

# System for Appropriation & Management of Vehicular Spare-Parts

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**Abstract.** This paper proposes a system that simplifies the procurement and sale of vehicular spare parts and is particular focused on automotive spare parts. Car manufacturers have immense pressure to provide spare parts for all vehicles. For a car in production spares are available until the term decided by the manufacturer. For a car that is off production spare parts are available through sources such as local market and third-party dealers. But, sometimes there can be a scenario where a customer wants to buy a part from the manufacturer but the part may be very expensive for the customer. The main objective of the work is to bring the manufacturer, supplier and buyer on a common platform and enable customers to purchase spare parts in an efficient and easy manner providing multiple options through a cloud based platform.

## 1 Introduction

Car sales have tremendously increased over the last few years, with some families owning more than one vehicle. Car manufacturers have immense pressure to provide spare parts for all these vehicles. For a car in production spares are available until the term decided by the manufacturer. And, for a car that is off production spare parts are available through sources such as local market and third-party dealers. But, sometimes there can be a scenario where a customer wants to buy a part from the manufacturer but the part may be very expensive for the customer. In this case the customer has no option but to buy the part from local market. This also applies for the person owning an off-production vehicle. Customers can face problem such as overpriced parts. Hence, there is a need for a system that provides customers with all the required information associated while buying parts from the local market. Customers should be able to get information about the parts such as recommended dealers, customer's reviews of the part, manufacturing information, pricing details and other related information regarding that part. This can help the customer while making the right choice.

### 1.1 A look at various scenarios

#### 1.1.1 Buying spare parts for a car still in production

This covers all the vehicle that are currently in production and have spare parts available with the

manufacturer. There can be a scenario that customer wants to buy a part from the original manufacturer but isn't satisfied with price of the part and decides to buy parts from local market. They can face a problem where multiple dealers have the same parts for different prices. They might get confused from whom to buy the parts.

#### 1.1.2 Buying spare parts for a car off- production

This covers all the vehicle that are discontinued from production car that have exceeded 5 years after going off production and doesn't have spare parts available with manufacturer. Here also customer is forced to buy from the local market.

#### 1.1.3 Buying spare parts for vintage cars

These are the car owners who deal with vintage car parts and want to sell parts for other vintage car owners. Finding spares for vintage car is hideous task as most of them aren't easily available in local markets.

## 1.2 Problems associated with the local market

As a mechanical geek there are many owners who would like to purchase the spare parts from local dealers and like to replace themselves using self-help videos available. This is especially true for non-critical body related spare parts. Some of the issues associated with purchasing car spare parts from local dealers in India are listed here.

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- 1) Lots of dealers for the same part
- 2) Pricing issues with the dealers
- 3) No assurance for the quality of parts
- 4) No proper history of the parts
- 5) No proper warranty of the parts

To overcome these issues we have proposed a cloud based system in this paper. The major components of the system and its implementation aspects are discussed in section 3. We look at some of the work published in related areas in section 2.

## 2 Related Work

Fang Li, [1] in year 2015 have proposed that in China and the rest of the world, the full-vehicle industries are rather booming but there is also a need for additional spare parts management system alongside it. In this paper, they've concluded that there is a need for automobile spare parts management system to balance out the weak after sales service market of the full-vehicle industries. It is also beneficial for profit earning and cost saving. It will help ensure easy searching of products and timely delivery of products. With the help of information and network technology, application can be built for spare parts management. In this spare parts management model, they've used an IDEF method for system design.

Gong PingPing and Liu Feng, [2] in year 2009 have proposed that the current spare parts management system is under constant financial pressure, insufficient maintenance and lacks in a good design. This problem would be solved by running a spare parts management system with the help of computer/browser instead of using much manpower. In this paper, they've said that instead of "Client-Server" architecture, "Browser-Server" architecture can be followed. By making use of the internet and dealing with spare parts by the involvement of server, client, warehouse without much need for manpower, spare parts management system will be cost effective and can save time.

Nizam Baluch et.al. [3] give an operational perspective of sales part management for asset intensive industries and automotive manufacturing falls in this category.

Raghad Hemeimat et.al. [4] give an interesting analysis of the usage of statistical analysis for forecasting the demand for spare parts.

## 3 Proposed Methodology

We propose a cloud based system having a simple and user friendly user interface for purchasers, suppliers and

administrator which can be accessed from any device. There is a backend database which stores the product information and is useful for processing of purchase, management of the items and providing various functional aspects to the users of the system.

The proposed system makes use of Flask framework which is a small web framework written in Python. It does not require any special tools or libraries and can be set up quite easily.

The products added are categorized by brands and category along with their proper attributes such as product origin, price, colour, etc. which the proposed system later use for building its recommendation module.

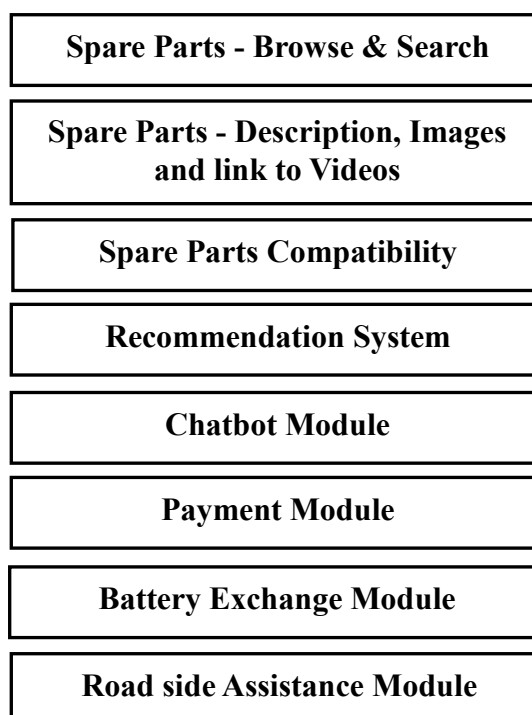
Recommendation module uses collaborative filtering, which finds similarity between two products of same category using the correlation obtained from the products rating and the numbers of rating users have given for a particular product.

The payment gateway used needs to be reliable, robust and trustworthy. Therefore, the system uses Stripe API. Using stripe, payment can be accepted online and users can track payments made.

### 3.1 System Design

The spare part appropriation and management system has been designed to be accessible from desktop as well as mobile devices, this is achieved by building a user interface that adapts to screen size being used.

Functionality provided by the system is as follows.



The interface scales according to number of products being added in the system, this is achieved without cluttering the screen. For a better browsing experience, the system needs to recommend products to the users based on what they are purchasing. This is achieved using recommendation system that provides product recommendation based on category they are browsing.

Overall system should be reliable for best user experience, this is achieved by using proper database technology in backend to process user orders. The database should have high scalability as well as proper security features to prevent against tampering of data.

In the designed application we have four databases namely

- 1) User Information
- 2) Product Information
- 3) Shipping Cart
- 4) Payment Information

User information database is used for storing user information such as their name, address, password etc. This is used during authentication.

Next, we have product information database, here all the product information such as product name, brand, category, pictures etc. are stored.

The shipping cart database is used to store all shipping related information such as customer shipping address, mode of payment, total amount and mode of shipping.

Payment information database is used to store payment information such as amount paid/due and transaction details.

Customer begins by directly browsing products on webpage, if they are interested in product they go for registration. Once registered they get confirmation on their email address. They can then login to the website using the registered credentials and then browse through the catalogue, if they like something they will add it to their cart and proceed for checkout. In checkout they have option to opt for cash on delivery (COD) or online payment such as net banking etc.

Once the payment is done, an invoice is sent to their registered email address.

Customers can also choose for installation help (if available) for their purchase.

In addition to this we have also implemented a battery exchange system. It provides an interface for the user to provide information and request for exchange of battery.

There is a module included to provide road-side assistance to users. This module uses the GPS location of the user to provide the facility of road-side assistance, where the service can be requested using the mobile during travel.

## 3.2 Recommendation System

Isinkaye et. al. [5] and Aggarwal [6] have given a very good introduction to the working and the types of generic recommendation systems.

The recommendation systems employ an algorithm to seek a recommendation based on the content searched, browsed or rated by a user based on the similarities. Many multi-millionaire companies also use recommendation systems in one or the other way.

A recommendation System majorly uses two techniques of filtering described in the following sub-sections.

### 3.2.1 Content Based Filtering Technique

Content-Based filtering uses the similarities between the products based on their attributes. For example, recommending a product based on its colour, type, sizes, etc.

### 3.2.2 Collaborative Filtering Technique

Collaborative filtering uses collaboration among different data sources, agents to give accurate results. It works on the fundamental principle of similarity.

The proposed system uses collaborative filtering to find the similarity between the products using correlation of the number of rating given by the users and ratings given.

Collaborative filtering works around the user interactions that the items have. Patterns can be found, which the data about the items, or users can't find easily, and, this can be done with these interactions. The main reasons why we used collaborative filtering for our development are as follows.

- 1) The features about the items or users to be known are not required by this type of filtering

- 2) For a set of items of different types, this is best suited type of filtering
- 3) For our spare parts inventory where items of various categories can be added, this was most appropriate
- 4) In a set of similar items (e.g., oils) such as that of our spare parts inventory, though, known features like brands and for what vehicle (e.g., cars or bikes) this oil is used can be useful, and might benefit from content-based or hybrid approaches
- 5) Recommenders can be helped by this type of filtering to not overspecialize in a user's profile and completely different items can be recommended than what they have seen before

- 3) As per customer usage and their experience, the script of the WhatsApp chatbot can be changed and personalized
- 4) The end-to-end encryption in WhatsApp helps to make customer communication more comfortable and secure

### 3.3 Chatbot System

E. Adamopoulou and L. Moussiades [7], [8] have given a very good discussion on the chatbot technologies.

A chatbot is a platform which is used as a texting agent, depicting a human, in a software and is used for chat conversations. It is an automatic conversing platform which gives a response every time the user texts something on it.

In this system, chatbot will be used by the users who wishes to obtain information and use our services as for example, roadside assistance, battery exchange program and installation services.

It was implemented using Twilio and Dialog flow. Twilio is a cloud communication platform-as-a-service company. By using its web API services, Twilio helps developers in making and receiving calls, sending and receiving text messages and performing other communication functions.

Dialog flow is a natural language platform which is used to create and design conversational user interface for a chatbot.

In this proposed system, we will be using WhatsApp as a chatbot platform. Benefits of WhatsApp as a platform are as follows.

- 1) It helps as assistance for customers on their preferred daily use platform and supports customers by responding to questions they ask in no time
- 2) Trust and loyalty are built with the customers

### 3.4 Comparison of our System with Traditional E-Commerce Sites

A user survey of the prototype was conducted to see the satisfaction level for purchase of spare parts. From the feedback received the following table has been prepared.

SN	What Other Do?	What We Do?
1	Only General parts or accessories of car are available	Our system is purely based on spare parts. All types of spares such as general and complex are available
2	No proper testing of parts are done	Proper testing of product by team will be done
3	Authenticity of part are questionable	Certificate of authenticity will be provided
4	Verification of the dealers are not done	Strict verification of dealer will be done by checking their background
5	Battery Exchange not provided	Battery Exchange module provided
6	Road side assistance usually not provided by spare dealers in India	Road side assistance module included
7	Whatsapp based chatbot usually not provided	Whatsapp based Chatbot module provided

### 4 Conclusions and Future Work

We conclude that developing a cloud based system for spare parts online selling management works more efficiently than a conventional application for the same.

Various new components such as recommendation system, chatbot, roadside assistance and battery

exchange will be very useful for the customers and will help in increasing the marketability.

The proposed system makes use of Flask framework for implementation. All the products are categorized by brands and categories for easy product selection by users. Recommendation module is helping in recommending products to the customers.

The system is also made compatible for usage in various screen sizes. Stripe is being used as a secure payment gateway. The system is deployed using Scalingo.

To help automotive enthusiasts to be able to perform repairs using spares, there is a need to have more self-help videos. In fact for each part, multiple videos need to be created.

Incentives can be provided to local mechanics to purchase spare-parts. This would need to have a quick delivery mechanism in place.

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