American International University-Bangladesh (AIUB)

Department of Computer Science

Faculty of Science &Technology (FST)

Spring 21 22

Smart Parking Management System

Software Requirement Engineering

Sec: **A**

Project submitted

By

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The project will be evaluated for the following Course Outcomes

Table Of Context

Revision History

Revision	Date	Updated by	Update Comments
0.1	2022.04.18	Ahammed, Md. Nafiz	First Draft
0.2	2022.04.23	Sajjad, Md.	Second Draft

1. PROBLEM DOMAIN

1.1 Background to the Problem

With the high percentage of vehicle ownership in the United States, parking has become a conflicting and confusing for a number of people.

The sharp contradiction between the rapidly growing number of vehicles and limited parking lots in Bangladesh results in the phenomenon of "difficult parking and disorderly parking", which has serious impacts on citizens' quality of life and the running of urban roads. Car parking is a major problem in urban areas in both developed and developing countries. Following the rapid incense of car ownership, many cities are suffering from lacking of car parking areas with imbalance between parking supply and demand which can be considered the initial reason for metropolis parking problems. Parking problems in cities and urban areas are becoming increasingly important and have been one of the most discussed topics by both the general public and professionals. The imbalance between parking supply and parking demand has been considered as the main reason for metropolis parking problems. Moreover, the parking system plays a key role in the metropolitan traffic system, and lacking of it shows closed relation with traffic congestion, traffic accident, and environmental pollution. Although efficient parking system can improve urban transportation and city environment besides raising the quality of life for citizens, parking problem is an often-overlooked aspect of urban planning and transportation. Whether at an airport, bus stations and shopping centers, problems with parking are an everyday occurrence. Lack of accessible parking can hurt local business and decrease the quality of life for residents.

The report examines car parking problem in the city; its different causes and conventional - yet non -successful- approaches. Modern technology has produced a variety of new solutions and techniques in this respect. The report reviews new planning trends and creative technological solutions which can help alleviate the strain of the problem. Because car parking solutions are not an end in itself, but rather a means of achieving larger community goals in order to improve urban transportation and make cities more livable and efficient, the report also discusses the environmental impacts which should be taken into considerations for solutions proposed.

1.2 Solution to the Problem

The proposed solution to the parking problem in Bangladesh is to create an app that would assist drivers in locating the closest open parking place based on their location. Because there are so many buildings, malls, apartment complexes, and parking lots with available parking places for a set period, most individuals who own cars or bikes do not always park their vehicles in their

garages. They have to use their vehicle to go to the office, school and other places so most of the time their parking space in the garage remains vacant. At that time, those who come to this area and want to park their vehicle they can utilize the parking place in exchange for a fee per hour, which will also ease the parking issue. The software will serve as a bridge between the two users. In this way, the parking place owner makes money by allowing other users to use it, while the other user is freed of the trouble of looking for a parking spot. This software will be beneficial to both parties. The primary goal here is to fix the parking issue while also providing some financial advantage to the garage owner.

Additionally, when looking for a parking place, the user can lose a significant amount of time and fuel. If they use this app, they will save time and fuel also. Currently, in Bangladesh, there is no app available for smart parking. However, in other countries, this type of system is available, so we will use those system features and add some extra features depending on the environment of Bangladesh. We will make our app like "SpotHero- Find parking" this service is available only in the USA. We will implement it in Bangladesh and it will solve the parking issue, minimize fuel consumption, and provide a financial advantage to users who will assign their space to our users.

1.3 Proposed App as the Solution of the Problem

Users can search and book available parking spaces in a parking garage using the Smart Parking App. The System can be described as follows. The parking garage will be operated based on the computerized system. In a smart parking app, those who are the owner of their garage have to provide the time off availability off their parking space so that if any user wants to book the parking space, they can do that also.
Also, the garage owner has to install a sensor and camera to know how much time a car was parked. The camera will check the car's license plate which enters and exiting. Those who use the parking spaces have to provide their vehicle name and the license plate. When a driver wants to park their car, they can click on the "Space available nearby" then the app will show the available parking spaces. The driver has to select a place and provide the time he will park there. Suppose a driver selects 3 hours and he leaves before that. In that case, the garage camera will track the license plate while exiting the vehicle and it will add the remaining time as vacant automatically so that no time and space will be wasted and other users can use those spaces. A system will monitor all the activity.

2. SOLUTION DESCRIPTION

2.1 System Features:

This app will have the following specifications/features :

1. Accountcreation for new users
2. Loginfeature for existing users
3. Userprofile
4. Profileinfo. Update
5. Userverification
6. SMS& email alert for login
7. SMS& email alert for failed authentication
8. SMS& email alert for payment slip
9. Paymentoption
10. Realtime info. of a parking spot
11. Navigation using GPS andintegrated google map
12. Alert for both of the users whileparking at the spot and leaving the spot.
13. Automatic generated bill
14. Rating
15. User details
16. Interacting app interface
17. Booking spot
18. status of the parking spot

2.2 UML Diagrams:

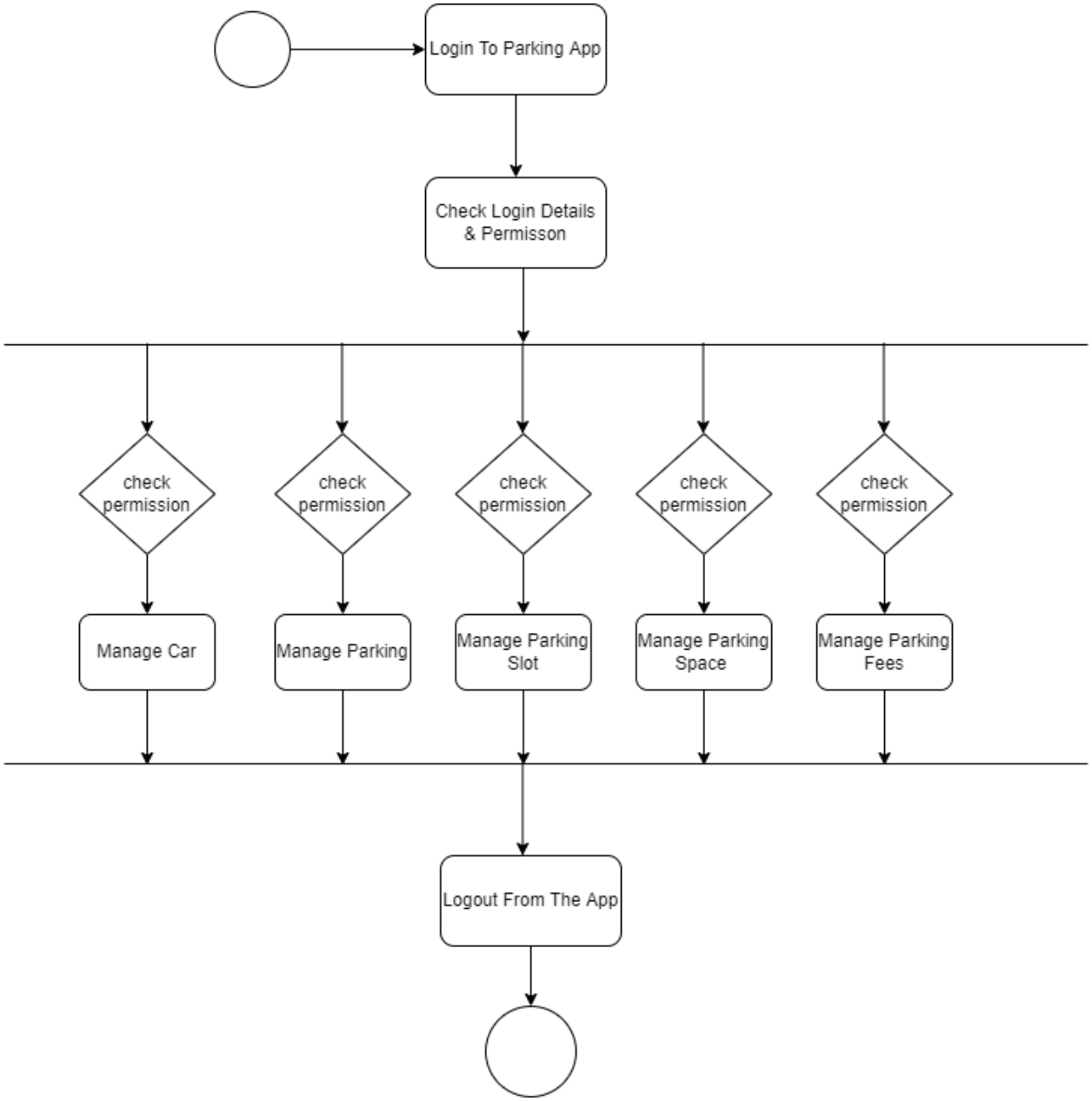


Fig:01

The diagram is about activity diagram. In this activity diagram we can see the activity of the smart parking app. where customer have to log in to the parking app then check login details and permission. After that customer can go to check permission of manage

car, manage parking, manage parking slot, manage parking space manage parking fees. After that customer can log out from the app.

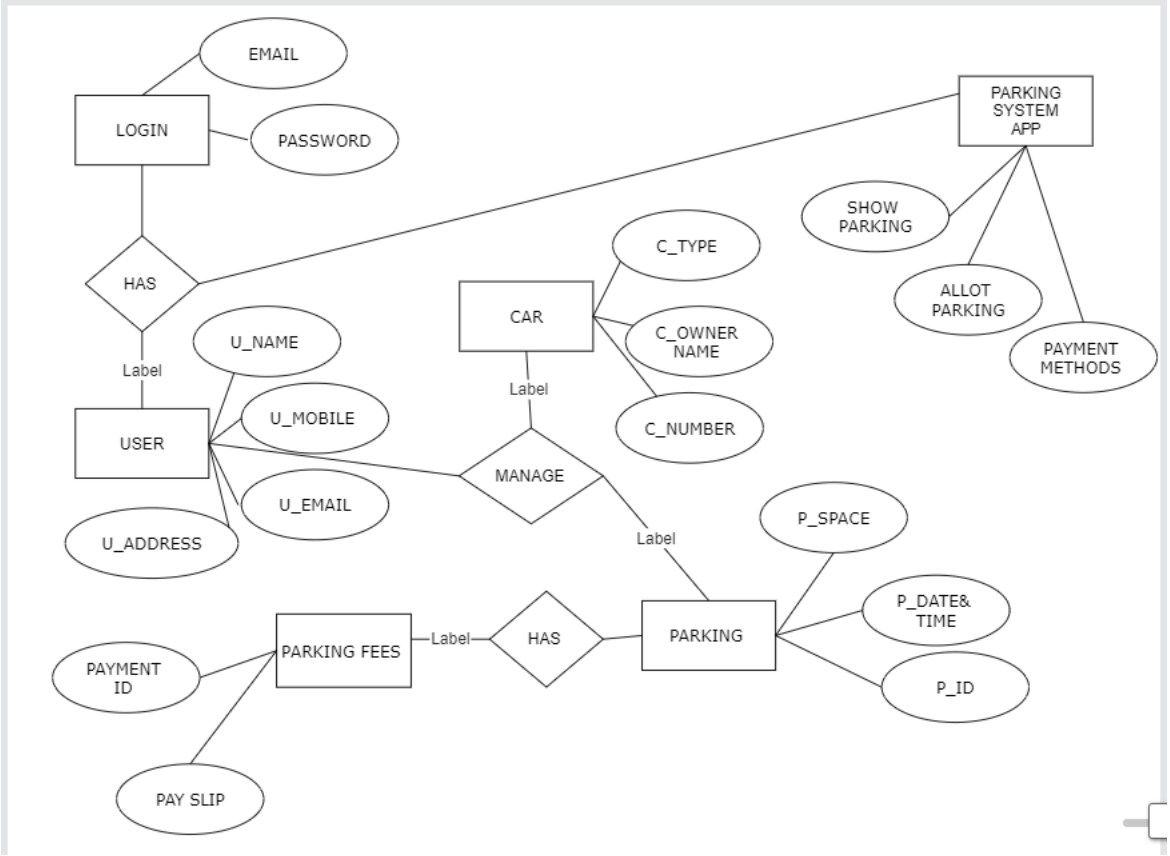


Fig: 02

This diagram is about entity relationship diagram.Here customer can log in through their email id and password. Then if customer has parking system app they can see parking allot parking and payment methods. After that user need to add their user name, user mobile number, email address, user address and also manage car type, car owner name, car number and also user can manage parking space, parking date and time and parking ID. Parking has parking fees. For parking fees we need payment ID and pay slip

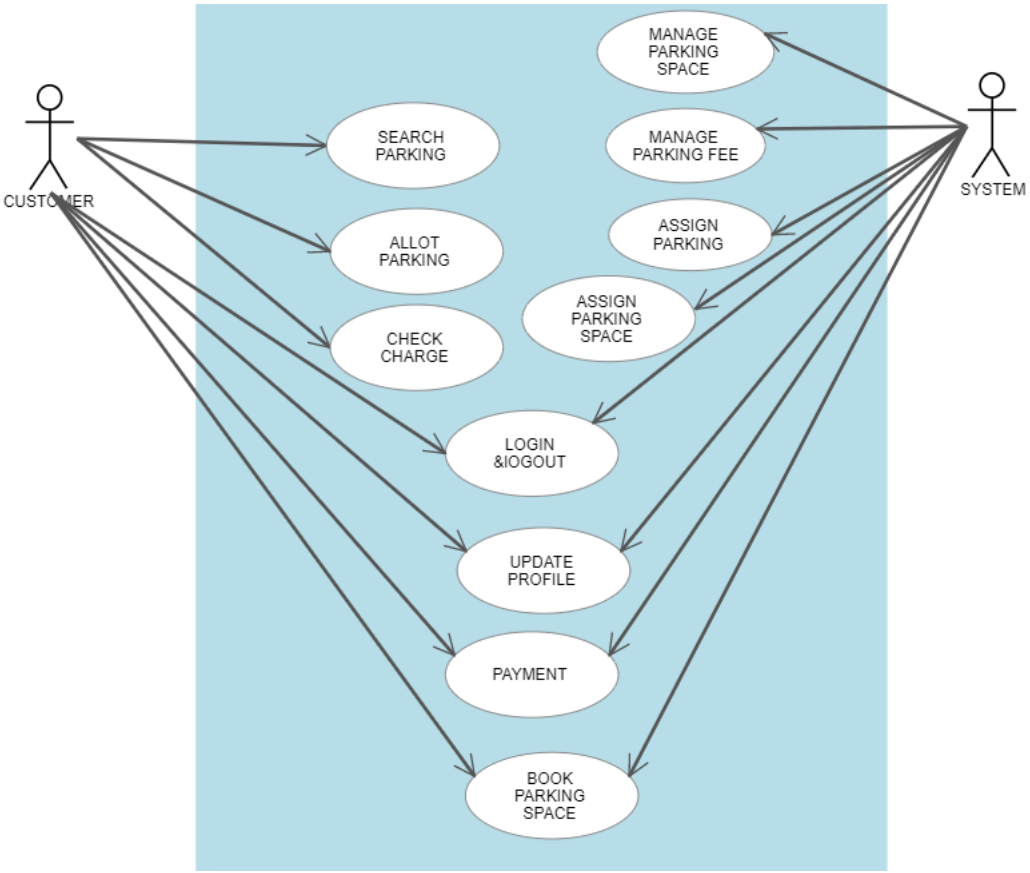


Fig : 03

Here customer can search parking, allot parking and check charge and they can also login and logout. They can update their profile also check payment status and then book parking space. Here in the diagram system can manage parking space, manage parking fee, assign parking, assign parking space, login and log out, update profile, payment and book parking space.

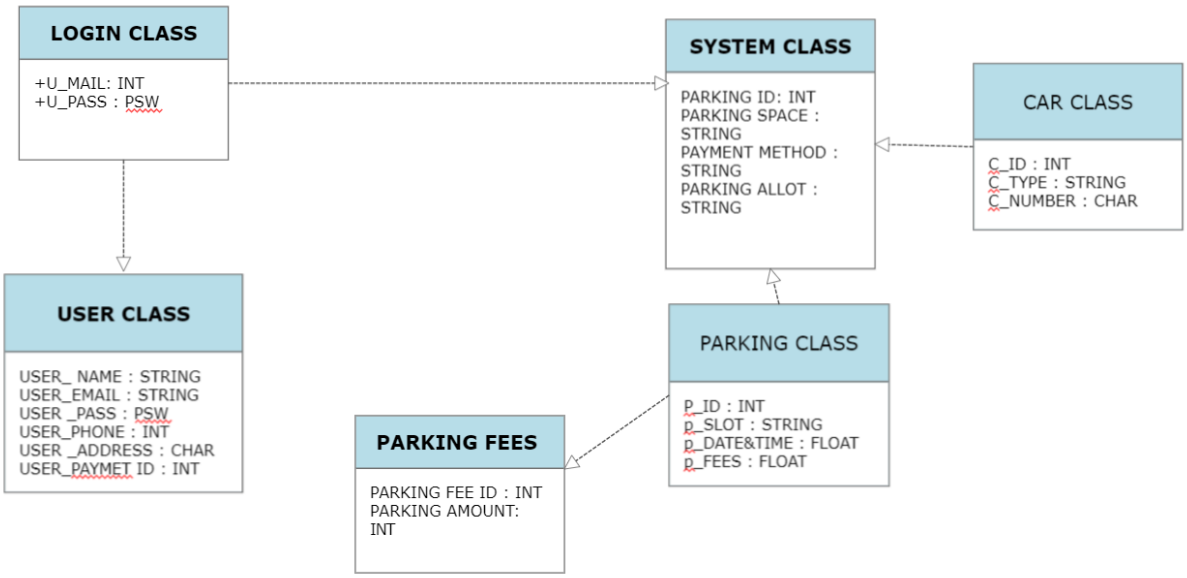
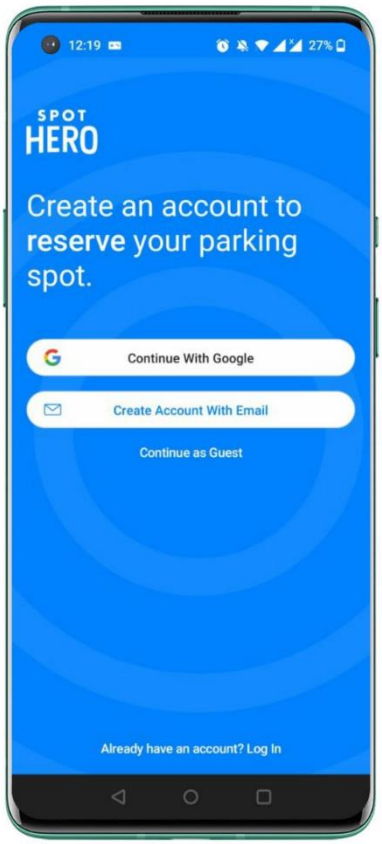


Fig : 04

Here in login class there are attributes of user mail and user password. From login class we can go user class in user class there are attributes of user name, user Email, user pass, user phone user address and user payment id. From log in class we can also go in system class and in system class there are attributes of parking id, parking space, string ,payment method, string parking allot and string. Here in car class there are attributes of c _id, c _type and c _number. From car class we access into system class. Here in parking class there are attributes of p _id, p _slot, p _date and time and p _fees. From parking class we can access to system class. And last in parking fees there are attributes of parking fee id and parking amount.

2.3 System Interface



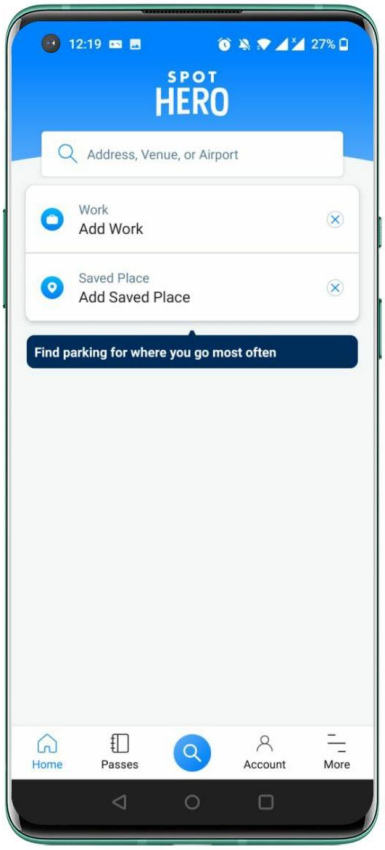


Fig: 5 Fig: 6

here in fig 5 shows create and account page user have to login through their Email account. And in fig 6 customer can find parking for where they go most often.

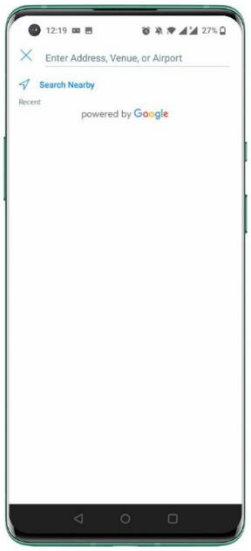


Fig: 7

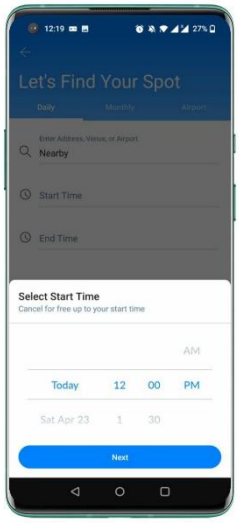


Fig: 8

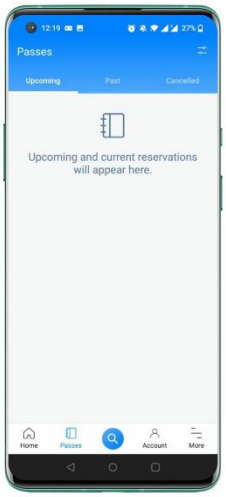


Fig: 9

In fig 7 customer can search address venue or airport and in fig 8 customer can find their spot and they can select start time.in fig 9 upcoming and current reservations will appear there.

3. Social Impact

Upon completion, the project will have a significant influence on society. In addition to resolving the traffic congestion and parking issues, it will provide a financial advantage to those who utilize it. The problem of unexpected automobile damage, car accidents caused by car parking, and a lack of available road space will be addressed in this project. Users seeking a parking place for their vehicle will be able to find one, and users who have open parking spaces may make money from it. Additional job opportunities will be produced throughout implementation, which will be highly beneficial to society and its citizens. Implementing the project will result in employment in all categories since the unoccupied space may require frequent cleaning. The owner will assign a cleaner worker, or it may be a worker responsible for the area at all times.

4. Project Estimation

To develop this project we need one Sr. Manager, one Sr. Analyst, one Analyst, one Ui/Ux Designer, three Developer (one leader), three Quality Assurance Engineer(one Leader). We need **705** hours from 28th March,2022 to 8th May 2022 to develop this project. The cost will be **$60,120.00 USD**

Total Hours Required = 705 Hours
Total cost =$60,120.00

Task ID	*Task	Resource Type	Resource Cost	Hours Required	Budget Hours	Total Cost	Remarks
Requirment							
Elicitation		SR.Analyst	$100	45	6	$4,800	Done
Analysis		SR.Manager	$120	28	25	$5,880	Done
Design							
Sketch		Analyst	$70	10	5	$910	Done
UI/UX		Designer	$50	68	5	$3,650	Done
Development							
1		Developer1	$40	36	8	$1,800	Done
2		Developer2	$75	36	8	$3,200	Done
3		Developer3	$70	52	8	$3,920	Done
4		Developer1	$40	36	8	$1,800	In Progress
5		Developer2	$75	36	8	$3,200	In Progress
6		Developer3	$70	52	8	$3,920	In Progress
7		Developer1	$40	28	8	$16,00	To Do
8		Developer2	$75	28	8	$3,200	To Do
Testing							
1		**QA Engineer1**	$45	36	8	$1,800	Done
2		**QA Engineer2**	$85	28	8	$2,720	Done
3		**QA Engineer3**	$80	28	8	$2,560	Done
4		**QA Engineer1**	$45	28	8	$1,840	In Progress
5		**QA Engineer2**	$85	28	8	$2,720	In Progress
6		**QA Engineer3**	$80	36	8	$3,400	In Progress
7		**QA Engineer1**	$45	28	8	$1,840	To Do
8		**QA Engineer2**	$85	28	8	$2,720	To Do
Maintenance							
Task 1		Lead Developer	$150	6	4	$1,800	To Do
Review							
Task 1		Lead Tester	$140	4	2	$840	To Do

5. Project Schedule

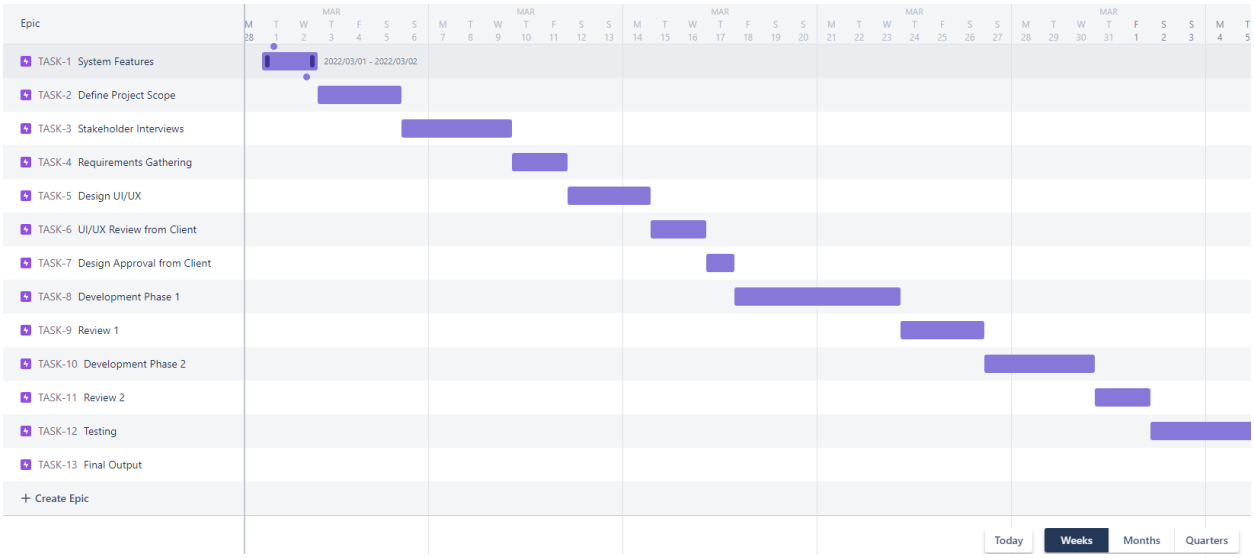


Fig: 10

6. Development Plan

Projects have timelines, budgets, and requirements to adhere to. We use agile project planning to construct the project plan. Agile project management is designed to be flexible enough to handle projects with potentially moving, changing and evolving requirements. Agile planning gives an agile team a clear picture of the goals of their project. We developed this Smart Parking management software using Scrum agile development technique, which is focused on iterative and incremental procedures. Scrum is an agile framework that is designed to provide value to the user throughout the project's development. It is so much adaptable, user friendly, rapid, flexible, and effective.

Scrum's primary goal is to meet the users' needs by creating an environment of open communication, shared responsibility, and continuous improvement. The development process begins with a fundamental understanding of what needs to be constructed, followed by developing a list of characteristics sorted by priority (product backlog) that the product's owner desires.

Stages of the Software Development Lifecycle:

Fig: 11

The most critical and fundamental level of the SDLC is requirement analysis. The planning step also includes determining the project's quality assurance requirements and identifying the project's risks.

Following are the 3 activities that occur once the solution is implemented and our users start to use the developed system.

- Bug fixing – bugs are reported because of some scenarios which are not tested at all
- Upgrade – Upgrading the application to the newer versions of the Software
- Enhancement – Adding some new features into the existing software

The primary goal of this SDLC phase is to ensure that requirements are fulfilled and that the system continues to work according to the above phase's specifications.

System owners give necessities for their framework's needs in agile scrum model development. Developers then get to work on what they have planned. After each session, there is a meeting. After each session, each iteration engineer provides an update to the customer and the entire group, and after each session, the client can adjust their requirements and include innovation.

7. Change Management Plan

In software development projects, change management refers to identifying, planning, and implementing software changes. It's used through the software development process. New requirements and the need for change might emerge from nowhere and alter many times. A project may be doomed if we don't handle them properly. A methodical technique for coping with a shift is known as change management.

1. Employees who would be affected should be polled to determine the optimum timing to implement the change.

2. Simultaneously, allow individuals to express their concerns and ensure that they are addressed as quickly and openly as feasible. Throughout the process, keep in touch with team members.

3. Begin with the end in mind and develop milestones to help you reach your objectives.

4. Make a training program with enough sessions to get users used to the new procedures. Give folks a phone number to call if they have any queries.

5. Determine some potential hurdles and how to get through them if they arise.

6. Keep track on the progress of the process and be prepared to make changes if necessary.

8. Marketing Plan

We must evaluate how users or society members are generally engaged with each social media platform since this will significantly influence the app's public perception. Here are some of the most widely used social networking platforms:

Facebook: With over 1 billion members globally, Facebook is the biggest social network. This platform will be used to advertise the parking management apps feature. The finest marketing method for promoting any program is to use Facebook ads. As a result, advertising on Facebook may be the best solution.

Twitter: Another famous social networking tool is Twitter. It links us with the most important and influential individuals at the most receptive times. Twitter has indeed been used to create political awareness, disseminate political messages, and organize collective action. As a result, we will be able to bring our software to this social network effortlessly.

Target audience and the persona: The first stage in developing a successful marketing strategy is identifying and comprehending the target customer. So, in order to develop a marketing plan, we must first determine who our target customer is. In general, targeting the right audience improves the performance of the marketing efforts and leads to more sales or conversions. Creating an ideal customer profile, also known as a buyer persona, is the first step in finding potential prospects. We may create customized content for the clients based on their user personas using target audience research.

Efficient budget use: A marketing budget details how much money a company plans to spend over a quarter or year on marketing efforts. Paid advertising, sponsored site content, additional marketing personnel, a registered blog domain, and marketing automation tools should all be included in marketing budgets.

Short and Long term marketing goals: Short-term objectives are those that we desire to achieve in less than six months. These objectives are usually completed in a couple of days, weeks, or months. With things like email reporting and monitoring outcomes via tracked links, we can more quickly measure the performance of the short-term marketing goals. Long-term marketing objectives should include a plan for managing clients and growing a loyal consumer base. Long-term marketing objectives that are the greatest and most brilliant include a plan to persuade committed clients to pass their brand loyalty on to their offspring.

9. Cost and Profit Analysis

Requirement Cost:

Elicitation + Analysis

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= $4,800+ $5,880
= $10680

Design Cost:

Sketch design + UI/UX design
= $910 + $3,650
= $4560

Development Cost:

Devoloper 1 + Devoloper 2 + Devoloper 3

Devoloper 1= 1800+1800+1600
= $5200
Devoloper 2= 3200+3200+3200
= $9600

Devoloper 3= 3920+3920
= $7840

Total Development Cost= $5200 + $9600 + $7840
= $22640

Testing Cost:

QA Engineer1 + QA Engineer2 + QA Engineer3

QA Engineer1= 1800+ 1840+ 1840
= $5480
QA Engineer2= 2720+ 2720+ 2720
= $8160
QA Engineer3= 2560+ 3400
= $5960

Total Testing Cost = $5480 + $8160 + $5960
= $19600

Maintenance Cost: $1800

Review Cost: $840

Requirement Cost	$10680
Design Cost	$4560
Development Cost	$22640
Testing Cost	$19600
Maintenance cost	$1800
Review Cost	$840
Market promotion cost	$10000
Launching website Cost	$5000
Total Cost	$75120

Profit:

Those who will use their garage for parking have to buy a subscription. We set our monthly subscription rate at 10$. We are assuming at least 10000 people will use our app.

So, 10000 X $10 = $100000

So from the first month, we are getting $25000 profit. After one-year subscription fee will be reduced.

10. Reference

1. G. Im, M. Kim and J. Park, "Parking Line Based SLAM Approach Using AVM/LiDAR Sensor Fusion for Rapid and Accurate Loop Closing and Parking Space Detection", *Sensors*, vol. 19, no. 21, p. 4811, 2019. Available: 10.3390/s19214811.
2. [1]G. Im, M. Kim and J. Park, "Parking Line Based SLAM Approach Using AVM/LiDAR Sensor Fusion for Rapid and Accurate Loop Closing and Parking Space Detection", *Sensors*, vol. 19, no. 21, p. 4811, 2019. Available: 10.3390/s19214811.