Computerized Transport System

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Object Oriented Analysis & Design Project Deliverable I

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1.1 Project/Product Feasibility Report

1.1.1 Technical Feasibility:

For the development of this project we will use GPS devices for tracking the buses, a database server for storing the records of buses, the login details, the bus routes and their stops, a web browser so that users could use this system. An internet connection and a regular device for accessing the website such as Android, iOS or a PC will be required. A potential infeasibility can be argued for potential users e.g. bus drivers who do not have a smart device or a stable internet connection would not be able to use the website. However, almost all of the potential users have compatible devices as well as an internet facility. Hence,the number of users who can avail themselves on this project are far more than those who cannot. As for the GPS devices,their maintenance costs and any potential loan repayments can be funded by running ads on the website. Database servers will be available in the university labs.Thus the project is technically feasible.

1.1.2 Operational Feasibility:

The day to day operational feasibility would only include tracker and records maintenance other than the general overhauling of the website time to time.
The only factor affecting operational feasibility would be the servers and/or the trackers running out of order. However, this is highly improbable, given the constant supervision. However, any disorders would not cause a major disruption but this could happen very rarely. Checking of servers and replacement of trackers after a specific interval of time will prevent this from happening. Operationally,the project is feasible as students will save a lot of time not having to go through the trouble of checking for the bus schedules. Hence,by its development the end users will be benefited. Any problems that arise can be reported on the website and to the transport department. FIrstly, there is a low chance of a disruption being caused, and even if one occurs, it would not cause any significant losses.

1.1.3 Economic Feasibility:

***Cost estimate**:*

The estimated cost will include the purchasing of trackers ,cost of maintenance of trackers and servers and paying database specialists for data entry. The project does not require a whopping budget so funding the project will not be very difficult.
The project can be funded by the university itself, the students ior a third party that decides to sponsor the project either in return for advertisement or as a goodwill gesture toward the institute.

Benefit estimate:

Tangible benefits:
Ads could be generated and displayed on the side panes of the website leading to recovery of the investments, profits, and even capital for further investment by the transport department in the future.

Intangible benefits:
Sharing the website with more end users, leading to other organizations developing an interest in buying our services and also enhancing the digitization level of the university. By providing bus facilities on time and properly will motivate students to use university buses instead of other local transport as means of economic travel.

1.1.4 Schedule Feasibility:

The deadline provided for the project is 4 months and also we need to capture some milestones coming time by time according to deliverable submissions.By taking into consideration the timelines and the available number of project team members ,there is a feasibility that our project will be achievable within the desired timeline.
As our team members are very motivated to play their roles in project development ,we can assure that we will achieve our goals by the teamwork and collaboration of members. So there is no pressure of time and less availability of human resources Hence the project is realistic and has schedule feasibility.

1.1.5 Specification Feasibility:

Design and implementation of our technology backed transportation system is possible as all the functional requirements and specifications are clear and required resources are available. The scope of our project is well defined and it articulates what the project entails so that stockholders can understand what's involved.
Due to some unforeseen events or technical issues, any problem can arise but the elements like budget defining, tracking for a smooth process, database management, objectives and timeline are established, also the requirements have distinct limits thus the boundaries of the project are completely accessed. This makes the project feasible.

1.1.6 Information Feasibility:

The assessed information for feasibility of our project includes:

Meaningfulness:

In the present transport system of our university the Passengers often face severe difficulties caused by dysfunctioning or any unforeseen events .All data records are made manually so there can be discrepancies in the data ,also tracking is not available. All of these failures of the existing system shows the significance of creating a computerized transport system where the whole system will be automated and the whole transportation process will run smoothly without any difficulties for passengers.

Completion:

We have a designed system for checking whether the Goals & Objectives as were defined are achieved or not in the final analysis of the project .We will check if our project will be able to meet criteria associated with other successful similar projects. It will also be checked whether or not the project is completed under budget and within the required timeline. Meeting these all conditions will lead to completion of a successful project.

Reliability:

Our aim is to develop a failure free operational software for meeting user's needs. The project will follow the complete SDLC model and it will pass through proper testing phases before deployment to ensure the quality of the software.
All of these analysis phases make sure that our project is feasible.

1.1.7 Motivational Feasibility:

We all know that It can feel frustrating and demoralizing to work on a project where you can't wait for it to be over. Once a project effort reaches stress points, communication starts to break down and critical milestones can be missed or completely overlooked. For handling such situations, Our team is aligned around a few critical goals. Our efforts are to create an environment that fosters positive communication and collaboration amongst all Project Team members to capture the milestones . Every member clearly understands their roles and responsibilities and knows how their contribution will directly impact achieving a successful outcome and reaching the destination. Input from every project team member is taken to ensure that everyone on our project teams feels like they are part of the effort in a meaningful way.

On the other side, the authorized university users will be motivated to use this application to avail the transport service. The resources actually determine the work motivation. A proper evaluation method is defined that will be done by checking frequency of use and effectiveness of service availed by the use of software.So the project is motivationally feasible.

1.1.8 Legal & Ethical Feasibility:

From a legal point of view, we analyzed barriers in legal implementation of the project to check if there is any conflict with legal requirements like zoning laws, data protection acts and copyrights etc. By investigation, we found that our project conforms legal and ethical requirements. The ownership of software is also taken by the members of the institute.

Ethical issues including privacy and accountability were also taken into view while working on the project. Our project is legally doable as its main purpose is to provide benefits to university authorized members for a friendly transport service. This service has no conflicts with any outside organizations or authorities. As we are not dealing with any anti - trust laws, contractual obligations, outsourcing etc, the project hence is feasible.

1.2 Project/Product Scope

Scope of our automated transportation includes the boundary of our system and everything inside this boundary.

Goals:

- To design a workable technology backed transportation system software for buses.
- Make students able to track every information about the buses and the services they want to avail.
- Obtain and maintain bus and user records.
- Develop a user-friendly application for passengers and staff members.
- To ensure faster and efficient service of buses for passengers on operation with a simple smartphone.

Objectives:

- Passengers will be able to check operational bus routes and their stops.
- They will be able to check the timings of departure and arrival of every available bus.
- Users will be able to track live location of buses to avail their service.
- Users will be able to file complaints if they are not satisfied with the service or find any issue while using the software.
- The customer service support will be able to entertain queries and complaints.
- To get information about the personnel in charge of each bus.
- To check for availability of vehicle and bus schedules when required.
- Administrative staff will maintain the database and the website maintenance for smooth operationality.
- Proper collaboration with the investor team (optional)that will provide a budget for trackers on sponsorship or some other basis.

Requirements:

- Only authorized users having a valid email address will be allowed to use this service
- Viewing operational bus routes and stops
- Filing complaints about any problems with service of transport or website
- System for Recording data of passengers and updating if requested in database.
- Fully functional trackers for live location tracking
- Creating record of bus services, fuel details and maintenance
- System could check availability, departure and arrival of buses
- Sending mail in case of any inconvenience
- Allotting buses to drivers keeping them in records and providing them to users if necessary.
- Making proper connection to the database.
- Obtaining proper Connection of Web server and Internet Server.

Specific stakeholders:

- Passengers include students, faculty and staff members. All of these will be university authorized members.
- Transport department
- Investor(optional)
- Web development team
- Bus personnel

Major Deliverables:

1. Project Proposal
2. Feasibility Report
3. Requirement specification document
4. Design diagrams
5. Graphical user interface
6. Backend Development
7. Set up of test system
8. Set up of live system

Timelines:

The timelines are set according to the deliverables and our team will work efficiently to reach these milestones.
Also, the final deadline is a period of 4 months where we will deploy the whole product in a fully operational mode.

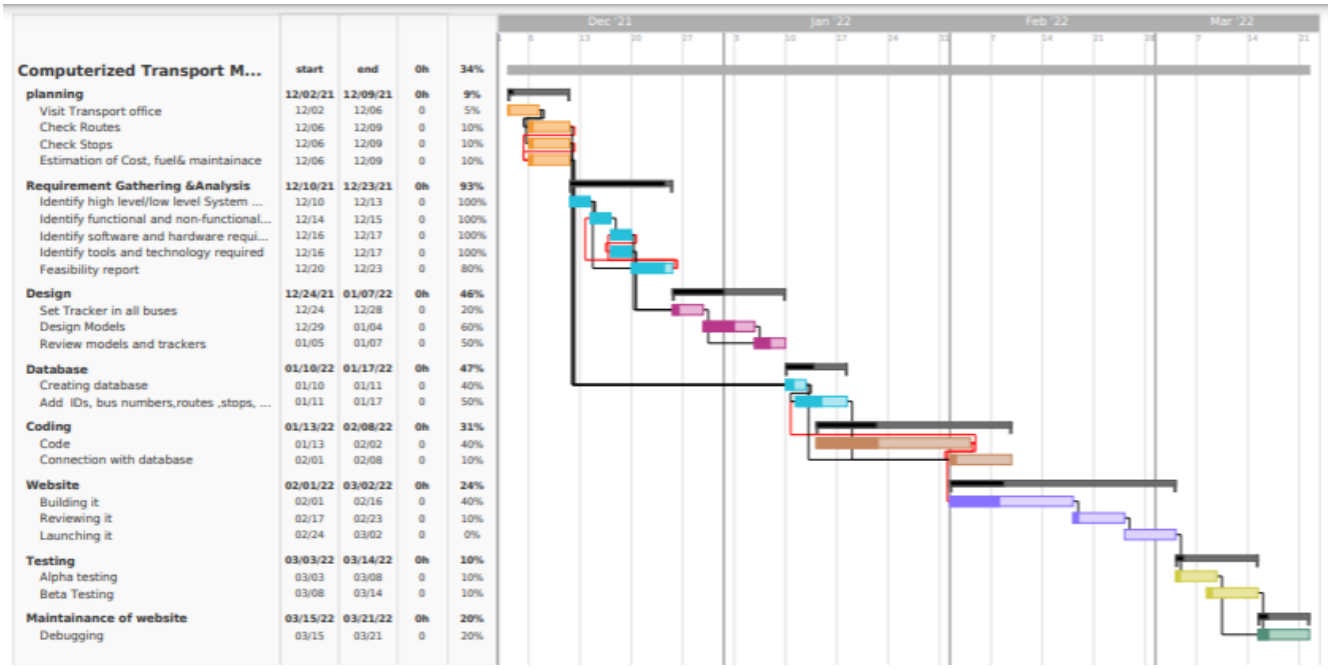
Project Scope Management:

Our Project's scope is accurately defined and mapped. Using scope management techniques like requirement priority, efforts and risks we allocated the right amount of work necessary to successfully complete the project. This also helped us to control what is and what is not part of our project's scope.
We have managed the project scope to fit the available resources including milestones, deadlines, stakeholders, users and available costs for the project.
For the complete traceability of requirements for our project scope management we have set attributes for each requirement separately to account for the stability of the requirement, development inputs and tracking status of that requirement.
Benefits received by each of the requirements and level of efforts to implement these requirements are also monitored properly. Also, we have gathered the amount of each type of risk involved in implementing. These risks included:

- Schedule risks.
- Resource risks.
- Technical risks.

Hence,the scope of our project is managed efficiently by the inclusion of detailed requirements.

1.5 Gantt Chart



Computerized Transport M...	start	end	0h	34%
planning	12/02/21	12/09/21	0h	9%
Visit Transport office	12/02	12/06	0	5%
Check Routes	12/06	12/09	0	10%
Check Stops	12/06	12/09	0	10%
Estimation of Cost, fuel& maintainace	12/06	12/09	0	10%
Requirement Gathering &Analysis	12/10/21	12/23/21	0h	93%
Identify high level/low level System ...	12/10	12/13	0	100%
Identify functional and non-functional...	12/14	12/15	0	100%
Identify software and hardware requi...	12/16	12/17	0	100%
Identify tools and technology required	12/16	12/17	0	100%
Feasibility report	12/20	12/23	0	80%
Design	12/24/21	01/07/22	0h	46%
Set Tracker in all buses	12/24	12/28	0	20%
Design Models	12/29	01/04	0	60%
Review models and trackers	01/05	01/07	0	50%
Database	01/10/22	01/17/22	0h	47%
Creating database	01/10	01/11	0	40%
Add IDs, bus numbers,routes ,stops, ...	01/11	01/17	0	50%
Coding	01/13/22	02/08/22	0h	31%
Code	01/13	02/02	0	40%
Connection with database	02/01	02/08	0	10%
Website	02/01/22	03/02/22	0h	24%
Building it	02/01	02/16	0	40%
Reviewing it	02/17	02/23	0	10%
Launching it	02/24	03/02	0	0%
Testing	03/03/22	03/14/22	0h	10%
Alpha testing	03/03	03/08	0	10%
Beta Testing	03/08	03/14	0	10%
Maintainance of website	03/15/22	03/21/22	0h	20%
Debugging	03/15	03/21	0	20%

1.6 Introduction to Team Members

Roll Number	Full Name	Forte
BSEF19M501	ALEEMA IMRAN	Team Lead, Management, Programming
BSEF19M505	HIZA TARIQ	Coding & Deployment
BSEF19M510	AMINA ATIQUE	Planning & Problem Solving
BSEF19M522	ZAINAB TAHIR	Designing,Surveying
BSEF19M548	IFRAH MASOOD	Problem Identification, Testing & Debugging

1.8 Vision Document

Introduction

Purpose:

This vision document aims to provide a high level scope of the said project along with the purpose of this project. This project aims to digitalize the university transport system. This project will help the passengers and/or potential passengers of the university buses to update themselves on the bus routes, stops, departure and arrival times as well as live locations through a website.

High Level Scope:

Deliverables:

1. A project proposal stating the project overview statement, high level system components, optional functional units, functional and non functional requirements, exclusions application architecture, gantt chart, software and hardware requirements along with the tools and technologies required. The proposal has already been submitted.
2. A report about the existing system that we will build our project on. This report will be about the current situation of the transport department, the vehicles and the passengers. This report is also included later in this document.
3. A feasibility report for the project. This will include the technical, operational, economic, schedule, specification, information, motivational, legal and ethical feasibility of the project. This report has been attached before the vision document.
4. The fourth deliverable would include design diagrams to allow programmers to better understand the design of the system. Several design diagrams have already been included in this document as well as the proposal.
5. The first programming deliverable would be the object oriented Java code containing necessary classes for the entities in the system.
6. The second programming deliverable would include databases to store the records of the buses, routes, stops, passengers and the staff.
7. The third programming deliverable would be the Graphic User Interface for the system.
8. The eighth deliverable will be a report on the progress on tracker installation and their performance on an existing tracking system.
9. The fourth programming deliverable would show the live location from the trackers to users who login using their official account.
10. The second last deliverable will be an alpha testing report of the final project. The servers will then be made live publicly and the website will be made available to the users.
11. The last deliverable would be the beta testing report after the debugging has been done. The website will be fully functional and not on a trial basis after this deliverable.

12. Several short deliverables might be delivered after considerable progress has been made. Deliverables can also be submitted during the maintenance phase.

Boundaries: (Exclusions)

1. Adjusting the predicted arrival and departure times of the buses according to traffic conditions or unforeseen events such as protests etc.
2. Any change in route for a specific bus for a specific trip will not update that route in the database. The live location will however show the exact location of the bus.
3. Dysfunctioning or technical problems of buses anywhere and anytime will not be reported on the app. A bus will however be mentioned as unavailable or unoperational should an issue arise. From the moment the issue arises up until it is reported to the authorities and the "operational" status is changed, the users will stay unaware of the issue.
4. Whether or not any other bus is available in case a bus becomes dysfunctional.
5. Unavailability of the driver causing changes in the bus schedule.
6. Any bus running out of fuel, getting a flat tire etc. might take time to be reported on the website.
7. The legal records of the bus will not be a part of our system. The number of speeding tickets a bus gets or whether its custom has been paid or not would not be a part of our system
8. Any issues with the tracker of the bus will not be reported to the user by the website.
9. Time taken for picking up or dropping passengers is variable and would not be added to the waiting time for the passenger.
10. Like any delays due to unforeseen events would not be updated immediately, similarly a bus arriving at a stop a few seconds earlier than expected would not be predicted immediately. The live location, however, can always be depended upon.
11. This project will be restricted to the university transport system. All other transport systems (public/private) are out of scope. The application can however be modified and the code refactored to be sold to an external organization once the website has been fully developed. University of the Punjab, however will be given the services free of cost.
12. We will deliver our solution to the transport department. All other departments are out of scope.

Definitions, acronyms and Abbreviations:

1. Transport System :PU Transport System
2. CTS : Computerized Transport System
3. Passengers:Students/Faculty member/Employee
4. Bus Personnel: Driver/Conductor
5. Transport Management System: managerial, administrative and the junior staff

References:

1. A project proposal
2. A report about the existing system
3. A feasibility report for the project
4. Design diagrams
5. Java code
6. Information about databases
7. GUI information
8. Report on the progress on tracker
9. Testing report
10. Maintenance report

Overview:

We have discussed following points in our vision document:

1. Purpose
2. High level Scope
3. Boundaries
4. Definitions, acronyms and Abbreviation
5. References
6. Positioning
7. Problem Statement
8. StakeHolder
9. User Description
10. Market Demographics
11. User Summary
12. Stakeholder’s profile
13. User Environment
14. User profile
15. Product overview
16. Product Features
17. Precedence and Priority
18. Product Requirements
19. Documentation Requirements

Positioning:

Business Opportunity:

Although the website is currently not being built for commercial use, the product can always be made available commercially once it has been launched. Many institutes which have a transport system do not have a live tracking website. We can sell our project to other organizations owing to the major market gap in this regard. The program might have to be modified and/or refactored, so the product will be almost fully reusable due to its object oriented and polymorphic build. Hence this website could be sold in the future for profit. Considerable revenues can be generated. We can also provide the code for little to no cost to the customers and earn from ads displayed on the sold website.

Problem Statement:

The project solves the problem of students and staff who take the university transport for travel.They face problems finding bus routes ,bus stops and bus timings of arrival and departure. The passengers either have to go to the Transport Office and ask for information, which is a time consuming process, or they go for local transport. An online help desk would encourage students to use the university transport and save them the trouble of waiting for and missing buses. Hence,this online bus tracking system is a beneficial solution to this problem. The points below describe how this solution will be beneficial:

- End users will be able to find buses location ,their timings of arrival and departure and their routes easily through this system.
- They will not need to go to the Transport Office to check the buses schedule. Reliable and up to date information will be available on the website.
- Their time and energy will be saved. Passengers will be at greater ease while looking for dependable data.
- Students and staff who use local transport will prefer to use university buses

Product Position Statement:

Students and university employees have to face a lot of difficulties, in everyday life, when traveling by bus. Sometimes the bus is delayed or sometimes it is not available due to some technical glitch. Due to which the passengers have to suffer a lot. In addition, passengers also have to struggle in getting the information about the buses, routes and stops. The **Computerized Transport System** facilitates passengers by tracking the bus. It will facilitate us in: Checking of operational bus routes and their stops, their Timings of departure and arrival of buses, Live locations of buses, entertain queries of passengers and complaints, Maintenance of the records of the buses, Fuel and maintenance costs, Availability of the vehicle, to check personnel in charge of each bus, Updation of the record for students. Our system will facilitate us to file complaints. It also sends email in case of any inconvenience. Driver will be able to tell us about the breakdown of the bus or any traffic jam via the website. Unlike other transportation facilities which are not computerized and the passengers have to compromise with all the issues, our system will save the precious time of our passengers and will provide support to them 24/7 in case of any inconvenience.

Stakeholder and user descriptions

Market demographics:

The University of the Punjab has over 50,000 students on roll. Accordingly, there is a massive faculty that works at the university. A large number of the students and university employees take the university buses to and from the campus everyday. So there is a large number of potential users of this website. This website is initially not being made for sale, so market factors are insignificant. However, most of the universities across the country do not have a computerized transport system and could make use of the website that we are developing. Hence this website could be sold to universities, colleges and schools with a transport system in the future for profit. Since there is a large number of organizations with their own transport systems that would want them to be computerized. We can earn substantial profits and maybe even fund the maintenance of our own website.

People who are new to the university often face difficulty getting to know the bus routes, their stops, alternative routes and the bus timings. This usually involves going to the transport office and looking for a schedule. With this app, newcomers would be able to learn about the buses and their routes on the go, without having to visit the transport department, and have reliable and up to date information. Existing users will be able to check new routes, and also the live location of their bus to see if the bus is late, or if the bus will be missed before they reach the stop and any alternate buses available.

Similar designs have already been implemented on public transport services e.g. the Speedo Feeder Bus and taxi services such as Uber, Careem, InDriver etc. This indicates that we can successfully develop and implement the project on the university transport system as well, since it operates in a similar way.

Stakeholder summary:

Name	Represents	Role
Transport Department	The transport department of the university that manages the campus vehicles. This includes the managerial, administrative and the junior staff.	The Transport Department will have to enter data before the launch of the website. They may have to hire IT technicians for the purpose or ask for student volunteers. They will be responsible for keeping the databases up to date once the website is launched.
Passengers	All potential users of the app including students and the university employees.	The passengers will use the website to access the information regarding the buses, their routes, stops, timings of departure and arrival, alternate routes and the live locations of the buses. They can register complaints and ask queries.
Investor	The firm that will provide funding for the project. This can be the university itself, students if the project is student funded or a third party that decides to sponsor the project either in return for advertisement or as a goodwill gesture toward the institute.	The investor will fund the development of the app, the purchase, installation and the maintenance of trackers as well as the website. If the investment is a goodwill gesture or a grant, the developers will not be obliged to pay them back. However, if the investment is a loan or intended for profits, the income from the ads displayed on the website will be used to recover the investment
Bus Personnel	This includes the workforce employed for smoothly operating the vehicles including the bus drivers and conductors.	The bus personnel can use the app as a regular passenger as well as some extra features such as entering information about a traffic jam, vehicle break down etc. (regional language support will be provided)
Web Development Team	This includes the planning, modeling, construction, deployment, testing, debugging and the maintenance team.	The Web Development Team will survey, plan, program, construct, deploy, alpha and beta test as well as maintain the website after it has been launched in line with the transport department.

User Summary:

Name	Description	Stakeholder
Member of the Transport Department	Can access the website and use it as a regular user, update the databases, view and answer queries and complaints.	Transport Department
Regular User	A potential passenger (student or a university employee) who wants to view the information regarding the vehicles and details regarding their routes. They can view the information in a read only mode, except for filing and submitting complaints and queries.	Passengers
Driver/ Conductor	Can access the website as a regular user and enter live information e.g. about traffic jams etc.	Bus Personnel

Stakeholder Profiles:

Stakeholder Name	Type	Responsibility	Success Criteria
Transport Department	Administrator	Providing and maintaining complete data of buses,maintenance of databases after project deployment	Transport department can successfully edit or maintain the records of bus details,routes and also the records of users of the system.
Passengers	Customer	Utilizing and executing the system	The passengers will be saved from hustle of the manual system by using the digitized system
Investor	Provider	Provide funds or budget for trackers either by sponsorship or loan	The investor will get its recognition among people and its reputation for success will increase .
Bus Personnel	Employee	Responsible for providing operating service of vehicles	Bus personnel will be awarded with retention and payment.
Web Development Team	Influencer	Develop and deploy a complete operation digitized transportation system	The team by developing an operational and demanding software will get recognition among its environment.

User Profiles:

User Name	Type	Responsibility	Success Criteria
Member of the Transport Department	Experienced user	Members of the transport department should manage the user queries and complaints section and also they should maintain the database records.	Members of the transport department will ensure the correctness of database records and a smooth customer support service.
Regular User	Casual user	Using and executing the system to avail the bus service	By use of this system ,the regular users(passengers) will be able to avail an efficient transport service.
Driver/ Conductor	Casual user	Using the software as a casual user but have access to some extra features of software to maintain the tracking record of buses.	By their efficient service ,the tracking system of software will be easily accessible and they will be rewarded with retention and payment.

User Environment:

- All of the user's requests will get responded to by the server at any time except the complaint or query he/she has filed.
- Our Customer Support team will provide the 24/7 assistance to our passengers and will entertain their queries.
- Unavailability of the IT technicians or staff would result in delay of the problem being handled.
- Activity completion time will depend upon the server. If the server is down, the users have to face the delay in their request being responded to. Otherwise the response time of the server will be in nanoseconds.
- Our users need to have an electronic device connected to the internet in order to get facilitated by our website.
- If they have a stable internet connection and there is no problem on the server-end, then the website would work completely fine.
- Any disruption in internet signals e.g. due to the internet service being off (for ex due to security reasons etc) will lead to an error page.
- Server could get affected by natural calamities i.e. fire explosion, earthquake etc.
- If there are jammers in locations such as cantt areas, the trackers may not be able to send signals properly
- Bad weather may cause issues with tracker signals e.g. during a thunderstorm etc
- Users have to face problems, if incorrect information gets entered in the database.
- Any kind of malicious activity could cause severe damage.

Alternatives and Competition:

A solution to the problem could be bought from a competitor, such as the firms that have developed and deployed the solutions for previously mentioned transport systems such as Speedo Feeder Bus Service, Airlift, Swvl, InDriver etc. The solution from Speedo would not have to be modified much, however the solution from the latter three will have to be modified to a larger extent. However, the competitors may not provide an open source solution and hence, it might not be editable. This solution would also be more expensive considering the scale of the project and the option of building a homegrown solution. Another option would be maintaining the status quo, but that does not solve the problem.

Product Overview

A high-level view of the product capabilities, interfaces to other applications, and systems configurations is given here.

Product perspective: The product is independent and completely self-contained. The product however will interact with the databases and the web servers. This will require an appropriate DBMS interface e.g. SQLyog for MySQL and Oracle interface for the Oracle Solaris DBMS etc.

Summary of capabilities:

Customer benefit	Supporting features
New support staff can quickly learn how to use the product.	A knowledge base assists support personnel in quickly identifying known fixes and workarounds.
User satisfaction is improved because updated and live information is available at their fingertips. Travel is made more convenient.	Throughout the resolution process, problems are uniquely listed, classified, and kept a track of. Aging issues are automatically notified.
The web development team can identify problem areas and gauge staff workload.	Distribution and progress reports enable a high-level review of the problem status.
Distributed support teams can work together to solve problems.	With a replication server, current database information can be shared throughout the enterprise.
Users can help themselves, lowering support costs and improving response time.	A knowledge base can be made available over the Internet. The knowledge base includes hypertext search capabilities and a graphical query engine. Self explanatory tutorials make learning easier.

Assumptions and dependencies: We assume that the host system will have a Windows or Linux Operating System. The computer would at least have a 32 bit processor. A database and a web server would be easily installable. The app would be developed using MySQL, so any changes in the DBMS software would result in a change in the web xml file only. We assume that the trackers will be easily available and not have outrageous power requirements.

Cost and pricing: The product would not be solved commercially in the first phase. If later upon expansion of the project, the product is made commercially available, the price will be kept a notch lower than the market price since the main income would be through ads. A relatively lower price would increase sales and hence, revenue generated through advertisements.

Product Features:

1. Feature_1 : login
2. Feature_2: view departure and arrival timings
3. Feature_3 view operational bus routes and stops
4. Feature_4: track live location
5. Feature_5 : File complaint
6. Feature_6 : View bus driver
7. Feature_7: Check availability of bus
8. Feature_8: Maintaining records
9. Feature_9 : Allot buses
10. Feature_10 : Enter fuel and maintenance cost
11. Feature_11 : Bus info update
12. Feature_12 : Send email
13. Feature_13 : view system information

Constraints:

1. Issues e.g. running out of fuel would cause unpredictable delays
2. Predicted arrival & departure times would not account for traffic jams
3. Without a network service, the website would not be accessible
4. Buses could face technical problems anywhere anytime
5. The driver of a functioning bus could be unavailable someday
6. If the transport department makes a mistake while updating the information, inaccurate information will be displayed to the users.
7. If the tracker of a bus is switched off, passengers would not be able to view its location on the map
8. The Internet or the DBMS server might be down

Quality Ranges:

Our database should be properly connected.User can do whatever they want after logging in but they'll only get a response if it is available.If due to some mistake there is an error in the database then it'll cost a lot and it will cost a lot.If the server is slow down then the whole website will be slow and it will make problems for user of website.Trackers should also be fully operational and functional so that it can give us live location so that user can access all information smoothly.If transport office management doesn't enter data carefully then website will show that faulty data that will be harmful.

Precedence & Priority:

Priorities:

High Priority:

1. Check the login details of the users and only allow users with authorized emails/accounts
2. View operational bus routes and stops
3. Track live location of the buses
4. Maintenance of the records of the buses and passengers.

Medium Priority:

1. FIle complaints
2. Check the timings of departure and arrival of every available bus.
3. Check availability of vehicle
4. Enter fuel details and total maintenance cost
5. Allotting buses

Low Priority:

1. View the information about the Driver
2. Sending mail in case of any inconvenience
3. Viewing complete system information

Precedence:

1. We will get the information about the routes and stops from the Transport Office.
2. Estimation of the cost of fuel and maintenance depends on the route and number of stops.
3. Feasibility report will be generated on the basis of high/low level system requirements, functional/non-functional requirements, hardware/software and tools and technology required.
4. Trackers will be set in all buses and all models will be designed and then we will review models and trackers.
5. Database would be created by gathering all the information about the routes, stops, cost, trackers and models.
6. Code will be written and then it will be connected to the database.
7. Website would be built on the basis of code and will be gone through alpha testing.
8. After alpha testing, the website will be launched and set up for beta testing.
9. The maintenance of the website will be done on a daily basis.

Other product requirements:

The following would be the applicable standards, hardware, platform, performance, and environmental requirements at a high level:

Applicable standards:

The product must comply with the following standards:

- The local legal and regulatory standards
- Communications standards (TCP/IP Model)
- Platform compliance standards (Android, iOS, Linux, Windows etc.)
- Quality and safety standards

System requirements:

- Supported host operating systems: Android, iOS, Linux, Windows
- Memory Requirements: No special memory requirements other than the memory required for deployment of the database and web servers, and for storing the databases
- Peripheral Devices: At least one tracking device will have to be installed in each bus in a tamper proof location
- Companion Software: A web browser, a web server and a database server would be required for the complete deployment of the program.

Performance requirements:

- The website should have an acceptable response time (no more than 10 seconds) during the peak hours e.g. morning and evening.
- The live location should not be delayed more than 10 seconds in order to provide the users with a reliable update on the current location of the buses.
- User Load would seldom be higher than a few thousand at a time. The servers should be capable of handling requests efficiently for at least one hundred users simultaneously.
- The bandwidth or the communication capacity should be according to the number of potential users and the bandwidth consumed per user. The bandwidth should be enough to handle at least a hundred users simultaneously.
- The ideal throughput would be between 3 to 5 seconds. Most users would not wait longer than that before abandoning the website and opting for a different means of transport
- Accuracy and Reliability: The data stored and retrieved from the database should be extremely accurate, reliable and up to date. Inaccurate or unreliable data would be a severe blow to the purpose of the project. The GPS trackers should provide a highly precise location and have a high refresh rate to avoid discrepancy between the actual and the live location.

Environmental requirements:

- For hardware: The trackers installed in every vehicle should be in a tamper and theft proof location. They should not be installed in a place too remote to allow normal speed of data transfer. The trackers should either be temperature, shock, humidity, and radiation proof or installed in a location that is so.
- For software: The use conditions would not involve any special circumstances and the user environment would be general. There are no requirements for environmental resources and hence no maintenance, error handling, and recovery issues related to the environment.

Documentation Requirements

The documentation that will be developed to support successful application deployment will be as follows:

Release Notes & Readme File: Release notes or A readme file or release notes including a "What's new" section, detail about forward or backward compatibility issues, installation and upgrade alerts and links to troubleshoot may be provided for later versions if required.

Online Help: An online help system will be provided to assist the users as well as the administrators. This will lessen the burden of the development team. Self explanatory tutorials will increase user interaction and allow them to learn on their own. This help will have to be provided in English as well as the regional languages to assist members of all communities to use it efficiently. This aspect will combine aspects of programming with technical writing. This is a project within a project that will benefit from scope management and planning at the project outset.

Installation guides: A document containing installation, configuration, and upgrade instructions can be offered as a part of the full solution. However, since the web development team will deploy and maintain the project on the host systems themselves, this document may not be required unless the app is sold to a third party for installation and use.

Labeling and packaging: A consistent look and feel on the product packaging will apply to all installation menus, splash screens, help systems, GUI dialog boxes etc. A copyright/patent notice and a corporate logo would be included if the app is sold to a third party. Standardized icons and other graphic elements will be a constant feature of the app, across all versions.

Target Release: 22nd March, 2021

1. Introduction

1.1 Systems Specifications:

Introduction:

Transport system deals with transport related facilities provided to students ,teachers and employees .There is a drawback of the current system that passengers have to wait for bus mostly because of lack of knowledge of bus information our goal is to computerized this system to facilitates passenger by tracking the bus .Thus our project system requirement is a fully functional ,operational and computerized transport system .It will facilitates us in: Checking of operational bus routes and their stops ,Their Timings of departure and arrival of buses, Live locations of buses ,Entertain queries of passengers and complaints ,Maintenance of the records of the buses ,Fuel and maintenance costs ,Availability of the vehicle ,To check personnel in charge of each bus , updation of the record for students. Our system will facilitate us to file complaints. It also sends email in case of any convenience.Driver will be able to tell us about breakdown of vehicle or any traffic jam via website.

Existing System :

Our existing system is a non-computerized Transport System of University in which we (As a passenger) have to go to the Transport office to get information of specific bus numbers, routes and timing. But this system sometimes fails due to some failure like if the bus halts due to some problem in it or due to less fuel in this case passengers have to face difficulties. Bus personnel have to enter details of buses , cost of fuel and maintenance in a register placed in a transport office. Transport office staff store all the buses related data in a manual register. Transport office has information of buses arrival .Passengers know the ideal time of arrival of buses at a specific time.

Scope of the system:

- To design a workable technology backed transportation system software for buses.
- Make students able to track every information about the buses and the services they want to avail.
- Obtain and maintain bus and user records.
- Develop a **user-friendly application** for passengers and staff members.
- To ensure **faster and efficient service of buses** for passengers on operation with a simple smartphone.
- Management will place **trackers** in every bus so that trackers will give the location of our buses and facilitate us (As a passenger).we'll also have an alternative tracker so that in case one fails, the other will work.
- **Transport Management** will process all data coming from the database .They are well aware of each and every detail related to buses and all the stakeholders. They'll also hire employees for maintaining buses and trackers in fully operational mode.
- **Database** will contain data of students, faculty, drivers, buses and trackers

- Database will send data to the Computerized Transport Management System.
- **Student/faculty/employees** just have to login to the website to access all the information.
- There will be **IT technicians** for entering records in DB. This will be administrative staff.
- There will be a third party that will provide a budget for Trackers and in return our university will give them profit.(the **Investor**)

Initial Requirements:

Only those students , faculty members or employees are allowed to access all information on our website that has a valid email address of the university. Drivers will have their specific IDs also. Admin will give access to only valid users. Valid passengers can also file complaints if they want. Passengers can also request for updating his record, Tracker will provide live location ,and we will provide email facility to passengers so that in case of any inconvenience passenger doesn't have to face difficulty. Trackers should be working accurately and bus maintenance costs will be entered in the database on a daily basis. Passengers and bus personnel can log in to the website at any time. Database should be properly connected and updated.

1.2 External Entities:

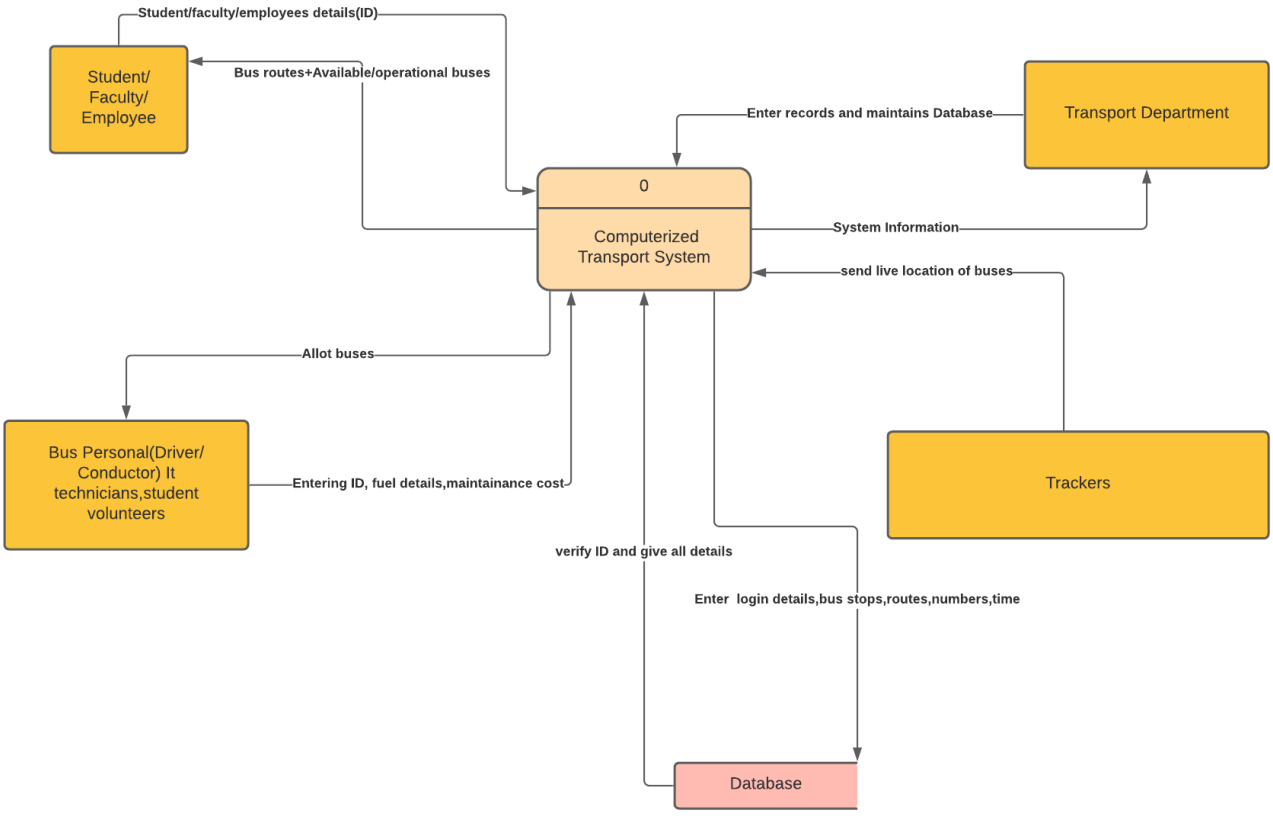
(a) Over specify entities from abstract:

- Students
- Faculty
- Employee
- Tracker Company
- Bus Driver/Conductor
- IT technicians
- Database
- Tracker
- Maintenance staff
- Mobile Phone
- Transport Management Staff
- Live location

(b) Perform refinement

- Students
- Faculty
- Employee
- Bus Driver/Conductor
- IT technicians
- Database
- Tracker
- Transport Management Staff

1.3 Context Level Data Flow Diagram



1.4 Shall Statements

- System **should** check the login details of the users and only allow users with authorized emails/accounts.
- Passengers **shall** be able to check operational bus routes and their stops.
- Passengers **shall** be able to check the timings of departure and arrival of every available bus.
- Passengers **shall** be able to track live location of buses to avail their service.
- Passengers **shall** be able to file complaints if they are not satisfied with the service or find any issue while using the software.
- The customer service support **shall** be able to entertain queries and complaints.
- Passengers **shall** be able to get information about the personnel in charge of each bus.
- Passengers **shall** be able to check the availability of vehicles when required.
- The Transport department **shall** be able to update, delete or insert the records of passengers, buses and drivers.
- Our system **shall** allot the buses to the individual bus personnels(drivers, conductors and IT technicians).
- Bus drivers **shall** be able to see the live location of the bus.
- Driver will be able to tell us about the breakdown of the bus or any traffic jam via the website.
- The system **should** let the bus drivers enter the fuel details and total maintenance cost into the system.
- The System **shall** send the mail to the registered users in case of any inconvenience.
- The Transport Department **shall** be able to see all the system information.

1.5 Allocate Requirements

REQUIREMENTS	**USE-CASE NAMES**
User initiates a login request and if his/her record exists, the browser will take the user to the main page of our web application.	UC_LOGIN
Departure and arrival timings of the available bus will be shown to the user.	UC_VIEW_DEPARTURE AND ARRIVAL_TIMINGS
Users can view the operational bus routes and stops.	UC_VIEW_OPERATIONAL_BUS ROUTES AND STOPS
User will be redirected to the map where he/she could see the movement of buses.	UC_TRACK_LIVE_LOCATION
User will go to the Customer Service Support section and will file the complaint or query with his/her Username. And their problem would get resolved through the email address they provided.	UC_FILE_COMPLAINT
Users can view the basic information about the personnel in charge of each bus.	UC_VIEW_BUS_DRIVER
Users can see whether the bus is available or not.	UC_AVAILABILITY_OF_BUS
Transport department can update, delete or insert a record.	UC_MAINTAINING_RECORDS
The transport department will allot the buses to the individual bus drivers, conductors and IT technicians(in case of any defective problem).	UC_ALLOTATION_OF_BUSES
Bus drivers will enter the fuel details and total maintenance cost into the system.	UC_ENTER_FUEL AND MAINTENANCE COST
Driver will be able to tell us about the breakdown of the bus or any traffic jam via the website by updating the information on the website.	UC_BUS_INFO_UPDATE
The transport department will send a mail if there would be any problem to prevent the users from facing any sort of inconvenience.	UC_SEND_EMAIL
The Transport Department will be able to see all the system information.	UC_VIEW_SYSTEM_INFORMATION

1.6 Prioritize Requirements

Requirements	**Priority**
Check the login details of the users and only allow users with authorized emails/accounts	HIGH
View operational bus routes and stops	HIGH
Track live location of the buses	HIGH
Maintenance of the records of the buses and passengers.	HIGH
Telling the breakdown of the bus or any traffic jam via the website.	HIGH
File complaints	MEDIUM
Check the timings of departure and arrival of every available bus.	MEDIUM
Check availability of vehicle	MEDIUM
Enter fuel details and total maintenance cost	MEDIUM
Allotting buses	MEDIUM
View the information about the Driver	LOW
Sending mail in case of any inconvenience	LOW
Viewing complete system information	LOW

1.7 Requirements Traceability Matrix

	User Authentication	View operational bus routes and stops	Check the timings of departure and arrival of every available bus.	Track live location of the buses	File complaints	View the information about the Driver	Check availability of vehicle	View complete system information	Allot the buses to the individual bus personnels	send email in case of inconvenience	Telling the breakdown of the bus or any traffic jam via the website.	Enter fuel details and total maintenance cost	Maintenance of the records of the buses, drivers and passengers.
Logging in to the system as a passenger	x	x	x	x	x	x	x						
Logging in to the system as a bus driver	x	x	x	x							x	x	
Logging in to the system as an administrartor	x	x	x	x		x	x	x	x	x	x		x
Correct stops displayed on a particular route		x		x									
Correct arrival and departure times		x	x	x							x		
Live location not delayed more than 10 sec			x	x									
Entering correct fuel details												x	
Updating/deleting/Adding the record of passenger													x
Updating/deleting/Adding the record of bus driver						x							x
File a complaint about the delay of the arrival of bus.			x		x						x		
Correct information of the bus driver						x							
Bus faces a techinal defect				x			x			x			
Bus is availabe or not							x						