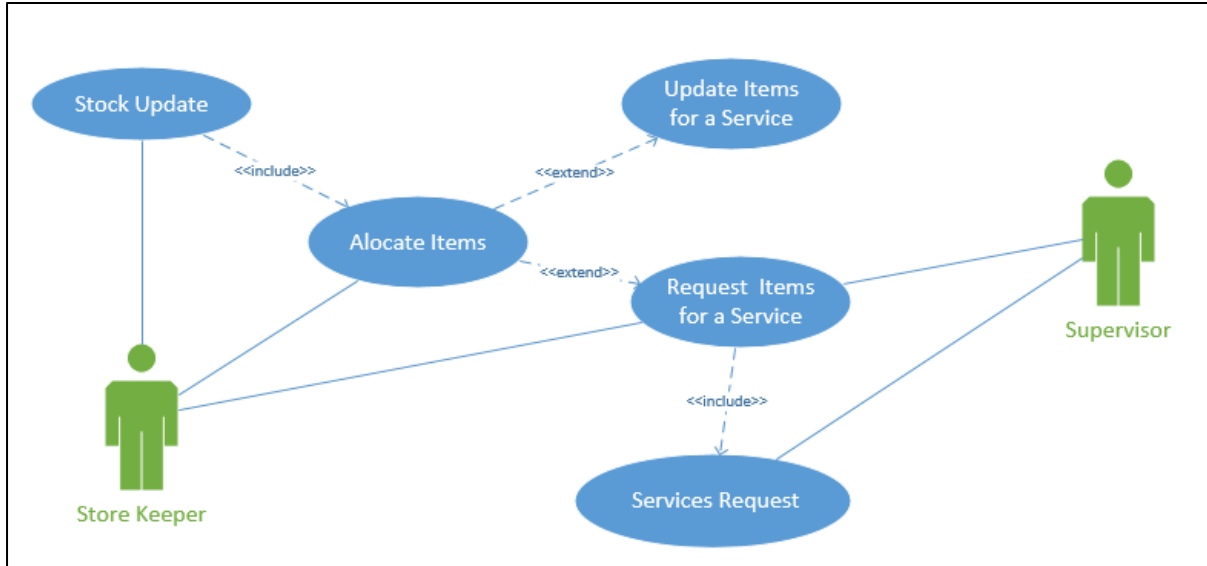


Figure 11 : Use case - Material Request and Update

Use Case	Material Request and Update
User Roles	Storekeeper, Manager
Description	Material Update
Details	Supervisor who is allocated for the particular service, must request materials from the Stocks. Stock keeper must record each requests and issued items. When it issues available stock must be updated. Stock keep should be able to add, update or remove items from the stocks.

Table 9 - Material Request and Update

3.10.1.9 Use Case: Report Generating

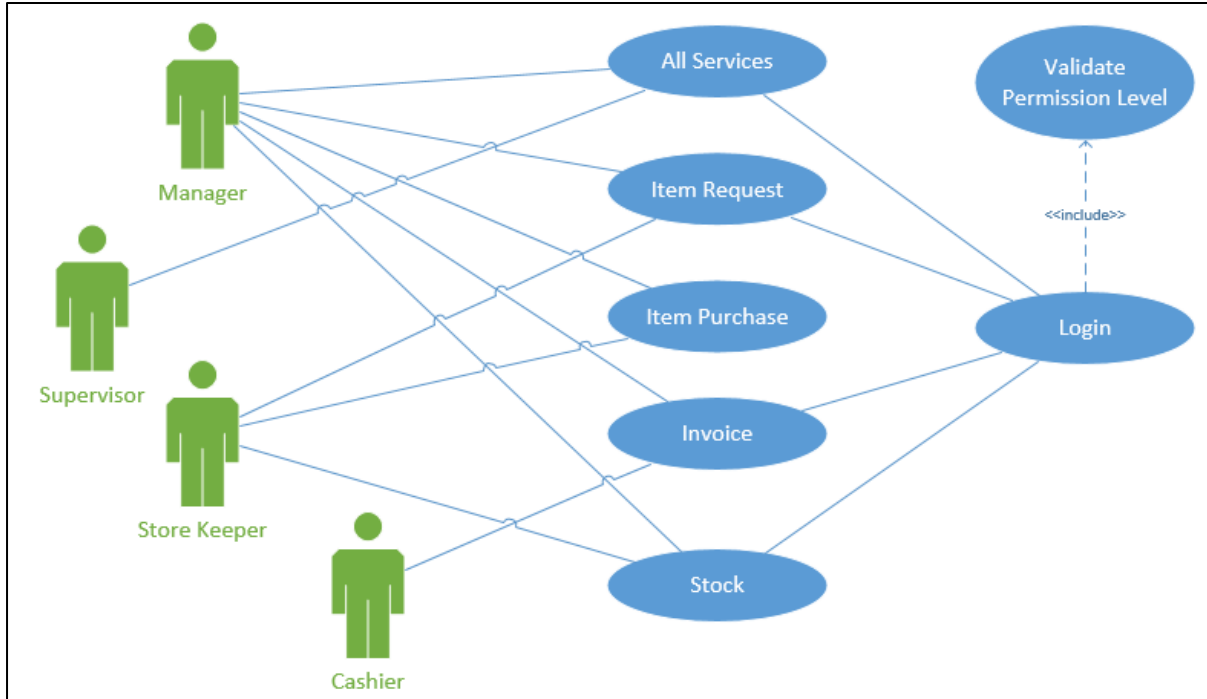


Figure 12 : Report Generating

Use Case	Reports
User Roles	Storekeeper, Manager, Supervisor, Cashier
Description	Generate reports.
Details	Report must be generated for Vehicle services, Stocks and Items. All reports can be accessed by the Manager and other must be accessed based on their job role. All reports can be extracted to excel.

Table 10 - Reports

3.10.10 Workflow Diagram

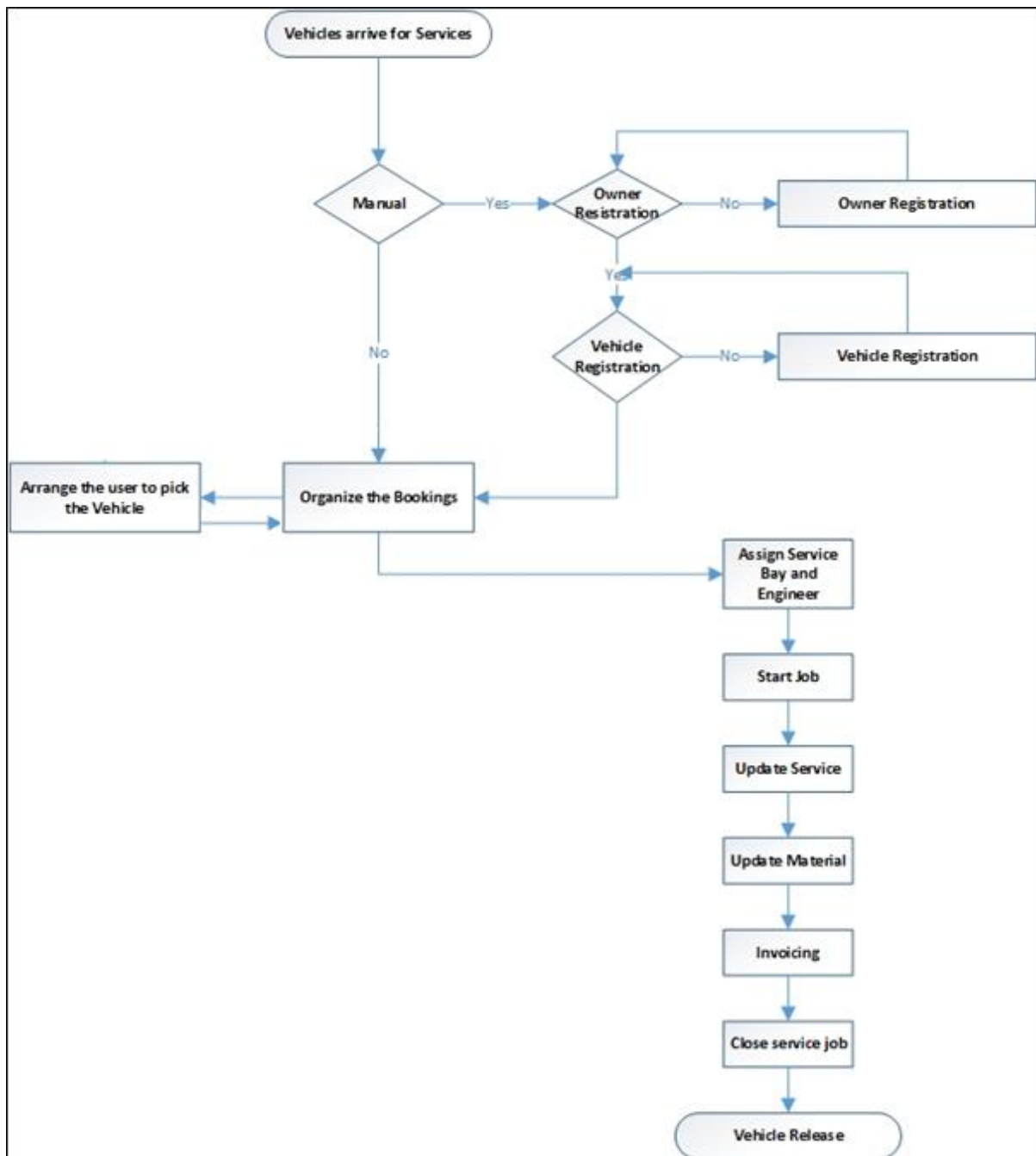


Figure 13 : Workflow Diagram

3.10.11 ER Diagram

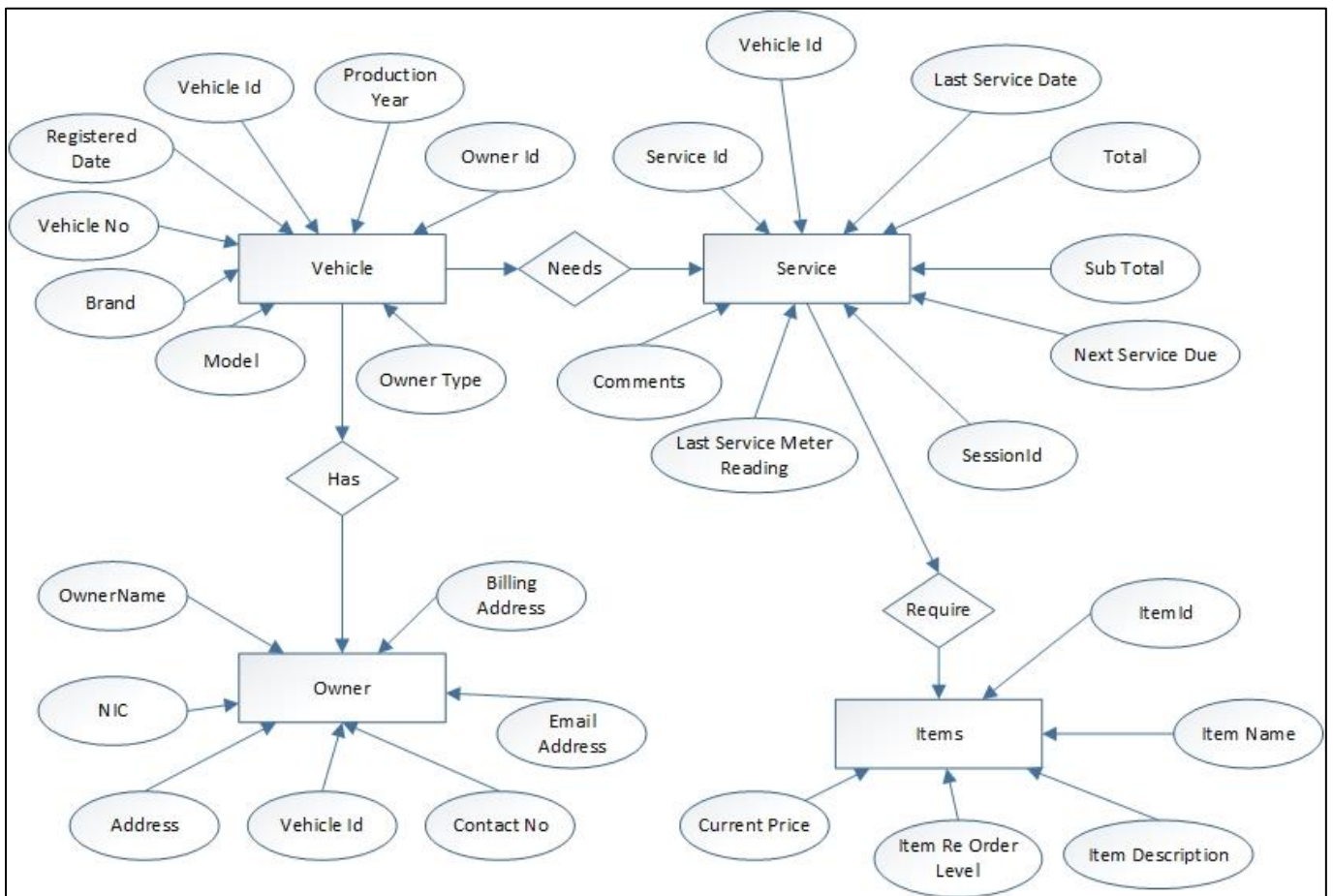


Figure 14 : ER Diagram

3.11 Design

Module architecture

The Main solution has been divided in to two sub solutions. Company website and internal Solution. Through the company website, the organization is expecting to promote their products and services. Internal Solution provides the main core system for the organization which has 6 sub modules.

Registration module includes all registration related functionalities. Any vehicle should be registered in the system before getting a particular service. A vehicle can't have many owners and basically a vehicle should be registered under a personal owner or a corporate owner.

Online Management module facilitates to manage the online service requests and inquiries from the customer.

Service Management module facilitates to arrange all online and manual service requests, items and materials requests for each service and generate invoices for service job completion.

Store Management Module facilitates to manage all items which need for services.

Reports Module consists of all report related functionalities.

User Management Module consists of all user handling functionalities in the system.

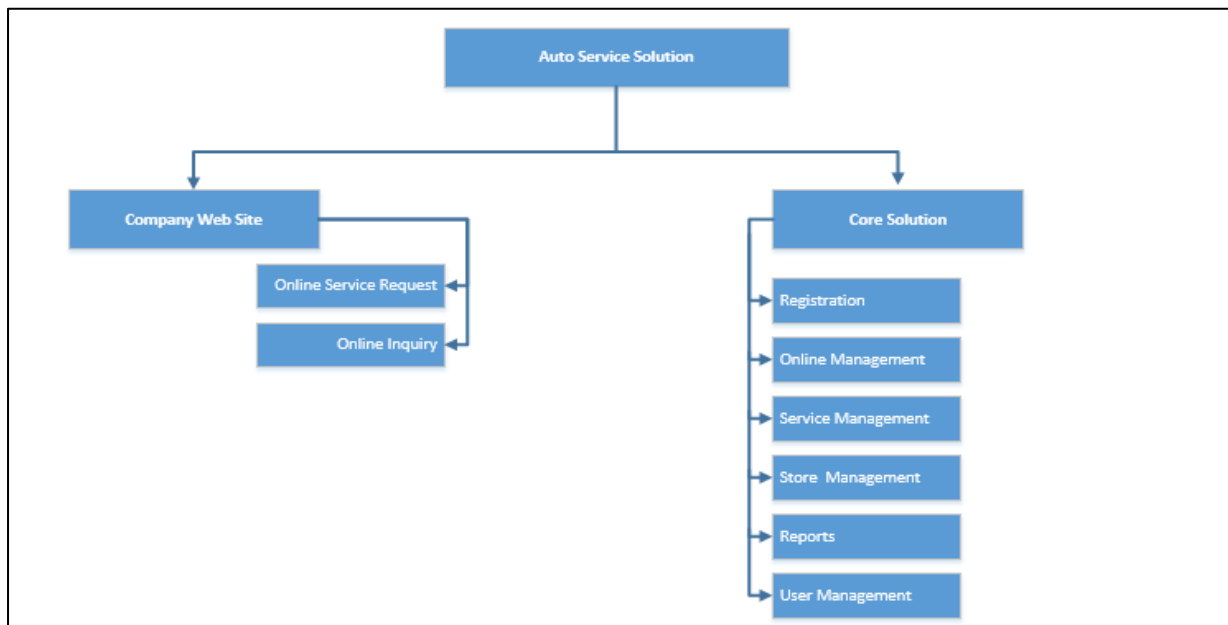


Figure 15 : Module architecture

3.12 Sequence Diagram

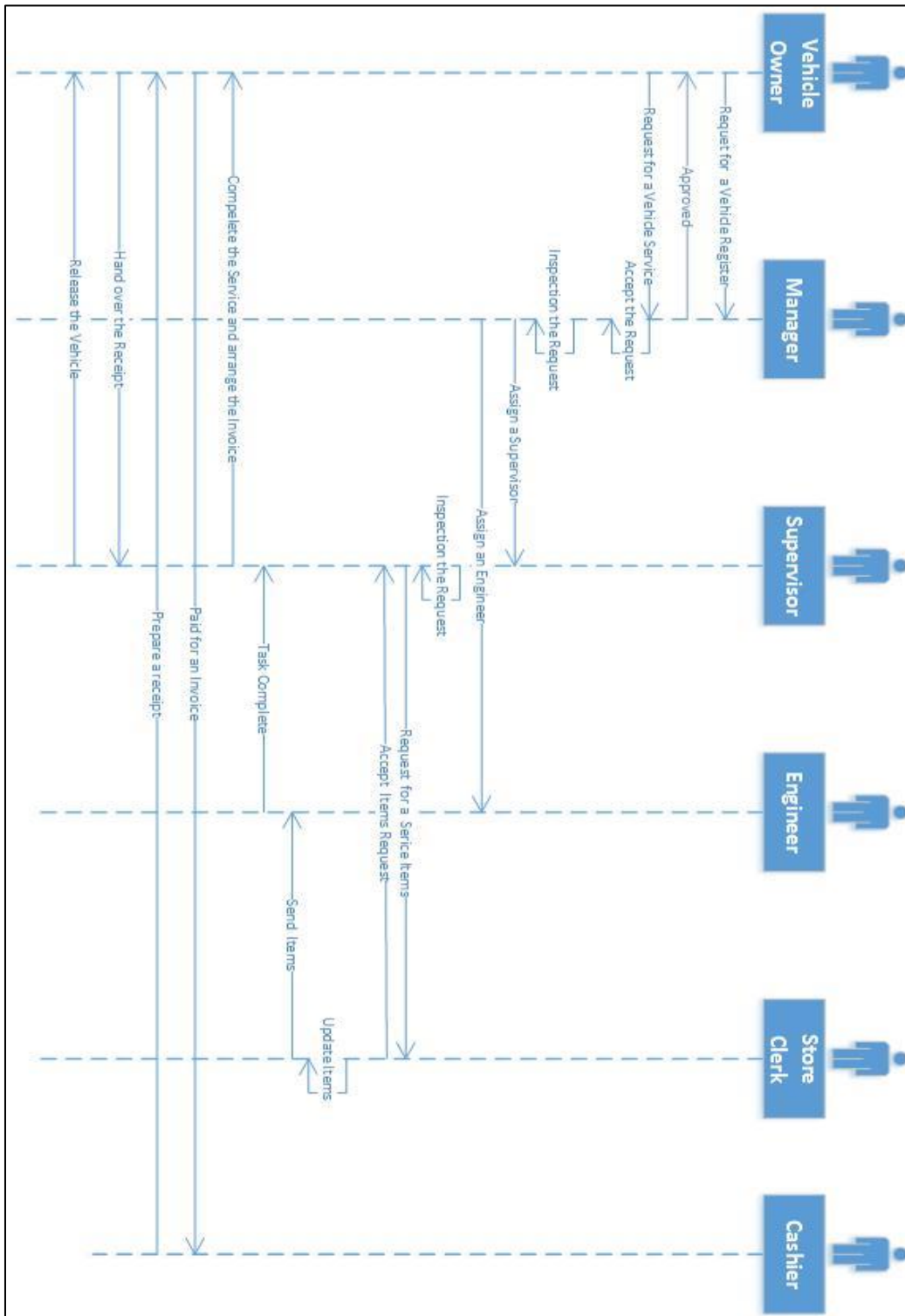


Figure 16 : Sequence Diagram

3.13 Software architecture

PHP being an open source enjoys lot of free available frameworks. Codeigniter is one of the best frameworks which supports Agile and rapid development with Dynamic Instantiation, Loose Coupling and Component Singularity.

Codeigniter consists of Model-View-Controller (MVC) architecture.

- Controllers receive all requests from users and call models and views to render the information as directed in the request.
- Models are modulation for any database or other system. Models do not play a role in every request received by controllers. Actually controllers manage models if a change occurs. Views are not aware of any change in models, it's the controller's responsibility to notify related views about the change.
- Views are customized output representations, generated as per current models state and request sent to controller [4].

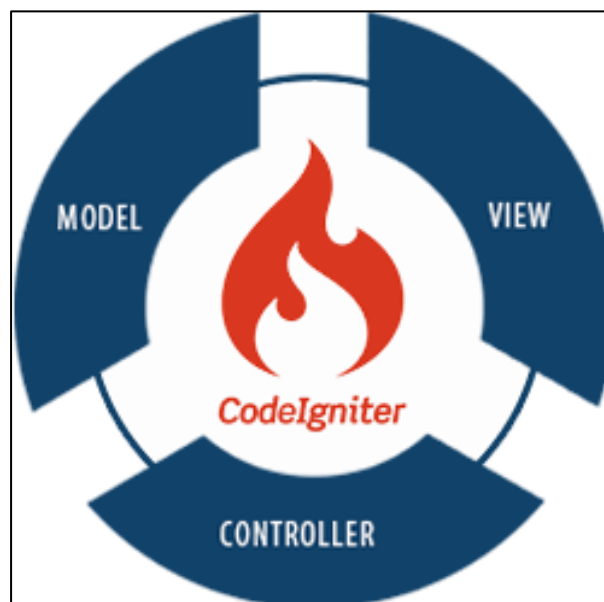


Figure 17 - Codeigniter Model View Controller Representation

CHAPTER 4: IMPLEMENTATION

4.1 Introduction

This chapter includes details about the Software, Hardware and Networking Setup of this development and Deployment.

4.2 Technology Selection

At the point of discussion, it was decided that the customer needs new technology with minimum number of expenses and dependencies. There is no point of using CMS module for this development due to the many customizations and minimum number of content Managements.

But it was decided to go for a better Framework, instead of using pure PHP due to the many of security issues and finally selected the Codeigniter.

4.3 Development Environment

The screenshot displays two panels of system information. The left panel, titled 'SYSTEM VITAL', lists system details such as Canonical Hostname (ICT-LPT-Thilina.icasl.com), Listening IP (192.168.56.1), Kernel Version (6.3.9800), Distro Name (Microsoft Windows 8.1 Pro), Uptime (1 days 6 hours 20 minutes), Last boot (Tue, 10 Jan 2017 02:52:47 GMT), Current Users (1), Load Averages, System Language (English - United States (1033)), and Code Page (windows-1252). The right panel, titled 'HARDWARE INFORMATION', shows a tree view of hardware components including Processors (Intel(R) Core(TM) i5-4200M CPU @ 2.50GHz), PCI Devices (Intel(R) Xeon(R) processor E3-1200 v3/4th Gen Core processor DRAM Controller - 0C04, Intel(R) 8 Series/C220 Series PCI Express Root Port #2 - 8C12, Intel(R) HM86 LPC Controller - 8C49, Intel(R) 8 Series/C220 Series USB EHCI #2 - 8C2D, Intel(R) Dual Band Wireless-N 7260 #2, Intel(R) 8 Series/C220 Series PCI Express Root Port #3 - 8C14, Intel(R) 8 Series/C220 Series USB EHCI #1 - 8C26, Intel(R) Management Engine Interface, Intel(R) Ethernet Connection I217-V, High Definition Audio Controller, Intel(R) USB 3.0 eXtensible Host Controller - 0100 (Microsoft), Intel(R) 8 Series Chipset Family SATA AHCI Controller, Intel(R) 8 Series/C220 Series PCI Express Root Port #1 - 8C10, Intel(R) 8 Series/C220 Series PCI Express Root Port #5 - 8C18, Realtek PCIE CardReader, Synaptics SMBus Driver, Intel(R) HD Graphics 4600), IDE Devices, SCSI Devices, and USB Devices.

Figure 18 - Server Configuration

Development Server		
Windows NT ICT-LPT-THILINA 6.2 build 9200 (Windows 8 Business Edition) AMD64		
Components	Version	
Web Server	Apache	Apache/2.4.9
Development Language	PHP	5.5.12
Database	MySQL	5.0.11
Framework	Codeigniter	3.0.1

Table 11 - Software Configuration

4.4 Development IDEs

4.4.1 Sublime Text Editor - For Code, markup and prose

Sublime Text 2 is a minimalist coding editor that will let you focus completely on your code. Sublime Text works by focusing on what it really important - the code - and leaves the other types of eye candy out. The minimalist interface that can be customized with a dozen different color schemes. It also includes a really handy mini map on the right side, which enables you to quickly move from top to bottom in your code. This isn't seen in other code editors and is a really big plus [5].

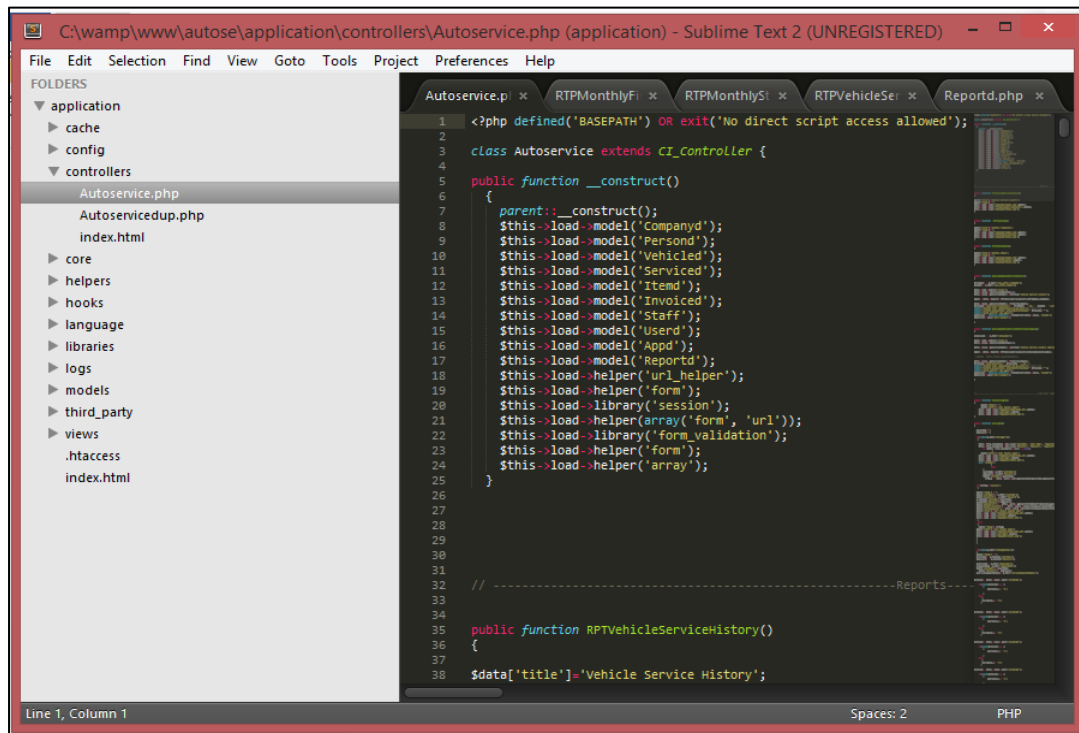


Figure 19 - Sublime Text Editor IDE

4.4.2 Toad for MySQL

Quickly and easily develop code, create and execute queries, and automate database object management with Toad for MySQL. This freeware development tool enables to compare, extract and search for objects, record and play back keyboard commands, transfer data across MySQL databases and much more. It accelerates MySQL learning curve and helps you manage projects, while making MySQL run more efficiently [6].

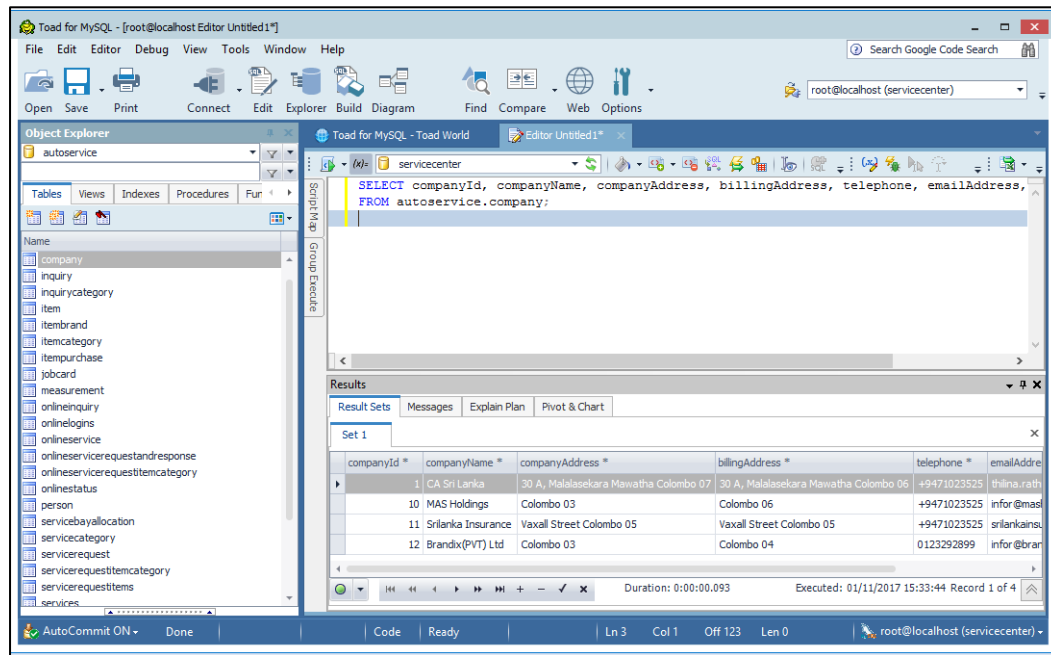


Figure 20 - Toad for MySQL for table creations, store procedures and functions creations

4.4.3 Bootstrap – for Responsive Page designing

Bootstrap is a free and open-source front-end web framework for designing websites and web applications. It contains HTML- and CSS-based design templates for typography, forms, buttons, navigation and other interface components, as well as optional JavaScript extensions. Unlike many web frameworks, it concerns itself with front-end development only [7]

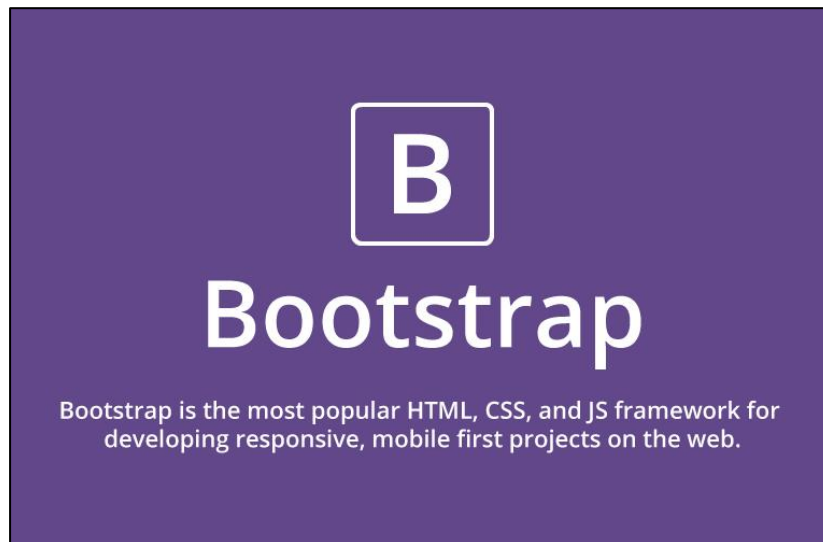


Figure 21 - For Responsive Page designing

4.5 Web Environment

Development Server		
Windows NT ICT-LPT-THILINA 6.2 build 9200 (Windows 8 Business Edition) AMD64		
Components	Version	
Web Server	Apache	Apache/2.4.9
Development Language	PHP	5.5.12
Database	MySQL	5.0.11
Framework	Codeigniter	3.0.1

Table 12 - Development Server Configuration

4.6 Screenshots

4.6.1 Main Page – Backend Operation

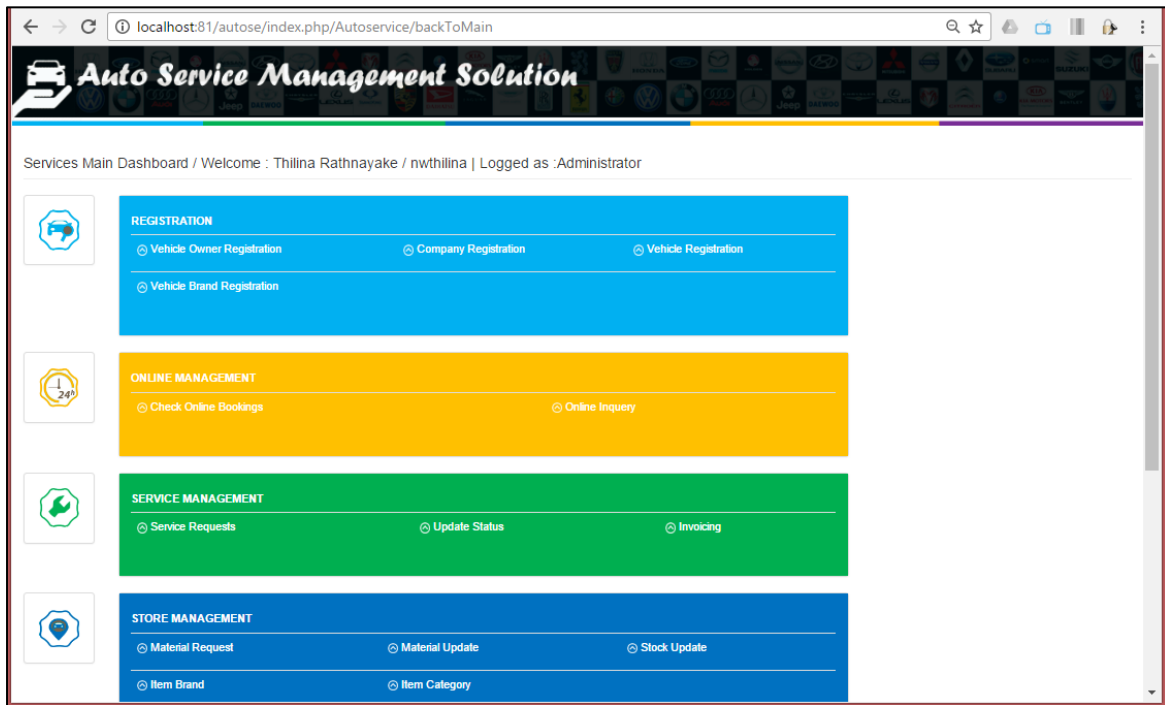


Figure 22 - Main Page – Backend Operation

4.6.2 Main Page – Customer-end

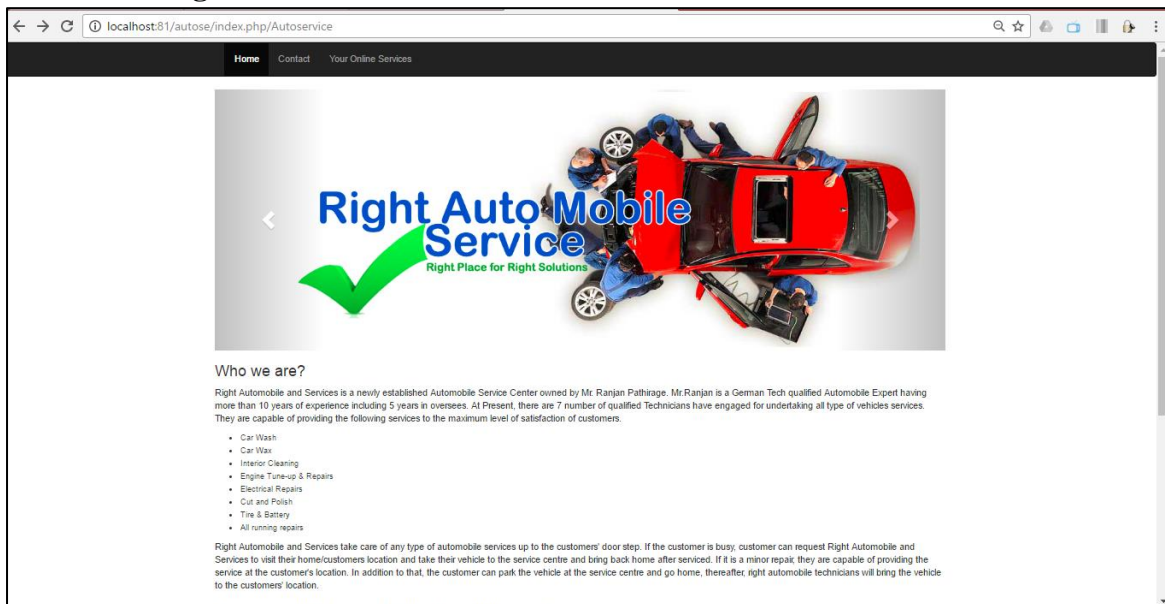


Figure 23 - Main Page – Backend Operation

4.7 Design Patterns

Consider with Codeigniter framework, Singleton pattern run the major role here. An object is a singleton if the application can include only one of object at the time. For a example connection to the database through the database handler is exclusive.

```
$active_group = 'default';
$query_builder = TRUE;

$db['default'] = array(
    'dsn' => '',
    'hostname' => 'localhost',
    'username' => 'root',
    'password' => '',
    'database' => 'autoservice',
    'dbdriver' => 'mysqli',
    'dbprefix' => '',
    'pconnect' => FALSE,
    'db_debug' => (ENVIRONMENT !== 'production'),
    'cache_on' => FALSE,
    'cachedir' => '',
    'char_set' => 'utf8',
    'dbcollat' => 'utf8_general_ci',
    'swap_pre' => '',
    'encrypt' => FALSE,
    'compress' => FALSE,
    'stricton' => FALSE,
    'failover' => array(),
    'save_queries' => TRUE
);
```

```
public function allcompanies()
{
    $this->load->database();
    $sql = 'CALL allcompanies()';
    $query=$this->db->query($sql);
    $this->db->close();
    return $query->result_array();
}

public function editCompany($cmpId_)
{
    $this->load->database();
    $sql = 'CALL Edit_company(?)';
    $parameters = array($cmpId_);
    $query=$this->db->query($sql, $parameters);
    $this->db->close();
    return $query->result_array();
}
```

Figure 24 - Design Pattern in IDEs

4.8 Specific Code Segment

Instated of direct sql query in data layer, it has been used Store procedures to write and read data from the database.

```
280  
281     public function insertItems($VehicleBrand,$brnd_id,$itemCategoryId,$itmCode,$itmName  
282     {  
283         $this->load->database();  
284         $sql = 'CALL Insert_Item(?,?,?,?,?,?,?,?,?,?,@rt)';  
285         $parameters = array($VehicleBrand,$brnd_id,$itemCategoryId,$itmCode,$itmName,$itmDe  
286         $query=$this->db->query($sql, $parameters);  
287         $this->db->close();  
288         $row=$query->row();  
289         return $row->rt;  
290     }  
291
```

Figure 25 - Specific Code Segment

CHAPTER 5: USER EVALUATION AND TESTING

5.1 Introduction

This chapter presents the user evaluation and testing of the application

5.2 Usability Testing and Evaluation Scenarios and Tools

Usability testing is the best way to understand how real users experience about the application. To conduct a usability test, target audience must be identified it will consist of one or more user groups. Mainly two groups are identified in this case and those as follows,

- Customers who are looking for an auto service.
- Staff users who use the system to generate good productivity

In Usability testing, it's basically concerns user performance about 5 or 10 tasks with in a 90 minute of session. Considered tasks are

From Customer End:

- Login and Request for a New Service,
- Login and Check Past Records or Inquiry

From Staff User End:

- Login and Register Vehicle, Owner or Company
- Login and Edit Vehicle, Owner or Company
- Login and Initiate Service Request or Assign Supervisor and Engineer
- Login and Change or Update Service Request
- Login and Generate Invoices
- Login and Initiate Material Request
- Login and Issue Materials
- Login and Generate Vehicle Service History Report
- Login and Generate Monthly Financial Report
- Login and Generate Item Stock Report

User Evaluation scenario was conducted in two ways for above two groups. The Survey which was done by giving them a Questioners and by monitoring them the way How they behave about the system.

5.3 Evaluation Results Analysis

User Evaluation form has been attached in the Appendices C. The figure 26 show the Evaluation Result.

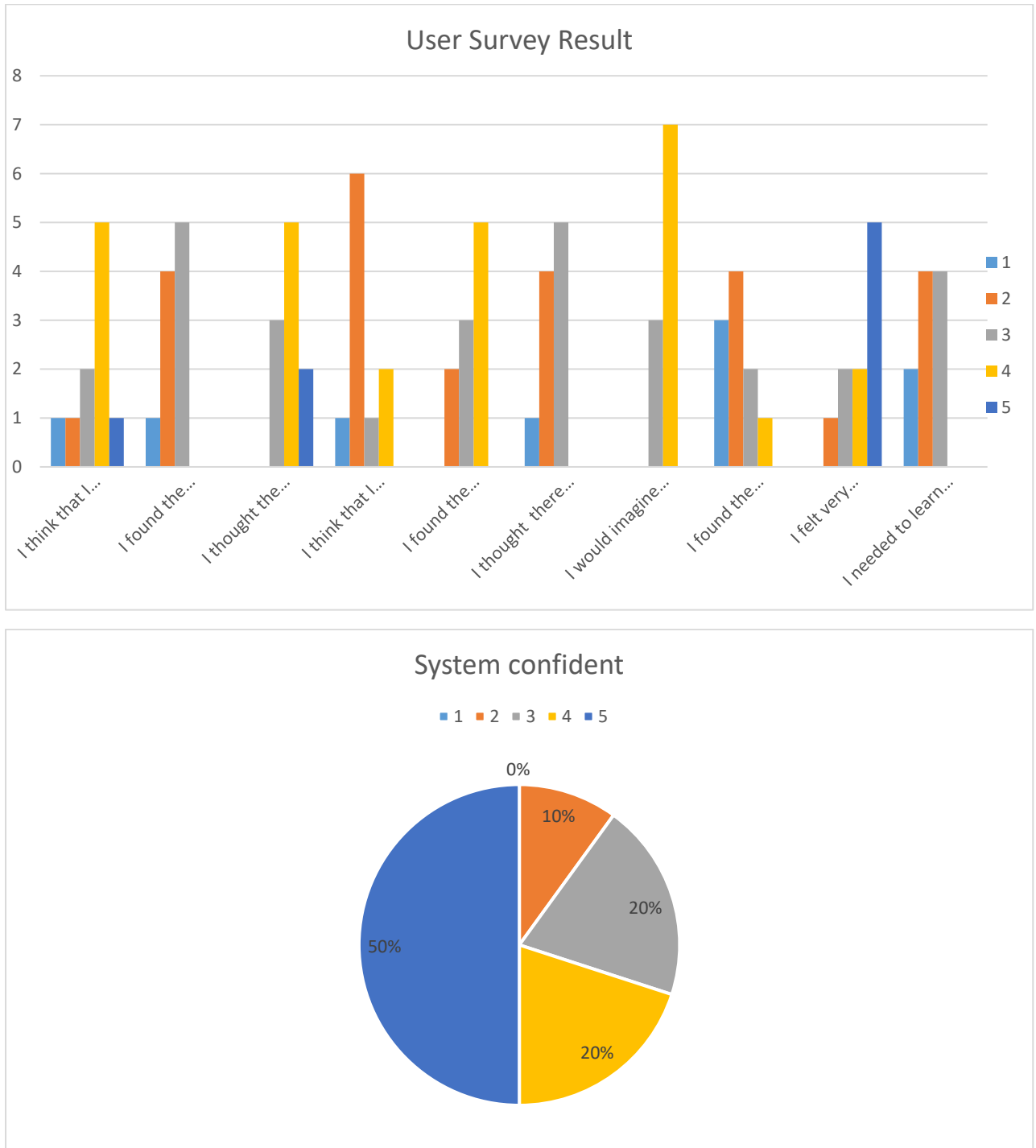


Figure 26 : Survey Results

Accordinging the survey results, Stockholders are willing to use this system and they believe that system has covered users' needs well. 50% of Stockholders strongly confident about the system.

5.3 System Testing

System testing is carried out at the completion of the integration testing. The purpose of system testing is to prove that the software meets the agreed user requirements and works in the target environment. System testing covers both functional and non-functional requirements. Those have been covered in Chapter 3.7 Overview sections.

5.4 System Test Plan

The system test plan is based around the agreed requirements. Test plan covers functional requirements and non-functional requirements such as performance. The system test plan is written by the author of the requirements document to avoid assumption introduced during specification.

Detailed Test Plane is available in Appendices A.

5.5 System Test Cases

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 leaves the system at some end point or also known as execution post condition.

Detailed Test Cases are available in Appendices A.

5.6 Test Automation Tools

Automated software testing is becoming more and more important for many software projects in order to automatically verify key functionalities, test for regressions and help teams run a large number of tests in a short period of time. Selenium is an open source tool that allows to perform functional testing for both web application and desktop applications. With help of selenium it's easy to automate browser events and record and replay the script. Working with selenium is very easy. Selenium allows to write scripts using web driver according to requirements and run it.

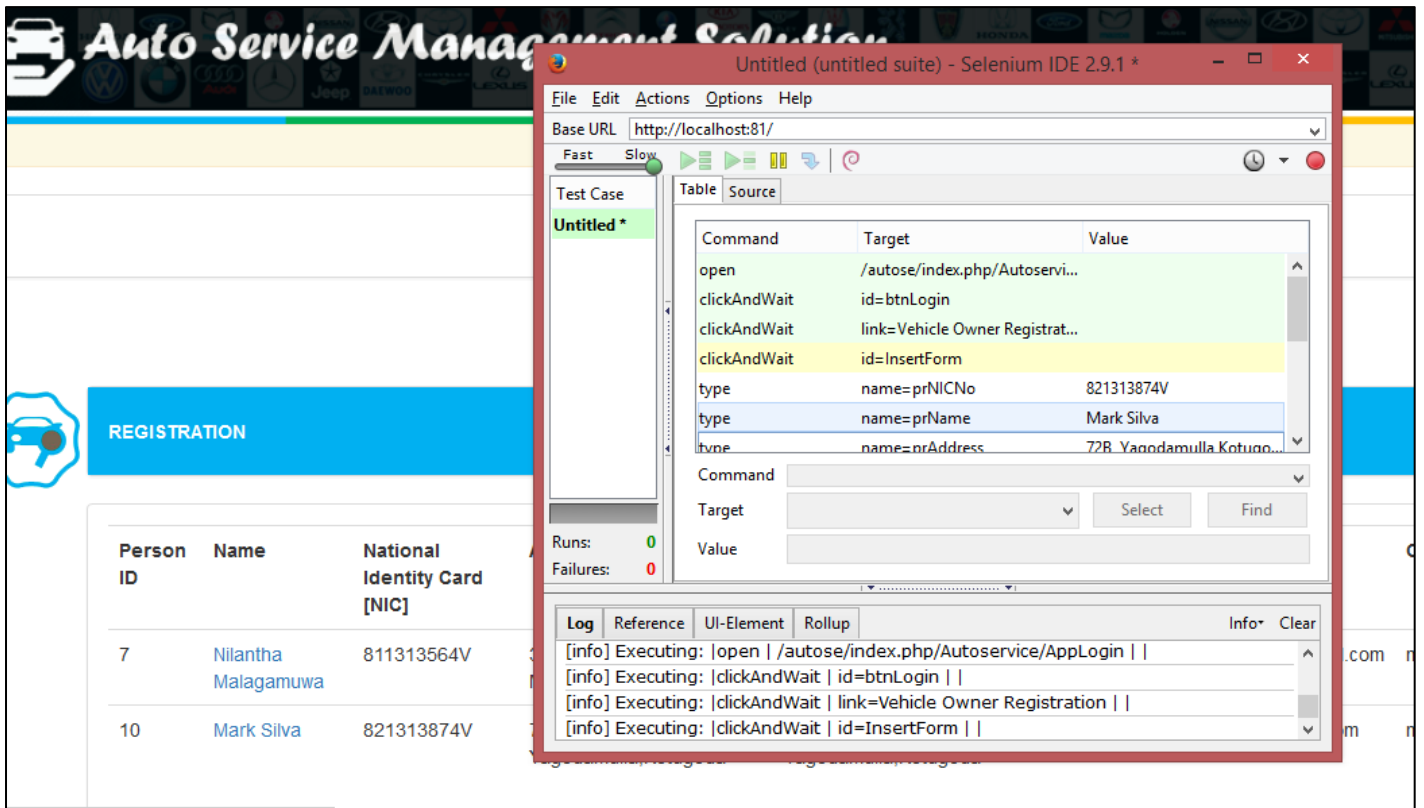


Figure 27 : Test Automation Tool IDE

5.7 Testing Framework

A testing framework or more specifically a testing automation framework is an execution environment for automated tests. It is the overall system in which the tests will be automated. It is defined as the set of assumptions, concepts, and practices that constitute a work platform or support for automated testing.

CHAPTER 6 : CONCLUSION AND FUTURE WORK

6.1 Introduction

This chapter discuss the details about Objectives which are achieved, Major findings when developing the Project, Limitation which are found during the project, how to extend the work and Lesson Learnt.

6.3 Major findings

Backend Programming (Database Level Programming) is very important same as front end Programming. Which is helped to release more than 35 % of front end coding and enhance more security features and increase the flexibility to change coding with minimum dependencies. Third party tool like “Toad for MySQL” can be used to manage database programming than PHPmyAdmin.

6.4 Limitation of Current Work

Unclear Scope

Even though Client has good understood about Manual processes, they do not know the Extract boundaries what software wants to cover.

Technology Phobia

Most of users are feared to handle the system and their feedback about the system is too small. Due to this issue, productivity what it can be gained from this system is not realistic.

Time Limitation for resources planning

Much more time has to spend for self-learning purposes and environment settings.

People support

Lack of support from the people who would actually have to use it.

Security Issues

Open-source software is typically patched to address security threats faster than proprietary programs, simply due to the source code’s availability to the public. With many eyes searching for loopholes, potential threats become obvious quickly

Cost of Training

Due to the inadequate computer literacy trainings for the staff are needed to do frequently. So it’s more cost effective and time consuming tasks.

6.5 Lesson Learnt

If the System needs more customization functionalities than content management, there is no point to use CMS type developing framework to develop this kind of Software Solution. Lots of dependencies might be applicable. On the other hand, using pure PHP, which is not narrow down the coding styles and security concerns. Middleware framework like Codeigniter is the best framework which is support to Agile and rapid development environment like this.

6.6 Achievement of objectives

- **Expecting to align manual operations and past and easy records maintenance.**
By implementing the workflow methodology to the system, most of manual operations have been aligned and responsibilities are being spread according to that.
- **Expanding the client base and client satisfaction in providing flexible services even at their door step.**
Service for the door step is expected to implement in second Stage of the System implementation due to the lack of resources. Client satisfactions are being increased by online bookings, reminding by notifications, providing quick and flexible service to their needs
- **Increase Sales, Performance and Profits**
Which can't be predicted at this point and hope this will manage at least end of two or three quarter left.
- **Manage Resources and avoid unnecessary stock items delay**
Real time stock monitoring and controlling facility (e.g.: Stock Reorder Level) have been given through the system
- **Eliminate quality problems of Service Items**
Using the system, It can be monitored Items which are already issued for particular Services, issued persons and keep exciting Items in the stocks before the out of stocks. So It had been minimized the use of fault or damage items using the system
- **Real time reporting**
Report generating facility for Past Service records, Invoices and Items which are purchased from the Service have been given specific Permission Level.
- **Reduce heavy workload for engineers**
Since the system has control to handle work load and freely available engineer, no one can bypass the process and assign too much of workload for any engineers

6.7 How the work could be extended

Email Clarification.

After invoice is generated and Payment was success, Receipt can be emailed from the System for Future Use.

SMS Notification for customer

System can be send SMS notification by reminding the Next Service Due Date and Time Slots which are available on that period.

SMS Notification for Engineers

After assigning the task by the supervisor or Manager, Engineer can be updated it by sending SMS notification.

Online Payments

Extend the system for Online Payments, IPG (Internet Payment Gateway) can be integrated and Customer can easily pay from that.

Smart Access to the service

Mobile Application can be implemented for customers for their online bookings and other notifications.

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APPENDICES A– TEST PLAN & TEST CASES

Test Plan

No	Function	Testing procedures	Expected output	Priority
Logging Control - Staff User End				
01	Login to the system with wrong user name or Password	Insert wrong user name	Display error message on Same Page “Invalid User Name or Password”	High
02	Login to the system with Administrator user name and password	Insert administrator’s user name and password	Redirected to Main Dashboard Page and available all admin functionalities	High
03	Login to the system with correct user name and password	Insert staff customer’s user name and password	Redirected to Main Dashboard Page and available granted functionalities for that particular group	High
04	Logout from the system	Click on logout button from top menu	Successfully logout and redirect to the login page	High

No	Function	Testing procedures	Expected output	Priority
Logging Control - Customer End				
05	Login to the system with wrong user name or password	Insert wrong user name or Password	Display error message on Same Page “Invalid User Name or Password”	High
06	Login to the system with correct user name and password	Insert customer’s user name and password	Redirected to Main Customer Page	High
07	Logout from the system	Click on logout button from top menu	Successfully logout and redirect to the home page	High

No	Function	Testing procedures	Expected output	Priority
Vehicle Registration – Add New Vehicle details				
08	Register new Vehicle	Insert Vehicle No with Other Details	Display message “Successfully Saved!”	High
09	Register with Previously Entered Vehicle No	Insert Vehicle No with Other Details	Display message “Vehicle is already registered”	Medium

No	Function	Testing procedures	Expected output	Priority
Vehicle Owner Registration – Add New Vehicle Owner details				
10	Enter Details with Incorrect NIC Number	Insert incorrect NIC format	Display message “Incorrect NIC Number”	High
11	Enter Details with Correct NIC Number	Insert correct NIC format	Display message “Successfully Saved!”	High
12	Enter Details with Correct NIC Number twice	Insert correct NIC No	Display message “NIC is already registered!”	Medium

No	Function	Testing procedures	Expected output	Priority
Company Registration – Add New Company				
13	Enter Company Name with Other Details	Insert correct Name for Company	Display message “Successfully Saved!”	High
14	Enter Same Company Name with Other Details	Insert Previously entered correct Name for Company	Display message “Company is already registered!”	Medium

No	Function	Testing procedures	Expected output	Priority
Vehicle Brand Category– Add New Vehicle Brand				
15	Enter New Vehicle Brand Category	Insert New Vehicle Brand Category	Display message “Successfully Saved!”	High
16	Try to Save without insert Vehicle Brand Category	Save Empty Record	Display message “Vehicle Brand Category is not be null”	High

No	Function	Testing procedures	Expected output	Priority
Service Management – Add New Service Request				
16	Enter Already registered vehicle No	Entered Registered Vehicle No	Redirected to “Accept Service Request Page”	High
17	Enter vehicle No which is already assign for the service request	Entered Registered Vehicle No	Display message “Vehicle is already arrange for Services”	High
18	Enter unregistered vehicle no for service	Enter unregistered vehicle No	Display message “Vehicle must be registered in the system before get the service request”	High

No	Function	Testing procedures	Expected output	Priority
Service Management – Add New Material Request				
19	Mark the Order request without Adding Materials.	Click Accept the button without adding Items	Error message display “Cannot Accept the Order Request without Issuing Items ”	High
20	Mark the Order request with Items	Click Accept button after adding Items	Display message “Successfully Saved!”	High

No	Function	Testing procedures	Expected output	Priority
Service Management – Material Issue for the Service Request				
21	Complete the Order without issuing Materials.	Click Update Service Request button without issuing Items	Error message display “Cannot Accept the Order Request without Mark the Items ”	High
22	Complete the Order with Material Update	Click Update Service Button	Display Message “Successfully Saved!” Decrease the Item from Stock	High

No	Function	Testing procedures	Expected output	Priority
Service Management – Completion the Service Request				
23	Complete the Order without filling “Last Service Date” or “Last Service Meter Reading” or “Next Service Due”	Click Complete this Service Request button	Error message display “The Last Service Date field is required.” or “The Last Meter Reading field is required.” or “The Next Service Due field is required.”	High
24	Complete the Order filling with “Last Service Date” and “Last Service Meter Reading” and “Next Service Due”	Click Update Service Button	Display Message “Successfully Update!” and Change Order Status as “I”	High

No	Function	Testing procedures	Expected output	Priority
Service Management – Generate the Invoice				
25	Generate Invoice	Click Paid button to generate Invoice	Successfully generate the Invoice and Display to Print	High

No	Function	Testing procedures	Expected output	Priority
Online Management – Inquiry				
26	Complete the inquiry without the response	Click Submit button to complete the response	Display Error Message “Response should not be null”	Low
27	Complete the inquiry with response	Click Submit button to complete the response	Display Message “Successfully Responded!”	Low

No	Function	Testing procedures	Expected output	Priority
Online Management – Generate the Invoice				
28	Complete the inquiry without the response	Click Submit button to complete the response	Display Error Message “Response should not be null”	Low
29	Complete the inquiry with response	Click Submit button to complete the response	Display Message “Successfully Responded! ”	Low

Table 13 : Test Plane

Test Cases

ID	Action	Expected System Response	Pass / Fail	Comment
Login to the system				
01	Login to the System with correct user name and password	Successfully accept the User credentials and redirected to Main Dashboard Page	Pass	
02	Use incorrect User Name or Password	Display the message "Invalid User Name Or Password"	Pass	
Registration – Vehicle Owner				
03	Verify NIC format	Display the message "Incorrect NIC No"	Pass	
04	Verify that new vehicle owner can be registered with required information	Display the message "Required must not be null"	Pass	
05	Verify that same information cannot be Duplicated	Display the message "Information is already entered!"	Pass	
06	Verify Email Address format	Display the message "Incorrect email format!"	Pass	
Registration - Company				
07	Verify that Required fields are empty	Display the message "Required fields must not be null"	Pass	
08	Verify the same information can't be duplicated	Display the message "Information is already entered!"	Pass	
Registration – Vehicle				
09	Verify that Vehicle No cant be null	Display the message "Vehicle No Can't be Null"	Pass	

10	Vehicle No Can't be duplicated	Display the message "Vehicle No Can't be duplicated"	Pass	
11	Verify that Same Company or Vehicle Owner information can be used to registered more vehicle	More vehicle can be registered under the company or personal	Pass	
12	Same vehicle cannot be registered under the different company name or personal name	Display the message "Vehicle cannot be duplicated"	Pass	
ID	Action	Expected System Response	Pass / Fail	Comment
Service Management – Service Request				
13	Assign the Service Request for the vehicle which is not registered in the system	Display the message "Vehicle is not Available. You must get registered this vehicle before get the service"	Pass	-
14	Issue Service Request for the vehicle which is successfully registered in the system	Redirected to service request page	Pass	
15	Submit the Service Request form without selecting the particular services	Display the message "Service Request can not be initiated without selecting service(s)"	Pass	
Store Management – Material Request				
16	Request Material Items for only Request Service	Only Selected Services are display to place the Item Request	Pass	
17	Check Items availability before Request it	Only available items can be requested	Pass	
18	Issue Request Items	Only selected items can be issued	Pass	

19	Mark the Service Request as Item Issued Service request Without Issuing Items	Display message “Can not complete, need to issue items before it complete”	Pass	
Service Management – Service Request				
20	Complete Service Request without Submitting Require fields	Display message “You must entered Required fields before it complete	Pass	
Service Management – Invoice Generation				
21	Automatically generate the total amount for purchased services	Automatically generate the total amount for purchased services. Discount is only allowed to give manually	Pass	
22	Invoice generate for print	Invoice generate for print	Pass	

Table 14 : Test Cases

APPENDICES B– USER MANNUAL

Staff Login Page

The Figure 28 shows the staff login control for Auto Service Management Solution.

Five types of users are involved with this system, according to their user types they are redirected to the system after authenticate.

Use your email address for the user name and insert correct password for the login.

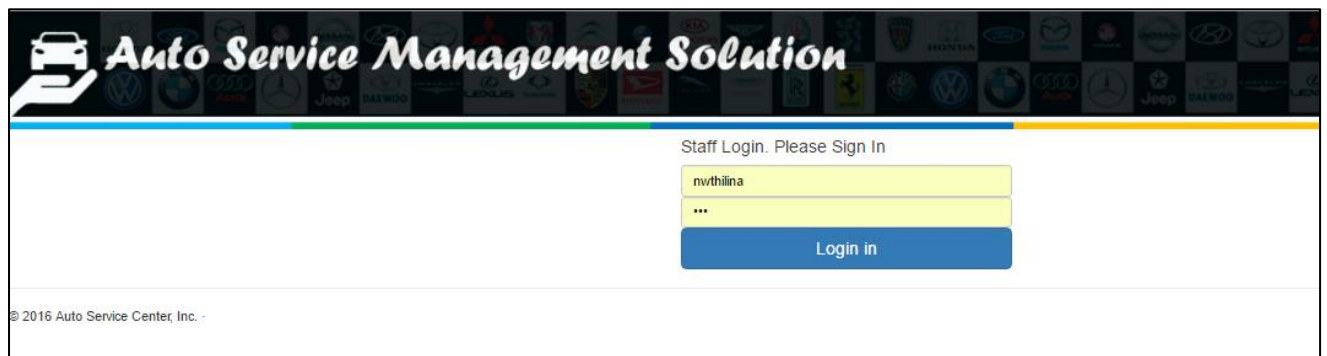


Figure 28 : Staff Login Page

Main Control Page

After Successful authentication user is redirected to the Main Control Page. Based on user privilege menus are activated.

Administrator has fully permission to access all menus.

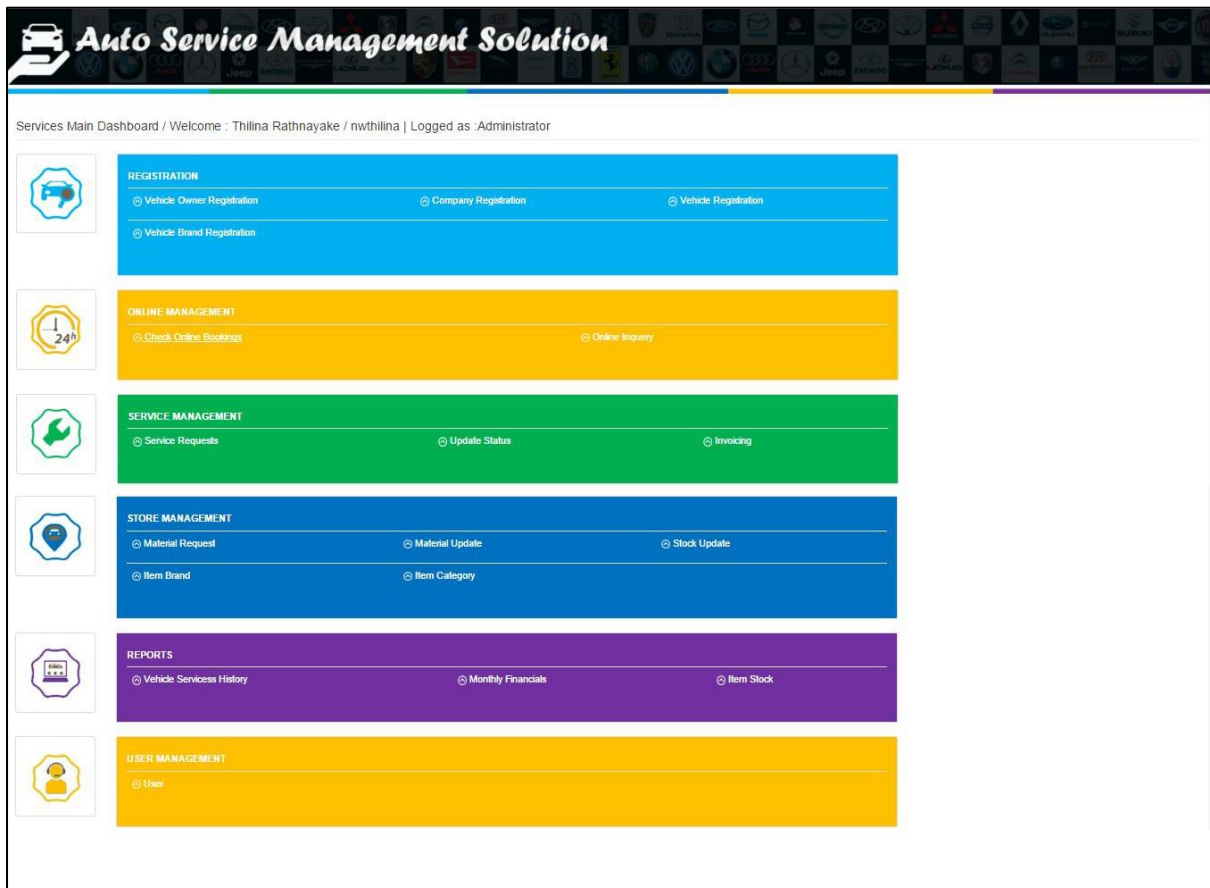
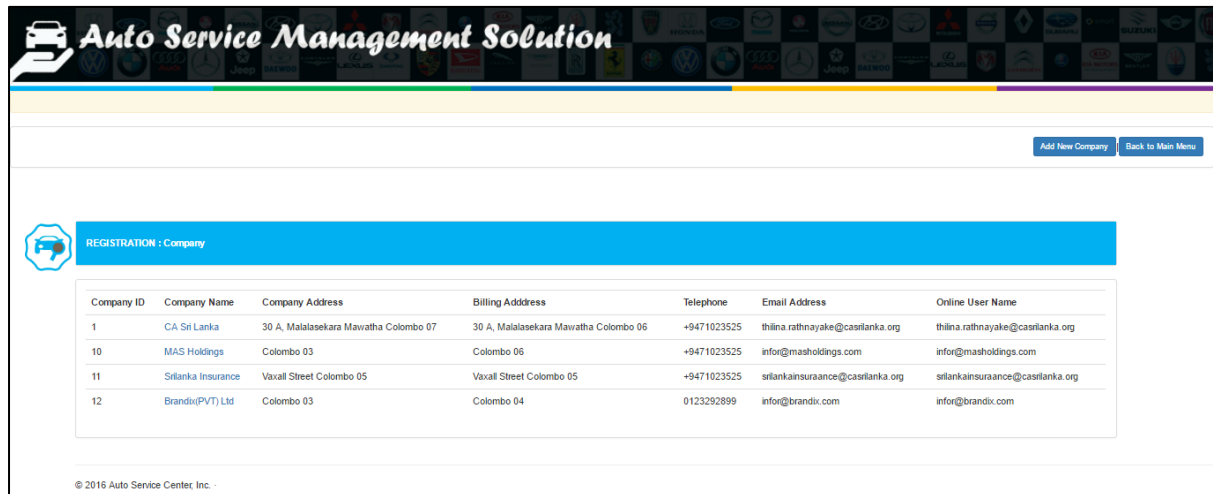


Figure 29 : Main Control Page

Vehicle Owner – Company

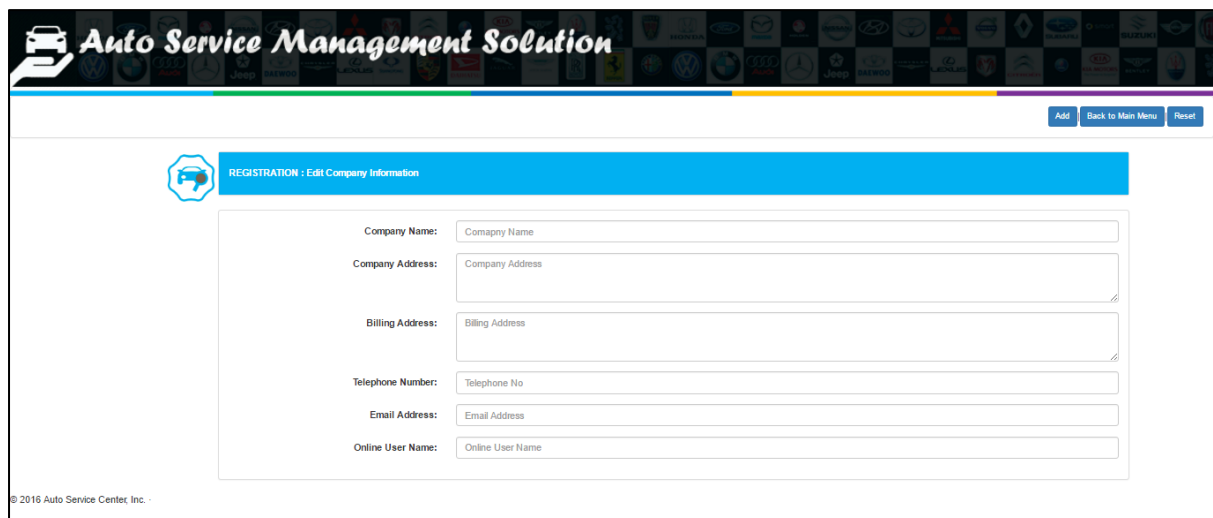
The Figure 30 shows the company main form and the registration form. This component facilitate to maintain the company related information.



REGISTRATION : Company

Company ID	Company Name	Company Address	Billing Address	Telephone	Email Address	Online User Name
1	CA Sri Lanka	30 A, Malalasekara Mawatha Colombo 07	30 A, Malalasekara Mawatha Colombo 06	+9471023525	thilina.rathnayake@casrilanka.org	thilina.rathnayake@casrilanka.org
10	MAS Holdings	Colombo 03	Colombo 06	+9471023525	infor@masholdings.com	infor@masholdings.com
11	Srilanka Insurance	Vaxall Street Colombo 05	Vaxall Street Colombo 05	+9471023525	sri.lankainsuraance@casrilanka.org	sri.lankainsuraance@casrilanka.org
12	Brandix(PVT) Ltd	Colombo 03	Colombo 04	0123292899	infor@brandix.com	infor@brandix.com

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REGISTRATION : Edit Company Information

Company Name:

Company Address:

Billing Address:

Telephone Number:

Email Address:

Online User Name:

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Figure 30 : Company Registration

Vehicle Owner – Personal

The Figure 21 shows the Personal owner maintain and registration form.



Auto Service Management Solution

[Add New Person](#) [Back to Main Menu](#)

REGISTRATION

Person ID	Name	National Identity Card (NIC)	Address	Billing Address	Telephone	Email Address	Online User Name
7	Nilantha Malagamuwa	811313564V	30 A, Malalasekara Mawatha Colombo 07	30 A, Malalasekara Mawatha Colombo 07	+947102352	malagamuwa@gmail.com	malagamuwa@gmail.com
10	Mark Silva	821313874V	72B, Yagodamulla Kotugoda	72B, Yagodamulla, Kotugoda	0112298391	mark.silva@gmail.com	mark.silva@gmail.com
15	Dhanushka Bandara	8678738747	Hokandara Road, Hokandara	Hokandara Road, Hokandara	012352009	dhanushka.bandara@gmail.com	dhanushka.bandara@gmail.com

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Auto Service Management Solution

[Update](#) [Back To Vehicle Owner Main Page](#) [Reset](#)

REGISTRATION : Edit Vehicle Owner Information

Person Id:

Person NIC No:

Person Name:

Person Address:

Billing Address:

Telephone:

Email Address:

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Figure 31 : Vehicle Owner - Personal

Vehicle Registration

The Figure 32 shows the Vehicle maintain and registration form. Owner should be already in before register any vehicle to the system. Multiple vehicle are allowed to be registered under any single owner.



No	Vehicle No	Vehicle Owner Type	Vehicle Owner Name	Vehicle Type	Year Of Registration	Brand	Model	Registered Date / Last Update
1	JM-1234	P	Nilantha Malagamowa	CAR	2000	NISSAN	Lion Face	2016-10-28 05:25:15
2	KF-4377	C	MAS Holdings	VAN	2008	MAZDA	VANETTE	2017-01-12 13:54:24
3	CAB-4567	P	Dhanushka Bandara	CAR	2012	TOYOTA	ACQUA	2017-01-17 19:47:00



Vehicle ID: 4

Vehicle No: CAB-4567

Owner: Company Personal

Company Name: Brandix(PVT) Ltd

Person Name: Dhanushka Bandara

Vehicle Type: CAR

Year: 2012

Brand: TOYOTA

Model: ACQUA

Figure 32 : Vehicle Registration

Service Management – Service Request

The Figure 33 shows the Service request maintain forms. All Service Requests (Online and Manual) are able to control from this.

Auto Service Management Solution

Successfully Saved!

Online Requests are scheduled on Today :

SERVICE MANAGEMENT : Services

Service Request Id	Vehicle No	Service Bay	Timeslot	Request Date	Request Date Time	Engineer	Supervisor
91	CAB-4567	BAY A01	1:30 A.M - 3:30 P.M	2017-02-28	2017-02-28 00:00:00	Asanka Weerasekara	Dhanushka Madushanka

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Auto Service Management Solution

Update Service Task | Back to Main Menu

SERVICE MANAGEMENT : Accept Services

Service Request Id: 91

Vehicle No: CAB-4567

Vehicle ID: 4

Owner: Dhanushka Bandara

Vehicle Type: CAR

Year: 2012

Brand: TOYOTA

Model: ACQUA

Requesting Services:

- Body Wash
- Body Wax
- Interir Cleaning
- Cut and Polish
- Tire Balancing
- Tire Rotation
- Wheel Alignment
- Replace the Engine Oil
- Replace Fuel Filter
- Repalce windshield washer fluid
- Inspect tires for pressure
- Replace battery
- Replace Brake Pad
- Replace Engine Coolant
- Repalce Spark Plugs
- Replace Air Filter
- Repalce Timing Belt
- Replace Power Steering Oil
- Engine Tuneup
- Replace Break Oil
- Replace Windshield Wipper
- Fuel Lines and Pipes
- Replace Clutch Hydraulic System
- Replace Belts

Service Bay: BAY A02 | 1:30 A.M - 3:30 P.M

Service Engineer: Asanka Weerasekara

Service Supervisor: Dhanushka Madushanka

Special Note: -

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Figure 33 : Service Management

Store Management – Item Request

The Figure 34 shows the Item request maintain forms. All items which are needed for a service must be requested from this.

Service Request Id	Vehicle No	Service Bay	Timeslot	Request Date	Request Date Time	Engineer	Supervisor
87	JM-1234	BAY A02	3:30 P.M - 5:30 P.M	2017-01-16	2017-01-16 00:00:00	Asanka Weerasekara	Dhanushka Madushanka
91	CAB-4567	BAY A02	1:30 A.M - 3:30 P.M	2017-02-28	2017-02-28 00:00:00	Asanka Weerasekara	Dhanushka Madushanka

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Service Request Id: 91
 Vehicle No: JM-1234
 Vehicle ID: 4
 Owner: Dhanushka Bandara
 Vehicle Type: CAR
 Year: 2012
 Brand: TOYOTA
 Model: ACQUA
 Service Bay: BAY A02 1:30 A.M - 3:30 P.M
 Service Engineer: Asanka Weerasekara
 Special Note: -

Requesting Services

- Body Wash
- Body Wax
- Interior Cleaning
- Cut and Polish
- Tire Balancing
- Tire Rotation
- Wheel Alignment
- Replace the Engine Oil
- Replace Fuel Filter
- Replace windshield washer fluid
- Inspect tires for pressure
- Replace battery
- Replace Brake Pad
- Replace Engine Coolant
- Replace Spark Plugs
- Replace Air Filter
- Replace Timing Belt
- Replace Power Steering Oil
- Engine Tuneup
- Replace Break Oil
- Replace Windshield Wiper
- Fuel Lines and Pipes
- Replace Clutch Hydraulic System
- Replace Belts

Service Request Category	Vehicle Brand	Item Brand	Item Name
Body Wash	TOYOTA	3M	Select

Service Request Category: Body Wash
 Vehicle Brand / Item Category / Item Name / Description: TOYOTA / 3M / 3M / CAR BODY WASH 3m / 1200

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Figure 34 : Item Request for a Service

Service Management – Service Completion

The Figure 35 shows the Service completion form. All items which are taken to the service display here before the invoice. Based on the completion this form invoice will be generated.

Auto Service Management Solution

Complete this Service Request | Back to Main Menu

SERVICE MANAGEMENT : Service Completion

Service Request Id: 91
 Vehicle No: JM-1234
 Vehicle ID: 4
 Owner: Dhanushka Bandara
 Vehicle Type: CAR
 Year: 2012
 Brand: TOYOTA
 Model: ACQUA
 Service Bay: BAY A02 1:30 A.M - 3:30 P.M
 Service Engineer: Dhanushka Bandara
 Service Supervisor: BAY A02 1:30 A.M - 3:30 P.M
 Special Note: -

Requesting Services

Body Wash
 Body Wax
 Interir Cleaning
 Cut and Polish
 Tire Balancing
 Tire Rotation
 Wheel Alignment
 Replace the Engine Oil
 Replace Fuel Filter
 Repalce windshield washer fluid
 Inspect tires for pressure
 Replace battery
 Replace Brake Pad
 Replace Engine Coolant
 Repalce Spark Plugs
 Replace Air Filter
 Repalce Timing Belt
 Replace Power Steering Oil
 Engine Tuneup
 Replace Break Oil
 Replace Windshield Wipper
 Fuel Lines and Pipes
 Replace Clutch Hydraulic System
 Replace Belts

Service Request Category	Vehicle Brand / Item Category / Item Name / Description
Body Wash	TOYOTA / 3M / 3M / CAR BODY WASH 3m / 1200 thina / 2017-03-01 04:18:32

Last Service Date: _____
 Last Service Meter Reading: _____ [Calculate Next Service Due](#)
 Next Service Due: _____
 Service Description: _____

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Figure 35 : Service Completion

Service Management – Invoice Generation

The Figure 36 shows the Invoice Generation form. Total amount calculates based on item purchase, tax and discount.

Auto Service Management Solution

Generate Invoice | Back to Main Menu

SERVICE MANAGEMEN : Generate Invoice

Service Request Id: 91

Vehicle No: JM-1234

Vehicle ID: 4

Owner: Dhanushka Bandara

Vehicle Type: CAR

Year: 2012

Brand: TOYOTA

Model: ACQUA

Service Bay: BAY A02 1:30 A.M - 3:30 P.M

Service Engineer: Asanka Weerasekara

Service Supervisor: BAY A02 1:30 A.M - 3:30 P.M

Special Note: -

Requesting Services:

- Body Wash
- Body Wax
- Interir Cleaning
- Cut and Polish
- Tire Balancing
- Tire Rotation
- Wheel Alignment
- Replace the Engine Oil
- Replace Fuel Filter
- Repalce windshield washer fluid
- Inspect tires for presure
- Replace battery
- Replace Brake Pad
- Replace Engine Coolant
- Repalce Spark Plugs
- Replace Air Filter
- Repalce Timing Belt
- Replace Power Steering Oil
- Engine Tuneup
- Replace Break Oil
- Replace Windshield Wipper
- Fuel Lines and Pipes
- Replace Clutch Hydraulic System
- Replace Belts

Service Request Category	Vehicle Brand / Item Category / Item Name / Description	
Body Wash	TOYOTA / 3M / 3M / CAR BODY WASH 3m / 1200	thlina / 2017-03-01 04:18:32

Last Service Date: 2016-01-17

Last Service Meter Reading: 1333

Next Service Due: 4333

Service Description: -

SubTotal: 1200.00

NBT: 24.00

VAT: 2.40

Other: 0.00

Discount %: 0.0

Calculate Total

Reason: -

Total: 1226.40

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Figure 36 : Invoice Generation

Payment Receipt

The Figure 37 shows the Payment Receipt. After the payment done this will print. Auto generated invoice no, Service Information, Vehicle information, Requested Service and Items what are used for a service display under the payment receipt.

Auto Service Management Solution

[Print Invoice](#) [Back to Main Menu](#)

Invoice

Billed To: 91_8_1_3_2017
 Dhanushka Bandara
 Hokandara Road, Hokandara

Vehicle Information:
 CAR
 TOYOTA
 ACCOJA
 CAB-4567

Service Information:
 Last Service Date : 2016-01-17
 Last Service Meter Reading : 1333
 Next Service Due : 4333

Date:
 2017-03-01 04:50:51

Order summary

- Body Wash
- Body Wax
- Interir Cleaning
- Cut and Polish
- Tire Balancing
- Tire Rotation
- Wheel Alignment
- Replace the Engine Oil
- Replace Fuel Filter
- Repalce windshield washer fluid
- Inspect tires for presure
- Replace battery
- Replace Brake Pad
- Replace Engine Coolant
- Repalce Spark Plugs
- Replace Air Filter
- Repalce Timing Belt
- Replace Power Steering Oil
- Engine Tuneup
- Replace Break Oil
- Replace Windshield Wipper
- Fuel Lines and Pipes
- Replace Clutch Hydraulic System
- Replace Belts

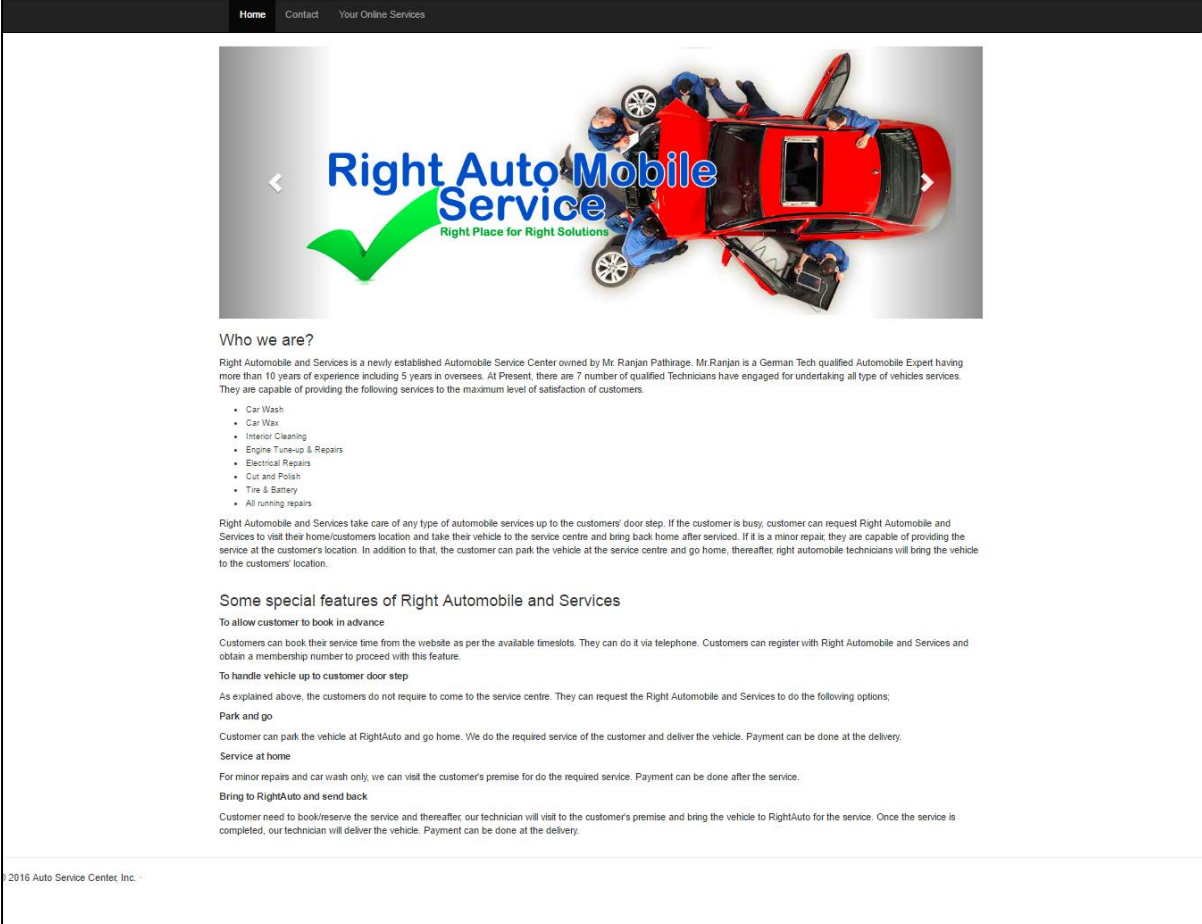
Service Request Category	Vehicle Brand / Item Category / Item Name / Description
Body Wash	TOYOTA / 3M / 3M / CAR BODY WASH 3m / 1200
Subtotal	
	1200
NBT	
	24
VAT	
	2.4
Other	
	0
Discount	
	0
Total	
	1228

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Figure 37 : Payment Receipt

Organization Home Page

The Figure 38 shows the Organization website home page. All communication can be done through this. Registered customer has facility to get their service after login. Customer can book their service via online.



Home Contact Your Online Services

Right Auto Mobile Service

Right Place for Right Solutions

Who we are?

Right Automobile and Services is a newly established Automobile Service Center owned by Mr. Ranjan Pathirage. Mr. Ranjan is a German Tech qualified Automobile Expert having more than 10 years of experience including 5 years in overseas. At Present, there are 7 number of qualified Technicians have engaged for undertaking all type of vehicles services. They are capable of providing the following services to the maximum level of satisfaction of customers.

- Car Wash
- Car Wax
- Interior Cleaning
- Engine Tune-up & Repairs
- Electrical Repairs
- Cut and Polish
- Tire & Battery
- All running repairs

Right Automobile and Services take care of any type of automobile services up to the customers' door step. If the customer is busy, customer can request Right Automobile and Services to visit their home/customers location and take their vehicle to the service centre and bring back home after serviced. If it is a minor repair, they are capable of providing the service at the customer's location. In addition to that, the customer can park the vehicle at the service centre and go home, thereafter, right automobile technicians will bring the vehicle to the customers' location.

Some special features of Right Automobile and Services

To allow customer to book in advance
Customers can book their service time from the website as per the available timeslots. They can do it via telephone. Customers can register with Right Automobile and Services and obtain a membership number to proceed with this feature.

To handle vehicle up to customer door step
As explained above, the customers do not require to come to the service centre. They can request the Right Automobile and Services to do the following options:

Park and go
Customer can park the vehicle at RightAuto and go home. We do the required service of the customer and deliver the vehicle. Payment can be done at the delivery.

Service at home
For minor repairs and car wash only, we can visit the customer's premise for do the required service. Payment can be done after the service.

Bring to RightAuto and send back
Customer need to book/reserve the service and thereafter, our technician will visit to the customer's premise and bring the vehicle to RightAuto for the service. Once the service is completed, our technician will deliver the vehicle. Payment can be done at the delivery.

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Figure 38 : Customer Home Page

User Home

The Figure 39 shows the User home. User must provide the user credential before coming to this place. All Services history, Inquiries are displayed here.

The screenshot shows a user interface for a service center. At the top, there is a dark navigation bar with the following links: Home (highlighted), Contact, and Your Online Services. Below the navigation bar, the main content area is white and contains the following elements:

- Welcome : Nilantha Malagamuwa**
- My Information** section containing:
 - Address 30 A, Malalasekara Mawatha Colombo 07
 - Billing Address 30 A, Malalasekara Mawatha Colombo 07
 - Telephone +947102352
 - Email Address malagamuwa@gmail.com
- Your Previous Services information** section containing a table with the following data:

Service No	Vehicle No	ServicedDate	Next Service Due
1	JM-1234	2017-01-16 23:31:39	27000
- An **Add New Service Request** button.
- Online Request for a Service and Response** section containing a table with the following headers:

Request No	Vehicle No	Request Date	Status
------------	------------	--------------	--------

At the bottom left of the page, there is a copyright notice: © 2016 Auto Service Center, Inc. .

Figure 39 : User Home

APPENDICES C– USER EVALUATION TOOLS

User Survey Questionnaire

(1) Working Area:

(2) Designation:

* Please mention which the satisfaction of the system by using following symbols. (Please mark on relevant cage)

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

1	I think that I would like to use this system					
2	I found the system unnecessarily complex					
3	I thought the system was easy					
4	I think that I would need the support of a technical person to be able to use this system					
5	I found the various functions in the system were well integrated					
6	I thought there was too much inconsistency in this system					
7	I would imagine that most people would learn to use this system very quickly					
8	I found the system very cumbersome to use					
9	I felt very confident using the system					
10	I needed to learn a lot of things before I could get going with this system					

Figure 40 : User Survey Form