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Software Project Management in the Development of a Car Sharing Service

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Abstract:
The trend of moving a larger part of people's lives online has been supplemented by the development of applications to effectively mimic the real world. The development of an efficient peer to peer car rental system for the usage of every day individuals and professional rental services is an extension of the arm of this revolution that seeks to make mobility cheap, efficient and easy for everyone connected to the internet. In this paper, we seek to implement a vehicle sharing system and elucidate out findings following a software project management based development approach.

1. Introduction

The young working population of this country is increasing day by day. Metropolitan cities are getting more and more working class people who have just graduated. The fresh set of young working class which majorly contributes to the middle level income of the population. That set of people who want to enjoy the various luxuries of life. These luxuries might not always be their top priority though. To explain it in a better way, let's talk about cars. Cars: Initial investment is heavy but in the long run it's handy.

The peer-to-peer car sharing concept of **Let Me Drive** was inspired by AirBnB. A peer to peer model is gaining popularity because we already have a huge amount of massive underutilized vehicle resource. And being a secondary source of income, the rental prices are expected to be lower than those of rental services. **Let Me Drive** is an application idea that plans to start of a peer to peer car sharing marketplace. The main idea revolves around the private car-owners renting out their vehicles through this interface. Here, the car owners have the freedom to set their own prices.

2. Rise of Car Sharing Applications

Car sharing is a car renting model where individuals lease cars for brief time periods, mostly by the hour. They are appealing to clients interested in temporarily availing a car of an alternate sort than their pre-existing vehicle, which they use on an everyday premise, and other people who might make occasional use of a vehicle. The organization leasing the vehicle might be a business or the clients might be sorted out as an organization, open office, helpful, or specially appointed gathering.

Off late, the pattern of car sharing has been getting the spotlight. Some of the most popular car sharing applications are:

→ Zipcar
→ Uber
→ Craigslist

Some car share operations coordinate with vehicle rental firms in their vicinity, specifically in conditions where classical rental might be a cost saving alternative. Car sharing provides large number of transportation, social and environmental benefits. Peer-to-peer car sharing is often marketed as a worthy alternative to investing in a vehicle where publictransport, and other such options can be utilized more often than not, and a personal vehicle is only truly useful for trips, moving locations, or events. Likewise, a contrasting option

would be owning numerous vehicles in families with a greater number of drivers. Peer-to-peer car sharing is emerging wherein existing proprietors can rent out their vehicles for others to lease for brief periods of time.

P2P car sharing is a type of loaning, more specifically, a segment of sharing economy. The plan of action is firmly adjusted to conventional auto clubs, for example, Streetcar or Zipcar, however replaces a run of the mill armada with a "virtual" one, comprising of cars from partaking proprietors. With such a sharing mechanism, partaking auto proprietors can charge an expense to lease their vehicles when they are not utilizing them. Taking part tenants can get to close-by and reasonable vehicles and pay just for the time they have to utilize them.

Organizations inside this segment screen members (both proprietors and leaseholders) and offer a technical platform, generally in the form of a website and mobile application, that bring these parties together, oversees rental appointments and gathers installment. Organizations take somewhere around 25% and 40% of the aggregate salary, which covers borrower/tenant protection, working costs, and roadside help.

Although numerous individual car safety net providers in the USA reject scope for business utilization of protected vehicles either through a livery and public transportation exclusion or a particular "personal vehicle sharing system" exclusion, a few states in the US have passed enactment permitting people to share their vehicles without danger of losing their own vehicle protection.

Similarly, as with person- to-person loaning, empowering innovation for this conduct has been the Internet and the selection of geo-area based administration.

3. Drivers for Peer to Peer Car Sharing
There are multiple factors that drive the aforementioned system. They are listed as follows:

3.1. Demand Drivers

3.1.1. Demographics
The young working population of India is increasing day by day. Metropolitan cities are getting more and more working class people who have just graduated. These fresh set of young working class contribute majorly to the middle level income of the population. They are also the ones who want to enjoy the various luxuries of life. These luxuries might not always be their top priority though. In other words, owning a private car is seen as a luxury with a high initial investment. Providing a platform to fulfil one's desire without the need of high investment is what the project wants to fulfil.

Moreover, people these days have different values compared to their parents.

They now, don't just look for prosperity and stability but flexible schedules and financial and geographical independence.

3.1.2. Population Density
Researches have shown that the car sharing demand is higher in areas with below average car ownership. Making car sharing facility available will not only help the people to exploit the given service but also help the rentee generate a side income and thus help in boosting the economy.

3.1.3. Car Sharing by Different Genders
The gender of car sharing users has also been tested in several studies and has revealed that males, on an average, use such services more frequently than females. Let Me Drive is a platform for any and every one without any discrimination.

3.1.4. Dynamic Pricing
The rentee can in particular, adjust the rent according to other rentees with same car models, or depending upon peak time during festival seasons etc. The aim of dynamic pricing is to increase the ad uploader base by giving them this flexibility and also increasing the customer base by giving them such a wide variety of choices.

3.2. Supply Drivers

3.2.1. Expanding the Travel Sector and Shared Economy
With the ongoing IOT revolution and the expansion of the sharing economy, peer to peer interactions had become the crux of the new age service industry. "Let me drive" expands the scope of the travel sector to enable individuals with multiple vehicles some of which are unused to rent these cars and its services thus replacing existing traditional car rental systems

3.2.2. Overwhelming Movement to Online Private Taxi Services
The World Bank reports a stunning half increment in per capita salary since 2006 as of recently. With more people moving up the social ladder the need to travel in a private vehicle becomes more of a necessity than a luxury. "People have more money to spare than time" said the CEO of Uber. The ability of people to be able to access swift vehicle rental services with no restrictions on where it can be taken is freedom like never witnessed before

4. Existing System Functions

Car rental is the process of utilizing a vehicle briefly for a specific time period which incurs some charge. Renting a vehicle assists individuals to attain a comfortable level of mobility even if they do not own a vehicle or do not have access to their own personal vehicle. The person who wants to rent the car must primarily contact the rental service for the desired car. This is can be done on the website or mobile app. Then the person needs to provide pertinent data, for example, dates, time, and preferences. Once this is completed, the individual renting must present a valid government approved Identification Card.

The rental cars are sorted into economy, compact, compact premium, premium and luxury. Furthermore, clients are allowed to select any car based on the availability of the car of the requested dates. This company makes use of manual system for booking, registering, renting and record keeping. The functions are explained in detail as follows-

- During the booking, the clients book a vehicle by making a call to the organization; else he/she is required to go to the organization to make a booking.
- In the car renting process, personal details, rent agreements and payment status are noted in the car rent agreement form to hold lawful contract between the client and association for leasing the vehicle.
- The operating time of the services is from 1:30am-6:00pm; thus giving services for ten and half hours a day.
- The organization files all instances of leased cars monthly, and creates a detailed report on the same.

Car sharing is for the most part not savvy for driving to an all-day work all the time. Most car sharing promoters, administrators and cooperative public agencies trust that the individuals who don't drive every day or those that drive under 10,000 kilometers yearly might observe car sharing to be a better solution than owning a car. On the off chance that the occasional use of a shared vehicle costs essentially not as much as vehicle ownership, it makes car utilization more open to low-income families.

Car sharing has another benefit of decreasing pollution and congestion. Replacing personal cars with regular sharing of vehicles directly decreases the need for parking spaces. Much vital for congestion, the solid metering system gives an incentive to drive more infrequently. In the case of owned vehicles, most expenses are sunk costs and therefore do not rely on how much the car is driven, (for example, the purchase amount, insurance, registration and maintenance).

Car sharing has been seen in thickly populated areas, for example, downtown areas, universities, etc. There are a few projects to give administrations in lower populations. Less populated areas are viewed as hard to present with car sharing owing to the absence of alternative modes of transport and the greater distances.

5. Software Methodology

Let me Drive was made with the assistance of the Waterfall model:

5.1. Defining Requirements

Analyses based on pre-exiting applications of similar kind assists in finding the necessary features and their respective functions. The customer elicited features are as follows:

5.1.1. Register

One of the features of the user end of the system which would be used for registering. The user can register either as a renter or a rentee.

5.1.2. Browsing

The user can use the application to browse for availability of cars. Browsing can be done either area wise or car model wise.

5.1.3. Fare Calculator

It is the features that will be used to help the user to avail instant rent rates.

5.1.4. Payment

Payment is the feature that will used to make the payment for the rented car. It is done with the help of payment gateway.

5.1.5. Ad upload

Ad upload feature can be used by the user to upload a car ad for renting.

5.2. Design of the System and Software

We make the application design workflow for the renter or rentee using Unified Modelling Language. It consists of Use case diagram, class diagram, sequence diagram, activity diagram, state transition diagram, dataflow diagrams, etc.

5.3. Coding

All the different parts of the system are coded and built. The databases are made using MySQL, the code is written in Java.

5.4. Integration and Testing
All the modules developed are combined into one system and tested for errors.

6. Performance Measure
The graphs summarize the performance of various team members based on the stress levels at different stages of completion of the project and the breakdown of the work based on the strengths and weaknesses of specific team members.
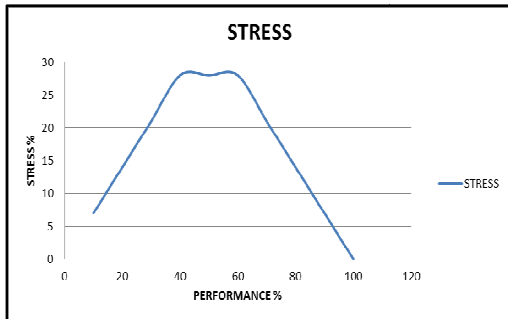

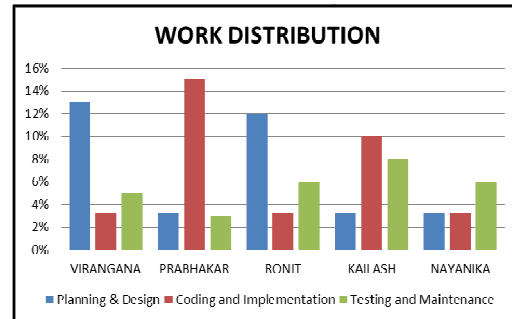*Figure 1 a. Performance plotted against stress*

Figure 1.b. Work distribution amongst team members

7. Estimates
Software Project Management can only be carried out via the proper estimation or projection of effort required for the successful completion and execution of any project.
One such type of estimation technique which we have learnt and applied is the COCOMO or the Constructive Cost Model. The model uses a basic regression formula with parameters that are derived from historical project data and current as well as future project characteristics. Basic COCOMO computes software development effort (and cost) as a function of program size. Program size is expressed in estimated thousands of source lines of code (SLOC, KLOC).
The categorization of our project that takes into account requirements, team mix and experience would classify this project as an Organic project. We are a "small" team with "good" experience working with "less than rigid" requirements.

The basic COCOMO equations take the form

Effort Applied (E)	$=a_b (KLOC)b_b$ [man-months]
Development Time (D)	$= c_b$ (Effort Applied) db [months]
People required (P)	= Effort Applied / Development Time [count]

Table 1

Where, KLOC is the estimated number of delivered lines (expressed in thousands) of code for project. The coefficients a_b, b_b, c_b and d_b are given in the following table:

Software Project	a_b	b_b	c_b	d_b
Organic	2.4	1.05	2.5	0.38
Semi-detached	3.0	1.12	2.5	0.35
Embedded	3.6	1.20	2.5	0.32

Table 2. a. COCOMO coefficient calculations

Catering to our project, the following estimation costs are calculated, given,

LOC: 4824
KLOC: 4.824

Effort Applied= $a_b (KLOC)b_b$
     [E]   =   2.4 (4.824)1.05
             =   12.525 man-months
             ~   12 man-months
or the amount of work performed by an average worker during one month

Development Time= cb (Effort Applied)d_b

[D]   = 2.5 (23.525)0.38
                = 6.532 months
                ~ 7 months [July to January]

People Required   = E/D
                            = 12.525 / 6.532
                            = 1.917 people

However, considering the fact that our semester has exactly 3.5 months of proper working days, we require 5 people for the timely implementation of this project.

8. Conclusions
This project was designed keeping in mind the wide range of users both on the supply side and the demand side that can use the common platform. The market research also concludes a relatively unsaturated market for rental service applications that enable peer to peer communications and renting. The on-field survey based on the usage off the application and the success concludes that professionals aged between 23-27 are the most frequent users of the service.

9. Future Scope
The integration of the profiles created on the application with social media profiles can strengthen the background of the user and make the application more reliable. The application can add a health meter for both the demand side and the supply side. The demand side health bar will depend on the condition of the car and various other parameters whereas the supply side health bar will depend on the punctuality of the car and the status of the car on being returned to the user. The health bar can result in discounts and a priority in getting better cars of choice.

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xvi. A Comparison Between Five Models Of Software Engineering Nabil Mohammed Ali Munassar1 and A. Govardhan21 Ph.D Student of Computer Science & Engineering Jawahrlal Nehru Technological University Kuktapally, Hyderabad- 500 085, Andhra Pradesh, India2 Professor of Computer Science & Engineering Principal JNTUH of Engineering College, Jagityal, Karimnagar (Dt), A.P., India