Garage Management System

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Garage Management System

Project Overview :

The Garage Management System (GMS) is a comprehensive web-based application designed to streamline and automate garage operations. This system enables efficient management of vehicle servicing, inventory control, customer records, and staff assignments. It aims to eliminate manual record-keeping and enhance the overall productivity of garage operations.

The GMS allows administrators and authorized users to manage vehicle details, track service history, and monitor the time each vehicle spends in the workshop. It maintains an updated inventory of car components and provides tools for generating repair estimates and scheduling deliveries. Additionally, the system can send automated service reminders to customers based on previous service dates, ensuring timely follow-ups and improved customer satisfaction.

Administrative access is secured and restricted to authorized personnel only. The administrator can manage different user roles such as supervisors, receptionists, and mechanics, thereby ensuring organized workflow and accountability. The system also supports task allocation, enabling administrators to assign engineers and technicians specific jobs according to their expertise.

Overall, the Garage Management System serves as a smart and efficient web application that enhances the management of day-to-day garage activities, reduces manual effort, and improves operational efficiency.

Introduction:

The Garage Management System (GMS) is a web-based application designed to efficiently manage and automate all garage operations. It provides separate access levels for administrators, principals, receptionists, and supervisors, ensuring secure and role-based functionality. The system enables users to monitor vehicle service status, track spare parts inventory, record work hours, and process repair or service payments. Built using HTML and PHP, it offers a user-friendly interface for smooth navigation and interaction.

The primary objective of this project is to identify and fulfill the functional and non-

functional requirements of an efficient garage management solution. The GMS assists auto repair businesses in organizing daily operations, maintaining client and vehicle histories, and managing transactions with customers and suppliers. Through automation and data management, the system enhances productivity and accuracy. This document also presents system models such as DFD, ER diagrams, and UML diagrams to describe the hardware and software interface requirements of the project.

Problem Statement :

Traditional garage operations rely heavily on manual record-keeping and paper-based processes, which often lead to inefficiencies such as data loss, delayed service tracking, inaccurate inventory management, and poor customer follow-up. Managing multiple activities—such as vehicle servicing, spare parts inventory, employee assignments, and payment processing—becomes difficult without a centralized system.

Additionally, garages face challenges in maintaining proper service histories for vehicles, notifying customers of upcoming maintenance, and coordinating tasks among staff members. The absence of an integrated digital solution results in reduced productivity, lack of transparency, and potential financial discrepancies.

Therefore, there is a need for a web-based Garage Management System that automates day-to-day operations, maintains accurate records, facilitates communication between staff and customers, and provides real-time access to essential garage data. This system aims to improve efficiency, accuracy, and customer satisfaction while minimizing manual effort.

Objectives :

The main objective of the Garage Management System (GMS) is to automate and streamline garage operations to improve efficiency, accuracy, and customer satisfaction. This system aims to replace traditional manual methods with a digital platform that manages all aspects of a garage's workflow — from vehicle servicing and spare parts inventory to customer records and payment processing.

Specific Objectives :

- To provide a user-friendly web interface for managing garage operations efficiently.
- To enable online booking and appointment scheduling for vehicle servicing.
- To maintain a complete service history of all vehicles for easy tracking and

reference.

- To manage and monitor inventory of spare parts and materials in real time.
- To allow secure and quick payment processing through the system.
- To send automated service reminders and notifications to customers

Tools and Technology :

Software configuration

- Operating system: Windows XP Professional
- Environment: Visual studio NET 2005 4.6
- Frontend: CSS, HTML, Javascript, JSON, jQuery
- Backend: MySQL, PHP

Tools Used

- Xampp
- My SQL Workbench
- VS Code

Technology :

Database:

Any collection of data or information specially organized for quick computer search and retrieval is called a database, generally referred to as an electronic database. The database is designed to make data storage, retrieval, modification, deletion and other data processing procedures as simple as possible. To obtain information from the database, records and documents must be organized. Users access the information in the database mainly through queries. The advantage of a database management system (DBMS) is that new relationships can be created based on the basic relationships provided by tables and use them to answer queries.

Frontend - HTML, CSS, Javascript, JSON andjQuery:

HTML: HTML stands for HyperText Markup Language in its entire form. HTML programming allows people to share their ideas with the rest of the world via the internet. Pages have a clearer, more straightforward element structure, making them easier to design, change, and debug—as well as to create automated services that aid

in the discovery of key web resources. HTML is one of the 3 most significant tools for building a website: HTML defines the structure of a website, including how text, images, and other content will appear. Websites and web-based content use HTML as their primary language. It aids a browser's comprehension of the structure and style of a document or files for internet reading.

CSS: Cascading style sheets (CSS) is used to optimize pages for responsive web design and to generate more advanced graphics such as hover effects, in addition to adjusting simple things like colors, fonts, and spacing. A style sheet instructs the web browser on how to display the content in question.

A style sheet instructs the web browser on how to display the content in question. All style sheets in CSS are cascading, which is a crucial idea to grasp. Even if the designer hasn't applied any styles, every web page is touched by at least one style sheet. The User Agent stylesheet contains the default styles added by the browser.

Javascript: JavaScript is a web programming language that adds motion to websites to make them look more alive. To be more specific, it's a programming language that allows to create complicated and beautiful web pages. It's an interpreted high-level programming language.

JSON: JavaScript Object Notation (JSON) is a text- based, schema less structured data representation that uses key-value pairs and organized lists. Although JSON was developed from JavaScript, it is compatible with most major programming languages either directly or through libraries. It is widely used, but not specifically for sending and receiving data between Web clients and servers.

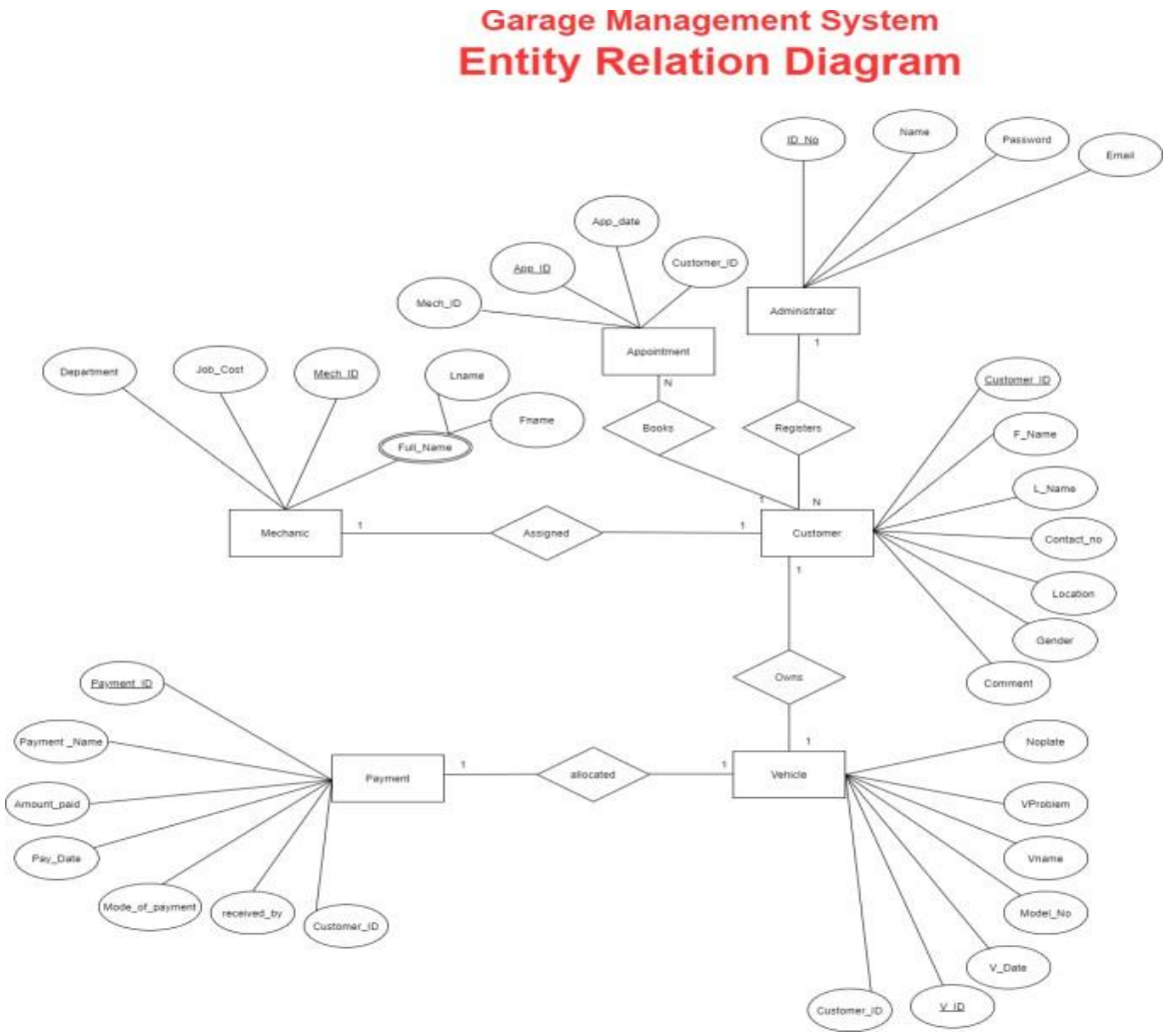
Backend :

PHP: PHP is a server-side, open-source, object-oriented scripting language. PHP is a popular web development language. The current development paradigm PHP organizes without a structure, combining data access code, business logic processing code, and web display layer code.

MySQL: In today’s modern big data world, MySQL is one of the most well-known technologies. MySQL is a structured query language-based relational database management system (RDBMS) created by Oracle (SQL). A database is a collection of data that has been organized into a logical structure. A relational database, in particular, is a digital repository for data that is organized using the relational paradigm. Tables in this model are made up of rows and columns, and data element relationships are all organized logically.

Database Design Phase:

Database Design (ER Diagram):



Database Schema:

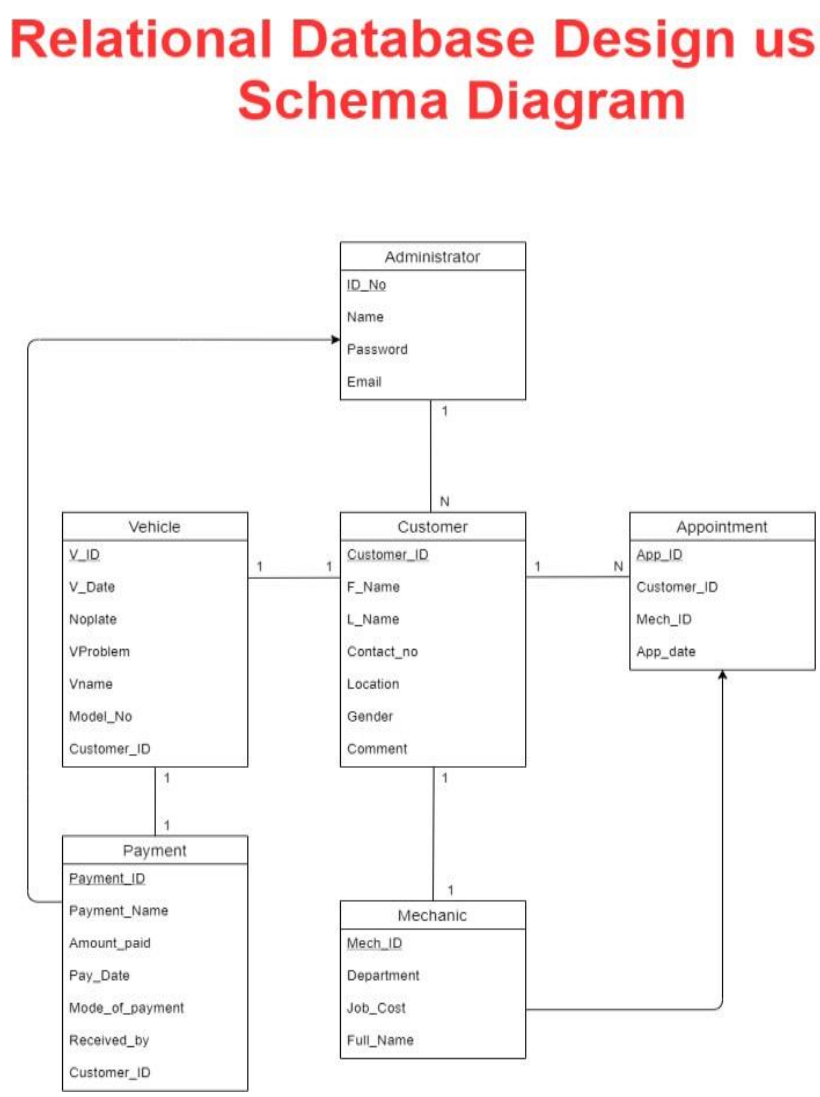
Customer (Customer_ID, F_Name, L_Name, Contact_no, Location, Gender, Comment)

Vehicle (V_ID, V_Date, Model_No, Vname, VProblem, Noplate, Customer_ID)

Payment (Payment_ID, Payment_Name, Amount_paid, Pay_Date, Mode_of_payment, Received_by, Customer_ID)

Mechanic (Mech_ID, Department, Job_Cost, Lname, Fname) Appointment (App_ID, Customer_ID, Mech_ID, App_date) Administrator (ID_No, Name, Password, Email)

Relational Database Design Using Schema Diagram :



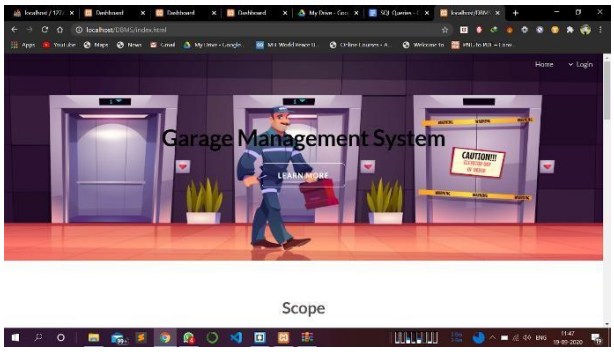
Database Normalization till 3 NF :

Customer (Customer_ID, F_Name, L_Name, Contact_no, Location, Gender, Comment)
Its in 1 NF since the atomicity is one. Its also in second NF since there is no partial dependency and also in 3 NF since there is no transitive dependency.
Hence, its in 3 NF.
Vehicle (V_ID, V_Date, Model_No, Vname, VProblem, Noplate, Customer_ID)
Composite key: V_ID+ Customer_ID
Table is in 3NF since all attribute depend on primary key V_ID and foreign key Customer_ID.
Payment (Payment_ID, Payment_Name, Amount_paid, Pay_Date, Mode_of_payment, Received_by, Customer_ID)
Composite key: Payment_ID+ Customer_ID
Table is in 3NF since all attribute depend on primary key Payment_ID and foreign key Customer_ID.
Mechanic (Mech_ID, Department, Job_Cost, Lname, Fname)
Its in 3 NF since all attributes only depend on Mech_ID which is primary key.
Appointment (App_ID, Customer_ID, Mech_ID, App_date) Composite key: App_ID+ Customer_ID+Mech_ID
Table is in 3 NF since all attribute depend on primary key App_ID, Customer_ID, Mech_ID
Administrator (ID_No, Name, Password, Email)
Its in 3 NF since all attributes only depend on ID_No which is primary key.

EXPERIMENTAL WORK :

Frontend& UI/UX

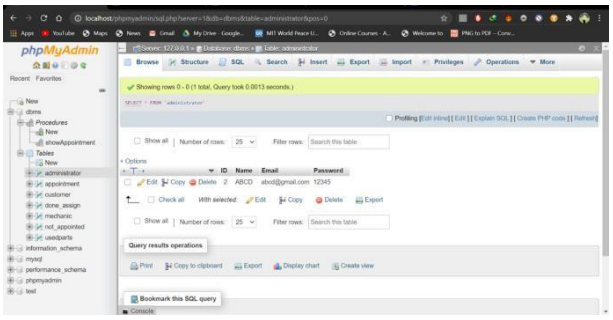
HTML, CSS, JSS, and Bootstrap are used to create the UI/UX. Admin, Mechanic, and Customer all have login access at the navigation bar on the homepage.



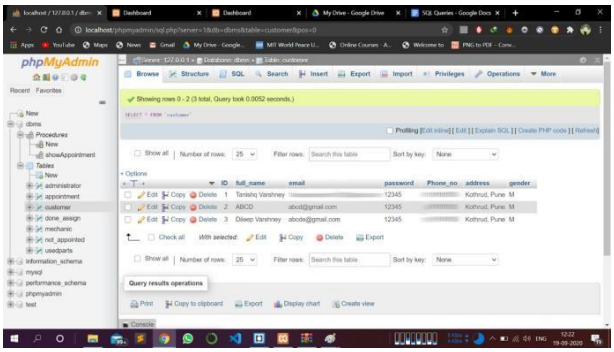
Garage Management System Homepage

PHP and MySQL :

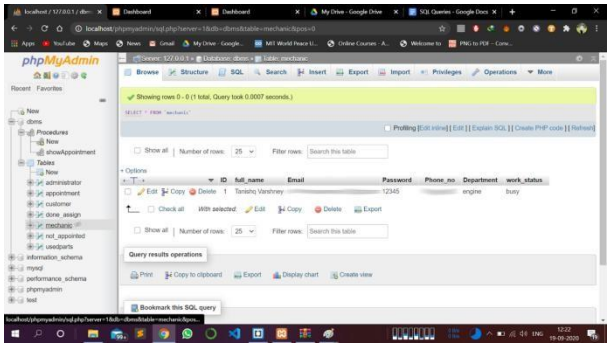
PHP is used for the backend, and MySQL is used for the database. Three different tables for Admin, Mechanic, and Customer are constructed for login. HTML performs password validation on the password field.



MySQL table for Administrator



MySQL table for Customer

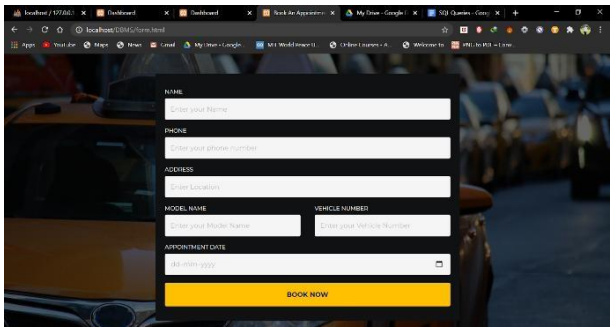


MySQL table for Mechanic

Query used for creating these tables are:

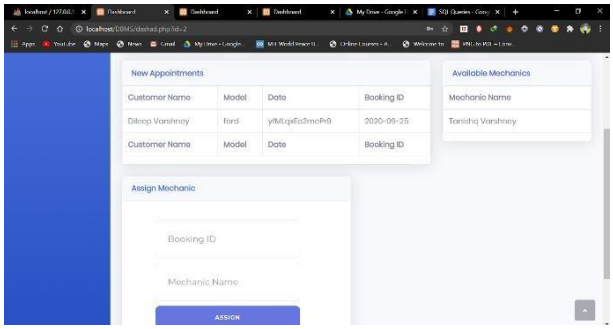
- create table administrator(ID int(30) primary key auto_increment, Name char(30), Email varchar(30), Password varchar(30));
- create table customer(ID int(10) primary key auto_increment ,full_name char(30), email varchar(30), password varchar(30), Phone_no bigint(30) check(Phone_no>0), address varchar(50), gender char(10));
- create table mechanic(ID int(10) primary key auto_increment, full_name char(30), Email varchar(30), Password varchar(30), Phone_no bigint(30) check(Phone_no>0), Department char(30), work_status char(10));

ID is set to auto increment and is set as the primary key to prevent its duplication. The status of mechanic will be free initially because the admin has not allocated any impending appointments to him. After logging in, a customer can schedule an appointment for his vehicle, which will appear on the admin's dashboard along with the names of available mechanics which is done by creating routines.



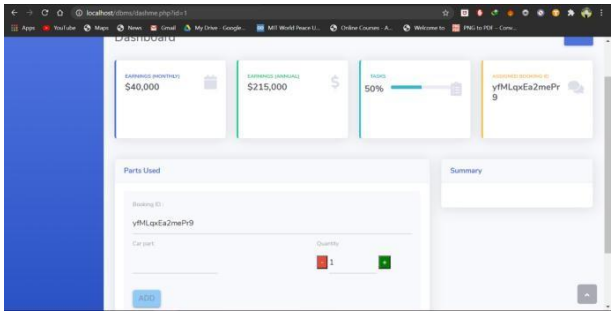
Booking an Appointment

The appointment booking form is written in HTML with a POST method. All of the information will be saved in the database table Appointment. A 14-digit booking id is generated using PHP's Random string function and later allocated to a specific appointment. Admin can easily assign the available mechanic to an upcoming appointment and both the customer and mechanic will be notified on their respective dashboards.

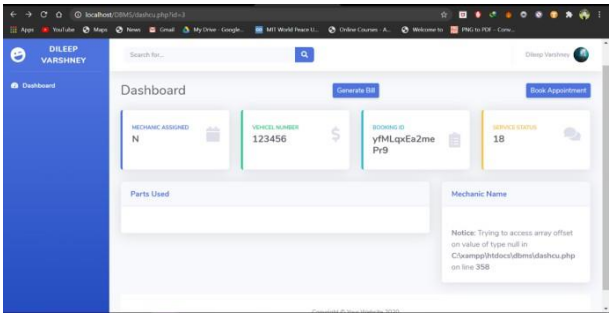


Admin's Dashboard

The value of Mechanic assigned at the customer's dashboard is changed to Y, and the value of status at the mechanic's dashboard is set to busy once the mechanic is assigned. Create triggers on the customer and mechanic tables to complete this operation. Mechanics can enter a list of components that were used in the vehicle's servicing, which will be saved in the Used Parts table and displayed to the client. The components will be recorded as JSON data, which will consist of a collective array of Name and Quantity. At the end of the process, the mechanic can complete the task on his end, and the customer will receive a thorough copy of the bill that contains all of the parts and their amounts.

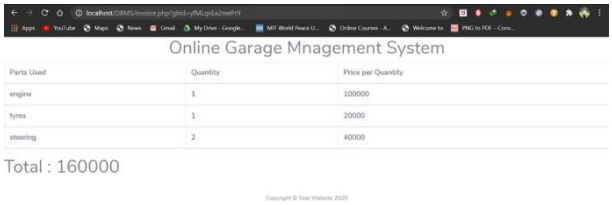


Mechanic's Dashboard



Customer's Dashboard

Final Bill :



Final Bill

Routine used in the database is :

```
BEGIN
 DECLARE cname, m_name char(30);
 DECLARE bookid varchar(30); DECLARE bdate date;
 DECLARE exit_loop BOOLEAN DEFAULT FALSE; DECLARE c1 CURSOR FOR
 SELECT full_name,
model_name, date, gbid FROM appointment WHERE mech_assign = 'N';
 DECLARE CONTINUE HANDLER FOR not found SET
exit_loop = TRUE;
 TRUNCATE TABLE not_appointed; OPEN c1;
 book_loop:LOOP
        FETCH FROM c1 INTO cname, m_name, bdate,
bookid;
        IF exit_loop THEN LEAVE book_loop;
        END IF;
    SELECT cname, m_name, bdate, bookid;
    INSERT INTO not_appointed VALUES (cname, bookid, m_name, bdate);
  END LOOP book_loop; CLOSE c1;
END
```

Advantages:-

1. Automation of Operations

The GMS automates key garage functions such as booking, service tracking, billing, and inventory management. This reduces manual work, saves time, and minimizes human errors in daily operations.

2. Efficient Record Management

All vehicle service histories, customer details, and spare parts information are stored in a centralized database. This ensures quick data retrieval and better organization compared to traditional paper-based systems.

3. Improved Customer Experience

Customers can easily book services online, track the status of their vehicles, and receive timely notifications about service schedules. This convenience enhances customer satisfaction and loyalty.

4. Real-Time Inventory Tracking

The system helps supervisors and administrators monitor the availability of spare parts and materials in real time. This prevents stock shortages and ensures that repair work proceeds smoothly.

5. Time and Cost Efficiency

By streamlining operations and automating routine tasks, the GMS saves both time and operational costs. It also optimizes resource utilization, leading to higher productivity.

6. Enhanced Communication

The platform facilitates better communication between garage staff and customers through notifications, updates, and feedback modules. This helps maintain transparency and trust.

7. Secure Data Management

Role-based access control ensures that only authorized users can access specific modules. This enhances data security and prevents unauthorized modifications.

8. Reporting and Analysis

Administrators can generate detailed reports on services, payments, inventory usage, and employee performance. These insights support better decision-making and business planning.

Disadvantages:-

1. Initial Setup Cost

Implementing the GMS requires investment in hardware, software, and internet infrastructure, which may be expensive for small or newly established garages.

2. Technical Knowledge Requirement

Users such as mechanics or receptionists may need basic computer and software training to effectively use the system, which can take time and resources.

3. Internet Dependency

As the system is web-based, it relies heavily on a stable internet connection. Poor connectivity can disrupt access to the system and delay operations.

4. Data Security Risks

Although the system includes access control, there is still a potential risk of data breaches, hacking, or unauthorized access if proper cybersecurity measures are not maintained.

5. System Maintenance and Updates

Regular maintenance, software updates, and backups are required to keep the system running smoothly. Neglecting these tasks may lead to errors or system downtime.

6. Possibility of Technical Failures

Technical issues such as server crashes, software bugs, or power outages can temporarily halt operations, affecting productivity and customer service.

7. Limited Accessibility for Non-Digital Users

Customers or staff who are not comfortable with online systems may find it difficult to adapt to digital booking and management processes.

Future Scope :-

- Integration of **Artificial Intelligence (AI)** and **Machine Learning (ML)** to predict vehicle maintenance needs and provide automated service recommendations.
- Development of a **mobile application** version to allow users to access the system conveniently from anywhere.
- Implementation of **online payment gateways** and **digital wallet integration** for faster and more secure transactions.
- Addition of **GPS and mapping services** to help users locate nearby garages in real time, especially during emergencies.
- Introduction of an **automated customer feedback and rating system** to maintain and improve service quality.
- Expansion to support **multi-garage networking**, enabling collaboration between different service centers for inventory sharing and customer referrals.
- Incorporation of **automated notifications and reminders** using SMS or email for upcoming services or offers.
- Enhancement of **data analytics and reporting tools** to help administrators monitor performance and make informed decisions.

Conclusion:

The Garage Management System (GMS) provides an efficient, reliable, and user-friendly solution for managing all aspects of garage operations. By automating key processes such as vehicle service tracking, inventory management, appointment scheduling, and payment processing, the system reduces manual effort, minimizes errors, and improves overall productivity. It enhances customer experience by offering timely updates, service reminders, and convenient online booking. With role-based access and secure data management, the GMS ensures smooth coordination among administrators, staff, and customers. Overall, this system modernizes traditional garage operations, making them more organized, efficient, and customer-centric.