RENT A CAR

Rent or Reserve a car (Car bookings)

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A thesis submitted in partial fulfilment of the requirements for the degree of BSCS.

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Declaration

We certify that this project titled "***RENT A CAR***" is our work. The work has not been presented elsewhere for assessment. The material that has been used from other sources has been properly acknowledged/referred to.

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DEDICATION

This humble effort is dedicated to our **Parents**, relatives, advisor, friends, and family for their extreme support, love, and care who enable us to achieve the goal of success.

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Abstract

This application presents a data management system for a car rental company. This enables the administrator to keep track of all the customers' information. This system increases customer retention and simplify vehicle and customers management in efficient way. The car rental management system has a very user-friendly interface. Thus, the users will feel very easy to work on it. By using this system admin can manage their rental, bookings, and customer issues and vehicle issues etc. The car rental information can be added to the system, or existing information can be edited or deleted by the administrator. The transaction reports of the car rental system can be retrieved by the administrator, when it's required. Thus, there is no delay in the availability of any car information, when ever needed the car rental information can be captured very quickly and easily.

Key Words: *car, car booking, booking, reserve, rent, rent a car, fyp.*

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CHAPTER 1:

INTRODUCTION

INTRODUCTION

RENT A CAR (RAC) is a web based system for a company that rents out cars. This system enables the company to make their services available to the public through the internet and also keep records about their services. The world has become a place where there is a lot of technological development; where every single thing done physically has been transformed into computerized form. Nowadays, people's activities have been transformed into work done by computerized systems. One of which is the main target of this project which is about Car Rental System. The system of renting cars exist back in the previous years, were people rent cars for their personal reasons. Car renting is essential to many peoples' plan to travel or move from one place to another for business purposes, tour, and visit or holidays, for these reasons Car renting is very helpful.

PROJECT DEFINITION

As the internet improves the life of people, it also gives access to things that were inaccessible before. The internet is one of the most important tools of communication. The world has become a place where there is a lot of technological development which brings the result of almost every single thing has been transformed into computerized form. These days, individual activities have been changed into work done by information systems. One of which is the primary objective of this project which is about car rental management system. Renting car system exists in the previous years where people rent cars for their own reasons. Car rentals is basic to numerous individuals' arrangement to travel or move from one place to another for business purposes, tour, and visit occasions. Thus, car rental is extremely useful.

Our RENT A CAR (car rental management system) is a web-based system for an organization that rents out cars. This system empowers the organization to make their services accessible to the public through the web and furthermore keep records about their services.

PROBLEM STATEMENT

The problem with some of the current system is that:

Based on observations, some small companies already have a car rental system which is not a web based application. This is a limitation that gives them capability to store customer's details, but at the

same time they cannot make their services more available to the public through the internet, they rather make use of posters to advertise their services to the public. These types of companies can overcome these problems by switching to the web base application of their type of system.

They also make use of phone call reservations which is also limited to many features as compare to a web base system. For example a customer may make a phone call reservation for a particular car, but when he/she comes to pick the car, he/she might turn not to like the car; this could be because the customer could not see a sample picture of the car he/she wants to rent. Some other problems with the manual renting a car are as follows:

- To rent a car, a prospective renter must first go to the nearest office to register as a client, what of if the customer doesn't have enough time to do that?
- Cars that provide difficulties to rent out are normally advertised in local or national newspaper. It involves a lot of paper work and consumes time.
- The process of managing customer's data is slow if the company is using manual system and there might be thousands of clients.
- It is very hard to keep record of all rental cars and so on.

OBJECTIVES

The main objectives of this project are:

- · To develop a web based system that will help manage the business transactions of car renting.
- · To help in advertising the car rental services of a company, through the availability of the system online. Development of their proposed idea around the Software development Life Cycle (SDLC).
- To develop a simple and secure system that protects client information and confidential information of the organization
- To design a user-friendly system that enables client check for availability of vehicle and book or reserve a vehicle online.
- To design a system that enables clients pay their car rent online
- To develop a system that stores bookings and reservations information as well as payment history to help the organization keep track of transactions.

PROPOSED SOLUTION

The proposed solution to the above-mentioned problems is to develop a web based system that will help manage the business transactions of car renting that will help clients or customers check for availability of vehicle and book or reserve a vehicle online. That will make sure that customer are capable of reserving car from the comfort of their home and don't need to physically go to bargains for reserving cars for their next journey. Businesses will boost their revenue by collecting their car rents online at the time of car booking. While using manual system it's very difficult to keep track of all the transactions and it's difficult to manage customer's data so this proposed system will keep track of all the transaction and manage the customer's data automatically.

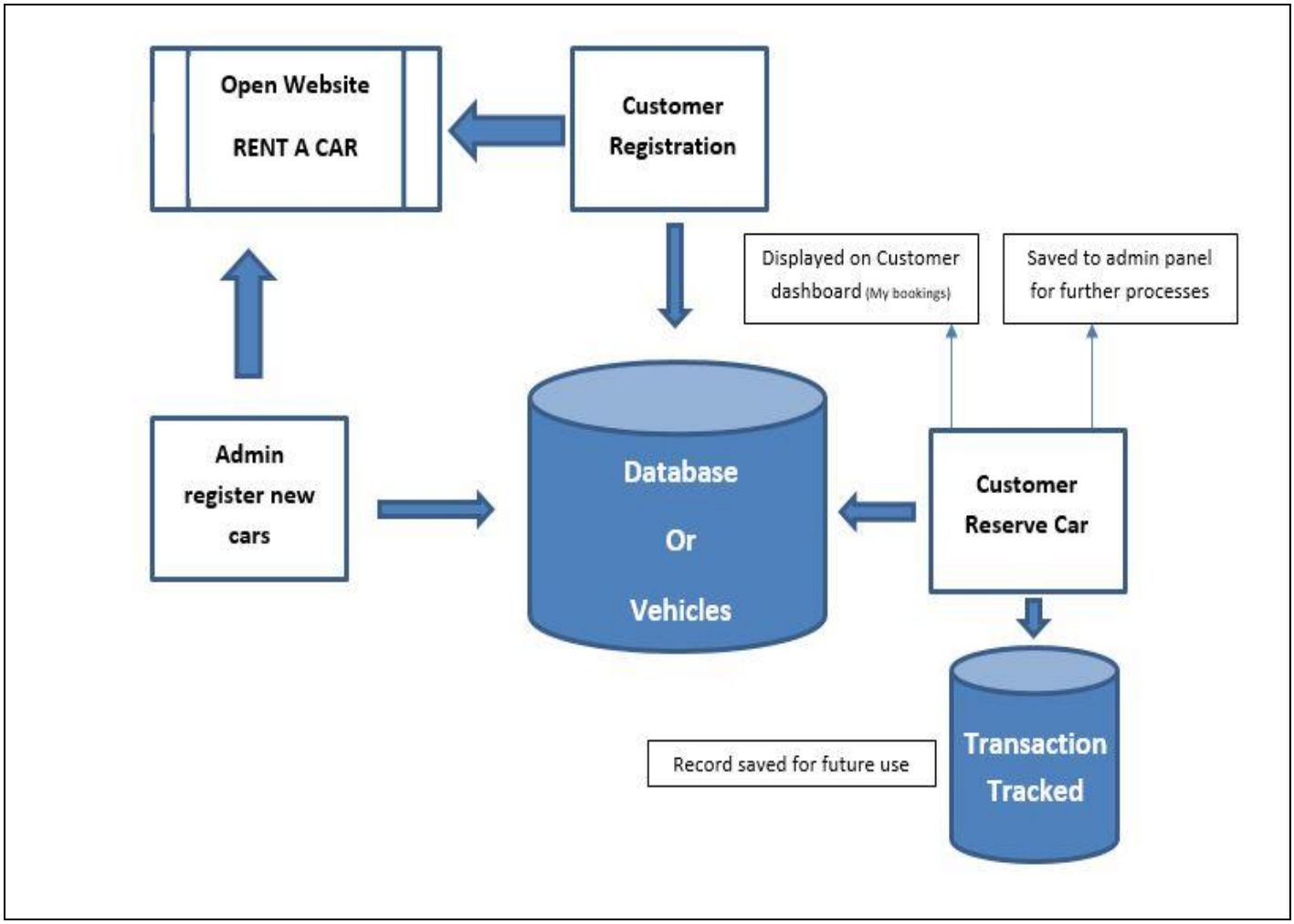

Figure 1. Proposed solution architecture

MOTIVATION

In consideration with historical and rapid development of car rental companies, the way processes in the companies are taking place today which is quite problematic, this project is planned to ease those processes through developing an effective and efficient car rental system, just like other developed countries are using technologies towards facilitating their customers processes through projects. There are problems with already existing similar systems so keeping in mind those problems and constraints we are here with a plan to bring ease and comfort regarding those issues. This will help people not to go physically for renting a car for their next journey. In similar existing system there are no way of keeping transaction history, keep track of their customers and clients, keep their business up to date etc. So this web service will try to overcome those problems.

SCOPE OF THE PROJECT

Over time, the scope of this project will expand and it will provide different renting car associated services that will cover lots of things. RENT A CAR will try their best to assist people in a wide variety. With time, its services will expands because somehow this will be in use by everyone related to vehicle bargains. Someone who wants to reserve a car for their business journey, for their road trip, or for visiting somewhere from the comfort of their home, this web service will help them accomplish their task very easily. This will help people with cars or people who have bargains to commercialize their work and put their business on cloud that will be accessible by everyone having active internet connection and will be available to anyone by 24/7 hours. Bargain owners will no need to advertise their shops by putting large banners on street walls or showing them on large boards present on roads, in fact once a customer visit this site he/she will be happy using this and will tell their known peoples to use this. Because its time saving, easy, convenient and useful to be used. In short words this web service will be used by customers/clients who wants to have a car for their upcoming journey, this will be used by those bargains who wants to keep track of their cars renting, customers and transactions. This will be used by bargains who wants to solve their renting issue and customers issue without calling customer to be physically appear and so on.

CHAPTER 2:

BACKGROUND / LITERATURE

EXECUTIVE SUMMARY

Before RENT A CAR (web service), problems were addressed to different platforms but the overall experience of the bargain owners and people who have habit of reserving car for their journey, was bad. People were facing lots of problems but there was no such tool exists that could efficiently solve those problems. People who wants to reserve car need to be go physically to the nearest bargains, which were time consuming and of course expensive. Where they need to wait for their turn and after need to be provide all of his/her details at the reception disk. This was also difficult for vehicles owners to keep track of their customer activities like transactions, renting etc. In short people were facing problems and issues regarding renting cars (vehicles) and bargain/vehicles owners were facing problems regarding their businesses. Now this web service will put their business on cloud and it will bring ease to both the clients and owners.

INTRODUCTION

After RENT A CAR was officially introduced and launched, we assert that there will be no issue for those who have before RENT A CAR. Because it will provide services in a wide range and will try to expand more in future. It will bring lot of ease in the life of many people. Before RENT A CAR people were using traditional way to reserve a car that will be needed for their upcoming business tour, or something else. Now people who wants to take a car on rent have a way to do it while staying at their home (no need to physically go and waste time and money). Now it's a very convenient way of taking a car on rent because it can be done through using your smartphone or PC. All you need is to have an active internet connection and a smartphone. Reserving a car is now few taps away you need to take your smartphone make an account on RENT A CAR and reserve a car for yourself. .

SIMILAR EXISTING SOFTWARE APPLICATIONS

The following software products may have similar services with RENT A CAR.

1. Car Rental Service
2. Let's Reserve
3. Maybe other web services.

PROBLEMS WITH EXISTING SOFTWARE

As Google becomes a very popular search engine it is the number one search engine used by people. And it is difficult that on Google you are unable to find something related to education. The idea here is that maybe the mentioned platforms are related to RENT A CAR and maybe they are also somehow benefiting people with the services that RENT A CAR wants to. But the thing is how friendly they are, does people with a poor understanding of using the internet getting advantage of it? Here they fail and RENT A CAR comes in. This web portal has a very friendly user interface and people who are not from IT background can easily navigate through this website. In future, team will also try their best to put AI concept to make RENT A CAR capable of taking decisions for their clients.

PROPOSED SOLUTION FOR PROBLEMS

RENT A CAR is here to solve those problem being faced by people at the time of car reservation. This will help clients or customers as well as the bargains owners. Both the parties will get advantage of it. As it will save time and money of the customers who are willing to use rent cars for their journey. While it will boost bargains productivity by putting their business live for 24/7 hours. As their business will become online (computerized) handled by machines and we know machine do not get tired.

CONCLUSION

The study reveals that all the variables (Customers, Clients and Bargains) are the core value of RENT A CAR. So it will try their best to make sure that the following

1. Brand trust
2. Customer satisfaction and
3. Brand loyalty

Are high, meaning that consumers have already believed and are satisfied with the website and services and are loyal to RENT A CAR.

Besides, it appears that brand trust and customer satisfaction may directly influence brand loyalty.

SDLC Software development life cycle:

SDLC or the Software Development Life Cycle is a process that helps us produces software that has the highest quality and lowest cost in the shortest time possible. SDLC provides a structured flow of phases that help an organization to quickly produce software that has high quality.

The SDLC involves six phases as given below

- Requirement gathering or analyzing
- Planning
- Design
- Software development (Actual coding)
- Testing(Unit and Integrated testing)
- Deployment (Launching)

There are lots of SDLC models used but some of them become outdated for nowadays use because nowadays customers want products that can adopt changes. Following are the well-known SDLC models.

- Waterfall model
- Incremental model
- Spiral model
- Agile model

In earlier life developers were using the waterfall model for developing software but it was not flexible and do not provide flexibility for developers. And nowadays developers face some problems using the waterfall model which is handling changes requests from the customer during development and the high cost and time required to make those changes. We don't want to face these issues thus we decided to use the agile model for our project RENT A CAR.

AGILE development model:

The agile model was primarily designed to help a project adapt to change requests. The main aim of the agile model is to make the project able to adapt to changes during the development phase. In the agile model, we remove all those activities which do not important for that project. So by doing this we save lots of time and effort. The agile model decomposes the project into iterations (time-boxes) where each iteration is completed separately and after planning, development, and deploying hands over to the customer. Just like other models AGILE model also consists of the following

- Requirements
- Planning
- Design
- Development (Actual coding)
- Testing(Unit and Integrated testing)
- Deployment (Launching)
- Review

Following is a picture was taken to demonstrate the functionality of the Agile model (SDLC).

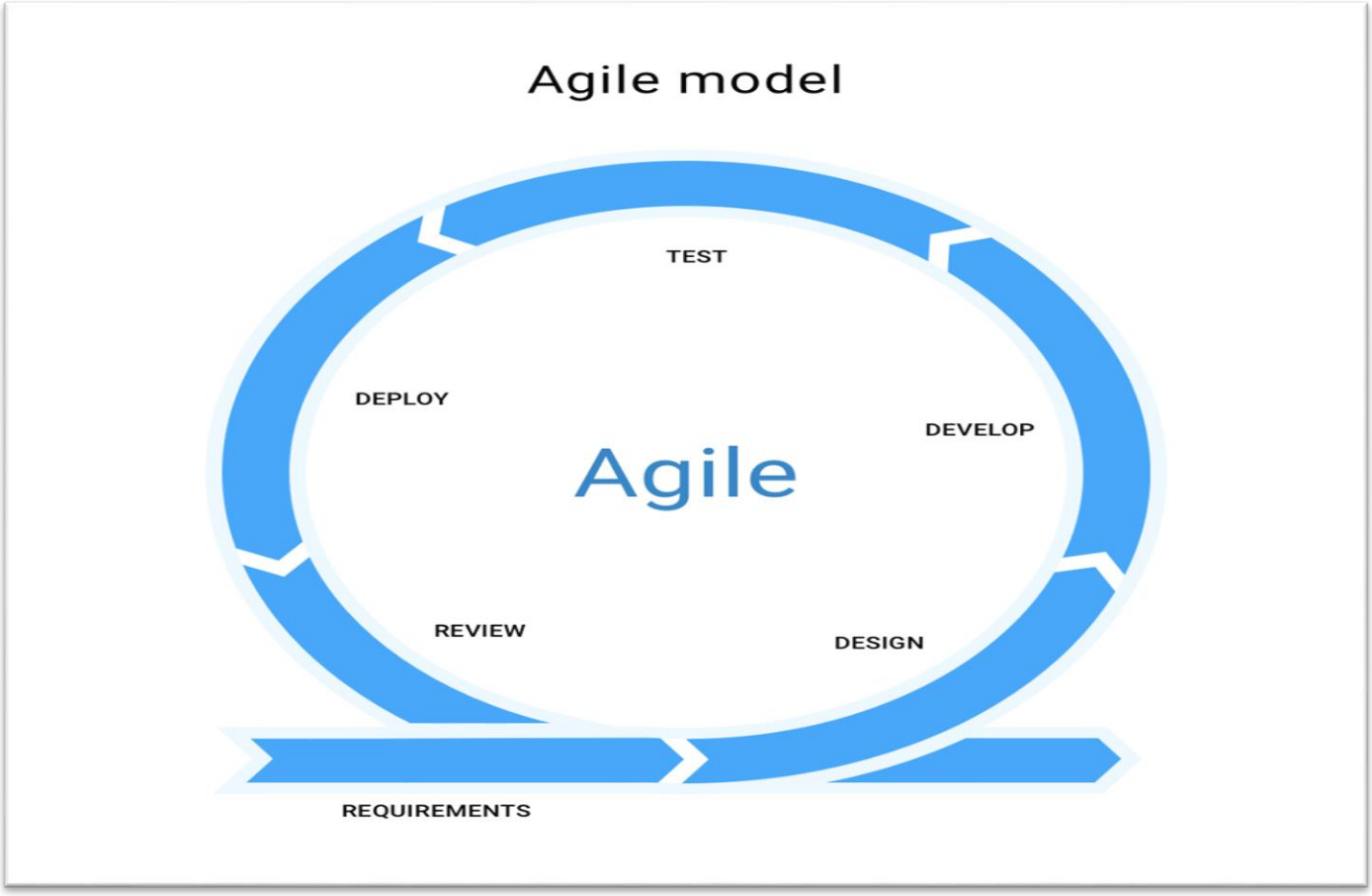

Figure 2. Demonstration of SDLC (Agile Model)

CHAPTER 3:

REQUIREMENTS

REQUIREMENTS GATHERING

Requirements gathering is one of the most essential parts of any project and adds value to a project on multiple levels. Requirements gathering is easier said than done, it is generally an area that is given far less attention than it needs. Requirements gathering is also an exploratory process that involves researching and documenting the project's exact requirements from start to finish. Effective requirements gathering and requirements management start at the beginning of the project.

FUNCTIONAL REQUIREMENTS

Functional requirements refer to the need and working of the project. As we are building a web application titled (RENT A CAR) here the functional requirements will be as to how the user will interact with (RENT A CAR). In the case of this project, our functional requirements may include the following.

1. **Content (VEHICLES) being registered by admin**

Our first functional requirement will be how the system will respond to and accept the content (vehicles) being registered by admin. As there will be different types of vehicles, so the first focus will be on how the system will respond to these publications and it should happily accept things like these.

2. **Operations performed by each screen**

The second thing that we need to put focus on is how each screen will perform its operation(s). Like if we have a registration page that will be used by new users/customer for registrations so we have to make sure that, that page works fine for getting user/customer details as a new user will provide. And same goes for every page and screen that will properly work for their respective task.

3. **Content approval and workflow process**

As contents are everywhere and it is very important to have valid content. If you have lots of content present on your portal but they don't have any valid meaning and do not help that portal to deliver its services effectively then it is very necessary to check them again and replace them with the

specified contents. To accomplish that, RENT A CAR should also have the functionality of checking and verifying contents being provided by the users. RENT A CAR will approve those contents which are valid and have meaning to RENT A CAR that will improve this web service and will help provide services effectively. RENT A CAR should also focus on the workflow of the system like a user/customer cannot reserve a car if they aren't registered. Or user/customer cannot reserve a car if it is already being reserved Etc.

NON-FUNCTIONAL REQUIREMENTS

Non-functional requirements refer to the conditions rather than specific behaviours. It is also known as the "quality attributes" of a system. While functional requirements are for what the system will do, non-functional requirements are for how the system will do that. Non-functional requirements are not that much necessary for a project but surely it adds more quality to a project and helps in making the workflow lots smoother and effective. Non-functional requirements may include:

1. **System Performance**

Performance refers to how fast the system is while responding to a user request. In our case performance will be the time a page is taking while loading. You may not include this feature of being fast, it will work fine for the basic tasks but users love fast processing and it will add more value to your system if it is performing fast.

2. **Scalability**

Scalability can be defined as, to grow as the users increase. This means that the system needs to be able of handling a large number of users' data. And should be scalable if in future time the number of users or data increases. A system is said to be scalable if it is able of changing its behaviours over time and with the changes in data.

3. **Availability**

The system availability is necessary it means that the system should be available and awake to provide its services to users. Availability should be as greater as you can and the downtime should be

as less as you can. If a system uses to become available for some time and then go to sleep and then come available, the user will become bored and will start leaving that system and go away.

4. **Security**

This contains the security of the contents and encryption. Its means that unauthorized user cannot access the content. Security also refers to show different content to different users. As there are many types of users so make sure to provide the user with the content they needed.

5. **User-friendly Interface**

Visitors and users like a user-friendly interface where they can easily navigate among different things and features. Nowadays programmers work hard to make the interface also called UI as friendly as they can because everyone wants to have a large number of visitors and visitors love the user-friendly environment. So your system should be enough friendly to treat users and visitors in such a way that they wish to visit your system again and utilize the services.

METHODS OF REQUIREMENTS GATHERING

Requirements gathering begins with the idea of what and how the system will perform its tasks. As we need to collect requirements from different sources and places so there exists plenty of methods that can be used to gather requirements. Some of the common methods used for gathering functional and non-functional requirements are as follows:

1. **Interviews**

The interview is the most common way of knowing the system requirements. Different interviews are held between the user and the client for the sake of knowing what the system is proposed to do. During the interview, the project manager or the programmer asks the clients about the problems they have been facing.

2. **Surveys**

Surveys are used to collect information and requirements within a short time frame from a large user group. Surveys on different sites and places are done for collecting user problems and requirements.

3. **Questionnaires**

Questionnaires refer to the interviewers, as they ask different types of system-related questions to collect more information. When the interview conduct between the programmers (software experts) and the client (to whom the project is going to be built) then the programmer or the project manager asks the client regarding problems they have been facing and notes down those problems to must-have solutions for these.

4. **Brainstorming**

Subject specialists conduct different meetings and sessions to discuss different problems being faced by users before the proposed system and they do brainstorming to bring solutions to those problems and other complex issues. As we discussed earlier that in an interview the client asked different questions about the problems being faced by them but after the developer or the project experts also do brainstorming to add more features from their side as they are professionals and have more knowledge than the clients.

5. **Prototyping**

Prototyping refers to making a prototype (not the actual system) of the system so that it will not be the actual system but will look like it and will help you understand the functions and requirements.

CHAPTER 4: DESIGN AND ANALYSIS

DESIGN PHASE

During the design phase, developers and technical architects start the high-level design of the software and system to be able to deliver each requirement. The selected architectural design defines what components should be in, what third-party packages will be used, how the user flow will occur and different components communicate with the database along with front-end representation and behaviours of different components etc. In this phase, the gathered requirements document maps the requirements into an architecture. That architecture defines the components, their interfaces, and behaviours. Design deal with the UI (user interface) means that in this phase developers or architects focus on the alignment of different elements and components to make the system more attractive.

1) **Components involve**

Components are the building blocks of every software, they may be buttons, headings, links, etc. Designers and developers focus on all the components involved in software, along with their alignments and interaction with one another in the front-end.

2) **Third-party packages**

Third-party packages are libraries and packages which have built-in functionalities to improve the software. Just like NODE JS uses express for routing and Mongoose for mongo database are the third-party packages. So it is the time of designing, designers and developers decide which third-party packages and libraries would be used for an upcoming project (software).

3) **User flow**

The designer also keep eye on how the user flow will occur. It means first of all how the user will register themselves then what should be the next screen to show when a user got to register. How our application will interact differently with a different type of user etc.

1) ERD (Entity Relationship Diagram)

Entity Relationship Diagram, also known as ERD. An ERD consists of different symbols and connectors for their connection those symbols and connectors visualize two important information: **All the important entities within that system**, and their **inter-relationships.**

Following is the RENT A CAR *ERD.*

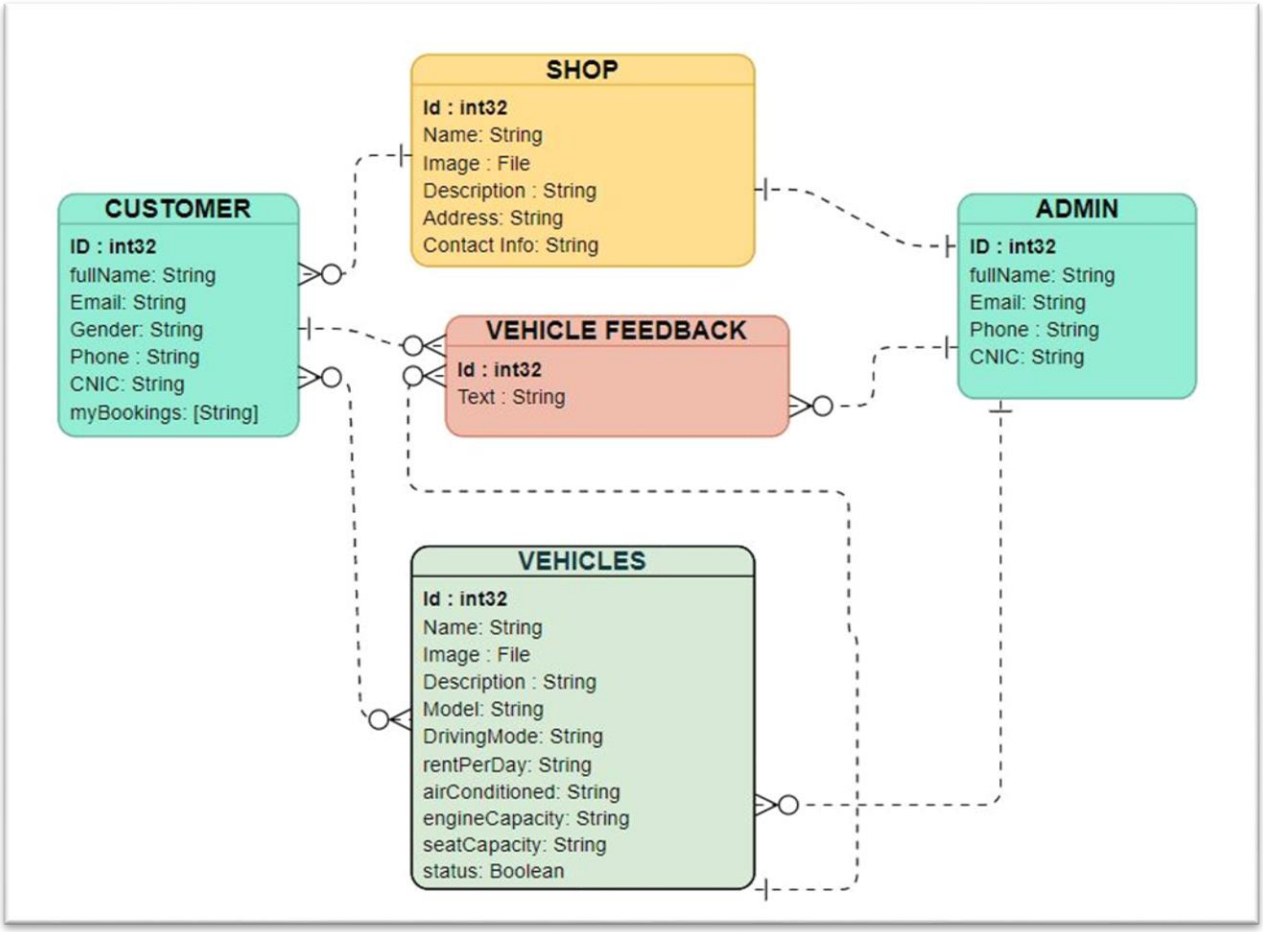

Figure 3. RENT A CAR ERD (Entity relationship diagram)

2) DFD (Data flow diagram)

DFD tells us about the flow of data among the different components of the software. It shows us how the data flow occurs and how different components of the system are communicating among themselves. DFD shows us what data these components or elements transfer with each other and how that flow occurs.

DFD has different levels and as RENT A CAR also have DFD so let's have a look at the different level of DFD. Following are the different levels of DFD (data flow diagram) of RENT A CAR.

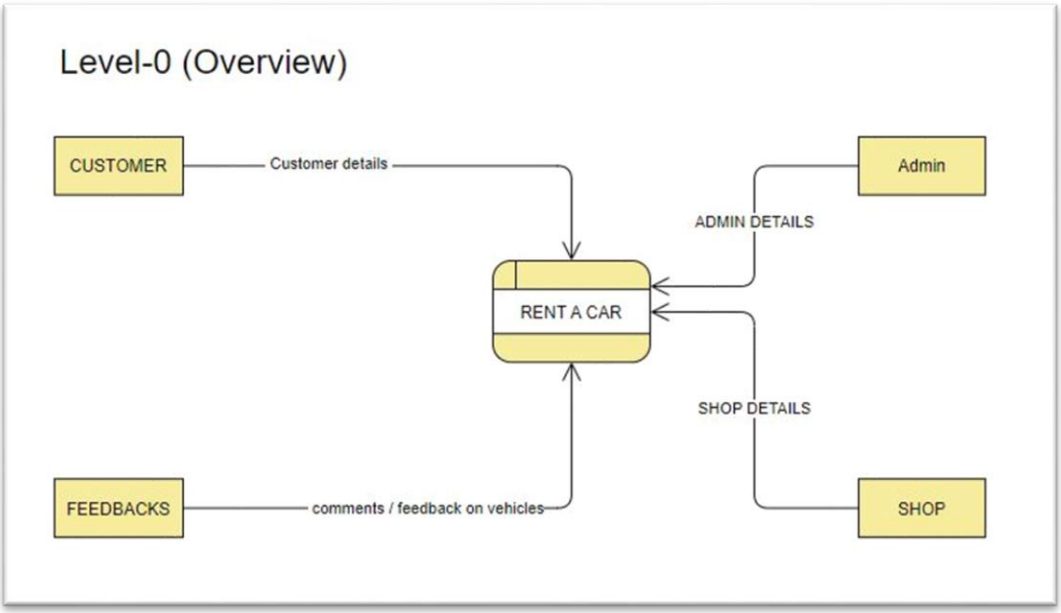

Figure 4. Level Zero (0) of RENT A CAR DFD (Overview)

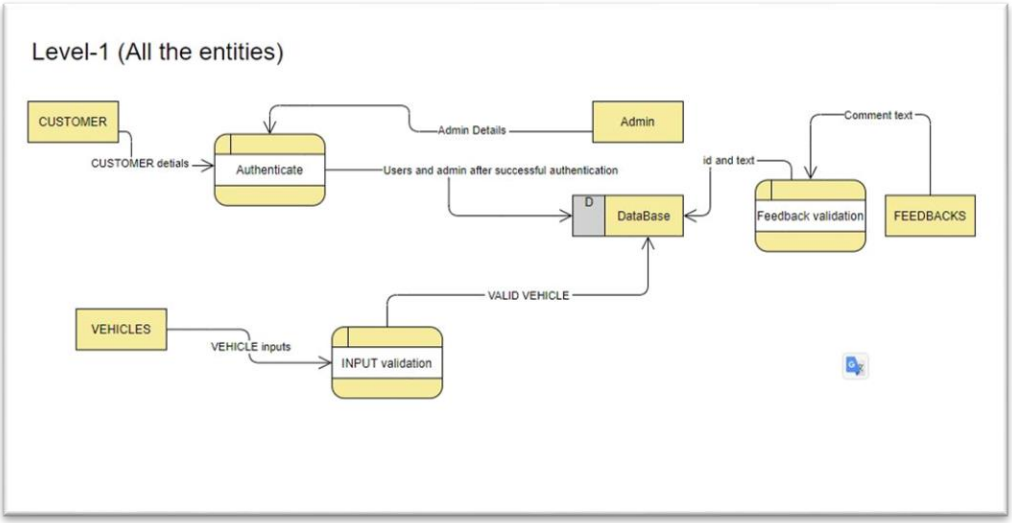

Figure 4.1: Level 1 of DPaPIC DFD (all the entities)

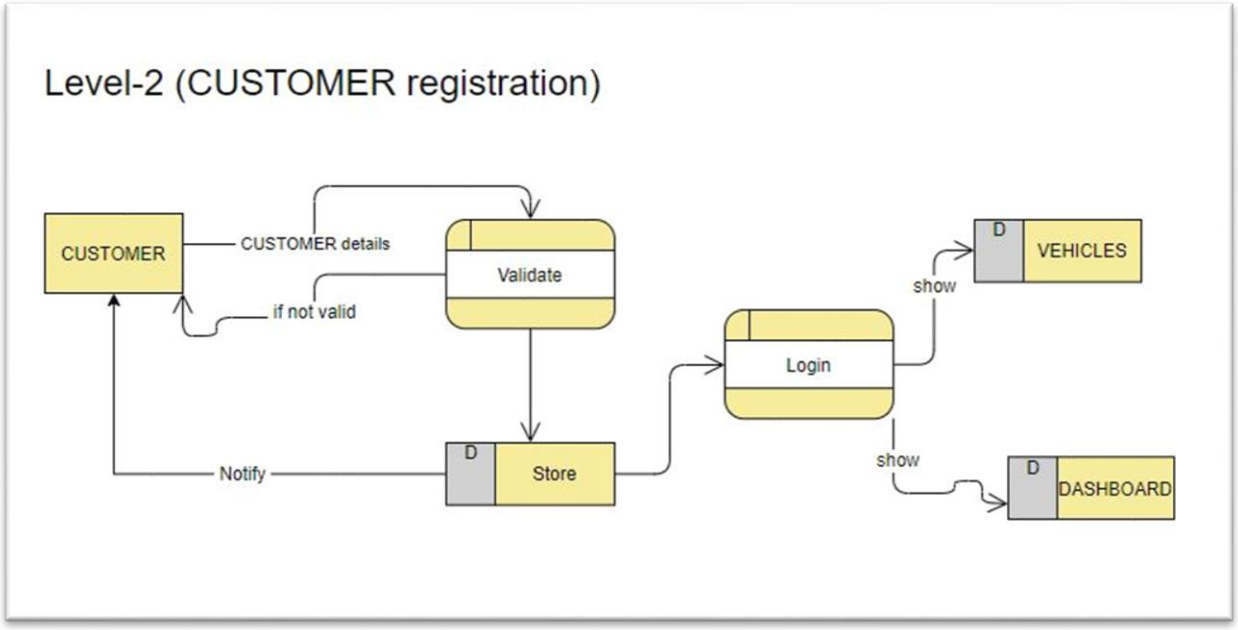

Figure 4.2: Level 2 of RENT A CAR DFD (CUSTOMER registration)

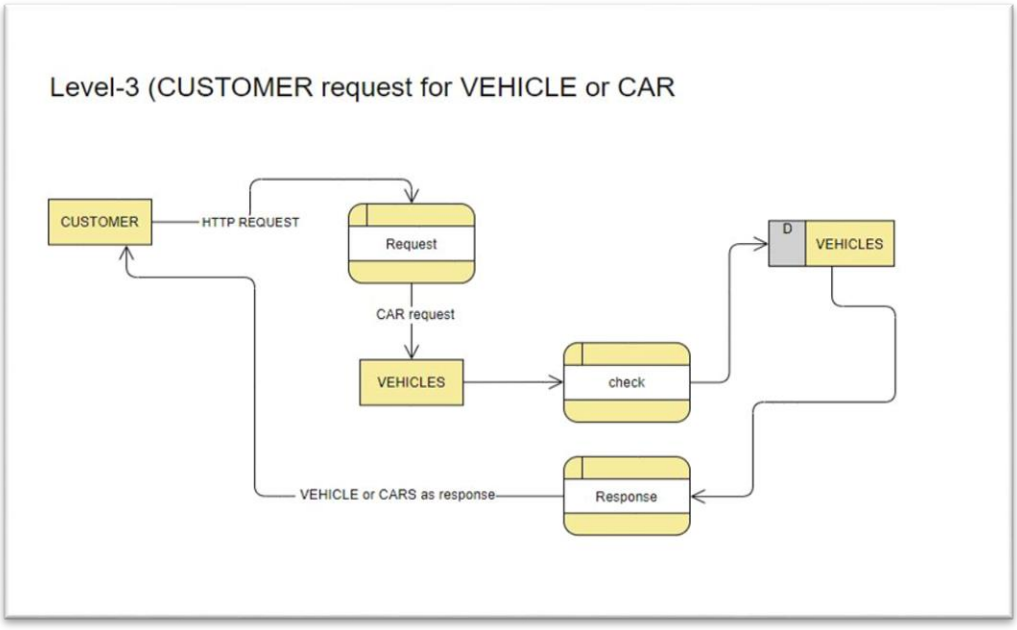

Figure 4.3: Level 3(CUSTOMER Request for VEHICLE or CAR)

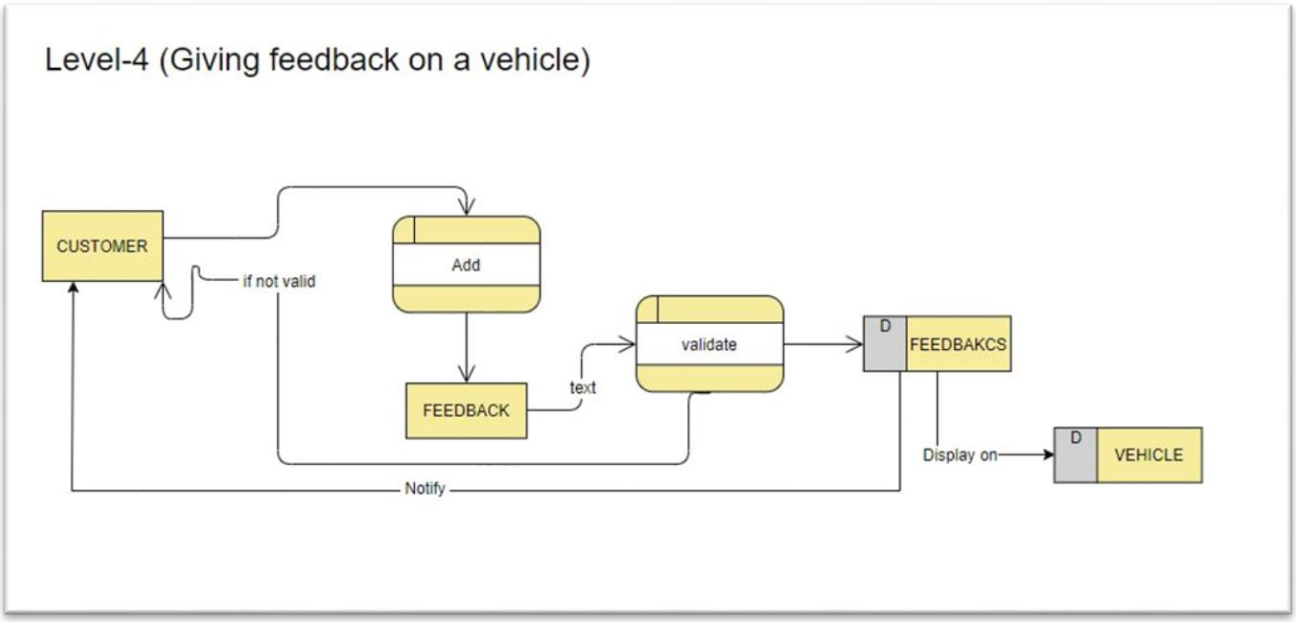

Figure 4.4: Level 4 (Adding FEEDBACK)

3) Activity diagram

An activity diagram is used to represent the flow from one activity to another activity inside a system. The activity inside a system is an operation of that system. The control flow is drawn from one operation to another. This flow can be sequential, branched, or concurrent. Activity diagrams deal with all types of flow control by using different elements.

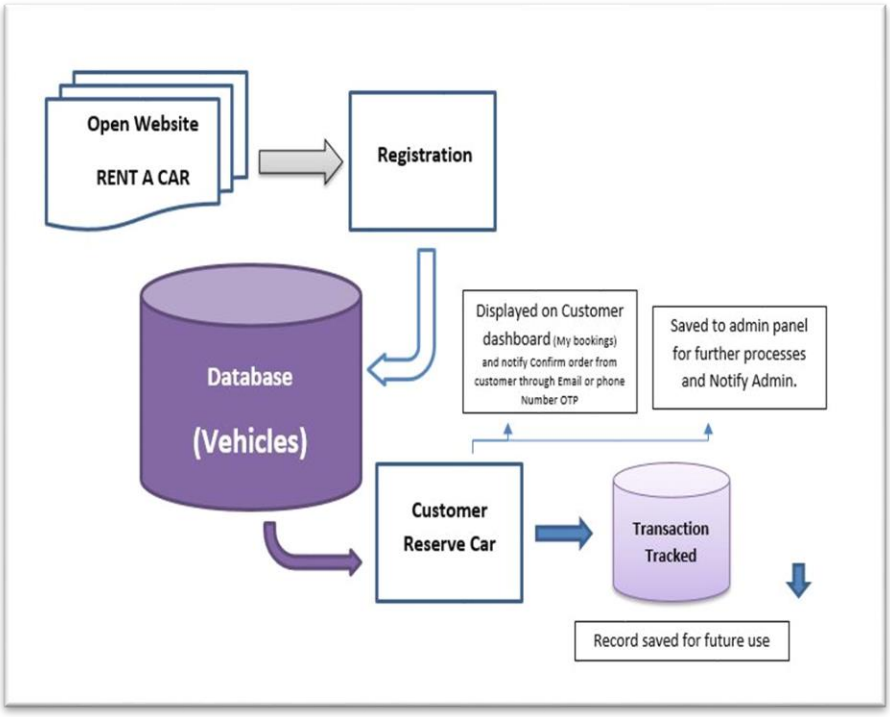

Figure 5. Activity Diagram

Use case diagram

Use a case diagram use to summarize the details of your system's users and tells about their interactions with the system. An effective use case diagram helps your team demonstrate the following.

- Scenarios in which your system interacts with people, or external entities
- Goals that your system helps those entities to achieve etc.
- Below is the Use case diagram of RENT A CAR

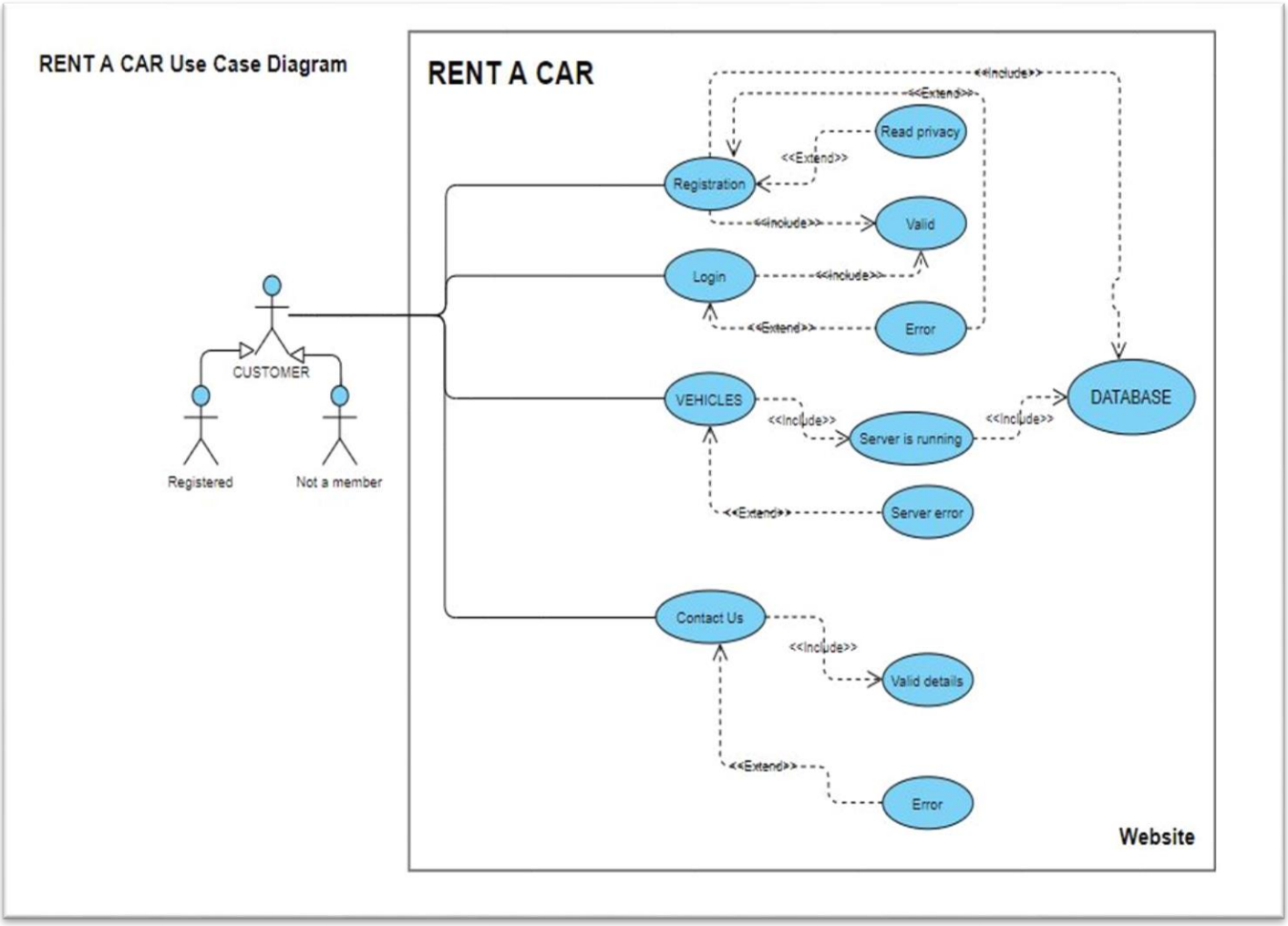

Figure 6. RENT A CAR Use Case Diagram (Types of users)

4) Components interaction with DB

The database involves everywhere and it's the thing that keeps data for future use. Databases are the storage that saves application data somewhere on the disk or online. So it's also the responsibility of the designer to show how the application components will communicate and interact with the database, how data will come from the database to the front-end (in front of the user on-screen).

ANALYSIS

This process is also called discovery, in this phase, we discover and analyze all the requirements and relevant data. Our goal in this phase is to determine the specific ways of how you will get benefits from this application. In the analysis phase, we look after requirements and project expectations. The analysis phase consists of

1) Gather requirements

We discussed earlier in the requirement phase that the first thing that we need is to analyze both the functional and non-functional requirements. Requirements are the expectation from the project (Application). This means that what the system will do. We also discover more relevant requirements in the analysis phase.

2) Analyze gather requirements

It is also necessary to analyze and double-check already gather requirements for ambiguity, repetition, vulnerability. The main purpose of the analysis is to transform requirements into high-level requirements specified in the earlier phase into

a. Unambiguous: There should be no ambiguity (free of dauts)
b. Testable: result well when tested.
c. Complete: There should be no deficiency.
d. Consistent: Consistency is the key, they should be consistent. Able to change over time mean should be adaptable over time.

In short, the analysis phase is all about gathering more specific requirements through questioners and asking and it's about gathering information about

a. What should be inside the application (in our case in a web application)
b. What are the goals and objectives (what you want from the site to do for you)
c. What you want to communicate and whom you want to attract (your targeted audience).

CHAPTER 5:

IMPLEMENTATION

IMPLEMENTATION

Implementation is installing a new system in its target environment. The purpose of the Implementation Phase is to deploy and enable operations of the new information system in the production environment. After planning, requirements gathering and developing, now your project is ready to be implemented. Implementation is the important phase of the project management life cycle. In the implementation phase, we put the project plans into action because in this phase the project team does the project work to produce the deliverables. “Deliverable” means all the products or services a project delivers. Here we need to coordinate and direct project resources to meet the objectives being planned.

Here the project manager's job is to direct the work, but also he/she need to do more than deliver the results. They also need to keep track of how's your team is performing. The importance is that the implementation phase keeps the project plan on track with careful monitoring and control processes to make sure that the final deliverable meets the acceptance criteria set during the planning or requirements gathering phase. The Implementation phase consist of sub-phases: Monitoring & Control, Change control and Move to Production:

1) **Monitoring & Controlling**

Monitoring and controlling the progress of projects play an important role in the successful implementation of a project. It involves tracking the items. By tracking mean checking every item of the project against their services (as they are performing well) if not then make changes according to the cost, scope, and time.

2) **Change control**

Any changes within the project during the implementation phase can affect the scope, timeline, and budget. So the project manager submits the change request to the project sponsor and upon approval that change going to be made.

3) **Move to production**

When a project got completed and we move the new products and services into a production environment, some safeguards need to be in place so that there is no data interruption toward end-users.

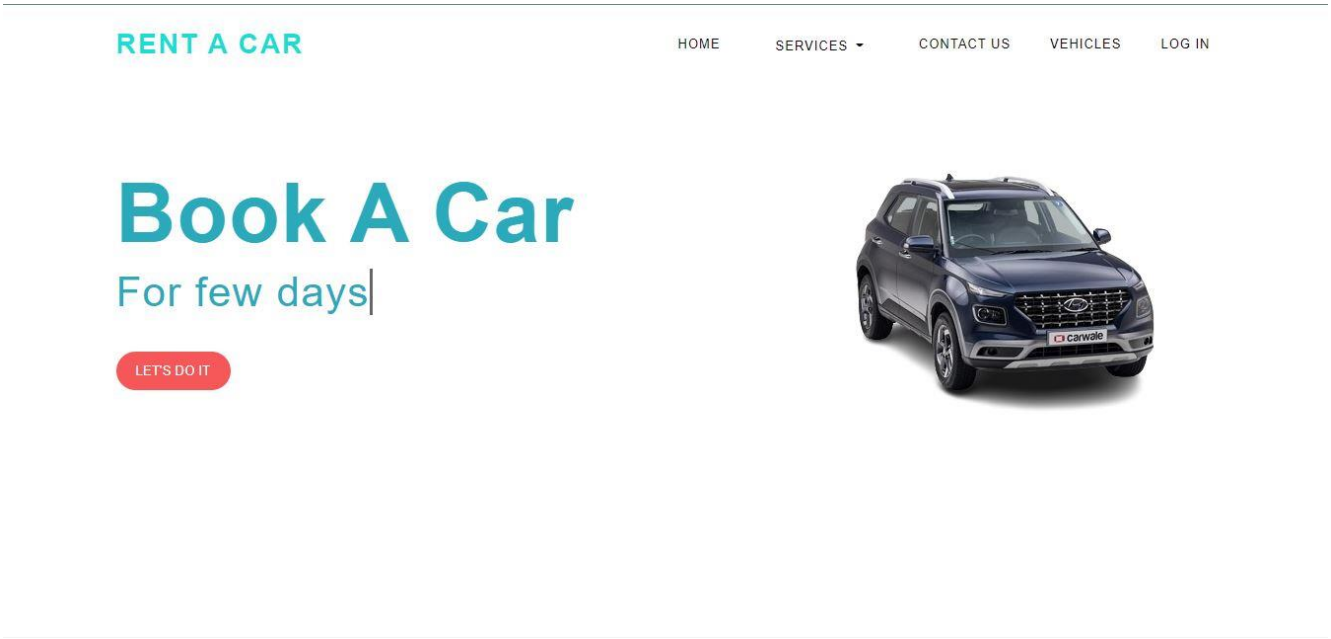

Figure 7. Rent A Car Landing Page main screen

Steps involve in the implementation

Following are some of the important steps to be taken before implementing the project in a production environment. These steps should be taken ahead of time.

1) Prepare the infrastructure

Many solutions are implemented in such environments that are different from where the solution or project was developed and tested. So it's important to check the characteristics of the production environment which may include checking the hardware, software, etc. used there. When you are ready for implementation the production environment needs to be in place.

2) **Coordinate with the organizations involved in the implementation**

The next steps are to coordinate or communicate with the organization involved in the implementation for that you may need to talk with the client community, this may be groups that have a role in getting the solution successfully deployed, etc.

3) **Implement training**

Many solutions require users to attend training or coaching session so that they learn how to use that newly implemented system. The advantage of this training is, to make the end-user capable of using the new system easily and to make the system more productive.

4) **Perform final verification in production**

You should have prepared to test the production solution to ensure everything is working as you expect. There are mainly two checks the first one is to check whether everything is working fine and the second check is done along with passing data into the system to make sure that the new system is also working fine with the data flow.

5) **Implement new processes and procedures**

Many IT solutions require changes to be made to business processes as well. These changes should be implemented at the same time that the actual solution is deployed.

6) **Monitor the solution**

Usually, the project team spent some time testing the system in the production environment and monitor the solution. If there are problems that come after immediately implementing the solution the project team addresses and fix them.

After implementation below is the snapshot of the RENT A CAR system. Those snapshot has been taken after the actual implementation of the system. The system has been checked for every type of user response and after implementation RENT A CAR system passed every type of test that has been taken. Test like responsiveness, the user interface for a different type of screen, user response, email verification etc.

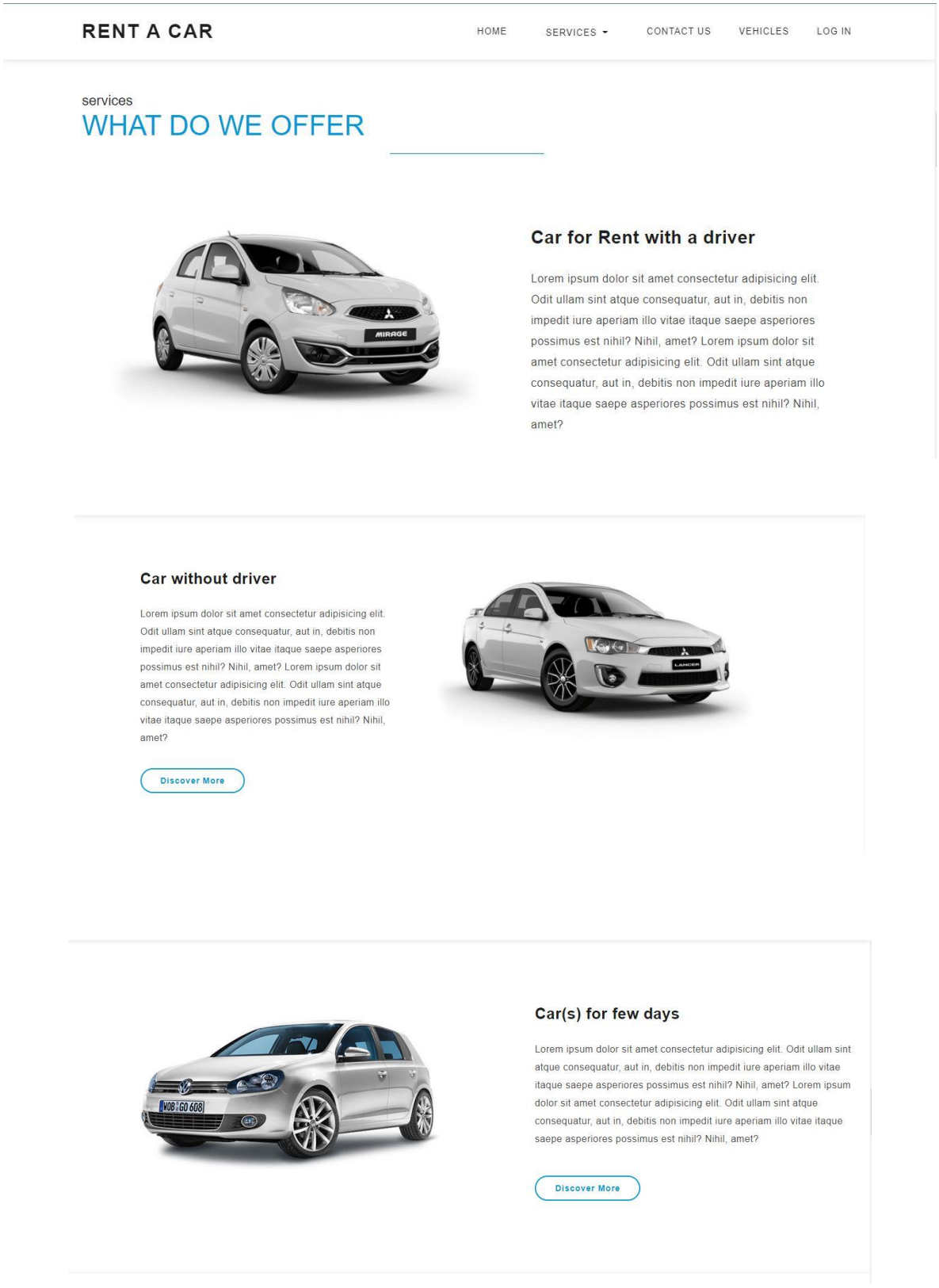

Figure 7.1: Rent a Car Services section

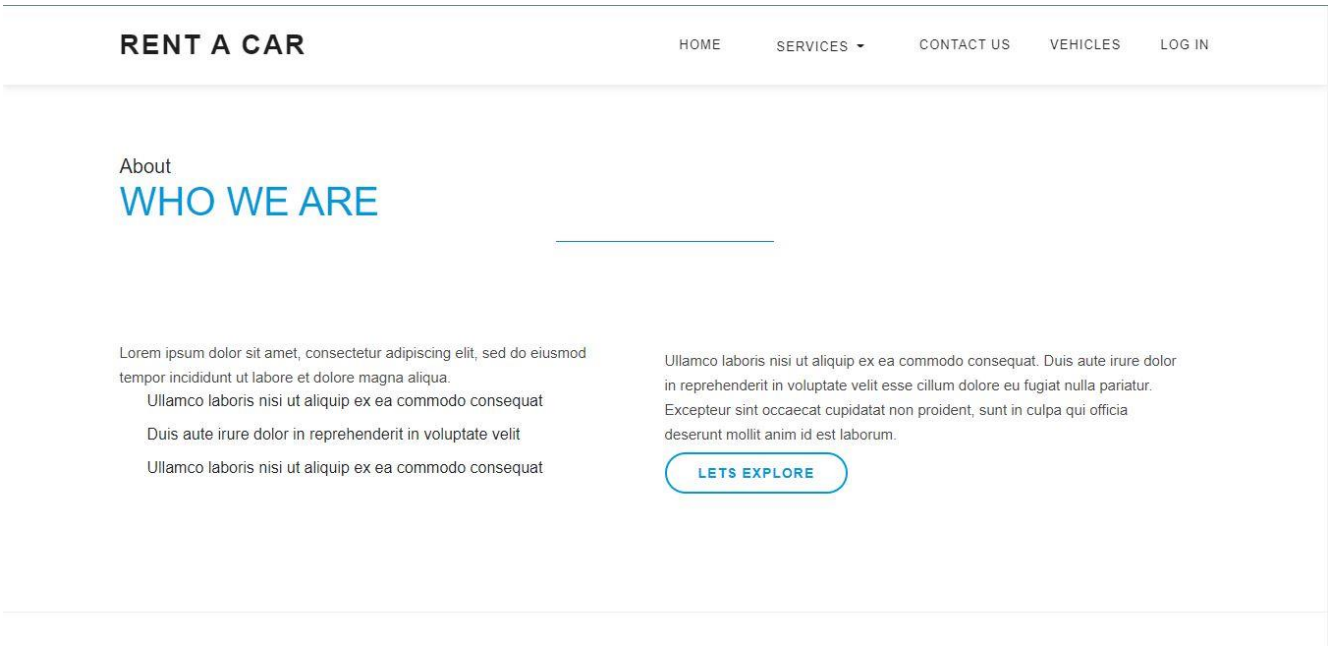

Figure 7.2: Rent a Car about us section

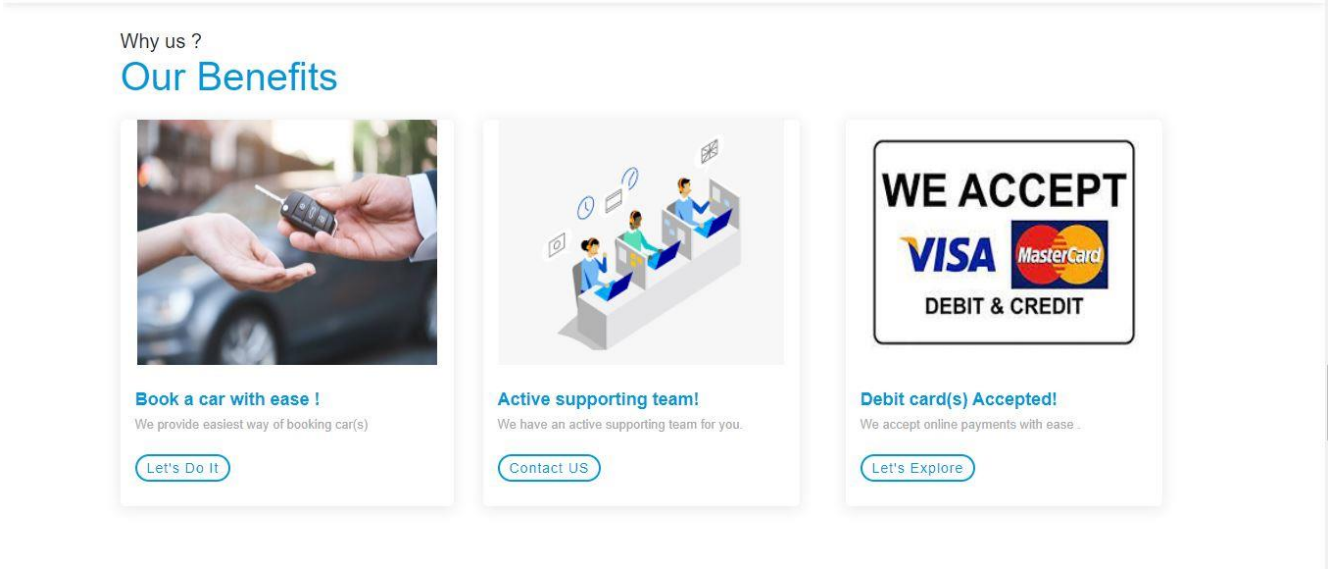

Figure 7.3: Our Benefits Section

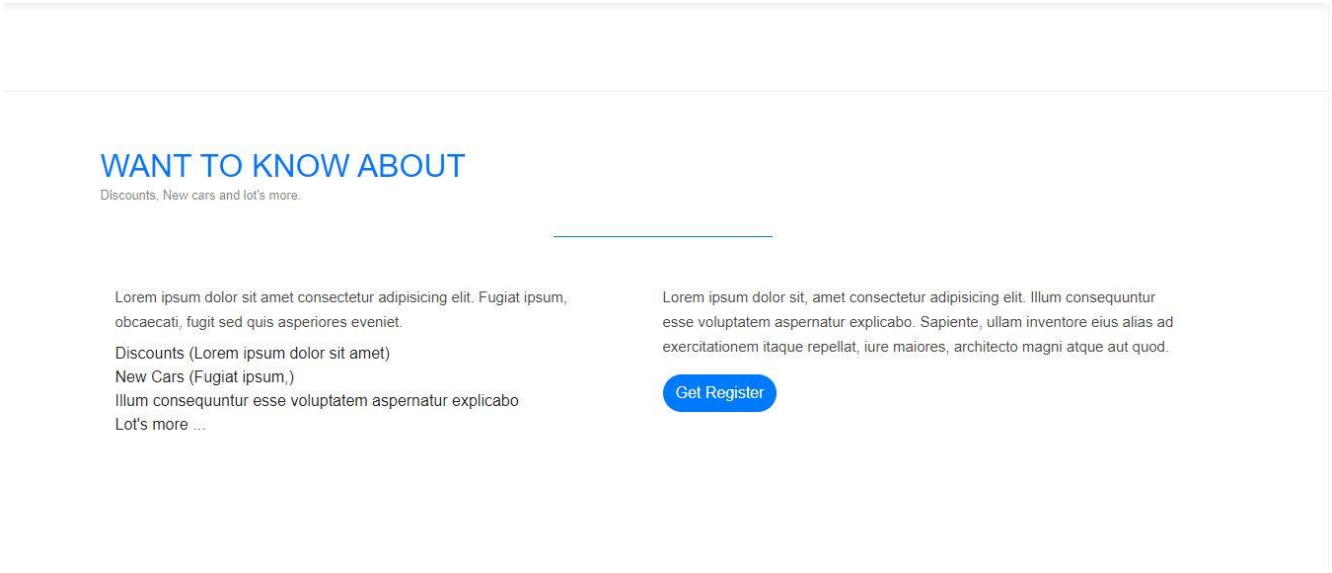

Figure 7.4: Rent a Car Customer Registration

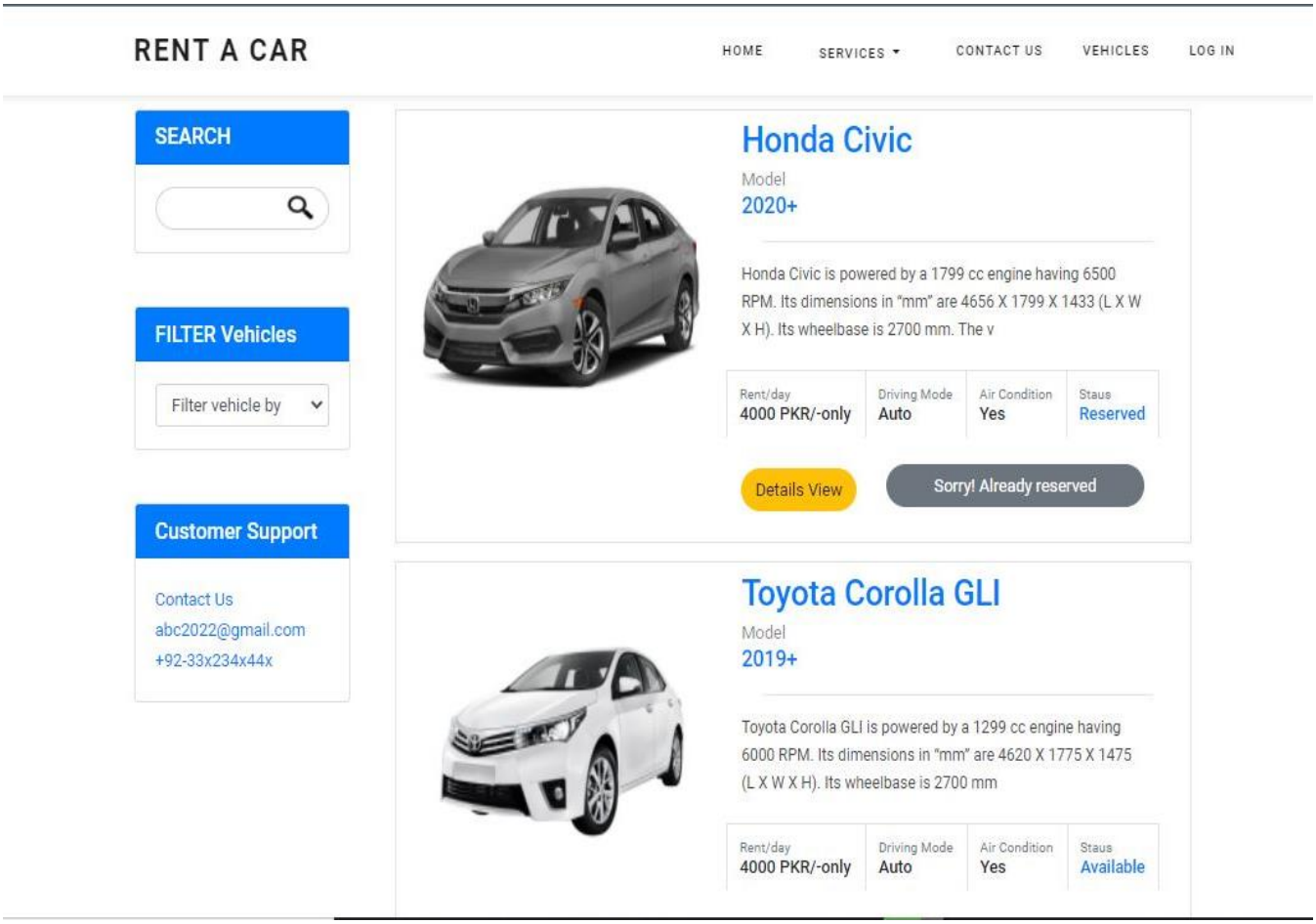

Figure 7.5: Rent a Car Vehicles page

CHAPTER 6: TESTING AND EVALUATION

Testing

In this phase, the developed software is checked or tested and the team evaluated the performance or the result. The software passed different tests and in case of failure the team note and hands over it again to the developer team. Following are some of the well-known tests that are done on software (RENT A CAR) to prove their efficiency.

Black Box Testing

In the black-box test, we focus on the inputs and their related outputs without knowing the code or underlying architecture. In black-box testing, we give some input to that software and compare its actual output with the desired output and try to detect the percentage of error. Black box testing is achieved by testing the following three components.

- Unit Testing
- Integration Testing
- System Testing

1) Unit Testing

In unit testing we test the single unit or individual unit of that software like user registration form, adding something new, removing a user, etc.

2) Integration Testing

In integration testing, one or more integrated units are tested, like registration form along with sign-in form, etc.

3) System Testing

The tests are conducted on a desktop (localhost). The browsers used for testing are all updated versions to date. It was tested in the browser on the local computer by setting up the environment like http://localhost:3000/index. Further, we test our system for the following.

1. Test(1) check that all the links are working properly

Test 1: Make sure all the links are working and redirecting properly.
Steps: • Open home page. • Click on each hyperlink. • Repeat the same for every available page.
Desired outcome: The application needs to redirect the desired page to be opened without any errors.
Actual outcome: The application redirected the desired page to be opened without any error

2. Test (2) for checking content is loading correctly.

Test 2: Check that all the images and content are loaded correctly without missing and the images fit perfectly
Steps: • Open home page. • Check for missing elements i.e. images and also check for formatted text. • Repeat the same for each available page.

Desired outcome: The application needs to load the images and formatted text properly on every page.
Actual outcome: The application loads its images and text is formatted properly on every page

3. Test(3) for searching the desired car in vehicle categories

Test 3: Check the search for the desired CAR by different categories.
Steps: • Search for filters. • Select any category. • Check that the results are reasonable for the CAR search. • Repeat by searching in different categories. • Observe the number of results. • Try to click any of the resulted CAR and check if it is best for you.
Desired outcome: The application needs to perform perfectly the above steps in terms of searching the CAR and retrieving the results.
Actual outcome: The application just worked fine passing all the steps mentioned above.

The following JavaScript code is used to apply different filters on VEHICLE page. Users/Customer will be able to see interest-related vehicle with the help of this filter. This filter will show those CAR(s) whose category got matched with the user's chosen category. For example, if the user chooses to see only Honda Cars then he will choose Honda as the filter term, and below code will search for vehicles with name include (Honda) and will show all those cars/vehicles.

```
const filterVehicles = (req,res)=>{
    const givenCategory = req.body.category;
    if(givenCategory=='All'){
        cars.find()
        .then(results=>{
            res.render('vehicles.ejs',{sentTitle:'Vehicles',Vehicles : results});
        })
        .catch(error=>{
        res.render('error.ejs',{sentTitle : " Page Not Found"});
     })
    }else{
        cars.find({category : givenCategory})
        .then(cars=>{
            res.render('vehicles.ejs',{sentTitle:'Cars',
                                       cars:cars});
        })
        .catch(error=>{
            res.render('error.ejs',{sentTitle : " Page Not Found"});
        })
    }
}
```

4. Test (4) Check for form(s) validation and authentication.

Test 4: Form validation and authentication test

In this test, for the first, we entered the wrong credential and check the system that if it's generating an error or allowing us to enter the system. If it generates an error like (You entered wrong credentials or something like this) then the test is passed.

Steps:

- Open login page.
    - After opening the page the first test is also done here which is we check for loading all the components.
    - Now we need to enter the details.
    - For first we will enter the wrong details
    - Next, we entered the correct details (which is already stored in the database)
- Try to log in.
- Enter wrong credentials and check the validation.
- If login is successful, try to log out and again open the login page.
- Try to enter the wrong password or wrong email and check
- Now enter the correct email and password.

Desired outcome:

The application needs to validate the form and can only allow user login by providing the correct email and password.

Actual outcome:

Everything mentioned in the above step worked without a problem.

Below is the JavaScript code for checking user credentials and allowing them to log in.

```
const checkLoginCredentials = (req,res,next)=>{
   let  customerEmailArray = [];

    customers.find()
    .then(customers =>{
        customers.forEach(oneCustomer=>
            {
                customerEmailArray.push(oneCustomer.email)
            })

             if((customerEmailArray.indexOf(req.body.username))== -1){
                req.flash('error',`Email not registered`);
                return res.redirect('/customer/login');

             }
            else{
                return next();
            }
    })
        .catch(error=>{
            console.log(error);
            req.flash('error','Invalid Credentials, Please try again.');
            return res.redirect('/customer/login');
    })

}
```

Non-functional (quality) testing:

While developing the **RENT A CAR**, there is a need of testing the functionality and operations along with the quality of that software. The results that come after testing RENT A CAR are mentioned below.

- The navigation was visible and was able to respond accordingly.
- Graphical elements and text alignment were according to the interface of each browser view and were a good look and feel.
- The user interface was consistent in terms of widgets, buttons, keys, etc. and the display was clear.
- The software was user-friendly and was easy to navigate every part.
- User will be able to easily get, what he visited **RENT A CAR** for.

Now let's check RENT A CAR for efficiency:

i. Analyze performance

Performance analysis has been carried out for the application to provide an insight into meeting the requirements and monitoring the performance of the application. The performance has been analyzed by using different tools. Tests are conducted in terms of validation, page size, load time, display in several browsers, response time, etc.

ii. Launch time

Launch time refers to the time delay when the application starts. The developer analyzed the launch time and discovered that if the system launches in less than 10 seconds.

iii. Responsiveness

Responsiveness means that the application GUI can react quickly without delays or freezes. Delays between switching pages can be measured in code, by GUI automation tools, or by the tools dedicated specially for this purpose.

RENT A CAR responsiveness was also measured to ensure the quick response of the system and the concluded results were quick when searching or navigating in pages or contents. Responsiveness also refers to the adjacent of the website according to different screen resolutions. This

means that it adjusts their look according to the size of the screen (screen resolution) like Mobile screen, Desktop screen, LCD etc.

Evaluation:

Evaluation can be done after testing and the RENT A CAR team evaluate that the developed software performance was really good and the proposed solution unit testing, integrated testing, and system testing results were fine and efficient. The overall evaluation result was:

- RENT A CAR team planned well for developing the software.
- Requirements were gathered from different sources and the results were satisfactory.
- During the design phase, all the necessary diagrams (ERD, DFD, Class diagram, etc.) were designed beautifully and things related to design like mockups were also made.
- Implementation was effectively done and the project was tested on the local desktop for errors.
- RENT A CAR passed (unit, integration, and system) testing with efficient results.
- The performance, launch time and responsiveness were according to requirements and RENT A CAR performed well during the launch time and responsiveness testing. Because RENT A CAR showed that it is a responsive website and is capable to adjust with maximum types of screen resolutions. And the launch time was less than 10 seconds than every software should be.
- RENT A CAR user interface was very friendly and users can easily navigate through each component. Navigation was very easy and each component(s) was displayed. There should be no issue for the user to get something available on the website and RENT A CAR has that feature. Users can easily get the things they want.

The overall performance and results of RENT A CAR were tested during the test phase and the output was of satisfactory level. The DPaPIC team evaluated the result after checking there is no broken link all the links are redirecting to desired pages/components, contents are properly loaded and displayed on their places, responsiveness was checked and RENT A CAR played well with adjusting their self with different screen resolution.

CHAPTER 7: CONCLUSION AND FUTURE WORK

Conclusion

RENT A CAR played well in each phase and showed that it's a good option to be used. It passed

- Unit testing
- Integrated testing, and
- System testing.

And showed that it is a responsive website that can be fit on different types of screen resolution.

RENT A CAR performance was good in terms of

- Launch time
- UI (user interface)
- Link redirecting
- Components or page navigation.

- After the successful implementation, testing and integration the team conclude that RENT A CAR (web application) will help people easily book or reserve a car from the comfort of their home.
- RENT A CAR also allows people to save their time and money while reserving a car for their next day journey.
- It will help car owners / people with bargains to boost their productivity by allowing their business to be present on cloud and anyone will have access to reserve their car without visiting their bargains.

Usability

RENT A CAR will be easy in terms of use. Everyone with an active internet connection will be able to use it. It is a web application so an active internet connection is the only thing needs to run RENT A CAR.

Reliability

RENT A CAR has been built using the latest development model (AGILE) that's why changes can be done over time so it is reliable. Also, we have tuned this application to run on the maximum browser.

Accessibility

As RENT A CAR is an online service that's why it will be available 24/7 for every user and everyone will have the access to at least visit RENT A CAR.

Future work

To today date RENT A CAR is performing well, but in the future, its team will do more effort than they do and will try their best to make it a market capturing web application. RENT A CAR team is planning to add more possible features like

- **Adding AI** to its components will make them (artificially intelligent) and will become easier to use because the user will not be required to do more effort and spent time while finding a thing they are searching for or to navigate a specific component. Because RENT A CAR will help them in doing their work more easily.
- They will focus more on UI and will make RENT A CAR more **user-friendly** so that the UI looks attractive and the user doesn't get bored while using it. UI is an of the main features of a website so in the future, the RENT A CAR team will focus more on making UI more attractive and user friendly.
- Reliable software is those which change over time and adjust themselves self-according to user requirements. So they will make RENT A CAR a **reliable** web service and will change its feature according to user needs. As it has been built using the AGILE development model so in future requirements changes are adaptable and can be done at any stage.
- RENT A CAR team will make it **faster** by using the latest technologies so that its launching time, page or content loading time, something uploading time, removing something from

database time, user registration time, etc. become minimum. And its performance becomes more time-saving.

- **Responsiveness** is also involved in RENT A CAR team planning, that they will make it more responsive so it could originally display on the maximum screen. In short, just like every software company should, the main aim of the RENT A CAR team is user **satisfaction** at any cost. They will make RENT A CAR in such a way that every type of user gets satisfied by its services.
- RENT A CAR team is also planning to **commercialize** their web application so that in the future it could generate some sort of revenue for its team.

In short RENT A CAR team will mainly focus on user satisfaction and at any cost, they will try their best to satisfy their users with its services. When users are satisfied with your services then without any hesitation they visit the same web portal again and again. And not just that, they also invite others they care about like their friends and relatives. And that user wants that everyone who needs the same service should visit this web portal. So keeping this strategy in mind RENT A CAR team decides to make their web application more attractive, easy to use, user-friendly, and the most important one intelligent.

In the future, the priority will be given to make RENT A CAR artificially intelligent by adding AI concepts. It will recognize that for what type of Vehicle or Car the customer is looking for. At the time of registering a new car, it will detect the car category (Honda, Toyota, Suzuki etc.) from its description and there will be a filter that will be responsible for showing customer interest related vehicles to them. The team will work hard to include semantic-based search filters that will search RENT A CAR, not for the typed words but the meaning of those words.

REFERENCES:

1. A picture to demonstrate the feature and phases of the AGILE development model has been taken from a website and the link to that website is given below.
   https://www.google.com/url?sa=i&url=https%3A%2F%2Fproducttribe.com%2Fproject-management%2Fagile-sdlc-guide&psig=AOvVaw0CWWM98EeiHCjJtYLejOxd&ust=1628873205797000&source=images&cd=vfe&ved=0CAsQjRxqFwoTCLD6iPX5q_ICFQAAAAAdAAAAABAD
2. ERD (Entity relationship diagram has been drawn by using an online tool called a visual paradigm.
https://online.visual-paradigm.com/share.jsp?id=313438373532342d33
3. RENT A CAR, use case diagram has been drawn with the help of using an online tool (designing tool) that is the visual paradigm.
https://online.visual-paradigm.com/w/ifnebfjp/diagrams/#diagram:workspace=ifnebfjp&proj=0&id=9
4. All the snapshots used in chapter 5 were captured from the website called RENT A CAR. RENT A CAR is the name of this system and all the snapshot given in chapter 5 is of this system.

PLAGIARISM REPORT BY TURNITIN