Project Charter And Work Breakdown Structure for Electronic Toll Collection (ETC): An Automated Toll Collection System

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Course Name : Software Project Management (CSE6301)

Project Charter

General Information		
Project Title		Date of Authorization
Electronic Toll Collection (ETC): An Automated Toll Collection System		10/9/2023
Project Start Date	Project Finish Date	
10/9/2023	10/9/2024	
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1.1		28/9/2023

Project Manager Background
Mr. Md. Palash Miah, Chief Engineer of RTHD, is a professional with more than 25 years of experience in the IT/ECE/SWE project management field. He has been working within Road Transport and Highway Division (RTHD) since 2004 and has served as project manager for several certified projects.

Project Scope
Situation / Problem / Opportunity
Current reporting functionality in toll collection system is very limited, conducting manual toll collection, may causing traffic jam, and not that much user friendly.
Project Goals
The Automated toll collection system project intends to plan, design, construct and implement an Electronic Toll Collection System (ETC) conducted by Road Transport and Highway Division. This project will support various areas of toll plaza by automation and digitalize the toll collection process. The automated collection of toll fairs by using this service will be available to create a faster and more efficient service depending on the customer's need. The vision of the project is to improve efficiency and faster service levels of countrywide toll collection system.
In Scope / Out of Scope
In Scope: - Identify and communicate with the RFID tags installed on vehicles passing through the toll collection points.   - Handles the processing of toll transactions, i.e., calculate toll amount based on vehicles classification, generating electronic receipts or records etc.   - Control and management of the toll lanes, ensuring proper functioning of toll gates, sensors, and barriers.   - Integrates with the other relevant systems like payment gateways, central servers, or databases to facilitate real-time and accurate toll collection.   Out of Scope: - System may utilize vehicle classification data for toll collection that can be managed by separate systems or infrastructure, such as loop detectors or camera-based recognition systems.

- Physical maintenance or repair of toll lanes, toll gates or other related infrastructure components is typically handled separately by appropriate maintenance teams or authorities.
- Controlling overall traffic flow, congestion management, or routing decisions usually lies outside the scope of the toll collection system.

Project Objectives

The project objectives for an RFID-based automated toll collection system can be defined as the specific goals and outcomes that the project aims to achieve. Here are some objectives for such a system:

- Ability to process toll transactions quickly and accurately, resulting in shorter queues and reduced waiting times for commuters.
- Contribute to smoother traffic flow by reducing congestion and delays at toll plazas, by minimizing the time taken for toll payment and ensuring seamless vehicle movement.
- Enhance revenue generation for toll authorities by capturing all eligible toll payments, minimizing instances of evasion, and reducing revenue leakage.
- Provide convenience to commuters by offering an easy and hassle-free toll payment experience.
- Accurately calculate toll amounts based on predefined criteria such as vehicle type, distance traveled, time of pay, or other parameters.
- Implement strong security measures to prevent counterfeit or unauthorized RFID tags, as well as fraudulent activities like tag tempering and cloning.
- Designed to accommodate future growth, changing needs, allowing for scalability as traffic volume increases or requirements evolve.

Project Success Criteria

- The system should accurately calculate toll amounts based on predefined criteria, such as 99% accuracy.
- A significant reduction in waiting times at toll plazas, such as an average wait time of less than 15 sec/vehicle.
- Significant improvement in the average speed of vehicles passing through toll points.
- Increase in overall toll revenue by a certain percentage, such as a 10% increase.
- A high satisfactory rating, such as 95% of users rating the system as satisfactory or above.
- A high system uptime, such as 99.9% availability throughout the year.
- A minimal number of instances of counterfeit or unauthorized RFID tags, less than 0.1% of all transactions.

Approach

- Develop work breakdown structure GANTT chart, resource, and cost estimate within a month.
- Purchasing all required hardware within 2-3 months.
- Develop system maintenance software according to the requirement meets with necessary hardware.
- Perform initial and periodic risk assessments.
- Use internal staff as much as possible for planning, analysis, and installation.
- Generate periodic project reports.
- Conduct weekly progress review meeting with project team and stakeholders.

Key Schedule Milestones and Timeline

- Project Charter Approved: Oct 9, 2023
- Kickoff Meeting: Oct 23, 2023
- Identify and Document High Level Requirements: Oct 31, 2023
- Finalize Requirements: Nov 17, 2023
- Design and Development Completed: TBD
- Unit Testing Completed: TBD
- UAT Completed: TBD
- Training Completed: TBD
- Go-Live: Aug 2024

Note: Dates and milestones are subject to change pending final requirements and resource availability.

Resource Requirements

- People:
  - Executive Sponsor
  - Project Manager
  - Business Analyst
  - Software Engineers/Developers
  - RFID Experts
  - Network Engineers
  - Database Administrators
  - Quality Assurance/Testers
  - System Administrators
  - Operations Staff
  - Compliance and Legal Experts
  - Procurement and Vendor Management Staff
  - User Representatives/Stakeholders

- Time:
  - The initial estimate for the Automated Toll Collection System Project duration is approximately 1 year with an implementation occurring at the end of 2nd quarter for fiscal year 2024. (December 2023)
- Budget:
  - The approved budget for the Automated Toll Collection System Project is $1.2 billion.
    - The actual Budget will be estimated after finalizing the requirements.

Project Team Roles and Responsibilities		
Team Member	Roles	Responsibilities
Mr. M. Rahman	Executive Sponsor	Deputy Cabinet Secretary
Mr. Md. Palash Miah	Project Manager	Chief Engineer
Mr. Rakib Hossain	Project Coordinator	Business Analyst
Mr. Abir Khan	Team Member	Software Developer
Ms. Tasnim Barua	Team Member	RFID Expert
Mr. Abdullah Al Mamun	Team Member	Network Engineer
Mr. Shahriar Kabbo	Team Member	System & Database Administrator
Mr. Hasan Jamil Sany	Team Member	Quality Assurance/Tester
Mr. Md. Imran Hossain	System Complier	Compliance and Legal Experts

Sign-off: (Signatures of all the stakeholders above)

Rahman   Palash   Rakib
Abir   Tasnim   Mamun
Kabbo   Sany   Imran

Comments:

"This project must be done within 1 year at the absolute latest." Mr. Md. Palash Miah, PM

"We are assuming that we have enough resources and time available to conduct the project. And for some cases, we will go for after-hours work or overtime and will hire more resources, if it requires." Mr. Rakib Hossain, PC

Work Breakdown Structure (WBS) For Developing Automated Toll Collection System by Using Bottom-Up Approach

Identifying Specific Task

- Evaluate current situation, problem, and opportunities.
- Define the requirements and objectives.
- Determining Hardware and Software Requirements (i.e., RFID Reader, antennas, backend Server, and databases).
- Select appropriate RFID tags for vehicles and integrate RFID tags into the vehicles.
- Install RFID Readers at toll gates to detect and read the RFID tags on passing vehicles.
- Setup antennas position strategically to ensure reliable tag detection.
- Establishment of backend server and choose the appropriate communication protocol (e.g., Ethernet, Wi-Fi, cellular) to communicate with backend server.
- Develop a server-side application to handle incoming data from RFID readers and implement algorithms to process and validate the collected RFID data.
- Design the database schema and define appropriate data structures to store and manage the collected RFID data and Implement data storage, retrieval, and backup mechanisms.
- Design a user-friendly interface for toll booth operators or administrators.
- Develop functionality to generate reports on toll transactions, revenue, and performance.
- Perform extensive testing to ensure accurate tag detection and conduct field trials to validate the system's effectiveness and identify any potential issues.
- Deploy the system in toll plazas and monitor its performance.
- Provide ongoing support and maintenance services to address any system issues (i.e., Regular update software components and firmware).

Grouping Specific Task into Categories

1. Concept:
   - Evaluate Current systems.
   - Define the requirements and objectives of the automated toll collection system.
2. System Design:
   - Determine the hardware and software components required.
   - Design the system architecture, including the RFID reader, antennas, backend server, database, CCTV, sensors etc.
3. RFID Tag Integration:
   - Select appropriate RFID tags for vehicles and establish a unique identification scheme.
   - Integrate the RFID tags into the vehicles (e.g., affixing the tags to windshields).
4. RFID Reader and Antenna Setup
   - Install RFID readers at toll gates to detect and read the RFID tags on passing vehicles.
   - Position antennas strategically to ensure reliable tag detection.
5. Backend System Development:
   - Develop a server-side application to handle incoming data from RFID readers.

- Implement algorithms to process and validate the collected RFID data.
- Integrate with the existing toll management system or develop a new one.

6. Communication Infrastructure:
   - Set up a reliable network infrastructure to enable communication between RFID readers and the backend server.
   - Choose the appropriate communication protocol (e.g., Ethernet, Wi-Fi, cellular).

7. Data Management:
   - Set up a database to store and manage the collected RFID data.
   - Design the database schema and define appropriate data structures.
   - Implement data storage, retrieval, and backup mechanisms.

8. User Interface and Reporting:
   - Design a user-friendly interface for toll booth operators or administrators.
   - Develop functionality to generate reports on toll transactions, revenue, and system performance.

9. Testing and Deployment
   - Perform extensive testing to ensure accurate tag detection.
   - Conduct field trials to validate the system's effectiveness and identify any potential issues.
   - Deploy the system in toll plazas and monitor its performance during regular operations.

10. Maintenance and Support:
    - Provide ongoing support and maintenance services to address any system issues.
    - Regularly update software components and firmware for improved performance and security.

Integrating those Categories into High-Level Categories (Numbering Scheme based WBS)

1. **Concept**
   1.1. Evaluate current systems
   1.2. Define requirements
       1.2.1. Define user requirements
       1.2.2. Define system requirements
       1.2.3. Define service requirements
       1.2.4. Define operational requirements
   1.3. Define specific functionality
   1.4. Define risk and risk management
2. **System Design**
   2.1. Determine required hardware and software components
   2.2. System architecture design
   2.3. Database design
   2.4. User interface design
3. **Hardware Implementation**
   3.1. RFID reader and antennas installation
   3.2. RFID tag deployment
       3.2.1. Vehicle classification
   3.3. Wiring and connectivity setup
   3.4. Hardware integration testing

4. **Software Development**
    4.1. Backend Development
        4.1.1. Database configuration
        4.1.2. Develop server-side application
        4.1.3. Communication system implementation
        4.1.4. Algorithm implementation
        4.1.5. API development
        4.1.6. Transaction management
        4.1.7. Data storage and retrieval
    4.2. Frontend Development
        4.2.1. User interface development
        4.2.2. User experience design
        4.2.3. Payment gateway integration
5. **Testing and Quality Assurance**
    5.1. Unit testing
    5.2. Integration testing
    5.3. Performance testing
    5.4. Security testing
    5.5. Field testing
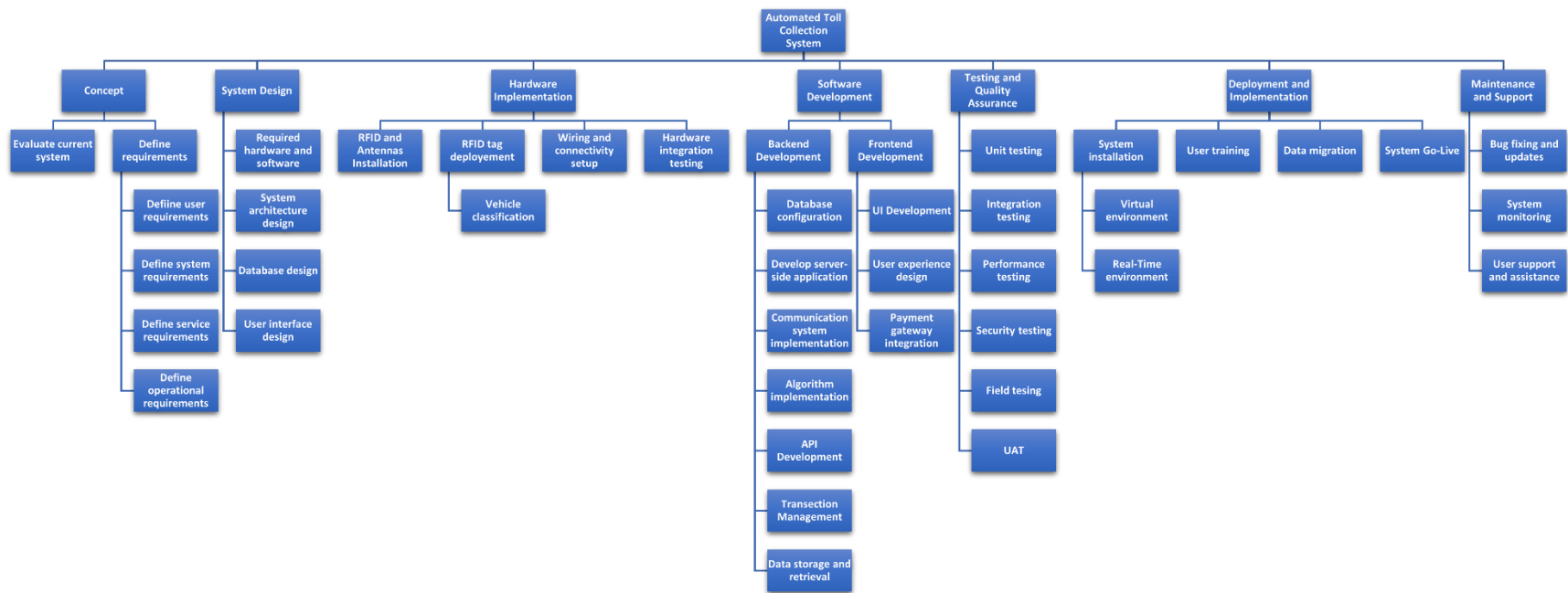   5.6. User acceptance testing
6. **Deployment and Implementation**
    6.1. System installation
        6.1.1. Virtual environment
        6.1.2. Real-Time environment (i.e., Toll Plaza)
    6.2. User training
    6.3. Data migration
    6.4. System Go-Live
7. **Maintenance and Support**
    7.1. Bug fixing and updates
    7.2. System monitoring
    7.3. User support and assistance

Task Oriented Work Breakdown Structure

Automated Toll Collection System

- **Concept**
  - Evaluate current system
  - Define requirements
    - Defiine user requirements
    - Define system requirements
    - Define service requirements
    - Define operational requirements

- **System Design**
  - Required hardware and software
  - System architecture design
  - Database design
  - User interface design

- **Hardware Implementation**
  - RFID and Antennas Installation
  - RFID tag deployement
    - Vehicle classification
  - Wiring and connectivity setup
  - Hardware integration testing

- **Software Development**
  - Backend Development
    - Database configuration
    - Develop server-side application
    - Communication system implementation
    - Algorithm implementation
    - API Development
    - Transection Management
    - Data storage and retrieval
  - Frontend Development
    - UI Development
    - User experience design
    - Payment gateway integration

- **Testing and Quality Assurance**
  - Unit testing
  - Integration testing
  - Performance testing
  - Security testing
  - Field tesing
  - UAT

- **Deployment and Implementation**
  - System installation
    - Virtual environment
    - Real-Time environment
  - User training
  - Data migration
  - System Go-Live

- **Maintenance and Support**
  - Bug fixing and updates
  - System monitoring
  - User support and assistance

N.B. Please do a little zoom for clear view.