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Project Title: Automated Toll Management System
Section: C

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1.0 Introduction:

The purpose of this document is to visualize the project objectives as a whole. We will estimate the time and effort required to develop the software by calculating the number of people working on the project and the total work hours. The main audience of this documents are the developer team and the management. This will briefly explain who manages what and when how much work has to be done during this development period. The financial feasibility is also discussed here as it the project has to be financially feasible in order to develop the software. Many risks may arise during this time period. This may include Lack of transparency and lack of clarity and many more. These risk factors are also analyzed. Our project is based on "Automated Toll Management System". So, our primary stakeholders are a wide number of people. The stakeholders are also classified in this document. So, this document gives an overview of the development phase of our software.

2.0 Project Title:

Automated Toll Management System

3.0 Objectives:

Travelling via toll plaza is an extra hassle for the travelers. A recent study analyses current reasons for congestion. The delay and queue are mainly due to two different charging methods namely known as 'Manual Toll Collection (MTC)' and 'Electronic Toll Collection (ETC)'. In an Electronic Toll Collection, the user has to pay the fee using their credit card which is also time consuming. All the lanes are having mixed lane system that is both MTC and ETC vehicles pass through the same lane. Toll booth capacity and type of toll service have influence on traffic operation and the efficiency of the toll plaza. The vehicles need to halt and pay the toll which cause time delay and may also cause traffic jam. Most of the people prefer to work in Dhaka and as a result, they travel to their hometown whenever possible. The transport most people use has to pass through multiple toll plazas to get to the desired destination. Trucks transport commodities from one district to the next in our country. They can be seen in lines waiting to pay tolls to cross bridges. They spend hours at a time in the same place, waiting in lines. As a result, the goods are damaged while being transported. Raw materials are more likely to be damaged, resulting in significant losses for many businesses. Toll plazas also require continuous man power to operate as the tolls have to be manually collected. This causes significant delay and also human errors. The goal of our project is to develop an automated toll management system which will check if the passing vehicle's RFID (Radio-frequency identification) tag is activated or not. If the chip is activated then it will check user's information from the database and deduct balance from the car owner's account automatically. When the tag is inactive or the tag is not found the laser will trigger the camera and the camera will take two photos, one on the rear number plate and another of the back name-plate. Then according to the registered number plate, a mail will be sent to the respective owner for paying the money within certain amount of time to avoid fine. This will require no vehicle to stop or slow down at the toll plaza. This will save valuable time and people can travel without any hassle.

4.0 Justification:

The common problem with the current manual toll management system as well as already existing automated toll management system can be solved by using an automated online payment system which will allow all the vehicles to pass the toll plaza even if the vehicle doesn't have any RFID tag. This doesn't mean that the unregistered vehicles don't have to pay. In this system whenever any vehicle approaches the toll plaza, the laser detector detects the vehicle. Then it will check if the vehicle's RFID (Radio-frequency identification) tag is activated or not. If the chip is activated then it will check user's information from the database and deduct balance from the car owner's account automatically. When the tag is inactive or the tag is not found the laser will trigger the camera and the camera will take two photos, one on the rear number plate and another of the back name-plate. Then according to the registered number plate, a mail will be sent to the respective owner for paying the money within certain amount of time to avoid fine. Using this RFID tag, both time consumption is decreased and extra security measures are ensured. In this way, people don't have to stop at the toll gate even if they don't have registered for a RFID tag. Authority can still collect the fee from the unregistered users. This will completely remove any kind of traffic congestion at the toll gate. If a registered vehicle is stolen, the user can report the theft, and all toll plazas will be notified if that vehicle goes through. If the car goes through a toll plaza, local authorities will be notified of the vehicle's last known location, allowing them to monitor and locate it.

There are software which can do these tasks only if the vehicle is registered and it has RFID tag on the windshield. If the vehicle is unregistered then the owner has to manually pay the toll fee. But the difference between our system and the existing system is that our system will detect the vehicle owner even if the vehicle is unregistered to our system and send a mail to the respective owner informing him to pay the fee in time to avoid fines.

5.0 Systems Overview:

In our system, when a car approaches the toll plaza, a sensor detects the approaching car and searches for RFID tag. If the sensor detects a RFID tag, it marks the vehicle as a registered vehicle and deducts balance from that registered users account automatically and proceeds to checkout. If the vehicle doesn't have any RFID tag, a camera mounted on the roll plaza will take a photo of the vehicle's license plate and search for the owner's information from the authority's database. After receiving the owner's information, an automated mail will be sent to the owner to pay the toll fee in a limited amount of time to avoid fines. While all these works are taking place, the vehicle will already be passed through the toll plaza without stopping.
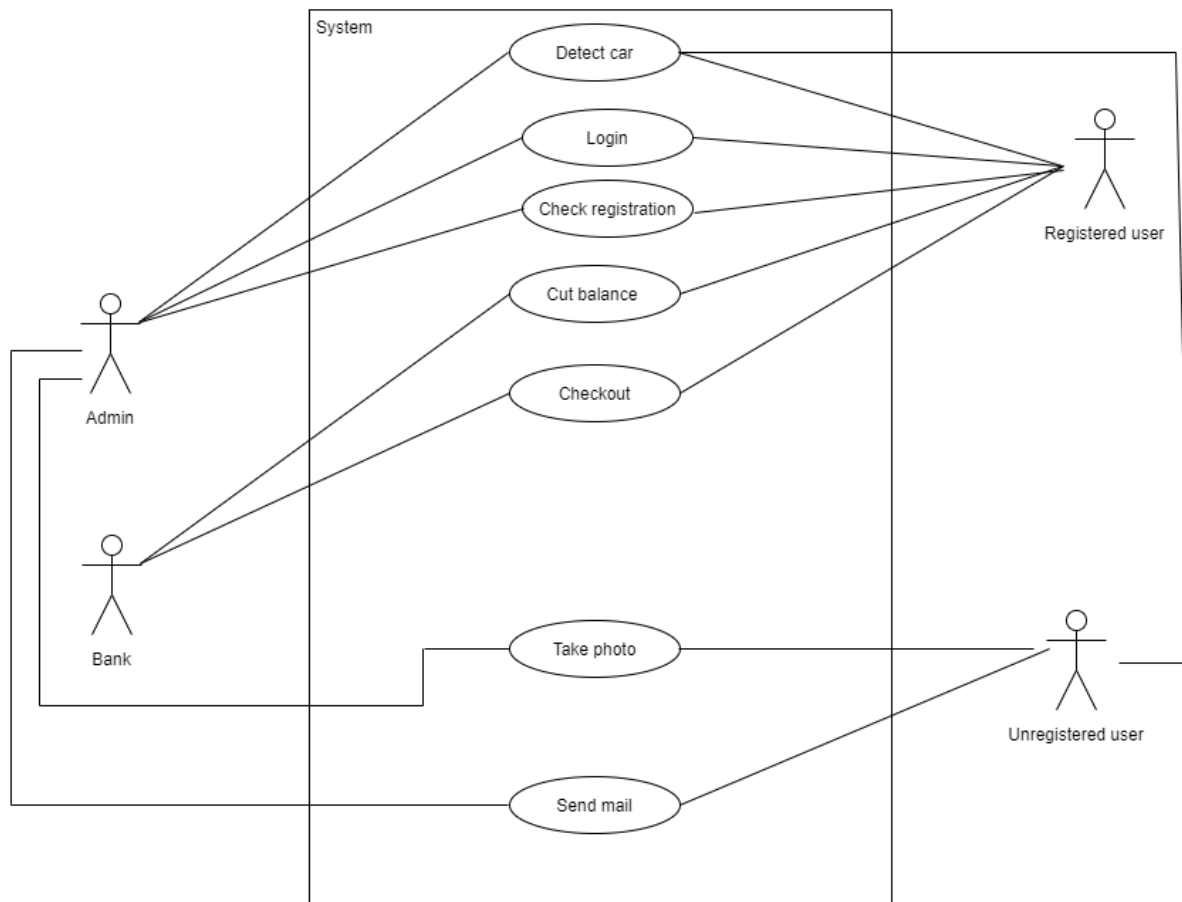
Use case diagram

Fig: Use Case Diagram

6.0 Stakeholders analysis: There are two stakeholders in our system. The first type of stakeholder is an internal stakeholder, while the second type of stakeholder is an external stakeholder.

Internal Stakeholders: employees, owners, and managers are examples of internal stakeholders. Internal stakeholders in our project include:

1.   Employee: The primary internal stakeholder will be the employee. Employees are heavily invested in the company both financially and personally, and they are crucial to its operations, strategy, and tactics.

2.   Manager: Managers are internal stakeholders since staff members depend on the success of the business to maintain their employment and get compensation. Depending on the nature of the firm, employees can be particularly concerned about health and safety.

3.   Developer: They have the technological know-how to advise executives on which features are feasible and how long they will take to implement.

External stakeholders are people who do not work for a company but are impacted by its actions and outcomes in some way.

1. Suppliers: Suppliers supply a firm with the raw materials or components it need to manufacture its goods. A company may rely on a single supplier who manufactures a superior or unusual product, in which case the supplier is given particular consideration.

2. Banks and lenders: Lenders are external stakeholders since they stand to gain financially from the project's success as well as via possible networking, insider information, and reputation.

3. Government: In all businesses, the government is an external stakeholder. It is, in fact, one of the most important stakeholders because it collects taxes from these businesses in the form of corporate income tax and employee income tax.

4. Customers: Customers are the most significant external stakeholders. These are the individuals who will use the company's services or ultimate goods. Thus, while not being involved in a company's daily operations, they decide whether it succeeds or fails.

7.0 Feasibility study:

The solution will be discussed in the first portion of this project. As the world nears the pinnacle of technological accomplishment, our country is doing its best to catch up by digitizing its traditional procedures, and people prefer to handle their problems online rather than offline. Our approach is the most effective online solution to the following issue. Everyone engaged will profit once this initiative is done. To complete this project, we need to use RFID (Radio-frequency identification) on vehicle. In today's world this automated method is being used to cross toll plaza. So, it is easy and normal to use and maintain. This can be done using a precision algorithm. Ordinary toll plaza's counters will no longer be needed once it is used. As a result, the required manpower will not be required in this sector. Economically, it is possible to save a large amount of money here. As well as this system will be able to prevent traffic jam and save our time which will greatly put a positive impact on our economy. In current technology, all the components and software system required for the implementation of this system are easy to get and available. To reduce the use of manpower and save money and time, this system will help in various ways.

8.0 Systems component:

We have divided the system components into five different sections. They are

- Planning
- Analysis and Specification
- Design and Development
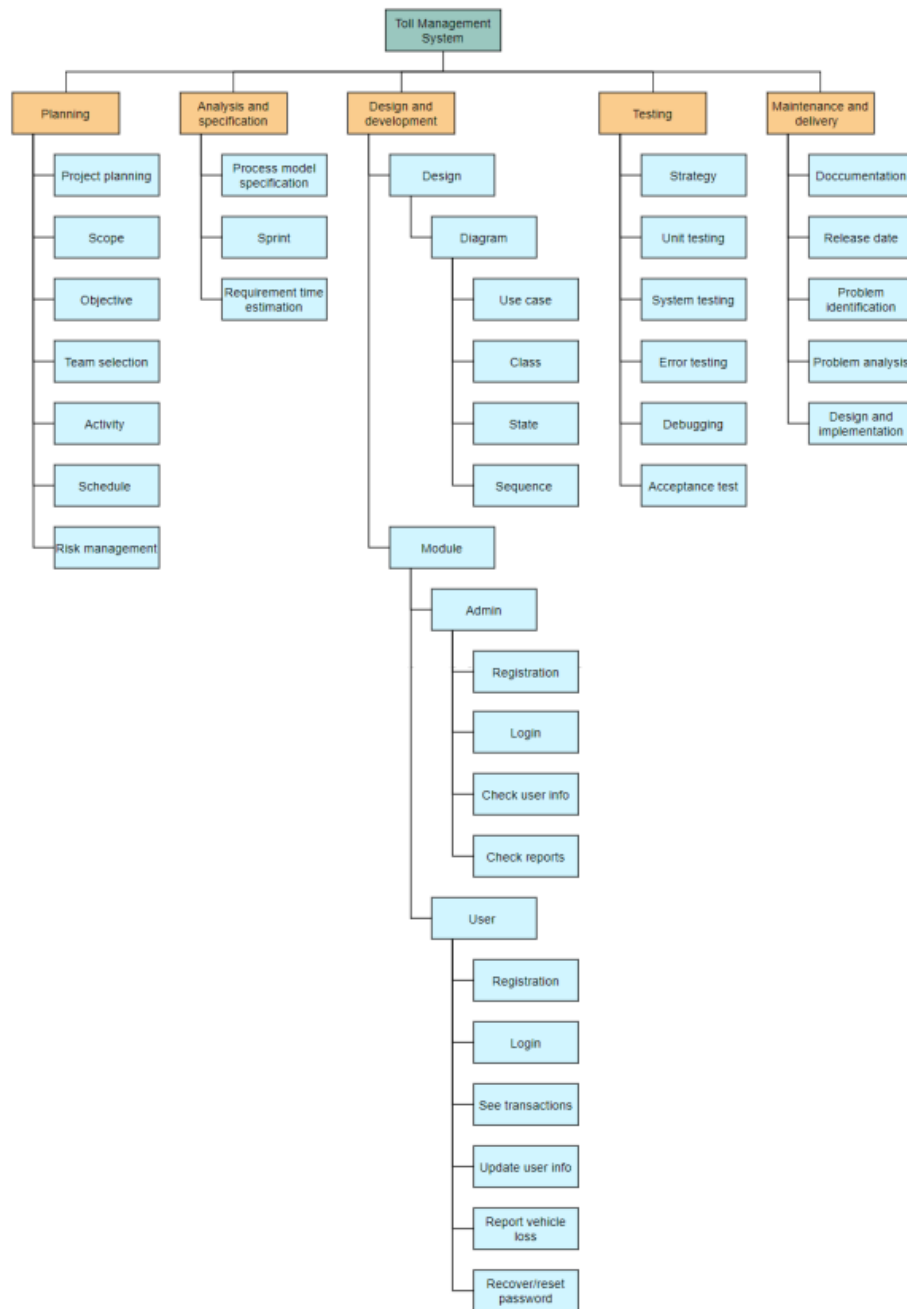- Testing
- Maintenance and Delivery

Figure1: Work Breakdown Structure of the project

9.0 Process Model:

The nature of software medium has many consequences for systems engineering of software intensive systems. Our project is on Online Toll Management System. The suitable process model for our project is V-Model. V-Model is a linear process model. We are using V-model as no back tracking is required in our project. We are choosing V-model because it begins with analysis and the identification, which feeds product information into the design and implementation phases. There are two branches representing integration and testing activities. For every single phase in the development cycle there is a directly associated testing phase.

V-Model is a very straightforward model to implement. It is an upgraded Waterfall model. It allows the development team to verify the product at multiple levels. Its benefit over basic Waterfall model is that the testing phase is done at the end of the project in the basic Waterfall model. There are no direct involvements of clients required. So, Sawtooth model is also not needed. We don't need to revisit previously completed phrases so Spiral model and Unified process model can't be applied. No iteration is being done so Extreme Programming (XP) is not used. Scrum is an agile methodology so it also can't be used. So, depending on our project's characteristics, we find V-Model to be the most appropriate among other models.

10.0 Efforts estimation: An estimation of each task using COCOMO model is given below-

According to our project, the software project type is Organic. So, Coefficient = 2.4

P = 1.05

T = 0.381

Based on SLOC characteristics, and operates according to the following equations:

Effort = PM = Coefficient* $(SLOC/1000)^P$

$= 2.4*(8000/1000)^{1.05}$

≈ 21.303

= 22 person-month

Development Time = DM = $2.50*(PM)^T$

$= 2.50*(22)^{0.38}$

≈ 8.09 Months

= 33 weeks

Required number of people = ST = PM/DM

= 21/8

= 2.75

≈ 3 Persons

11.0 Activity Diagram:

Precedence Network:

A→Hardware Selection

B→Software Design

C→Install Hardware

D→Code and Test Software

E→Check All Hardware

F→User Requirements

G→User Training

H→Test System

Activity	Duration	Precedents
A→Hardware Selection	6	
B→Software Design	4	
C→Install Hardware	3	A
D→Code and Test Software	4	B
E→Check All Hardware	3	B
F→User Requirements	8	
G→User Training	3	E,F
H→Test System	2	C,D

ES = Early Start
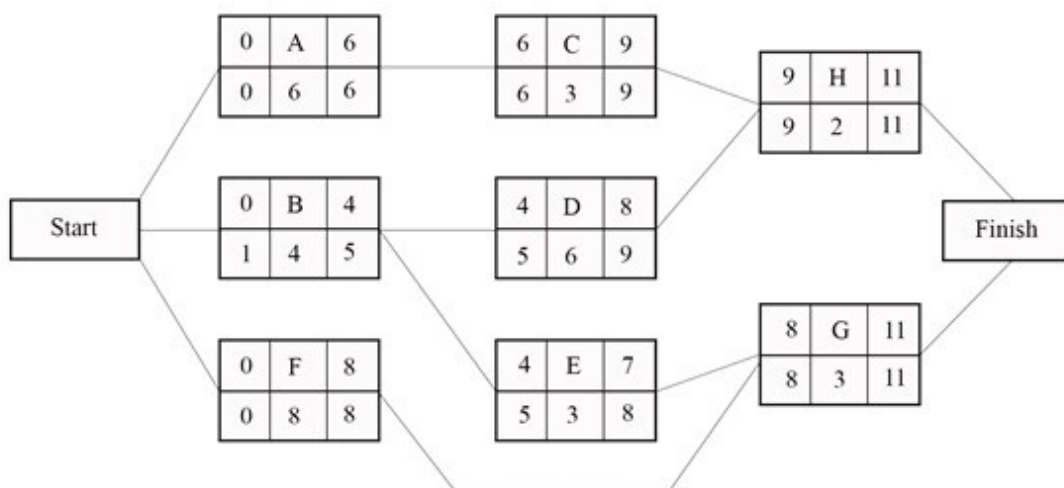EF = Early Finish
LS = Late Start
LF = Late Finish

Fig: Precedence activity network diagram

12.0 Risk Analysis: The risk for this system is very low. Without some resource problem there is no risk or problem present.

S/N	Risk Description	Probability	Impact	Mitigation Plan
1	Unrealistic time estimate	40%	High	Take multiple estimations.
2	Loss of work due to equipment failure/loss	30%	High	Weekly data backup to Hard drive.
3	Unavailability of API's	20%	Medium	Alternative API's will be checked for.
4	Developers needs to hardware or software requirements	5%	Medium	Select the best available hardware or software components.
5	Exceeding budget	15%	Medium	Some extra budget needs to be added.
6	Testing and debugging error	10%	Medium	Adopting qualitative testers.
7	Failure of server	10%	Low	Backup system database regularly.
8	Staff/Personnel shortfall	5%	Low	Take some extra members in the team.

13.0 Budget for the project:

Cost Analysis:

Developer Team:

Team Member	Total Number	Hour/Day	Monthly Salary (Per Person)	Total Salary
Business Analyst	1	6	90,000/-	90,000
Senior Developer	2	6	120,000/-	240,000
UX Designer	2	4	60,000/-	120,000
Front-end Developer	3	3	70,000/-	210,000
Back-end Developer	3	3	100,000/-	300,000
Quality Tester	2	5	84,000/-	168,000

Table 1: - Developer Cost Table

Office Employees:

Team Member	Total Number	Monthly Salary (Per Person)	Total Salary
CEO	1	300,000	300,000
Managing Director	1	200,000	200,000
General Manager	1	120,000/-	120,000
Marketing Manager	1	80,000/-	80,000
Accounts Executive	1	80,000/-	80,000
Receptionist	1	20,000/-	20,000

Estimated Monthly Salary for Developers:

$$90,000 + 240,000 + 120,000 + 210,000 + 300,000 + 168,000 = 1,128,000/-$$

So, the total salary cost for one month of development is 1,128,000 BDT

The time it will take to finish development is estimated to be around 15 weeks or 3.5 months

Estimated Total Salary During Project Development: 1,128,000 X 3.5 = 3,948,000 BDT

Salary cost for office employees per month: 800,000 BDT

Total Salary for office employees (During project development + 1 year of software release):

$$(300,000 + 200,000, 120,000 + 80,000 + 80,000 + 20,000) X 15.5 = 12,400,000$$

So, the total cost of salary during project development is: 3,948,000 + 12,400,000
$$= \underline{16,348,000}$$

Annual Office Rent and other Cost:

- *Office Space Rent:*
  Approximately 115,000 BDT Per Month [In Gulshan Area]
  Total Office Rent (During project development + 1 year of software release):
  $$= 115,000 X 15.5 = \underline{1,782,500}$$

- *Electricity Bills:*
  Average electricity bill for a typical office space is around 50,000 BDT
  So, Total electricity bill (During project development + 1 year of software release)
  $$= 50,000 \text{ X } 15.5 = \underline{775,000 \text{ BDT}}$$
- *Food:*
  Monthly Chef cost = 15,000/-
  Per day food cost allowance = 250/-

  Total food cost during project development: 250 X 19 X 20 X 3.5 = 332,500/-
  Total food cost for 1 year after software releasing: 250 X 6 X 20 X 12 = 360,000/-

  So, the grand total for food (During project development + 1 year of software release):
  $$= 332,500 + 360,000 = \underline{692,500/\text{-}}$$
- *Others:*
  Internet Cost (During project development + 1 year of software release): 1000 X 15.5 = 15500/-
  Approx. office accessories cost 50,000/-

Annual Marketing Cost:

- Advertisement:
  Package that includes a total of 30 minutes advertisement 4,10,000/-   [5]
- Social Media Sponsored Post:
  Facebook/Instagram sponsored post cost per month 25,000/-   [6]
  Sponsored post cost in 1 year = 25,000 X 12 = 300,000/-

- Search Engine Optimization (SEO):
  For mid-range companies the cost of SEO per month is 80,000/-   [7]
  For 1 year the cost will be: 80000 X 12 = 960,000/-

Grand Total:

16,348,000 + 1,782,500 + 775,000 + 692,500 + 15,500 +50,000 + 4,10,000 + 300,000 + 960,000

$$= 21,365,500 \text{ BDT}$$

So, in total the cost is 21,365,500 BDT in one year including software development.

14.0 Conclusion:

This document's goal is to provide a comprehensive picture of the project's aims. By figuring out the number of individuals working on the project and the overall work hours, we can estimate the amount of time and effort needed to build the program. The management and programming team are the primary recipients of this documentation. In a nutshell, this will clarify who oversees what and when there is a lot of work to be done throughout this growth phase. Since the project must be financially viable in order to create the software, the financial viability is also covered here. During this time, there are a lot of potential hazards. There are numerous others, such as a lack of openness and clarity. These risk elements are also studied. Based on the "Automated Toll Management System," our project. Therefore, a large number of individuals make up our main stakeholders. In this publication, the stakeholders are also categorized. Consequently, this paper provides a summary of our software's development process.