

ON SITE AUTO REPAIR



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ONSITE AUTO REPAIR

INTRODUCTION:

In this busy world, people need services at the convenience of their home or office. Hence, our business phenomenon on which we will be working on is to create a business for onsite auto repair. This phenomenon deals with an auto repair company willing to changing their mode of service. This company here is looking forward to changing their business model. Company which does auto repairs at their shop will now be completely doing at customers location of choice.

Idea here is to design information system for a company that does auto repairs right at your doorstep or office. Such a business not only allows customers to get vehicle repaired at their residence/office, but also flexibility to choose their preferred date and time. Such a business phenomenon makes auto repair process smooth and hassle free for the customers, also saves time and money.

The basic idea is to allow Customer to provide zip code, vehicle details (make, year, model, trim), based upon which customer is then provided with a list of services pertaining to different car parts. Also, if customer is unsure about exactly what service to use, business provides a variety of diagnostics options which enables customer to determine the exact problem with the car. Also, there is a list of articles in the system that helps customers to effectively maintain their vehicles. Customer can choose services to avail, timeslot and date for the service. Mechanic's contact details are provided to the customer. A cost estimate is given to the user, also user provides his card details for later payment. Business also hires mechanics through interview and referral process.

SYSTEM REQUEST - ONSITE AUTO REPAIR

PROJECT SPONSOR:

Project sponsor is the owner of auto repair company, who is now willing to implement a new system. Sponsor thought this as a really good idea to invest upon. Sponsor felt the need of this system as an essential requirement in today's busy life, which will not only provide an ease to get vehicle repaired but also an assurance of a quality service .

BUSINESS NEED:

Owner of auto repair company felt a need to change their business model as company wasn't generating enough revenue. This is due to poor experience that customers have been facing because of high waiting time, poor service quality at auto shop, and lack of transparency in parts and labor cost.

In today's busy life car repair can be a frustrating experience. Dealing with car problems is not only a time-consuming and frustrating experience, it is often expensive. Car owners often lack visibility regarding the quality of mechanics or fairness of price. Auto repair industry is broken these days with problems like bad quality repair, warranty after repair, price fairness.

Also, there is a genuine need of a business that provides a hassle-free auto repairs to customers without even moving their vehicle to an auto shop. Such a business phenomenon is bound to provide a value to its customers, especially in fast paced metroplexes across the United states. Current auto repair industry is crippling with issues like poor service quality, unfair pricing (labor and parts), post service warranty. Our system will effectively deal with these issues as this business hires professional quality mechanics, has a transparency on pricing and provides a 12000-mile post service warranty.

Another important issue that drives need for such a business is timing and flexibility. With most of the auto shops and mechanics timing and flexibility is a big issue. Customers not always get flexibility to choose preferred time slot. Also on time delivery of the vehicle after service is not promised. So, our business addresses that issue to a great extent.

BUSINESS REQUIREMENTS:

The sponsor is looking for the system that helps achieving the objective of the business with the following requirements to be fulfilled-

1. Ease of Application.
2. Enhancing auto repair experience.
3. Provide transparency on auto part and labor cost.
4. Empowering mechanics to live a better life.
5. Provide a reliable auto repair to customers.
6. Provide flexibility to customers in terms of timing.

BUSINESS VALUE:

The application of such a system will provide an effortless method to repair auto, compared to tedious traditional methods. Customer experience will be enhanced, as our system will also give estimate of each auto-repair shops. Also, it will attract more customers who are looking for an alternative to traditional methods.

The end to end system with the cost estimates, distance from the customer, availability and ratings of Auto-Repair Shops given by customers will help new customers make their decision on which services to go for.

Moreover, customer will be able to schedule the appointment at their own convenient times and location, at which the service provider will appear with their repair kit, or even customer can choose to go to the service centers.

SPECIAL ISSUES:

It will be customer's responsibility to ensure that the Technician has proper access and permission, and is legally authorized to complete the Job at the location chosen by the user. Also, sudden unavailability of mechanic due to serious illness or personal work is a challenge. Another special issue that can be encountered is damage of certain fragile parts during repairs. Plastic, composite and rubber engine and cooling system components are often affected by age and temperature fluctuations and become fragile over time. Because of this, such parts can break or even disintegrate during procedures that involve their disassembly or handling.

FEASIBILITY ANALYSIS:

1. Technical feasibility:

- a. **Familiarity with functional area:** Users in this case are customers seeking auto repairs. This system is a fairly simple system that just prompts user to enter details like zip code, auto make/year/model and problem with the vehicle. Thus, there is no risk from user point of view. However, since this a new system from implementation point of view, thus involves a risk.
- b. **Familiarity with the technology:** This system involves use of HTML5, CSS, JavaScript on frontend, and Oracle database on backend. These technologies have been great used in IT market, thus developing this system does not possess any risk from technology point of view.
- c. **Project size:** It's a fairly small system involving a small team size of about 5-6 people, thus involves no risk in terms of project size.
- d. **Compatibility:** There involves no risk from compatibility point of view as this is a new system, and doesn't needs to be integrated with a previews existing system.

2. Economic Feasibility:

Costs:

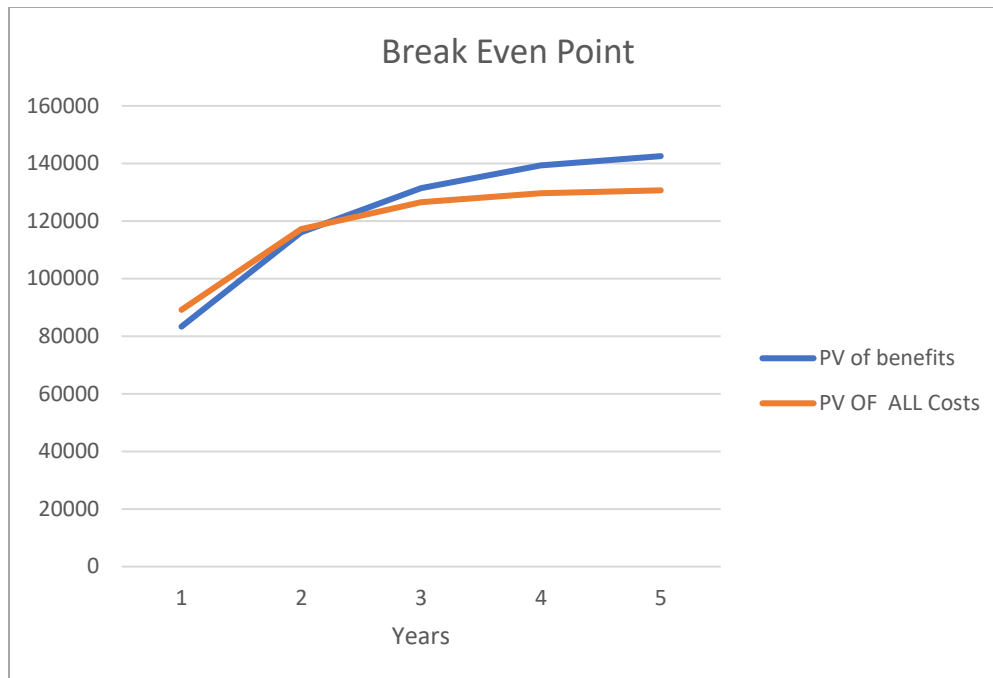
- a. Development of the system will have a development costs like Development Team Salaries, Hardware/software, Database Server costs etc., which needs to be approved by the sponsors.
- b. Initial stage will have high maintenance and updating costs.
- c. As this is a new website and new mode of business, huge advertising costs are also included.

Benefits:

- a. There will be large number of new customers that will register with our website, and give revenue to our company.
- b. This system is expected to give auto repair company a yearly revenue growth of 10% as compared to their previous business model.

Quantitative Benefits	2017	2018	2019	2020	2021	Total
Increased Sales	200,000	240000	350000	550000	650000	
Reduced waiting times	50000	55000	65000	90000	120000	
Total Benefits	250,000	295,000	415,000	640,000	770,000	2,370,000
PV of benefits	83333.33333	32777.7778	15370.37	7901.23457	3168.724	142551.44
PV of all benefits	83333.33333	116111.111	131481.5	139382.716	142551.4	
Software Licenses	500	0	0	0	0	
Server software	500	0	0	0	0	
5 Workstations@500	2500	0	0	0	0	
2 All in one printers @900	1800	0	0	0	0	
2 Servers@2500	5000	0	0	0	0	
Development labor	5000	0	0	0	0	
Total Development Costs	15300	0	0	0	0	
Hardware	2000	2000	2000	2000	2000	
Software	200	200	200	200	200	
Operational Labor (website support and development)	250000	250000	250000	250000	250000	
Total Operational Cost	252200	252200	252200	252200	252200	
Total Costs	267500	252200	252200	252200	252200	1276300
PV of Costs	89166.66667	28022.2222	9340.741	3113.58025	1037.86	130681.07
PV OF ALL Costs	89166.66667	117188.889	126529.6	129643.21	130681.1	
Total Project Benefit Costs	350000	42,800	162,800	387,800	517,800	
Yearly NPV	-5833.333333	4755.55556	6029.63	4787.65432	2130.864	11870.3704
Cumulative NPV	-5833.333333	-1077.77778	4951.852	9739.50617	11870.37	
ROI	9.083465856					
Break Even Point	1.226635514					
Intangible Benefits	Customer satisfaction generated from new business model					

It would take 1.23 years for the project to start earning profit according to our break-even analysis.



ORGANIZATIONAL FEASIBILITY:

A champion who can assign all his/her time and resources to the project will be assigned to make sure the new system is implemented in the organization carefully.

Those system users are chosen who have both technical and business knowledge who can perform hands on activity on the new system.

There seems to be a lot of organizational feasibility in our new system.

REQUIREMENT DEFINITION:

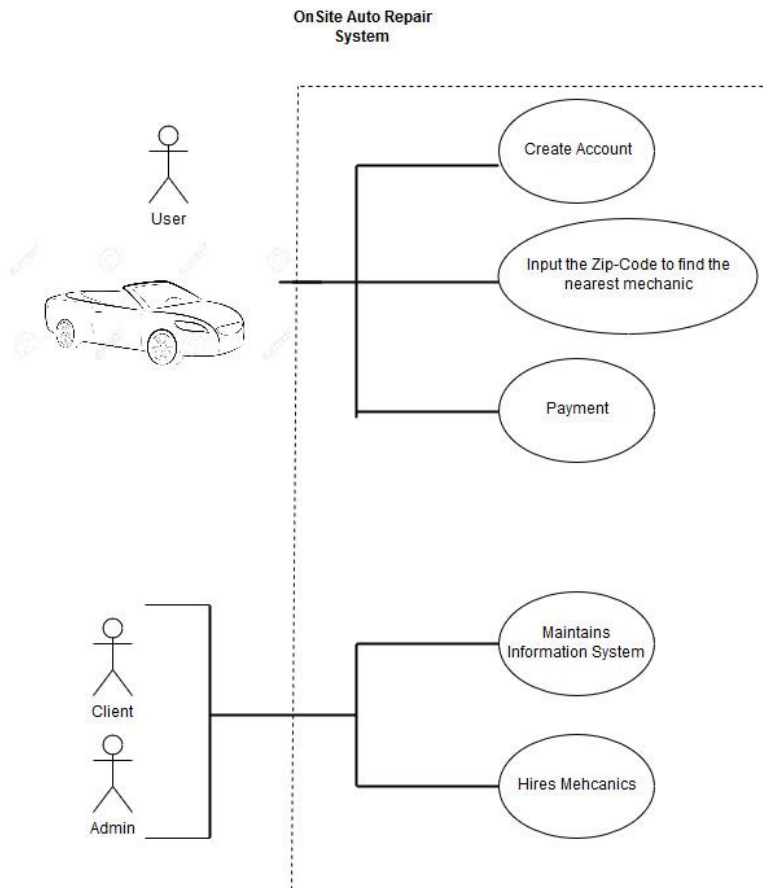
FUNCTIONAL REQUIREMENTS:

- a. The system should provide the best estimate of costs if the user knows and provides the fault details.
- b. The system should allow the Auto-shops to register their company, by taking necessary details.
- c. The system should allow the customer to rate the shops after they use the services, for the referral of new customers.
- d. The system should allow the user to book an appointment at their own convenient times given the availability timings of the repair shops.

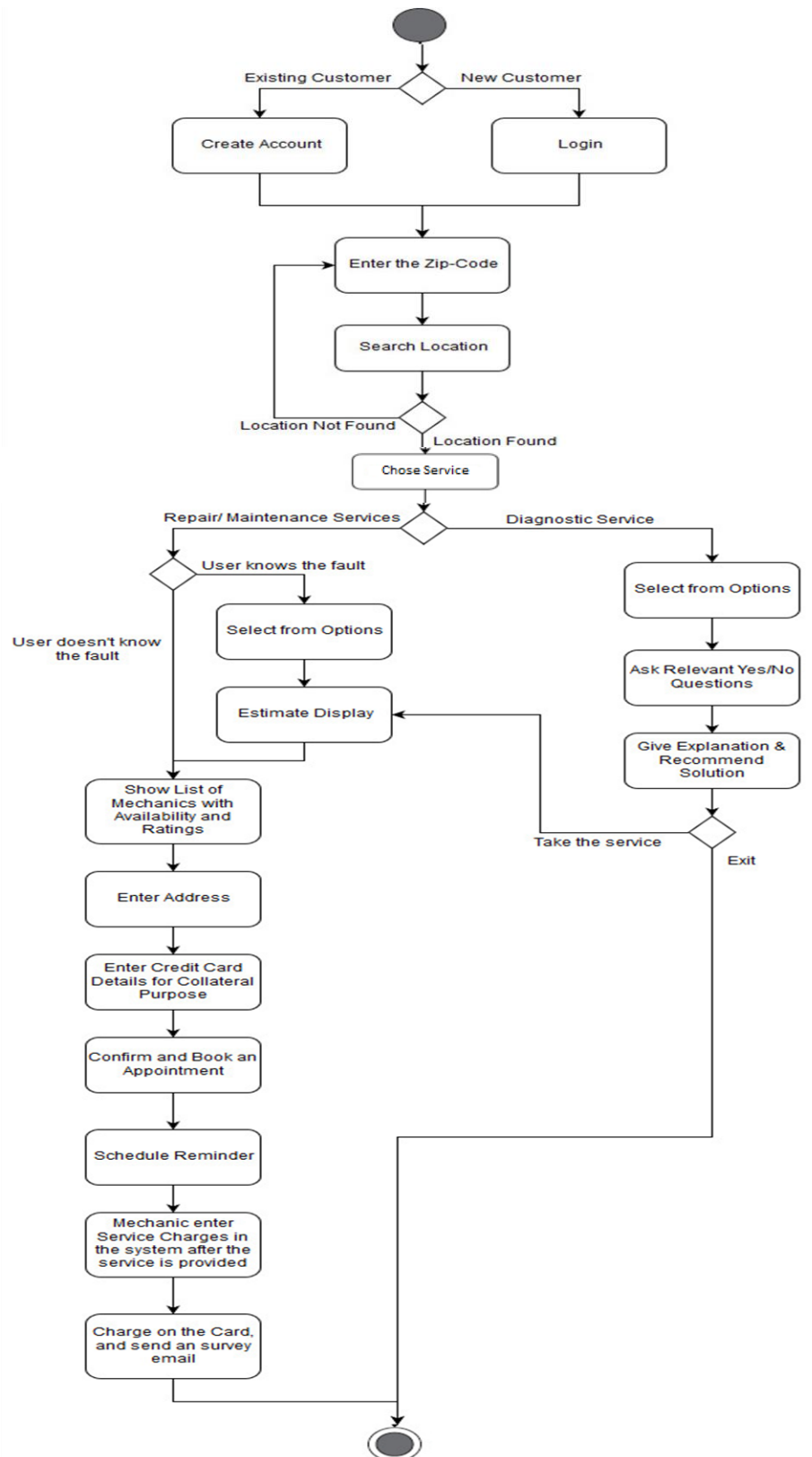
NON-FUNCTIONAL REQUIREMENTS:

- a. Should support various OS for the app, and web browser for the website.
- b. Proper security should be included.
- c. System should be built to handle error in effective manner.

USE CASE DIAGRAM:



ACTIVITY DIAGRAMS:



USE CASE DESCRIPTION:

Use Case Name: Location Availability	ID: 1	Importance Level: Medium
Primary Actor: Customer	Use Case Type: Detail, Essential	
Stakeholders and Interests: Customer - Wants to check the availability of the mechanic in his/her locality		
Brief Description: This use case portrays how client check the availability of mechanic in their locality		
Trigger: The user provides zip code. Type: External		
Relationships: Association: Customer Include: Login Extend: Generalization:		
Normal Flow of Events: 1. Customer is prompted to enter zip code. 2. Customer is then provided with a list of repair services and diagnostics available in that area.		
Sub Flows: S1: Customer choses a repair/maintenance service. S2: Customer choses a diagnostic service.		
Alternate / Exceptional Flow: A1: A message should be shown if there is no service available at the zip code entered. Also, customer is asked for new zip code again.		

Use Case Name: Repair/ Maintenance Service	ID: 2	Importance Level: High
Primary Actor: Customer	Use Case Type: Detail, Essential	
Stakeholders and Interests: Customer - Wants to avail repair/maintenance services		
Brief Description: This use case portrays how a customer books a repair service		
Trigger: The customer choses on the “Repair and maintenance services” Type: External		

Relationships: Association: User Include: Login Extend: Generalization:
Normal Flow of Events: 1. The customer choses the Repair and maintenance services. 2. Customer choses the type of repair service he/she needs. 3. Customer choses date and time slot convenient to him/her. 4. Details of available mechanics are provided in that time slot, along with rating and reviews. 5. Customer then gives repair location.

Use Case Name: Diagnostic Service	ID: 3	Importance Level: Medium
Primary Actor: Customer	Use Case Type: Detail, Essential	
Stakeholders and Interests: Customer - Wants to avail diagnostic services		
Brief Description: This use case portrays how a custom identifies exact problem in his/her vehicle, and then chooses a repair service.		
Trigger: The customer choses on the “Diagnostic services” Type: External		
Relationships: Association: Customer Include: Repair/ Maintenance Service Extend: Generalization:		
Normal Flow of Events: 1. The customer choses the “Diagnostic services” 2. Customer then answers yes/no questionnaires. 3. Customer is then recommended with repair services required. 4.Customer then selects a service. 5.Custmoer selects date and time slot convenient to him/her. 6. Customer is then provided with details of available mechanics in that time slot, along with rating and reviews. 7. Customer then gives repair location.		

Use Case Name: Payment and confirm booking	ID: 4	Importance Level: High
Primary Actor: Customer	Use Case Type: Detail, Essential	
Stakeholders and Interests: Customer - Wants to pay and confirm the booking for service		
Brief Description: This use case portrays how a customer provide his payment details and confirms booking for a service.		
Trigger: The user choses the “Enter Payment details” Type: External		
Relationships: Association: Customer Include: Repair/ Maintenance Service Extend: Generalization:		
Normal Flow of Events: 1. The customer choses the “Enter Payment details” 2. Customer then provides his/her card details. 3. System performs an authorization check on the cards to ensure availability of funds. 4. Customer confirms the booking appointment for previously selected time slots. 5. Customer is then provided with a card with all details in it. 6. Customer’s card is finally card post repair service.		

EFFORT ESTIMATION:

Unadjusted Actor Weighting Table:

Actor Type	Description	Weighting Factor	Number	Result
Simple	External system with well- defined API	1	1	1
Average	External system using a protocol-based interface, e.g., HTTP, TCT/IP, or a database	2	1	2
Complex	Human	3	5	15
			Unadjusted Actor Weight Total (UAW)	18

Unadjusted Use Case Weighting Table:

Actor Type	Description	Weighting Factor	Number	Result
Simple	1–3 transactions	5	1	5
Average	4–7 transactions	10	3	30
Complex	>7 transactions	15		0
			Unadjusted Use-Case Weight Total (UUCW)	35

Environmental Factors:

Factor Number	Description	Weight	Assigned Value(0-5)	Weighted Value	Notes
E1	Familiarity with system development process being used	1.5	5	7.5	
E2	Application experience	0.5	4	2	
E3	Object-oriented experience	1	1	1	
E4	Lead analyst capability	0.5	2	1	
E5	Motivation	1	3	3	
E6	Requirements stability	2	4	8	
E7	Part-time staff	-1	0	0	
E8	Difficulty of programming language	-1	0	0	
		Environmental Factor Value (EFactor)			22.5
		Environmental factor		0.725	

Technical Complexity Factors:

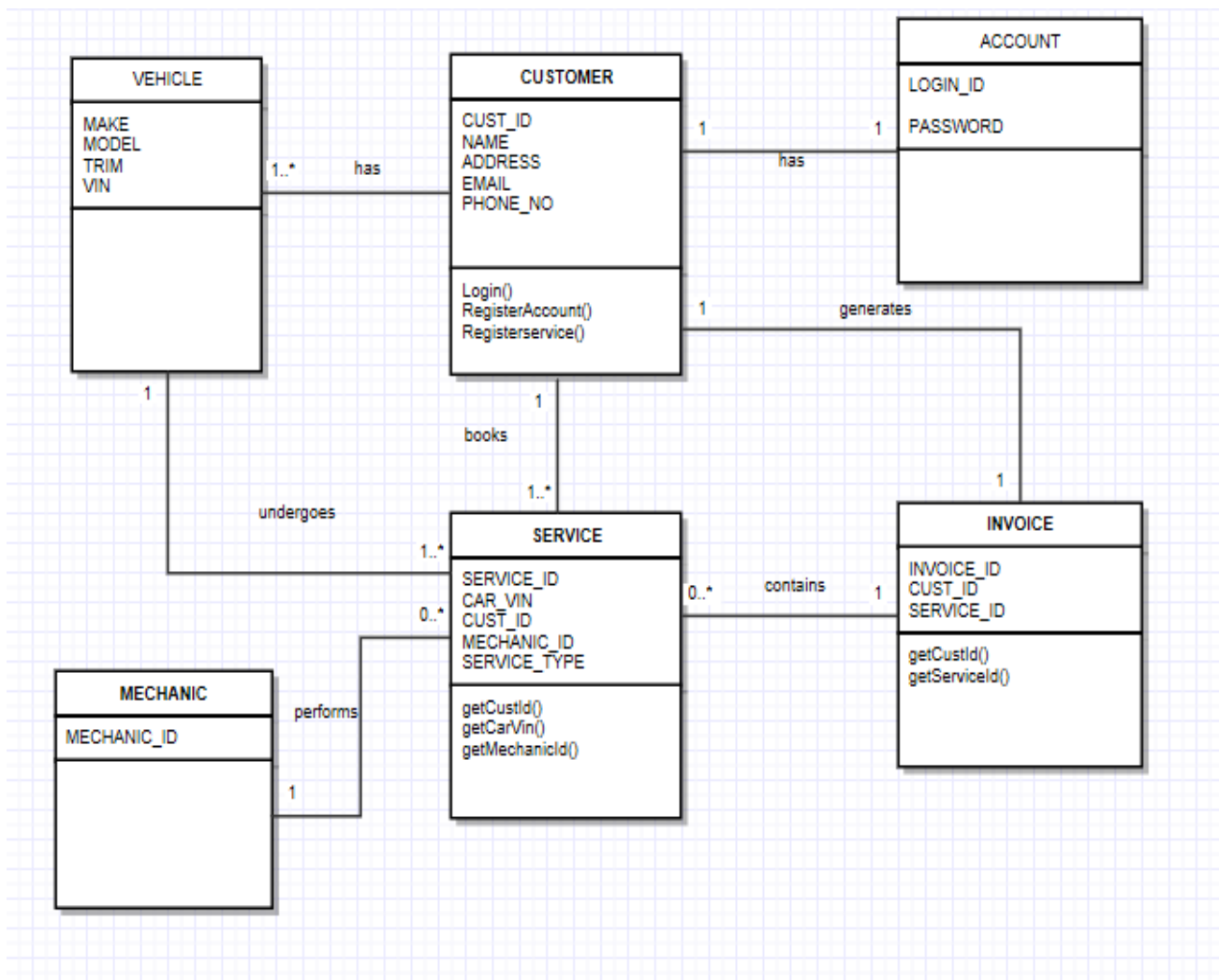
Factor Number	Description	Weight	Assigned Value(0-5)	Weighted Value	Notes
T1	Distributed system	2	0	0	
T2	Response time or throughput performance objectives	1	0	0	
T3	End-user online efficiency	1	5	5	
T4	Complex internal processing	1	2	2	
T5	Reusability of code	1	4	4	
T6	Ease of installation	0.5	5	2.5	
T7	Ease of use	0.5	5	2.5	
T8	Portability	2	5	10	
T9	Ease of change	1	5	5	
T10	Concurrency	1	2	2	
T11	Special security objectives included	1	3	3	
T12	Direct access for third parties	1	0	0	
T13	Special user training required	1	0	0	
	Technical Factor Value (TFactor)	36			
	Technical Complexity Factor (TCF)	0.96			

Unadjusted Use-Case Points (UUCP) = UAW + UUCW = 35 + 18 = 53

Adjusted Use Case Points (UCP) = UUCP * TCF * ECF = 53 * .96 * .725 = 36.88

Effort in person-hours = UCP * PHM = 36.88 * 20 = 737.76

Class Diagram:



CRC Cards:

Class Name: Vehicle	ID: 1
Description: A vehicle that needs mechanical attention	
Responsibilities:	Collaborations: Service Customer
Back of the CRC Card	
Attributes: MAKE(String) MODEL(String) TRIM(String) VIN(Number)	
Relationships: Generalization (a-kind-of): Aggregation (has-parts): Other Associations: Customer, Service	

Class Name: Customer	ID: 2
Description: Individual who needs a vehicle service	
Responsibilities: Owns a Vehicle Creates & Handles an Account Books a Service Generates an Invoice	Collaborations: Vehicle Account Service Invoice
Back of the CRC Card	
Attributes: CUSTOMER_ID(string) NAME(string) ADDRESS(string) EMAIL(string) PHONE_NO(number)	
Relationships: Generalization (a-kind-of): Aggregation (has-parts): Other Associations: Vehicle	

Class Name: Account	ID: 3
Description: Personal activity of user to explore the system	
Responsibilities:	Collaborations: Customer
Back of the CRC Card	
Attributes: Login_Id(string) Password(string)	
Relationships: Generalization (a-kind-of): Aggregation (has-parts): Other Associations: Customer	

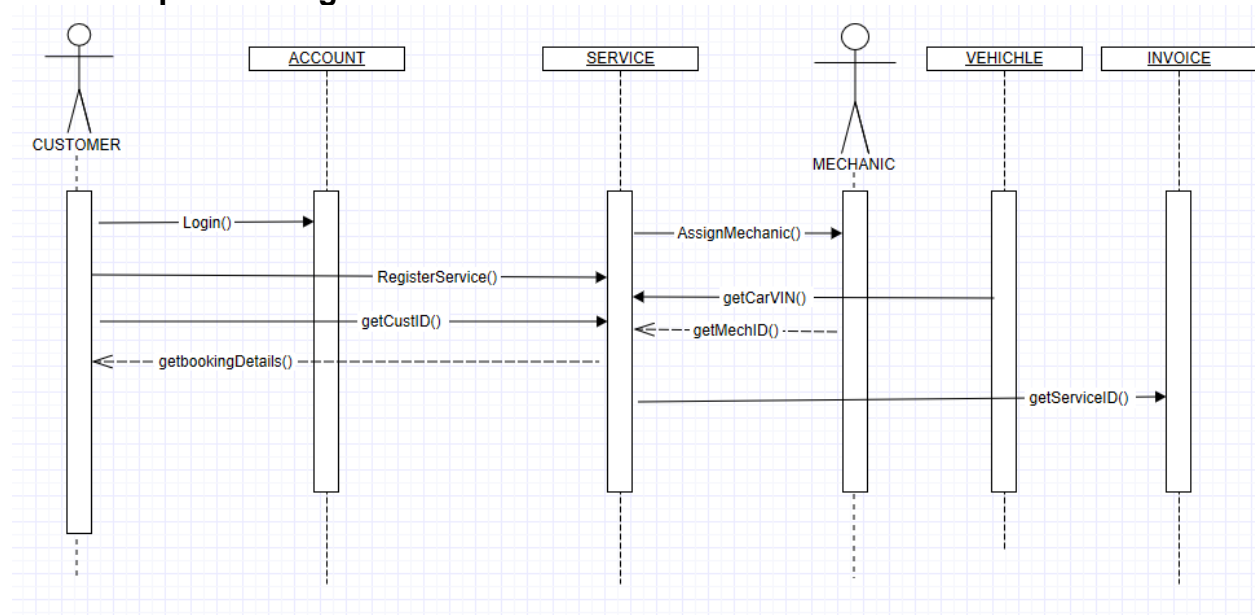
Class Name: Mechanic	ID: 4
Description: Individual who provides vehicle services	
Responsibilities:	Collaborations: Service
Back of the CRC Card	
Attributes: Mechanic_Id(Number)	
Relationships: Generalization (a-kind-of): Aggregation (has-parts): Other Associations: Service	

Class Name: Service	ID: 5
Description: An activity that allows servicing of a vehicle	
Responsibilities: Allows customer to book a service Services Vehicle Allows mechanic to perform service Invoice	Collaborations: Customer Vehicle Mechanic Invoice
Back of the CRC Card	
Attributes: Service_Id(Number) Car_VIN(Number) Cust_ID(Number) Mechanic_Id(Number) Service_Type(String)	
Relationships: Generalization (a-kind-of): Aggregation (has-parts): Other Associations: Vehicle, Customer, Mechanic, Invoice	

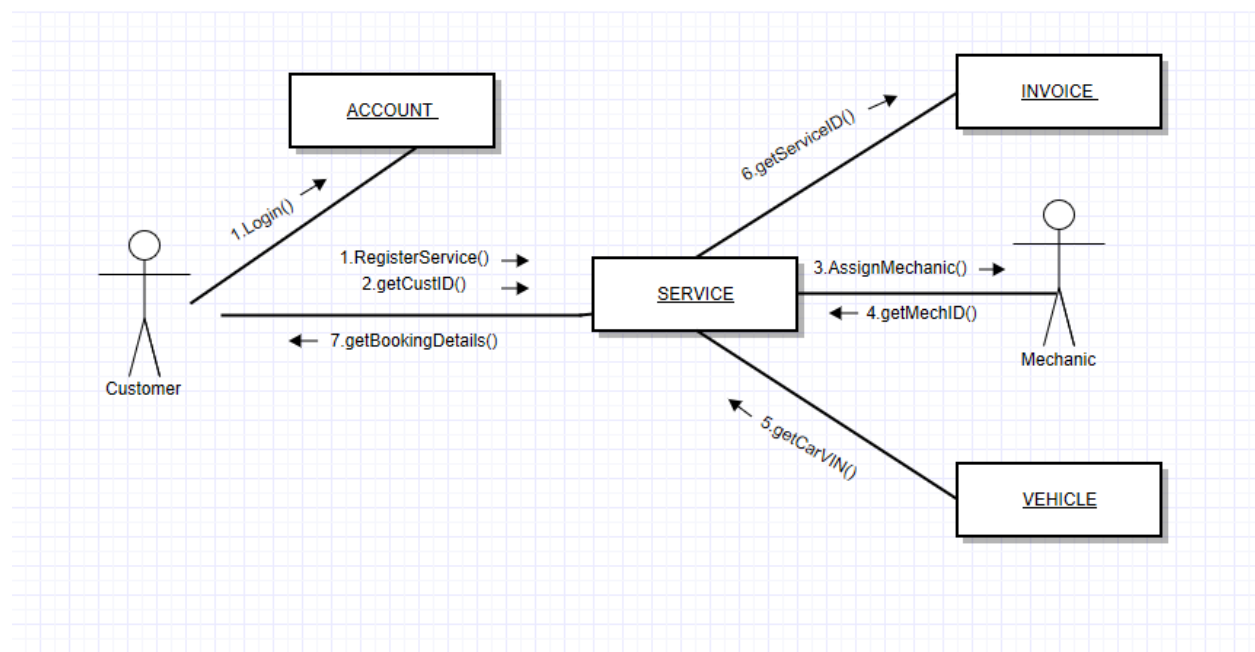
Class Name: Invoice	ID: 6
Description: Provides invoice information	
Responsibilities: Allows Customer to generate Invoice	Collaborations: Customer
Back of the CRC Card	
Attributes: MAKE(String) MODEL(String) TRIM(String) VIN(Number)	
Relationships: Generalization (a-kind-of): Aggregation (has-parts): Other Associations: Customer, Service	

Behavioral Model:

a. Sequence Diagrams:



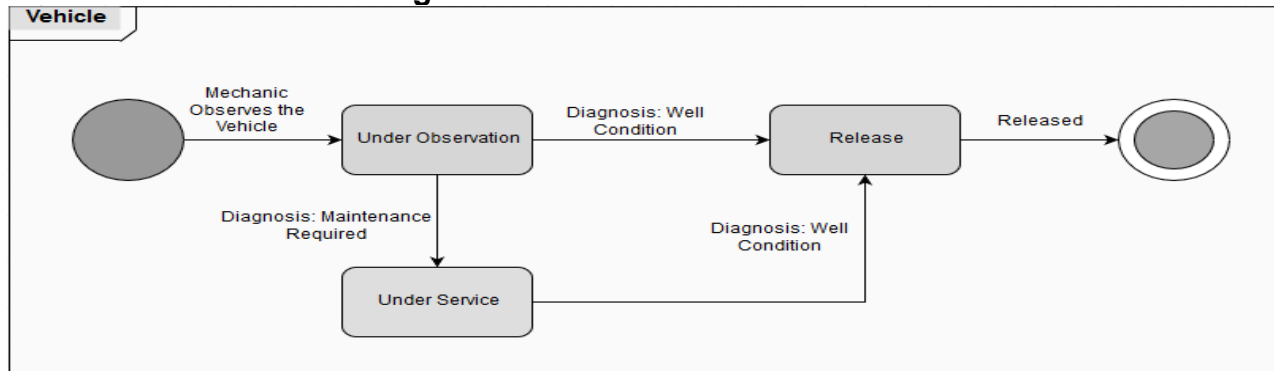
b. Communication Diagrams:



c. CRUDE matrices:

	Custo mer Actor	Mecha nic Actor	Vehicle Class	Custo mer Class	Acco unt Class	Mecha nic Class	Servi ce Class s	Invoic e Class	Acco unt	Stora ge	Diagnostic Sevrice Info
Custo mer Actor		E							C,R,U ,D,E		R
Mecha nic Actor	E		C,R,U, D,E	C,R,U, D,E	R,U	R,U	R,U	R,U	C,R,U ,D,E		
Vehicle Class											
Custo mer Class											
Accoun t Class											
Mecha nic Class											
Service Class											
Invoice Class											
Accoun t											
Storag e											
Diagno stic Service Info											

d. Behavioral State Diagrams:



Verification and Validation of Functional Model:

1. All diagram-specific rules must be enforced: Merge Node needs to be incorporated after a decision node in activity diagram.
2. Ensure one recorded event in the flows of the use-case description for each action/activity on the activity diagram: Functional model satisfies this criteria.
3. All objects in an activity diagram must be mentioned in an event of the use-case description: Activities in activity diagram also listed in events of use-case description.
4. The sequence of the use-case description should match the sequence in the activity diagram: Sequence of use-case description matches with activity diagram.
5. One and only one description for each use-case: Functional model satisfies this criteria.
6. All actors listed in a use-case description must be shown on the use-case diagram: Few actors needs to be removed from use-case diagram.
7. Stakeholders listed in the use-case description may be shown on the use-case diagram (check local policy): All stakeholders listed in use-case description are listed in use-case diagram too.
8. All relationships in the use-case description must be depicted on the use-case diagram: Functional model satisfies this criteria

Verification and validation of structural model.

- a. First, every CRC card should be associated with a class on the class diagram, and vice versa: Structural Model satisfies this criteria.
- b. Second, the responsibilities listed on the front of the CRC card must be included as operations in a class on a class diagram, and vice versa: This criteria was not satisfied for CRC Vehicle, Mechanic & Account class, hence modified.
- c. Third, collaborators on the front of the CRC card imply some type of relationship on the back of the CRC card and some type of association that is connected to the associated class on the class diagram: Structural Model satisfies the criteria.
- d. Fourth, attributes listed on the back of the CRC card must be included as attributes in a class on a class diagram, and vice versa: Structural Model satisfies the criteria.
- e. Fifth, the object type of the attributes listed on the back of the CRC card and with the attributes in the attribute list of the class on a class diagram implies an association from the class to the class of the object type: Structural Model satisfies the criteria.
- f. Sixth, the relationships included on the back of the CRC card must be portrayed using the appropriate notation on the class diagram: Structural Model satisfies the criteria.

- g. Seventh, an association class, should be created only if there is indeed some unique characteristic (attribute, operation, or relationship) about the intersection of the connecting classes: Structural Model satisfies the criteria.
- h. Finally, as in the functional models, specific representation rules must be enforced. For example, a class cannot be a subclass of itself: Structural Model satisfies the criteria.

Verification and validation of behavioral model:

- a. First, every actor and object included on a sequence diagram must be included as an actor and an object on a communication diagram, and vice versa: Behavioral Model satisfies the criteria.
- b. Second, if there is a message on the sequence diagram, there must be an association on the communications diagram, and vice versa: Behavioral Model satisfies the criteria.
- c. Third, every message that is included on a sequence diagram must appear as a message on an association in the corresponding communication diagram, and vice versa: Behavioral Model satisfies the criteria.
- d. Fourth, if a guard condition appears on a message in the sequence diagram, there must be an equivalent guard condition on the corresponding communication diagram, and vice versa: Behavioral Model satisfies the criteria.
- e. Fifth, the sequence number included as part of a message label in a communications diagram implies the sequential order in which the message will be sent: Behavioral Model satisfies the criteria.
- f. Sixth, all transitions contained in a behavior state machine must be associated with a message being sent on a sequence and communication diagram, and it must be classified as a (C) Create, (U)Update, or (D)Delete message in a CRUDE matrix: Behavioral Model satisfies the criteria.
- g. Seventh, all entries in a CRUDE matrix imply a message being sent from an actor or object to another actor or object: Behavioral Model satisfies the criteria.
- h. Finally, many representation-specific rules have been proposed: Behavioral Model satisfies the criteria.