ISD316D PROJECT

TUT vehicle Registration System

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ISD316D
Tshwane University of Technology

Phase 1

Client Overview

COMPANY NAME: TSHWANE UNIVERSITY OF TECHNOLOGY(TUT)

Tshwane University of Technology (TUT) is a prominent higher education institution based in Pretoria, South Africa, known for its commitment to quality-driven education and innovation.

TUT offers a wide range of undergraduate and postgraduate programs across various fields such as Engineering, Science, Arts, and Management. The university is dedicated to fostering research and community engagement, aiming to address societal challenges and contribute to the development of both the local and international community.

OBJECTIVES: The university's objectives include reducing manual administrative workload, enhancing data accuracy, and providing a superior visitor experience. These goals align with TUT's mission to be a quality-driven institution at the forefront of innovation and societal contribution.

GOALS: The university primary goals are to enhance campus security, improve operational efficiency, and ensure data privacy and compliance. By implementing the Vehicle Registration System, TUT aims to streamline visitor management, ensuring a secure and efficient registration process.

Key Stakeholders

- **Sponsors**: Vice-Chancellor's Office, ICT FACULTY.

These sponsorship will provide strategic direction and oversight furthermore, ensure adequate resources, including budget and personnel, are allocated to the project.

- **Users**:

Visitors/Drivers: External individuals who need to register their vehicles when entering TUT premises.

Security Personnel: Responsible for managing and verifying vehicle registrations at entry points.

Administrative Staff: Handling backend data management and reporting.

IT Staff: Supporting the technical aspects, maintenance, and troubleshooting of the system.

Students and Faculty: May use the system for visitor registrations or during events.

- **Project Team**:

Software Developers: Software developers write code to implement the functionality of the vehicle registration system. They work closely with business analysts and system architects to understand requirements and design specifications, and they collaborate with other developers to integrate system components.

Business Analysts: Business analysts gather and analyze requirements from stakeholders to ensure that the system meets user needs and business objectives. They document requirements, create use cases, and translate business requirements into technical specifications for the development team.

Quality Assurance (QA) Testers: QA testers design and execute test plans to identify defects and ensure the quality of the vehicle registration system. They validate that the system meets functional and non-functional requirements, and they report defects to the development team for resolution.

Database Administrators: Database administrators manage the database systems that store vehicle registration data. They ensure that the database is secure, reliable, and efficient, and they perform tasks such as database design, data modeling, performance tuning, and backup and recovery.

Define Project & Why It's Needed.

Tshwane university of technology(TUT) currently uses the traditional method of recording visitors/drivers's information, and reason for visiting using pen and paper at campus entry points.

The opportunity at hand is the implementation of the TUT Vehicle Registration System. The project need for the TUT Vehicle Registration System arises from the necessity to enhance campus security, streamline visitor management, and improve overall operational efficiency at Tshwane University of Technology (TUT). Several key factors contribute to the justification and requirement for this system:

1. **Security Enhancement**: TUT, like many educational institutions, prioritizes the safety and security of its campus community. Implementing a robust vehicle registration system allows for better control over who enters the premises, thereby reducing the risk of unauthorized access, incidents, and potential threats.

2. **Visitor Management**: With a large number of visitors accessing TUT campuses regularly, managing their entry and ensuring compliance with security protocols can be challenging. A dedicated vehicle registration system provides a centralized platform for registering and tracking visitor vehicles, streamlining the check-in process, and improving overall visitor experience.

3. **Data Accuracy and Compliance:** Manual recording of visitor and vehicle information is prone to errors and inconsistencies. By transitioning to an automated system, TUT aims to improve data accuracy, maintain compliance with privacy regulations, and ensure the integrity of recorded information.

4. **Operational Efficiency**: Manual processes for vehicle registration and visitor management are time-consuming and resource-intensive. Automation through a dedicated system reduces administrative burden, optimizes resource utilization, and allows security personnel to focus on more critical tasks.

5. **Scalability and Future-Readiness**: As TUT continues to grow and evolve, it's essential to adopt scalable solutions that can accommodate increasing visitor traffic and evolving security requirements. The vehicle registration system provides a foundation for future expansion and integration with other security and administrative systems.

Work That Must Be Done to Deliver a Product

Functions:

The system will allow security officers to initiate the registration process when a visitor arrives at the campus entrance. Visitors provide personal details such as name, contact information, and identification documents and security officers enter visitor information into the system, including the purpose of the visit and vehicle details such as license plate number, make, model, and color into the system. The system will then store the visitor's information and vehicle information in the database for future reference

Features:

Visitor registration form : TUT Vehicle registration system will have a form feature that will allow security officers to input visitor personal and vehicle information and enable them to upload documents such as driver's licence or ID

User Support and Assistance: The application includes a comprehensive help section with FAQs, troubleshooting guides, and contact information for support.

What Is Not Included?

Real-Time Feedback Process: Drivers do not receive real-time feedback and confirmation upon successful registration of visitor and vehicle information.

Appropriate Tools/Techniques Used to Communicate the Information

- Email Communication : email updates to keep stakeholders informed about project milestones, developments, and upcoming events.
- Surveys: Feedback surveys to gather input from end-users, security officers, and administrators regarding their experience with the system and suggestions for improvement.
- PowerPoint or Google Slides presentations to deliver key information about the system to stakeholders.

External Interfaces

There's no external interface for the system. The reason being:

1. System Scope: The system may is designed to operate independently without the need for integration with external systems.

2. Limited Requirements: The system's requirements may not necessitate interaction with external interfaces, as it fulfills its intended purpose within the campus environment.

Describe In Detail the Method for Managing Scope Creep

To keep the project deliverables or features of a project expand from what was originally agreed upon the methods applicable are:

- Clear outline of priorities (As part of laying a strong foundation).
- Record all changes (use of change control process).
- Detailed documentation of implication of changes/influenced by changes.
- Assess the impact of changes on the project.
- Monitor the changes.
- Risk management plan for in case change occurs.
- Create a clear project schedule.
- Approve all necessary changes before implementation.
- Inform stakeholders about any change.

Project communication

Email Updates: These updates will provide clear information about the nature of changes, their impacts on the project, and any immediate actions taken. They ensure everyone is aligned, facilitate quick decision-making, and serve as a documented communication trail.

Stakeholder Meetings: These meetings will foster direct interaction, consensus-building, and collaboration, helping to manage scope creep and keep the project on track.

Phase 2

Introduction

The purpose of this document is to provide a concise overview of the TUT Vehicle Registration System's objectives, scope, deliverables, and key stakeholders. It outlines the rationale behind the project, highlight its importance to the organization, and summarize the approach that will be taken to achieve its goals. Additionally, the document may touch upon the anticipated timeline, budget, and potential risks or challenges that may arise during project execution. This

document serves as a high-level snapshot for stakeholders, providing them with a clear understanding of the project's purpose and scope.

Project Scope

Deliverables

Functional Vehicle registration system with user (direct user) friendly interface to accommodate both visitors and administrators.

Improved comprehensive documentation outlining system requirements user manuals and design specifications.

Ongoing support services to address any issues provide technical assistance and implementation of updates.

Training materials and sessions for relevant stakeholders on system usage, maintenance, and troubleshooting.

Provide analytics and reporting tools to actively monitor visitor traffic and produce insights.

What the Vehicle Registration System Won't Do.

The project won't involve modification to academic curriculum or teaching methodology as it lies beyond the scope of access control of Institution properties.

The project will not address broader campus security measures beyond the scope of visitor and vehicle registration and access control.

The project will not replace or modify existing security hardware (e.g. gates and barriers).

The system will not involve vehicle tracking beyond the scope of registration and identification at points of entry.

Customer Acceptance Criteria

The criteria the customer (security officer, visitor, and administrator) will use to determine if they are satisfied with the final deliverables:

Security Officer:

1. The system must enable easy verification of registered vehicles.

2. Access to accurate and up-to-date vehicle information.

3. Efficient logging of vehicle entry and exit.

4. User-friendly interface for quick and efficient verification.

5. Minimal training required to use the system.

Visitor:

1. Simple and intuitive vehicle registration process.

2. Immediate feedback on the status of their registration application.

3. Easy submission and validation of necessary documents.

4. Secure handling of personal and vehicle information.

5. Visitors should have their details easily captured, including their names, contact info, and reason for visiting the property.

6. The system will prompt the user for vehicle information, including license plate number, vehicle model, and vehicle colour.

Administrator:

1. Comprehensive administrative controls for managing user roles and permissions.

2. Ability to monitor system performance and user activity.

3. Efficient workflow for reviewing and approving vehicle registration applications.

4. Notification system for pending approvals and other administrative tasks.

The Organisational Chart
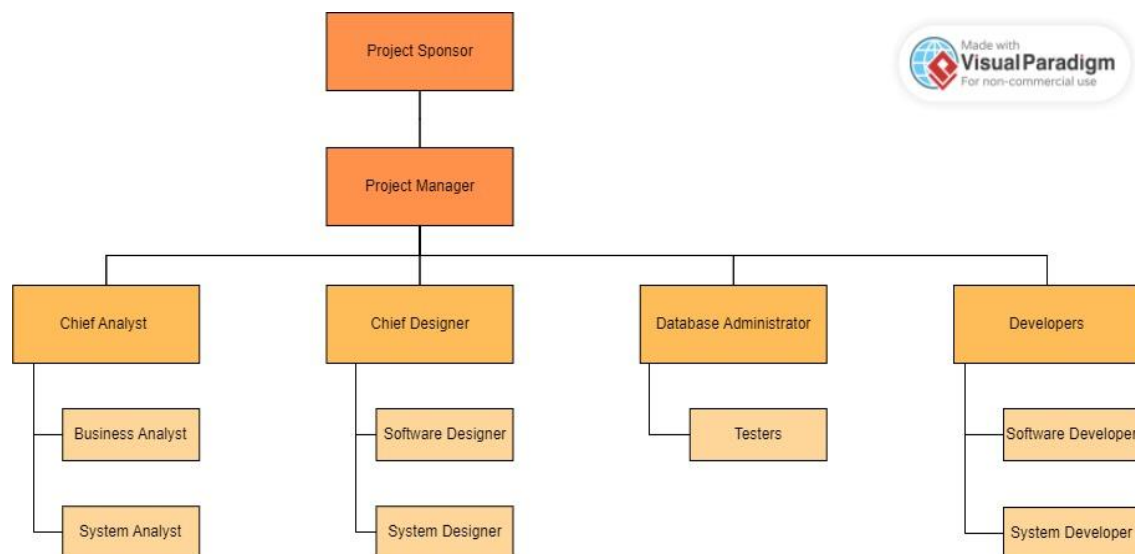
<u>Project tasks or milestones, duration, responsibilities and deliverables</u>

Phase	Tasks or Milestones	Stakeholder responsible	Duration	Deliverable
Planning	- Define the system to develop. - Define and document the project scope.	Project Manager.	115days	- Business Requirements Report

	- Develop the project plan.			- Testing Strategy - Project scope - Implementation Strategy - Acceptance Criteria - Project charter
Analysis	- Gather Requirements. - Prioritize the requirements. - Conducting a feasibility study.	Business Analyst and System analyst.	28days	- Business requirements report - Conceptual system design plan - Strategy documents for the entire process.
Design	- Design the technical architecture. - Design the software. - Design the system model.	Software designers and system designers.	120 – 150 days	- Flow charts - UML diagrams - Prototypes - Sketches
Development	- Build the technical architecture. - Build the software. - Merge the system with the existing database	Software developers and System developers.	150 – 180 days	- System development document - System Implementation plan - Training plan
Testing	Document test conditions/ criteria. - Perform the testing of the system. • Unit testing – Test each individual component to	Software tester, Software quality assurance engineers, and Quality assurance testers.	21 – 42 days	- Test plan - Test case - Faulty documentation - Status report

	ensure it is fault-free. • System testing – Test the whole new system to verify that all components work correctly. • Integration testing – Verify that existing systems and our new system can work together. • User acceptance testing – Test if the new system meets the business requirements and enables both the ophthalmologist and the patients to use the system correctly.			
Implementation	- Document a detailed user manual of how to use the system. - Provide training for the new system.	Project manager	Minimum of one year and above.	- Complete system - System Documentation - Post Implementation review report - Implementation notice
Maintenance	- Create a help desk to support the System users. - Enhance the system as an ongoing process and make an environment to	System analyst, Users and the development team	Continuous process after all phases have been completed.	- Software upgrades - Repairs - Fixes of software

	support system changes			

Allocation Of Resources

<u>Work Breakdown Structure</u>
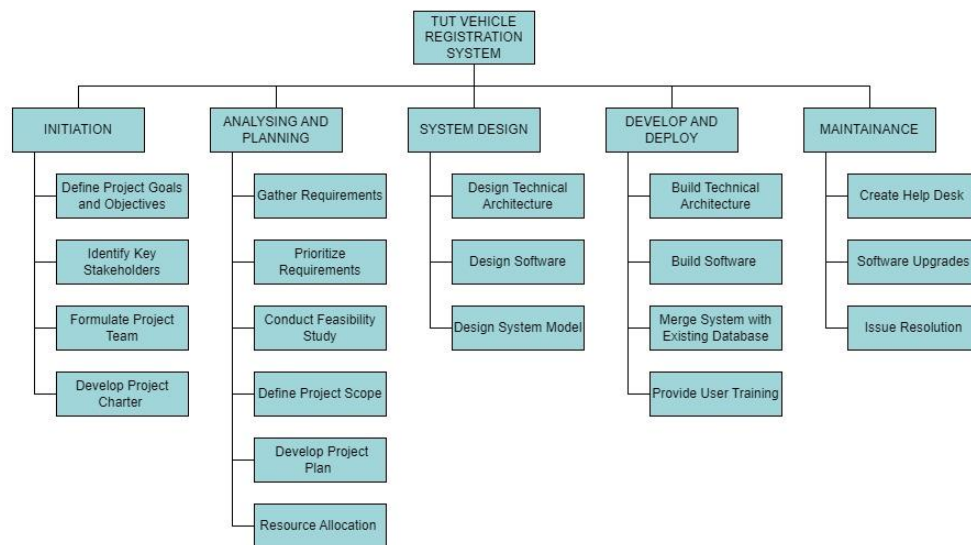
Planning Dependencies

Dependencies

1. Gather Requirements: The analysis and planning phase depends on gathering requirements. Without a clear understanding of what the system needs to accomplish, it's challenging to plan the project effectively.

2. Feasibility Study: The analysis and planning phase also depend on conducting a feasibility study. This study informs stakeholders about whether the project is viable and achievable given the available resources and constraints.

3. Define Project Scope: Defining the project scope is crucial before moving forward with planning and design activities. Without a clear scope, the project risks scope creep, which can lead to delays and budget overruns.

4. Design Technical Architecture: The development and deployment phase depend on the design of the technical architecture. Without a well-thought-out architecture, the development team may face challenges in building and deploying the system effectively.

5. User Training: Deployment and maintenance depend on providing user training. Users need to understand how to use the system efficiently to achieve the desired outcomes. Delaying training could lead to user frustration and decreased productivity.

6. Software Upgrades: Maintenance activities depend on the completion of software upgrades. Upgrades may include bug fixes, performance improvements, or feature enhancements. Failure to upgrade software in a timely manner could lead to security vulnerabilities or system instability.

Assumptions

1. We assume that key stakeholders, including administrators, security officers, and visitors, are available and willing to participate in system testing, training, and user acceptance activities as needed.

2. We assume that the system will comply with all relevant regulations and standards governing vehicle registration processes, data privacy, and security.

3. We assume that our operational project team can deliver and completing all milestones effectively

Constraints

1. The project is limited by budget constraints, which may affect the scope of the project, resources allocated, and the timeline for implementation.

2. There may be tight deadlines for the project, limiting the amount of time available for each phase of development, testing, and deployment.

3. Some of the features suggested might not be feasible or work as expected.

Risks, countermeasures, and the person accountable for each countermeasure.

1. Risk: Unclear Project Objectives

- Countermeasure: Conduct thorough stakeholder interviews and requirements gathering sessions to ensure a clear understanding of project objectives before proceeding.

- Person Accountable: Project Manager

2. Risk: Inadequate Requirements Gathering

- Countermeasure: Engage stakeholders from different departments to gather comprehensive requirements and conduct multiple review sessions to ensure alignment.

- Person Accountable: Business Analyst

3. Risk: Design Complexity

- Countermeasure: Break down the system design into manageable components and conduct regular design reviews to identify and address any complexity issues early on.

- Person Accountable: Lead System Designer

4. Risk: Technical Challenges

- Countermeasure: Allocate sufficient time for development, conduct prototyping where necessary, and involve experienced developers to mitigate technical risks.

- Person Accountable: Technical Lead

5. Risk: Resource Constraints

- Countermeasure: Prioritize maintenance tasks based on criticality, allocate resources effectively, and establish a help desk to address user issues promptly.

- Person Accountable: Maintenance Team Lead

6. Risk: Integration Issues

- Countermeasure: Implement thorough integration testing at each phase of development to identify and resolve integration issues before deployment.

- Person Accountable: Integration Testing Team Lead

7. Risk: Data Security Breach

- Countermeasure: Implement robust security measures throughout the development process and conduct regular security audits to identify vulnerabilities.

- Person Accountable: Security Officer

8. Risk: User Acceptance

- Countermeasure: Involve end-users in the testing and validation process to ensure that the final product meets their needs and expectations.

- Person Accountable: User Acceptance Testing Lead

Project budget

The following system involves estimating costs associated with various aspects of the project. The cost breakdown of the potential budget is:

Development Costs	(Total)	R77,100.00
software development		R32,000.00
database development		R20,000.00
testing and quality assurance		R15,100.00
project management		R10,000.00
Hardware and Infrastructure Costs	(Total)	R78,000.00
Server infrastructure		R30,000.00
Network equipment		R20,000.00
Workstation		R28,000.00
Training and Documentation Costs	(Total)	R30,000.00
Training Expenses		R15,000.00
Documentation Cost		R15,000.00
Ongoing Maintenance and Support Costs	(Total)	R50,000.00
Maintenance Expenses		R20,000.00
Technical Support		R20,000.00
Hardware Upgrades		R10.000.00
Software and Licencing Cost	(Total)	R40,000.00
Operating System Licenses		R10,000.00
Development Tools		R15,000.00
Database Software		R10,000.00
Security Software		R5,000.00
Total Project Budget	(Total)	R275,100.00
Estimated project total		R275,100.00

Problem Escalation

The project team will report any problems impacting the project to the project manager immediately upon identification.

The project manager will assess the severity and impact of the problem and escalate it to relevant stakeholders as well as provide regular updates on the status and proposed solution.

Reporting

Multiple periods or types of reporting can be used when using this system: weekly, monthly, and quarterly. These reports can be used to compare.

Which periods had the most visitors?

Which visiting purpose is the most given when gaining access to the institution?

Change-Management Process

The approach to dealing with the transition or transformation of an organization's processes or technologies. The following are the steps that will be followed to implement the changes in the project are:

Step 1:

As soon as a change that impacts project scope, schedule, staffing, or spending is identified, the Project Manager will document the issue.

 Step 2:

The Project Manager will review the change and determine the associated impact on the project and will forward the issue, along with a recommendation, to the Steering Committee for review and decision.

Step 3:

Upon receipt, the Steering Committee should reach a consensus opinion on whether to approve, reject, or modify the request based on the information contained within the project website, the Project Manager's recommendation, and their judgment. Should the Steering Committee be unable to reach a consensus on the approval or denial of a change, the issue will be forwarded to the Project Sponsor, with a written summation of the issue, for ultimate resolution.

Step 4:

If required under the decision matrix or due to a lack of consensus, the Project Sponsor shall review the issue(s) and render a final decision on the approval or denial of a change.

Step 5:

Following approval or denial (by the Steering Committee or Project Sponsor), the Project Manager will notify the original requestor of the action taken. There is no appeal process.

Phase 3

Business Opportunity

Overview:The existing vehicle registration process is currently focused on inefficiencies and limitations. In numerous instances, the process is done by hand, using paper, and is susceptible to mistakes and delays. This old-fashioned method not just slows down effectiveness but also adds to customer unhappiness because of extended wait times and administrative obstacles. Moreover, the absence of digitalization results in restricted accessibility and transparency during the registration process.

Current Situation: The current process for registering vehicles requires individuals to submit paperwork manually at campus entry points upon arrival, where security personnel manually enter visitor/driver details into the system. This procedure takes up a lot of time, is prone to errors, and does not have real-time tracking features. Customers frequently experience extended waiting periods and administrative difficulties, resulting in dissatisfaction. Also, the lack of online platforms requires people to go in person to registration centers, which can be difficult for those with limited mobility or living far away. In general, the present circumstances underscore the requirement for an updated, digital registration system to tackle current shortcomings and enhance customer contentment.

Alternative Solutions

Identified Possible solution.

- TUT Vehicle Registration system(Initial Solution)

- Visitor Pre-registration Portal

- Interactive Kiosks

TUT Vehicle Registration System

Security officers enter data directly into the system at the gate.

Securely stores data in a database, accessible for administrative tasks.

Allows for quick identification and verification of visitors.

Enables comprehensive administrative functions, including data retrieval and reporting.

Designed for ease of use by both security officers and administrators.

It will have its own database that will store, organize and retrieve visitor and vehicle information.

Visitor Pre-registration Portal

Online Registration: Visitors can pre-register their visit by providing personal and vehicle details through an online portal accessible from any device with internet connectivity.

The portal will have an intuitive interface to ensure ease of use, allowing visitors to complete the registration process without technical assistance.

Once registered, visitors receive confirmation emails or messages containing a unique identifier (e.g., QR code or confirmation number) to present at the gate for expedited entry.

The portal will employ robust security measures to protect personal information, ensuring compliance with data protection regulations.

Information entered by visitors is immediately updated in the central database, making it accessible for verification by security staff.

Interactive Kiosks

Interactive kiosks placed at campus entry points will allow visitors who have not pre-registered online to register their details upon arrival

The kiosks will feature touchscreens with clear instructions to guide visitors through the registration process.

Visitors who have pre-registered can use the kiosks to quickly check in by scanning their QR code or entering their confirmation number.

Information entered at the kiosks will be synchronized in real-time with the central database, ensuring security staff have up-to-date information for verification.

The kiosks will include help sections and tooltips to assist visitors with the registration and check-in processes.

Assess, Compare and Conclude on the Alternative Solutions

Assessment

Criteria	Visitor Pre-registration Portal	TUT Vehicle Registration System	Interactive Kiosks
Cost	Moderately priced	High Cost	Moderate Cost
Ease of use	Moderate ease of use	High ease of use	Very high ease of use
Scalability	Moderately scalable	High scalability	Moderate scalability
Security	High security	Moderate security	High security
Implementation Time	Moderate	High	Moderate
Integration	Moderate	Moderate	Moderate
Compliance	High	High	High
Support and Maintenance	Moderate	High	Moderate

1. Cost:

Visitor Pre-registration Portal: Moderately priced due to development and maintenance costs.

TUT Vehicle Registration System: High cost due to custom development and ongoing support needs.

Interactive Kiosks: Moderate cost, involving initial hardware and software investment.

2. Ease of Use:

Visitor Pre-registration Portal : Moderate ease of use, may require some training.

TUT Vehicle Registration System: High ease of use with a user-friendly interface.

Interactive Kiosks: Very high ease of use, intuitive touch-screen interface.

3. Scalability:

Visitor Pre-registration Portal : Moderately scalable to accommodate growing data and users.

TUT Vehicle Registration System: Highly scalable to handle large volumes of registrations.

Interactive Kiosks: Moderate scalability, may require additional kiosks for increased traffic.

4. Security:

Visitor Pre-registration Portal: High security, handling sensitive vehicle and user data.

TUT Vehicle Registration System: Moderate security, dealing with visitor information.

Interactive Kiosks: High security, especially if integrated with backend systems.

5. Implementation Time:

Visitor Pre-registration Portal : Moderate implementation time for development and deployment.

TUT Vehicle Registration System: High implementation time due to custom development.

Interactive Kiosks: Moderate implementation time for setup and integration.

6. Integration:

Visitor Pre-registration Portal: Moderate integration with existing vehicle databases.

TUT Vehicle Registration System: Moderate integration with security systems.

Interactive Kiosks: Moderate integration with backend systems for data access.

7. Compliance:

Visitor Pre-registration Portal: High compliance with legal and regulatory requirements.

TUT Vehicle Registration System: High compliance with data protection regulations.

Interactive Kiosks: High compliance, especially with sensitive data handling.

8. Support and Maintenance:

Visitor Pre-registration Portal : Moderate support and maintenance needs.

TUT Vehicle Registration System: High support and maintenance requirements.

Interactive Kiosks: Moderate support and maintenance, including hardware upkeep.

Comparison

· **Visitor Pre-registration Portal**:

Pros: High security, compliance, and integration capabilities. Moderately priced with moderate ease of use.

Cons: Moderate scalability and support/maintenance needs. Moderate implementation time.

· **TUT Vehicle Registration System**:

Pros: High ease of use and scalability. High compliance and integration capabilities.

Cons: High cost, implementation time, and support/maintenance needs. Moderate security.

· **Interactive Kiosks**:

Pros: Very high ease of use. Moderate cost with moderate scalability and support/maintenance needs.

Cons: Moderate security and integration capabilities. Moderate compliance and implementation time.

Conclusion

Based on this detailed analysis, the initial solution which is TUT Vehicle registration system emerges as the preferred solution due to its high ease of use, scalability, and compliance with security and regulatory requirements.

Risk Analysis for each Alternative Solution

TUT Vehicle Registration System:

There might be challenges in integrating the new system with existing databases or infrastructure, leading to compatibility issues or data migration problems.

If the system is not user-friendly or lacks proper training, there could be resistance from users, leading to low adoption rates or errors in data entry.

Storing sensitive vehicle and owner information poses security risks such as data breaches or unauthorized access if adequate security measures are not implemented.

Failure to comply with regulatory requirements regarding data privacy and vehicle registration standards could lead to legal repercussions or fines.

Visitor Pre-registration Portal:

Development challenges or software bugs may arise during the implementation phase, delaying the launch or affecting the portal's functionality.

Inaccurate data entry by visitors or system errors could result in incorrect visitor information being recorded, leading to confusion or security issues upon arrival.

Storing visitor data in a digital format increases the risk of data breaches or cyberattacks if the portal is not adequately secured or regularly updated with patches.

Visitors may be hesitant to use the pre-registration portal if they perceive it as cumbersome or time-consuming, impacting its effectiveness and adoption rate.

Interactive Kiosks:

Malfunctions or hardware failures in the kiosks could disrupt the visitor registration process, leading to delays or frustration among users.

If the kiosks are not properly maintained or serviced, they may experience usability issues or become non-functional, negatively impacting the visitor experience.

Kiosks may store sensitive visitor information, making them potential targets for theft or unauthorized access if proper physical or digital security measures are not in place.

Regular maintenance and updates are essential to keep the kiosks operational and secure. Failure to maintain them could result in increased downtime or security vulnerabilities.

To assess and compare the alternative solutions, we used formal analysis techniques such as a decision matrix or cost-benefit analysis. These techniques helps to evaluate the alternatives based on predefined criteria and make an informed decision.

Cost-benefit analysis of Alternative Solution

1. **TUT Vehicle Registration System**:

   Costs:

   - Development Costs: Designing, developing, and implementing the system will require significant upfront investment in terms of software development, hardware acquisition, and infrastructure setup.
   - Maintenance Costs: Ongoing maintenance, updates, and support will be needed to ensure the system's functionality and reliability over time.
   - Training Costs: Training staff members and users on how to use the system effectively may incur additional expenses.

   Benefits:

   - Efficiency Gains: Automating the vehicle registration process can lead to time savings for both administrators and vehicle owners, streamlining operations and reducing paperwork.

- Accuracy Improvements: Digital record-keeping and automated validation can minimize errors and discrepancies in vehicle registration data, enhancing data accuracy and integrity.
- Regulatory Compliance: Implementing a modern vehicle registration system can help ensure compliance with regulatory requirements and standards, reducing the risk of penalties or legal issues.

2. **Visitor Pre-registration Portal**:

Costs:

- Development Costs: Designing and developing the portal, including user interface design, backend development, and integration with existing systems, will require investment in software development resources.
- Marketing Costs: Promoting the portal to visitors and encouraging pre-registration may incur marketing expenses to increase awareness and adoption.
- Maintenance Costs: Ongoing maintenance, updates, and support for the portal will be necessary to address any issues and ensure its continued functionality.

Benefits:

- Visitor Experience: Pre-registration can enhance the visitor experience by reducing wait times and streamlining the registration process, leading to improved satisfaction and perception of the organization.
- Operational Efficiency: Pre-registration can help optimize resource allocation and staffing levels by providing advance visibility into visitor arrivals, enabling better planning and resource management.
- Data Insights: Collecting visitor data through pre-registration allows for better analytics and insights into visitor demographics and behavior, enabling data-driven decision-making and targeted marketing efforts.

3. **Interactive Kiosks**:

Costs:

- Hardware Costs: Acquiring and installing interactive kiosks at various locations may involve significant upfront investment in hardware procurement and installation.
- Development Costs: Developing the kiosk software, user interface design, and integration with backend systems will require investment in software development resources.
- Maintenance Costs: Ongoing maintenance, repairs, and updates for the kiosks will be necessary to ensure their continued functionality and reliability.

Benefits:

- o Visitor Convenience: Interactive kiosks provide a self-service option for visitor registration, offering convenience and flexibility for visitors to complete the registration process independently.
- o Resource Optimization: Kiosks can help optimize staffing levels and resource allocation by reducing the need for manual registration processes, freeing up staff to focus on other tasks.
- o Brand Image: Implementing interactive kiosks can enhance the organization's brand image by showcasing modern technology and commitment to innovation, improving the overall visitor experience.

Phase 4

Introduction

This phase outlines the user requirements for the Vehicle Registration System. It details the project objectives, system requirements, database requirements, managerial and operational reports, security requirements, user interface specifications, look and feel preferences, operational requirements, and the process for managing new requirements.

<u>Purpose</u>

The purpose of this project is to enhance the manual way of capturing visitor's data at Tshwane University of Technology, by putting in place a digital vehicle registration system.

<u>Project Objectives</u>

The project objectives are detailed as follows:

- **Enhance Security**: Improve the recording and management of vehicles entering and exiting the university premises.
- **Improve Efficiency**: Transition from a pen-and-paper system to a digital system.
- **Ensure Accurate Record Keeping**: Store data electronically for better accuracy and retrieval.
- **User-Friendly Interface**: Develop an interface that is easy to use for security personnel and administrators.
- **Data Privacy and Security**: Ensure data is secure and protected from unauthorized access.

<u>Project Team</u>

Sponsors: the TUT administration, could provide necessary funding and support for the development of the system.

Direct Users (Gate Security Personnel): responsible for acquiring vehicle registration information, drivers' information, passengers' information, and reason for visit.

Indirect Users (Drivers/Visitors): Drivers entering the premises will indirectly interact with our system by giving out necessary information to security.

Authorized Personnel: University staff authorized to access vehicle information records, they're also responsible for analyzing vehicle data collected by the VRS and generate reports for decision-making purposes.

Project Team: Project team is us, the project manager, developers, system analyst, database administrator, training coordinator, software tester, and the support team. Each have their responsibilities

Description

1. <u>System Requirements</u>

Include visitors' information capturing feature, visitor's vehicle information capturing feature, ID verification feature and a selection list of reasons for the visit. Visitors, or visitor groups will be listed and prioritized to ensure that the automated vehicle registration system meets the needs and expectations of all stakeholders.

<u>Functional Requirements:</u>

High priority requirements:

1. User Registration:
   - Secure and easy registration of user details.
   - Verification mechanisms for user authentication.
2. Visitor Registration:
   - Capture visitor details such as name, contact info, and reason for visit.
   - Prompt for vehicle information including license plate, model, and color.
3. Access Control:
   - Restrict access to registered visitors and personnel.
   - Security personnel can grant or restrict access based on information provided.

Medium Priority Requirements

1. Search and Retrieval:
   - Search for specific vehicles or visitors using various criteria.
2. Reporting and Analytics:
   - Generate reports on visitor activities.
   - Provide analytics tools for visitor trend analysis.

Low Priority Requirements

1. User Training and Support:
   - Training for property administrators and security personnel.
   - Ongoing technical support.
2. Security and Data Privacy:
   - Adhere to industry standards for data protection.
   - Encrypt and securely store user and vehicle information.

2. <u>Database Requirement:</u>

- ❖ Requirements such as data storage, retrieval, security, and scalability will be listed and prioritized to ensure that the system's database effectively manages vehicle information with accuracy and efficiency.
- ❖ Vehicle Information Table with the following attributes: Vehicle's license plate, model, and colour.

❖ Visitors Information Table with the following attributes: Visitors ID, contact numbers, visiting reason, name, and surname.

➢ **Data Storage:** Store user and vehicle information securely.

Data Types:

- User details (names, contact information, authentication details)
- Vehicle details (license plate number, vehicle model, vehicle color)
- Visitor details (names, contact info, reason for visit)
- Access logs (entry and exit times)

Database Functionalities:

➢ Data encryption
➢ Efficient retrieval and querying
➢ Backup and recovery mechanisms

Priority (High, Medium, and Low):

- High: User and vehicle details, access logs
- Medium: Visitor details
- Low: Historical data for long-term storage

3. Managerial Report Requirements

Requests for managerial reports, including analytics, trends, and performance metrics, will be listed and prioritized to provide decision-makers with the necessary information for effective management and decision-making, these reports often include daily security metrics, daily number of visitors, and weekly performance metrics/stats.

High Priority Reports:

- Monthly Visitor Report (High Priority): Summary of visitor activities
- Security Incident Report (High Priority): Report of any security incidents.

Medium Priority Reports:

- Access Logs Report (Medium Priority): Detailed log of access attempts.

Low Priority Reports:

- Trend Analysis Report (Low Priority): Analysis of visitor trends over time.

4. Operational Report Requirements

Vehicle and visitors' information logs and operations (System's nonfunctional characteristics) metrics. Provide reports on compliance for easy tracking of metrics , and giving feedback on functionalities and performances of the system.

- ➢ Daily Access Report (High Priority): Daily summary of access logs.
- ➢ Vehicle Registration Report (Medium Priority): Summary of vehicle registrations.
- ➢ User Activity Report (Low Priority): Detailed log of user activities within the system.

5. Security Requirements

Include information confidentiality through the use of encryptions, integrity and availability upon request, risk (e.g. virus) measures. To ensure the measures are up to date audits should be performed frequently.

High Priority:

- ➢ Data Encryption (High Priority): Encrypt sensitive user and vehicle information.
- ➢ Access Control (High Priority): Implement role-based access control.
- ➢ Backup and Recovery (High Priority): Implement regular backup and recovery procedures.

Medium Priority:

- ➢ Audit Logs (Medium Priority): Maintain logs of all access and changes.
- ➢ Regular Security Audits (Medium Priority): Conduct regular security audits to identify vulnerabilities.

6. Interface requirements

Interface requirements such as user-friendly design, intuitive navigation, accessibility features, and multi-platform support will be listed and prioritized to ensure that the system is easy to use and accessible to all users.

Form Layouts:

- ➢ **User Registration Form:** Capture user details securely.
- ➢ **Visitor Registration Form:** Capture visitor details efficiently.
- ➢ **Access Control Dashboard:** Interface for security personnel to manage access.
- ➢ **Search and Retrieval Form**: Interface to search for specific records.
- ➢ **Reporting Dashboard:** Interface for generating and viewing reports.

7. Look and Feel Requirements

Look and feel requirements related to color schemes, font sizes, navigation menus, help sections, tooltips, and hotkeys will be listed and prioritized to ensure that the system is visually appealing and easy to navigate, promoting ease of learning and use throught the use of clear instructions.

- ➢ **Color Scheme**: Use a consistent color scheme aligned with the university's branding.
- ➢ **Font Sizes:** Use readable font sizes for all text.
- ➢ **Navigation:** Intuitive navigation with clear labels and easy access to all features.
- ➢ **Help Section:** Provide a help section with tooltips and hotkeys for ease of use.

8. Operational Requirements

Operational requirements such as business rules, decision workflows, usability attributes, installation requirements, and user training needs will be listed and prioritized to ensure that the system meets operational needs effectively and efficiently.

Other requirements include:

- ➢ **Compliance**: Ensure the system complies with all relevant regulations and standards.
- ➢ **Scalability**: System should be scalable to handle increasing data and users.
- ➢ **Performance**: Ensure the system performs efficiently under load.
- ➢ **Maintenance**: Plan for regular maintenance and updates to the system.

Steps In Managing New Requirements:

- **Capture and Document** the new requirements in a requirement management tool as they are identified for tracking purposes.
- **Analyze** the new requirements in terms of feasibility, impact on the project schedule, resources and budget.
- **Prioritize** the requirements in terms of importance, dependencies, and risks.
- **Communicate and review** the new requirement change **with relevant stakeholders**, including management, end users, and project team members, to ensure alignment and gather feedback.
- **Communicate** the new requirement change to all relevant stakeholders to ensure awareness and understanding of the update.
- Establish a change management process of reviewing monitoring and evaluating, approving of new requirements.
- Conduct a lesson learned session to reflect on the process of managing the new requirements, identify areas to improve for future projects.

Phase 5

Definition of the TUT Vehicle Registration System

Purpose of the document

The purpose of this document is to clearly outline the requirements and specifications of the TUT Vehicle Reg System. This document outlines the functionality, deliverables and behaviour of this system

Purpose of the system

The purpose of the Vehicle registration system is to enable TUT security officers to record visitor vehicles as they enter the institution's properties and facilitate validation of information given to ensure accuracy. This system aims to improve records keeping (Data accuracy) through the use of a centralized database, and improve efficiency of the operations and optimize resource utilization of the gate registration process. Including:

Registration of drivers

Registration of vehicle

Verification of driver information

Reduce the cost of materials used

Increase the capacity of data recorded before new materials are needed

Background of the company

Tshwane University of Technology is a higher education institution in South Africa established in 2004 through the merger of three Technikons — Technikon Northern Gauteng, Technikon North-West, and Technikon Pretoria. The institution offers a wide range of programs under different faculties such as the Faculty of Science, faculty of Engineering and Built Environment and, Faculty of Information and Communication Technology to name a few.

An important aspect of the institution's operations is security, hence we are proposing The Vehicle Registration System to improve the data recording aspect of access control at the different campuses.

With the use of this system, Tshwane University of Technology will operate more efficiently improve efficiency for both institution and visitors, improve the data (Vehicle and driver information) process, efficiency, and data storage. The system will also help the organisation by improving the efficiency of the process of capturing information, this will help the organization to accurately analyse recorded information to produce needed results and metrics.

Success Criteria according to the client

In this acceptance testing, users will be testing the system using defined criteria of their requirements on the developer's environment. Success will depend on the following criteria:

The criteria the customer (security officer, visitor, and administrator) will use to determine if they are satisfied with the final deliverables:

Security Officer:

1. The system must enable easy verification of registered vehicles.

2. Access to accurate and up-to-date vehicle information.

3. Efficient logging of vehicle entry and exit.

4. User-friendly interface for quick and efficient verification.

5. Minimal training required to use the system.

Visitor:

1. Simple and intuitive vehicle registration process.

2. Immediate feedback on the status of their registration application.

3. Easy submission and validation of necessary documents.

4. Secure handling of personal and vehicle information.

5. Visitors should have their details easily captured, including their names, contact info, and reason for visiting the property.

6. The system will prompt the user for vehicle information, including license plate number, vehicle model, and vehicle colour.

Administrator:

1. Comprehensive administrative controls for managing user roles and permissions.
2. Ability to monitor system performance and user activity.
3. Efficient workflow for reviewing and approving vehicle registration applications.
4. Notification system for pending approvals and other administrative tasks.

Features of the system

- Vehicle registration feature: Will allow users to capture and store vehicle information and owner information.
- Driver information feature: Will allow users to capture and store drivers' information.
- Validation and verification feature -Will validate the provided vehicle and owner information.
- Error handling feature: Will alert users of any discrepancies or incomplete information during registration.
- Report feature: Will generate reports on registered vehicles.
- Touch screen: Will be used by the user to input information.

- User registration feature: Will be used to register new system users, by capturing and storing their details.
- Log-in feature: Will be used to log in by the system's users.
- Forgot password feature: Will be used to reset password.
- User Support and Assistance: The application includes a comprehensive help section with FAQs, troubleshooting guides, and contact information for support.

Security Requirements listed by the client

Data privacy – the system should comply with all relevant privacy protection laws such as POIPA. It should protect patient privacy, secure transmission of information, and protect overall potential threats.

Secure infrastructure – underlying infrastructure supporting smart eyecare should be secure. This includes regular patching and updating of the software, use of firewall and intrusion detection systems, and implantation of secure configuration servers.

User training and awareness – Provide training for all the users(Security Officers) on best practices accurate data capturing and safe usage of the system.

Audit trails and logging – logs system activity including user action, access attempts, and data modification(visitor information and vehicle information). Enables administrators to monitor, and detect suspicious behaviour, this is a main activity in forensic analysis in the event of security incidents.

Performance & Response Time Requirements of the system

Real-Time Response – The vehicle registration System should be able to provide real-time feedback confirmation on whether information has been recorded successfully. This is important in ensuring that information is recorded accurately.

Efficient Data Processing – The system should have the ability to process multiple users efficiently. It should be able to hand data in such a way that that accurate analysis of the different metrics used.

Scalability – The system should be able to handle an increase in the number of users being registered and the user base expands (most likely to expand when other campuses are introduced to the system).

High Accuracy - The system should have checks/validation points at each text box where users will be entering information for improved data accuracy. This can include detecting anomalies in the information entered in ID, Phone Number Vehicle License Plate data slots.

Data Backup for the system

As a system analyst, implementing robust data backup procedures for the vehicle registration System is crucial to ensure data integrity, availability, and disaster recovery precedencies. The following outlines the responsibilities, methods, and consideration for data backups:

1) Individuals responsibilities:

- **System administrator**
  - Responsibility: The primary responsibility for executing data backup processes lies with the system administrator or the IT department

  Actions
  - Execute and oversee the backup procedures.
  - Monitor backup logs for any errors or anomalies.
  - Coordinate with relevant stakeholders for data restoration, if required.

- **Data Protection Officer (DPO):**
  - Responsibility: If a designated DPO exists, they should oversee and ensure compliance with data protection regulations during the backup process.

  Actions:
  - Verify that backup procedures align with data protection laws.
  - Oversee data retention policies and compliance.

2) Backup Schedule:

Regular and Automated:
- Frequency: Conduct regular and automated data backups based on the criticality and frequency of data changes.
- Schedule: Daily incremental backups and weekly full backups are recommended.
- Automation: Implement automated backup processes to ensure consistency and reduce the risk of human error.

3) *Data Retention Period:*
- Determining Period: Define the appropriate data retention period based on legal, business, and compliance requirements.

- Factors: Consider data sensitivity, regulatory obligations, and industry standards.

- Consultation: Collaborate with legal and compliance teams to align with data retention and disposal policies

4) Backup Storage:

- Off-site and Redundant:

  - Off-site Storage: Maintain backups in off-site locations to protect against physical damage or disasters at the primary site.

  - Redundant Storage: Implement redundant storage solutions (e.g., RAID) to enhance data availability and minimize the risk of data loss due to hardware failures.

5) Encryption and Access Controls:

- **Encrypt Backup Data:**
  - Mechanism: Implement encryption mechanisms (e.g., AES) to protect backup data from unauthorized access during storage and transmission.
- **Access Controls:**

- o Limit Access: Restrict access to backup systems and storage devices to authorized personnel only.
- o Authentication: Apply strong access controls, including authentication and role-based access, to prevent unauthorized access.

6) Regular Testing and Verification:

- **Perform Regular Tests:**
  - o Testing: Regularly test the restore functionality to ensure the integrity and recoverability of backup data.
  - o *S*imulated Scenarios: Conduct simulated disaster recovery scenarios to validate the effectiveness of backup and restoration processes.
  - o Backup Integrity: Regularly verify the integrity of backup files to detect and address any potential data corruption or backup failures.

7) Documentation and Auditing:

- **Detailed Documentation:**

  - o Documentation: Maintain detailed documentation of backup procedures, including the backup schedule, storage locations, encryption mechanisms, and access controls.

  - o Audits: Conduct regular audits to ensure compliance with backup policies, assess the effectiveness of the backup process, and identify areas for improvement.

8) Notification Protocols:

- **Alerts and Notifications:**

  - o Alerts: Establish notification protocols for system administrators to receive alerts in case of backup failures or anomalies.

  - o Timely Responses: Ensure timely responses to address any issues identified during the backup process.

Reports required from the Vehicle Registration System

The Vehicle Registration System is designed to provide insight into the individuals who visit campus and their reasons for visiting campus.

Access Log Report: This report will provide a detailed record of vehicles that have entered and exited the university premises daily.

Security Incident Reports: The report will provide a summary of the security incidents that may have occurred related to access control, such as breaches and suspicious activities.

Performance Report: The report will provide weekly or monthly reports of how the system has worked, so they can know when improvements are needed.

Software and Hardware Requirements for the Vehicle Registration System

<u>Software Requirements</u>

1. Operating System:
    - ❖ Windows Server 2016 or later for server components
    - ❖ Windows 10 or later for the different access points on campus
2. Web Sever:
    - ❖ Apache 2.4 or later as the primary database for sharing applications
3. Programming Language:
    - ❖ PHP 7.4 or later for serving-side scripting
4. Web Brower Compatibility:
    - ❖ Google Chrome, Mozilla Firefox, Microsoft Edge, or Safari for accessing the web-based interface.
5. Framework:
    - ❖ Laravel 8.0 or later for efficient development and maintainability.
6. Security Software:
    - ❖ Antivirus and firewall software on both server and client devices
7. SSL Certificate:
    - ❖ Secure Socket Layer (SSL) certificate for encrypted data transmission.
8. Email services:
    - ❖ SMTP server configuration for email notifications and alerts

<u>Hardware Requirements:</u>

1. Server:
- ❖ Dual-core processor (2.0 GHz or higher).
- ❖ 8 GB RAM or higher.
- ❖ 100 GB of available hard disk space.
- ❖ Gigabit Ethernet adapter.

2. Database Server:
- ❖ Separate server recommended.
- ❖ Quad-core processor (2.5 GHz or higher).
- ❖ 16 GB RAM or higher.
- ❖ Dedicated RAID storage for database.

3. Client Devices:
- ❖ Dual-core processor (1.5 GHz or higher).
- ❖ 4 GB RAM or higher.
- ❖ 20 GB of available hard disk space.
- ❖ Ethernet or Wi-Fi connectivity.

4. Network Infrastructure:
- ❖ High-speed internet connection.
- ❖ Local Area Network (LAN) for internal communication.

❖ Virtual Private Network (VPN) for remote access.

5. Backup System:
❖ Scheduled backup system for data protection.
❖ Redundant storage for critical data.

6. Load Balancer (for Scalability):
❖ If needed for handling increased user loads.

7. Physical Security (for Servers):
❖ Adequate measures to protect servers, including access controls and environmental considerations.

Installation and Deployment:

1. Installation Procedures:
• Follow step-by-step installation procedures provided in the system documentation.
• Configuration of server roles and permissions.

2. Testing and Quality Assurance:
• Conduct thorough testing of all system functionalities.
• Ensure compatibility with different web browsers.
• Validate security measures and data encryption.

3. User Training:
• Provide training sessions for end-users on system functionalities.
• Offer documentation for reference.

4. Maintenance and Updates:
• Regularly update server software, including the operating system and database management system.
• Implement patch management for security updates.

5. Data Migration (if applicable):
• Plan and execute data migration from any existing systems.
• Ensure data integrity and accuracy during the migration process.

Installation and Testing of the Vehicle Registration System

Installation Procedures:

1. Planning:
• Conduct a thorough planning phase to identify system requirements, hardware specifications, and deployment strategies.
• Engage with relevant stakeholders, including IT personnel, system administrators, and end-users.

2. Server Infrastructure Setup:
- Configure the server infrastructure, ensuring it meets the specified requirements.
- Install the necessary server components, including the operating system, web server (Apache or Nginx), and PHP.
3. Database Configuration:
- Set up and configure the MySQL database, ensuring proper user permissions and database schema creation.
- Populate initial data if required for system initialization.
4. Web Application Deployment:
- Deploy The Vehicle Registration System web application using the chosen web server and PHP framework (Laravel).
- Configure the web application settings, including database connections and security parameters.
5. Security Measures:
- Implement security measures, such as SSL certificate installation for encrypted communication.
- Configure firewall settings to allow necessary traffic and block unauthorized access.
6. Email Configuration:
- Set up SMTP server configuration for email notifications and alerts.
- Verify email functionality within the application.
7. Client Devices Setup:
- Install The Vehicle Registration System client application on end-users' devices.
- Ensure compatibility with different operating systems (Windows 10, macOS).
8. Testing in Staging Environment:
- Conduct initial testing in a staging environment to identify and resolve any issues before full deployment.
- Confirm proper communication between the server and client applications.
9. User Training:
- Provide training sessions for end-users on how to use The Vehicle Registration System.
- Distribute user manuals and documentation for reference.
10. Backup System Implementation:
- Set up a scheduled backup system for data protection.
- Verify the backup and restoration processes.

Testing procedures:

1. Functional Testing:
- User Authentication: Verify that user authentication and authorization mechanisms are working correctly.
- Shift Scheduling: Test the system's ability to create, modify, and delete work shifts.
- Time Tracking: Confirm accurate time tracking for employees' clock-in and clock-out activities.
- Leave Management: Ensure proper handling of leave requests and approvals.
- Reporting: Validate the generation and accuracy of reports related to workforce activities.
2. Usability Testing:

- User Interface Evaluation: Assess the user interface for intuitiveness and ease of navigation.
- User Feedback: Collect feedback from end-users regarding the overall user experience.

3. Performance Testing:

- Load Testing: Simulate a high number of concurrent users to assess system performance.
- Response Time: Measure response times for key functionalities to ensure optimal performance.
- Scalability: Evaluate the system's ability to handle increased workloads.

4. Security Testing:

- Data Encryption: Confirm that data transmission is encrypted using SSL.
- Access Controls: Validate that user roles and permissions are correctly enforced.
- Vulnerability Assessment: Perform security scans to identify and address potential vulnerabilities.

5. User Acceptance Testing (UAT):

- End-User Involvement: Engage end-users in real-world scenarios to ensure the system meets their needs.
- Feedback Collection: Gather feedback on any issues or improvements identified during UAT.

6. Bug Fixing:

- ❖ Issue Documentation: Document any identified issues, bugs, or areas for improvement.
- ❖ Prioritization: Prioritize bug fixing based on severity and impact on system functionality.
- Iterative Testing: Conduct iterative testing after bug fixes to ensure no new issues are introduced.

7. Performance Optimization:

- Code Review: Conduct a code review to identify and address any performance bottlenecks.
- Database Optimization: Optimize database queries and indexing for improved performance.
- Caching Implementation: Implement caching mechanisms to enhance system responsiveness.

8. Final Deployment:

- Approval: Obtain approval from stakeholders, including end-users and project managers.
- Full Deployment: Deploy The Vehicle Registration System in the production environment.

9. Post-Deployment Monitoring:

- Monitoring Tools: Implement monitoring tools to track system performance and identify potential issues.
- User Support: Provide ongoing user support and address any post-deployment concerns.

Select the most appropriate methodology and use the required tools

Methodology to be used:

- SDLC – Agile Methodology

1. Requirements Gathering:
- Objective: Clearly define and document the project requirements.
    - Activities:
    - Engage stakeholders to understand their needs and expectations.
    - Document functional and non-functional requirements.
    - Define user stories and acceptance criteria.
2. System Design:
- Objective: Create a detailed design based on the defined requirements.
    - Activities:
    - Design the overall system architecture.
    - Create detailed technical specifications.
    - Develop user interface (UI) and user experience (UX) design.
3. Implementation (Coding):
- Objective: Transform the design into a working system.
    - Activities:
    - Write and test code based on the design specifications.
    - Implement both frontend (mobile application) and backend components.
    - Use the chosen programming languages and technologies.
4. Testing:
- Objective: Ensure that the system functions as intended and meets quality standards.
- Activities:
    - Conduct unit testing for individual components.
    - Perform integration testing to ensure different parts work together.
    - Execute system testing to validate the entire system.
    - Conduct user acceptance testing (UAT) with stakeholders.
5. Deployment:
- Objective: Release the system to users or the production environment.
  Activities:
    - Plan and execute the deployment process.
    - Provide necessary training to end-users.
    - Monitor system performance during the initial deployment.
6. Maintenance and Support:
- Objective: Ensure ongoing support, updates, and improvements.
  Activities:
    - Address and fix reported issues.
    - Provide regular software updates and patches.

Enhance features based on user feedback and evolving needs.

Context Diagram
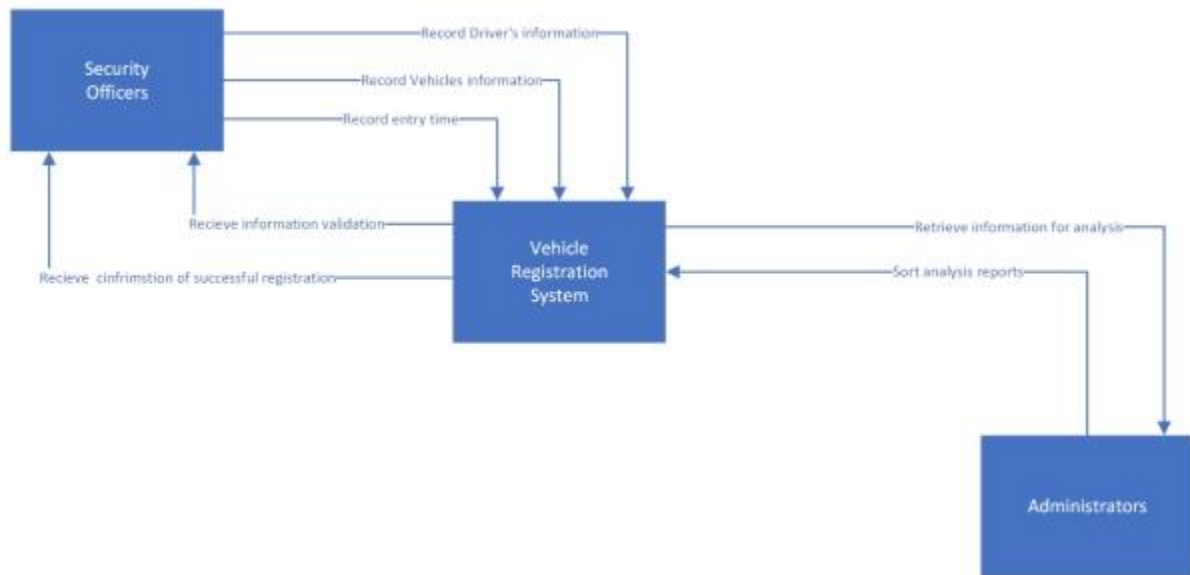
DFD– make sure the data flows and numbers your processes
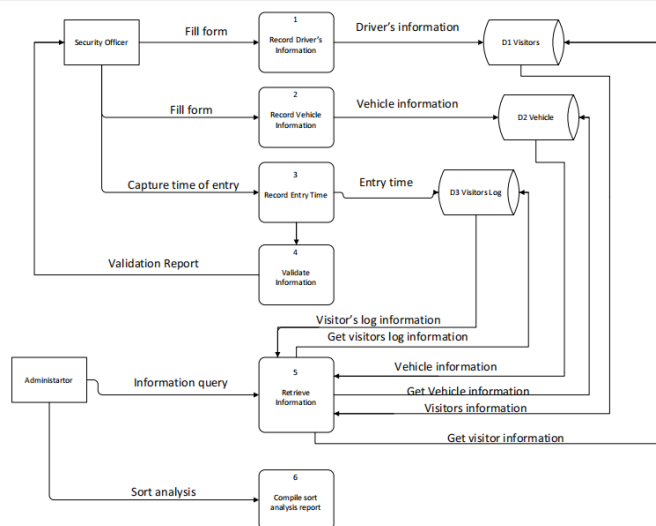
Data Dictionary

Visitor Table

Data Element	Description	Keys	Type	Example
VisitorID	Unique identifier for each visitor	PK	INT	1
FirstName	First name of the visitor		VARCHAR(20)	John
LastName	Last name of the visitor		VARCHAR(20)	MICHAEL
IDNumber	ID number of the visitor		VARCHAR(20)	0111096399452
PhoneNumber	Phone number of the visitor		VARCHAR(15)	+27 123 4567
Email	Email address of the visitor		VARCHAR(20)	Johnmichael@gmail.com
CreatedAt	Timestamp when the visitor was registered		DATETIME	2024-01-01 08:00:00
UpdatedAt	Timestamp when the visitor details were last updated		DATETIME	2024-05-01 12:00:00

User Table (Security Officer/Administrator)

Data Element	Description	Keys	Type	Example
UserID	Unique identifier for each user	PK	VARCHAR(13)	1
Username	Username of the user		VARCHAR(15)	Johnmichael
PasswordHash	Hashed password of the user		VARCHAR(15)	#62t1$56..
Role	Role of the user		ENUM ('Admin','SecurityOfficer', 'DPO')	SecurityOfficer
CreatedAt	Timestamp when the user was created		DATETIME	2024-01-01 08:00:00

Data Element	Description	Keys	Type	Example
UpdatedAt	Timestamp when the user details were last updated		DATETIME	2024-05-01 08:00:00

Vehicle Table

Data Element	Description	Keys	Type	Example
VehicleID	Unique identifier for each vehicle	PK	INT	1
LicensePlate	License plate number of the vehicle		VARCHAR(20)	ABC123GP
Make	Make of the vehicle		VARCHAR(30)	Toyota
Model	Model of the vehicle		VARCHAR(30)	Corolla
Color	Colour of the vehicle		VARCHAR(20)	Black
OwnerID	Reference to the owner(visitor)		INT	1
CreatedAt	Timestamp when the vehicle was registered		DATETIME	2024-01-01 08:00:00
UpdatedAt	Timestamp when the vehicle details were last updated		DATETIME	2024-01-01 08:00:00

Visitors Log Table

Data Element	Description	Keys	Type	Example
VisitID	Unique identifier for each visit	PK	INT	1
VisitorID	Reference to the visitor	FK	INT	1
VehicleID	Reference to the vehicle	FK	INT	1
EntryTime	Timestamp when the vehicle entered the premises		DATETIME	2024-01-01 08:00:00

ExitTime	Timestamp when the vehicle exited the premises		DATETIME	2024-01-01 08:00:00
Purpose	Purpose of the visit		VARCHAR(50)	Meeting
SecurityOfficerID	Reference to the security officer who logged the visit		INT	1
CreatedAt	Timestamp when the visit was logged		DATETIME	2024-01-01 08:00:00

Normalization

First Normal Form (1NF): Ensure that each table has a primary key, and there are no repeating groups or duplicate rows.

User Table(1NF)

UserID	Username	PasswordHash	Role	CreatedAt	UpdatedAt
User01	johnmichael	#7r3r8736..	SecurityOfficer	2024-01-01 08:00:00	2024-05-01 12:00:00

Visitor Table(1NF)

VisitorID	FirstName	LastName	IDNumber	PhoneNumber	Email	CreatedAt	UpdatedAt
Visitor01	John	Michael	01234567891234	+27 012 4567	Johnmichael@gmail.com	2024-01-01 08:00:00	2024-05-01 12:00:00

Vehicle Table(1NF)

VehicleID	LicensePlate	Make	Model	Colour	OwnerID	CreatedAt	UpdatedAt
Vehicle01	ABC123GP	Toyota	Corolla	Black	Visitor01	2024-01-01 08:00:00	2024-05-01 12:00:00

VisitLog Table(1NF)

VisitID	VisitorID	VehicleID	EntryTime	ExitTime	Purpose	SecurityOfficerID	CreatedAt
Visit01	Visitor01	Vehicle01	2024-05-01 08:30:00	2024-05-01 10:30:00	Meeting	User01	2024-05-01 12:00:00

Second Normal Form (2NF): Ensure that each non-key attribute is fully dependent on the primary key. Split tables with composite primary keys if necessary.

User Table(2NF)

UserID	Username	PasswordHash	Role	CreatedAt	UpdatedAt
User01	johnmichael	#7r3r8736..	SecurityOfficer	2024-01-01 08:00:00	2024-05-01 12:00:00

Visitor Table(2NF)

VisitorID	FirstName	LastName	IDNumber	PhoneNumber	Email	CreatedAt	UpdatedAt
Visitor01	John	Michael	01234567891234	+27 012 4567	Johnmichael@gmail.com	2024-01-01 08:00:00	2024-05-01 12:00:00

Vehicle Table(2NF)

VehicleID	LicensePlate	Make	Model	Colour	OwnerID	CreatedAt	UpdatedAt
Vehicle01	ABC123GP	Toyota	Corolla	Black	Visitor01	2024-01-01 08:00:00	2024-05-01 12:00:00

VisitLog Table(2NF)

VisitID	VisitorID	VehicleID	EntryTime	ExitTime	Purpose	SecurityOfficerID	CreatedAt
Visit01	Visitor01	Vehicle01	2024-05-01 08:30:00	2024-05-01 10:30:00	Meeting	User01	2024-05-01 12:00:00

Third Normal Form (3NF): Ensure that there are no transitive dependencies by removing attributes dependent on non-key attributes.

User Table(3NF)

UserID	Username	PasswordHash	Role	CreatedAt	UpdatedAt
User01	johnmichael	#7r3r8736..	SecurityOfficer	2024-01-01 08:00:00	2024-05-01 12:00:00

Visitor Table(3NF)

VisitorID	FirstName	LastName	IDNumber	PhoneNumber	Email	CreatedAt	UpdatedAt
Visitor01	John	Michael	01234567891234	+27 012 4567	Johnmichael@gmail.com	2024-01-01 08:00:00	2024-05-01 12:00:00

Vehicle Table(3NF)

LicensePlate	Make	Model	Colour	OwnerID	CreatedAt	UpdatedAt
ABC123GP	Toyota	Corolla	Black	Visitor01	2024-01-01 08:00:00	2024-05-01 12:00:00

VisitLog Table(3NF)

VisitorID	VehicleID	EntryTime	ExitTime	Purpose	SecurityOfficerID	CreatedAt
Visitor01	Vehicle01	2024-05-01 08:30:00	2024-05-01 10:30:00	Meeting	User01	2024-05-01 12:00:00

Entity relation Diagram (ERD) – remember to show the association/relationship
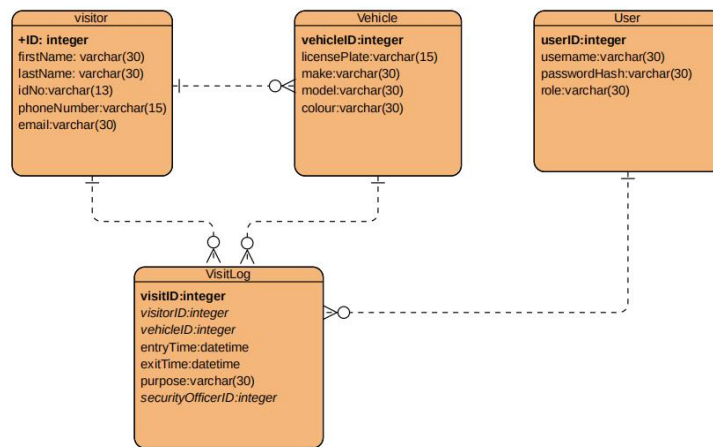
CRUD(Process and location)

Functionality	User Table	Visitor Table	Vehicle Table	Visitors log Table
User Registration	Create			
Modify User Info	Update			
Add Visitor		Create		
Modify Visitor Info		Update		
Register Vehicle			Create	
Modify Vehicle			Update	
Reporting/Print Report	Read	Read	Read	Read

Functional Decomposition Diagram

```
                          ┌─────────────────────────┐
                          │ TUT Vehicle Registration │
                          │         System          │
                          └─────────────────────────┘
                    ┌───────────────┴───────────────┐
          ┌──────────────────┐              ┌──────────────────┐
          │  Security Officer │              │  Administration  │
          └──────────────────┘              └──────────────────┘
              │                                  │
              │   ┌──────────────────┐           │   ┌──────────────────┐
              ├──▶│ Record Driver's  │           ├──▶│ Conduct Information│
              │   │   Information    │           │   │     Analysis      │
              │   └──────────────────┘           │   └──────────────────┘
              │   ┌──────────────────┐           │   ┌──────────────────┐
              ├──▶│ Record Vehicle   │           └──▶│  Compile Reports  │
              │   │   Information    │               └──────────────────┘
              │   └──────────────────┘
              │   ┌──────────────────┐
              ├──▶│ Record visiting  │
              │   │ information(time,│
              │   │     purpose)     │
              │   └──────────────────┘
              │   ┌──────────────────┐
              └──▶│ Save all captured│
                  │information to database│
                  └──────────────────┘
```

Process Specification – this is a diagram

Vehicle registration system

Administrator	Visitor	Security Officers	System

When visitor enter campus

- Start
- Visitor drives onto campus
- Give officer visitor and vehicle information
- Capture information in the system
- Capture Entry time
- Verify information
- Verify against parameters
- No, recapture infomration
- yes
- Store information

When visitors leave campus

- Visitor leaves campus
- Officer records Exit time

Administrator performing regular data analysis

- Retrieve Visitors data
- Send Visitors list
- Create analysis reports
- Store analysis reports

Finding specific vehicle during an incident

- Gets report of incident and vehicle involved
- Send vehicle description
- Receive vehicle information
- Search Database for description
- Send search results
- Identify involved vehicle
- Send vehicle information to officer
- Receive vehicle infomration

Phase 6

Introduction

The focus of this document is on the testing aspect of the Vehicle registration system. This phase involves defining the test approach, specifying deliverables, executing tests, managing defects, establishing completion criteria, and addressing risks and contingencies. The test plan for the TUT Vehicle Registration System includes:

- Purpose: Clearly state the objectives and purpose of the test plan.

- Scope: Define what will be tested and what will not be tested, including boundaries and limitations.

- References: List any related documents, such as project plans, system requirements, and design specifications.

- Test Objectives: Detail the specific goals and objectives of the testing activities, such as ensuring all functional requirements are met, identifying bugs, and verifying performance criteria.

- Test Items

Identify the items to be tested, including the software modules, features, and interfaces.

- Features to be Tested

List and describe the features and functionalities that will be tested.

- Features Not to be Tested

Identify any features or functionalities that will not be included in the testing process and provide reasons for their exclusion.

- Test Approach

Testing Levels: Describe the different levels of testing (unit testing, integration testing, system testing, acceptance testing).

Testing Types: Outline the types of testing to be performed (functional, performance, security, usability, etc.).

Test Methods: Specify the methodologies and techniques that will be used (manual testing, automated testing, exploratory testing, etc.).

Relationship to other documents

For a vehicle registration system, the relationship between the test plan and other documents remains similar. But the test plans differ according to each document, here's an explanation of the relationship between the test plan and the relevant documents for a vehicle registration system:

- Scope statement: The scope statement defines the boundaries, objectives and what will and not be included in the vehicle registration system. The relationship between the scope statement and the test plan is that the test plan is derived from the scope statement, to verify that the system is meeting it's intended goals. Meaning the test activities cover all the relevant aspects and functionalities of the vehicle registration system within the defined scope.
- Project Plan: The project plan provides a roadmap for the vehicle registration system project, including timelines, resources and budget allocations and task dependencies. The test plan relies on the project plan for scheduling and allocating of resources for testing activities. It needs to align with the project timeline to ensure that testing activities are integrated into the overall project schedule.
- Alternative Solution Analysis: The alternative solution analysis evaluates different options or approaches for implementing the vehicle registration system. The test plan considers the finding from the alternative solution analysis to determine test cases that validate the chosen solution. It ensures that the test cases cover the functionalities and the features uniquely to the selected vehicle registration system's solution.
- User requirements: The user requirement document outlines the specific needs, preferences, and expectations of the users of the vehicle registration system. The test plan uses user requirements to create test cases, that will validate whether the system meets the user's expectations.
- System specification: The systems specification document provides a detailed description of the requirements, architecture, components, and behavior of the vehicle registration system. The test plan ensures that the vehicle registration system meets the specifications outlined in the system specification document, by defining test cases and procedures aligned with those specifications. In essence the test plan ensures that the vehicle registration system performs as intended according to the guidelines set forth in the system specification document.

System Overview

The TUT Vehicle Registration System is designed to facilitate the recording and verification of visitor vehicles by TUT security officers.

1. Purpose of the System:

The TUT Vehicle Registration System is designed to streamline and automate the process of registering vehicles and visitors at the TUT campus. The system aims to enhance security, improve efficiency, and provide real-time data access for security officers and administrators. By digitizing the registration process, the system ensures accurate record-keeping, reduces manual errors, and facilitates better monitoring and management of campus access.

2. Key features:

- Visitor Registration: Captures and stores details of visitors, including their personal information, vehicle information, and purpose of visit.
- Vehicle Registration: Records details of vehicles entering the campus, including vehicle type, registration number, and owner details.

- User Authentication: Provides secure login and authentication mechanisms for different user roles such as security officers, administrators, and visitors.
- Data Validation and Error handling: Ensures that all input data is validated to maintain accuracy and integrity. Provides error messages and prompts to guide users in correcting input errors.
- Real-Time Data Access: Allows authorized users to access and retrieve registration data in real-time for monitoring and reporting purposes.
- Reporting and Analytics: Generates reports and analytics based on the collected data to assist in decision-making and enhance campus security.

3. Workflow of the System:

- User Authentication:
  Security officers and administrators log into the system using their credentials.
- Visitor Registration:
  Visitors provide their details at the entry point.
  Security officers enter the details into the system via the web interface.
  The system validates the information and generates a visitor pass with a QR code.
- Vehicle Registration:
  Visitors or staff members register their vehicles upon entry.
  Vehicle details are entered into the system, and the vehicle is associated with the visitor or staff member.
- Monitoring and Reporting:
  Security officers monitor real-time data to ensure campus security.
  Administrators generate reports and analyze data for decision-making.
- Logout:
  Users log out of the system after completing their tasks to maintain security.

4. Benefits:

- Enhanced Security: Real-time monitoring of vehicles and visitors. Reduced risk of unauthorized access.

- Efficiency in Registration Processes: Automation reduces manual effort and waiting times. Quick access to up-to-date information.

- Improved Data Accuracy and Integrity: Validation mechanisms ensure accurate data entry. Centralized storage for consistent records.

- Time and Cost Savings: Lower operational costs and reduced administrative burden.

- Enhanced User Experience: Streamlined registration process for users. Automated alerts and notifications.

- Environmental Benefits: Paperless process contributes to sustainability.

Features to be tested/not to be tested

Features to be tested and reasons:

- User registration and authentication feature: Verify the ability of the users to register and log in securely using their university credentials.
- Visitors' registration form: Test the functionality of inputting visitor personal and vehicle information. Verify the ability to upload documents such as driver's licenses or IDs. This is a core feature essential for the system's primary purpose.
- User Support and Assistance: Test the help section including FAQs, troubleshooting guides, and contact information. Ensure users can easily access support resources.
- Security: Validate data encryption and secure access protocols.
- User Interface (Touch screen) – Verify that it is intuitive and user-friendly, all buttons, menus, and input fields to ensure they function correctly, and check for consistency in design elements and layout across different screens.
- Input validation – Test the system's ability to validate user inputs such as vehicle and owner information.
- Error Handling – Test that appropriate error messages are displayed for invalid inputs considering factors like datatype and format and ensure that the system prevents users from submitting incomplete or incorrect information.
- Registration Process (User, Vehicle, and owner registration) – It should be tested thoroughly to ensure accurate input and proper handling of registration submissions.
- Reporting - Verify ID the system cab provides an accurate record of registered vehicles.
- On-Screen Keyboard – Verify the keyboard for usability and accuracy, ensuring it appears when needed and disappears when not in use.

Features not to be tested and reasons:

- Network infrastructure- While the connectivity of the system is important for proper functioning and testing, the university's entire network infrastructure is beyond the scope of testing the vehicle registration system.
- University admission and academic system- The vehicle registration system is separate from the university's admission or academic system and should not be tested for integration or compatibility with these systems, as they serve different purposes.
- Physical durability- The durability of the kiosk hardware, such as the touchscreen display, should be assessed by the manufacturer.

Describe the generic pass/fail criteria used in this plan

Pass Criteria:

- The actual outcome of the test case matches the expected outcome as specified in the test case documentation.
- The system behaves according to the requirements and specifications.
- No critical errors, defects, or malfunctions are observed during testing.

- All critical and high-priority test cases are executed successfully.
- User acceptance criteria are met, and stakeholders approve the system.

Fail criteria:

- The actual outcome of the test case does not match the expected outcome.
- The system exhibits deviations from the requirements and specifications.
- Critical errors, defects, or malfunctions are identified during testing.
- Critical or high-priority test cases fail or produce unexpected results.
- User acceptance criteria are not met, and stakeholders do not approve the system.

General Testing Approach to Testing Processes

The testing approach for the Vehicle Registration System is comprehensive and follows a structured methodology that includes the following key elements:

Test Approach:

1. **Testing Levels:**
   - Unit testing: Individual components are tested in isolation to ensure they function correctly.
   - Integration Testing: Integration between integrated components is validated.
   - System Testing: End-to-end testing of the entire system to ensure it meets specified requirements.
   - User Acceptance Testing (UAT): Involves real users to validate the system against business requirements.
2. **Testing Types:**
   - Functional Testing: Validates that the system functions according to the specifications.
   - Performance Testing: Assesses the system's performance under various conditions.
   - Security Testing: Ensures that the system is secured, and data is protected.
   - Usability Testing: evaluates the system's user interface and overall user experience.
3. **Automation:**
   - Automated testing will be employed for repetitive and regression testing.
   - Test scripts will be created to expedite the testing process.
4. **Testing Environment:**
   - A dedicated testing environment will mirror the product environment.
   - Various devices and platforms, mainly Windows, but also including Android and iOS, will be considered for compatibility testing.
5. **Test deliverables**
   - Test Plan: Outline the structure and contents of the test plan document itself.
   - Test Cases: Detail the test cases to be executed, including test scenarios, inputs, expected results, and test data.
   - Test Scripts: Furnish detailed test scripts or procedures for executing the test cases.
   - Test Data: Define the test data requirements, including sample vehicle data, owner information, and expected results.
   - Test Reports: Identify the specific reports to be produced, such as test execution reports, defect reports, and test summary reports.
6. **Test Execution**
   - Test Schedule: Present a timeline or schedule for the test execution process.

- Test Responsibilities: Assign roles and responsibilities to the testing team members, including testers, test coordinators, and subject matter experts.
- Test Execution Strategy: Describe the strategy for executing the test cases, including the sequencing, prioritization, and dependencies of test activities.
- Test Environment Setup: Specify the steps required to set up the test environment, including the installation and configuration of the TUT Vehicle Registration system and any necessary test data or resources.
- Test Execution Procedures: Outline the procedures for executing the test cases, capturing test results, and reporting defects. Include any preconditions or setup steps required for each test case.

7. **Defect Management**
   - Defect Reporting: Define the process for reporting and documenting defects or issues encountered during testing, including the required information, severity levels, and the defect tracking system to be used.
   - Defect Resolution: Outline the steps for defect triaging, prioritization, and resolution. Specify the roles and responsibilities of the development team and testers in the defect resolution process.
   - Retesting and Regression Testing: Describe the approach for retesting the fixed defects and conducting regression testing to ensure that changes or fixes did not introduce new issues.

8. **Test Completion Criteria**
   - Exit Criteria: Define the conditions that must be met to determine when testing can be considered complete for each testing level, such as achieving a certain level of test coverage, stability, and meeting predefined acceptance criteria.
   - Suspension and Resumption Criteria: Identify the circumstances under which testing may be suspended or resumed, such as critical defects or environmental issues.

9. **Risks and Contingencies**
   - Risk Assessment: Identify potential risks and issues that may impact testing, such as resource constraints, schedule delays, or system integration challenges. Evaluate their impact and likelihood.

Suspension and resumption

1. System Stability and Reliability: Testing may be suspended if frequent crashes or unresponsiveness and inconsistent performance (e.g., slow response times, random errors) arise.
2. **U**ser Authentication and Access Control: If the system experiences the inability to securely manage user credentials and the failure to correctly authenticate users, testing should be suspended. As it can lead to the system experiencing a critical failure that renders it inoperable.
3. Hardware Functionality: If while testing there is failures in key hardware components (e.g., touchscreen), testing should be suspended in order for the hardware to get fixed. As without it the core functionality cannot be done.
4. Data Integrity and Security: If testing reveals the Loss or corruption of registration data and vulnerabilities in data encryption or storage that expose sensitive information,

testing should be suspended. This will allow the necessary steps to be taken to solve the problem.

5. Safety Concerns: If testing uncovers safety concerns or hazards that could potentially harm individuals or physical assets, testing should be suspended to address and resolve these issues. Safety should always be a priority, and any potential risks should be mitigated before testing can resume.

Test Activities to be Repeated When Testing is Resumed

- Regression Testing: Re-testing should be performed to all previously tested functionalities to ensure that recent changes or fixes have not introduced new issues and verify that critical issues have been resolved and no longer impact system performance.
- Data Integrity: Re-testing data entry, storage, and retrieval processes to ensure data integrity.
- Security Testing: Security testing should be conducted to verify encryption and protection of sensitive information.
- Hardware Functionality Testing: Testing should be performed on all hardware components to ensure they are functioning correctly.
- User Authentication Testing: Testing should be conducted to observe whether the system can correctly authorize users.
- Retesting of Failed Test Cases: Test cases that were impacted by the critical system functionality issues should be retested to verify if the issues have been resolved.

List of test cases

Testcase ID	Test Case Description	Expected Outcome	Test Status
TC001	Verify users' ability to register using valid information	Created user profile And redirected back to the log-in page	Pass
TC002	Verify users' ability to register using invalid information	Error massage being displayed on the screen And redirected back to the sign up page	Pass
TC003	Verify users' ability to log-in using valid credentials	Getting access to the vehicle registration page	Pass
TC004	Verify users' ability to log-in using invalid credentials	Error message being displayed on the screen and being redirected back to the log-in page	Pass
TC005	Verify users' ability to register a vehicle using valid information	Granted access to the owner's registration page	Pass
TC006	Verify users' ability to register a vehicle using invalid information	Not granted access to the owner's registration page and an error massage being displayed on the screen	Pass
TC007	Verify users' ability to register the owner using valid information	"Successfully saved Visitor" message being displayed on the screen	Pass

TC008	Verify users' ability to register the owner using invalid information	Error message being displayed on the screen	Pass
TC009	Verify the system's ability to display notification	Getting error messages whenever invalid information is entered	Pass
TC0010	Verify users' ability to get a record/report	Provided a list of all registered visitors that entered the campus	Pass
TC0011	Verify the interfaces buttons for usability	Access to a new page	Pass
TC0012	Verify the user's ability to update visitors' information	Getting access to visitors record, ability to input and save changes made	Pass
TC0013	Verify users' ability to log -out	"Logged out" message being displayed on the screen	Pass
TC0014	Verify users' ability to reset password	Reset email being sent to the user and being able to log-in using the new password	Pass
TC0015	Verify users' ability to update their own information	Changes added on the profile	Pass

Testing Schedule

1. Test Planning Phase:
   - Duration: 2 week
   - Activities: Define testing objectives, scope, deliverables, and establish the test environment.
2. Test Design and Preparation Phase:
   - Duration: 3 weeks
   - Activities: Review requirements, design test cases, prepare test data, and create test scripts.
3. Test Execution Phase:
   - Duration: 4 weeks (may vary depending on the system complexity)
   - Activities: Execute unit testing, integration testing, system testing, performance testing, security testing, and user acceptance testing.
4. Test Reporting and Defect Resolution Phase:
   - Duration: Ongoing throughout the testing phase
   - Activities: Report defects, collaborate with the development team for resolution and perform retesting activities.

Responsibilities:

1. **Test Manager**:
- Responsible for overseeing the entire testing process.

2. **Testing Team:**
- Develop the test plan, test cases, and test scripts.
- Execute test cases and document the test results.
- Report and track defects using a defect tracking system.
- Collaborate with the development team to resolve defects.
- Perform regression testing and retesting activities.
- Prepare testing-related documentation and reports.

3. **Development Team:**
- Support the testing team in setting up the test environment.
- Address defects reported by the testing team in a timely manner.
- Collaborate with the testing team to understand and reproduce defects.
- Provide necessary code fixes and updates for defect resolution.

Risks and Contingencies

- Risk: Delays in environment setup.
- ❖ Mitigation: Prepare backup environments in advance.
- Risk: Unavailability of key personnel.
- ❖ Mitigation: Cross-train team members to ensure continuity.

This comprehensive test plan ensures that the TUT Vehicle Registration system is thoroughly tested for functionality, reliability, performance, and compliance, ultimately delivering a robust and user-friendly vehicle registration and management solution.

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Year: 2021

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