A

MAJOR PROJECT ON

VEHICLE MAINTAINANCE INDEX

A Report for Major Project

Submitted By -

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in partial fulfillment for the award of the degree of

Bachelors in Computer Applications

DECLARATION

I undersigned, hereby declare that the project titled “Vehicle Maintenance Index” submitted in partial fulfillment for the award of Degree of Bachelors in Computer Application of MAKAUT is a bonafide record of work done by me under the guidance of Mrs. Rupa Saha.

BONAFIDE CERTIFICATE

Certified that this project work was carried out under the supervision development of a feature rich, “Vehicle Maintenance Index” is the bonafide work of

Student Name: ***Signature:***

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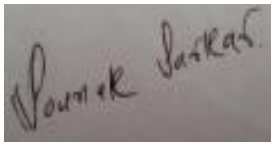

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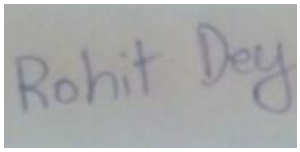

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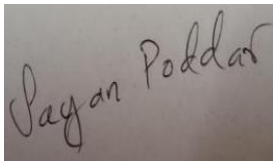

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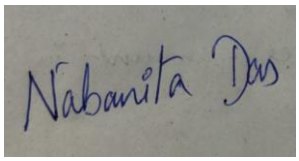

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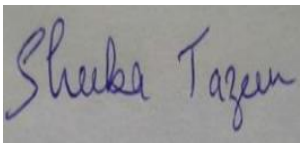

ACKNOWLEDGEMENT

We are over helmed in all humbleness and gratefulness to acknowledge our depth to all those who have helped us to put these ideas, well above the level of simplicity and into something concrete. We would like to express our special thanks of gratitude to our professor and mentor Mrs. Rupa Saha as well as our principal who gave us the golden opportunity to do this wonderful project to create a Vehicle Maintenance application, which also helped us in doing a lot of Research and we came to know about so many new things. We are really thankful to them. Any attempt at any level can ‘t be satisfactorily completed without the support and guidance of our mentors and group members. We would like to thank our parents who helped us a lot in gathering different information, collecting data and guiding us from time to time in making this project, despite of their busy schedules, they gave us different ideas in making this project unique.

Sounak Sarkar

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LIST OF TABLES

1. ABSTRACT

Vehicle Maintenance System is a system that is developed to assist car owners from facing problems especially when there is a vehicle breakdown. Vehicles in Malaysia do not have any available platform system that can provide assistance, diagnostic and telematics services to car owners. As vehicles are connected with various components of vehicle control unit, huge number of data are generated. Gathering this data has become a part of the connected vehicle research scope. However, car owners do not understand raw vehicle data unless their vehicles are brought to a service center. Thus, enabling in-vehicle system to interpret and monitor this data is an advancement of technology and provides a convenient driving environment for car owners.

2. INTRODUCTION

Entering the twenty-first century, information technology weapons and equipment have gradually developed, high-tech weapon ratio has increased, and the corresponding equipment support forces have also been changed. In order to improve the support capability of the maintenance support system and give full play to the effectiveness of the existing support resources, the allocation structure of the support force must be optimized and adjusted. The traditional maintenance support resources have a shortage of scientific calculation methods. They mainly rely on subjective experience, historical data comparison, and other methods and lack the support of quantitative methods, which leads to bad phenomena such as low maintenance efficiency and waste of resources.

As an important part of modern military weapons and equipment, vehicle equipment is one of the important factors to improve the combat effectiveness of the army. However, the current situation of vehicle equipment maintenance support is still difficult to meet the requirements of the new circumstances, and the corresponding theoretical research does not dive deep enough. There are still some problems in terms of vehicle equipment, such as low maintenance efficiency and unreasonable allocation of maintenance personnel. The optimization of maintenance personnel is an important research content of support force allocation. The reasonable allocation of maintenance personnel and the adjustment of the number of technical personnel at various levels can enable the maintenance organization to have a reasonable structure of technical personnel, support tasks can be completed in a timely and efficient manner, and equipment support can obtain maximum benefits. Maintaining and repairing the normal use function and technical condition of the vehicle is the main measure to ensure the combat capability of the vehicle equipment. It is a realistic and meaningful work to do a good job in the optimization of vehicle equipment maintenance personnel.

2.1. RCPSP (Resource-Constrained Project Scheduling Problem)

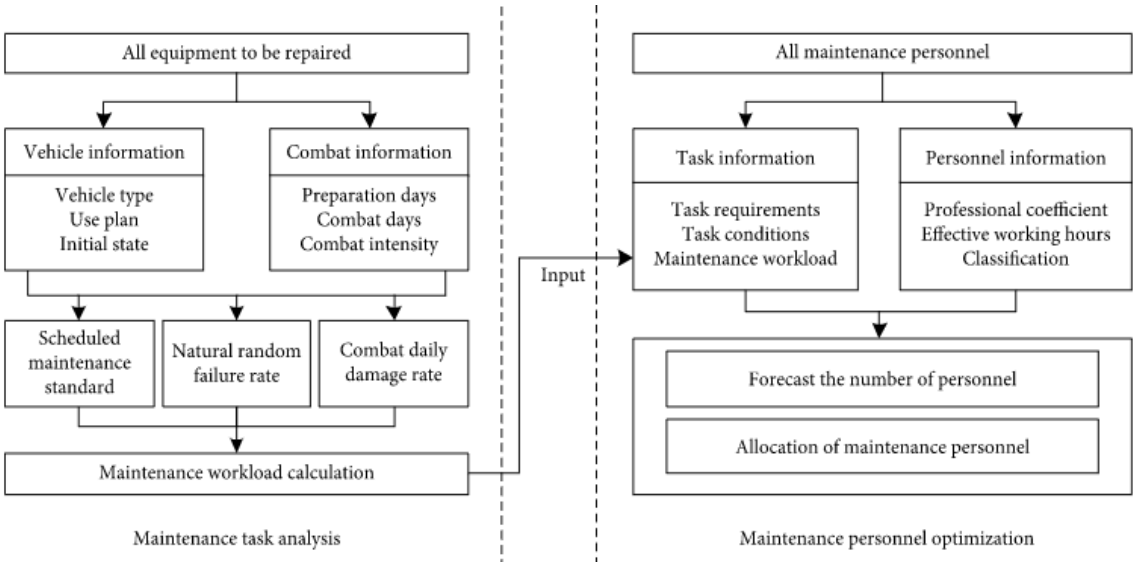
The contents of the research on the optimization of maintenance support resources are varied, and the methods adopted are also different. It mainly includes three types: RCPSP (Resource-Constrained Project Scheduling Problem), inventory control of maintenance spare parts, and prediction optimization of maintenance personnel.

The RCPSP is a scheduling optimization problem in an environment where maintenance resources have been determined. In the aspect of modeling and solving the RCPSP problem, researchers mainly establish the multi constrained programming model and use the heuristic algorithm to study. References study the MRCPSP (Multimode Resource-constrained Project Scheduling Problem), considering human, machinery, equipment, and consumptive resources,

and use the meta-heuristic algorithm to solve these problems effectively. The PRCPSP (Preemptive Resource-Constrained Project Scheduling Problem) mathematical model aiming at the shortest maintenance time and the minimum total load of maintenance personnel is established in references. Literature introduces GPRs (Generalized priority relation) and AON (Activity-On-Node) to describe the sequential relationship of tasks and uses an improved cuckoo algorithm to solve the problem. Literature improves the tabu search algorithm and solves the RCPSP model. Literature considers the resource constraints such as personnel, support equipment, workstation space, and replenishment resource and establishes a mathematical model of RSPFDO (robust scheduling problem for flightdeck operation), with the goal of maximizing the probability of completion and minimizing the expected completion time.

2.2. Analysis of Maintenance Tasks of Vehicle Equipment

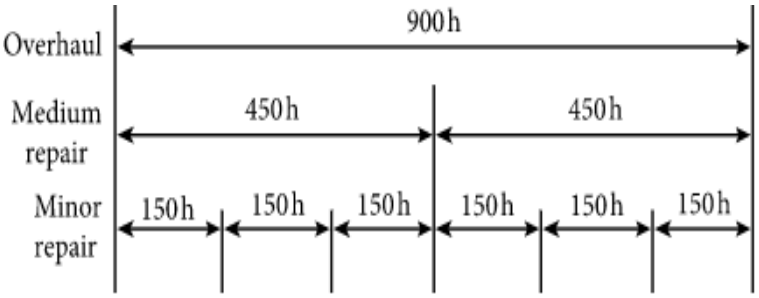
Scientific analysis of vehicle equipment maintenance tasks is the basis of human resources optimization. The determination process of personnel resources in maintenance support is shown below. First, group the damage types of vehicle equipment, and estimate the workload of each group of maintenance tasks based on information such as the use plan of the vehicle equipment during the guarantee period, the initial state, the maintenance standard, and the failure rate of the scheduled maintenance. Then, according to the existing maintenance personnel and actual needs, the number of maintenance personnel is predicted and so is the configuration of staffing.



The use phase of vehicles includes the daily training phase and combat phase, mainly for preventive maintenance and damage repair. Due to the relatively long period of time in the daily training phase, the sources of maintenance tasks mainly include scheduled preventive maintenance and natural fault repair.

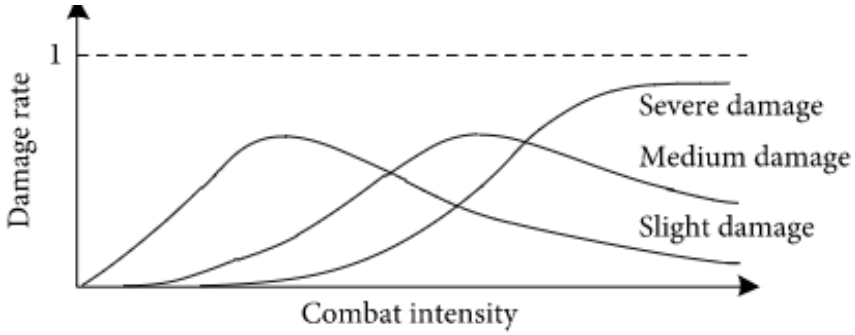
In addition, the source of maintenance tasks in the combat phase mainly includes combat damage repairs.

Scheduled repairs include minor repair, medium repair, and overhaul, which are determined by the intensity of vehicle use. The intensity of use is related to the working hours of the vehicle. Minor repair refers to the activity of maintaining the tactical and technical performance of equipment; medium repair refers to the activity of restoring the tactical and technical performance of equipment; overhaul refers to the activity of fully restoring the tactical and technical performance of equipment. Taking a certain type of armored vehicle as an example, the ratio of the number of major, medium, and minor repairs during each major repair interval is 1: 1: 4, as shown below. After general overhaul, the vehicle is equipped as new and the working hours are reset to zero.



Natural failure and combat damage maintenance are restorative maintenance, which refers to damage failures that have not been used until the specified repair interval. Natural failures are often closely related to the working hours of vehicles. The law of vehicle fault distribution includes Poisson distribution, normal distribution, and Weibull distribution. The failure rate based on vehicle-working hours can be predicted by vehicle historical fault data and some existing prediction models, such as neural network, ARMA model, and grey prediction model [30, 31]. Generally speaking, the longer the vehicle equipment engine works, the greater the probability of natural random failure.

Combat damage repair is mainly to repair vehicles damaged by weapons in the combat phase. According to the level of damage, it can be divided into complete damage, severe damage, moderate damage, and minor damage. In general, the relationship between the damage rate of vehicle equipment and combat intensity is shown below.



2.3. The main contributions of this research

(1) The maintenance task source of vehicle equipment and the determination process of maintenance personnel optimization are analyzed in detail, and the maintenance workload model of vehicle equipment is constructed, which mainly includes scheduled maintenance, natural random failure, and combat damage.

(2) In order to avoid the waste of human resources, in view of the maintenance tasks with enough human resources and aiming at minimizing the total number of maintenance personnel, a prediction model for the number of maintenance personnel is constructed. The model can be used to solve the number of maintenance personnel at each professional level, minimize the number of maintenance personnel, and meet the cumulative maintenance time limit.

(3) In order to maximize maintenance efficiency, in view of the shortage of maintenance human resources and the diversity of professional skills, an optimal allocation model of maintenance personnel with the goal of minimizing the cumulative repair time is constructed. The model can be used to allocate limited maintenance personnel to maximize maintenance efficiency and meet maintenance time constraints.

(4) The traditional fruit fly optimization algorithm (FOA) is improved by using the location update method of group collaboration, which improves the defect as the algorithm is easy to fall into local extreme value. The simulation results show that the improved FOA has good solution efficiency, and the personnel allocation scheme can effectively shorten the equipment maintenance time.

3. PROBLEM STATEMENT

3.1. Objectives

In Today's world with so many cars, models in the market, it is hard to find out which car has a high maintenance cost/index that is authentic source.

- System that shows the health and Maintenance Index of various components of car models or car parts based on multiple factors.

- This will help new buyers to understand the maintenance costs of a certain model and probability of which car part requires more often servicing /change, OEMs to understand which part is requiring frequent change and needs to be recalled and made better in the new models.

- Vehicle maintenance patterns across car models by mileage, usage, age of the vehicle, regional patterns across dealers, service stations and car manufacturer.

- Purpose and who will benefit.

- Consumers so they know which car has a higher maintenance and maintenance index.

- Car Manufacturers, so they know which parts are getting serviced often based on the part change.

- How does it help the nation.

- Better understanding for consumers on which car to purchase with low Vehicle Maintenance Index.

- Govt has better understanding of car maintenance index before approving cars on the Road (ARAI Authority).

- Practical and reasons why this idea could be a challenge from Implementation.

4. APPLICATION FOR VEHICLE MAINTENANCE INDEX

4.1. Software Requirements

- **Operating System:** Windows
- **Programming Language:** MS.NET
- **Web Technology:** Django
- **Front-End:** HTML, JavaScript
- **Back-End**: SQLServer2000
- **Web-Server**: IIS5.1

4.2. Modules

This project contains 3 modules namely:

- User Registration
- Vehicle Issue Registration
- Request Approval

User Registration

In this module, the users register themselves with their respective username, password, email id and photo.

Vehicle Issue Registration

In this module, the user registers the problem dealt with their vehicles and can request for a mechanic to solve the issue.

Request Approval

An admin from a automation center will approve the order and a mechanic will be delivered to the respective customer according to their orders.

4.3. Overview of Technologies used

HTML (Hyper Text Markup Language)

The hypertext markup language (HTML) is a simple markup language. Used to create a hypertext documents that are portable from one platform to another HTML documents are SGML (Standard generalized markup language) documents with generic semantics that are appropriate for representing information from a wide range of applications. This specification defines HTML version 3.2. HTML 3.2 aims to capture recommended practice as of early ‘96 and as such a replacement for HTML2.0 (RFC 1866). A set of instructions embedded in a document is called markup language. These instructions describe what the document text means and how it should look like in a display. Hyper Text Mark Up language (HTML) is the language used to encode World Wide Web documents.

WHY TO USE HTML?

Website is a collection of pages, publications, and documents that reside on web server. While these pages publications and a document as a formatted in a single format, you should use HTML for home page and all primary pages in the site. This will enable the millions of web users can easily access and to take advantage of your website. HTML is considered first for formatting

any new material you plan to publish on the web. HTML documents are platform independent, meaning that they don‘t confirm to any standard. If they are created properly, you can move home page to any server platform or you can access them with any complaint www browser.

JavaScript

JavaScript (JS) is a lightweight, interpreted, or just-in-time compiled programming language with first-class functions. While it is most well-known as the scripting language for Web pages, many non-browser environments also use it, such as Node.js, Apache CouchDB and Adobe Acrobat. JavaScript is a prototype-based, multi-paradigm, single-threaded, dynamic language, supporting object-oriented, imperative, and declarative (e.g., functional programming) styles.

The standards for JavaScript are the ECMAScript Language Specification (ECMA-262) and the ECMAScript Internationalization API specification (ECMA-402). The JavaScript documentation throughout MDN is based on the latest draft versions of ECMA-262 and ECMA-402. And in cases where some proposals for new ECMAScript features have already been implemented in browsers, documentation and examples in MDN articles may use some of those new features.

Django

Django is a high-level Python web framework that enables rapid development of secure and maintainable websites. Built by experienced developers, Django 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 is free and open source, has a thriving and active community, great documentation, and many options for free and paid-for support.

When a request comes to a web server, it's passed to Django which tries to figure out what is actually requested. It takes a web page address first and tries to figure out what to do. This part is done by Django's URL resolver (note that a website address is called a URL – Uniform Resource Locator – so the name URL resolver makes sense). It is not very smart – it takes a list of patterns and tries to match the URL. Django checks patterns from top to bottom and if something is matched, then Django passes the request to the associated function (which is called view).

Imagine a mail carrier with a letter. She is walking down the street and checks each house number against the one on the letter. If it matches, she puts the letter there. This is how the URL resolver works!

In the view function, all the interesting things are done: we can look at a database to look for some information. Maybe the user asked to change something in the data? Like a letter saying, "Please change the description of my job." The view can check if you are allowed to do that, then update the job description for you and send back a message: "Done!" Then the view generates a response and Django can send it to the user's web browser.

SQLServer2000

Microsoft SQL Server is a Structured Query Language (SQL) based, client/server relational database. Each of these terms describes a fundamental part of the architecture of SQL Server. Database A database is similar to a data file in that it is a storage place for data. Like a data file, a database does not present information directly to a user; the user runs an application that accesses data from the database and presents it to the user in an understandable format. A database typically has two components: the files holding the physical database and the database management system (DBMS) software that applications use to access data. The DBMS is responsible for enforcing the database structure, including

:

- Maintaining the relationships between data in the database.
- Ensuring that data is stored correctly and that the rules defining data relationships are not violated.
- Recovering all data to a point of known consistency in case of system failures.

Relational Database

There are different ways to organize data in a database but relational databases are one of the most effective. Relational database systems are an application of mathematical set theory to the problem of effectively organizing data. In a relational database, data is collected into tables (called relations in relational theory). When organizing data into tables, you can usually find many different ways to define tables. Relational database theory defines a process, normalization, which ensures that the set of tables you define will organize your data effectively.

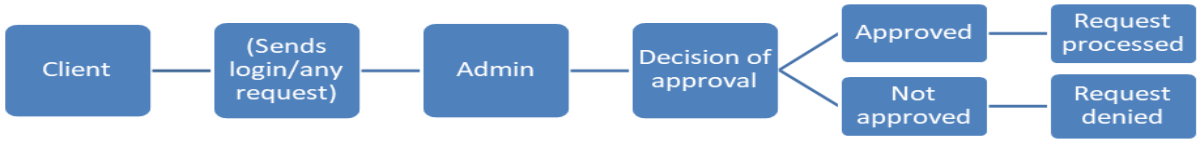
Client/Server:-

In a client/server system, the server is a relatively large computer in a central location that manages a resource used by many people. When individuals need to use the resource, they connect over the network from their computers, or clients, to the server. Examples of servers are: In a client/server database architecture, the database files and DBMS software reside on a

server. A communications component is provided so applications can run on separate clients and communicate to the database server over a network. The SQL Server communication component also allows communication between an application running on the server and SQL Server.

Server applications are usually capable of working with several clients at the same time. SQL Server can work with thousands of clients applications simultaneously. The server has features to prevent the logical problems that occur if a user tries to read or modify data currently being used by others. While SQL Server is designed to work as a server in a client/server network, it is also capable of working as a stand-alone database directly on the client. The scalability and ease-of-use features of SQL Server allow it to work efficiently on a client without consuming too many resources.

4.4. Application Design



4.5. Implementation

Implementation is the stage where the theoretical design is turned into a working system. The most crucial stage in achieving a new successful system and in giving

confidence on the new system for the users that it will work efficiently and effectively. The system can be implemented only after thorough testing is done and if it is found to work according to the specification.

It involves careful planning, investigation of the current system and its constraints on implementation, design of methods to achieve the changeover and an evaluation of change over methods a part from planning. Two major tasks of preparing the implementation are education and training of the users and testing of the system.

The more complex the system being implemented, the more involved will be the systems analysis and design effort required just for implementation.

The implementation phase comprises of several activities. The required hardware and software acquisition is carried out. The system may require some software to be developed. For this, programs are written and tested. The user then changes over to his new fully tested system and the old system is discontinued.

4.6. Software Methodology

The software methodology followed in this project includes the object-oriented methodology and the application system development methodologies. The description of these methodologies are given below.

Application System Development – A Life cycle Approach

Although there are a growing number of applications (such as decision support systems) that should be developed using an experimental process strategy such as prototyping, a significant amount of new development work continue to involve major operational applications of broad scope. The application systems are large highly structured. User task comprehension and developer task proficiency is usually high. These factors suggest a linear or iterative assurance strategy. The most common method for this stage class of problems is a system development life cycle modal in which each stage of development is well defined and has straightforward requirements for deliverables, feedback and sign off. The system development life cycle is described in detail since it continues to be an appropriate methodology for a significant part of new

development work.

The basic idea of the system development life cycle is that there is a well-defined process by which an application is conceived and developed and implemented. The life cycle gives structure to a creative process. In order to manage and control the development effort, it is necessary to know what should have been done, what has been done, and what has yet to be accomplished. The phrases in the system development life cycle provide a basis for management and control because they define segments of the flow of work, which can be identified for managerial purposes and specifies the documents or other deliverables to be produced in each phase.

The phases in the life cycle for information system development are described differently by different writers, but the differences are primarily in the amount of necessity and manner of categorization. There is a general agreement on the flow of development steps and the necessity for control procedures at each stage.

The information system development cycle for an application consists of three major stages.

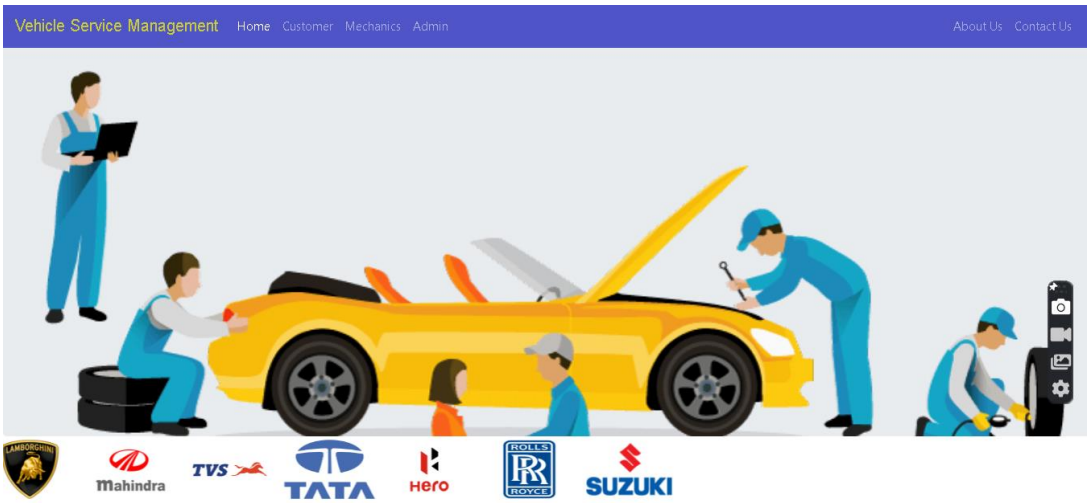
1) Definition.

2) Development.

3) Installation and operation.

The first stage of the process, which defines the information requirements for a feasible cost effective system. The requirements are then translated into a physical system of forms, procedures, programs etc., by the system design, computer programming and procedure development. The resulting system is test and put into operation. No system is perfect so there is always a need for maintenance changes. To complete the cycle, there should be a post audit of the system to evaluate how well it performs and how well it meets the cost and performance specifications.

4.7. Working of the Application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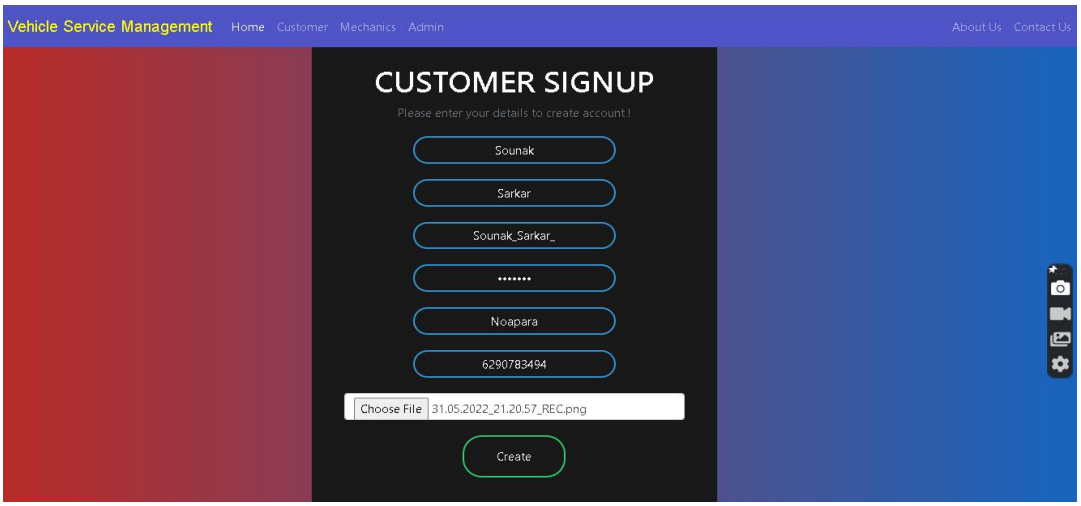
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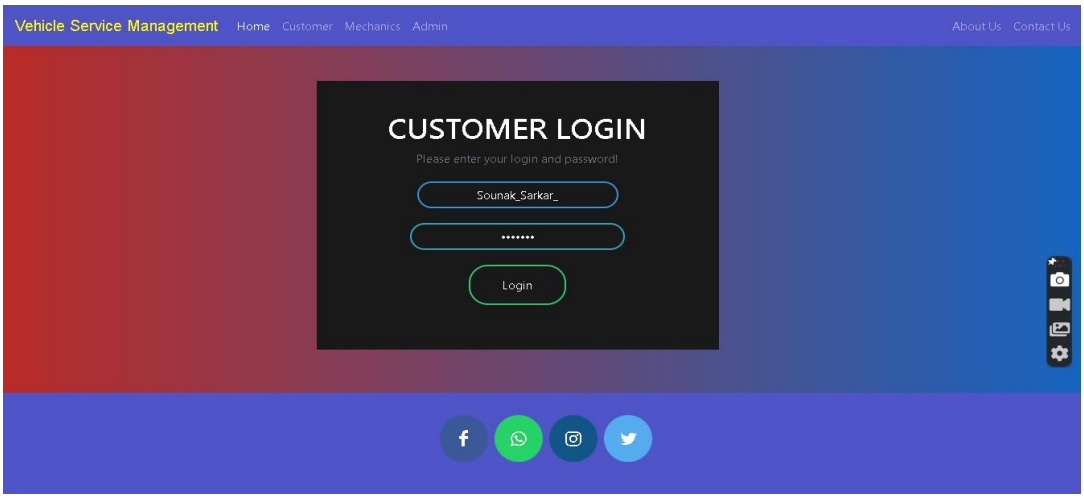
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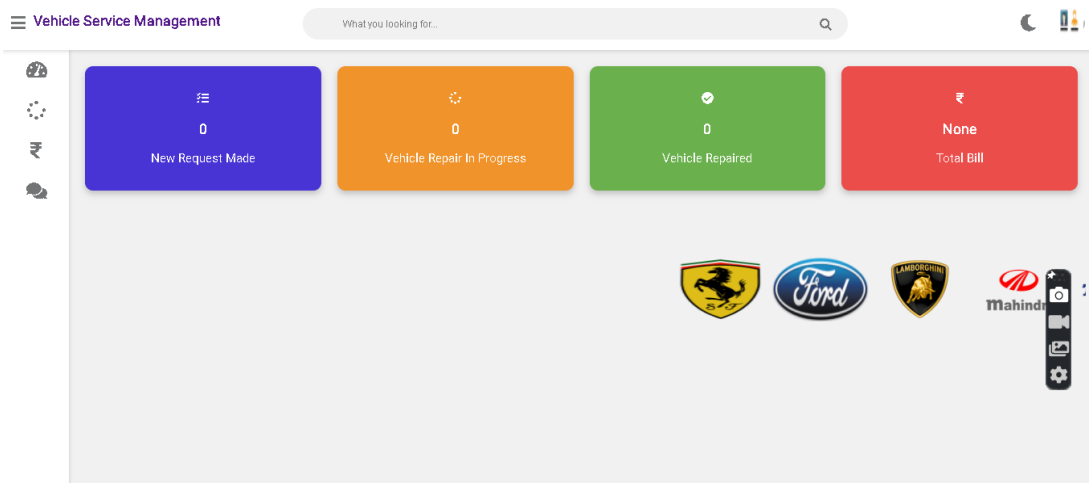
Vehicle Service Management
What you looking for...
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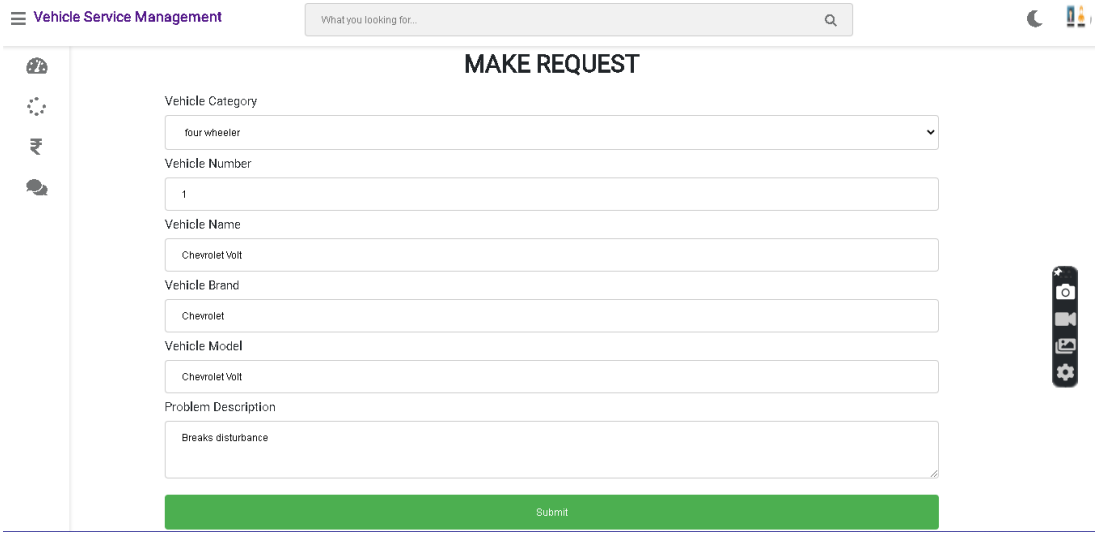
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What you looking for...
MAKE REQUEST
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Vehicle Model
Chevrolet Volt
Problem Description
Breaks disturbance
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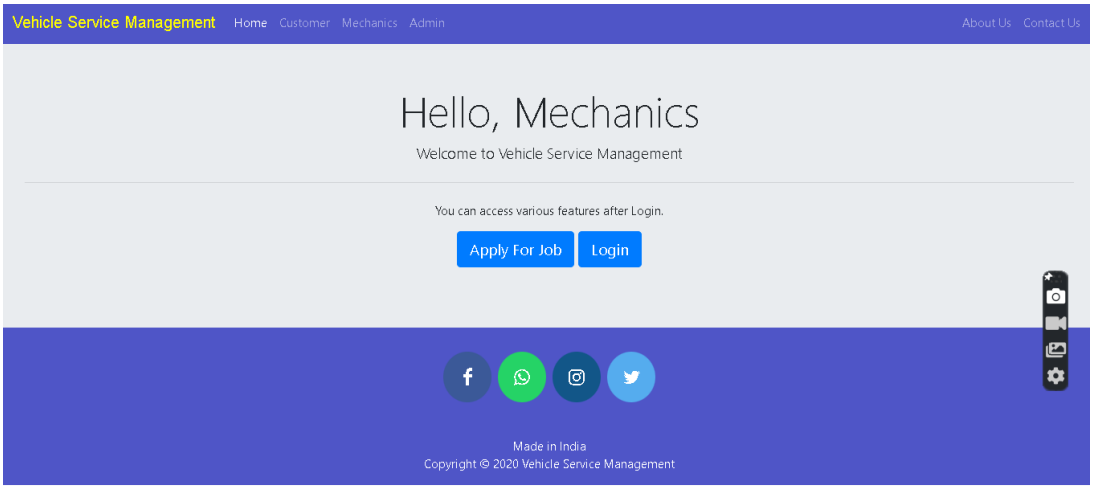
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Hello, Mechanics
Welcome to Vehicle Service Management
You can access various features after Login.
Apply For Job
Login
Made in India
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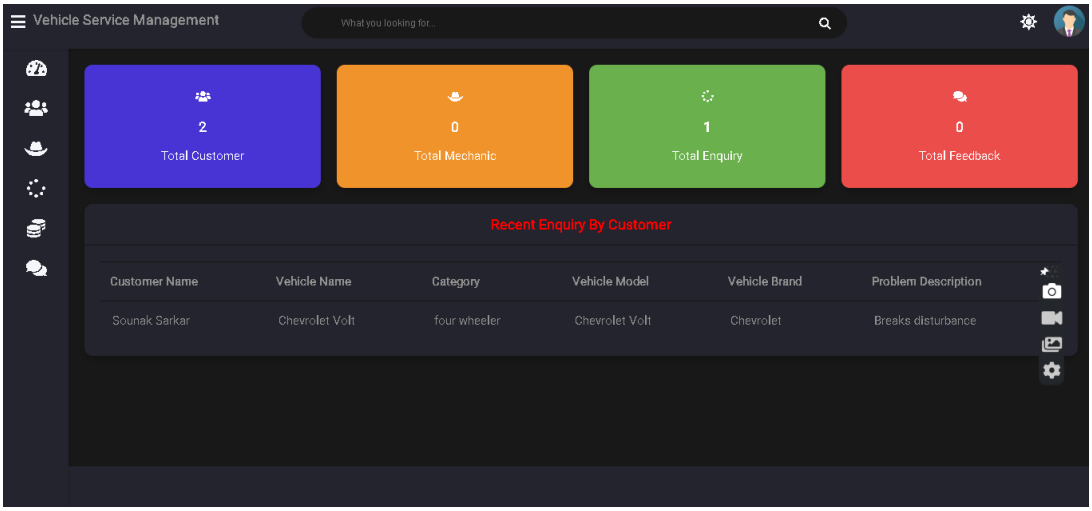

5. CONCLUSION

The package was designed in such a way that future modifications can be done easily. The following conclusions can be deduced from the development of the project.

- Automation of the entire system improves the efficiency.
- It provides a friendly graphical user interface which proves to be better when compared to the existing system.
- It gives appropriate access to the authorized users depending on their permissions.
- It effectively overcomes the delay in communications.
- Updating of information becomes so easier.
- The System has adequate scope for modification in future if it is necessary.

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