

VEHICLE SERVICE MANAGEMENT USING DJANGO

**A PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF**

MASTER OF COMPUTER APPLICATIONS

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DECLARATION

I hereby declare that this Project Report titled "**“VEHICLE SERVICE MANAGEMENT USING DJANGO”**" submitted by me to the Department of Computer science, **PRINCETON PG COLLEGE OF IT** is not submitted elsewhere.

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ABSTRACT

This project endeavored to design and develop a Web-based Automobile Service Management System for MAS Motors LLC, an accredited Toyota dealership in Libya. The system will help reduce the manual process from the everyday activities of the service division in all branches. The system is dedicated to be used by the following individuals: (1) Service Advisers, (2) Workshop Managers, (3) Storekeepers, (4) Technicians, (5) Customers, and (6) Upper Management. In addition, businesses cannot achieve their goals without having an efficient plan that direct their operation. The company's growth made the manual process ineffective and incompetent in handling the evolving business activities. The project aimed to provide a centralized system that will operate in all of the branches and accommodate the daily business needs. The software produced from the project was tested using Alpha and Beta software testing. The researcher also conducted an interview concerning the business process, current business difficulties, and features of the proposed system. Hewlett-Packard FURPS (Functionality, Usability, Reliability, Performance, and Supportability) model was used to assess the software quality, and questions were answered by a group of respondents. The system was found to be functional, meeting the requirements of the client. **Keywords**— Automobile Service Management, Information System, Toyota, Vehicle Maintenance

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1. INTRODUCTION

Today, the innovation of technology is fast, making people's lives become so much easier. New technology offers the ability for business organizations to manage their work adequately. It provides solutions to the increasing needs and demand to become more efficient. Accredited automobile dealerships are expected to provide quality services, and the management is always challenged to find solutions that are beneficial for both ends. Technology could offer to automobile dealerships solutions ranging from daily tasks management to more advanced business analysis tools that could optimize expenditures and raise profits. Workshops in the automobile industry are running systematically using job cards. Job cards are a detailed description of work that is performed for a client, that includes customer, vehicle, and work details. Productive automobile dealerships or workshops cannot effectively accomplish the daily business activities without the use of job cards.

The key roles of a job card include organizing the tasks of the employees, storing the details of the client and the work done including the spare parts used. In addition, the job card helps coordinate the duties of service advisors, 978-1-5386-7767-4/18/\$31.00 ©2018 IEEE A management system is used by organizations to manage the inter-related parts of its business in order to achieve its objectives. These objectives can relate to a number of different aspects, including product or service quality, operational efficiency, environmental performance, health and safety in the workplace, and many more [1]. Almost all business organizations grow and develop each year, month, week, or day. The evolution of information technology had changed the rules so that people today search and collect information from almost anywhere. Market competition and the rapid development of technology made organizations invest in utilizing information technology to store and analyze data aiming to efficiently increase their competitive advantage.

Automobile Service Management Information System (ASMIS) also known as Automobile Service Management System is a software solution that supports achieve automobile dealership duties and business rules electronically to reduce the manual tasks and process time, to enable easy and accurate access of data, and to provide decision support reports for the management.

1.1 SYSTEM STUDY

1.1.1 FEASIBILITY STUDY

The feasibility of the project is analyzed in this phase and business proposal is put forth with a very general plan for the project and some cost estimates. During system analysis the feasibility study of the proposed system is to be carried out. This is to ensure that the proposed system is not a burden to the company. For feasibility analysis, some understanding of the major requirements for the system is essential.

Three key considerations involved in the feasibility analysis are :

- ECONOMICAL FEASIBILITY
 - TECHNICAL FEASIBILITY
 - SOCIAL FEASIBILITY
-
- **ECONOMICAL FEASIBILITY:**

This study is carried out to check the economic impact that the system will have on the organization. The amount of fund that the company can pour into the research and development of the system is limited. The expenditures must be justified. Thus the developed system as well within the budget and this was achieved because most of the technologies used are freely available. Only the customized products had to be purchased.

- **TECHNICAL FEASIBILITY**

This study is carried out to check the technical feasibility, that is, the technical requirements of the system. Any system developed must not have a high demand on the available technical resources. This will lead to high demands on the available technical resources. This will lead to high demands being placed on the client. The developed system must have a modest requirement, as only minimal or null changes are required for implementing this system.

- **SOCIAL FEASIBILITY**

The aspect of study is to check the level of acceptance of the system by the user. This includes the process of training the user to use the system efficiently. The user must not feel threatened by the system, instead must accept it as a necessity. The level of acceptance by the users solely depends on the methods that are employed to educate the user about the system and to make him familiar with it. His level of confidence must be raised so that he is also able to make some constructive criticism, which is welcomed, as he is the final user of the system.

2. LITERATURE SURVEY

1) Web-Based Automobile Service Management System For Mas Motors

Author: Abdelsalam Shahlol , Abigail Alix, Ace Lagman

Year: 2024

This project endeavored to design and develop a Web-based Automobile Service Management System for MAS Motors LLC, an accredited Toyota dealership in Libya. The system will help reduce the manual process from the everyday activities of the service division in all branches. The system is dedicated to be used by the following individuals: (1) Service Advisers, (2) Workshop Managers, (3) Storekeepers, (4) Technicians, (5) Customers, and (6) Upper Management.

The company's growth made the manual process ineffective and incompetent in handling the evolving business activities. The project aimed to provide a centralized system that will operate in all of the branches and accommodate the daily business needs.

The software produced from the project was tested using Alpha and Beta software testing. The researcher also conducted an interview concerning the business process, current business difficulties, and features of the proposed system. Hewlett-Packard FURPS (Functionality, Usability, Reliability, Performance, and Supportability) model was used to assess the software quality, and questions were answered by a group of respondents. The system was found to be functional, meeting the requirements of the client.

2) Vehicle Service Management System

Authors: Arpit Singh, Ghanshyam Shukla, Shiv Singh, Shubham Shukla

Year: 2023

This project focuses on the design, development, and implementation of a Vehicle Service Management System (VSMS) using the Django framework. The system aims to streamline vehicle service appointments, maintenance tracking, inventory management, and customer interactions in automotive centers. The researchers emphasize automation over manual scheduling and record-keeping, which are prone to inefficiencies. The project objectives include enhancing operational efficiency, improving customer experience, and ensuring safety through regular maintenance. The methodology covers requirement analysis, system design, development, rigorous testing, deployment, and user training. Technologies used include Python, Django, MySQL, Bootstrap, RESTful APIs, Docker, and Kubernetes. The system was concluded to be effective in optimizing service operations, reducing errors, and improving customer satisfaction.

3) System for Managing Vehicle Services

Authors: Rayapati Hari Chandra Prasad, Mrs. J. Mounika, Sangala Gopi

Year: 2023

This capstone project proposes a Django-based system to automate vehicle service operations for garages. The study notes that most vehicle repair shops still rely on manual processes like customer record-keeping, billing, and service updates, leading to inefficiencies. The proposed system digitally manages repair orders, maintenance logs, transactions, and billing. Modules include Admin (manages mechanics, users, service fees, and approvals), Customer (raises service requests, tracks progress, views invoices), and Mechanic (updates repair status, views tasks, salary, and attendance). The researchers stress that this automation improves efficiency, reduces manual errors, and enhances customer satisfaction. The conclusion highlights that the system will help garages expand, modernize, and provide smoother customer experiences.

4) Vehicle Service Management System

Authors: Ashray Shetty, Bhavya Sheth, Pratham Solanki, Smith Shah, Mr. Sanjay Pandey

Year: 2022

This project, published in **IJCRT**, addresses the automation of manual tasks in automobile service centers. The researchers observed that most service centers still rely on manual handling of customer records, repairs, and billing. The proposed system provides a **web portal** for Admins, Customers, and Mechanics. Admins can handle operations like managing customers, assigning mechanics, tracking services, and managing billing. Customers can create service requests, view live service updates, and download invoices. Mechanics can log in, update service status, and track assigned work. The system was developed to improve operational efficiency, provide transparency, and enhance customer satisfaction. Future enhancements include integrating online payments and developing a mobile app version.

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3. SYSTEM ANALYSIS

3.1 EXISTING SYSTEM:

The current system faces several critical challenges that hinder its efficiency and effectiveness. One of the primary disadvantages is its dependence on outdated and rigid infrastructure, making it difficult to adapt to evolving technological demands. This results in slow processing times and delays in responding to urgent needs, particularly in cybersecurity incidents. Additionally, the existing system lacks proper integration with modern tools, creating data silos and fragmentation, which in turn obstructs a seamless flow of information. This fragmentation also leads to inefficiencies in identifying and addressing potential threats, as there is no unified platform to manage them effectively. Furthermore, the system requires significant manual intervention, making it prone to human errors, inefficiencies, and inaccuracies in handling sensitive data. Lastly, due to its inability to scale, it struggles to accommodate increased user demand, which can cause system crashes or slow performance during peak times, limiting overall productivity.

3.1.1 DISADVANTAGES OF EXISTING SYSTEM:

1. **Outdated infrastructure** leading to slow processing and limited flexibility.
2. **Lack of integration** with modern tools, resulting in data fragmentation and inefficiencies.
3. **Manual processes** prone to human error and inefficiency.
4. **Inability to scale** with increasing demand, leading to system crashes or slowdowns
5. **Poor threat detection and response** due to the absence of a unified management platform.

3.2 PROPOSED SYSTEM:

The proposed system offers a solution to the numerous drawbacks of the existing infrastructure by incorporating advanced technologies that enhance speed, accuracy, and scalability. One of the significant advantages is its automation capabilities, which drastically reduce the need for manual intervention, leading to fewer errors and greater efficiency. The system is designed with seamless integration in mind, allowing it to work effectively with modern cybersecurity tools, enabling real-time data sharing, and improving overall decision-making processes. Another crucial benefit is its scalability, which ensures that the system can grow and adapt as user demands increase, without compromising performance. The enhanced data management and threat detection features of the new system allow for faster and more accurate responses to potential security

risks. Moreover, its user-friendly interface ensures that both technical and non-technical users can easily navigate and operate the system, boosting overall productivity and reducing the learning curve.

3.2.1 ADVANTAGES OF PROPOSED SYSTEM:

1. **Automation** reduces human error and boosts efficiency.
2. **Seamless integration** with modern tools enhances data sharing and decision-making.
3. **Scalability** allows for growth without performance issues.
4. **Improved threat detection** enables faster and more accurate responses.
5. **User-friendly interface** simplifies operation, reducing the learning curve.

This comparison highlights the significant improvements the proposed system brings, addressing the limitations of the existing system while enhancing overall performance and security.

3.3 HARDWARE AND SOFTWARE REQUIREMENTS

3.2.2 REQUIREMENT ANALYSIS

The project involved analyzing the design of few applications so as to make the application more user friendly. To do so, it was really important to keep the navigations from one screen to the other well ordered and at the same time reducing the amount of typing the user needs to do. In order to make the application more accessible, the browser version had to be chosen so that it is compatible with most of the Browsers.

3.2.3 REQUIREMENT SPECIFICATION

Functional Requirements

- ❖ Graphical User interface with the User.

Software Requirements

For developing the application the following are the Software Requirements:

1. Python
2. Django

Operating Systems supported

1. Windows 10 64 bit OS

Technologies and Languages used to Develop

1. Python

Debugger and Emulator

- Any Browser (Particularly Chrome)

Hardware Requirements

For developing the application the following are the Hardware Requirements:

- Processor: Intel i9
- RAM: 32 GB
- Space on Hard Disk: minimum 1 TB

3.3 SYSTEM SPECIFICATION:

3.3.1 HARDWARE REQUIREMENTS:

- ❖ **System** : Intel i7
- ❖ **Hard Disk** : 1 TB.
- ❖ **Monitor** : 14' Colour Monitor.
- ❖ **Mouse** : Optical Mouse.
- ❖ **Ram** : 8GB.

3.3.2 SOFTWARE REQUIREMENTS:

- ❖ **Operating system** : Windows 10.
- ❖ **Coding Language** : Python.
- ❖ **Front-End** : Html. CSS
- ❖ **Designing** : Html ,css, javascript.
- ❖ **Data Base** : SQLite.

3.4 MODULES:

- User module
- Admin Module
- Web-Based Module

3.3.3 MODULES DESCRIPTION:

- **User Module**

The **User Module** focuses on customer interactions, enabling customers to book service appointments online, view their vehicle's service history, and receive automated notifications such as reminders for upcoming services. This module also offers features to generate service estimates and ensures a smooth follow-up process, including SMS notifications based on the customer's last service visit.

- Enables customers to book service appointments, view service history, and receive notifications.
- Provides service estimates and tracks vehicle maintenance.
- Includes SMS notifications for service reminders and follow-up reminders based on the last service.

- **Admin Module**

The Admin Module serves as the control center for managing user roles and access, specifically for workshop managers, service advisers, storekeepers, and technicians. This module allows administrators to manage configurations, monitor system usage, and track productivity metrics. Through detailed reports, the admin module supports management in tracking service history, assessing technician productivity, and performing forecasting to anticipate future service needs, ultimately aiding in decision-making and efficiency.

- Manages user access, including workshop managers, service advisers, storekeepers, and technicians.
- Controls system configuration and maintenance.
- Includes productivity tracking and analysis for technicians, as well as generating reports on service history and forecasting.

- **Web-Based Module**

the **Web-Based Module** connects all functions through a centralized, accessible platform, which provides real-time updates on inventory, job card management, and technician scheduling. Developed with PHP, Laravel, and JavaScript, the web-based interface ensures a responsive and user-friendly experience across devices. Each user role interacts with tailored features, from customer portals to administrative controls, all aimed at reducing manual tasks and ensuring seamless coordination across multiple branches. Together, these modules enhance MAS Motors LLC's ability to manage daily operations and improve service delivery efficiently.

- Centralized access for real-time updates on inventory, job card management, and scheduling.
- Web-based interface accessible by various users, with functionalities adapted to their roles (e.g., customers, technicians, managers).
- Utilizes PHP, Laravel, and JavaScript for dynamic, user-friendly interaction across devices.

4. DOMAIN DESCRIPTION

4.1 Introduction to Web Development

Web development is one of the most dynamic and rapidly evolving domains within the field of computer science and information technology. With the exponential rise in internet usage, the demand for websites and web applications has grown immensely, making web development a critical area of expertise in today's digital age.

At its core, web development refers to the process of building, creating, and maintaining websites or web applications that are accessible via the internet or a private intranet. These websites can range from simple static pages to complex web-based applications, social networking services, or e-commerce platforms.

The significance of web development lies in its ability to bridge the gap between users and digital services. It plays a central role in communication, information dissemination, e-commerce, education, and entertainment. A well-developed website ensures a smooth user experience, high performance, accessibility, and security, making it a vital tool for businesses and organizations in every sector.

Web development is typically divided into three main categories:

- **Front-End Development:** This involves everything that users visually interact with in their web browser—design, layout, and interactivity. Technologies include HTML, CSS, JavaScript, and libraries/frameworks like React, Vue.js, and Angular.
- **Back-End Development:** This focuses on server-side logic, databases, and application functionality. It includes programming languages and frameworks like Python (Django/Flask), PHP, Ruby on Rails, Java, and Node.js.
- **Full-Stack Development:** This combines both front-end and back-end responsibilities. Full-stack developers have knowledge of all layers of the development stack and can build entire applications independently.

Web development also involves related disciplines like database management, version control systems, API integration, security protocols (e.g., HTTPS, OAuth), and performance optimization.

As new technologies like Artificial Intelligence (AI), Progressive Web Apps (PWAs), and WebAssembly gain popularity, the domain of web development continues to evolve. Developers today must not only build efficient, scalable web applications but also ensure accessibility, responsiveness, and cross-platform compatibility.

4.2 What is Web Development?

Web development is the process of designing, developing, and deploying web-based software solutions. It encapsulates a broad spectrum of activities, including writing markup and code, setting up databases, configuring servers, and ensuring that web applications meet both technical and user requirements.

At a fundamental level, web development can be broken down into several components:

4.2.1 HTML (HyperText Markup Language)

HTML is the standard markup language used to create the structure of web pages. It defines the placement of text, images, links, tables, forms, and other content.

4.2.2 CSS (Cascading Style Sheets)

CSS handles the design and layout of web pages. It allows developers to control the look and feel of a site, including colors, fonts, spacing, and responsiveness across different screen sizes.

4.2.3 JavaScript

JavaScript is the scripting language used to add interactivity to web pages. It powers dynamic content updates, animations, form validation, and interactive UI components. JavaScript has become even more powerful with frameworks like React, Vue.js, and Angular.

4.2.4 Server-Side Programming

Server-side development involves building the logic that runs on web servers. This includes processing user requests, managing databases, authenticating users, and handling business logic. Common server-side languages include PHP, Python, Ruby, and JavaScript (Node.js).

4.2.5 Databases

Web applications often rely on databases to store and retrieve information. Common database systems include MySQL, PostgreSQL, MongoDB, and SQLite. Developers use Structured Query Language (SQL) to communicate with relational databases.

4.2.6 Web Servers and Hosting

A web server is software that handles incoming requests from users' browsers and delivers the appropriate content. Apache, Nginx, and Microsoft IIS are popular web servers. Hosting platforms such as AWS, Heroku, Vercel, and Netlify allow developers to deploy their applications online.

4.2.7 Version Control Systems

Version control tools like Git and platforms like GitHub or GitLab help developers track changes, collaborate with teams, and manage project versions efficiently.

4.3 Web Development Tools

Modern development often involves the use of development tools such as:

- **Code editors:** VS Code, Sublime Text
- **Package managers:** npm, Yarn
- **Build tools:** Webpack, Babel
- **Testing frameworks:** Jest, Mocha, Selenium

4.4 Frameworks and Libraries

Frameworks provide ready-to-use modules and libraries that simplify the development process. They offer pre-defined structures and reusable components, promoting code reusability and efficiency.

- **Front-end frameworks/libraries:** React, Angular, Vue.js
- **Back-end frameworks:** Django, Flask, Laravel, Express.js

5. SYSTEM DESIGN

5.1 DATA FLOW DIAGRAM:

The DFD is also called as bubble chart. It is a simple graphical formalism that can be used to represent a system in terms of input data to the system, various processing carried out on this data, and the output data is generated by this system.

The data flow diagram (DFD) is one of the most important modeling tools. It is used to model the system components. These components are the system process, the data used by the process, an external entity that interacts with the system and the information flows in the system.

DFD shows how the information moves through the system and how it is modified by a series of transformations. It is a graphical technique that depicts information flow and the transformations that are applied as data moves from input to output.

DFD is also known as bubble chart. A DFD may be used to represent a system at any level of abstraction. DFD may be partitioned into levels that represent increasing information flow and functional detail.

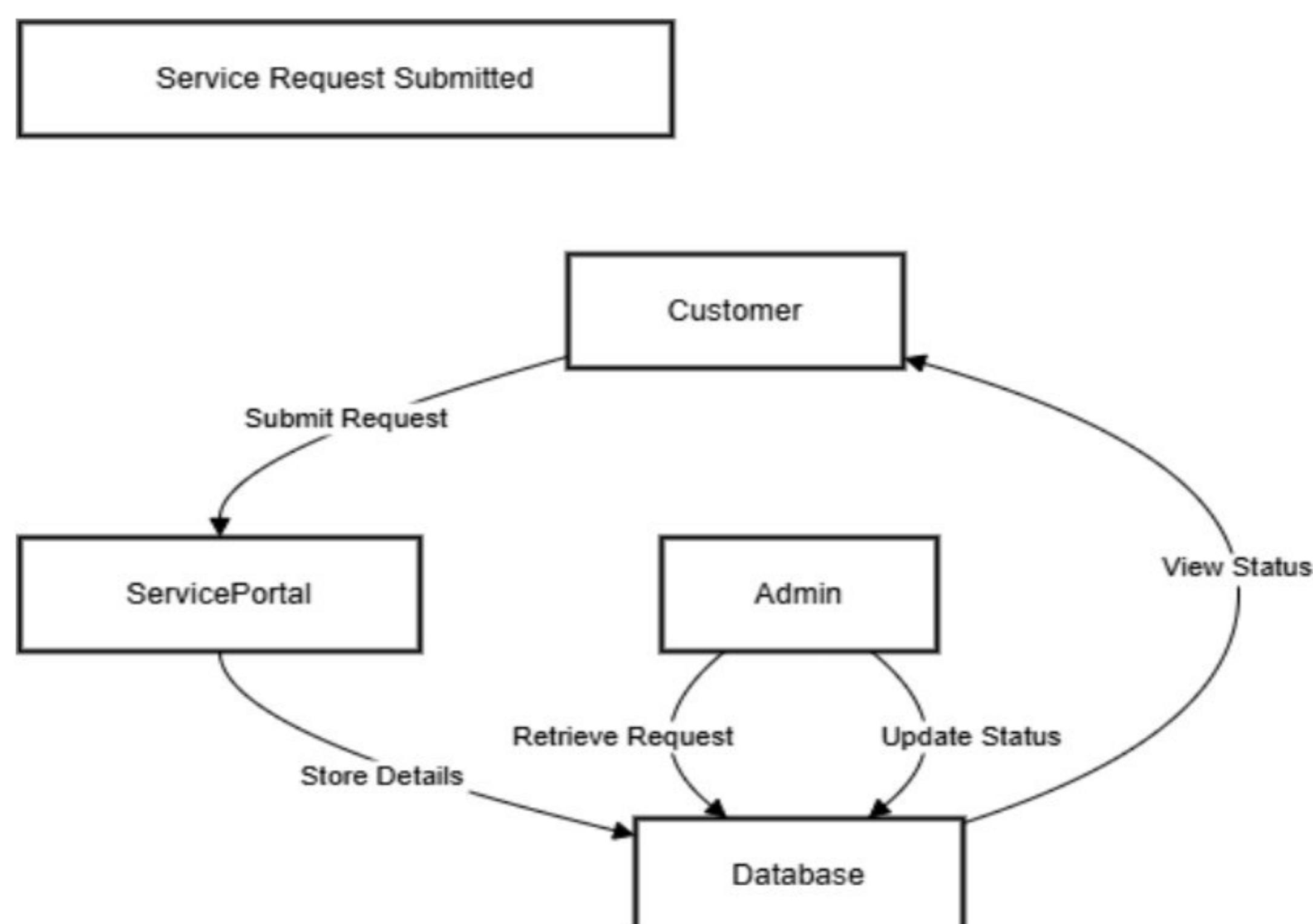


Fig - 5.1 Data Flow Diagram

5.2 UML DIAGRAMS

UML stands for Unified Modeling Language. UML is a standardized general-purpose modeling language in the field of object-oriented software engineering. The standard is managed, and was created by, the Object Management Group.

The goal is for UML to become a common language for creating models of object oriented computer software. In its current form UML is comprised of two major components: a Meta-model and a notation. In the future, some form of method or process may also be added to; or associated with, UML.

The Unified Modeling Language is a standard language for specifying, Visualization, Constructing and documenting the artifacts of software system, as well as for business modeling and other non-software systems.

The UML represents a collection of best engineering practices that have proven successful in the modeling of large and complex systems.

The UML is a very important part of developing objects oriented software and the software development process. The UML uses mostly graphical notations to express the design of software projects.

GOALS:

The Primary goals in the design of the UML are as follows:

1. Provide users a ready-to-use, expressive visual modeling Language so that they can develop and exchange meaningful models.
2. Provide extendibility and specialization mechanisms to extend the core concepts.
3. Be independent of particular programming languages and development process.
4. Provide a formal basis for understanding the modeling language.
5. Encourage the growth of OO tools market.
6. Support higher level development concepts such as collaborations, frameworks, patterns and components.
7. Integrate best practices.

5.2.1 USE CASE DIAGRAM:

A use case diagram in the Unified Modeling Language (UML) is a type of behavioral diagram defined by and created from a Use-case analysis. Its purpose is to present a graphical overview of the functionality provided by a system in terms of actors, their goals (represented as use cases), and any dependencies between those use cases. The main purpose of a use case diagram is to show what system functions are performed for which actor. Roles of the actors in the system can be depicted.

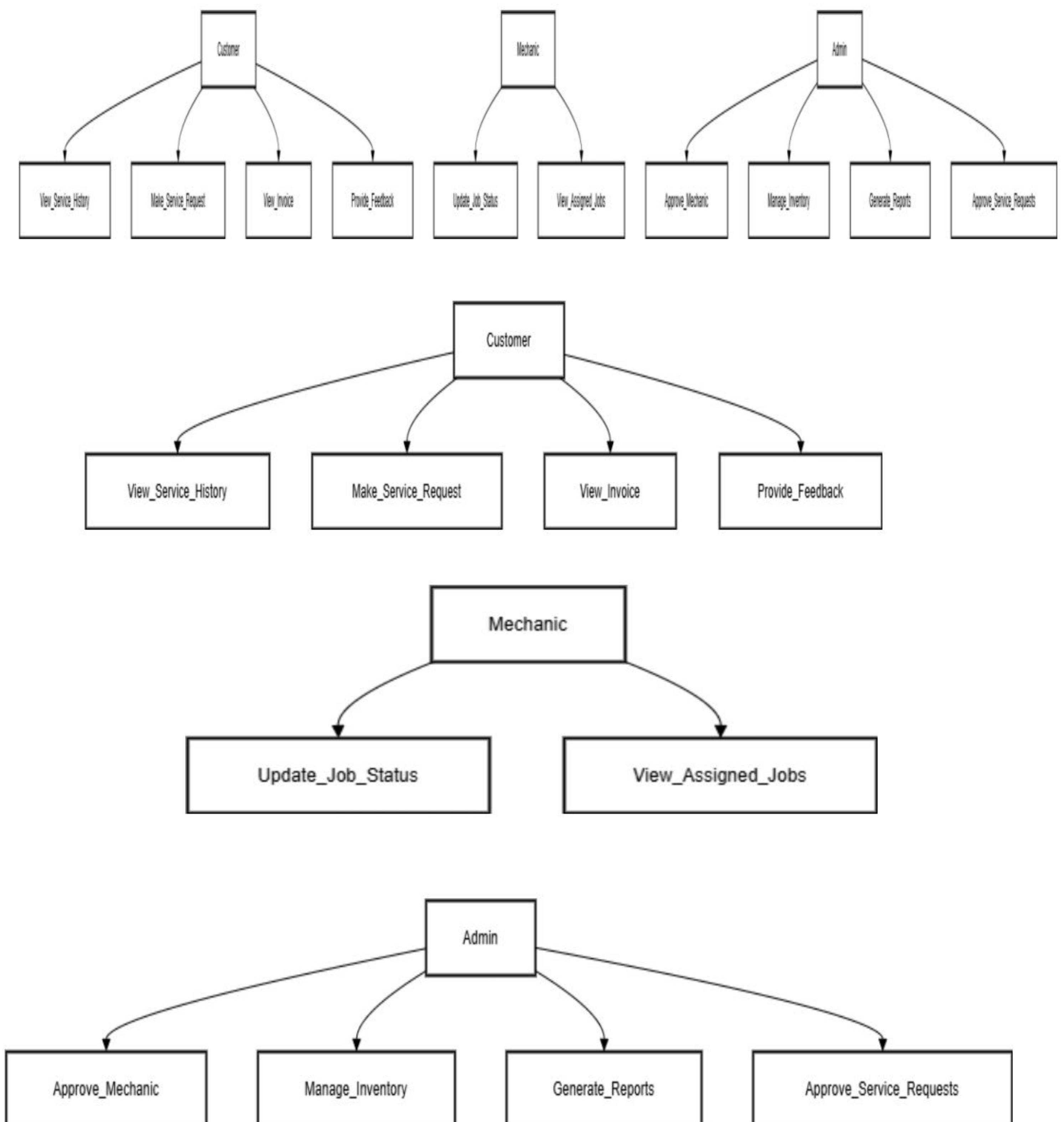


Fig - 5.2.1 Use Case Diagram

5.2.2 CLASS DIAGRAM:

In software engineering, a class diagram in the Unified Modeling Language (UML) is a type of static structure diagram that describes the structure of a system by showing the system's classes, their attributes, operations (or methods), and the relationships among the classes. It explains which class contains information.

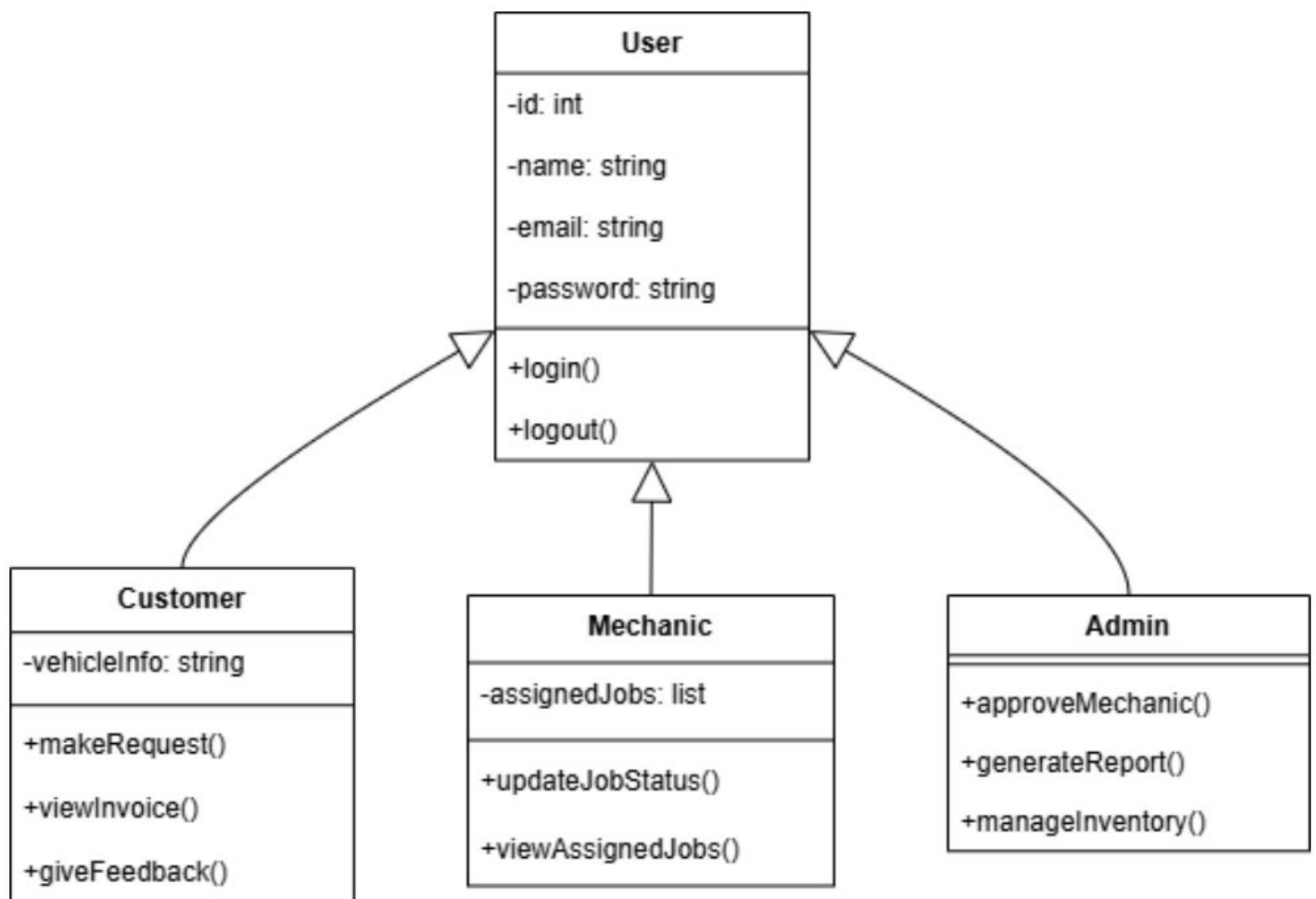


Fig - 5.2.2 Class Diagram

5.2.3 SEQUENCE DIAGRAM:

A sequence diagram in Unified Modeling Language (UML) is a kind of interaction diagram that shows how processes operate with one another and in what order. It is a construct of a Message Sequence Chart. Sequence diagrams are sometimes called event diagrams, event scenarios, and timing diagrams.

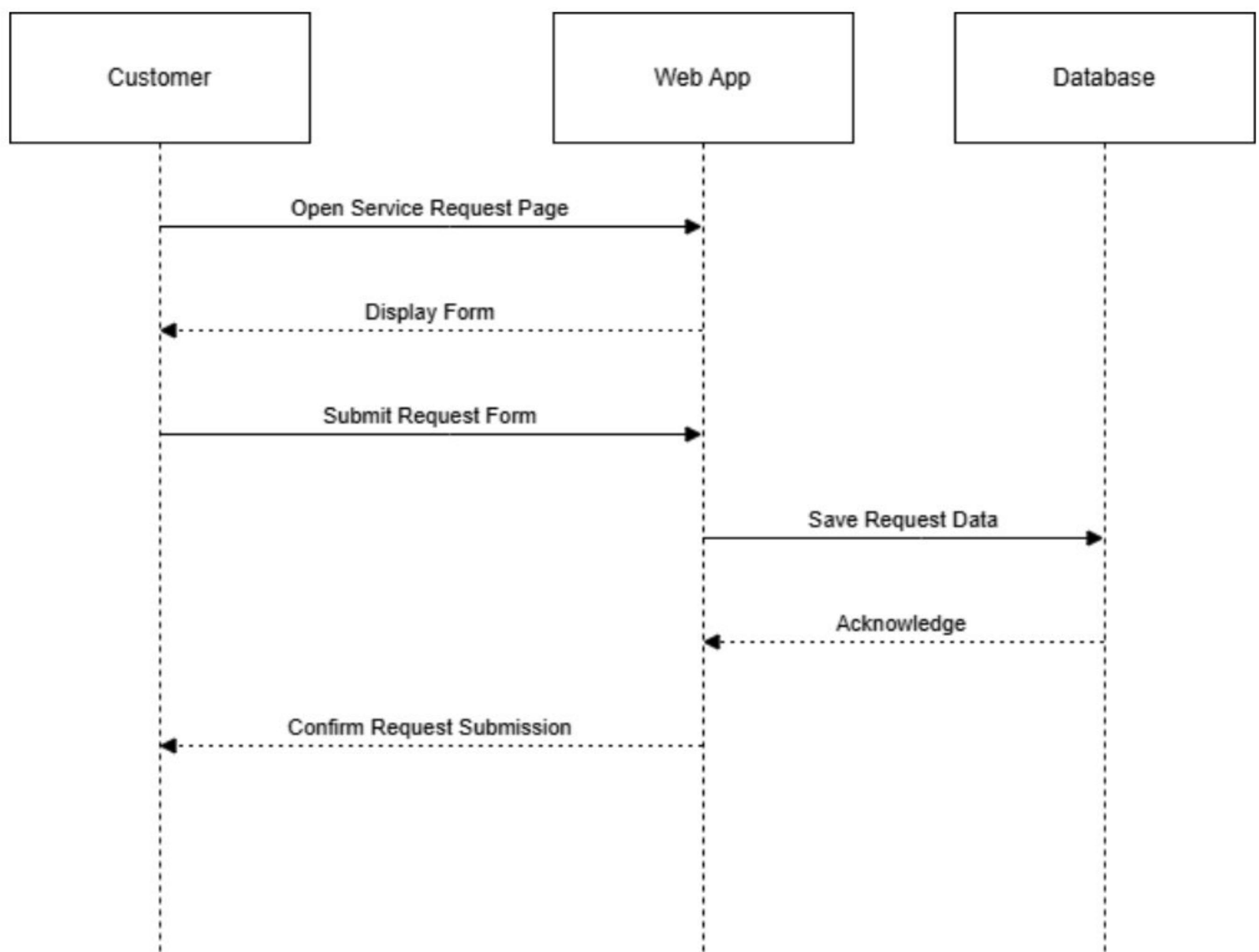


Fig - 5.2.3 Sequence Diagram

5.2.4 ACTIVITY DIAGRAM:

Activity diagrams are graphical representations of workflows of stepwise activities and actions with support for choice, iteration and concurrency. In the Unified Modeling Language, activity diagrams can be used to describe the business and operational step-by-step workflows of components in a system. An activity diagram shows the overall flow of control.

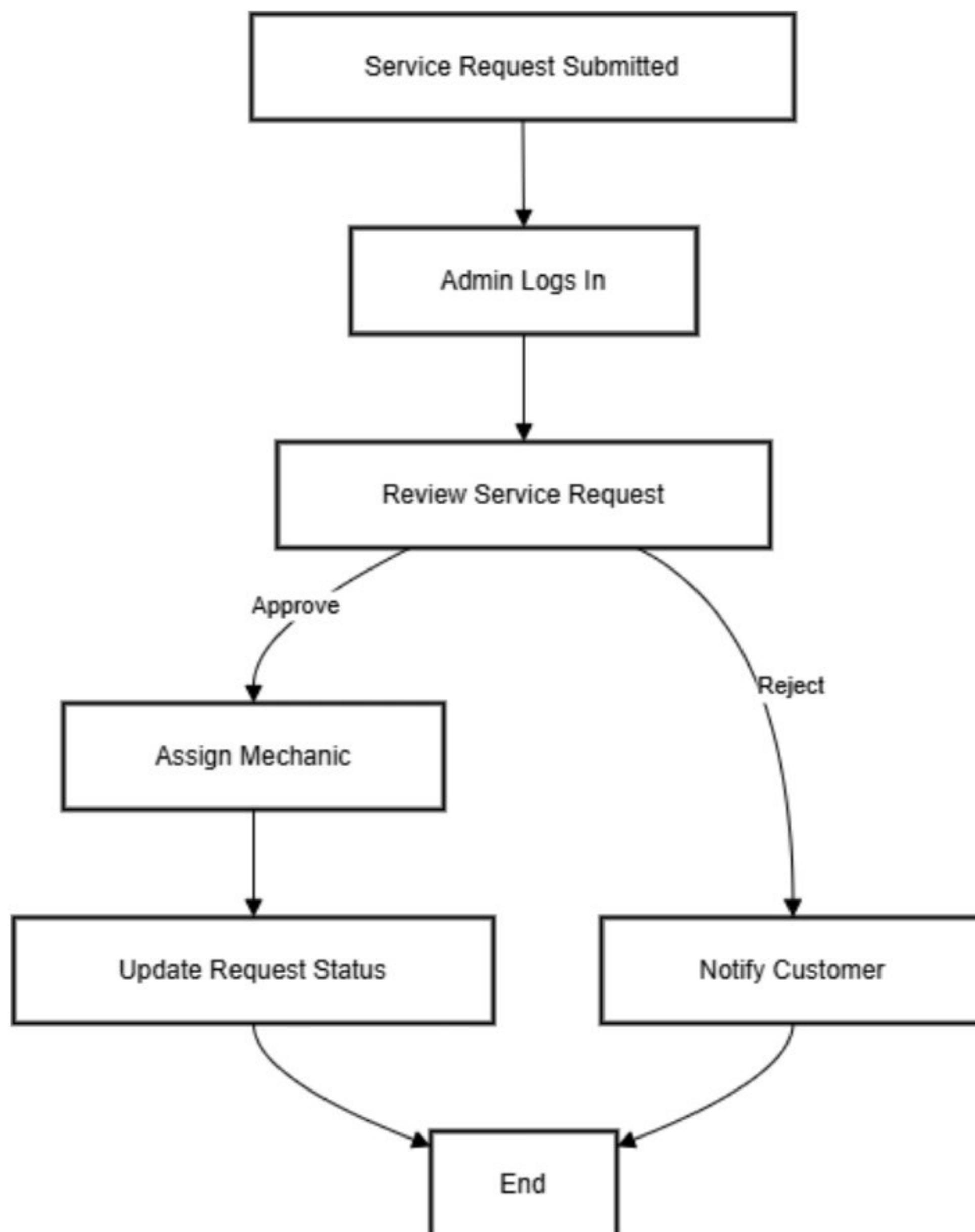


Fig - 5.2.4 Activity Diagram

6.SYSTEM IMPLEMENTATION

6.1 PYTHON

Python is a general-purpose interpreted, interactive, object-oriented, and high-level programming language. An [interpreted language](#), Python has a design philosophy that emphasizes code [readability](#) (notably using [whitespace](#) indentation to delimit [code blocks](#) rather than curly brackets or keywords), and a syntax that allows programmers to express concepts in fewer [lines of code](#) than might be used in languages such as [C++](#) or [Java](#). It provides constructs that enable clear programming on both small and large scales. Python interpreters are available for many [operating systems](#). [CPython](#), the [reference implementation](#) of Python, is [open source](#) software and has a community-based development model, as do nearly all of its variant implementations. CPython is managed by the non-profit [Python Software Foundation](#). Python features a [dynamic type](#) system and automatic [memory management](#). It supports multiple [programming paradigms](#), including [object-oriented](#), [imperative](#), [functional](#) and [procedural](#), and has a large and comprehensive [standard library](#).

6.2 Interactive Mode Programming

Invoking the interpreter without passing a script file as a parameter brings up the following prompt –

```
$ python  
Python 2.4.3 (#1, Nov 11 2010, 13:34:43)  
[GCC 4.1.2 20080704 (Red Hat 4.1.2-48)] on linux2
```

Type "help", "copyright", "credits" or "license" for more information.

```
>>>
```

Type the following text at the Python prompt and press the Enter –

```
>>> print "Hello, Python!"
```

If you are running new version of Python, then you would need to use print statement with parenthesis as in `print ("Hello, Python!");`. However in Python version 2.4.3, this produces the following result –
Hello, Python!

6.3 Script Mode Programming

Invoking the interpreter with a script parameter begins execution of the script and continues until the script is finished. When the script is finished, the interpreter is no longer active.

Let us write a simple Python program in a script. Python files have extension .py. Type the following source code in a test.py file – Live

```
Demo print "Hello, Python!"
```

We assume that you have Python interpreter set in PATH variable. Now, try to run this program as follows

```
$ python test.py
```

This produces the following result – Hello, Python!

Let us try another way to execute a Python script. Here is the modified test.py file –

Live

```
Dem
```

```
o
```

```
#!/usr/bin/python
```

```
print
```

```
    "Hell
```

```
o, Python!"
```

We assume that you have Python interpreter available in /usr/bin directory. Now, try to run this program as follows –

```
$ chmod +x test.py    # This is to make file executable
```

```
$./test.py
```

This produces the following result –

```
Hello, Python!
```

6.4 Python Identifiers

A Python identifier is a name used to identify a variable, function, class, module or other object. An identifier starts with a letter A to Z or a to z or an underscore (_) followed by zero or more letters, underscores and digits (0 to 9).

Python does not allow punctuation characters such as @, \$, and % within identifiers. Python is a case sensitive programming language. Thus, Manpower and manpower are two different identifiers in Python. Here are naming conventions for Python identifiers –

Class names start with an uppercase letter. All other identifiers start with a lowercase letter. Starting an identifier with a single leading underscore indicates that the identifier is private. Starting an identifier with two leading underscores indicates a strongly private identifier.

If the identifier also ends with two trailing underscores, the identifier is a language-defined special name.

6.5 Django

Django is a high-level Python Web framework that encourages rapid development and clean, pragmatic design. Built by experienced developers, it takes care of much of the hassle of Web development, so you can focus on writing your app without needing to reinvent the wheel. It's free and open source. Django's primary goal is to ease the creation of complex, database-driven websites.

Django emphasizes reusability and "pluggability" of components, rapid development, and the principle of don't repeat yourself. Python is used throughout, even for settings files and data models.

6.5.1 Features of Django:

1. **Full-Featured Framework:** Django comes with a wide range of built-in features like authentication, admin interface, and ORM, reducing the need for third-party tools.
2. **MTV Architecture:** It follows the Model-Template-View pattern, promoting clear separation between business logic, presentation, and data handling.
3. **Admin Interface:** Automatically generates a powerful admin dashboard for managing models and application data.
4. **ORM Integration:** Includes a built-in Object-Relational Mapper to interact with databases using Python code instead of raw SQL.
5. **Security:** Provides built-in protection against common web attacks such as CSRF, XSS, and SQL injection.
6. **Scalability:** Designed to handle large-scale applications efficiently through modular and reusable components.
7. **URL Routing:** Uses clean and readable URL patterns that are easy to manage and customize.
8. **Templating System:** Integrates a robust templating engine to generate dynamic HTML content efficiently.
9. **Middleware Support:** Offers middleware layers to process requests/responses globally for logging, authentication, and more.
10. **Comprehensive Documentation:** Comes with detailed and well-maintained documentation, ideal for developers at all levels.

6.5.2 Django Implementation diagram

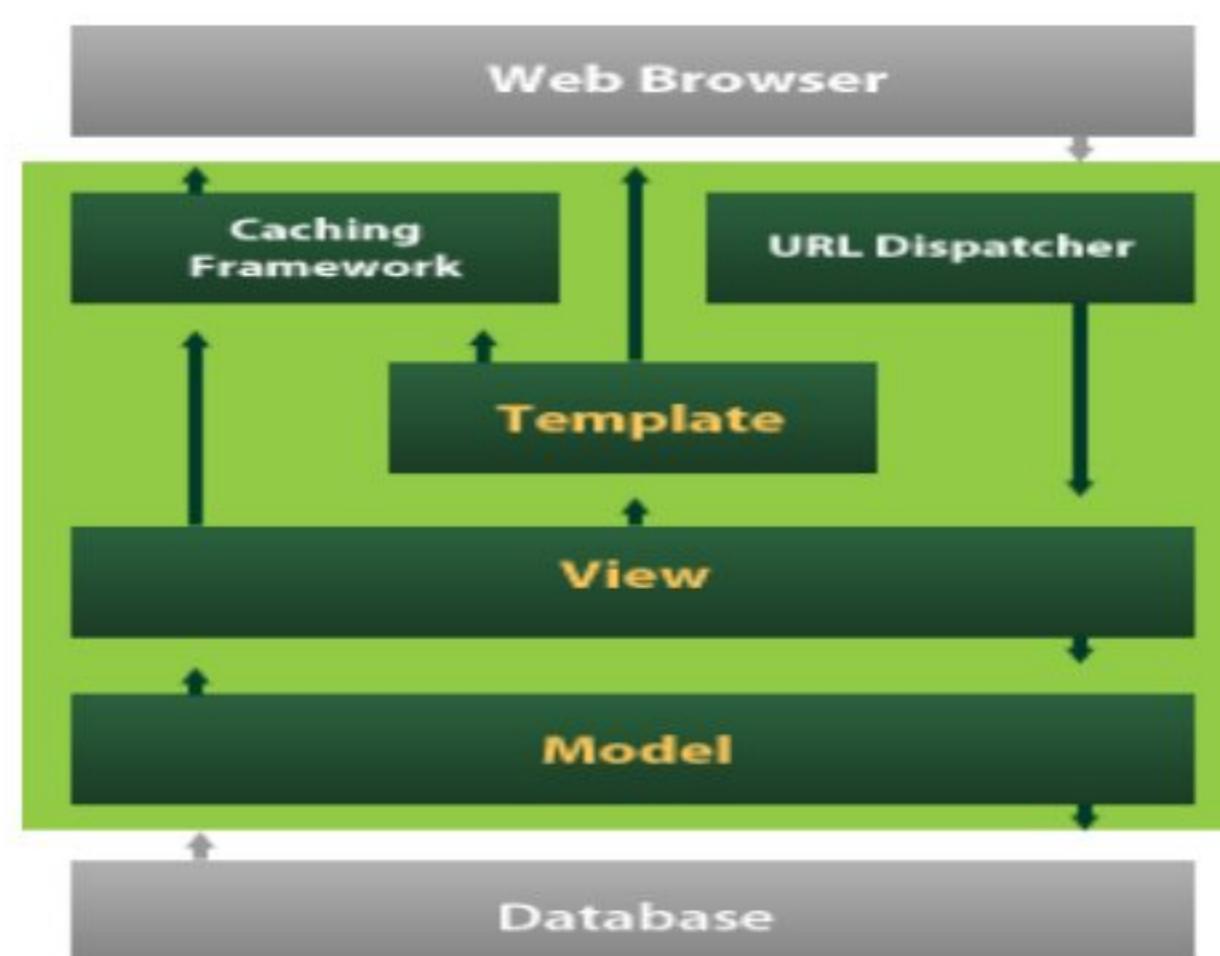


Fig- 6.5.2 Flask Implementation diagram

Basic Syntax of Django:

```

myproject/
    manage.py
    myproject/
        __init__.py
        settings.py
        urls.py
        wsgi.py

```

The Project Structure

6.6 Sample code(not change) :

Base.html

```

<!DOCTYPE html>
{% load static %}
<html>
<head>

    <meta name="viewport" content="width=device-width, height=device-height, initial-scale=1.0, user-scalable=0, minimum-scale=1.0, maximum-scale=1.0">
    <link rel="icon" type="image/png" href="{% static "assets/AT-pro-logo.png" %}">

    <!-- Import lib -->
    <link rel="stylesheet" type="text/css"
href="https://cdnjs.cloudflare.com/ajax/libs/Chart.js/2.9.3/Chart.min.css">
    <link rel="stylesheet" type="text/css" href="{% static "fontawesome-free/css/all.min.css" %}">
    <link href="https://fonts.googleapis.com/css2?family=Roboto&display=swap" rel="stylesheet">
    <!-- End import lib -->

    <link rel="stylesheet" type="text/css" href="{% static "style.css" %}">
</head>
<body class="overlay-scrollbar">
    <!-- navbar -->
    <div class="navbar">
        <!-- nav left -->
        <ul class="navbar-nav">
            <li class="nav-item">
                <a class="nav-link">

```

```

<i class="fas fa-bars" onclick="collapseSidebar()"></i>
    </a>
</li>
<li class="nav-item">
    <h3>Vehicle Service Management</h3>
</li>
</ul>
<!-- end nav left -->
<!-- form -->
<form class="navbar-search">
    <input type="text" name="Search" class="navbar-search-input" placeholder="What
you looking for...">
        <i class="fas fa-search"></i>
</form>
<!-- end form -->
<!-- nav right -->
<ul class="navbar-nav nav-right">
    <li class="nav-item mode">
        <a class="nav-link" href="#" onclick="switchTheme()">
            <i class="fas fa-moon dark-icon"></i>
            <i class="fas fa-sun light-icon"></i>
        </a>
    </li>

    <li class="nav-item avt-wrapper">
        <div class="avt dropdown">
            
            <ul id="user-menu" class="dropdown-menu">
                <li class="dropdown-menu-item">
                    <a href="/logout" class="dropdown-menu-link">
                        <div>
                            <i class="fas fa-sign-out-alt"></i>
</div>

```

```
<span>Logout</span>
</a>
</li>
</ul>
</div>
</li>
</ul>
<!-- end nav right --&gt;
&lt;/div&gt;
<!-- end navbar --&gt;

<!-- sidebar --&gt;
&lt;div class="sidebar"&gt;
&lt;ul class="sidebar-nav"&gt;

&lt;li class="sidebar-nav-item"&gt;
&lt;a href="/admin-dashboard" class="sidebar-nav-link"&gt;
&lt;div&gt;
&lt;i class="fas fa-tachometer-alt"&gt;&lt;/i&gt;
&lt;/div&gt;
&lt;span&gt;
    Dashboard
&lt;/span&gt;
&lt;/a&gt;
&lt;/li&gt;
&lt;li class="sidebar-nav-item"&gt;
&lt;a href="/admin-customer" class="sidebar-nav-link"&gt;
&lt;div&gt;
&lt;i class="fas fa-users"&gt;&lt;/i&gt;
&lt;/div&gt;
&lt;span&gt;Customer&lt;/span&gt;
&lt;/a&gt;
&lt;/li&gt;</pre>
```

```
<li class="sidebar-nav-item">
    <a href="/admin-mechanic" class="sidebar-nav-link">
        <div>
            <i class="fas fa-hat-cowboy"></i>
        </div>
        <span>Mechanic</span>
    </a>
</li>

<li class="sidebar-nav-item">
    <a href="/admin-request" class="sidebar-nav-link">
        <div>
            <i class="fas fa-spinner"></i>
        </div>
        <span>Request</span>
    </a>
</li>

<li class="sidebar-nav-item">
    <a href="/admin-report" class="sidebar-nav-link">
        <div>
            <i class="fas fa-coins"></i>
        </div>
        <span>Report</span>
    </a>
</li>
```

7.SYSTEM TESTING

The purpose of testing is to discover errors. Testing is the process of trying to discover every conceivable fault or weakness in a work product. It provides a way to check the functionality of components, sub -assemblies, assemblies and/or a finished product. It is the process of exercising software with the intent of ensuring that the Software system meets its requirements and user expectations and does not fail in an unacceptable manner. There are various types of test. Each test type addresses a specific testing requirement.

7.1 TYPES OF TESTING:

7.1.1 Unit testing

Unit testing involves the design of test cases that validate that the internal program logic is functioning properly, and that program inputs produce valid outputs. All decision branches and internal code flow should be validated. It is the testing of individual software units of the application .it is done after the completion of an individual unit before integration. This is a structural testing, that relies on knowledge of its construction and is invasive. Unit tests perform basic tests at component level and test a specific business process, application, and/or system configuration. Unit tests ensure that each unique path of a business process performs accurately to the documented specifications and contains clearly defined inputs and expected results.

7.1.2 Integration testing

Integration tests are designed to test integrated software components to determine if they actually run as one program. Testing is event driven and is more concerned with the basic outcome of screens or fields. Integration tests demonstrate that although the components were individually satisfaction, as shown by successfully unit testing, the combination of components is correct and consistent. Integration testing is specifically aimed at exposing the problems that arise from the combination of components.

7.1.3 Functional testing

Functional tests provide systematic demonstrations that functions tested are available as specified by the business and technical requirements, system documentation, and user manuals.

Functional testing is centered on the following items:

- **Valid Input** : identified classes of valid input must be accepted.
- **Invalid Input** : identified classes of invalid input must be rejected.
- **Functions** : identified functions must be exercised.
- **Output** : identified classes of application outputs must be exercised.
- **Systems/Procedures** : interfacing systems or procedures must be invoked.

Organization and preparation of functional tests is focused on requirements, key functions, or special test cases. In addition, systematic coverage pertaining to identify Business process flows; data fields, predefined processes, and successive processes must be considered for testing. Before functional testing is complete, additional tests are identified and the effective value of current tests is determined.

7.1.4 System Test

System testing ensures that the entire integrated software system meets requirements. It tests a configuration to ensure known and predictable results. An example of system testing is the configuration oriented system integration test. System testing is based on process descriptions and flows, emphasizing pre-driven process links and integration points.

7.1.5 White Box Testing

White Box Testing is a testing in which the software tester has knowledge of the inner workings, structure and language of the software, or at least its purpose. Its purpose. It is used to test areas that cannot be reached from a black box level.

7.1.6 Black Box Testing

Black Box Testing is testing the software without any knowledge of the inner workings, structure or language of the module being tested. Black box tests, as most other kinds of tests, must be written from a definitive source document, such as specification or requirements document, such as specification or requirements document. It is a testing in which the software under test is treated, as a black box .you cannot “see” into it. The test provides inputs and responds to outputs without considering how the software works.

7.1.7 Unit Testing

Unit testing is usually conducted as part of a combined code and unit test phase of the software lifecycle, although it is not uncommon for coding and unit testing to be conducted as two distinct phases.

7.2 Test strategy and approach

Field testing will be performed manually and functional tests will be written in detail.

7.2.1 Test objectives

- All field entries must work properly.
- Pages must be activated from the identified link.
- The entry screen, messages and responses must not be delayed.

7.2.2 Features to be tested

- Verify that the entries are of the correct format
- No duplicate entries should be allowed
- All links should take the user to the correct page.

7.3 Integration Testing

Software integration testing is the incremental integration testing of two or more integrated software components on a single platform to produce failures caused by interface defects. The task of the integration test is to check that components or software applications, e.g. components in a software system or – one step up – software applications at the company level – interact without error.

7.3.1 Test Results: All the test cases mentioned above passed successfully. No defects encountered.

7.4 Acceptance Testing

User Acceptance Testing is a critical phase of any project and requires significant participation by the end user. It also ensures that the system meets the functional requirements.

7.4.1 Test Results:

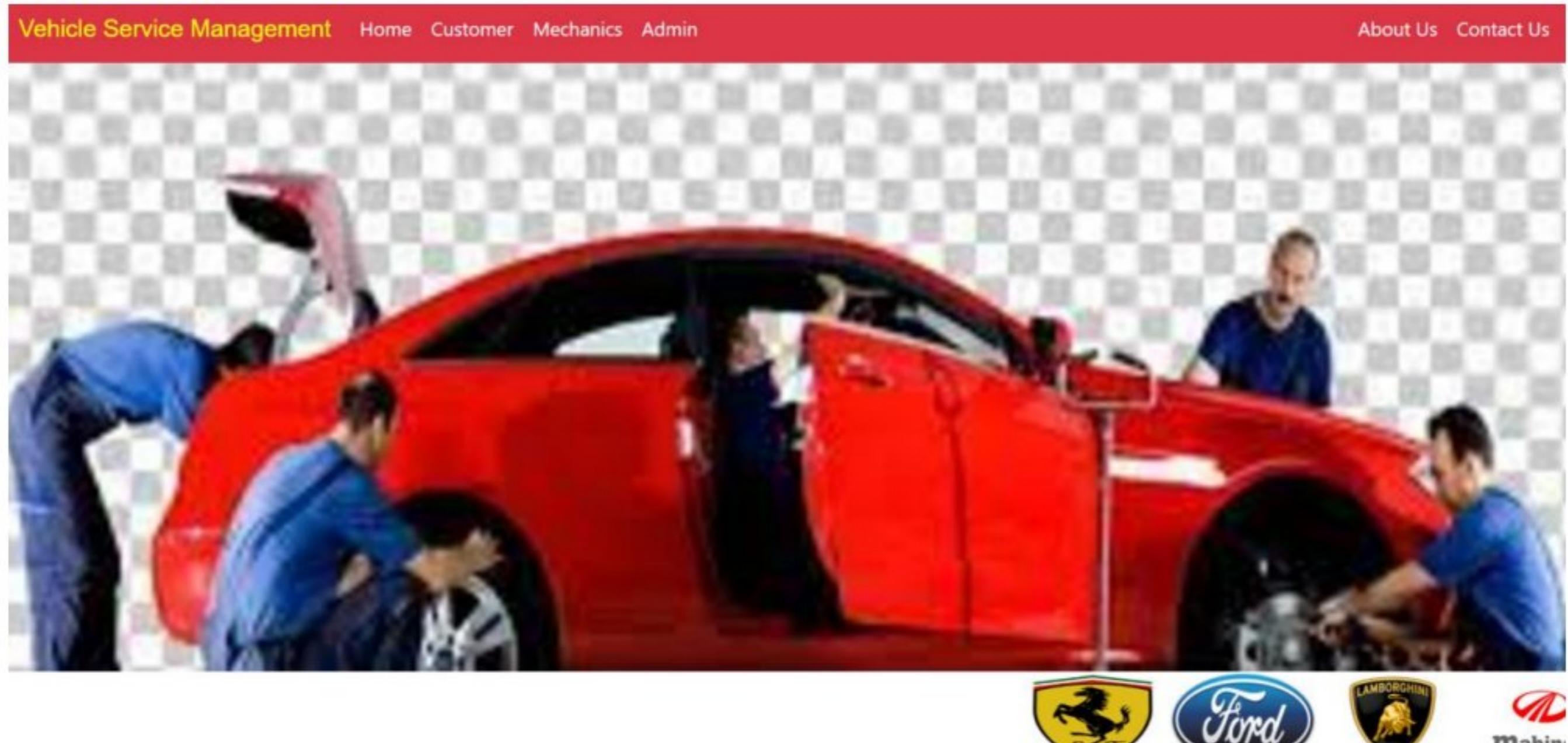
All the test cases mentioned above passed successfully. No defects encountered.

7.5 Test Cases:

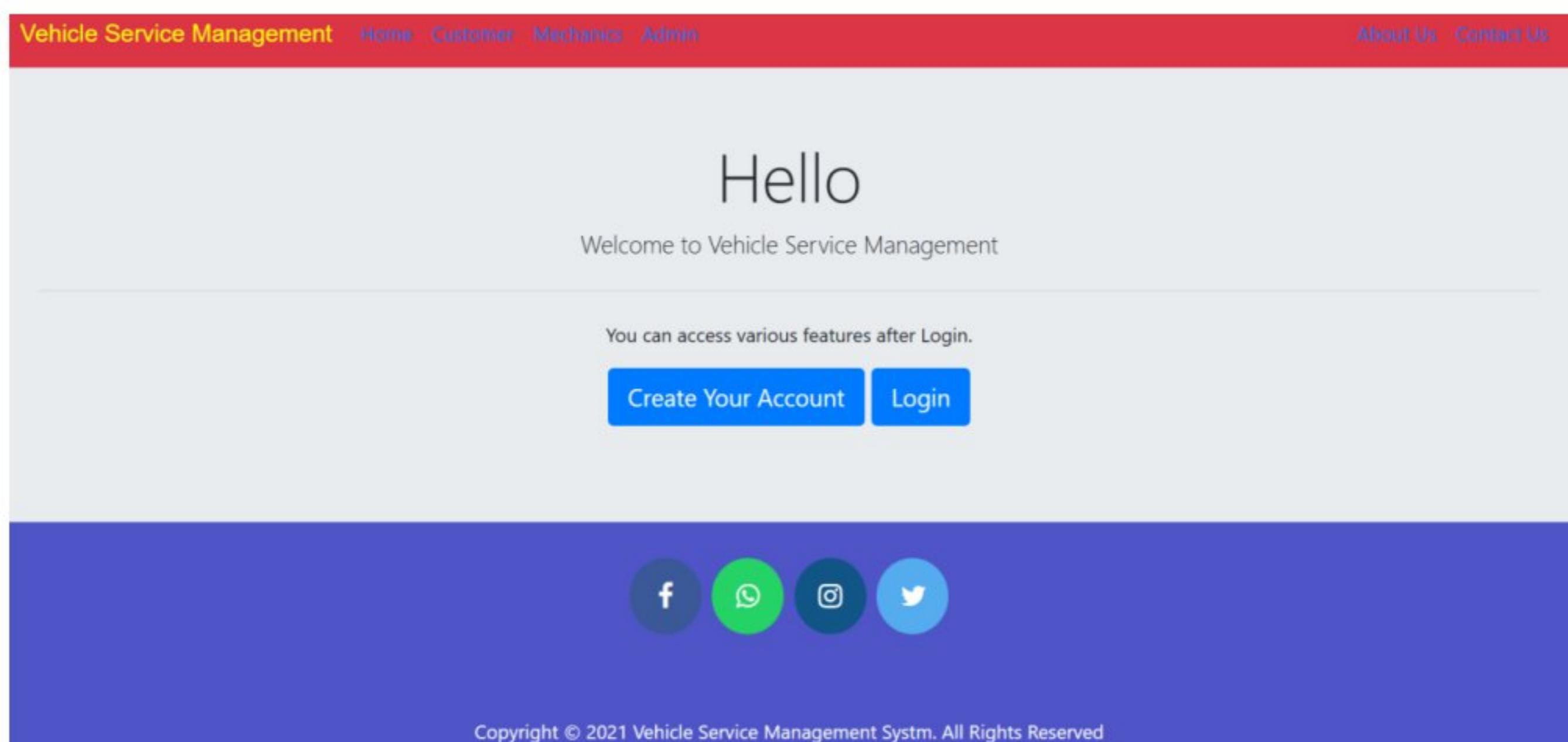
Test Case ID	Test Description Case	Test Steps	Expected Result	Result	Status (Pass/Fail)
1	User Registration	1. Navigate to the registration page. 2. Fill in all required fields. 3. Submit the form.	User should be registered and directed to a message saying "Registration Successful, Await Activation".	Pass	If already user registers then it fails
2	Admin User Activates	1. Admin logs into the admin panel. 2. Navigate to user activation section. 3. Activate the newly registered user.	The user should be marked as "Active" and receive activation confirmation via email.	Pass	If admin does not activate then user cannot login
3	User Login	1. Navigate to the login page. 2. Enter valid username and password. 3. Click "Login".	User should be logged in and directed to the dashboard/homepage.	Pass	If you did not registered user cannot login
4	Access Dataset Section After Login	1. After login, click on "Dataset". 2. Verify if the dataset page is loaded.	Dataset page should display, and available datasets should be listed.	Pass	Dataset page should display, and available datasets should be listed.
5	View Accuracy Score for Selected Dataset	1. On the dataset page, select a dataset. 2. Click on "View Accuracy Score".	The system should display the accuracy score of the selected dataset.	Pass	Results not true failed
6	Enter Input and Get Prediction	1. On the dataset page, enter the required input. 2. Click on "Get Prediction".	The system should return a prediction based on the input provided.	Pass	Prediction not true failed

8. REPORT

Home page:



Create account for customer:



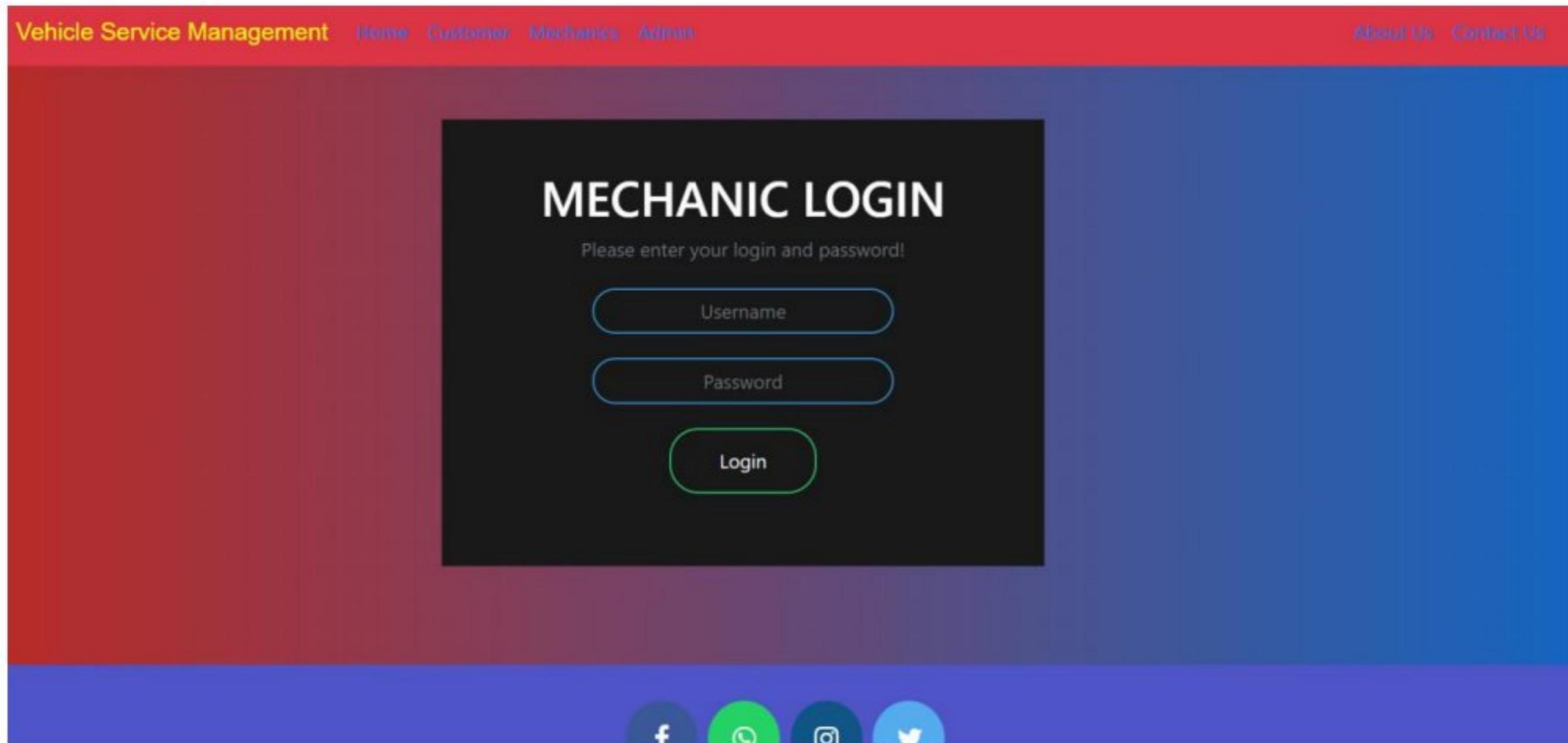
Customer Home page:

The screenshot shows the Customer Home page of a Vehicle Service Management system. At the top left is a navigation menu with icons for Home, Requests, Vehicles, and Profile. A search bar with placeholder text "What you looking for..." and a magnifying glass icon is positioned at the top right. Below the header are four colored cards: a blue card for "New Request Made" (0), an orange card for "Vehicle Repair In Progress" (0), a green card for "Vehicle Repaired" (0), and a red card for "Total Bill" (₹ None). To the right of these cards are four vehicle brand logos: Ferrari, Ford, Lamborghini, and Mahindra.

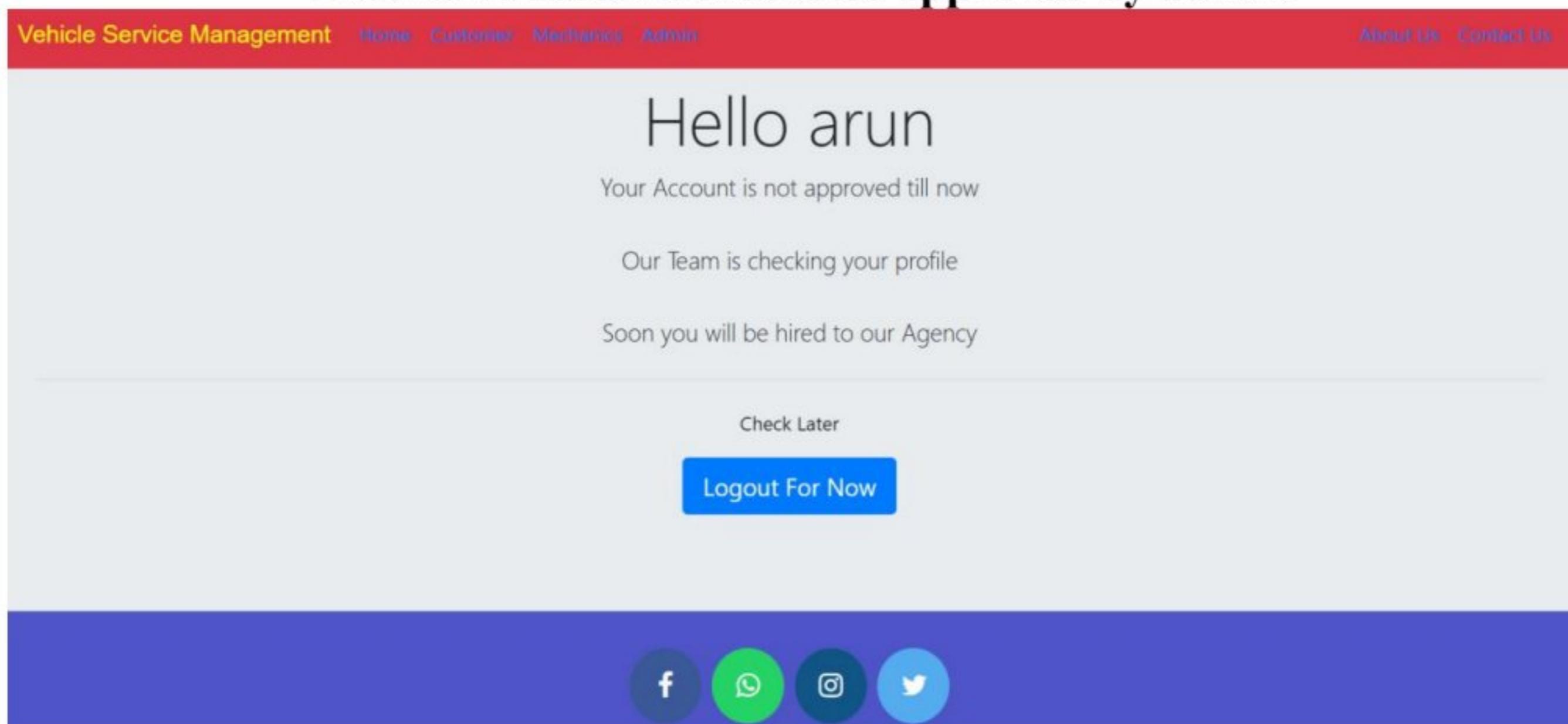
Request Form :

The screenshot shows the Request Form page. It features a navigation menu on the left with icons for Home, Requests, Vehicles, and Profile. A search bar with placeholder text "What you looking for..." and a magnifying glass icon is at the top right. The main area is titled "MAKE REQUEST" and contains the following form fields: "Vehicle Category" (dropdown menu), "Vehicle Number" (text input), "Vehicle Name" (text input), "Vehicle Brand" (text input), "Vehicle Model" (text input), and "Problem Description" (text input). Each field has a placeholder text indicating its purpose.

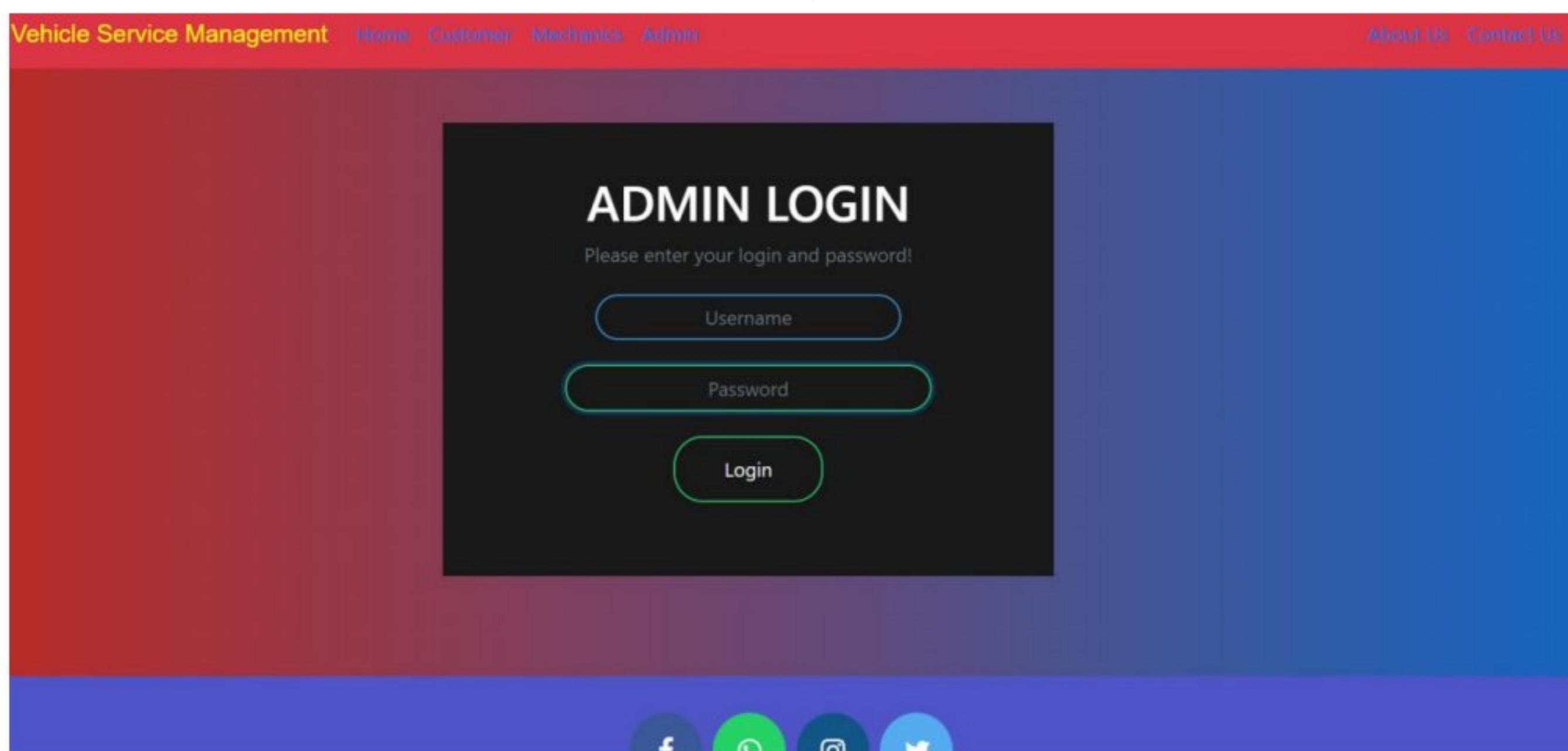
Mechanic Login:



Mechanic account should be approved by admin:



Admin Login:



Admin Homepage:

The screenshot displays the main dashboard of the vehicle service management system. On the left, there is a vertical sidebar with icons for Home, Customer, Mechanic, Enquiry, Feedback, and Logout. The main content area features a search bar at the top with the placeholder "What you looking for...". Below the search bar are four colored boxes showing summary statistics: a purple box for "Total Customer" (4), an orange box for "Total Mechanic" (2), a green box for "Total Enquiry" (3), and a red box for "Total Feedback" (1). The main content area also includes a section titled "Recent Enquiry By Customer" with a table showing recent customer inquiries. The table has columns for Customer Name, Vehicle Name, Category, Vehicle Model, Vehicle Brand, and Problem Description.

Customer Name	Vehicle Name	Category	Vehicle Model	Vehicle Brand	Problem Description
mee na	creta	four wheeler	2019	hyundai	overheating engine
naveen azmeera	civic	four wheeler	2019	honda	Brake pads worn out, causing squealing noise when braking.
Alex Alex	Fortuner	four wheeler	2019	Toyota	Engine overheating frequently during long drives.

Admin (Customer management):

The screenshot shows a table titled "Enquiry Made By Customer". The columns are: Customer Name, Vehicle Name, Category, Problem Description, Status, Change Status, and Delete. There are three rows of data:

Customer Name	Vehicle Name	Category	Problem Description	Status	Change Status	Delete
mee na	creta	four wheeler	overheating engine	Approved		
naveen azmeera	civic	four wheeler	Brake pads worn out, causing squealing noise when braking.	Approved		
Alex Alex	Fortuner	four wheeler	Engine overheating frequently during long drives.	Approved		

Admin (View Mechanic):

The screenshot shows a grid of five buttons:

- View All Mechanic** (Blue button with eye icon)
- Add Mechanic** (Green button with plus icon)
- Approve Mechanic** (Orange button with checkmark icon)
- View Mechanic Salary** (Red button with rupee symbol icon)
- Mechanic Attendance** (Blue button with calendar icon)

Admin(Mechanic approval page):

The screenshot shows a table titled "Hire Mechanics Based On Skill". It lists two mechanics: Raj Raj and arun kumar. Each row includes columns for Mechanic Name, Profile Picture, Mobile Number, Address, Skills, Approve, and Delete. The "Approve" column contains red checkmarks, and the "Delete" column contains blue X's.

Mechanic Name	Profile Picture	Mobile Number	Address	Skills	Approve	Delete
Raj Raj		8978675645	hyd	mechanical work	✓	X
arun kumar		9876543210	hyd	mechanic	✓	X

Mechanic Home Page:

The screenshot displays a dashboard for a mechanic. It features four colored boxes: blue (New Work Assigned: 2), orange (Work In Progress: 0), green (Work Completed: 0), and red (Salary: ₹ 10000). To the right are four brand logos: Ferrari, Ford, Lamborghini, and Mahindra.

Vechicles to repair and update the status by mechanic:

Vehicle Service Management

What you looking for...

Vehicles To Repair & Update Status

Vehicle Name	Category	Number	Model	Brand	Problem Description	Status	Update Status
civic	four wheeler	555678	2019	honda	Brake pads worn out, causing squealing noise when braking.	Approved	
creta	four wheeler	9021	2019	hyundai	overheating engine	Approved	

Mechanic change the status after repairing the vechicle as Repairing Done:

Vehicle Service Management

What you looking for...

Vehicles To Repair & Update Status

Vehicle Name	Category	Number	Model	Brand	Problem Description	Status	Update Status
civic	four wheeler	555678	2019	honda	Brake pads worn out, causing squealing noise when braking.	Approved	
creta	four wheeler	9021	2019	hyundai	overheating engine	Repairing Done	

Invoice bill for customer vehicle problem(Customer Page):

The screenshot shows a mobile application interface for 'Vehicle Service Management'. At the top left is a menu icon (three horizontal lines) and the text 'Vehicle Service Management'. To its right is a search bar with the placeholder 'What you looking for...' and a magnifying glass icon. Further right are icons for a crescent moon and a bell.

The main content area has a header 'Approved Request With Cost' in red. Below it is a table with the following data:

Vehicle Name	Vehicle Number	Problem Description	Enquiry Date	Total Cost
creta	9021	overheating engine	Nov. 21, 2024	12000

9. CONCLUSION

The evolution of the automobile service industry has been heavily influenced by digital transformation, as web-based platforms continue to streamline service management processes. The project on “Web-Based Automobile Service Management” reveals the significant potential and impact of integrating modern web technologies into traditional service models, allowing for unprecedented efficiency, transparency, and customer satisfaction. This system empowers both service providers and customers by offering real-time access to service details, tracking options, and scheduling, creating a user-centric and highly efficient platform.

1. Improved Customer Experience

Web-based automobile service management offers a more efficient and satisfying experience for customers. With easy online appointment scheduling, service status tracking, and digital service histories, the platform provides transparency and convenience that were previously lacking in traditional systems. Customers can schedule appointments based on availability, get real-time updates on the progress of their vehicle’s service, and review the complete history of past services—all without needing to call or visit the service center. This level of convenience aligns with modern expectations and enhances customer loyalty by addressing the frustration often associated with delayed communication or unclear service timelines.

Through personalized notifications, reminders, and feedback options, the platform can also engage customers more effectively, promoting a proactive approach to vehicle maintenance. Additionally, the digitalized approach reduces wait times and makes the process smoother, helping to create a long-term positive relationship between the customer and service provider. By offering these digital conveniences, automobile service providers can increase customer retention and potentially expand their customer base.

2. Operational Efficiency for Service Providers

For service providers, a web-based management platform automates many of the manual, repetitive tasks involved in automobile service management. Features such as digital scheduling, inventory management, and staff allocation optimize workflow, freeing up resources that would otherwise be consumed by administrative work. The system allows for better planning and allocation of service bays, personnel, and inventory by providing real-time information on appointments, parts needed, and service durations. The system also enables service providers to easily manage customer databases, which can be utilized for targeted marketing, reminders for maintenance services, and personalized offers. Furthermore, by integrating data analytics, the platform can deliver insights into peak service times, most-requested services, and customer behavior trends, which can guide decisions around staffing, inventory purchasing, and service offerings. This streamlining directly translates to cost savings, faster service turnaround, and an overall more

productive operation.

3. Enhanced Communication and Transparency

A significant aspect of web-based automobile service management is the improvement in communication and transparency between service providers and customers. Customers often experience anxiety when leaving their vehicle for service due to uncertainty around timelines and costs. The web-based platform alleviates this by providing a real-time view of the service process, including detailed diagnostics, cost estimations, and service stages. This transparency increases trust, as customers can clearly see what services are being performed and why they are necessary, without the need for technical knowledge.

For service providers, clear communication tools within the platform reduce the need for time-consuming phone calls and emails, enabling faster responses to customer inquiries. The system allows for better record-keeping as well, with all communications being stored within the customer's profile, ensuring that each interaction is documented and can be referenced later. This level of documentation is especially helpful in managing disputes or providing a clear history of the services performed, further adding to customer confidence in the service provider.

4. Cost-Effectiveness and Scalability

Traditional automobile service centers often face high operating costs due to inefficient workflows and outdated management practices. A web-based service management system drastically reduces these costs by automating routine processes, optimizing scheduling, and minimizing resource waste. For example, inventory management systems can alert service providers when parts are running low or identify parts that are infrequently used, ensuring that resources are managed economically.

The platform also allows for scalability. Whether a single-location service center or a chain of workshops, the system can be scaled according to the size and needs of the organization. As a cloud-based platform, it reduces the need for substantial upfront hardware investments and allows multiple locations to share data seamlessly. This scalability is particularly important in the automobile service industry, where businesses must quickly adapt to changes in demand and customer expectations.

5. Security and Data Management

In handling sensitive customer and vehicle information, security is paramount for a web-based automobile service management platform. Implementing stringent data security measures ensures that customer information is protected from unauthorized access, which is critical for maintaining trust and regulatory compliance. Additionally, features such as data encryption, secure login protocols, and regular software updates fortify the platform against potential cyber threats.

The platform also serves as a repository for valuable data that can support both operational improvements and customer satisfaction. Through effective data management, service providers can access critical information quickly, track historical records, and use customer data to provide personalized experiences. For instance, knowing a customer's service history can help in recommending specific maintenance services or upgrades, contributing to customer satisfaction and additional revenue opportunities.

6. Long-Term Sustainability and Market Competitiveness

By adopting a web-based service management system, automobile service providers position themselves as forward-thinking and customer-centric. This adaptability to digital solutions is becoming increasingly important as the automobile industry shifts toward a technology-driven future. Embracing such platforms not only makes service centers more appealing to today's digitally oriented customers but also keeps businesses competitive in an industry where efficiency and customer experience are paramount.

Moreover, a web-based service management platform supports long-term sustainability by reducing paper usage, minimizing waste, and optimizing resource use. Environmental sustainability is an important consideration for both companies and consumers, and demonstrating a commitment to greener practices can enhance a service provider's reputation. The system's efficiency and digital nature also mean that service providers can better align with eco-friendly goals, further positioning them positively in the marketplace.

10. FUTURE ENHANCEMENT

- **Automated SMS Notifications:** Implementing automated SMS notifications can enhance customer engagement by providing reminders for upcoming service appointments and notifications about follow-up services based on customers' last visits. This feature would improve customer satisfaction by making it easier for them to stay on top of their vehicle maintenance.
- **Enhanced Customer Contact Options:** Adding a phone number field to the customer contact form on the home page would make it easier for service advisers to reach out to customers directly, ensuring better communication and responsiveness.
- **Social Media Integration:** Integrating social media platforms with the system's blog feature could boost customer engagement and marketing outreach. This would allow MAS Motors LLC to reach a wider audience, promote services, and interact with customers through social channels, further building the brand's online presence.
- **Expanded Configurability and Customization:** Allowing for more account settings and custom configurations within the system would empower administrators and users to tailor the platform to specific needs. This flexibility could make the system more adaptable to different operational requirements or expanding branches.
- **Data Analysis and Business Intelligence Features:** Implementing additional data analysis and business intelligence tools could provide management with deeper insights into service trends, customer preferences, and technician productivity. Such tools would support strategic decision-making, enabling the company to predict demand and optimize resources.
- **Mobile App Extension:** Developing a dedicated mobile app for customers and employees could improve accessibility, allowing users to book appointments, view schedules, and receive notifications directly from their mobile devices, further enhancing user convenience and engagement.

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WEB-BASED AUTOMOBILE SERVICE MANAGEMENT SYSTEM FOR MAS MOTORS LLC

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Abstract—This project endeavored to design and develop a Web-based Automobile Service Management System for MAS Motors LLC, an accredited Toyota dealership in Libya. The system will help reduce the manual process from the everyday activities of the service division in all branches. The system is dedicated to be used by the following individuals: (1) Service Advisers, (2) Workshop Managers, (3) Storekeepers, (4) Technicians, (5) Customers, and (6) Upper Management.

The company's growth made the manual process ineffective and incompetent in handling the evolving business activities. The project aimed to provide a centralized system that will operate in all of the branches and accommodate the daily business needs.

The software produced from the project was tested using Alpha and Beta software testing. The researcher also conducted an interview concerning the business process, current business difficulties, and features of the proposed system. Hewlett-Packard FURPS (Functionality, Usability, Reliability, Performance, and Supportability) model was used to assess the software quality, and questions were answered by a group of respondents. The system was found to be functional, meeting the requirements of the client.

Keywords— *Automobile Service Management, Information System, Toyota, Vehicle Maintenance*

I. INTRODUCTION

Today, the innovation of technology is fast, making people's lives become so much easier. New technology offers the ability for business organizations to manage their work adequately. It provides solutions to the increasing needs and demand to become more efficient. Accredited automobile dealerships are expected to provide quality services, and the management is always challenged to find solutions that are beneficial for both ends. Technology could offer to automobile dealerships solutions ranging from daily tasks management to more advanced business analysis tools that could optimize expenditures and raise profits. Workshops in the automobile industry are running systematically using job cards. Job cards are a detailed description of work that is performed for a client, that includes customer, vehicle, and work details. Productive automobile dealerships or workshops cannot effectively accomplish the daily business activities without the use of job cards. The key roles of a job card include organizing the tasks of the employees, storing the details of the client and the work done including the spare parts used. In addition, the job card helps coordinate the duties of service advisors,

storekeepers, and technicians. Work coordination and teamwork are the keys to success. In addition, businesses cannot achieve their goals without having an efficient plan that direct their operation.

A management system is used by organizations to manage the inter-related parts of its business in order to achieve its objectives. These objectives can relate to a number of different aspects, including product or service quality, operational efficiency, environmental performance, health and safety in the workplace, and many more [1]. Almost all business organizations grow and develop each year, month, week, or day. The evolution of information technology had changed the rules so that people today search and collect information from almost anywhere. Market competition and the rapid development of technology made organizations invest in utilizing information technology to store and analyze data aiming to efficiently increase their competitive advantage.

Automobile Service Management Information System (ASMIS) also known as Automobile Service Management System is a software solution that supports achieve automobile dealership duties and business rules electronically to reduce the manual tasks and process time, to enable easy and accurate access of data, and to provide decision support reports for the management.

II. BACKGROUND OF THE STUDY

MAS translates to “diamond” in Arabic. It is also an acronym of the company owner's name Mubarak Abdullah Souri. MAS Motors LLC is an accredited Toyota dealership founded in the eastern region of Libya established in 2011.

The company originated in the city of Benghazi offering 3S function (sales, spare parts, and services) services to the customers under two main divisions: the sales and the service divisions. The sales division focuses on trading new vehicles on installment or cash basis. The service division offers services such as general repair, body and paint, preventive maintenance, accessories, and genuine spare parts. Through the past years, the company gained a fair number of individual and government clients. There are now a total number of three branches.

Since the establishment of the company, the daily business processes were handled manually using basic applications e.g. Visual Basic for applications-enabled Excel sheets, Word document files, and paper documents. Accidental human errors did occur, and the decision-making

was based frequently on managers' intuition. Presently, the company is still developing and the business further expands. Implementing the old-fashioned method is inadequate to handle the huge amount of work, and achieve continuous success. Moreover, the management of the increased number of branches, the spare parts warehouses associated with became challenging.

III. OBJECTIVES OF THE STUDY

A. General Objective

The general objective of this project is to design and develop a Web-based Automobile Service Management System for MAS Motors LLC.

B. Specific Objectives

1. Develop the following modules:
 - a. Administrator module,
 - b. Inventory module,
 - c. Job card management module,
 - d. Reports module,
 - i. Productivity and efficiency analysis for technicians,
 - ii. Service history, and
 - iii. Forecasting
 - e. Employee profiling module,
 - f. Unit of time management module,
 - g. Marketing module, and
 - h. Customer module
2. Design the user interface for the following users:
 - a. Upper management,
 - b. System administrator,
 - c. Workshop managers,
 - d. Service advisers,
 - e. Storekeepers,
 - f. Technicians, and
 - g. Customers
3. Evaluate the system according to the following criteria:
 - a. Functionality,
 - b. Usability,
 - c. Reliability,
 - d. Performance, and
 - e. Supportability

IV. REVIEW OF RELATED LITERATURE AND STUDIES

A. Review of Related Local Literature

Every time there is a sales transaction, the sales inventory system automatically updates the company's database to record the corresponding requirement in terms of inventory and finance. Generating sales from multiple points or locations would not be a problem; because there is an online sales and inventory system in place. The information will be updated in real-time eliminating delays in the transmission of information ,especially to the inventory unit. Delays in processing and delivery would, therefore, be avoided, much to the customer's satisfaction [2].

It was stated in the article that the real-time update of information in the database eliminates delays in which increases customer satisfaction. The proposed system includes an inventory module that organizes the business transactions done at branches and implements the updates in real-time to the centralized database. Moreover, the inventory module integrates with the job card module to allow branches to supply spare parts to job orders to provide services to clients.

The importance of Business Process Automation, as an effect to improve supply chain management, comes an enhanced ability to react to changes in the market. A good Business Automation Strategy enables an enterprise to react more quickly to their environments and demands, allowing them to move ahead of the competition, produce a better service, and cover a larger piece of the market. This will help the business owners focus on managing their businesses and on dominating the market [3].

It was highlighted in the article above the importance of business process automation using information systems. Utilizing such systems allows the management of the company to organize the internal business process, develop a flexible reaction to market demand, and concentrate on dominating the market.

The success of every company lies in its ability to organize its daily tasks in an efficient manner. Still, organizing internal processes can be time-consuming, which means that the speed and efficiency with which they are unrolled are slowed down. Luckily, technology is here to help us out, especially through the help provided by a Service Management System [4].

It was stated in the article that adopting new technologies and specifically service management systems can shorten the processing time, enables efficient tasks processing, and increases the chances of success of the organization.

B. Review of Related Foreign Literature

Web-based applications have evolved significantly over the recent years and with improvements in security and technology. Most web-based applications are far more compatible across platforms than traditional, installed software. Typically, the minimum requirement would be a web browser. The only requirement is the installation on the server, placing minimal requirements on the end user workstation. There are also dramatically lower costs due to reduced support and maintenance, lower requirements on the end user system, and simplified architecture [5].

It was stated in the article that the web-based applications enable covering different locations through a scalable, centralized, and secure way. Such applications on user's end consume low computer resources and only requires a web browser to run.

Elva Dealership Management System (DMS), service management functions include needed maintenance work and staff scheduling, service operation analysis, and an overview of service work status [6].

In regards to the article stated above, the proposed system has a job card management module, in which automatically schedules the work for technicians. The reports module provides the real-time status monitoring of technicians and vehicles in the workshop.

Due to lack of real-time information about inventory, auto parts available, and schedules, the service advisor may not be able to give adequate information about services, cost, and schedule to the customer. In case of serious damage, it is difficult to keep track of all the areas at fault. Maxworth's automobile service management solution tackles these problems while making the service process more agile, which resulted to a positive impression on the customer [7].

From the article stated above, the proposed system provides the users with real-time information about spare parts availability in the inventory. Moreover, it provides an easy dynamic method to generate detailed service estimates and to send service advertisements via (short message text) SMS to customers. Automated birthday greetings and service history reports improve customer experience and satisfaction with the service.

Before you buy a car, read through the car's handbook and see how much service history it has. Seeing a full history will not only give you the peace of mind that the car has been properly observed and must be reliable, but also help confirm the car's mileage. When the time comes that you decide to sell the car, it will add considerably to your car's value if it has a full history [8].

In regards to the article stated above, the proposed system includes a service history feature to help clients track the service records guaranteeing that the maintenance is done based on the manufacturer's recommendations; and in case of selling, the full-service history strengthens the vehicle's value in the market. This feature benefits the client's business since it increases the number of customers who will seek to have their vehicles serviced in the dealership and may request for the service history reports.

The adoption of information technology (IT) in organizations has been growing rapidly. The use of the technology has evolved from the automation of structured processes to revolutionary systems that introduce change to fundamental business procedures. Indeed, it is believed that "More than being helped by computers, companies will live by them, shaping strategy and structure to fit new information technology." [9].

It was stated in the article that the evolution of information technology made its adoption in businesses increase and almost inevitable. Technology brought a significant amount of advantages to businesses. The proposed system intends to provide an adequate set of features not limited to daily business process automation but also to provide the tools that support decision making.

C. Review of Related Local Studies

Based on the study entitled "Integrated Sales and Inventory Management System Implemented in Three-Tier Architecture" [10], after all the tests and evaluations, as compared to the manual system and other alternatives used

to enhance the business processes, the said system was cheaper, faster, could lessen the human resource, effective, and efficient for gaining hefty profit. It reduced failure reporting and analysis, and could provide timely and accurate reliable and quality reports.

The significance of this study to the proposed system is on the concepts of timesaving, reliability, and the possibility to reduce operating expenses and increase revenue by employing the integrated sales and inventory system. The said system was much better than manual alternatives. The system proposed under this project includes an inventory module which organizes and centralizes the inventory management of the different branches. The reporting and analysis provide timely, accurate and reliable information. The reports module can assist the management by giving data to serve as a reference in determining strategies to decrease unnecessary expenses.

D. Review of Related Foreign Studies

According to business intelligence and analytics (BI&A) and the related field of big data analytics have become increasingly important in both the academic and the business communities over the past two decades [11]. Industry studies have highlighted this significant development. For example, based on a survey of over 4,000 information technology (IT) professionals from 93 countries and 25 industries, the IBM Tech Trends Report (2011) identified business analytics as one of the four major technology trends in the 2010s. In a survey of the state of business analytics by Bloomberg Businessweek (2011), 97 percent of companies with revenues exceeding \$100 million were found to use some form of business analytics.

The study cited above shows the growing importance of business intelligence and analytics. It was found that 97 percent of big companies are using business analytics, which indicates the advantages of utilizing information technology in business especially in business analysis. The system proposed by the study provides forecasting and reports that will aid the management decision making.

Based on the study entitled "Car Dealer Management System for Chanota Automobiles" [12], it is the solution that helps manage the day-to-day work easily. This system also generates information to help in making managerial decisions. The implementation of this system will add great value to the organization and its support functions.

The significance of this study to the proposed system is focused on easing up managing the daily processes while also providing decision makers with supportive information.

Based on "Automobile repairs and maintenance information system for auto tech engineers" [13], the study indicated problems encountered using the old system:

- Considerable time spent to prepare cost estimates for repairing vehicles and assign the technical staff for particular work.
- Lack of a proper database system, so they are unable to access required data with the preferred format on time.

- Sometimes it is impractical to provide details about sold spare parts, repaired vehicles, and customers within accepted time boundaries.

The significance of this study to the proposed system is the data maintainability and timeliness in manageable and accessible format, which results in timesaving and reduced burden for the employees. The proposed system also has service estimate generation feature and technician assignment to job orders feature.

V. METHODOLOGY

A. Research Design

- Applied Research Method, the applied research method was adopted in this project. Applied research relates to systematic study that seeks to solve practical problems of an individual or group. This project is considered as applied research because it intends to solve the practical problem of the client. The researcher conducted an interview to collect information and data to identify the problems with the present business process then develop a new system, which will resolve the problems found. The information will also help in determining the effectiveness of the proposed system.
- Quantitative Research Method, the quantitative research conducted for this project, the Likert scale was used on the results of the respondents' evaluation of the stated system and evaluated these based on the table of interpretation.

B. System Development Tool

The Rapid Application Development (RAD) methodology (Fig. 1) was applied as the software development tool for the project. RAD was chosen because it promotes user feedback, flexibility, and responsiveness to change, and most importantly early delivery.

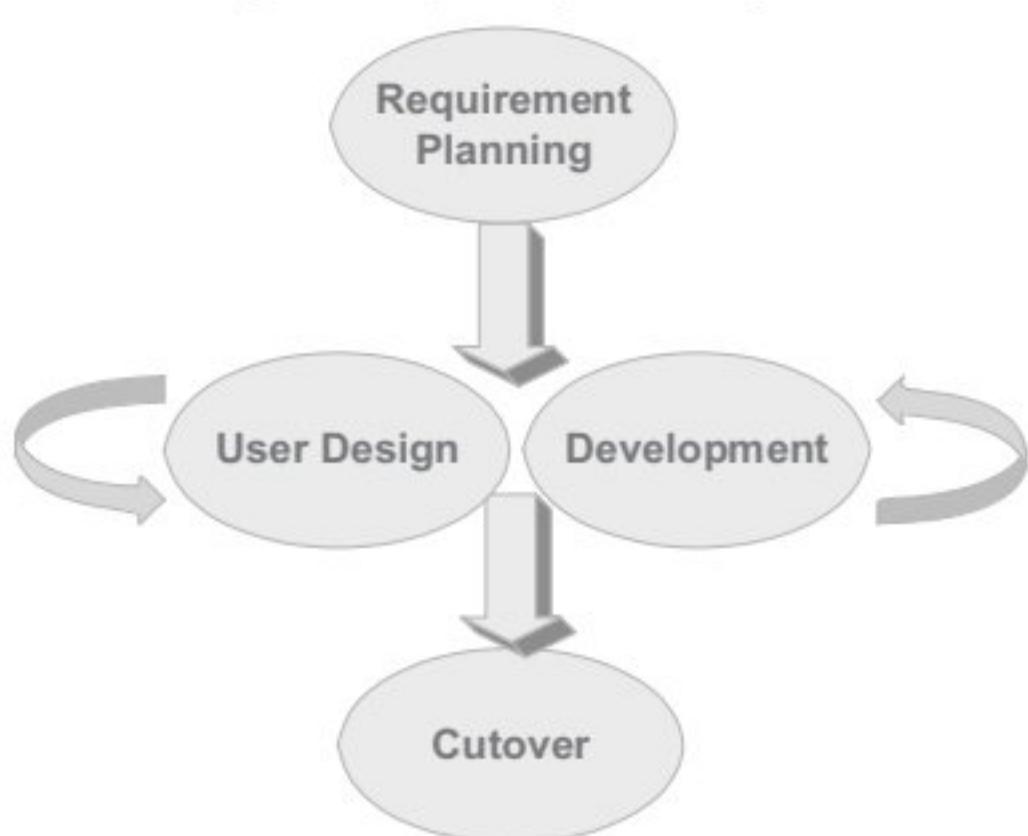


Fig. 1. RAD Software Development Methodology

C. Project Design

The system's back-end was developed using PHP scripting-language, MariaDB database management system, and Laravel framework. The system's front-end was developed using HTML5, JavaScript, CSS3 powered by Twitter Bootstrap 4 framework and JQuery, Offline.js, and Chart.js libraries.

D. System Testing Techniques

1) *Alpha Testing*: The alpha testing was performed by the developer. It is a type of software acceptance testing conducted at the software development site to recognize bugs prior to the release of the software to the public. The black-box testing method was adopted as it was more reliable and quicker to employ considering the system scope and its functionalities. The black-box testing technique focuses on inputs and outputs, it examines the functionality of the software without looking at the internal code structure.

2) *Beta Testing*: The software was released for a limited number of users to perform testing at their premises based on the functionality of all components. Beta testing uses user inputs to enhance the quality of the software ensuring the best quality of the final output. The researcher utilized beta testing as it focuses on the functionality of the software in which prevents product failure risks.

E. Statistical Treatment

The weighted mean (1) utilized in this project to determine the effectiveness of the suggested system for the client. The weighted mean is an average calculated by including an additional weight for one or multiple elements of the sample.

$$WM = \sum f\kappa / N \quad (1)$$

Where:

WM = Weighted Mean

Σ = Summation

f = Frequency / κ – scale value

N = Total number of respondents

The data obtained were interpreted using the Likert scale (Table 1).

TABLE 1 INTERPRETATION TABLE

Mean Range	Scale	Interpretation
4.51 – 5.00	5	Excellent
3.51 – 4.50	4	Very Satisfactory
2.51 – 3.50	3	Satisfactory
1.51 – 2.50	2	Fair
1.00 – 1.50	1	Poor

VI. ANALYSIS AND DISCUSSION

Purposive sampling technique was utilized in the project because it enables acquiring of samples of subjects with specific characteristics with only minimal effort. The developed system's output included: website with a content management and automobile service management systems. These were tested and evaluated in terms of (FURPS) Functionality, Usability, Reliability, Performance, and Supportability by 10 respondents. System evaluation survey was distributed to two different groups of respondents varying from MAS Motors LLC. customers and employees.

The tables shown below are the findings on the profile of the respondents (Table 2) based on retrieved data, five (5) employees and five (5) customers of MAS Motors LLC. service centers.

TABLE 2 FREQUENCY DISTRIBUTION OF THE RESPONDENTS

Group	Total	
	frequency	Percentage
Service Center Employees	5	50%
Service Center Customers	5	50%
Total	10	100%

Table 3 shows the weighted mean of both groups of respondents in terms of the functionality of the system. The indicator that got the lowest mean of 4.00 is “the system provides easy controls to change mistakes” because the system doesn't have controls for customers to edit their inputs after submitting. The two indicators with the highest mean of 4.40 are “using the system would enhance effectiveness on the job”, and “does the system functions give accurate results”. Both prove that the system aids the processes and provides accurate results as expected. The result of the criteria for functionality, based on the answers of the respondents, is a weighted mean of 4.27 which is equivalent to very satisfactory.

TABLE 3 WEIGHTED MEAN AND DESCRIPTION OF THE FUNCTIONALITY OF THE AUTOMOBILE SERVICE MANAGEMENT SYSTEM FOR ALL RESPONDENTS

Indicators	Group Response			
	A	B	Mean	Description
Does the system functions give accurate results	4.40	4.40	4.40	Very satisfactory
Using the system would enhance effectiveness on the job	4.60	4.20	4.40	Very satisfactory
The system provides easy controls to change mistakes	4.60	3.40	4.00	Very satisfactory
The system provides the common functionalities as it is expected	4.40	4.20	4.30	Very satisfactory
General weighted mean	4.50	4.05	4.27	Very satisfactory

Table 4 shows the weighted mean of both groups of respondents in terms of the usability of the system. The indicator that has the lowest mean of 3.90 is “does the system require extensive knowledge to operate” due to the

number of features available on the system that requires training for users. The indicator with the highest mean of 4.50 or very satisfactory is “the overall layout of the system and navigation of the interface is understandable” because the page view is rendered based on the user job title and shows all features associated with it. Overall, usability got a mean of 4.30 or very satisfactory as a result of the ratings given by the respondents.

TABLE 4 WEIGHTED MEAN AND DESCRIPTION OF THE USABILITY OF THE AUTOMOBILE SERVICE MANAGEMENT SYSTEM FOR ALL RESPONDENTS

Indicators	Group Response			
	A	B	Mean	Description
Software can be easily navigate and understood	4.40	4.40	4.40	Very satisfactory
Does the system require extensive knowledge to operate	3.80	4.00	3.90	Very satisfactory
The system functions can be easily understood as it is presented.	4.20	4.60	4.40	Very satisfactory
The overall layout of the system and navigation of the interface is understandable	4.60	4.40	4.50	Very satisfactory
General weighted mean	4.25	4.35	4.30	Very satisfactory

Table 5 shows the weighted mean of both groups of respondents in terms of the reliability of the system. The indicator with the lowest mean of 3.90 is “the system is always available to use” because of problems with shared hosting service that affects Laravel framework. The indicator with the highest mean of 4.50 is “generates right and accurate results” because the output of the system is accurate in most of its functions. Overall, the weighted mean for reliability is 4.27 or very satisfactory, as a result of the ratings given by the respondents.

TABLE 5 WEIGHTED MEAN AND DESCRIPTION OF THE RELIABILITY OF THE AUTOMOBILE SERVICE MANAGEMENT SYSTEM FOR ALL RESPONDENTS

Indicators	Group Response			
	A	B	Mean	Description
The system provides error messages in wrong data entries	4.20	4.40	4.30	Very satisfactory
The system is always available to use	3.80	4.00	3.90	Very satisfactory
Generates right and accurate results	4.40	4.60	4.50	Very satisfactory
Free from system error or crashes	4.40	4.40	4.40	Very satisfactory
General weighted mean	4.20	4.35	4.27	Very satisfactory

Table 6 shows the weighted mean of both groups of respondents in terms of the performance of the system. The indicator with the lowest mean of 4.30 is “the system does not take too much time to load” because the system uses

CDN based CSS and JavaScript libraries that take some time to load; and the system operate on shared hosting with limited resources and bandwidth. The indicator with the highest mean of 4.60 is “the system does not consume too much computer resources” because the system runs on a remote server and the customer side only requires a web browser. The weighted mean for performance is 4.46 or very satisfactory.

TABLE 6 WEIGHTED MEAN AND DESCRIPTION OF THE PERFORMANCE OF THE AUTOMOBILE SERVICE MANAGEMENT SYSTEM FOR ALL RESPONDENTS

Indicators	Group Response			
	A	B	Mean	Description
The system does not take too much time to load	4.20	4.40	4.30	Very satisfactory
The system does not consume too much computer resources	4.80	4.40	4.60	Excellent
The system does not take much time to boot up	4.80	4.20	4.50	Very satisfactory
General weighted mean	4.60	4.33	4.46	Very satisfactory

Table 7 shows the weighted mean of both groups of respondents in terms of the supportability of the system. The two indicators with the lowest mean of 3.60 are “can the system be easily configured” and “can the system be extended to meet the demands” because of the shortage of account settings available for customers and the fair number of system configurations required to run the system. The indicator with the highest mean of 3.70 “is the system easy to maintain” since it is really easy to maintain and update the system. Overall, the weighted mean for supportability is 3.63 or very satisfactory, as a result of the ratings given by the respondents.

TABLE 7 WEIGHTED MEAN AND DESCRIPTION OF THE SUPPORTABILITY OF THE AUTOMOBILE SERVICE MANAGEMENT SYSTEM FOR ALL RESPONDENTS

Indicators	Group Response			
	A	B	Mean	Description
Can the system be easily configured	3.80	3.40	3.60	Very satisfactory
Is the system easy to maintain	3.60	3.80	3.70	Very satisfactory
Can the system be extended to meet the demands	3.60	3.60	3.60	Very satisfactory
General weighted mean	3.66	3.60	3.63	Very satisfactory

I. CONCLUSION

The developed system from the project (Automobile Service Management System) introduced a large set of tools and features to support MAS Motors LLC. It increases the customers' satisfaction by reducing the process time and providing online services including booking and service

history reports via the customer portal. It also serves as a platform to be utilized by all branches to collect and analyze data for marketing and reporting purposes.

II. RECOMMENDATIONS AND FUTURE WORK

Based on the conclusions drawn, the following recommendations were made for the improvement of the developed system and for future work:

1. There should be an automated SMS notification for service customers for appointments reminders.
2. Customers should be notified through SMS to visit again, based on their last visit and factory service schedule.
3. On the home page, customer contact form should include a phone number field.
4. Integrate social media with the blog feature available in the system.

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