Design and Development of a Web-Based Platform for Pre-Owned Car Sales

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Abstract — Used car sales are currently booming, but for many ordinary people trying to buy or for those needing to sell a used vehicle, it continues to be a very common problem. People have had to deal with purchasing or selling a vehicle without being aware of mechanical problems, the use of poor pricing methods, and working with "middlemen" who charge high fees to help with these transactions. The purpose of this project is to create and develop an independent online marketplace for used vehicles that is totally transparent and allows the buyer to contact the seller directly to reinstate trust in the vehicle sales/purchase process. A simple-to-navigate web application lets sellers sign up and share vehicle information in a straightforward way, with only basic information needed (e.g. VIN, odometer, and photos). Buyers are then able to quickly shop your inventory, and also filter inventory based on their preferences (i.e. pricing levels, make and model, or geographical distance). The new web-based marketplace uses state-of-the-art web technology to create the best possible user experience across all devices and to store users' information securely for all time. The elimination of the need for middlemen creates both time savings and money savings for the end-user. Furthermore, it will assist with the restoration of consumers' confidence in the purchase/sale of used vehicles. This report will detail the entire development process, including an analysis of the existing marketplace's challenges; all the way through to final testing and live launch of the new responsive web application.

Keywords: Used Vehicle Marketplace; Online Vehicle Trading Platform; Direct Buyer-Seller Interaction; Transparent Vehicle Sales; Web-Based Marketplace System; Secure Digital Transactions;

I. Introduction

Historically, purchasing a second-hand vehicle has proven to be both difficult and risky. Although there has been a recent surge in the pre-owned vehicle market; the process of finding a trustworthy/ dependable pre-owned vehicle has many problems. Most buyers are forced to deal with local dealerships or scattered online classified ads that have inadequate information and the added expenses charged by brokers, inflating prices. Additionally, there are always considerations that you could be misled about a vehicle's actual mechanical condition or service history.

To solve these two problems, we have created, envisioned a centralized, internet-based platform inherently designed for pre-owned car transactions. The ultimate goal is to provide a digital marketplace where transparency will be the major focus (instead of paying a broker), thus giving the buyers & sellers of vehicles the ability to communicate directly with each other as opposed to going through a broker. Sellers will upload vehicle data with detailed description, while buyers will have the tools necessary to search, sort and compare vehicles with actual driver supplied data.

This paper will provide a summary of the entire process we used to create our application, including an overview of the following items: the procedures used to develop the current automotive market; the selection of architecture to create a secure application environment; and the core functionalities developed to allow for a trusted, continuous, and honest digital vehicle marketplace.

II. Literature Survey

A. Review of Existing Used Car Platforms

Nowadays, there are numerous digital classifieds that can help you sell your used car, most of which work like forums where you can post your car along with images and price (this is one of the most popular sites currently). But in addition to the fact that these sites have no verification process to check whether the car is damaged or has mechanical problems, they also don't verify the legitimacy of sellers. Because there is no third-party verification, buyers are left with a significant gap in trust, meaning that they might be uncomfortable purchasing a vehicle as it may have hidden damage.

B. The Challenge of Fair Pricing

Depreciation of value is documented in numerous studies regarding the automobile market. When a buyer drives a brand-new vehicle from the showroom, that automobile begins to depreciate in value once it has left the lot. Establishing the resale value of an automobile is very complicated due to the fact that it is based on many factors that need to be determined, including the number of miles the automobile has been driven, the original purchase invoice price of the automobile, how the automobile was viewed at the time of manufacture (i.e., vehicles that are 15 years old will typically have a better resale value than a vehicle that is 3 years old), and the condition of the engine of the automobile. Many automobile sellers are required to approximate (or otherwise inflate) the price they will be asking for the automobile; therefore, they will make it more difficult for themselves to price the vehicle fairly. Thus, since there has not been a standard method to assess the resale value of an automobile, any prospective owner of the vehicle currently using a platform (i.e., listing site) will not have a data-driven standard for pricing the resale value of the automobile at the time of the sale based on the listed price of the automobile.

The Middleman Problem

A significant conclusion from our study of both the online and off-line real estate marketplace was the fact that the dominant players (the third-party agents) in the market have become large organizations that use the Internet as a medium to gain ownership of all of the properties within the marketplace. In addition, brokers have also entered into the marketplace by acquiring vehicles from desperate sellers who have been forced to sell their vehicles at very low prices (due

to unforeseen defects) and immediately re-sell the vehicles at a much greater price than they originally acquired them for. As a result, this eliminated the fundamental purpose of making a transaction between two individuals via the Internet, which has placed an increase in the financial burden of the vehicle purchase on the buyer and caused many purchases to have many hidden costs/fees in addition to the purchase price of the vehicle.

III. System Design and Architecture.

A. Overall Architecture

The web application was built on a reliable Three-Tier Architecture to support the platform's smooth operation. The Three-Tier Architecture enables the web application to operate in three separate layers: visual (i.e., front-end) layer, background processing (i.e., business logic), and data (i.e., database). By separating these layers, we are able to avoid burdening the overall performance when heavy items—like loading numerous high-quality images of cars—occur.

B. The Presentation Layer (Frontend)

The visual component of the marketplace is designed around two criteria: maximum usability and minimal effort. Increasingly, many potential car buyers will search for their next vehicle on their smartphone. Thus, a very clean and well-organized user interface (UI) with the least possible friction was our priority. There are three features represented by this layer of the user experience (UX) - the interactive search fields, the image slideshows of vehicles, and the detailed specification pages (where potential car buyers can view a car's mileage, fuel type, and history of ownership).

C. The Application Layer (Backend)

The components of a platform's backend provide its engine. For instance, when a seller adds a car to the system, the back-end receives the vehicle's information, verifies that the user has provided the correct details for the vehicle (i.e. their user details), and subsequently updates the live feed of all vehicles and their respective users in the system including assigning a unique user ID for the user. The filtering rules maintained by the backend are very complex and the backend sends the filtered results (i.e. only sending records meeting the filtering criteria) to the front-end for users to view. So if someone searches for an Automatic SUV <= 8,00,000, the backend provides the front-end with only the best vehicle matches available.

D. Database Layer

The pre-owned vehicle platform is responsible for storing significant amounts of specific data about each vehicle owner (i.e. user profile data, contact data) as well as the vehicles in question (i.e. make, model, year of manufacture, service history). The way it organizes this information into logically connected tables in a database is through a secure database that can be accessed quickly and efficiently whenever a user requests vehicle information. If the platform had no way to properly save this data in a timely manner, then users would have to wait for every vehicle they requested, which could take forever (or longer than it would take them to drive to a dealership).

IV. Implementation

The Execution phase consisted of implementing a planned architecture of the site into a working web application. The used car platform was developed in distinct steps to ensure the system was capable and concentrated on performance and data security.

A. Setting Up the Environment

The first step in the development process was establishing a working environment for development to take place. The process started by providing a stable local environment that included installing the code editors, setting up local servers, and initializing the database schema to store vehicle data. With a solid foundation, there would be no conflicts with the various components for the subsequent coding phases in the overall project.

B. Creating the Frontend

The development of the project's front end paid special attention to keeping the user interface simple and easy to understand. All development was done with core web technologies and included code created for images of users logging into the site, dynamic galleries with images of cars available for sale and specification cards for all available vehicles. The emphasis throughout the project was placed heavily upon supporting both mobile phone and desktop monitor users with the same user experience.

C. Backend and Database Integration

After the frontend was complete, the essential functionality of the marketplace was coded. To support user authentication, as well as encrypting passwords and uploading information about vehicles, we also coded secure functionality. The core logic that supports these features is tightly bound to the database so that when a seller enters the make and model of their vehicle, as well as the desired price, contemporaneous with the entry of that information into the database, it is instantly available for buyers to search in the live marketplace feed.

D. Software Testing

The application was extensively tested to find and fix vulnerabilities before it was put into use, including user login security checking, high resolution vehicle image upload testing, and verifying the accuracy of search filters. We tried to "break" the system through invalid input for the final version of the deployed platform to improve performance, reliability, and transaction security.

V. Functional Features and User Workflows.

A. Key Functional Characteristics

This uploaded form provides the seller with the following vehicle information: year, mileage, fuel type, transmission, and whether or not the seller has active insurance. This provides the purchaser with a more complete and accurate view of the vehicle.

Because finding a vehicle can be overwhelming, we have created a complete search and filter system that will allow purchasers to quickly find a vehicle that is a match in the marketplace. Our filtering enables users to filter the real-

time monitoring feed by a manufacturer (e.g. Maruti Suzuki, Hyundai, or Honda), a maximum purchase price (e.g. $25000 or $50000), and/or a type of body style (e.g. SUV or Hatchback).

Purchasers will have confidence in their ability to purchase because they can see pictures of a vehicle before they purchase it through the system. The user will be able to upload up to 6 high-resolution images of different parts of the vehicle (e.g. outside view, inside view, etc.) to give the purchaser instant assurance of the condition of the vehicle prior to the purchase taking place.

Buyers And Sellers Directly Connect To Each Other: The platform provides buyers and sellers with an immediate connection, removing the role of a broker from these transactions entirely. Once the buyer logs into the system, they will have access to the seller's contact information so they can arrange for themselves to take a physical test drive of the vehicle, thus avoiding broker commissions on the transaction.

B. Real-World User Journeys

The following section describes how the software works for sellers and buyers in a typical scenario.

- The Seller Journey: A vehicle seller will open the website to sell their older vehicle. The seller will create an account that allows them to sign in to their dashboard, which contains a button that reads "List a Car." The seller clicks on the "List a Car" button and is taken to an online form where they are required to fill in various details related to their vehicle (such as mileage, registration, etc.) and include a price for the vehicle. In addition, the seller needs to upload photos of the vehicle as part of listing their vehicle. After all of the information has been entered on the website and submitted to the system back end, the car will be available live on the public feed immediately after submission.
- The Buyer Journey: The buyer starts by using the web application and sees the search bar which they can use to search for a vehicle. The buyer uses the dropdown filter(s) so only vehicles listed for sale with "Petrol", "Auto" and therefore "Under 5 Lakhs" will be returned to the buyer with the "Cars Listed for Sale" is displayed in an instant gallery format. Then the buyer will select the hatchback they liked; view the buyer's complete details on the sales page; and press the contact owner button directly from the sales page to call the owner and schedule a meeting.

VI. Results and Discussion

A. Results Achieved

The application was successful for testing and deployment as all were completed in development. The completed application functioned well for desktop or mobile devices. Users tested the application by establishing a secure account, uploading all required vehicle detail information and several images at high resolution per vehicle, and having their vehicles immediately posted to the live feed. The responses from both the database and the search engine responded to queries in less than one second after users entered parameters to search — example "automatic hatchback under Rs4,00,000".

B. Discussion and Impact

The operating experience of the digital platform validates that there is no longer a need for the second-hand car market to rely upon brokers/middlemen who make a commission based on a percentage or a flat fee for processing a vehicle purchase. The necessity for uploading standardised data (i.e. mileage, service history and manufacturing year) allows the potential buyer to have a more truthful, accurate representation of the condition of the used vehicle before they make an inquiry. By introducing direct contact means of sending information between the buyer and seller, the need for brokers/middlemen can be avoided as such both buyers and sellers can avoid paying hidden commissions, which are usually unfair. The net effect of the project has changed a high risk traditionally manual process into a transparent, secure and user-friendly digital marketplace; thus, successfully removing the trust issues that exist in today's used vehicle marketplace.

VII. Future Scope

Apart from addressing the basic issues of transparency and brokers in today's used vehicle marketplace, the design of our platform will allow it to expand and can include some very valuable upgrades in the future.

A. AI-Fuelled Pricing Recommendation

At present, sellers create their own pricing strategies, which creates the potential for issues. One future possibility is to develop a machine-learning algorithm that would allow an automated way to calculate "Fair Market Value" for a given automobile based on components such as make/model/year and mileage as well as current market conditions in local markets. This would ultimately create a level of trust in both buyers and sellers regarding the pricing of vehicles.

B. RTO Verification & Automation

Bringing enhanced transparency to the transactions on the platform, we could also integrate with APIs from the National Regional Transport Offices (RTOs). Once a seller provides the registration number of the vehicle, the platform could automatically display whether the vehicle has been leased by previous owners, has valid insurance coverage, has any outstanding fees/charges, is subject to legal cases/ramifications relating to accidents or other matters, etc.

C. Full 360 Degree Virtual Inspections

Pictures are good; however, having a way to view images in 360 degrees would allow users to have the next level of detail for their virtual test drives either of inside or outside the car utilizing their mobile device to save them time in making decisions to drive to an actual car for a test drive.

D. Integrated EMI Calculators and Finance

Purchasing a vehicle is a major purchase/financial commitment. One option for a future improvement would be to include EMI calculators for each vehicle displayed in the application. If we were able to partner with some sort of bank, we could also provide the ability to check loan eligibility and apply for vehicle financing right from the web application.

VIII. CONCLUSION

In summary, this web-based marketplace for used cars illustrates how acquiring or disposing of pre-owned vehicles can be done easily without fear or concern about whether you might lose money on the transaction. Our objective in launching this service was straightforward — create a digital location for the buying / selling of pre-owned vehicles while providing complete transparency to all parties involved, and giving back control to everyday people who make these transactions.

Through careful and consistent system design and execution, we have delivered a fast, safe, highly available web-based application with the integration of standardized detailed vehicle description and open, direct communication between qualified buyers and legitimate sellers, which entirely eliminates the need for hidden brokerage fees and inflated prices. The simplicity of the user interface ensures that everyone should be capable of using the marketplace regardless of technical capability.

This project demonstrates a very real-world solution to the substantial real-world issue of buying and selling second-hand cars. By utilizing 21st century web-based technologies, we can convert the age-old, difficult experience associated with the trade of second-hand vehicles into an easily accessible, secure, reliable, and entirely seamless digital experience.

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