St. Mary's University

Faculty of Informatics

Department of Computer Science

Garage Management Information System

For

Addis Ababa Police Commission

Project Report

For

The Partial Fulfillment of for the Requirements of Degree of Master of Science in Computer Science

Submitted by: BezuMoges

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Acceptance

Garage Management Information System

For

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By

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Declarations

I, the undersigned, declare that this project is my original work has not been presented for a Degree in this or any other universities, and all sources of materials used for the project work have been duly acknowledged.

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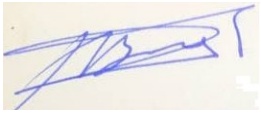

Addis Ababa Ethiopia

This thesis has been submitted for examination with my approval as advisor:

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BezuMoges

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List of Acronyms

GMIS	Garage Management Information System
RAD	Requirement Analysis Development
AAPCGMS	Addis Ababa Police Commission Garage Management Information System
ICT	Information Communication Technology
MOENCO	Motor and engineering company of Ethiopia
SDD	System development design
GUI	Graphical user interface
WWW	World Wide Web
INSA	Information Network Security Agency
SDLC	Development Life Cycle
ERP	Enterprise Resource Planning

Abstract

Web based management information system provides integration and optimization of various business processes that leads to improve the functional processes of an organization. The main purpose of this project was to develop web- based information management system in order to solve the existing challenges of the manual garage management system of the Addis Ababa Police Commission. For this purpose, the required data was collected using interview, questionnaires, direct observation and document reviews, and reports of the origination. From the collected data a quantitative and qualitative analysis was conducted which followed by testing and interpretation. From the result, sufficient evidence is found to support the stated problem that hindered the proper and smooth functional processes of the garage information management systems. The developed web-based information management system can alleviate the exiting manual and tedious work of the garage system which enhances the overall business process functions of the Addis Ababa police Commission.

Keywords: ***Garage Management Systems, System Development, System Design***

Chapter One
Introduction

1.1Overview

In the current technological era, information is so vital for the day to day decision of businesses and alike. Mobile, cloud, stock exchanges, commodity exchanges, financial institution are all connected through networks that are the integral part of message communication in the world now and in the future. The World Wide Web (WWW) is a techno-social system to interact humans based on technological networks [5]. The use of web is growing at a phenomenal rate across the globe. The reason for the Web's success is largely due to its simplicity for use and information retrieval. Its nature of simplicity and usability makes web to be preferably used in any sector for management and transaction of information. For the full functioning of the web, it requires cooperation between information providers and users [6]. As a basis for designing complex information systems the Web-technology has matured a lot over the last few years. The technology is still fairly simple with a number of unsolved problems, but the advantages and potentials are so significant that most of today's design of information systems to some extent is based upon web-technology.

1.2Background of the Organization

The Addis Ababa Police Commission is a Government institution managed under the administrative development section of the Federal Police. It had established by the Federal NegaritGazeta of the Federal democratic republic of Ethiopia 10thYear No. 11 ADDISABABA-7th November,2003. Council of Ministers Regulation No. 96/2003 Addis Ababa City Police Commission Establishment Council of Ministers' Regulation Page" 2448 council of ministers regulation no. 96/2003 council of ministers regulations for establishment of Addis Ababa police commission the Council of Ministers issues this regulation-pursuant to Article 5 of definition of powers and duties of Executive Organs of the Federal Democratic Republic of Ethiopia Proclamation No. 4/1994 and Article 24(4) of the Federal Police Commission Proclamation No. 313/2003.

The Addis Ababa Police Commission has a large size Garage which is giving full garage operational services for all types of the vehicles of the commission. The garage is located in front St. George Church, at Piassa, Doro Manekya. It is administering and maintains hundreds of vehicles that came from all the branches the Addis Ababa Police divisions.

Based on the nature of working condition of the commission, different types of vehicles starting from motor bikes to heavy duty vehicles are available to accomplish its mission (Table 1:). Based on that to facilitate and handle the proper transportation services for the proper functional processes and to decrease the down time of the vehicles, the Police commission had established its own garage that gives all types of maintenance service.

Table1.1: Available motor bikes and heavy-duty vehicles

Types of vehicles	Quantity	Types of Motor cycle	Quantity
Volkswagen	186	BMW	200
TOYOTA	420	Yamaha	461
Ford	96	Suzuki	56
BMW	153		
MarchdizeBenze	266		

This Garage which has been in existence for above 30 years under various designations has played the leading role in the adoption and use the maintenance and servicing of vehicles of the Commission with manual management systems.

The existing process function for handling the activities of the garage is totally manual operation, which is time consuming and tiresome paper-based information handling system.

Mostly the vehicles services get from here in Addis Ababa under the different divisions and directorates. The regional Addis Ababa Police cars are also serviced in this garage. Maintaining correct vehicle service records, keeping the merit and performances and general information of employees including drivers, estimation of maintenance cost , complete service history and repair tracking, complete material or spare parts management including Purchase Orders, Receipt, Return, Issues and Inventory, drivers

history and efficiency of car handling, managing car insurance policies and the different information exchange between the different departments, evaluation of the performance of the garage and controlling the total cost of budget of the garage as a whole for future planning and assessing its performance has been a great difficulty under the current manual system.

The Garage is currently organized into three units namely AAPC logistic Directorate, Vehicle distributer & Maintenance deputy director, Vehicle distributer & Insurance Division, Vehicle Maintenance Division.

1.3 Statement of the Problem

The Addis Ababa Police Commission has a large size Garage which is giving full garage operational services for the vehicles of the commission. The existing process function for handling the activities of the garage is totally manual operation. This is time consuming and tiresome paper-based information handling. All AAPC Garage Employee's currently operate all its Administrations using handwritten forms or slips stored in drover (files). The handwritten information may also cause some clashes in the records such as missing a particular slip or maintaining the records in large Garage. It is also difficult to search a particular record from a bunch of records. So, to avoid the problem arises, we need an automated system that keeps a track of all the records & related information. The existing system has different control mechanisms for different functionalities in the different roles and managerial hierarchies.

The existing manual of the Garage management system has been seen from the following two scenarios among others. These are when a problem has happened on the vehicles while they are on duty and when the vehicles are in need of services due to different cases. In all of them the whole process for the maintenance was tiresome when dealing manually. This can be seen from the following figure (Fig.1.2) diametrically. As can be seen from the diagram, the following steps of actions have been conducted. First driver write a letter to his immediate boss about the condition of his vehicle and the boss filed the case and transferred to vehicle control and hire department. After fulfilled the formalities the department sent to Garage Vehicle Maintenance and Hire deputy commissioner where final decision is made and an order is given to the reception. The

reception arranged a technician and sent to the place where a problem has occurred on defective the vehicle, in which the case of the problem to be investigated. If the problem is minor, it can be fixed otherwise it will be arranged for the defective vehicle to be transported to the garage for further maintenance and then vehicle service follows up sticker is given to the driver.

The same scenario of action is going to be conducted while there is a need of services for the vehicles for different cases at different times (Fig.1.3).

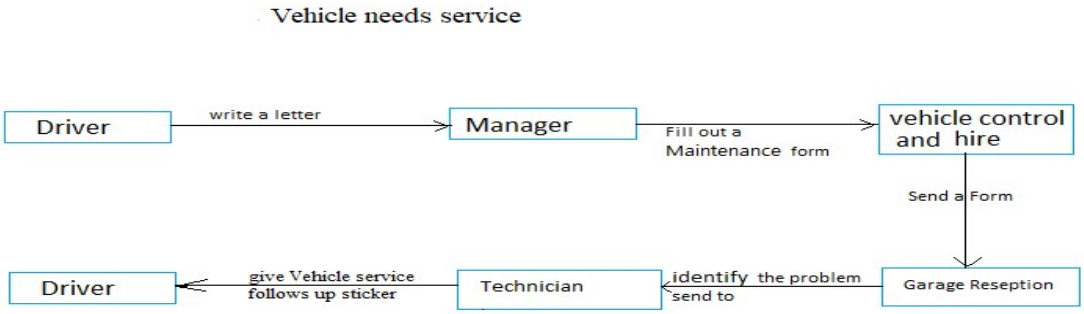

Fig.1. 1 Existing Manual system work process vehicles need service

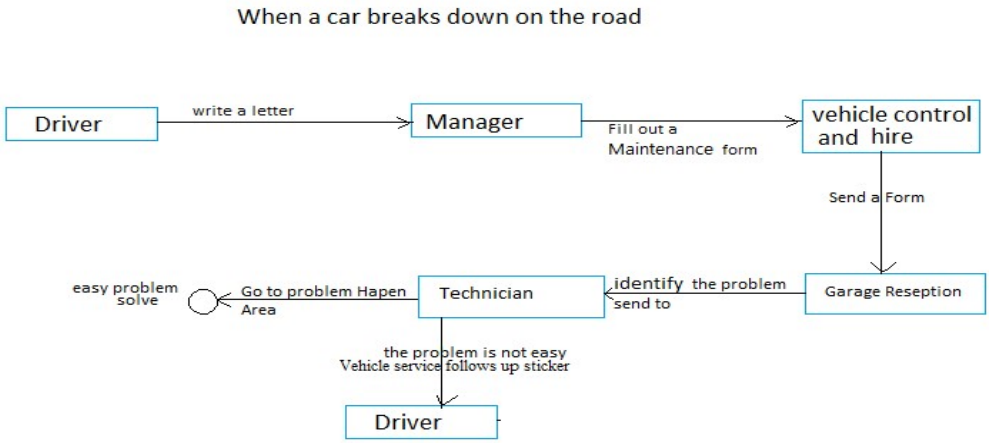

Fig.1. 2: Existing Manual system work process vehicles need service when break down on the road

The existing system has different control mechanisms for different functionalities in the different roles and managerial hierarchies. There are different forms for different tasks: for employees, vehicles, drivers, reception, maintenance checkup, maintenance, inventory, insurance, disciplining, registering and cannibalization and for attendance. Service or maintenance of vehicles passes through the different departments of the

garage to complete their maintenance process. As the management system is manual there isa problem in getting reliable and relevant reports timely for the management which is used for prompt decision making purpose, which triggered the need for automated Garage management system.

This project is therefore to develop a web-based garage management system which can solve the above problems which in turn enhance the overall service delivery of the garage system

1.4 Objective

1.4.1 General Objective

The General objective of this project is to design, develop and test web-based automated Garage information management system of Addis Ababa police Commission.

1.4.2 Specific Objectives

In order to achieve the general objective, this project aims to achieve the following specific objectives:

- To examine and access the existing manual data handling systems of the Addis Ababa Police Commission Garage.
- To determine the existing difficulties where more emphasis is required and propose possible alternatives.
- To perform the requirement analysis based on the existing data management.
- To design a better system that could be used to improve the workings of the Garage.
- To evaluate and test the developed system with the required parameters.

1.4.3. Research Questions

With respect to the stated problems and objectives of the study, this project should answer the following research questions.

What are the different steps to be conducted in the development process of the web-based Garage management system and how it will be evaluated for its functionality with regard to the proposed and required purpose of the Addis Ababa police commission garage Management?

1.4.4 Specific Research Questions

- What are the different types of methods used to examine the existing nature of the Garage management system of AA Police Commission?

- What are the different techniques used for the study of the requirement analysis and system development of the planned garage management system?
- What are the different parameters used for evaluating and testing for the developed web-based garage management system?
- What will be the contribution of the developed system in assisting the employees of the Addis Ababa Garage in decision making for the service delivery?

1.5 Scope and Limitation

1.5.1 Scope of the project

The project covered a design of web-based Garage Management Information System for the city Government of Addis Ababa Police Commission. The project mainly focused on analyzing the existing manual system, collecting the requirements of users and designs a web-based information system for the scheme.

1.5.2 Limitation of the project

As of the other research project, this research has also its own limitation. However, the project may have the following limitation primarily. The project doesn't cover the whole functional processes for the Garage management system due to limited time and finance to cover the activity.

1.6. Organization of the project

Generally, the paper is organized into five chapters. The first chapter starts with general information about the project, Back ground of the organization followed by statement of the problem and continued with the objective of the project, significance of the project, the scope of the project and limitation of the project. The second chapter is looking into some previously conducted related works and literatures on the subject, open source application and limitation, Development of garage management systems software from scratch. The Third chapter is about research design and methodology which presents the research design and methodology of the project with design and consideration. The fourth chapter deals with design and implementation and cost benefit analysis and functional requirement. The five-chapter detail testing the system and identify expected result with Evaluation. The last and the sixth chapter surfaces conclusions reached and the recommendations forwarded.

Chapter Two

Literature Review and Related Works

2.1. Introduction

This chapter shows the review of different literatures, reports, and different written documents regarding the existing problems of the research paper which focused on reviewing important literatures that have been done related with management information systems and common garage management systems.

The main purpose of writing this literature review is to understand what knowledge and ideas that have been established about Web Base Garage Management Information System. It also would help to identify the strength and weakness in that system. Besides that, it used to identify direct related work resources and to collect different information from research, articles and journal in web site.

There are several kinds of literatures that had been reviewed and the review is categorized in order to understand garage management systems, its characteristics and features, its benefits and challenges of implementation with regard to the business process management of the garage management systems

The use of Information Communication Technologies (ICTs) has changed the way how management of any business changed and dealt. Nowadays, most of the business organizations either public or private have a dependency on the technology for their management purposes by shifting from the manual traditional way of communication with their customers to adopting modern technologies.

Management information system is becoming a necessary tool for enterprise participating in international competition [11]. Research conducted by has examined the complexity of management information system. The research has tried to discover the application of the Management information system is a typical information technology which replaces traditional management system method either by upgrading the interior management or optimize the

relationships of customers and suppliers which directly enhance the competitiveness of the organization.

One of the information system management increasingly important in today businesses potentially comprises almost all the business process functions of all organizations is an Enterprise Resource Planning (ERP). ERP integrates most of the data that an organization can process and use in their operations. It has the ability to support organizational strategies, integrate the flow of information and enhance competitive advantage and individual performance [12].

In the process of building knowledge, the literature search was a fundamental requirement of all research projects. It was part of any research process and follows the definition of a topic and the preliminary gathering of data. It used to identify published information into the same, similar, or related areas of interest; and to sharpen the focus of the research topic [14].

2.2. Review of Related Works

Garage Management System is a web based responsive application for garage management that can manage the whole process functions of the Garage through a web application [2]. Organization use the ICT technology to manage the overall functional work processes in order to solve the different challenges occurred while using manual systems during in the course of implementation. This is also the same for the Garage management system.

In Garage system different types of business process functions related to the maintenance will be conducted, these are functional checks, servicing, repairing or replacing of necessary devices, equipment, machinery, body parts, and supporting utilities in industrial, business, governmental, and residential installations with the following definitions.

- Any activity—such as tests, measurements, replacements, adjustments, and repairs —intended to retain or restore a functional unit in which the unit can perform its required functions

- All action taken to retain material in a serviceable condition or to restore it to serviceability. It includes inspections, testing, servicing, classification as to serviceability, repair, rebuilding, and reclamation

- All supply and repair action taken to keep a force in condition to carry out its mission.

- The routine recurring work required to keep a facility in such condition that it may be continuously used, at its original or designed capacity and efficiency for its intended purpose.

Garage plays a vital role in the development of the modern era as an integral part of the socioeconomic and political structure of the country. This has a greater impact in developing countries as of Ethiopia. This is due to poor transport, transport infrastructure, and traffic management systems which they should involve optimal integration of the means and ways of mobility to create maximum ease and comfort maintaining the socioeconomic and physical integration of the city. This in turn has a direct effect on Garage operations.

Maintenance is strictly connected to the utilization stage of the product or technical system, in which the concept of maintainability must be included. In this scenario, maintainability is considered as the ability of an item, under stated conditions of use, to be retained in or restored to a state in which it can perform its required functions, using prescribed procedures and resources.

Chavan concludes that Automobile Service Center Management of Mazda Company is user friendly (easy to use. It is free of cost on android store) and of course it saves time besides to its cost effectiveness. Effective maintenance and services of the vehicles is one of the main factors for safety condition [1]. As Ganar et al. stated that the importance of web-based garage management system gave the functions of the garage real time monitoring, fault management, system management and maintenance service management issues[2]. It has been concluded that the system has improved the efficiency of the garage besides an information about any fault happened is transmitted timely to seek an immediate solution for the concerned department.

According to E-garage management system using the specified platform for the automobile servicing made easily accessible for those users who want to take the service functionality at the specified place and time[2]. This has definitely increased the business value of the garage as well. At the same time developed a vehicle maintenance management information system in which composed of most of the modules required by the user during the course of action [13]. However, there is no module which gives any tracking process mechanism to view and fellow up the status of the vehicles while they are in the garage during the maintenance processes. It also lacks troubleshooting module to help the driver for identifying the problems of the vehicles at hand.

FIAT general import model developed database management system-based inventory model and its timeframe for the spare parts import management for their automobiles and solved the delay of the spare parts import process systems [14].

2.3. Development of Garage Management Systems Software

Currently Garage Management Software can be either developed from scratch or obtained from commercial off the shelf. Even though the latter is better with respect to time frame and easily accessible, it has limitations which can be seen from the following points. Mostly the software commercial off the shelf are developed as standard software which fulfills all of the activities which can be conducted by the garage.

However, this standard software doesn't match or customize easily to the activities conducted by individual garage systems as per their requirements. In addition to that, the language of the software interface cannot be customized to the required language easily. Moreover, the cost of the commercial off the shelf software is high.

Currently there are many commercial off the shelf software/applications on Garage management systems software widely used in the world. These can have different functionalities and modalities. These are the listed with their features, properties and limitations:

RAMP is one of the on-shelf software,fully automated and offers secure online data

backups. **RAMP** is integrated **garage management software** which rapidly cuts down on the admin time and helps you focus more on fixing cars. It is smart car service software with all the features useful for day to day **auto service management [10].** RAMP has been the pioneer in Multi Brand Vehicle Workshop Management Systems. As it is cloud base, it has the Unlimited Users Unlimited Stock Items Unlimited Feature updates.

CarVueis is another on shelf**,** web-based garage management software for independent garages. It manages the customer's jobs,parts & invoices anytime on any device. Powerful auto repairing and garage management software that saves time and increases efficiency and visibility. It has got characteristics which include easy sign-up, user-friendly dashboard, contacting customers easily, security about vehicles, managing workshop, managing sales, analyzing all the work done [9].

MAM Auto work Online is a software application offer a rich array of management functionality that helps companies maximize value and drive business success. With a focus firmly on improving profitability and delivering a return on investment, our solutions help companies achieve tangible positive results across important business metrics such as sales revenue, productivity, stock turns and customer satisfaction.

Both our Auto part and VAST applications present new software models that combine the best aspects of off-the-shelf software with the advantages bespoke developed solutions; both can be deployed out-of-the-box, yet are fully customizable. Through the configuration of parameters and fields, we can quickly and easily add depth to our software in the areas where users need specific features or personalization. The result is bespoke software at off-the-shelf prices. It has got the best functionality which helps in for better sales management, inventory control, customer relationship management, stock management [10].

Mitchell1 is one of the leading auto repairing and garage management software for professional care shop. It serves numerous useful features for analyzing, shop management, marketing, and so on.

GarageHive is an auto repairing and garage software system. It is specially designed for medium and large size organizations. It is a complete package with features including car

service management, spare parts management, CRM and financial management.

From the above it has been seen that most of the mentioned garage are model based specific, they didn't have all type vehicle maintenance. This leads to that the developed software is also peculiar to the individual garage systems.

2.4 Summery of the Related Literatures

From the different literature survey, the concept of management information system especially in Garage Management for different organizations in decision making processes is discussed.

From the different literatures, such as Ganar et al. [2], though described and noted the need of the different functional modules of the garage management system, the troubleshooting module which is essential and easy problem tracker to help the driver for identifying the status and problems of the vehicles fault for further immediate and appropriate measure action to be taken is missed which is a big gap and required to be solved. In another paper [13] the importance and development of vehicle maintenance management information system composing most of the modules was described, but the process flow tracking module to view and fellow up the status of the vehicles while they are in the process of maintenance servicing was important. However, this part is missed and needs to acknowledge as gab to be filled. At the same time option for any help, request or approval by the driver for the whole processes of the garage management information systems is also missed which was very important for reacting and solving the appropriate action timely. Furthermore, the current status of the AAPCG systems and the different opportunities and challenges in implementing in the different functional processes are also discussed with the concerned body.

Based on that, this research paper aims to fill the above-mentionedgaps by adding the missed mentioned modules and adding additional features in the developed web-based garage management system thereby improving the overall optimized behavior under changes and uncertainties in perceived and inferred context information.

Chapter Three
Methodology

3.1 Introduction

Methodology is the combination of best practices, procedure, rules and guidelines in one word the methods, of the specific field of science and art by which professionals, specialists and researchers can conduct their projects, research, development and project activates. For this project a Software Development Life Cycle (SDLC) is used. SDLC is a framework that defines the steps that need to be followed in software development.The SDLC process involves several distinct stages, including planning, analysis, design, building, testing, deployment and maintenance. Every textbook author and information system development organization uses a slightly different life cycle model, with anywhere from three to almost twenty identifiable phases [1].

3.2 Research Approach

Method of research approach is one of theplans which give the direction of the scientific research conducted. Currently, different types of research philosophies are available for the research phenomenon. Among them design science is the one which gives more emphasis on exploring the source of the problem and come up with solution using pluralistic approaches instead of focusing on methods to answer a research question. The design-science paradigm seeks to extend the boundaries of human andorganizational capabilities by creating new and innovative artifacts. In the design-science paradigm, knowledge and understanding of a problem domain and its solution are achieved in the building and application of the designed artifact.Since design science has different features in its view, it is more suitable to the research project and to the nature of the problem of the research under consideration with qualitative and quantitative phases of project.

Design science research creates and evaluates IT artifacts intended to solve identified organizational problems. It involves a rigorous process to design artifacts to solve observed problems, to make research contributions, to evaluate the designs, and to communicate the results with appropriate audiences [5].

Based on this suggestions and applicability of design science view on most of the garage

management system, the researcher has chosen design science with agile mixed method research design for this research paper.

3.2.1. Research Design

Research design helps the researcher to organize ideas in a format for collecting and analyzing variables to answer research questions. For this project, the research design will consider the variables concerning to the baseline, current status of the organization and the future needs of the Garage management system to analyze the real-time information to address the need and help the organization for taking appropriate and responsive measures while planning for the future.

3.3. Data Source

The Addis Ababa Police Garage and Commission office were used as the required data source. These were purposefully selected to obtain the required data for the project .The necessary data from these will be collected from primary and secondary sources. The primary data sources will be from interviews, questionnaire, and informants of the project will be the management officials and senior experts of the organization. The major secondary data sources will be from the document analysis of a number of reports. [4]

To achieve the research objectives, both qualitative and quantitative methods were applied. Different types of data collection methods were used. The questionnaires data collection techniques were divided into three sections.

The first section comprises questions concerning basic demographic information regarding to the respondents such as gender, educational level, profession, position, year of service in the Garage.

The second section captured information about the existing information exchange mechanisms adopted within the Garage. The last section sought to explore the need and understanding about the web based information management system by the employees of the Addis Ababa Police Garage. Furthermore interviews, on-site observations, secondary data sources are also used to collect the data sources.

3.4 Sample size

To get accurate and validate information from the subject of the project, it would be impractical for the researcher to collect data from the entire population. As Sander (2009), sampling provides a researcher a numerous advantageous: the researcher budget constraints prevent the researcher from surveying the entire population, the time constraints prevent researcher from surveying the

entire population, and the researcher could collect all the data but need the results quickly. For all research questions where it would be impracticable for researcher to collect data from the entire population, the researcher needs to select a sample. This will be equally important whether the researcher planned to use interviews, questionnaires, observation or some other data collection technique. Sampling also saves time, an important consideration when the researcher has tight deadlines [7].

As Kothari, (2oo4) described, the size of sample refers to the number of items to be selected from the universe to constitute a sample. According to Kothari, the size of sample should neither be excessively large, nor too small. It should be optimum. An optimum sample is one which fulfills the requirements of efficiency, representativeness, reliability and flexibility. The parameters of interest in a research project must be kept in view, while deciding the size of the sample. Costs too dictate the size of sample that we can draw. As such, budgetary constraint must invariably be taken into consideration when we decide the sample size. Therefore the sample size of this research will be 10 % of employees of the Addis Ababa Police Garage employees at different levels and from the Head office the relevant departments are selected. The sample size composition ensured incorporation of systematically selected players from each of the phases or levels. Thus, totally 25 employees were considered for analysis. Systematic sampling approaches was adopted for this project because in this way we can get representation from all the departments in the commission and overcome the limitation of the simple systematic sampling. The project instrument was administered to the respondents through a personal contact and appropriate guidelines were provided to respondents in answering the questions [8].

3.5 Sampling techniques

Having chosen a suitable sampling frame and established the actual sample size required, the researcher needs to select the most appropriate sampling technique to obtain a representative sample, Sander (2009). These sampling techniques can be categorized in to five main techniques which include: simple random, systematic, stratified random, cluster and multi-stage. From these alternatives, for this project the researcher had chosen a Systematic sampling technique depending on research questions and on the objectives of the project. Subsequently, as

the population of the project is geographically concentrated, the researcher made face-to-face contact with respondents. Furthermore, the systematic sampling has certain plus points. It can be taken as an improvement over a simple random sample in as much as the systematic sampleis spread more evenly over the entire population. It is an easier and less costly method ofsampling and can be conveniently used even in case of large populations [7].

3.6 Data collection Method

The data collection will be performed from the primary as well as the secondary data sources through interviews, observation, and questionnaire, review of secondary data and reports. The physical processes under investigation will be viewed from different perspective point of views such as theoretical, practical, theories, etc. Using the above mentioned techniques the data collection processes will be carried out in different phases from the multiple sources of data using quantitatively and qualitatively. The details of each data collection tools used as stated as follow.

3.6.1 Questionnaire

The researcher has chosen this instrument because it is a quick way of gathering much information from a large group of individuals within a short period of time. It is also easy to administer to a large number of subjects in one place at a time. Since the subjects are the supportive staffs, Garage administrators, mechanics, drivers and different professionals, it is written in English language. In this method a questionnaire is sent to the persons concerned with a request to answer the questions and return the questionnaire. The respondents have to answer the questions on their own. Therefore, the researcher used the questionnaires method for the project due to the following advantageous: low cost even free from the bias of the interviewer; answers are in respondents' own words and the respondents have adequate time to give well thought out answers.

The primary data collection method in this research was semi structured questionnaires, which contained a mixture of closed ended and open-ended questionnaires. These two sets of questionnaires were used, for individual consumers and this was conducted during the work time frame for a week, the researcher had gone personally to the targeted location and distributed questionnaires to the respondents. The information gathered from the questionnaire consisted of quantitative continuous data and qualitative data according to a Likert-type scale. Researcher

employed a five-point Likert scale ranging from 5-very good/very much, 4-good/a lot, 3-satiscompany/little, 2- poor/very little and 1-very poor/none.

3.6.2. Interview

This method is used in order to validate the information gathered through questionnaire. In addition, others might observe what the researcher cannot observe. Therefore, 10 open-ended interview items were used to obtain a deeper understanding of the topic under project. The researcher used it because the face-to-face interaction enables to collect facts directly from the respondent by asking specific and well-defined open-ended questions. The interviewees are the Addis Ababa Police Garage support staff, mechanics, managers, and from head office employees. The researcher selected the how many number to be interview from the employees using purposive sampling technique. Purposive sampling enables researchers to squeeze a lot of information out of the data that they have collected. This allows researchers to describe the major impact their findings have on the population. The interview was conducted and used to substantiate and cross-check the data obtained from observation and questionnaire.

3.6.3. Observation

One of the instruments that the researcher used to collect the necessary data is direct observation. It is a planned, systematic and selective way of watching and listening to activities as the actual working processes takes place. The researcher used this tool to obtain information about current functional process system of the Addis Ababa Police Garage management system. Moreover it helps to crosscheck the views that are given by the respondents in the questionnaire and interview. 10 direct observations with sub sections were observed by using the following item checklist: Garage organizational structure, Garage layout, Quality standards and control activities, Human resource and development, Information Technology system, setting standard time application for every process, Management Capabilities, Store management. Therefore, the project carried out this tool to check out the collected data to eliminate the bias and to observe what is currently happening in the case of Addis Ababa Garage System.

3.6.4. Document review

Secondary data include both quantitative and qualitative data and they were used principally in both descriptive and explanatory research. The researcher used documentary data from files, office manuals, circulars and policy papers were used to provide additional information where appropriate with the concept of competitiveness. Besides, variety of published and/or unpublished garage and the commission documents, reports and newsletters were reviewed to make the project fruitful.

3.7. Design Methodology

3.7.1. System Development

Based on the data derived from multiple data source qualitatively and quantitatively, the web-based management system for Addis Ababa police garage will be designed and developed. The developed system can be further expanded it as a new suitable business management model that can give a guide to the web based Garage management system with the input of stakeholder roles and responsibilities expressing the requirements of the system and the expected solutions.

3.7.2. Agile methodology

Agile methodology is a practice that promotes continuous iteration of development and testing throughout the software development lifecycle of the project. Both development and testing activities are concurrent [15].

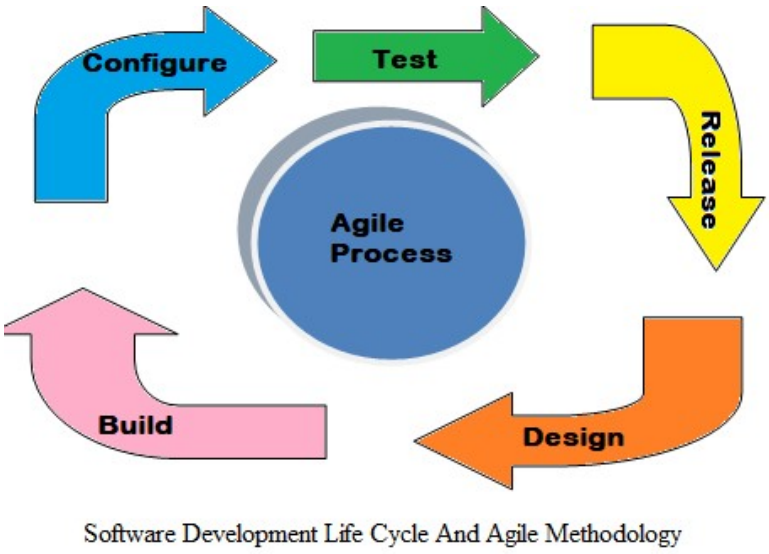

Fig 3.1 Software Development Life Cycle and Agile Methodology

The agile software development emphasizes on four core values.

- Individual and team interactions over processes and tools
- Working software over comprehensive documentation
- Customer collaboration over contract negotiation
- Responding to change over following a plan

Agile method proposes incremental and iterative approach to software design

The agile process is broken into individual models that designers work on the customer has early and frequent opportunities to look at the product and make decision and changes to the project.

Agile model is considered unstructured compared to the waterfall model Small projects can be implemented very quickly. For large projects, it is difficult to estimate the development time Error can be fixed in the middle of the project. Development process is iterative, and the project is executed in short (2-4) weeks iterations. Planning is very less. Documentation attends less priority than software development every Iteration has its own testing phase which allows implementing regression testing every time new functions or logic are released. In agile testing when an iteration end, shippable features of the product is delivered to the customer. New features are usable right

after shipment. It is useful when you have good contact with customers. At the end of every sprint, user acceptance is performed It requires close communication with developers and together analyze requirements and planning

3.8Development Environment

Development tools can be of many forms like linkers, compilers, code editors, GUI designer, assemblers, debugger, performance analysis tools etc. There are certain factors to be considered while selecting the corresponding development tool, based on the type of the project: Among the different tools the following are chosen for the development of this project.

3.8.1. Sublime Text 3

It is fast and feature packed text and development editor. Following some of the great features that make Sublime Text stand out from other code editors:

Multiple cursors: Once you have discovered multiple cursors you won't want to work without them anymore. As the name suggests they let you write or edit in multiple places in a document at the same time.

Vintage mode: Vim keyboard shortcuts will work just like in the original Vim editor. To use them, all you need to do is to enable vintage mode.

Lightning fast: This is the fastest code editor you will find right now.

Plugin collection: A hugely active community creates plugins for almost any task in Sublime Text. This includes syntax highlighting and code snippets for a large number of languages, for example Javascript, PHP, CSS, HTML, Python, LESS, XML and C++ to name just a few.

Package control: This add-on let's install plugins within seconds directly from the editor

3.8.2. XAMPP

Open-source software developed by Apache friends XAMPP software package contains Apache distributions for Apache server, MariaDB, PHP, and Perl. And it is basically a local host or a local server. This local server works on your own desktop or laptop computer. The use of XAMPP is to test the clients or your website before uploading it to the remote web server. This XAMPP server software gives you the suitable environment for testing MYSQL, PHP, Apache and Perl projects on the local computer.

3.8.3. CodeIgniter

For building a web application spend a lot of time in writing the same code again and again. Frameworks provide you a starting block and minimize the amount of code needed to build a website. PHP driven framework but it's not a PHP substitute. Diving into CodeIgniter doesn't mean you are leaving PHP behind. PHP is a server-side scripting language for building dynamic web-based applications.

CodeIgniter contains libraries, simple interface and logical structure to access these libraries, plug-ins, helpers and some other resources which solve the complex functions of PHP more easily maintaining a high performance. It simplifies the PHP code and brings out a fully interactive, dynamic website at a much shorter time. It supports PHP version of 5.2.6 or newer and MySQL version 4.1 or newer.

3.9. Ethical Considerations

Prior to the commencement of the research, the Addis Ababa police garage and the concerned body were informed about the research. Respondents were briefed on the purpose, scope, and outputs of the research. They were informed that personal identifiers would never be used in any form while reporting, presenting and communicating the findings of the research and that data for individual garage facilities would not be reported. Informed consent was obtained from respondents before interviewing them.

Chapter Four

System Analysis & Design

4.1 Introduction

Requirements Collection and analysis are of the basic and essential steps in the software development cycle. Investigations of the existing system in use by various means provide the basic and necessary inputs for the system to be designed. The collected inputs should be organized in a meaning full manner to provide the appropriate functionalities of the system in a way that shows the flow of information, data generated and the users of the system. In this chapter the existing system in use, the business process, the system modeling and the design of the new system are presented.

4.2 Analysis of the Current System

Analyzing of the current functional process of the Adds Ababa Garage management systems has done by collecting data from different departments/sector groups using the different data collection methods. After gathering all the complete data using the different types of data collection methods, total responses for each items were obtained and tabulated. Then the researcher transcribed the data that were collected from the interviews, direct observations to get a general sense. The data collected from all key informants were categorized into different themes based on the research questions of the project. Then the refined and adjusted ones are used for analysis purpose.

To provide a better indication of handling of the process flow of the existing Garage management system, the data and information obtained from targeted sources are analyzed and interpreted. Assessment of the existing system is conducted to identify the weakness and strengths, with regard to the management information system dimensions. Finally, the findings and analysis of the research are presented using qualitative and quantitative description statements and statistical analysis ways of data presentation techniques. The details will be as follows.

4.2.1. Age range structure of respondents

As can be seen from the tables below 30% of the respondents were found to be 18-25 age ranges 35% of the respondents also were relied that, the age of the respondents were 26-30 age ranges. 15% respondents were answered that, the age of the respondent were 31-40 years ago. 20 %

respondents were replied above 40 years. Therefore, the majority of the respondents' ages were 18-30 years.

Table3. 1: Age group structure of the respondents

Item	Age range	Number & Percentage of Response		Remarks
		Number	Percentage	
Age group	18-25	6	30	
	26-30	9	35	
	31-40	6	15	
	Above 40	4	20	
	Total	**25**	**100**	

4.2.2. Educational background of the respondents

As we can show the table below, 32% respondents were answered that they were High school complete and 36 % of the respondents also respond that was diploma holders. 28% were responded degree and Post graduate holders. Therefore, the majority of the respondents' educational backgrounds were diploma and High school complete holders.

Table3.2: Educational background of respondents

Item	**Number of respondents**	**Percentage**
High school complete	8	32
Diploma	9	36
Degree	5	20
Post graduate	2	8
Other	1	4
Total	25	100

4.2.3. Experience of Respondents

According to table-3.3below, out of the total respondents 28% of them were responded that the experience of the respondents was 1-3 years life experience. 24 % of the respondents were answered that the experience of the customers were 3-5 years. 16 % respondents also were responded that, the experience of the respondents were 5-10 years. The rest 32% respondents were answered above 10 years' experience. Therefore, the distribution of the respondents' experiences did not show much difference among the given ranges.

Table3. 3: Respondent's experience

Years of experience	Number of respondents	Percentage
0-2 years	7	28
3-5 years	6	24
6-10 years	4	16
Above 10 years	8	32
Total	25	100

4.2.4. Analysis of interview questions:

The set of interview questions, as tabulated below table 3.4, the following responses are obtained and tabulatedbuilt based on the overall comments and suggestions of the Garage employees and managements concerning what should be done towards making the service delivery. Among the comments and suggestions forwarded by the selected staffs form different departments and sections of the interviewers the major ones were the following;

Currently the existing garage management system has well defined organizational structure but the process flow is fully manual. Different forms are filled by the different staffs/users in the concerned sections and departments and then pass through a series of steps. Within the different steps there is a delay due different factors or situations that reflects in the less efficiency and effectiveness in the whole management system related to the garage which leads to poor service delivery.

Table3. 4: Respondent's Analysis of interview

No	Questions	Criteria	No of respondents	Percentage
1	Organizational structure	Good	3	60
		Fair	2	40
		poor		-
		Total respondents	5	100
2	Detail Knowledge of MIS	Yes	4	80
		No	1	20
		Total respondents	5	100
3	Presence of Manual document for the activities	Yes	5	5
		No	-	-
		Total respondents	5	100
4	Presence of Reporting format	Yes	5	100
		No	-	
		Total respondents	5	100
5	Document Handling	Good	1	20
		Fair	2	40
		poor	2	40
		Total respondents	5	100
6	Process function delay	Yes	5	100
		No	-	
		Total respondents	5	100
7	Effectiveness	Good	3	60
		Fair	2	40
		poor	-	-
		Total respondents	5	100

4.2.5. Researcher's Personal Observation

The following problems are identified and appear to be of paramount important which was obtained through the researcher's personal observation. Even though the organizational structure of the garage is good, weak regular communication and interrelated sections leads to lack of speedy, accurate and timely service delivery. There is a repetitive process work flow, lack of coordination & balancing of material flow and supervision. The working conditions of the garage system with the exception of the above issues and the manual system management and not using ICT technology in their processes, it is somewhat comfortable comprising staff members with different level of education and experiences.

4.2.6. Analysis of Existing System with its degree of performance

The assessment of the existing system is conducted to identify the weakness and strengths, with regard to the management information system dimensions.

As we can from the table 3.5 below, the analysis of the existing system 32% of the respondents were answered that it is low. Other respondents 36 % answered medium and 20 % answered high for the existing system. Only 12 % of the respondents give the rank of very high and no gives a rank of very low. This indicated that the category of the existing system falls in to low and medium rank.

Table3. 5: Analysis of Existing System

Degree of Performance	No of respondents	Percentage
Very low	-	-
Low	8	32
Medium	9	36
High	5	20
Very high	3	12
Total	25	100

4.2.7. Analysis of Process workflow

Functional process work flow at the garage management is the steps of actions to take place during the working time activities. They are used to initiate, track, and record all the garage management and related activities. Workflow process orders start as requests, which are then approved by the responsible body; the work is planned and scheduled, performed and finally recorded. Process orders contained tailed of data about the Garage management systems in question and they produce valuable information on maintenance performance, costs and equipment history. Among the information tracked with work orders are:

- Maintenance tasks and their start and completion dates
- detailed spare part usage
- detailed work instructions for each step
- labor and materials costs
- information about who performed the work
- Life cycle information: where the work order originated from, when it was scheduled, approved, performed etc.

4.2.8. Summary of the analysis of the existing system Results

As it can be seen from the above data analysis of the current garage management system obtained from respondents and participants with different experience, qualifications and document review in the different departments using the different types of data collection methods such as interviews and questionnaires, and researcher personal observations, the study has come out with the following significant findings.

- The existing garage management system has well defined organizational structure but report / communication / information exchange among the employees and other concerned bodies and reports prepared daily, weekly, monthly, and quarterly and annually submitted to the different

departments of the offices is totally manual, paper based or using telephone activities for the whole business process functions.

- From the evaluation point of view based on the degree of general processes functional performance, the existing garage management system falls to low and medium rank category.
- Due to the above-mentioned cases, within the different steps there is a delay process functions due different factors or situations that reflects in the less efficiency and effectiveness in the whole management system related to the garage which leads to poor service delivery.
- In the business manual processes transactions, there is data redundancy, incomplete and inaccurate data records, recording data on existing formats which is very tiresome and time consuming, In addition there has been loss of filled formats from individual clients files
- There appears to be lack of control in data and information flow, standard data storage, information retrieval leads to fragmented service provision mechanism which requires automated garage management system.

4.2.9. Conclusion

The Addis Ababa police commission with its mission to fulfill immediate response for the delivery of policing service that matches public satisfaction, the transportation issue with its base garage management needs automated functional process for its readiness.

The existing processes functions of the Addis Ababa Garage management system, based on the analysis from the different types of methods, the management system is using out dated manual system communication flow among the different sections, departments and individual staffs who have direct contact with the maintenance of vehicles. Therefore, this project come up with the suggestion that there is a need to be developed a web-based Garage management system that will help in solving the manual, fragmented and outdated process systems by providing accurate and timely required information with visual mode of process flow that leads to effective and efficient way of service delivery.

4.3 The Proposed system

Based on the analysis obtained from the collected data using different data collection methods of the Police garage with regard to the current management information system dimensions, I have seen

that the whole management system is functioning manually which is tenuous, time consuming and error prone among other activities which does not fulfill immediate response for the proper and timely process function required for smooth and efficient service delivery.

To fulfill the requirement of the Addis Ababa Police Garage management system, there is a need to propose and develop a web-based garage management system that will help to facilitate and improved service provision of the Garage management that enhances the creation of standard data sets with secured information transaction.

The new system would reduce the errors that were common in the manual paper-based recording process. It would also help real time, fast claim data and information processing. The generation of defined report from the system would also enable to make sound decision by the stakeholders and policy makers. Additionally, the system would help to reduce supply and demand side induced unnecessary service utilizations. To check the eligibility and manage any status change of scheme members with full security control from the garage scheme would also be another feature of the system. The system generally would support registration system, record management system, eligibility validation system; support to send the concerned body from sender to receiver of the system, sends notification messages.
The proposed system will have the following functional and non-functional requirements

4.3.1. Functional requirements

Functional requirements mainly deal with explaining on what has to be done by identifying the necessary task, action or activity and functionalities the system should provide to users and the tasks that must be accomplished.
This web based garage management system is designed in the way that enables the stakeholders to gather, analyze, distribute and utilize garage information management at whole organization levels. Besides those functionalities it will enhance proper control of service utilization and standard data definitions across the system.

The functional requirements were presented below.

Table4. 1: Functional Requirements

Function	Requirement Descriptions
Main login interface	Individual users enter in to the system and do their assigned activities
Admin interface.	The system should enables registration of client
Manager interface	Approve the vehicle help request, and to view the whole process flow of the system and reports.
Driver interface	Full access for the request for Help, view and fellow up Vehicle status.
Technician interface	Full access for the request for accessory, view and fellow up vehicle status, vehicle request.
Reception interface	Full access for receive vehicle for service, view vehicle request, vehicle status and report.
Encoder interface	Registration for vehicle management, employee management and driver's management
Store keeper interface	Full access the main modules. These are Accessory Management, Vehicle Assignment and Update Request Accessory. In the accessory management

4.3.2 Non-functional requirements

The non-functional requirements describe user visible aspects of the system that are not designated to the functional behavior of the system. It is the overall characters that make the product property attractive, usable, fast or reliable to the users. It is the feature (visual appearance of the human interactive interface of the system) of the new product. They cover on a number of issues from user interface to security issues and the constraints of

the system to improve quality service. Non-functional requirements lists include portability, availability, scalability, reliability, efficiency, testability, understandability, interface, security and modifiability of software quality.

These can be described as:

Reliability

The software should be a system users can trust or rely on due to the accuracy of the information or data it provides. When end users want to perform their task, the system should provide appropriate information without troubling users with ambiguous or unreliable data.

Reusability

Then system which is divided into sub systems, partitions, layers and modules, will attain immense reusability. The module will be used in the different sub systems. This makes software development to be smooth, speedy and modifiable.

Portability

The system development uses java and java program is compiled once and run anywhere i.e. .it is platform independent. Hence the system is readily installable and operable on any platform.

Traceability of the Requirements

The system aims to handle every requirement incorporated in the RAD so that the user of the system will be able to use the system with completeness and without inconvenience.

Fault Tolerance

Whenever the user commits errors intentionally or unintentionally the system should continue performing its task without interruption by displaying user friendly error messages.

High Performance

The system will have good performance as much as possible. This will be attained via easily loadable interface components and optimal algorithms which make searching, updating, deleting and saving and fast.

Good Documentation

The user documentation considers the different kinds of users. Besides, the team has prepared RAD and SDD as technical documentations for future development and maintenance.

Well Defined Interfaces

The system intends to provide user friendly GUI using consistent theme throughout all pages to avoid user confusion, with intuitively understandable buttons, wizards, etc. Moreover the GUI will consider different monitor resolutions of user workstation.

Ease of Learning Remembering and Use

Different users ranging from layman to professional visit the system; as a result the system should consider these gaps and should provide ease of use by avoiding complexity, unnecessary functionality and by giving descriptive name to different components. The buttons, shortcuts, menus, etc, used in the system should be instinctively guessed and remembered.

Readability

The code of the system will be written by using indentions and style conventions in away users can easily read and understand. INSA coding standards and common good practices will be followed.

Increase Productivity

The system should help users in terms of time and resources during preparation of reports, searching of documents, provision of good services etc. In a nut shell the system should facilitate the overall effectiveness of the employee and hence the productivity of the organization

4.4. System Analysis Model

Technique used to represent the conceptual framework of the basic business process (activities) in an organization is called modeling. Modeling is representation of the general activities that has overtaken in a business, data flow throughout the business domain and the business logics that should exist in the process. It shows the business flow within and between organizations. Modeling helps to simplify understanding of the general business scenario for a business system and depicts various processes of information transfer throughout the business domain. Thus understanding the common business knowledge in the organization enables one to identify present business situation and able to derive the new design requirements proposed.

4.4.1. Use Case modeling

Use Case modeling is the simplest and most effective technique for modeling system requirements from a user's viewpoint. Use Cases are used to model how a system works. Use cases are not inherently object-oriented approach. It is really a form of process modeling. It is, however, an excellent way to lead into object-oriented analysis of systems. It is an external (user) view of the system which is intended for modeling the dialog between the users and the system. The Use Case model consists of actors and use cases. An Actor is a role of an object or objects outside of a system that interacts directly with it as part of a coherent work unit (a use case)

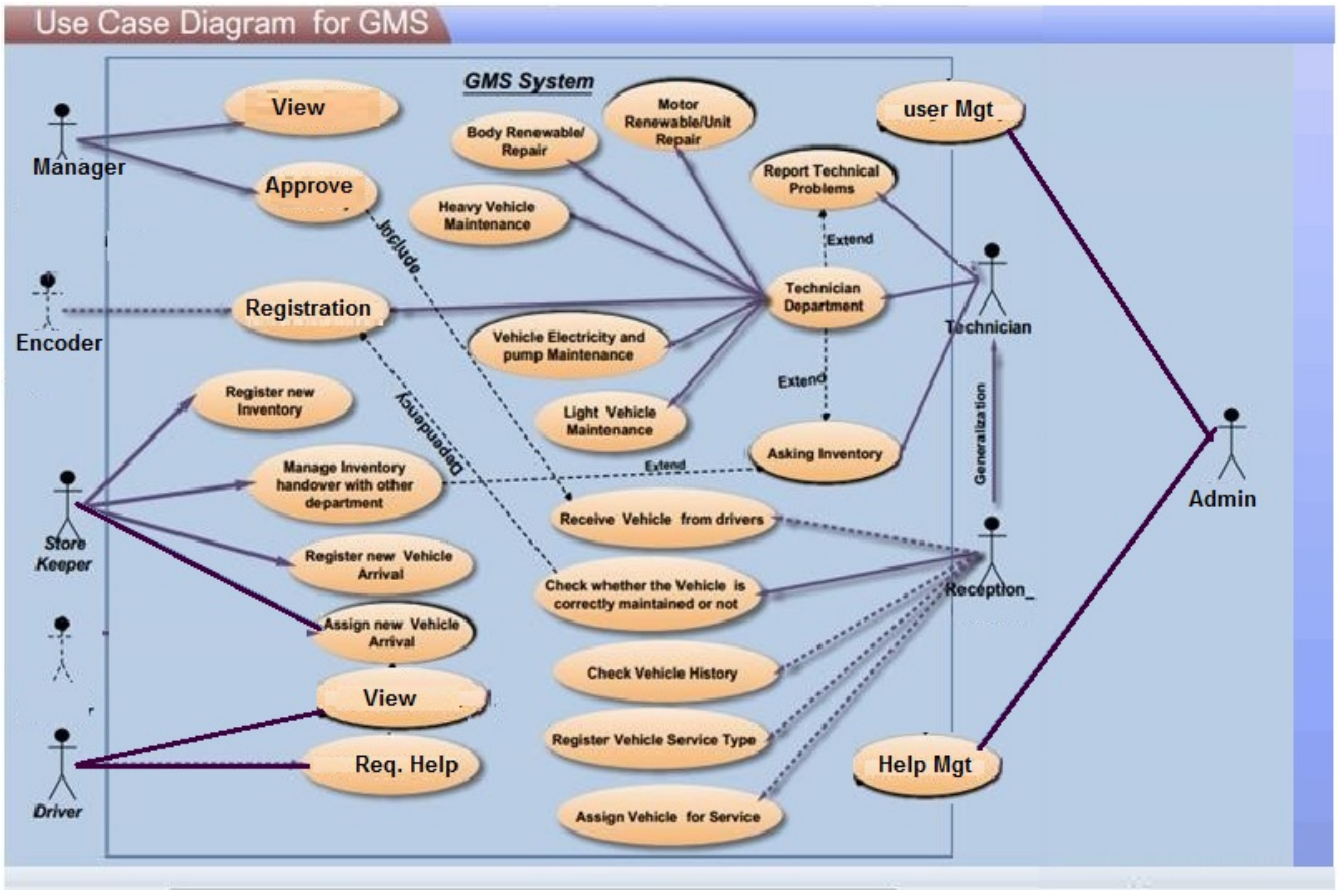

Fig.4. 1: Use Case Diagram

4.4.2. Sequence diagram

Sequence diagrams show a detailed flow for a specific use case or even just part of a specific use case. It is almost self-explanatory that shows the calls between the different objects in their sequence and can show different calls to different objects. A sequence diagram has two dimensions: vertical dimension shows the sequence of messages/calls in time order that they occur; the horizontal dimension shows the object instances to which the messages are sent.

To draw a sequence diagram it is important to put rectangular (square) box on top of your diagram, identify the class instances (objects) by putting each class instance inside a box. In the box, put the class instance name. If a class instance sends a message to another class instance (object), draw a line with an open arrowhead pointing to the receiving class instance (object) and place the name of the message/method above the line.

The sequence diagrams presented in the following diagrams depicts some of the use case in the

system. The diagrams are the use cases of system user registration, login system, client registration, validate eligibility and view report. The diagram consists of the classes (objects) in interaction; the messages (calls) between components and the lifeline time of interacting classes (objects) are presented as below.

The sequence diagrams

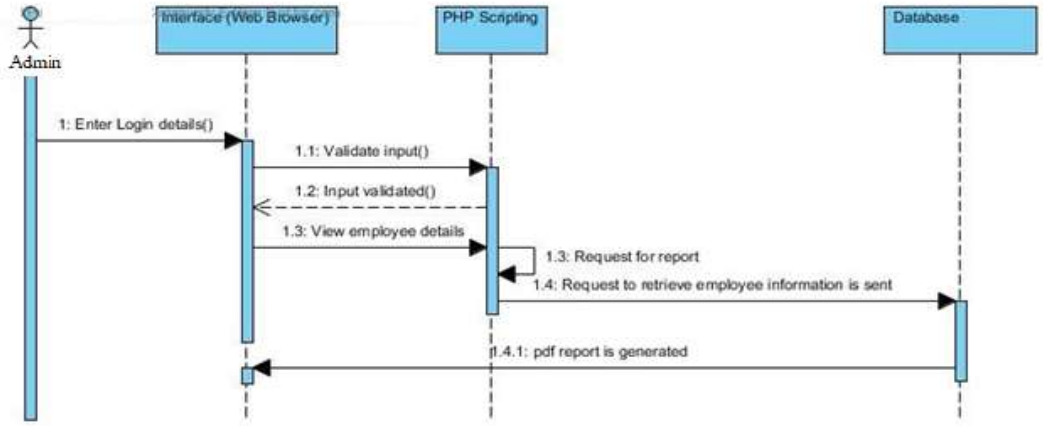

Fig.4. 2: Sequence Diagram Admin

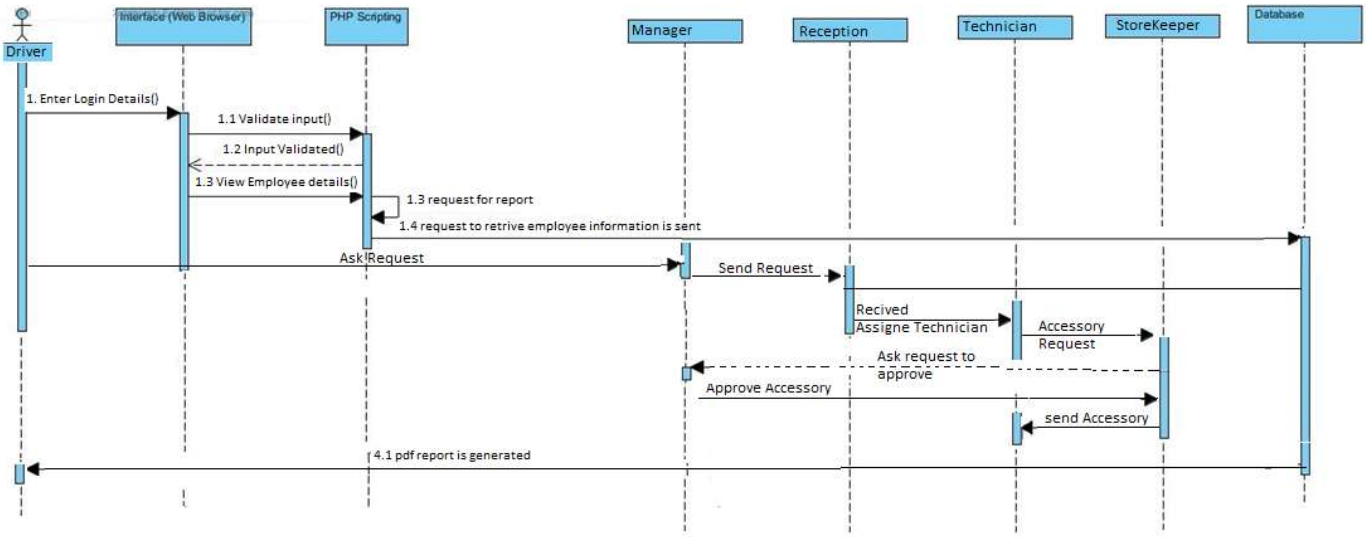

Fig.4. 2.1: Sequence Diagram Driver

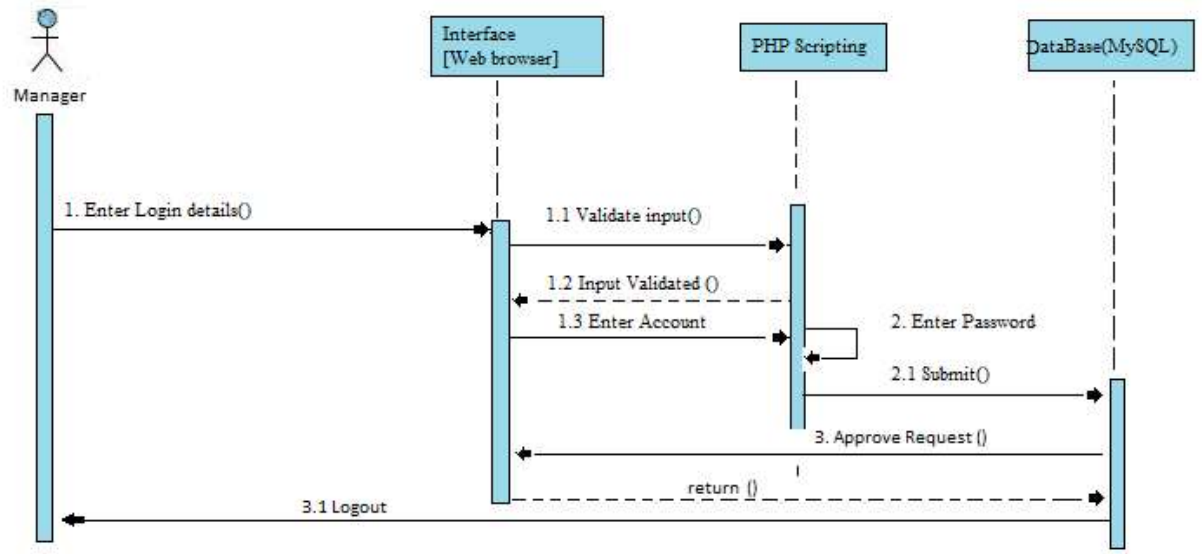

Fig.4. 2.2: Sequence Diagram Manager

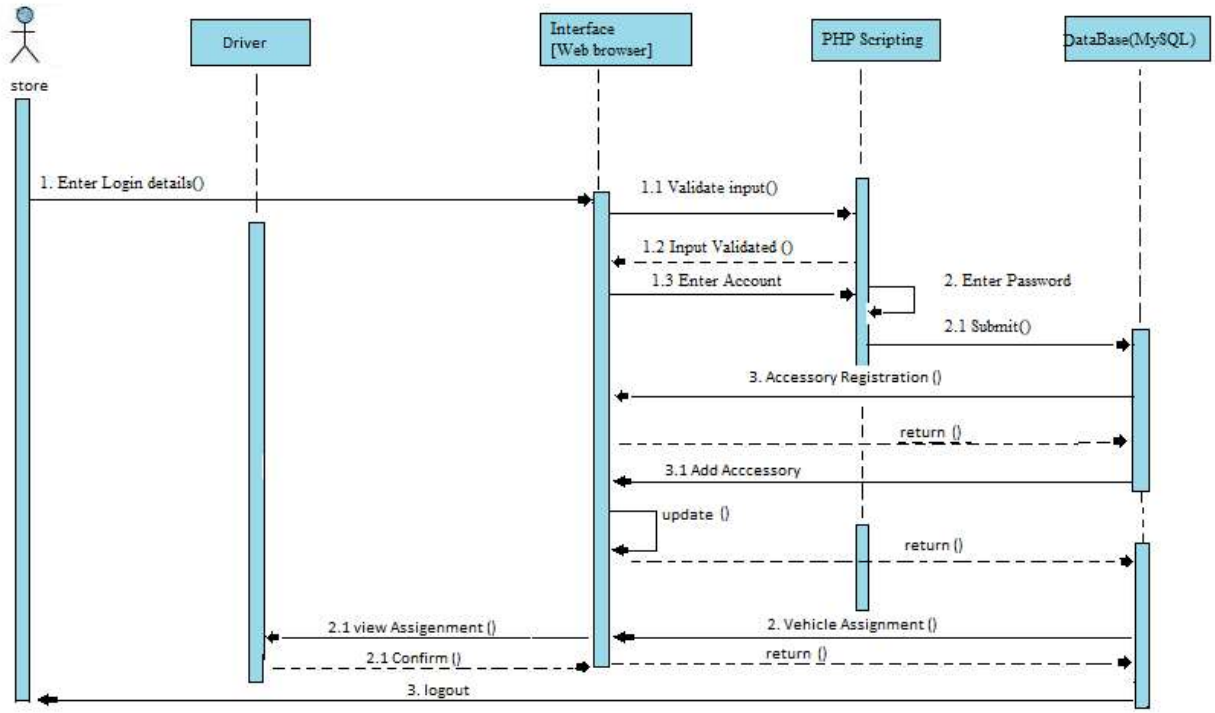

Fig.4. 2.3: Sequence Diagram store

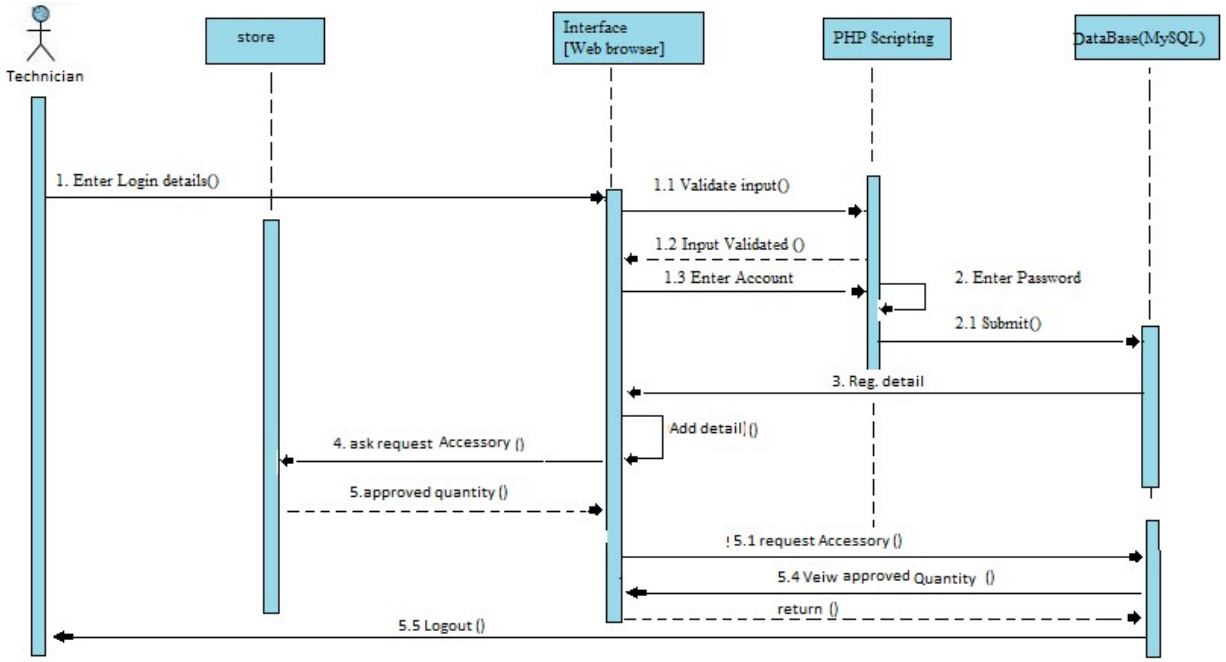

Fig.4. 2.4: Sequence Diagram technician

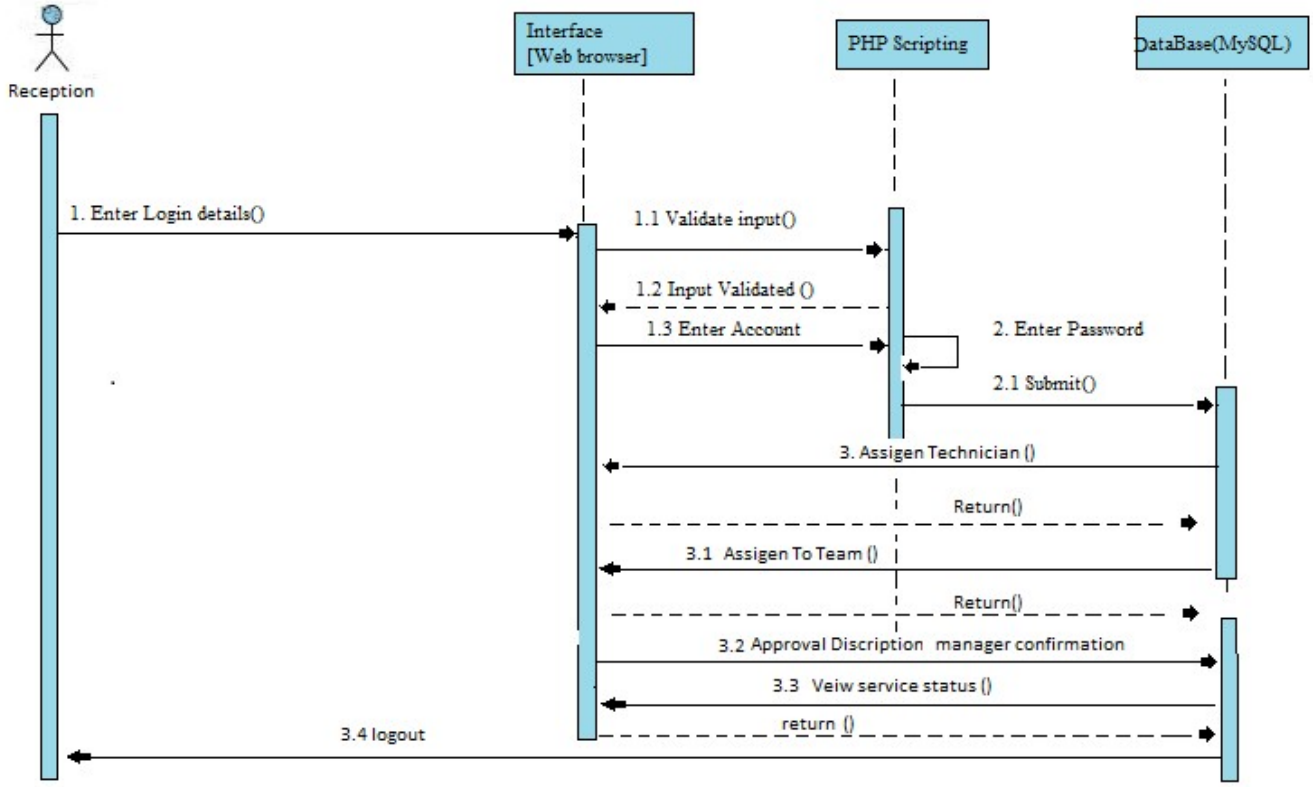

Fig.4. 2.5: Sequence Diagram Reception

The sequence diagram for system user registration

- System administrator wants to register new system user
- He/she enter his/her opens login page
- The system displays login page
- He/she enters user info
- The system check validity
- The system displays user registration home page
- System admin opens user registration form
- System displays registration form
- System admin fills necessary info
- System admin submit the data
- System checks the validity of the data
- The system displays message “assigned privilege”
- The system save the user info
- The system displays user ID

4.4.3. Activity Diagram

An activity diagram shows the procedural flow of control between two or more class objects while processing an activity. Activity diagrams can be used to model higher-level business process at the Business unit level, or to model low-level internal class actions. In this system an activity diagram is used to show flow of events in interaction of objects (classes) in the insurance service delivery system. It used to show how is the scheme currently doing business, or how would like to do the business.

The activity diagram starts with a solid circle connected to the initial activity. The activity is modeled by drawing a rectangle with rounded edges, enclosing the activity's name. Activities can be connected to other activities through transition lines, or to decision points that connect to different activities guarded by conditions of the decision point. Activities that terminate the modeled process are connected to a termination point.

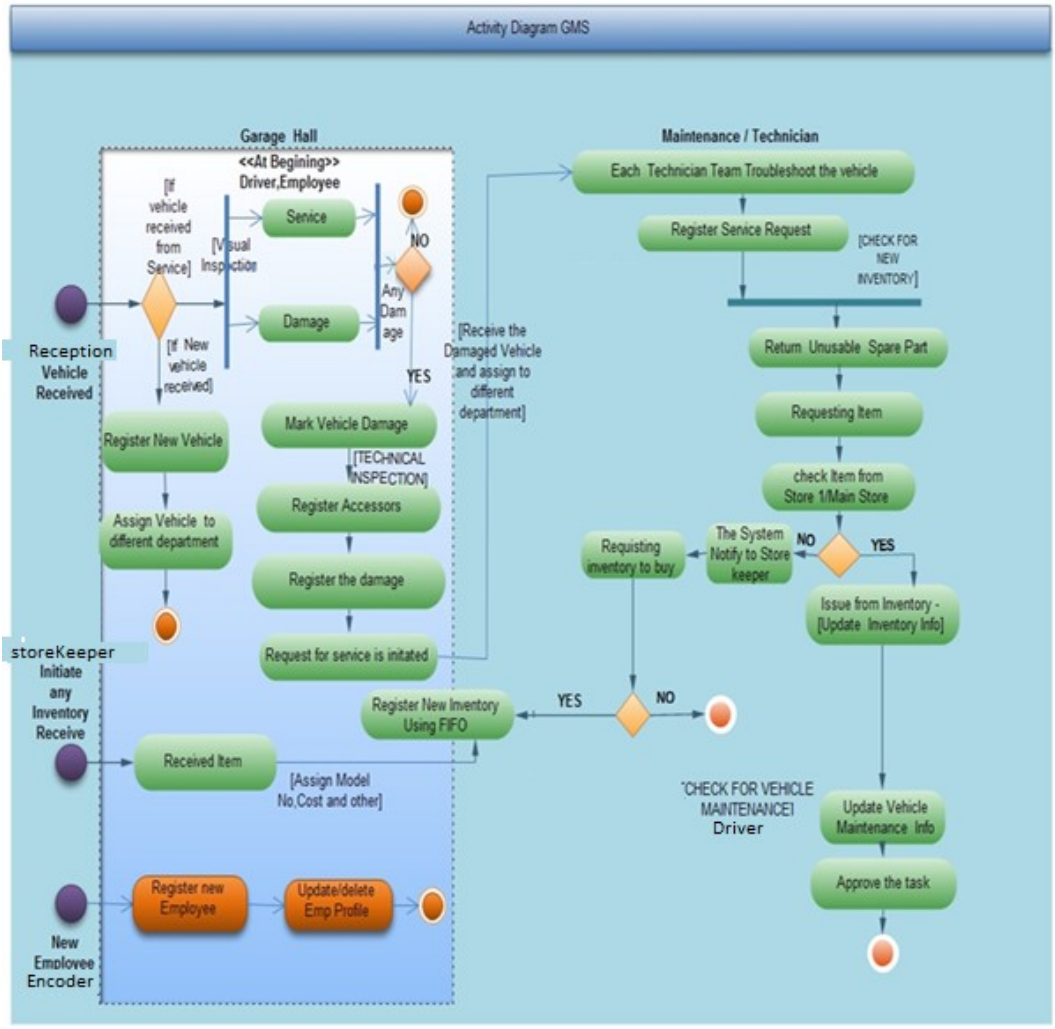

Fig.4. 3: Activity Diagram

4.4.4. Class diagram

Class diagram is representation of a collection of objects with common structure, behaviors and relationships. Most importantly class is an entity in object-oriented analysis and system design. It describes the types of objects that exist in the System and shows the static relationships among internal classes of the system. Class diagrams are the foundations of object oriented modeling. The Class diagram can be used to show the attributes and the operations of a class and also the constraints that apply to the way the objects are connected.

In other word class models show the classes of the system, their interrelationships (including inheritance, aggregation, and association), and the operations and attributes of the classes.

Conceptual and structural model of a system is depicted using class diagram. It has a wide

variety of purposes, like analysis and design of systems. Class diagram contains three main - sections: class, attribute (behaviors) and method (functions). Class is collection of related objects in a system. here are different classes in this system. The classes can either major class or subclass.

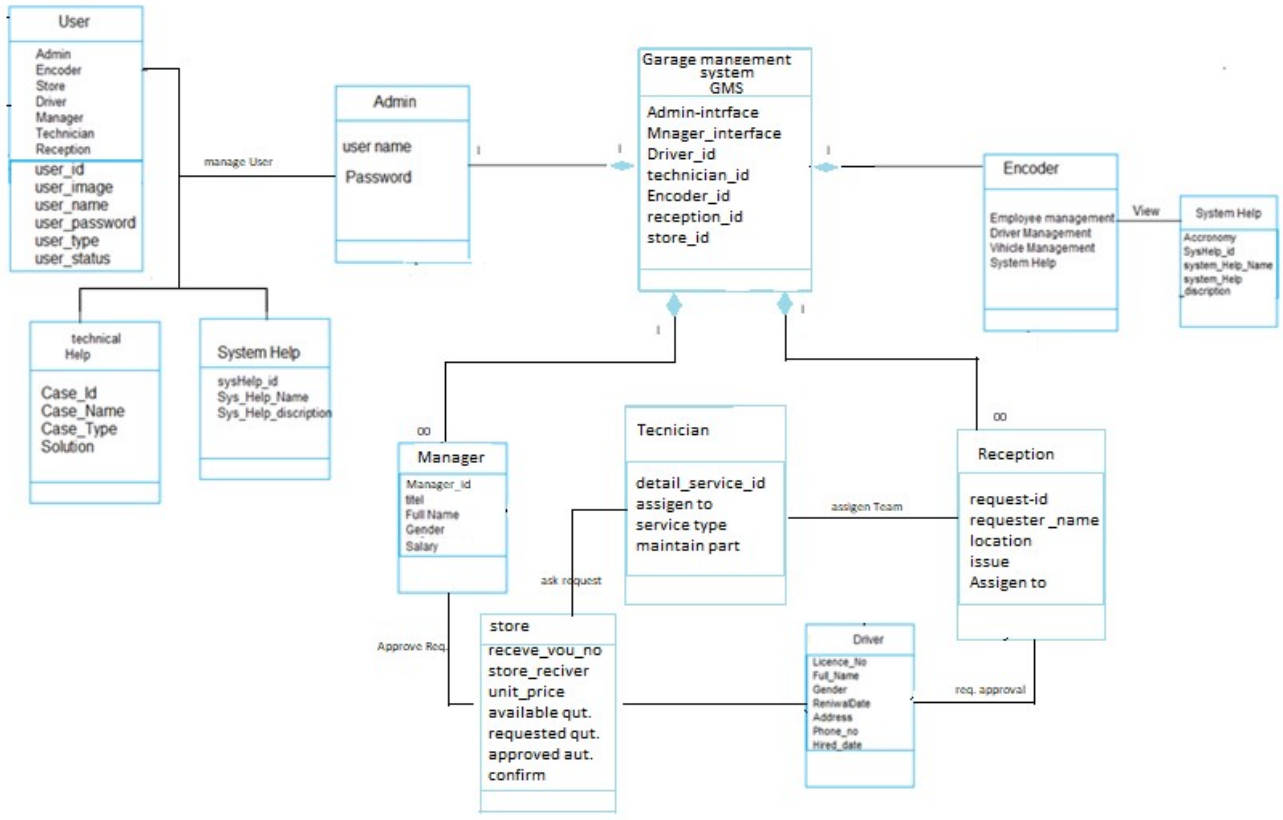

Fig.4. 5: Class diagram-1

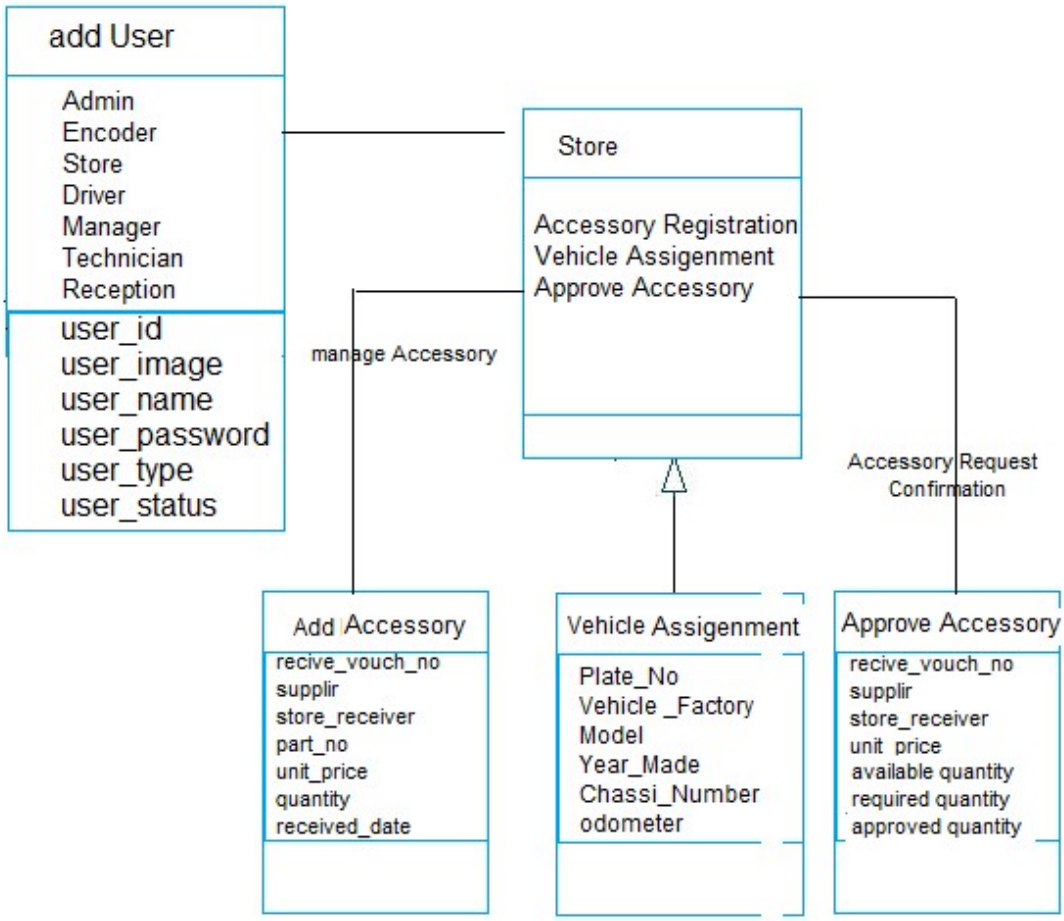

Fig.4. 5: Class diagram-2

Chapter Five

Detail Design, Implementation and Testing

5.1 Overview

Design is the first step in the development phase for any techniques and principles for the purpose of defining a device, a process or system in sufficient detail to permit its physical realization. Once the software requirements have been analyzed and specified the software design involves three technical activities - design, coding, implementation and testing that are required to build and verify the software.

The design activities are of main importance in this phase, because in this activity, decisions ultimately affecting the success of the software implementation and its ease of maintenance are made. These decisions have the final bearing upon reliability and maintainability of the system. Design is the only way to accurately translate the customer's requirements into finished software or a system.

Design is the place where quality is fostered in development. Software design is a process through which requirements are translated into a representation of software. Software design is conducted in two steps. Preliminary design is concerned with the transformation of requirements into data.

5.1.1 Design Considerations

Different design goals, tradeoffs, dependencies and constraints from the client, end user and developers perspectives are will be taken into consideration: Among them the major design goals include.

Reliability

The software should be a system user can trust or rely on due to the accuracy of the information or data it provides. When end users want to perform their task, the system should provide appropriate information without troubling users with ambiguous or unreliable data.

Reusability

Then system which is divided into sub systems, partitions, layers and modules, will attain immense reusability. The module will be used in the different sub systems. This makes software development to be smooth, speedy and modifiable.

Portability

The system development uses java and java program is compiled once and run anywhere i.e. .it is platform independent. Hence the system is readily installable and operable on any platform.

Traceability of the Requirements

The system aims to handle every requirement incorporated in the RAD so that the user of the system will be able to use the system with completeness and without inconvenience.

Fault Tolerance

Whenever the user commits errors intentionally or unintentionally the system should continue performing its task without interruption by displaying user friendly error messages.

High Performance

The system will have good performance as much as possible. This will be attained via easily loadable interface components and optimal algorithms which make searching, updating, deleting and saving and fast.

Good Documentation

The user documentation considers the different kinds of users. Besides, the team has prepared RAD and SDD as technical documentations for future development and maintenance.

Well Defined Interfaces

The system intends to provide user friendly GUI using consistent theme throughout all pages to avoid user confusion, with intuitively understandable buttons, wizards, etc. Moreover the GUI will consider different monitor resolutions of user workstation.

Ease of Learning Remembering and Use

Different users ranging from layman to professional visit the system; as a result the system should consider these gaps and should provide ease of use by avoiding complexity, unnecessary functionality and by giving descriptive name to different components. The buttons, shortcuts, menus, etc, used in the system should be instinctively guessed and remembered.

Readability

The code of the system will be written by using indentions and style conventions in away users can easily read and understand. INSA coding standards and common good practices will be followed.

Increase Productivity

The system should help users in terms of time and resources during preparation of reports, searching of documents, provision of good services etc. In a nut shell the system should facilitate the overall effectiveness of the employee and hence the productivity of the organization.

5.2. Database Design

Database design is the process of producing a detailed data model of database. This data model contains all the need logical and physical design choices and physical storage parameters needed to generate a design in a data definition language, which can then be used to create a database. A fully attributed data model contains detailed attributes for each entity.

The term database design can be used to describe many different part of the design of an overall database system. Principally, and most correctly, it can be thought of as the logical design of the base data structure used to store the data. In the relational model these are the tables and views. In an object database the entities and relationships map directly to object classes and named relationships. However, the term database design could also be used to apply to the overall process of designing, not just the base data structure, but also the forms and queries used as part of the overall database application within the database management system.

5.3. Modular Design

Based on the research methodology and the requirement analysis, the following modules are select for the system development with their information occupies.

This module is web based fully integrated with the entire modules and allows the user to have the required information quickly and accurately.

The modules are the followings:

A) Registration Module:

- Employee registration
- Vehicle registration
- Driver registration
- Accessory registration

B) Reception Desk Module:

- Create reference number to new vehicles
- Track time (in and out)
- View Reports
- View vehicle status

C) Transaction Module

- Assign vehicles to Drivers
- Accessory view
- Accessory Request View
- Update Accessory
- Confirm accessory request
- Spare part used view
- Help request
- Help request confirm

D) Report Module:

- Vehicle and Service Detail view
- Employee detail view
- Driver detail view
- Assign to Technician view
- Vehicle Diagnosis view
- Vehicle Work Orders view
- Finished Work Order view

E) Admin Module

- User Management

F) Help Module

- system Help
- Technical Help To drivers

5.4. Implementation

Implementation is the process of having system personal check out and provides new equipment's into use, train the user to install a new application and construct any files of data needed to use it.

The implementation part of the system incorporates different development environment which are more powerful for the garage management systems and server-side application development. The following section presents the tools that are used in the development environment and prototype.

Then user will provide their vehicle number which will be verified by using an API, then user have to choose the problem form given list on basis of it user will be provided with the list of nearby active garage and services offers by them. User will have freedom to choose the available options from his/her dashboard for the list as per his convenience and will send request to garage to get service.

The system can either accept or reject the request. User will be provided service detail such as status estimated time basis of it user also have option to reject the response of one garage and can choose other.

After acceptance from both sides, service will be provided and after completion of one services admin will be notified by garage and customer will give feedback about the service.

5.4.1. Implementation/Environment/ Interface

The implementation view of software requirement presents the real world manifestation of processing functions and information structures. This computerized system is specified in a manner that dictates accommodation of certain implementation details.

The implementation environment of the developed system facilitates multiple users to use this system simultaneously. The user interfaces are designed keeping in mind that the users of this system are familiar to using GUI-based systems. Thus, we restricted ourselves to developing GUI-based systems becomes easier for the end user to get acquainted to the developed system.

5.4.2. The prototype

This prototype shows the system client-side Management system interfaces that are accessed by the individual users and web application interface which are used by system administrators.

Garage Management System:

In this section I have demonstrated the various stages such as user have to register him/her on this application. After signing up user can login to application by providing the user name and password.
The developed system will be have the following features with their menu details: These are :

1. Homepage of the proposed system
2. Login interface
3. Main Menu interface
4. System Admin interface.
5. Manager interface.
6. Driver interface
7. Technician interface
8. Reception interface
9. Encoder interface
10. Store keeper interface

1. Homepage of the proposed system

   This interface provides the system administrator the whole responsibility to manage for the developed Garage management system. He/she can add, delete, update, modify, view, search, help options in the system. He/she has full privilege on the developed management of the system

Fig.5. 1: Home page Interface

The above figure shows the main menu of the Garage Management System. The following figures show how the individual users enter in to the system and do their assigned activities based on their respective dashboards.

2. Login interface

The user interface for login page of the proposed web-based garage management system of AACPC. This user interface enables users to enter into the different functionalities of the system. For anyone who has a privilege to interact with the system he/she must have the appropriate password and user name and assigned by the administrator of the system. It is a gateway to the system

Fig.5. 2: Login interface

3. System Admin interface.

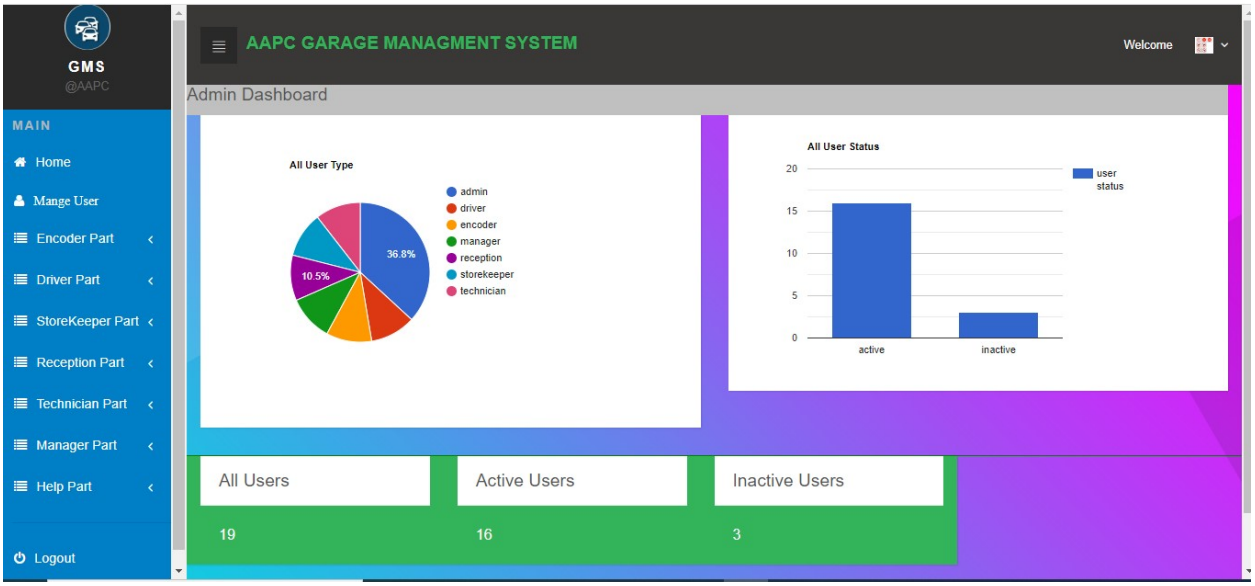

Fig.5. 3:System Admin Interface

4. Managerinterface.

The manager interface provides the manager to get the privilege to approve the vehicle help request, and to view the whole process flow of the system and reports.

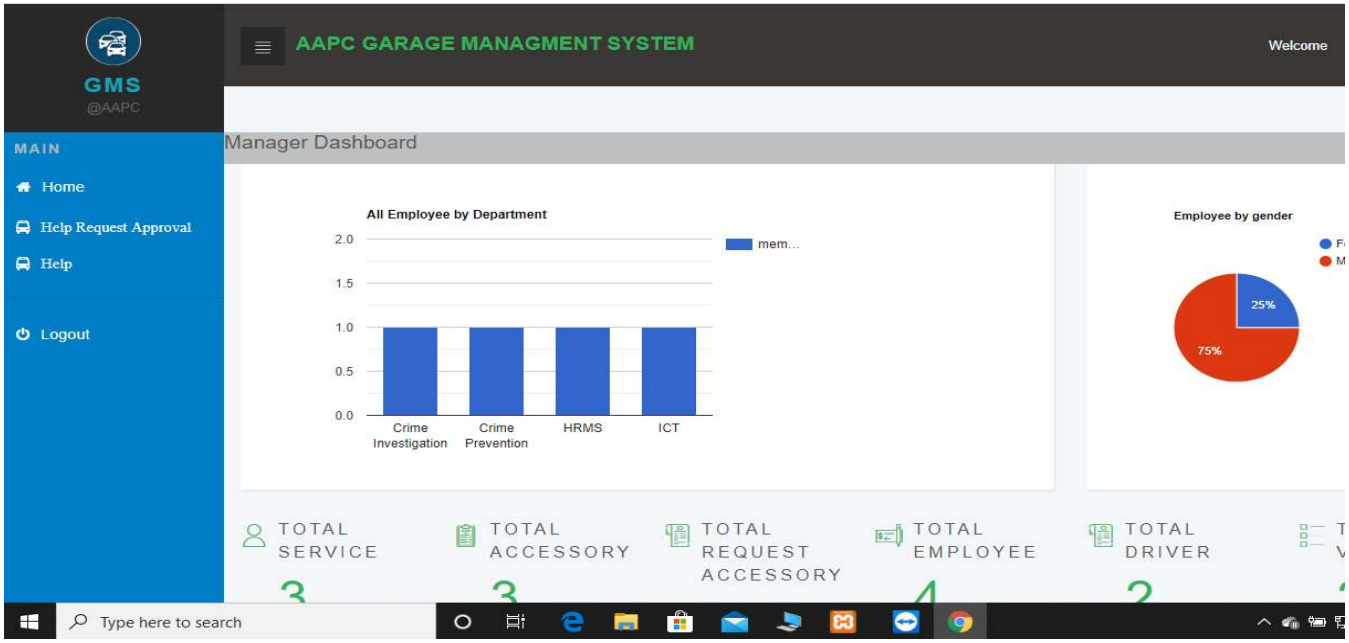

Fig.5. 4: Manager Interface

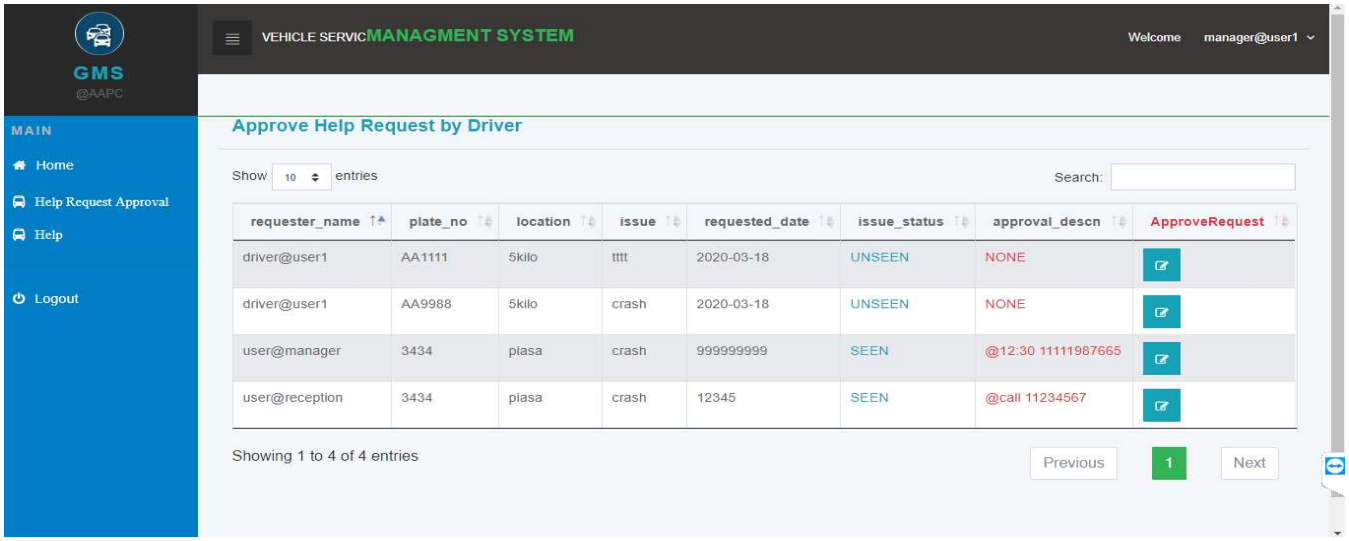

Fig.5. 5:Manager help approval

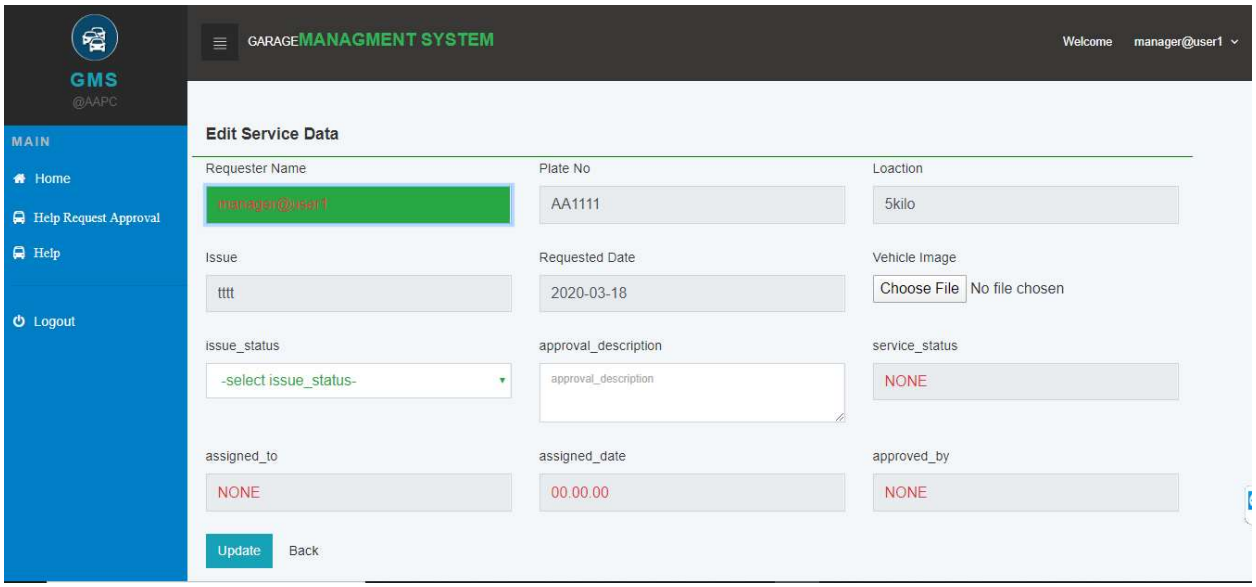

Fig.5. 6: Manager**Help approval Format**

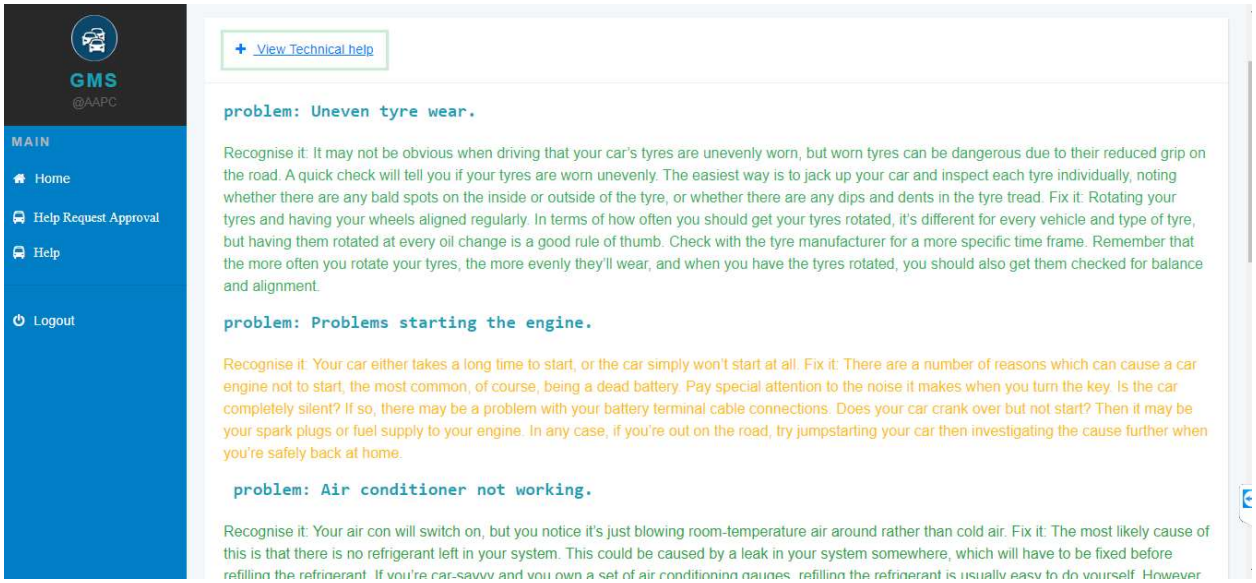

Fig.5. 7: ManagerTechnical helps view

This view used for Drivers in case the problem is easy they can solve by themselves

5. **Driver** interface

The driver interface provides the driver to get the privilege of full access for the request for Help, view and fellow up Vehicle status.

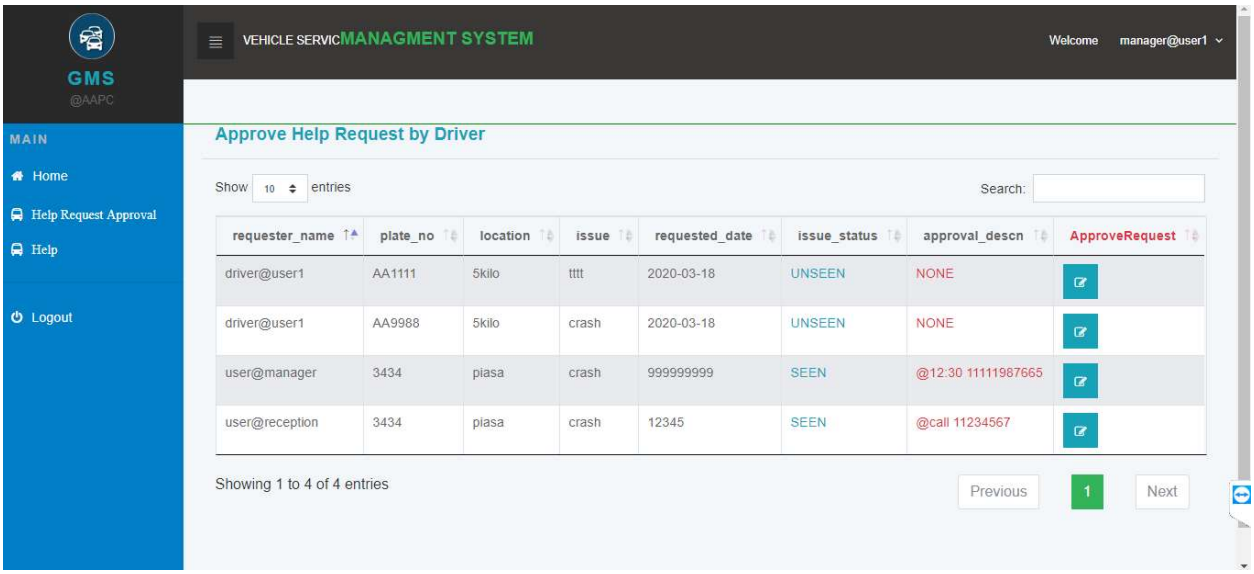

Fig.5. 8: Driver **front page**

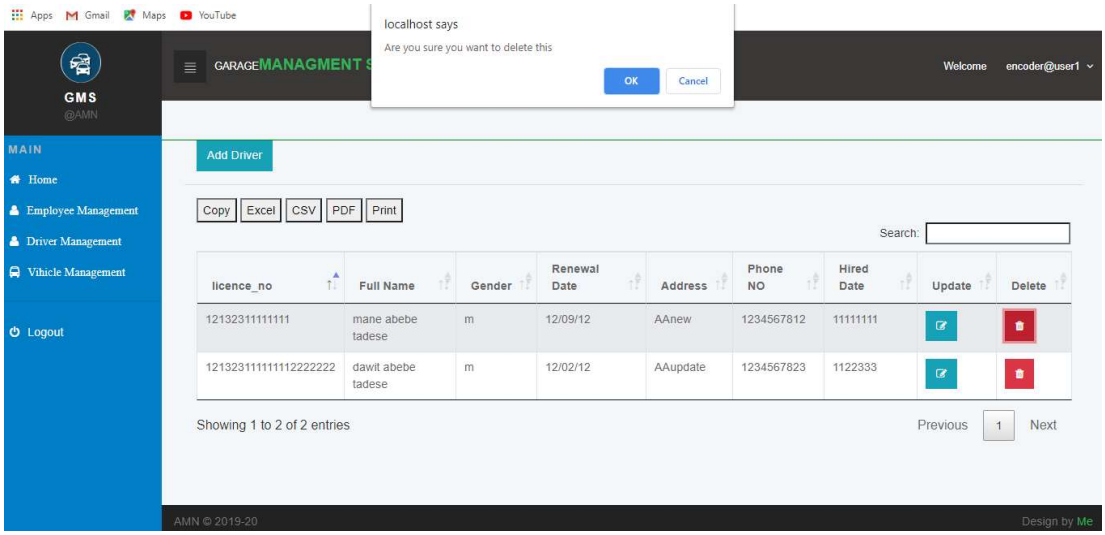

Fig.5. 9: Driver **Delete Driver data**

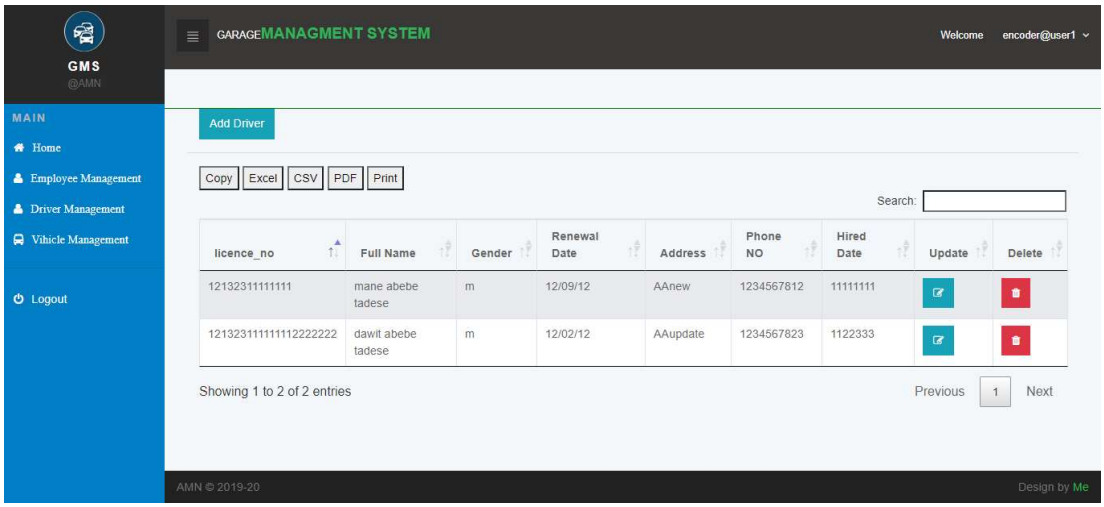

Fig.5. 10: Driver **management front**

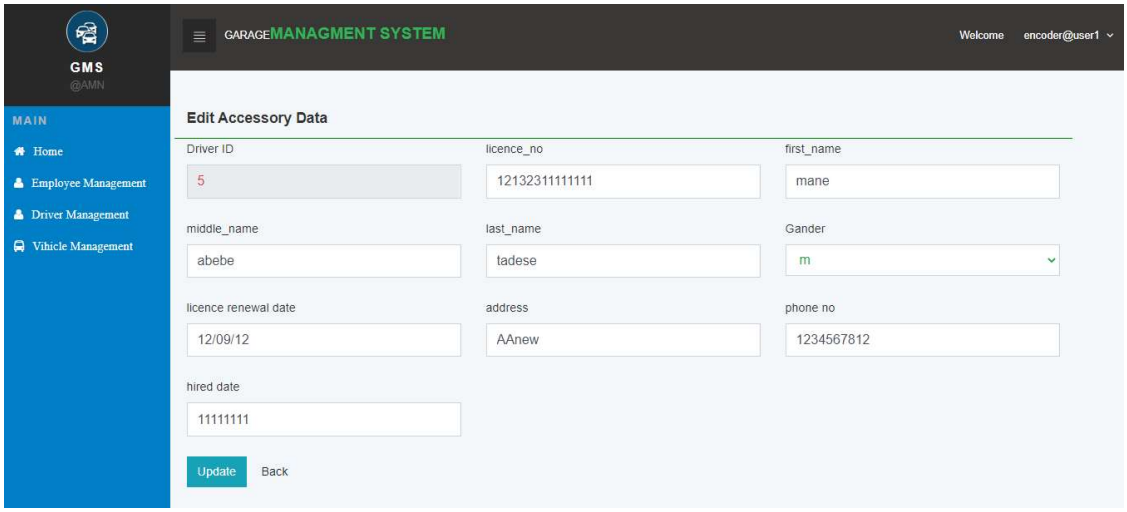

Fig.5. 11: Driver **Edit driver data**

6. **Technician** interface

The technician interface provides the technician to get the privilege of full access for the request for accessory, view and fellow up vehicle status, vehicle request.

Fig.5. 12: Technician**interface**

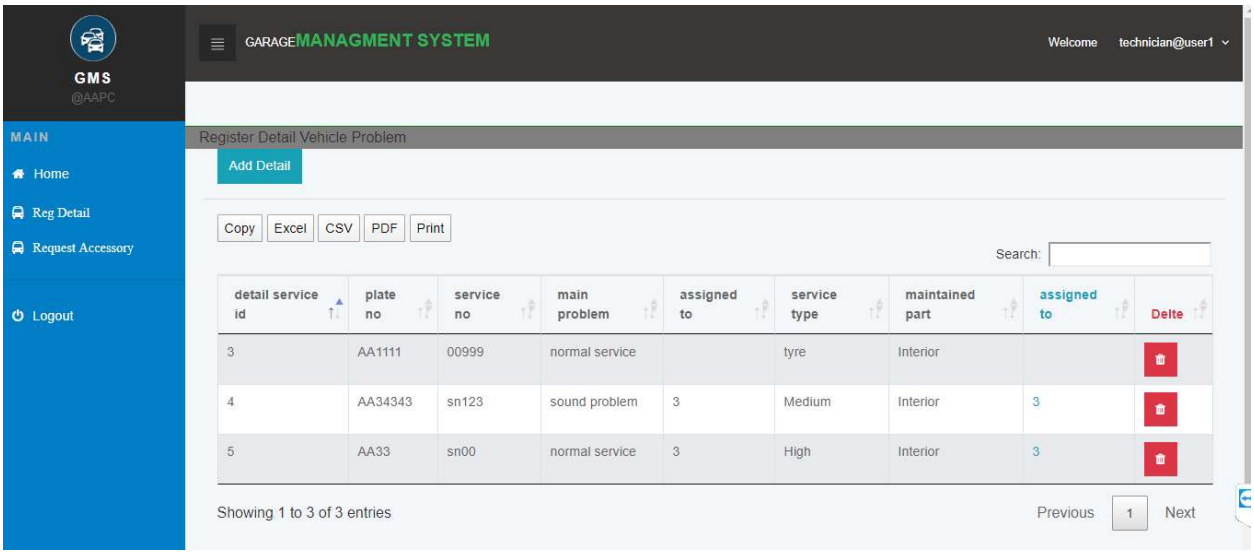

Fig.5. 13: Technician **register Detail Accessory problem**

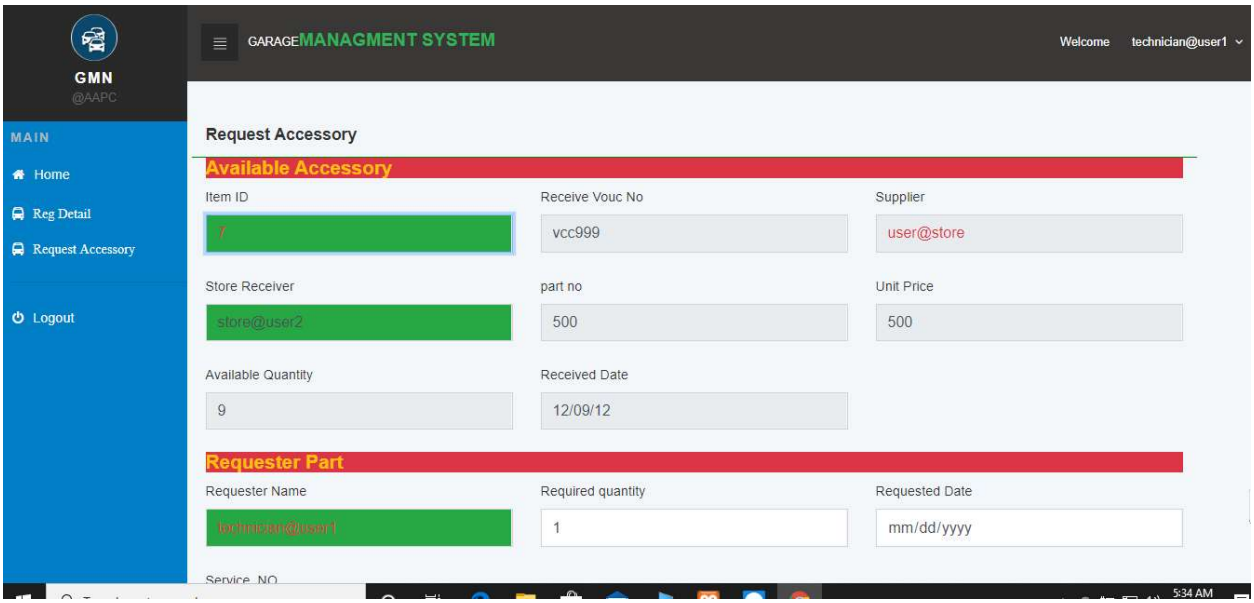

Fig.5. 14: Technician **request accessory form**

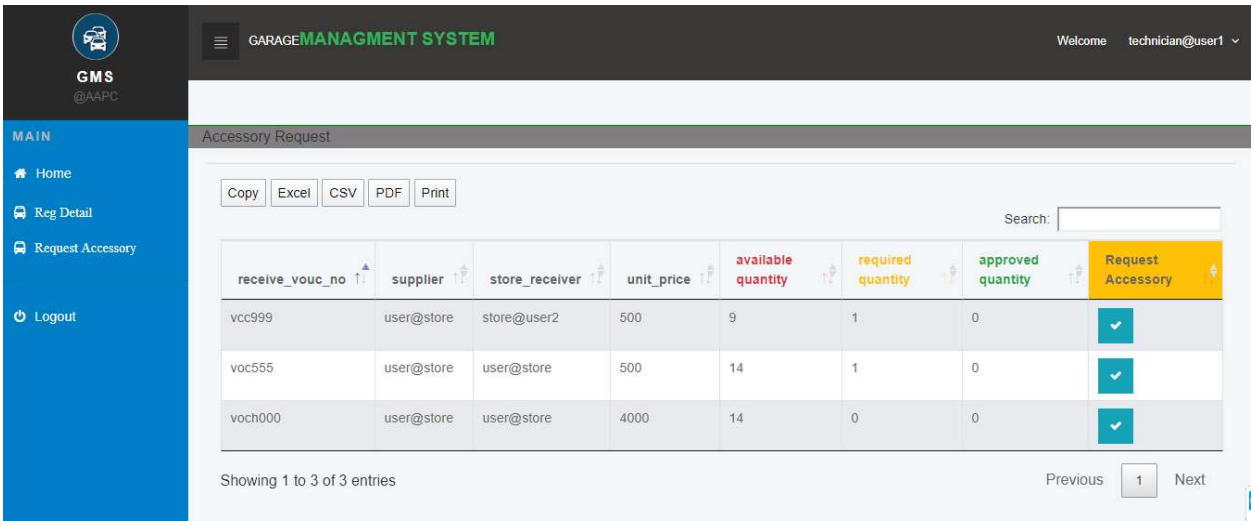

Fig.5. 15: Technician **request accessory**

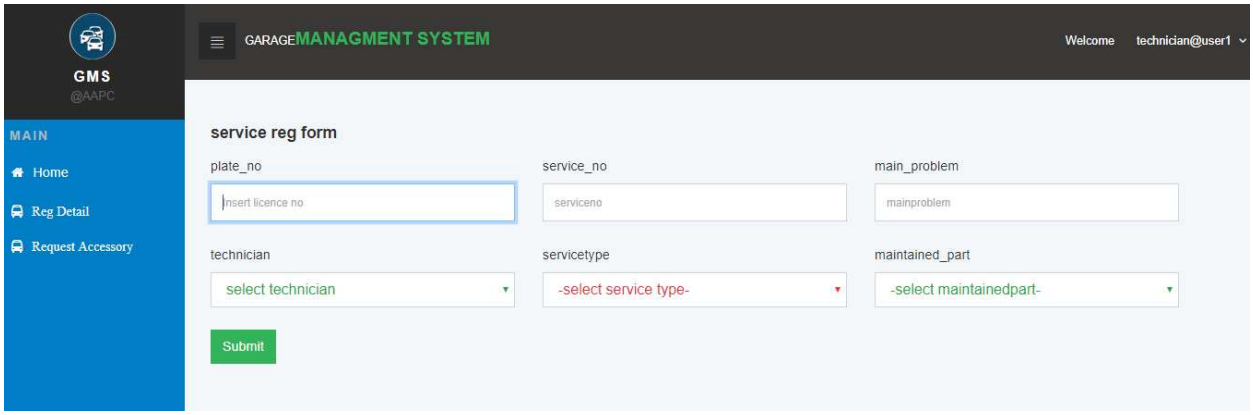

Fig.5. 16: Technician **service registration form**

7. **Reception** interface

The reception interface provides the reception to get the privilege of full access for receive vehicle for service, view vehicle request, vehicle status and report.

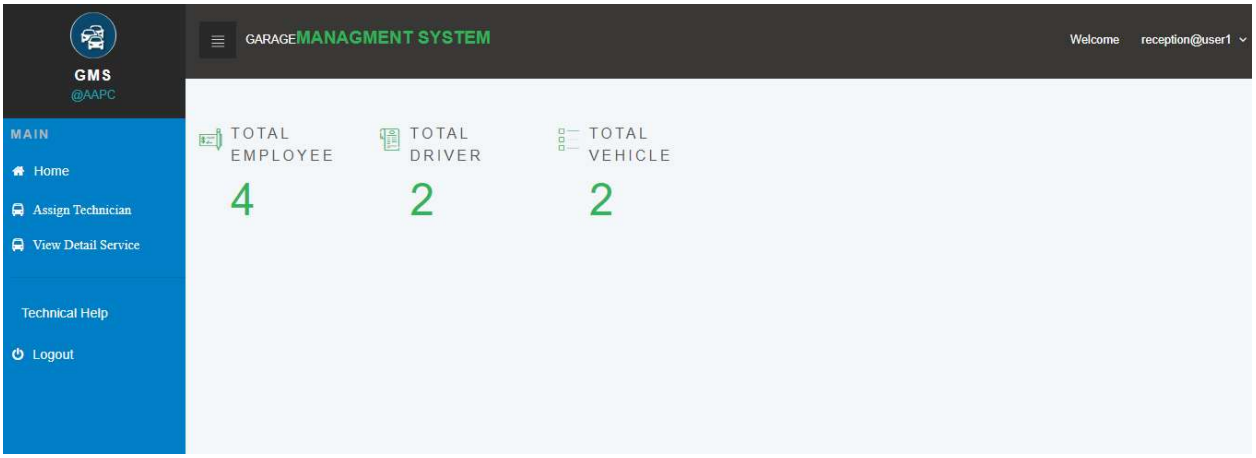

Fig. 5.17 Reception interface

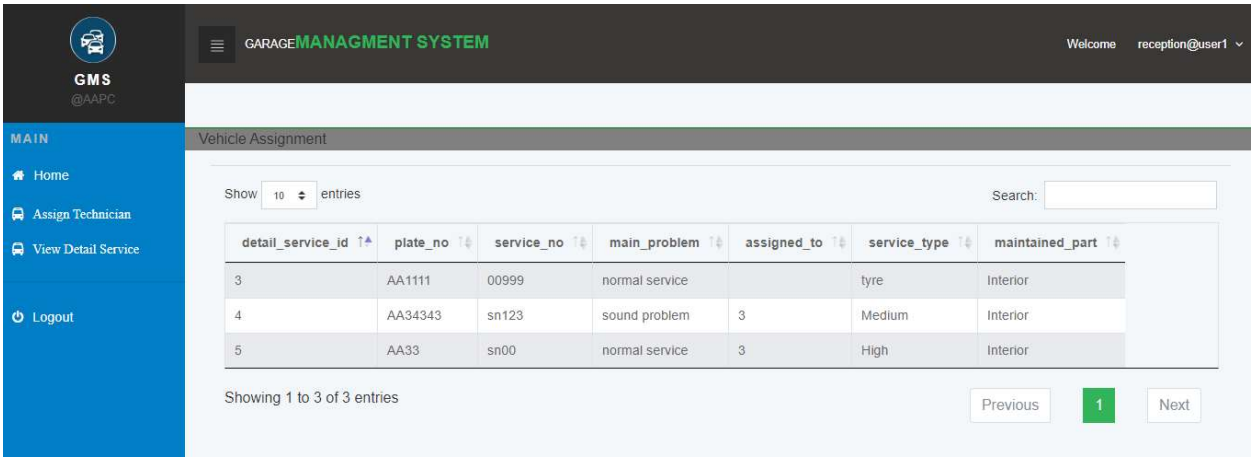

Fig.5.18 Reception view vehicle assignment

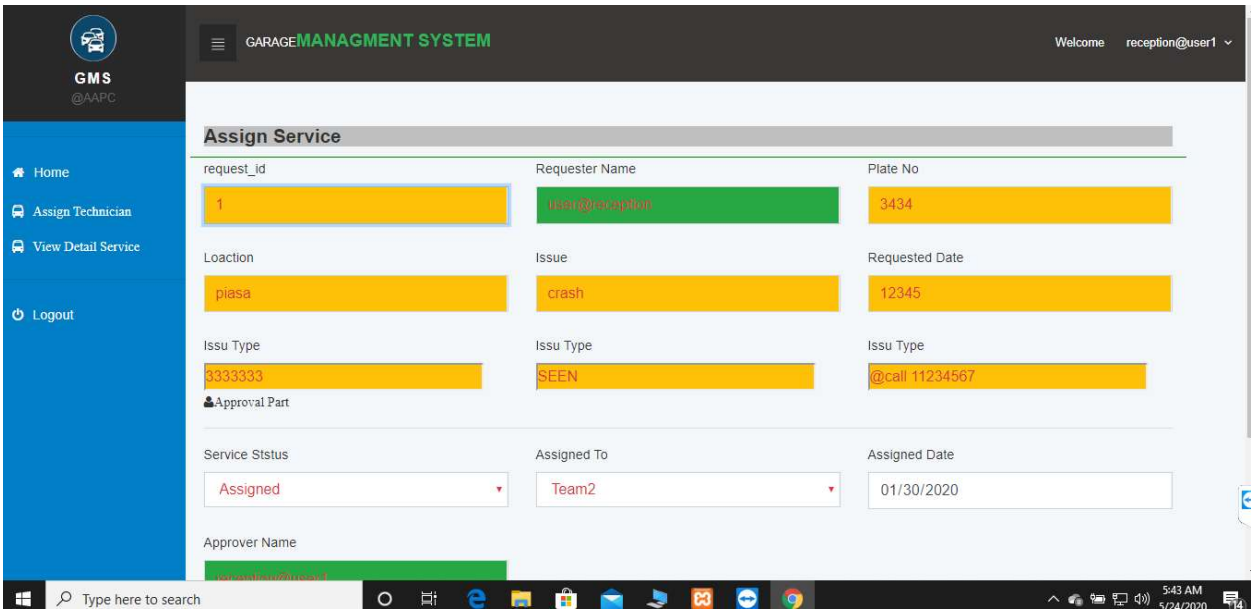

Fig.5.19 Reception assigns service form

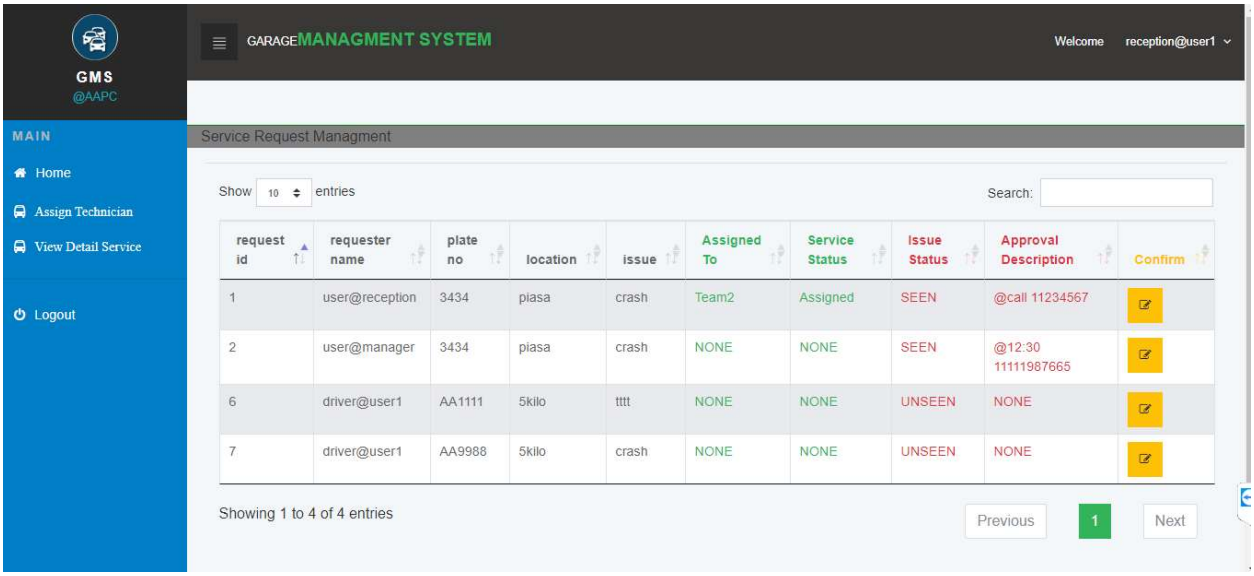

Fig.5.20 Reception assign technician

8. Encoder interface

The encoder interface provides the encoder to get the privilege of full access for registration for vehicle management, employee management and driver's management. He/she can also Have privilege to add, delete, update, view and search fields for the above modules.

Fig-5.21 Encoder interface

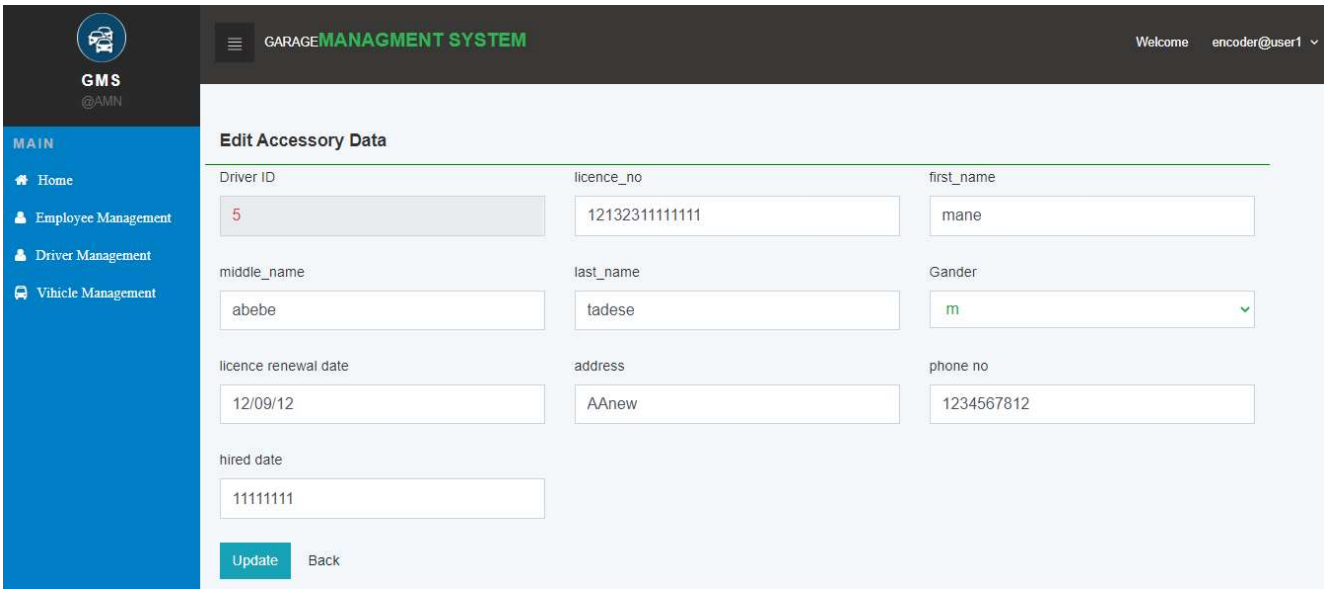

Fig5.22Encoder Employee Management Edit Driver Data

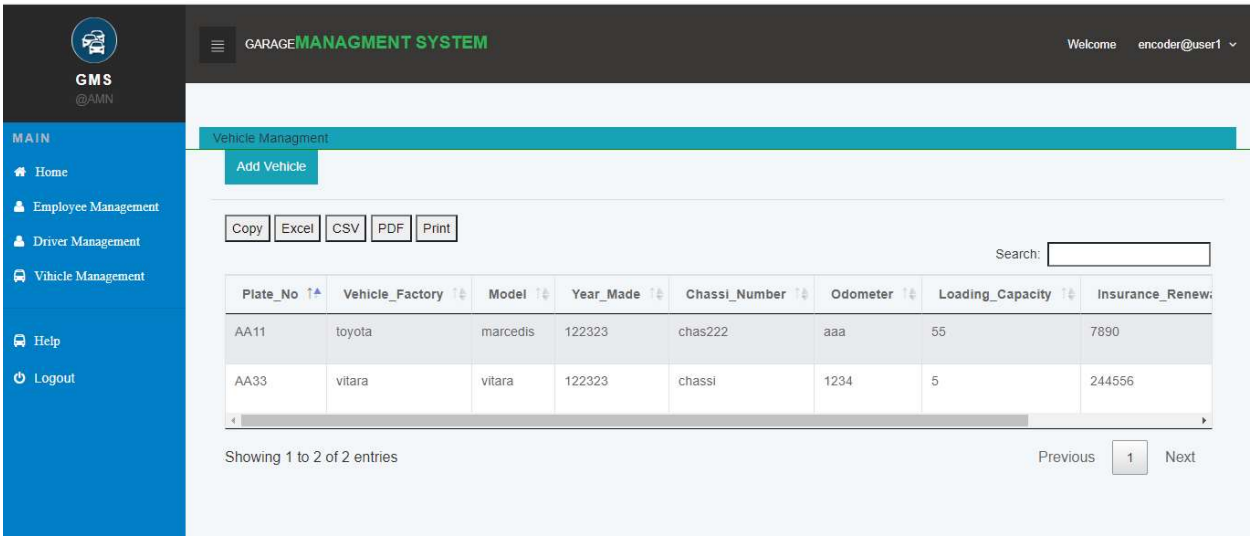

Fig5.23 Encoder Vehicle management Add Vehicle

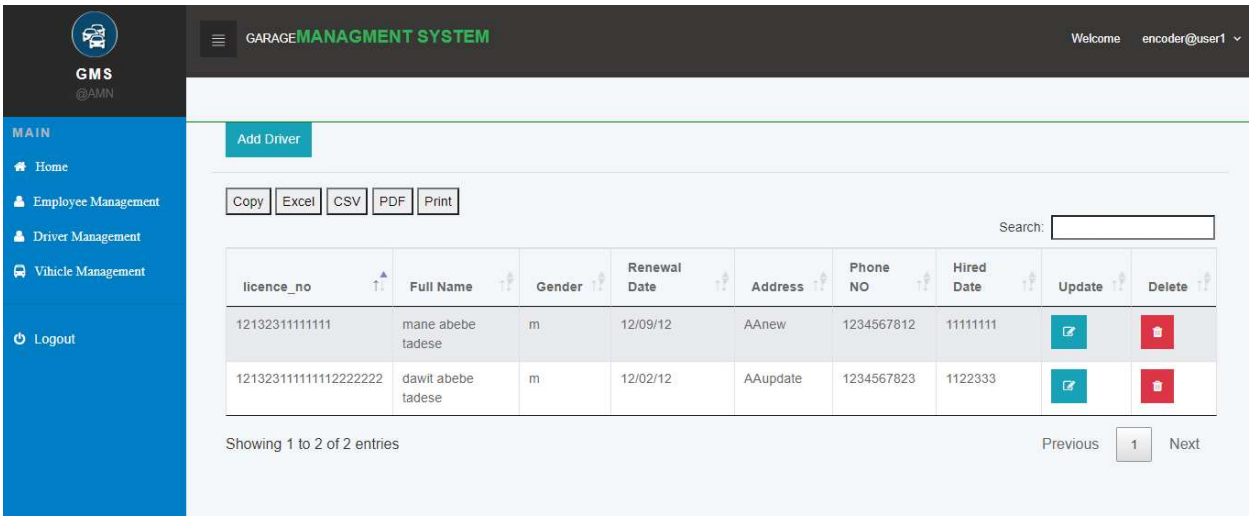

Fig 5.24 Encoder Employee Management add Driver

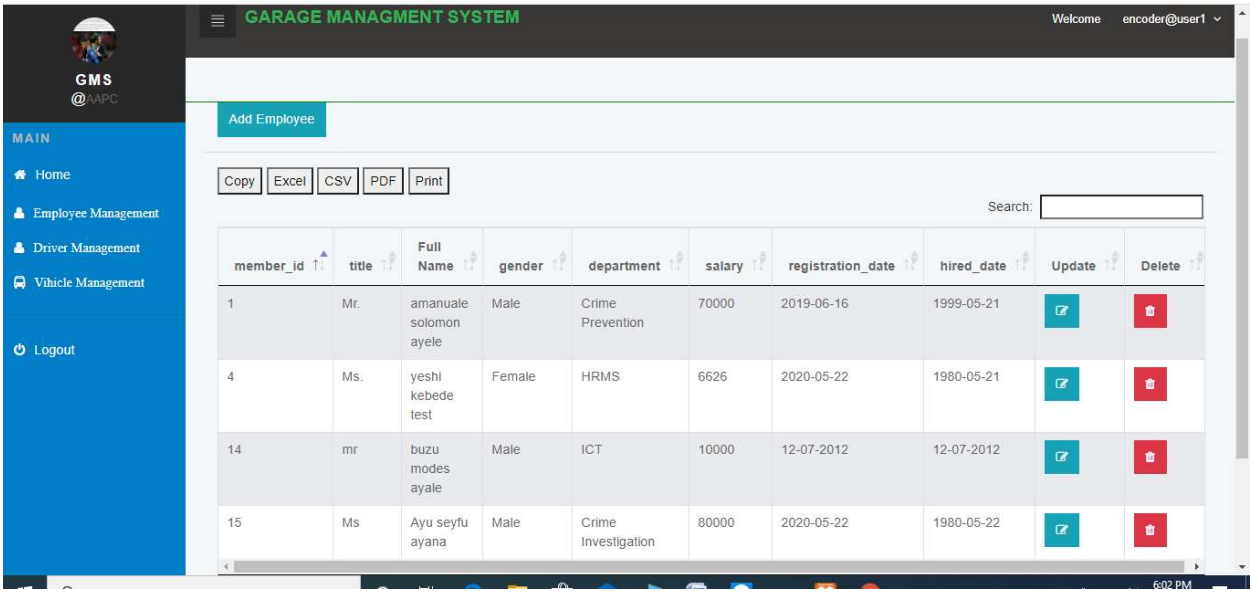

Fig5.25 Encoder Employee Management add Employee

8. Store keeper interface

The Store keeper interface provides the Store keeper to get the privilege of full access for the following three main modules. These are Accessory Management, Vehicle Assignment and Update Request Accessory. In the accessory management he/she can Add, delete, update components, view and search options. In the vehicle assignment module he/she can assign vehicle to driver, and in the update request accessory he/she can view and request the required accessories.

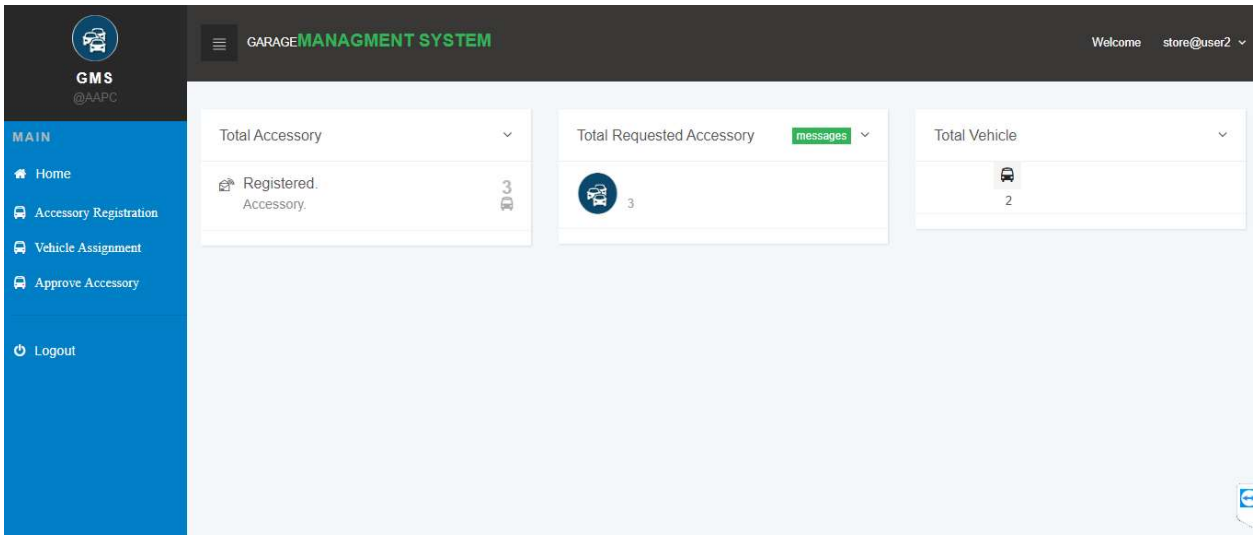

Fig-5.26 store keeper interface

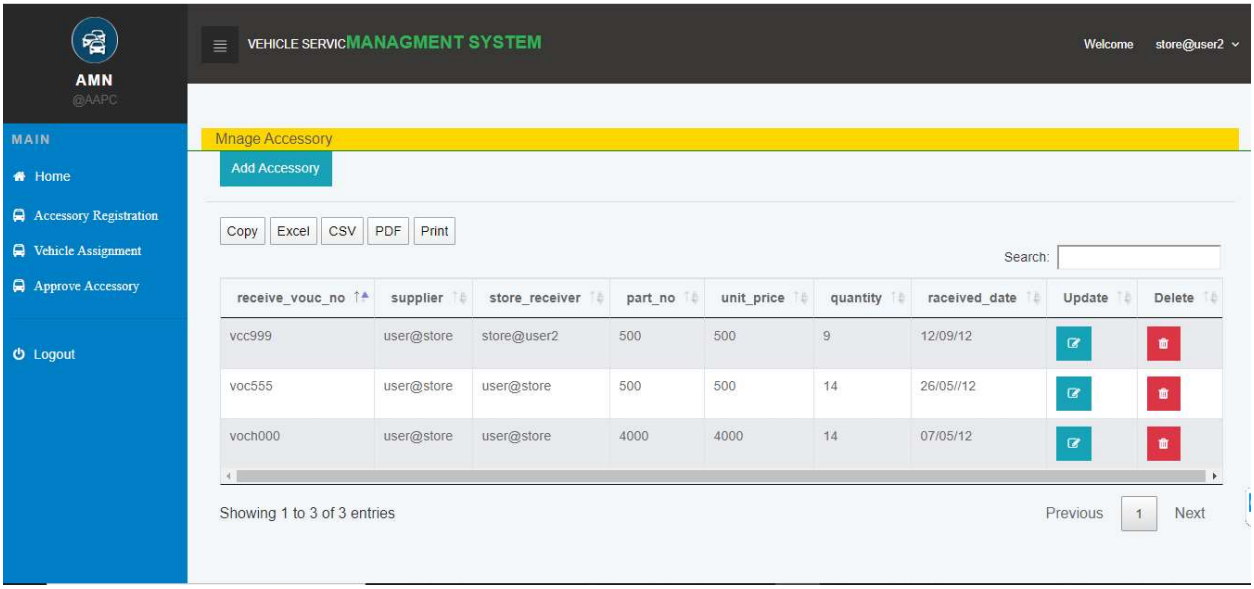

Fig.5.27 store keeper accessory management

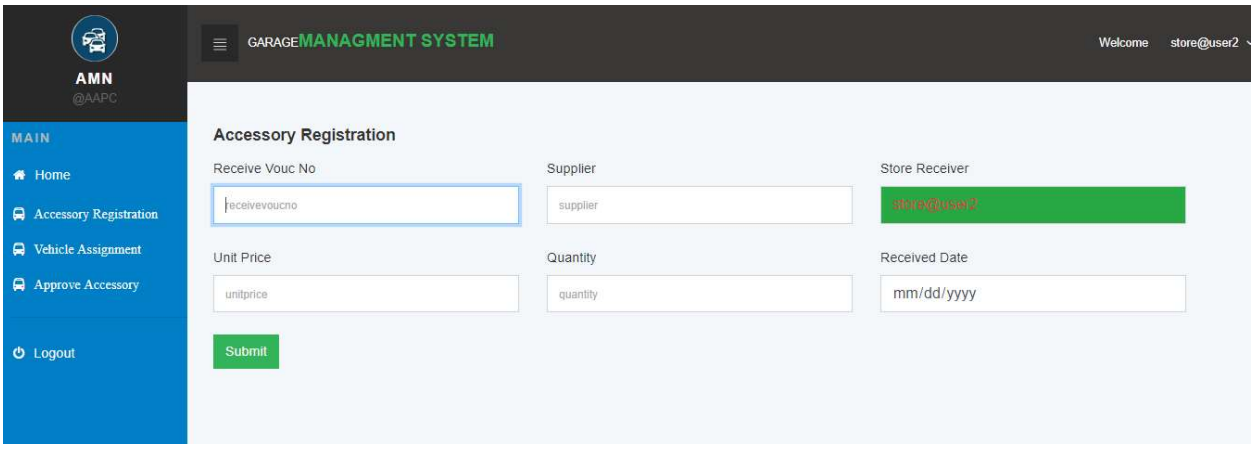

Fig.5.28store keeper **accessory management add new**

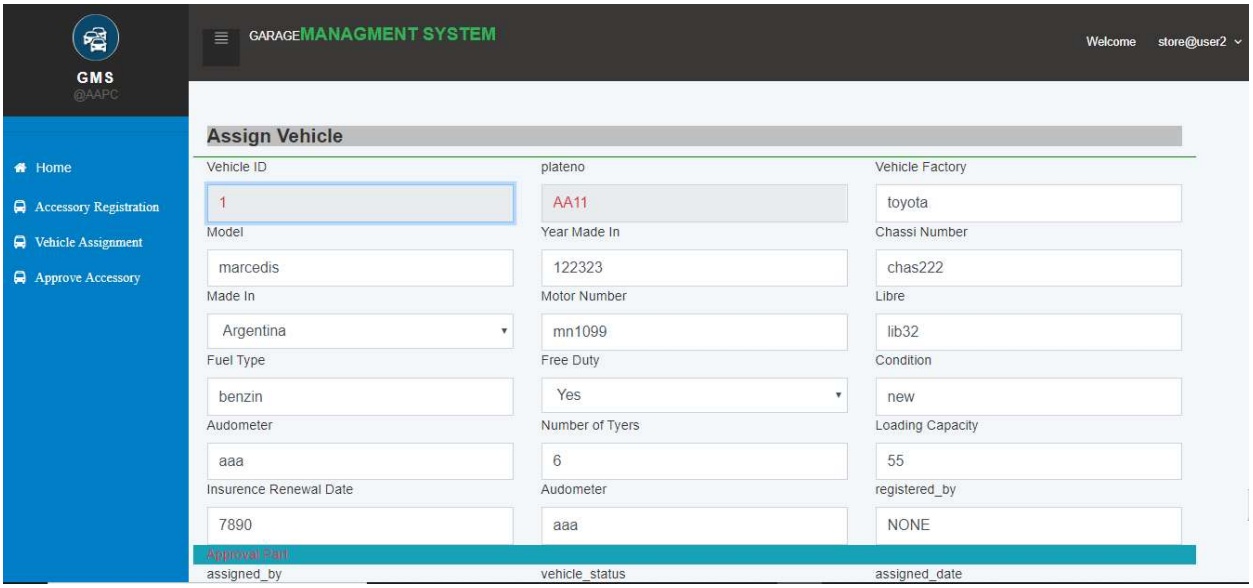

Fig.5.29store keeper vehicle Assignment

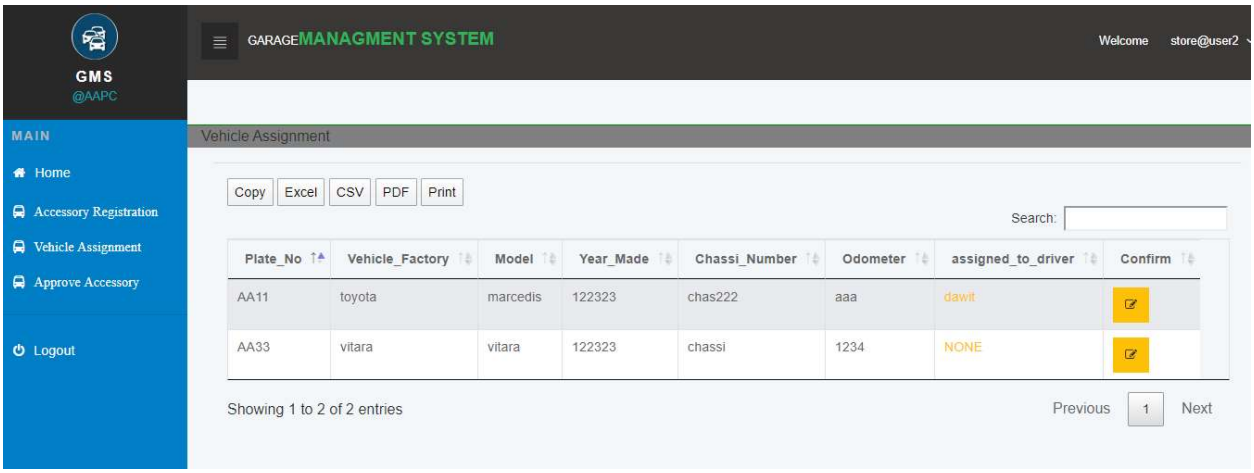

Fig.5.30 store keeper vehicle assignment confirmation

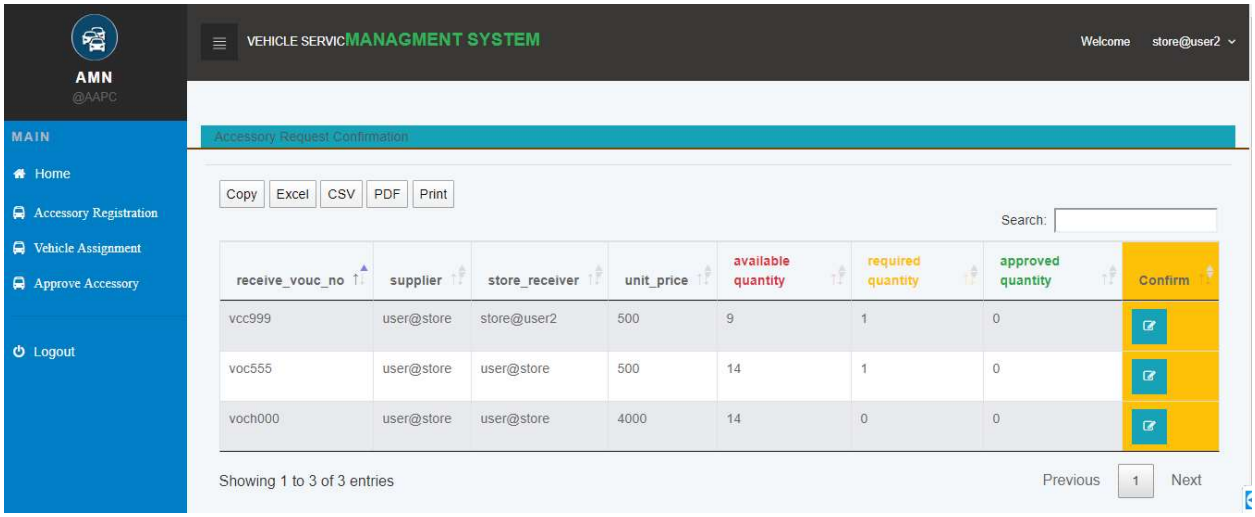

Fig.5.31 store keeper accessory request confirmation

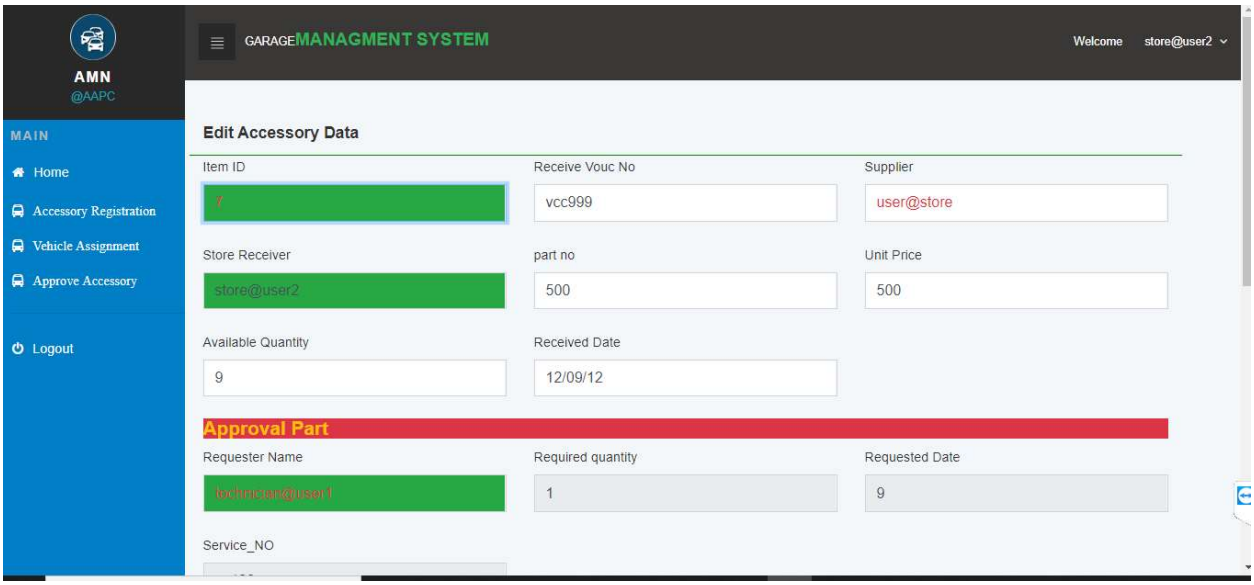

Fig.5.32 store keeper accessory update and delete

5.5. Testing

5.5.1. Introduction

Testing is the process by which a system or components are compared against requirements and specifications according to the user requirement. The results are evaluated to assess the progress of design, performance, supportability, etc. There are different types of testing methods; among them for this project three levels of testing have been conducted. These are unit testing, integration testing, system testing and user acceptance testing. The main purpose of these tests is to evaluate the system's compliance with the business requirements and to verify if the system has met the required application based on the criteria to deliver to end users. Accordingly, the testing is performed by the client to certify the system with respect to the requirements that was agreed upon during requirement components will be fulfilled. For this purpose, different testing criteria have been prepared and tested against them. Based on the above, the testing has been conducted for required parameters and the resulted is noted. The different types of criteria for the different modules with their test results are listed. These are User System testing, Integration testing and Acceptance testing (UAT).

For the testing processes, the stakeholder may be involved in any of these ways: Explicit or implicit interest in test activities, receive test work products and explicitly or implicitly affected by the deliverable quality

From this point of view, the following categories or process owner have been selected to conduct the overall processes of the testing cases. These are:

System developer leads and team – They are responsible for implementing the tests, receiving the test results and take actions like fixing bugs based on the results.

Database Administrators – They design the software, receive test results and take action based on test results.

Senior-level management and department managers - They contribute in defining test coverage, analyzing test results and taking decisions on the basis of those results.

Technical, customer and help desk support staff – They provide support to the customers and end-users who use the delivered software.

End users – They are the users who use the software directly, receive output from the software or get support from the software.

Based on the lists, a team of UAT testers composing of 10 people is formulated from the above

different groups to conduct the test and the following tests have been conducted.

5.5.2 System Testing

5.5.2.1 Roll and Expecting Result

Table5. 1: server and client side Os and Hardware Test

The roll of this table is to open smoothly server and client computers

No	**Test Objectives**	**Test Steps**	**Expected Result**	**Result**
1	To ensure that the server side correctly open the windows and run Os	Push : push button on computer : Choose and select for maintenance	Display windows server correct	Pass
2	To ensure that the client side computer starts correctly open the windows	Push : push button on computer	Display windows correct	Pass

5.5.2.2 System administrator

The roll of the Admin is add new user they have their own privilege and add all system help how the new user use this system add the technical help for drivers Create user (user name and password), system help and technical help and he/she view the activity of all users update and delete

Table5. 2: *Testing* admin login and manage user

No	Test Objectives	Test Steps	Expected Result	Result
1	Server /Client side open	Browser and write Open xampp control panel Apache Start Mysql Start	Status change detected :running	pass
2	Server /Client side open	Browser http://localhost/GMS/Authentication/login or http://localhost/192.168.1.10/Authentication/login	Display the login interface on server	pass
3	Server /Client side open	Browser http://localhost/GMS/Authentication/login or http://localhost/192.168.1.10/Authentication/login	Display the login interface on client	pass
4	Log in server side login form (Security Test)	GMS Admin@ user1 insert the wrong password	Display user account is not correct	pass
5	Log in server side	login form to GMS Admin@ user1 insert the correct password	Display Welcome Admin dashboard	pass

6	View Admin	Dashboard • Manage User • Encoder • Driver • Registrar • Technician • Storekeeper • Help request approval	help & logout View All user, Active User, Inactive user	pass
7	Manage user	Display click Add user interface	To add actors with them privilege	pass
8	Add user	Display a New user Registration • User name • Email • Password • User type • Choose to add file	○ Submit Successfully saved	pass
9	Log Out server	side user@Admin	Display login form to GMS	pass

Table 5.3 *Testing* admin login and Update user

No	Test Objectives	Test Steps	Expected Result	Result
1	Server /Client side open	Browser and write Open xampp control panel Apache Start Mysql Start	Status change detected :running	pass
2	Server /Client side open	Browser http://localhost/GMS/Authentication/login or http://localhost/192.168.1.10/Authentication/login	Display the login interface on server	pass
3	Server /Client side open	Browser http://localhost/GMS/Authentication/login or http://localhost/192.168.1.10/Authentication/login	Display the login interface on client	pass
4	Log in server side (Security Test)	login form to GMS Admin@ user1 insert the wrong password	Display user account is not correct	pass
5	Log in server side	login form to GMS Admin@ user1 insert the correct password	Display Welcome Admin dashboard	pass
6	View Admin Dashboard	• Manage User • Registrar • Technician • Storekeeper • Encoder	Help request approval help & logout All user, Active User, Inactive user	pass

7	Manage user	Display click update	To update /change role /remove actors	pass
8	Add user	Display Edit user Registration • User name • Email • Password • User type • Choose to add file	Update Successfully Updated	pass
9	Log Out server side	Admin@ user1	Display login form to GMS	pass

Table5. 3: *Testing* admin login and Add Technical Help

No	Test Objectives	Test Steps	Expected Result	Result
1	Log in server side (Security Test)	login form to GMS Admin@ user1 insert the Wrong password	Display user account is not correct	pass
2	Log in server	side login form to GMS Admin@ user1 insert the correct password	Display Welcome Admin dashboard	pass
3	View Admin Dashboard	Manage User, Registrar, Technician, Storekeeper, Encoder , Help request approval, help & logout All user,	Active User, Inactive user	pass
4	Help	Technical Help	Display Add Technical Help	pass
5	Add Technical Help	Display a case Registration Case Name Case type Case solution Issue date	Successes fully Registered!!	pass
6	Log Out server side	Admin@ user1	Display login form to GMS	pass

Table5. 4: *Testing* admin login and Add system Help

No	Test Objectives	Test Steps	Expected Result	Result
1	Log in server side (Security Test)	Login form to GMS Admin@ user1 insert the Wrong password	Display user account is not correct	pass
2	Log in server side	login form to GMS Admin@ user1 insert the correct password	Display Welcome Admin dashboard	pass
3	View Admin Dashboard	• Manage User • Registrar • Technician • Storekeeper • Encoder • Help • request approval	help & logout All user, Active User, Inactive user	pass
	Help System Help	Display(view)	+Acronomy& Add System Help	pass
4	Acronym	View the acronyms	Display Abbreviation and their meanings	pass
5	Add System Help	• Display a case Registration • System help Name • System help Description • Registered date o Submit	Successes fully Registered!!	pass
6	Log Out server side	Write Admin@ user1	Display login form to GMS	pass

5.5.2.3 Manager

The roll of Manager is he/she help request Approval And view help. He/she approve help request by driver means the driver ask to his boss when the vehicle need service send the request after the boss get the request, Approve the request and send to Reception Also the manager view technical help data all pages

Table5. 5: *Testing* Manager Login & Help request approval

No	Test Objectives	Test Steps	Expected Result	Result
1	Log in server side (Security Test)	login form to GMS manager@ user1 insert the Wrong password	Display user account is not correct	pass
2	Log in server side	login form to GMS manager@ user1 insert the correct password	Display Welcome manager dashboard Home, Help Request Approval, Help & logout	pass
3	Help request approval	Click right side • Approval Request • Edit service Data o Issue status o Approval description o service status o Assign to o Assign date Approved by	o Update Update successfully	pass
4	Log Out server side	Write manager@user1	Display login form to GMS	pass

5.5.2.4 Encoder

The roll **of Encoder** is to add all data in the system Employee Management : to add new employee edit and delete, Driver Management it is only add the driver history new, edit and delete Vehicle Management add vehicle, view/update DeleteVehicle

Table5. 6: *Testing* Encoder login & update/Delete *Employee*

No	Test Objectives	Test Steps	Expected Result	Result
	Log in server side	login form to GMS write Encoder@user1 insert the wrong password	Display user account is not correct	pass
	Log in server side	login form to GMS Encoder@user1 insert the correct password	Display Welcomemanagerdashboard Home, • Employee Management • Driver Management • Vehicle Management system Help & logout	pass
	Employee Management update	Click right side Update • Edit Employee data insert o Title o First name o Middle Name o Last name	Update Updated successfully	pass

		○ Gender ○ Department ○ Salary ○ Hired date		
	To Delete	Click right side Right click	Are you sure You won't delete this ? • Ok Deleted successfully!! • Cancel	pass
	Log Out server side	manager@user1	Display login form to GMS	pass

Table5. 7: Testing Encoder login & Add Employee

No	**Test Objectives**	**Test Steps**	**Expected Result**	**Result**
1	Log in server side	login form to GMS Encoder@user1 insert the wrong password	Display wrong password user account is not correct	Pass
2	Log in server side	login form to GMS Encoder@user1 insert the correct password	Display Welcome manager dashboard Home, • Employee Management • Driver Management • Vehicle Management system Help & logout	Pass

3	NEW Employee Management add	Add Employee • Employee registration o Title o First name o Middle Name o Last name o Gender o Department o Salary o Registration date o Hired date	Submit submitted successfully	Pass
4	Log Out server side	manager@user1	Display login form to GMS	Pass

Table5. 8: *Testing* Encoder login & update/Delete Driver

No	Test Objectives	Test Steps	Expected Result	Result
1	Log in server side login form to GMS	Encoder@user1 insert the wrong password	Display user account is not correct	pass
2	Log in server side login form to GMS	Encoder@user1 insert the correct password	Display Welcome manager dashboard Home, • Employee Management • Driver Management • Vehicle Management system Help & logout	pass
3	Driver Management update	Click right side Update	Update Updated successfully	pass

		• Edit Driver data o license No o First name o Gender o renewal Date o Address o phone No o Hired date		
4	Delete	Click right side	Are you sure You won't delete this ? • Ok Deleted successfully !! • Cancel	pass
5	Log Out server side	manager@user1	Display login form to GMS	pass

Table5. 9: Testing Encoder login & Add Driver

No	**Test Objectives**	**Test Steps**	**Expected Result**	**Result**
1	Log in server side login form to GMS	Encoder@user1 insert the fault password	Display user account is not correct	pass
2	Log in server side login form to GMS	Encoder@user1 insert the correct password	Display Welcome manager dashboard Home, • Employee Management • Driver Management • Vehicle	pass

			Management system Help & logout	
3	Driver Management add	Add Driver • Driver registration o license No o First name o Gender o renewal Date o Address o phone No o Hired date	Submit submitted successfully	pass
4		Log Out server side manager@user1	Display login form to GMS	pass

Table5. 10: Testing Encoder login &view/update Delete Vehicle

No	Test Objectives	Test Steps	Expected Result	Result
1	Log in server side login form to GMS	Encoder@user1 insert the fault password	Display user account is not correct	pass
2	Log in server side login form to GMS	Encoder@user1 insert the correct password	Display Welcome manager dashboard Home, • Employee Management • Driver Management • Vehicle Management system Help & logout	pass
3	Vehicle Management	View/update vehicle	Update	pass

	view and update	Edit vehicle Data o Vehicle Id o plate No o Vehicle factory o Model o Year Made o chassi Number o odometer o loading capacity o insurance renewal o update o delete	Updated successfully	
4	Delete	Click right side	Are you sure You won't delete this ? • Ok Deleted successfully !! • Cancel	pass
5	Log Out server side	manager@user1	Display login form to GMS	pass

Table5. 11:Testing Encoder login & Add Vehicle

No	Test Objectives	Test Steps	Expected Result	Result
1	Log in server side login form to GMS	Encoder@user1 insert the fault password	Display user account is not correct	pass
	Log in server side login form to GMS	Encoder@user1 insert the correct password	Display Welcome manager dashboard Home, • Employee Management • Driver Management • Vehicle Management system Help & logout	pass
2	Vehicle Management Add	Add vehicle Vehicle Registration o plate No o Vehicle factory o Model o Year Made o chassi Number o odometer o loading capacity o insurance renewal	Submit submitted successfully	pass
3	Log Out server side	manager@user1	Display login form to GMS	pass

5.5.2.5 Driver

The roll of **Driver** is he/she the main actor I think this system mainly solve the problem of Driver in case they can get the accidental or annual service easily this system.

- He/she face accidental problem view Help and troubleshoot and save the problem
- The problem is not solved or the vehicle goes above 5000 km need service at this time the driver need help and ask Request his boss/manager for maintenance
- The vehicle tack by garage receptionist driver watch daily the status of the vehicle

Table5. 12:*Testing* Driver login, View Help

No	Test Objectives	Test Steps	Expected Result	Result
1	Client side open	Browser http://localhost/GMS/Authentication/login or http://localhost/192.168.1.10/Authentication/login	Display the login interface on client	Pass
2	Log in view	login form to GMS Driver@user1 insert the wrong password	Display user account is not correct	Pass
3	View Help + View technical Help	Show created problems • Case id • Case name • Case type • Case solution • Issue date + View technical Help and click	View you can get the problem read and troubleshoot easy	Pass
4	Log Out	Driver@user1	Display login form to GMS	Pass

Table5. 13*Testing* Driver login, Request Help

No	Test Objectives	Test Steps	Expected Result	Result
1	Client side open Browser	http://localhost/GMS/Authentication/login or http://localhost/192.168.1.10/Authentication/login	Display the login interface on server	Pass
2	Client side open Browser	http://localhost/GMS/Authentication/login or http://localhost/192.168.1.10/Authentication/login	Display the login interface on client	Pass
3	Request Help If You didn't troubleshoot the problem by yourself ask help	Add Request write Request Help Form • Request Id • Requester Name • Plate No • Location • Issue • date • if you have IMAGE add	○ Submit	Pass
4	Log Out	Write Driver@user1	Display login form to GMS	Pass
5	Log in view login form to GMS	Driver@user1 insert the fault password	Display user account is not correct	Pass

Table5. 14: *Testing* Driver login, View Vehicle Status

No	Test Objectives	Test Steps	Expected Result	Result
1	Client side	open Browser write http://localhost/GMS/Authentication/login or http://localhost/192.168.1.10/Authentication/login	Display the login interface on client	pass
2	Log in view	login form to GMS Driver@user1 insert the fault password	Display user account is not correct	pass
3	Log in client side login	GMS Driver@user1 insert the correct password	Display Welcome Driver dashboard View Help Request Help View Vehicle Status and + view Technical Help	pass
4	View Vehicle Status	View approved your request & Vehicle status • Issue status • Service Status • View Approval Description • who assigned to help you • and his/her phone number	If you won't a hard copy print or copy by Pdf/ Excel	pass
5	Log Out	Write Driver@user1	Display login form to GMS	pass

5.5.2.6 Reception

The roll of Reception is From driver send request help to the Manager in case he/she need help and manager approve the request and send to Reception

- Then a car that crashed on the road driver need argent help send request and reception gave supporter phone number
- Accept vehicle service approved by manager and reception received the vehicle assign and give to Technician team
- View assigned technician when the vehicle is finished, on progress and not seen what type accessory they can used

Table5. 15:*Testing* Reception login, Assign Technician

No	Test Objectives	Test Steps	Expected Result	Result
1	To open Client side	open Browser http://localhost/GMS/Authentication/login or http://localhost/192.168.1.10/Authentication/login	Display the login interface on server	pass
2	Log in view login form to GMS	reception@user1 insert the fault password	Display user account is not correct	pass
3	Log in client side login form to GMS	reception@user1 insert the correct password	Display Welcome Reception dashboard • Assign Technician • View detail service	pass
4	To Assign Technician	Service Request Management View who send the request and confirm	• issue type ○ assign to TEAM	pass

		• Request Id • Requester Name • Plate No • Location • Issue • Date	○ assign date ○ approver name ○ update	
5	Log Out	reception@user1	Display login form to GMS	pass

Table5. 16:*Testing*Reception login**, View detail service**

No	**Test Objectives**	**Test Steps**	**Expected Result**	**Result**
1	Log in view login form to GMS	reception@user1 insert the fault password	Display user account is not correct	
2	Log in client side login form to GMS	reception@user1 insert the correct password	Display Welcome Reception dashboard • Assign Technician • View detail service	pass
3	To View detail service On Dashboard	Click View detail service	View Vehicle service status • detail service Id • Plate No • service No • main problem • assigned to • service type • maintained part	pass
4	Log Out	reception@user1	Display login form to GMS	Pass

5.5.2.8 Technician

The roll of the Technician he/she receive the vehicle from the reception and treble shoot and Maintain after he/she finished add detail the problem and how it solved

- Technicians ask Accessory for maintenance send request to Store

Table5. 17: *Testing* Technician login, view and received vehicle

No	Test Objectives	Test Steps	Expected Result	Result
1	To open Client side	open Browser write http://localhost/GMS/Authentication/login or http://localhost/192.168.1.10/Authentication/login	Display the login interface on client	Pass
2	Log in view login form to GMS	Write reception@user1 insert the fault password	Display user account is not correct	pass
3	Log in Client side login form to GMS	Write reception@user1 insert the correct password	Display Welcome Reception dashboard • Assign Technician • View detail service	Pass
4	To View and receive the assigned vehicle	Reg. Detail	View and receive the assigned vehicle • detail service id • Plate No • service No • main problem • assigned to • service type • maintained part	pass
5		Log Out reception@user1	Display login form to GMS	Pass

Table5. 18:*Testing* Technician login, register detail service

No	Test Objectives	Test Steps	Expected Result	Result
1	Log in view login form to GMS	reception@user1 insert the fault password	Display user account is not correct	Pass
2	Log in server side login form to GMS	reception@user1 insert the correct password	Display Welcome Reception dashboard • Assign Technician • View detail service	Pass
3	**To register detail service**	Reg. Detail **Click register detail service** **Add detail** • Plate No • service No • main problem • service type • maintained part • detail problem • used spare parts • solved • on progress • not seen	○ submit	pass
4	Log Out	reception@user1	Display login form to GMS	Pass

5.5.2.9 Storekeeper

- The roll of store keeper is new spare parts register, update and delete
- Give Accessory to the technicians
- Accessory inventory
- Assigned vehicles to Driver

Table5. 19: Testing StoreKeeper login, Accessory Registration update

No	Test Objectives	Test Steps	Expected Result	Result
1	To open Client side	open Browser http://localhost/GMS/Authentication/login or http://localhost/192.168.1.10/Authentication/login	Display the login interface on client	Pass
2	Log in view login form to GMS	Add store@user1 insert the fault password	Display user account is not correct	Pass
3	Log in client side login form to GMS	Add store@user1 insert the correct password	Display Welcome Reception dashboard • Accessory Registration • vehicle Assignment • Approve Accessory	Pass
4	To add Accessory Registration update	Click on right side Update and write • Edit accessory Data • Item Id • Receive vouch No • supplier • store receiver • part No • Unit Price • Available • Quantity • Received date	Update Updated successfully !!	Pass
5	Log Out	reception@user1	Display login form to GMS	Pass

Table5. 20: Testing Store Keeper login, Accessory Registration Add

No	Test Objectives	Test Steps	Expected Result	Result
1	To open Client side	open Browser http://localhost/GMS/Authentication/login or http://localhost/192.168.1.10/Authentication/login	Display the login interface on client	Pass
2	Log in view login form to GMS	store@user1 insert the fault password	Display user account is not correct	Pass
3	Log in server side login form to GMS	store@user1 insert the correct password	Display Welcome Reception dashboard • Accessory Registration • vehicle Assignment • Approve Accessory	Pass
4	To Add Accessory Accessory Registration	Accessory Registration Add Add Accessory Accessory Registration form • Receive vouch No • supplier • store receiver • part No • Unit Price • Quantity • Received date	Submit Submitted successfully !!	pass
5	Log Out	reception@user1	Display login form to GMS	pass

Table5. 21:Testing Store Keeper login, Approve Accessory confirm, approve

No	Test Objectives	Test Steps	Expected Result	Result
1	Client side	open Browser http://localhost/GMS/Authentication/login or http://localhost/192.168.1.10/Authentication/login	Display the login interface on client	pass
2	Log in view	login form to GMS store@user1 insert the fault password	Display user account is not correct	pass
3	Log in client side login form to GMS	store@user1 insert the correct password	Display Welcome Reception dashboard • Accessory Registration • vehicle Assignment • Approve Accessory	pass
4	vehicle Assignment confirm	Click Confirm o Vehicle Id o plate No o Model o Year Made o chassi Number o made in o motor Number o Libre o fuel type o condition o No of tiers o loading capacity o insurance renewal date o Registered by	update Updatedsuccessfully!!	pass

5	To View Approval	Click Approval part • Assigned by • Vehicle status • Assign date • Driver name	View Approval	pass
6	Log Out	reception@user1	Display login form to GMS	pass

Table5. 22: Testing Store Keeper login, Vehicle Assignment, Approval

No	Test Objectives	Test Steps	Expected Result	Result
1	Log in view login form to GMS	store@user1 insert the fault password	Display user account is not correct	pass
2	Log in server side login form to GMS	store@user1 insert the correct password	Display Welcome Reception dashboard • Accessory Registration • vehicle Assignment • Approve Accessory	pass
3	Approve Accessory confirm	Edit Accessory Data o Item Id o Receive vouch No o Supplier o Store receiver o part no o unit price o Available Quantity o Received date	Confirm update updated successfully !!	pass
4	View Request	Click Requester part	Requester part • Requester Name • Required quantity • Requested date • service No	pass

5	To Approve	Click Approve part • Approval status • Approved by • Approved date • Approved quantity	update updated successf ully !!	pass
6	Log Out	reception@user1	Display login form to GMS	pass

5.5.3 Integration Testing

Integration testing is the process of testing the interface between two or more module of the software units. This testing allows us to focus on data communication between these modules. A typical software project consists of multiple modules that are managed by different programs. Integration testing focuses on determining the correctness of the interface. The purpose of the integration testing is to expose faults in the interaction between integrated units.

Big Bang Integration test/Non-incremental integration testing

From the existing different types of integration testing, for this developed system the non-incremental integration testing is selected as the relationship between the different modules is mixed type. In this type of integration testing approach, most of the developed modules are coupled together to form a complete software system or a major part of the system, which is then used for integration testing. Here all components of the software are integrated at once and convenient for small systems.This method is very effective for saving time in the integration testing process.

The approach is described for data flow and control flow-oriented criteria and measures. The intention is to enable the tester to specify integration tests in advance in terms of effort, and to evaluate the results in terms of test completeness

Here the developed Garage information management systems consists of five modules. These are Log in module,Registration Module, Reception Desk Module, Transaction Module, Report Module, Admin Module, Help Module.

As all these modules are integrated and inter related logically for the processes of integration testing, the following test had been done using the following test cases, test objectives and test descriptions against to the expected results. We have focused on its interface link among the different modules as the individual modules already have been tested using unit testing.

For this integration testing process an integration test team which comprises five professionals is formulated, to conduct the Integration Testing. The team designed the whole process of the testing processes and procedures.

Based on the above, the following steps have been implemented for the process of Integration testing.

1. Preparation of Integration Test Plan.
2. Preparation of test scenarios & test cases
3. Preparation of test case objectives
4. Preparation of test description.
5. Preparation of expected result
6. Execute the test cases.
7. Record the output
8. Evaluate and report the outcome

The test cases for the developed systems in line with the above steps, the following **test cases** had framed.

Test case1. To test communication between Login and dashboard

Test case2. To check the integration between dash board and Admin Module

Test case3. To check the integration between Reception Desk Module and Transaction Module

Test case4. To check the integration between Transaction Module and Help Req. Module

Test case5. To check the integration between Admin Module and Registration module

Test case6. To check the integration between Registration module and Reception Desk Module

5.5.3.1 Integration Test of Each Modules

Table5.24Registration Module which consists the following

	Registration Module Test **Is the system capable to view and do the following activities?**	**Pass**	**Fail**	**Remark**
1	Employee registration	✓		
2	Vehicle registration	✓		
3	Driver registration	✓		
4	Accessory registration	✓		

Table5.25Reception Desk Module which consists the following

	Reception Desk Module **Is the system capable to view and do the following activities?**	**Pass**	**Fail**	**Pass with Remark**
1	Create reference number to new vehicles	✓		
2	Track time (in and out)	✓		
3	View Reports	✓		
4	View vehicle status	✓		

Table5.26Transaction Module which consists the following

	Transaction Test **Is the system capable to view and do the following activities?**	**Pass**	**Fail**	**Remark**
1	Assign vehicles to Drivers	✓		
2	Accessory view	✓		
3	Accessory Request View	✓		
4	Update Accessory	✓		
5	Confirm accessory request	✓		
6	Spare part used view	✓		
7	Help request	✓		

Table5.27 Report Module which consists the following

	Report test case Is the system capable to view and do the following activities?	Pass	Fail	Remark
1	Vehicle and Service Detail view	✓		
2	Employee detail view	✓		
3	Driver detail view	✓		
4	Assign to Technician view	✓		
5	Vehicle Diagnosis view	✓		
6	Vehicle Work Orders view	✓		
7	Finished Work Order view	✓		

Table5.28Admin Module which consists the following

	Admin management test case Is the system capable to view and do the following activities?	Pass	Fail	Remark
1	User admin management	✓		

Table5.29Help Module which consists the following

	Help Module test case Is the system capable to view and do the following activities?	Pass	Fail	Remark
1	System Help	✓		
2	Technical Help To drivers	✓		

Table5.30 Integration testing case

Test cases	Test Case Objective	Test Description	Expected Result	Obtained Result		
				Pass	Fail	Remark
Case 1	Check the interface link between the Login and Dashboard	Add the log in details and click the button	To be directed to the dash board	✓		
Case 2	Check the interface between dash board and Admin Module	Add the log in details and click the button	To be View on the Admin dash board	✓		
Case 3	Check Admin dash board and Transaction Module	click Manage user and Add user details	To be register a new user directed to View the dash board	✓		
Case 4	check the integration between Transaction Module and Help Req. Module	click Help part and choose Assign Technician	To view the Dashboard of Help Req. Module	✓		
Case 5	Check the interface link between Admin Module and Registration module	click Manage user and Add user details	Registration module should appear in the dashboard with its details	✓		
Case 6	check between Registration module and Reception Desk Module	click Reception part and choose Assign Technician	To view the Dashboard of Reception Desk Module Approval Description	✓		

5.5.4 Acceptance testing

Acceptance testing is a level of software testing where a system is tested for acceptability. The purpose of this test is to evaluate the system's compliance with the business requirements and assess whether it is acceptable for delivery. The environment used for conducting Acceptance Testing is similar to the production environment and is not the development. For the purpose of User acceptance testing, two types of testing have been framed. General Acceptance testing and Module based acceptance testing.

For the testing processes, the stakeholder may be involved in any of these ways: Explicit or implicit interest in test activities, receive test work products and explicitly or implicitly affected by the deliverable quality.

From this point of view, the following categories or process owner have been selected to conduct the overall processes of the testing cases. These are:

1. **System developer leads and team** – They are responsible for implementing the tests, receiving the test results and take actions like fixing bugs based on the results.
2. **Database Administrators**– They design the software, receive test results and take action based on test results.
3. **Senior-level management and department managers -** They contribute in defining test coverage, analyzing test results and taking decisions on the basis of those results.
4. **Technical, customer and help desk support staff** – They provide support to the customers and end-users who use the delivered software.
5. **End users – They are the users who use the software directly, receive output from the software or get support from the software.**

Based on the lists, a team of Acceptance testers composing of 10 people is formulated from the above different groups to conduct the test and the following tests are conducted.

Table5.31 Acceptance testing case

S.No	Criteria	Agree	Disagree	Neutral	Agree with comment
1	Is the developed system easy to learn and use?	8			2
2	Are the various functions in the system are well integrated?	9			1
3	Is the interface of the system user friendly and attractive?	10			
4	Is the information on the system is valuable?	9			1
5	Is the system have clean and simple presentation?	9			1
6	Does the links of the system work correctly?	10			
	Total	55			5

Summary

From the table above table based on the prepared test criteria, the selected acceptance test team members gave their result and views for acceptance test process. Accordingly, 91.66% of them responded their agreement and the remaining 8.33% agree with some comments. Taking in to consideration for the comments given to appropriate amendments, the system has passed for the acceptance testing.

Chapter Six

Conclusions and Recommendations

6.1 Conclusions

From the existing manual based garage information management system it is identified that different problems concerning data and the functional business processes have been occurred. Based on the information obtained from the different respondents, participants and document review, it is identified that in the existing manual system different problems exists. i.e

- Duplication of records, incompleteness of record on the different formats, imprecise data records and poor quality of data.
- The business processes of the manual system is time consuming and tiresome, data registration, poor data management, and difficult data retrieval and slow processing claims of members requests.
- Inconsistent data definitions, transaction of data between actors make difficulty in making timely decisions.

Based on that, the web-based Garage information management systems is developed which can generate detailed reports, process activities, management work flowof the garage system. It also has a facility of the various business functional processes of GMS of organizations such as login where clients, drivers, technician can login and see status of vehicle issued as well request from driver or give some suggestions. Beside of the above, the developed system has a facility of technician login where drivers can add request and also give necessary suggestion to garage and also add info about workshops or events happening in AAPC.

This, the developed system,will solve the existing manual, tedious work of the garage management system by replacing it with automated web-based management system by providing timely and accurate information accessible among the concerned staff members for their process functions and for the management body for their efficient and effective management decision in deliveringquality of services there by reducing organizational running cost.

6.2. Recommendations

For the developed web-based system to run smoothly the required and necessary infrastructure and human resources should be fulfilled.In addition, the different branches of the organization should have network connectivity so that the whole business processes can be interconnected for easily facilitation processes.From the designed web-based garage management information system, the following recommendations were drawn for the scheme and the other stake holders. The recommendations should be considered to resolve the different constraints that were identified during the requirements collection.
The Addis Ababa Police Garage Schemeshould deploy the system in the main office and enhance its functionality. The scheme should deploy the new system thought the organization. Considering the benefits of the designed system, the scheme should publicize the system to the different system users.The scheme should facilitate to deploy the necessary system accessories that support forfull implementation. The scheme should control and monitor the functionality of the system in different ways. The developed web-based system should be implemented for the specified functional processes.

6.3. Future *Enhancement*

This project addresses the current problems of the garage information management work process and developed an information management software system. Since any business process is dynamic in nature, there will be a change in the process flows in any organizations; the same is true for AAPC. So, future enhancement is open. The system has limited functionalities that do not handle transactions management with the rest of functional processes. So, further research will be required to integrate the system functionality with other functional systems and to enhance the overall functionality of the system. Finally, this project is open to update like video chat, stored video technical support to drivers and so on

References and Appendix

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Annex –I: Questionnaires

St. Mary's University

Faculty of Informatics

Department of computer Science

Questionnaire Filled by _____

Dear Respondents,

This is BezuMoges, who is a Master's student of Computer Science at **St. Mary's Universi**ty, in the department of Computer Science. Currently, am undertaking a research

Project entitled **"Garage Management Information System for Addis Ababa Police Commission"**. Your organization is being selected as valuable and accredited sources of data to completing this study.

You are one of the accredited respondents selected to participate for this study. I understand that your time is valuable, while for the successful accomplishment of the study is rely on your honesty and kindness cooperation, genuine and loyal information response of this questionnaire. That have vital role being used as valuable input for the study. Therefore, I kindly request you to genuinely fill and return this questionnaire.

I assure you that your participation in this study is voluntary, all information you provide and results will be recorded anonymously, and confidentiality is maintained. It is for only academic purpose. At last, if you have face any problems in filling this questionnaire, you can reach and communicate me via the following addresses anytime.

BezuMoges

Phone; **+251 911417214**

E-mail; bzmoges@gmail.com

General Directions

1. No need of writing your name and address on the questionnaire

2. For multiple choice questions, please encircle your responses from alternatives

3. For Likert scale type statement questions, indicate your answers with a symbol mark of **(X) or (√)** in the appropriate space

4. Feel free & attempt all questions please

Part I. Demographic Profile:

1. Gender: ☐ *male* ☐ *Female*

2. Age ☐ (18-25) ☐ (26—30) ☐ (31-40) ☐ (above 40) years

3. Educational level: ☐ High School complete ☐ Diploma
☐ First Degree ☐ Post Graduate

4. Your Profession: ☐ ICT ☐ Management ☐ Accounting & Finance ☐ Law
☐ Other

5. Position: ☐ Expert Level ☐ Managerial Level ☐ Other

6. Service years in the Office: ☐ 0-2 ☐ 3-5 ☐ 6 –10 years ☐ above 10 year

Part II. Analysis of the Existing System

7. How do you rate your garage with other public or private garages in time delivery, perfection or quality of services?

☐ *Excellent* ☐ *ry good* ***Go****od* ☐ *tisfactory* ☐ *or* ☐

8. What types of communication media is used for information exchange about the status of vehicles maintenance within the head office, branches and the Garage?

☐ Print Media

☐ Removable Media (e.g. flash disks, optical disks)

☐ Electronic Media (e.g. Email)

If others, please Specify_____

9. What kinds of problems encountered while using such Medias

☐ Lose of data

☐ Time delay

If others, please Specify_____

No		**Very low**	**low**	**medium**	**High**	**Very High**
10	Presence of skilled manpower					
11	Using of technology (IT, automation, innovation)					
12	capacity building					
13	capacity utilization					
14	customer satisfaction					
15	Spare parts supplier related problems					
16	Physical environment or working condition					

Part III. Need Analysis

17. What is your level of understanding or knowhow about Information system management?

☐ Maximum ☐ Average ☐ Minimum ☐ None

18. Do you believe the Garage management system will solve the current problem in handling of document management of your organization?

☐ Agree ☐ Neutral ☐ Disagree

19. If your organization decided to implement the garage management system, do you believe your organization would obtain benefits or additional opportunities from the technology?

☐ Agree ☐ Neutral ☐ Disagree

20. And finally, please specify any comment if you have.

_____

_____

_____

_____.

Annex -II-Interviews

St. Mary's University

Faculty of Informatics

Department of computer Science

This is Bezu Moges, who is a Master's student of Computer Science at **St. Mary's Universi**ty, in the department of Computer Science. Currently, am undertaking a research

Project entitled **"Garage Management Information System for Addis Ababa Police Commission"**. Your organization is being selected as valuable and accredited sources of data to completing this study.

You are one of the accredited respondents selected to participate for this study. I understand that your time is valuable, while for the successful accomplishment of the study is rely on your honesty and kindness cooperation, genuine and loyal information response of this questionnaire. That have vital role being used as valuable input for the study. Therefore, I kindly request you to genuinely fill and return this questionnaire.

I assure you that your participation in this study is voluntary, all information you provide and results will be recorded anonymously, and confidentiality is maintained. It is for only academic purpose. At last, if you have face any problems in filling this questionnaire, you can reach and communicate me via the following addresses anytime.

Dear Interviewee,

This is Bezu Moges, who is a Master's student of Computer Science at **St. Mary's Universi**ty, in the department of Computer Science. Currently, am undertaking a research Project entitled **"Garage Management Information System for Addis Ababa Police Commission"**. Your organization is being selected as valuable and accredited sources of data to completing this study.

You are one of the accredited interviewee for this study. I understand that your time is valuable, while for the successful accomplishment of the study is rely on your genuine and loyal information of this Interview. Therefore, I kindly request you to genuinely cooperating me in spending some minutes with me for this interview.

I assure you that your participation in this study is voluntary and all information you provide and

results will be recorded anonymously, confidentiality is maintained and for only academic purpose

Semi-Structured Interview

1. What are the total numbers of employees in the garage?
2. How the Garage information system is currently managed in your organizations?
3. Is there any limitations regarding to available reporting formats?
4. Is there any problem regarding to data management in data collection, analysis and processes?
5. What do you know about Garage management system? Explain briefly.
6. Does your Garage have an organizational structure?
7. Does your Garage have a written or documented working processes profile?
8. Have your Garage ever identified the problems related to information management systems?
9. Do you have specified local suppliers for the spare parts to your garage?
10. In your opinion and in practice, in what ways does implementing the garage management system affects the existing service delivery (Efficiencies, effectiveness, service qualities and so forth)?

Annex -III-Observation Check lists

St. Mary's University

Faculty of Informatics

Department of computer Science

Dear Respondents,

This is BezuMoges, who is a Master's student of Computer Science at **St. Mary's Universi**ty, in the department of Computer Science. Currently, am undertaking a research

Project entitled **"Garage Management Information System for Addis Ababa Police Commission"**. Your organization is being selected as valuable and accredited sources of data to completing this study.

As one of my methods of data collection, I will take an observation using my observation check list guide lines.

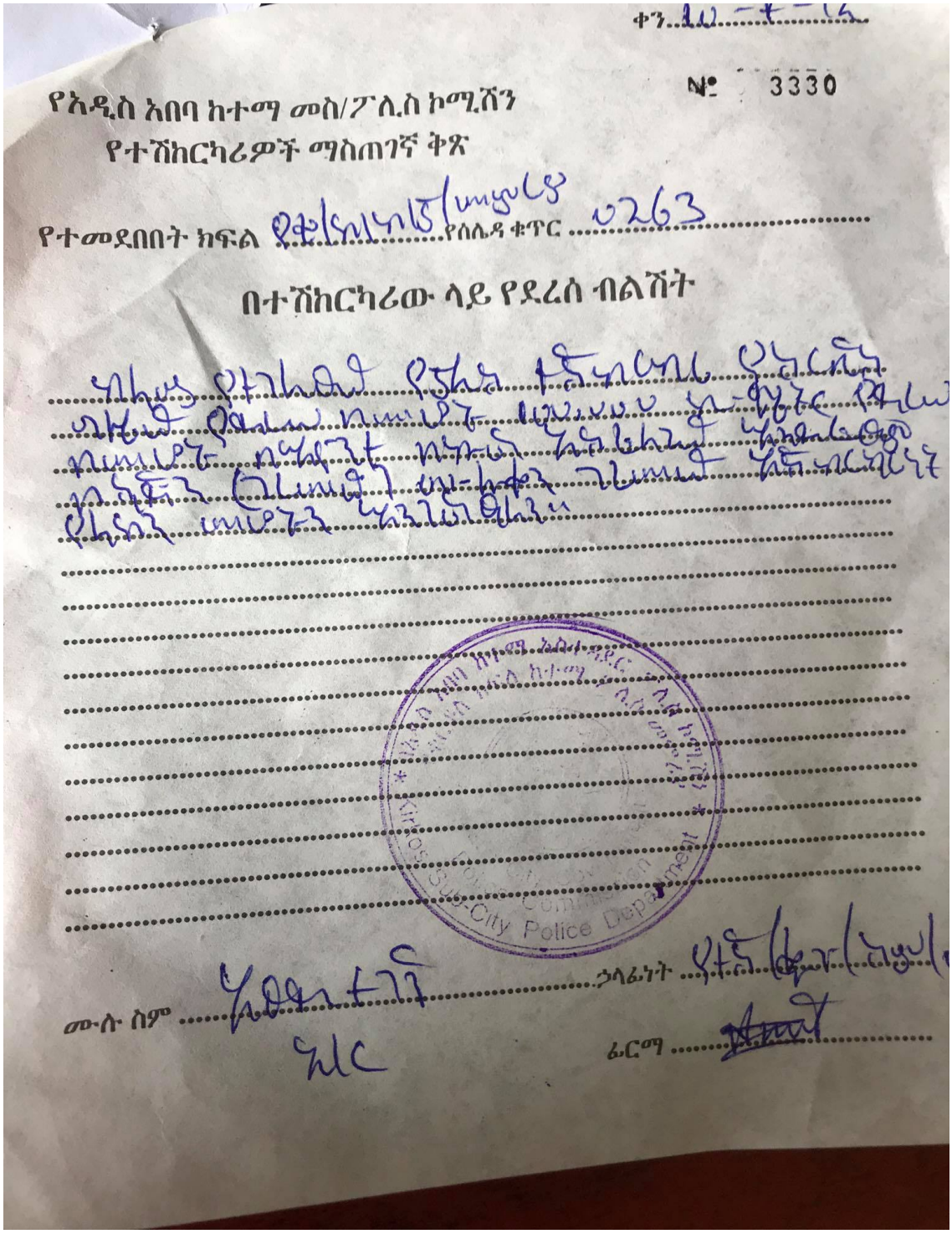
Thank you.

Observation Check-list of guide lines

1. Observation of the Police Garage's Organizational structure and work culture
2. Observation of the Police Garage's Human Resource Management (Educational background, availability, knowledge, skill, attitude, management, etc)
3. Observation of the Police Garage's ICT Materials & items (accessories, availability, quality, etc)
4. Observation of the Police Garage in supporting the technology section if available
5. Observation of the Police Garage's Technology (automation, information technology, etc)
6. Observation of the Police Garage's Physical environment or working condition
7. Observation of the Police Garage's Management (plans & schedules, instructions, ability to adjust staff size & duties, supervision etc)
8. Observation of the Police Garage's Capacity utilization to meet its plans & schedules due date.
9. Observation of the Police Garage's functionality and availability of any previous ICT systems
10. Observing the work processes activities of the whole processes of the Garage.

Annex –IVDifferent forms

1. Current Manual system asking vehicle service paper



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የተሽከርካሪዎች ማስጠገኛ ቅጽ

№ 3330

የተመደበበት ክፍል የቁ/አ/ሀ/ክ/ሠ/ሥ/ሊያ የሰሌዳ ቁጥር ሀ263

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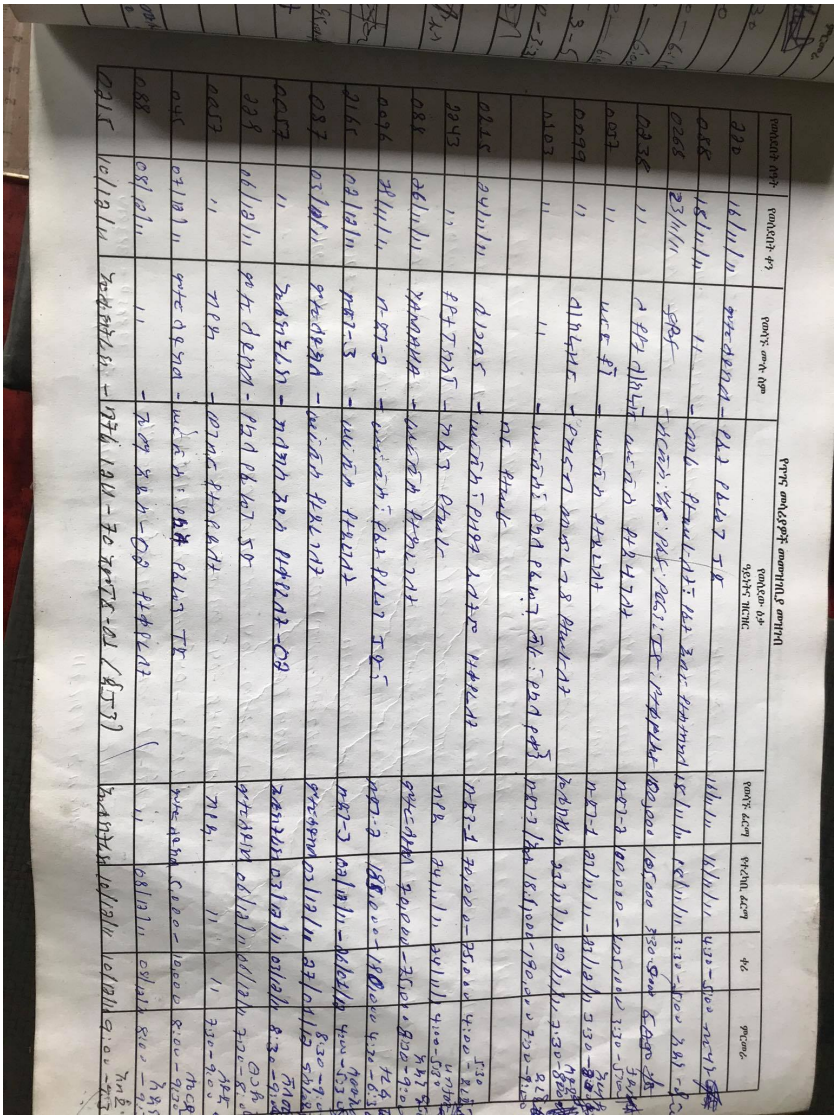
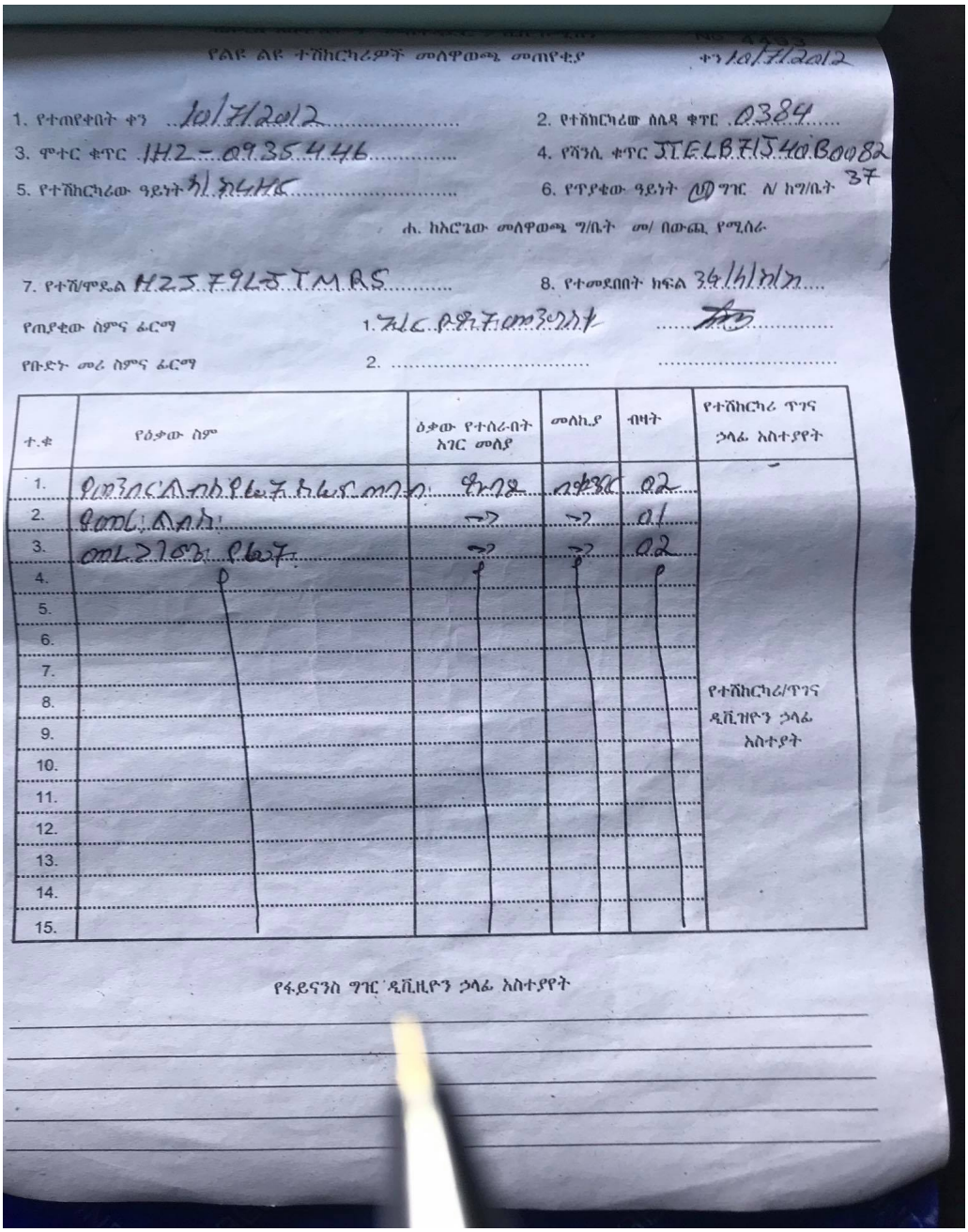
City Police Department

2. Current Manual system after maintenance the driver test and acceptance sheet



3. Current Manual system vehicle service accessory request



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1. የተጠየቀበት ቀን 10/7/2012
2. የተሽከርካሪው ሰሌዳ ቁጥር 0384
3. ሞተር ቁጥር 1H2-0935446
4. የሻንሲ ቁጥር JTELB71540B0082
5. የተሽከርካሪው ዓይነት ካ/ክሬዘር
6. የጥያቄው ዓይነት መ/ ግዥ ለ/ ኮንሰ/ቤት 37

ሐ. ከአሮጌው መለዋወጫ ግ/ቤት መ/ በውጪ የሚሰራ

7. የተሽ/ሞዴል H2J79L-TMRS
8. የተመደበበት ክፍል ጽ/ቤ/ክ/ን

የጠያቂው ስምና ፊርማ 1. ጫሬ ዶዳ ፕ/መንገስት

የቡድኑ መሪ ስምና ፊርማ 2. .....

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1.	የመንገርስ ተሰየሬ ክሬና መጋ	ቻይና	ለቁጥር	02	
2.	የመሪ ሰንሰለት	⁻⁻>	⁻⁻>	01	
3.	መሪ ጋንጫ የፊት	⁻⁻>	⁻⁻>	02	
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5.					
6.					
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8.					የተሽከርካሪ/ጥገና ዲቪዝዮን ኃላፊ አስተያየት
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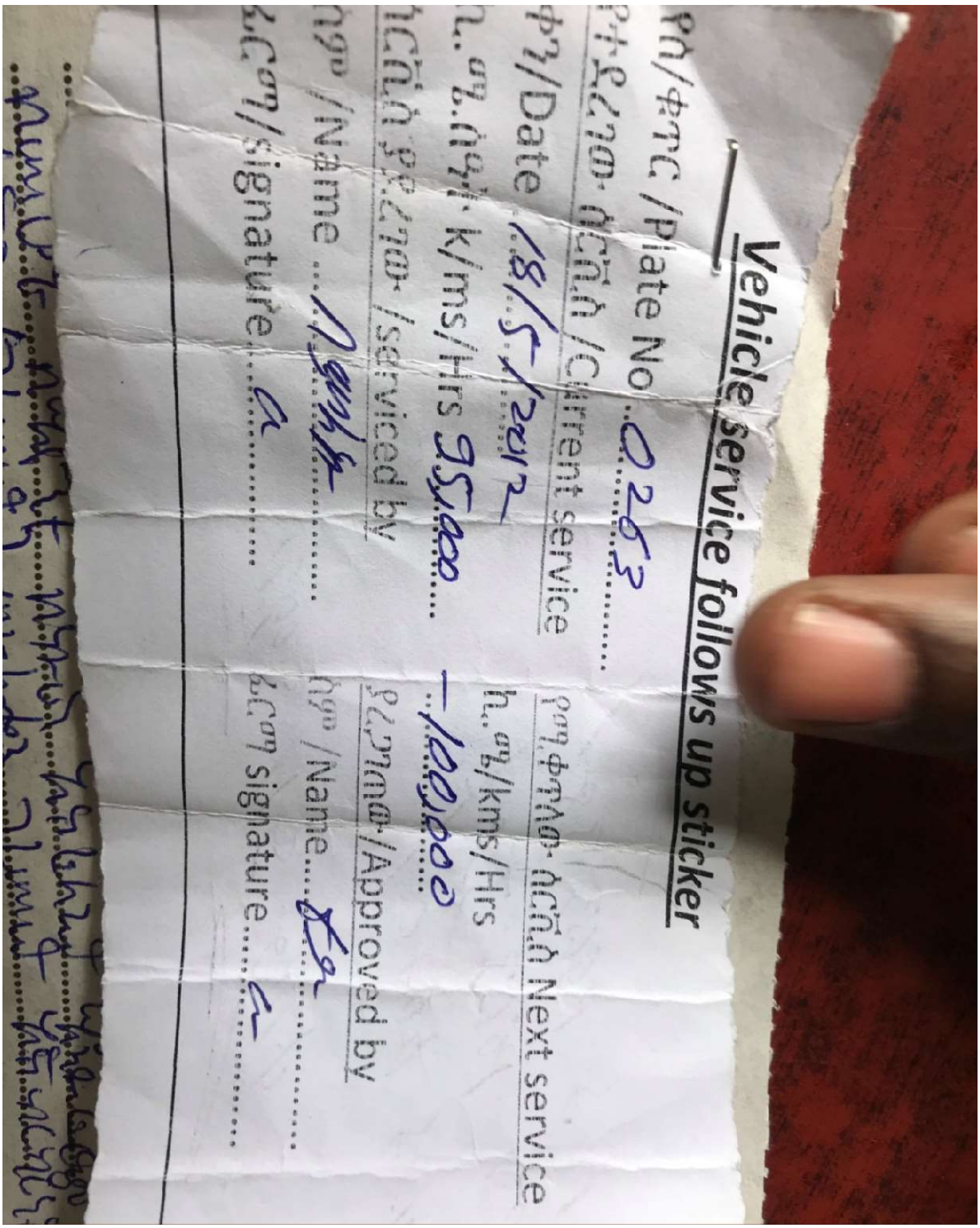
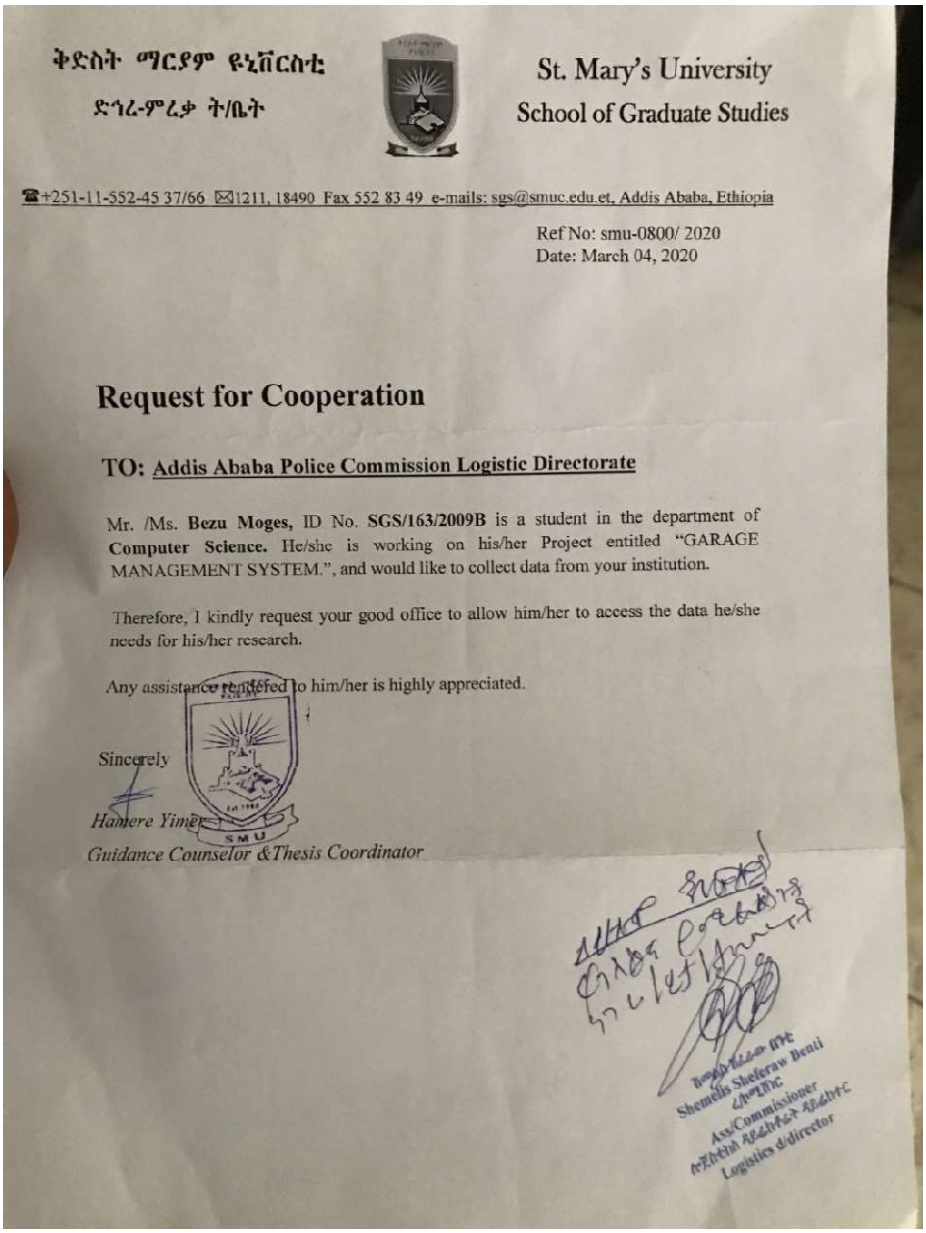
4. Current Manual system after mentenance pre order for next time serveceaccessorys



Annex –V

The existing garage system

Annex –VI Support Letters:



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ድኅረ-ምረቃ ት/ቤት

St. Mary's University
School of Graduate Studies

☎+251-11-552-45 37/66 ✉1211, 18490 Fax 552 83 49 e-mails: sgs@smuc.edu.et, Addis Ababa, Ethiopia

Ref No: smu-0800/ 2020
Date: March 04, 2020

Request for Cooperation

TO: Addis Ababa Police Commission Logistic Directorate

Mr. /Ms. **Bezu Moges,** ID No. **SGS/163/2009B** is a student in the department of **Computer Science.** He/she is working on his/her Project entitled "GARAGE MANAGEMENT SYSTEM.", and would like to collect data from your institution.

Therefore, I kindly request your good office to allow him/her to access the data he/she needs for his/her research.

Any assistance rendered to him/her is highly appreciated.

Sincerely

Hamere Yimer
Guidance Counselor &Thesis Coordinator

SMU

Shemelis Sheferaw Beali
Ass/Commissioner
Logistics d/director

ቅድስት ማርያም ዩኒቨርስቲ
ድኅረ-ምረቃ ት/ቤት

St. Mary's University
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☎+251-11-552-45 37/66 ✉1211, 18490 Fax 552 83 49 e-mails: sgs@smuc.edu.et, Addis Ababa, Ethiopia

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ዳዊት ተገኘ
ተገኘወርቅ ተገኘ
ጽ/ቤት: 9/7/2012.

ወንድሙ ደሳለኝ ደመቀ
WENDMU DESALEGN DEMEKE
ረ/ኮሚሽነር/Ass/Commissioner
የትራንስፖርትና ጥገና ም/ዳይሬክተር
Transport & Maintenance D/Director

ሽመልስ ሸፈራው በንቲ
Shemelis Shefferaw Benti
ረ/ኮሚሽነር
Ass/Commissioner
ሎጂስቲክስ ዳይሬክተር ጄኔራር
Logistics d/director