A COLLEGE OF NATIONAL DEFENCE UNIVERSITY – KENYA

IT WORKSHOP COMPUTER MAINTAINACE SYSTEM

PROJECT REPORT

DONE BY DEFTEC

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THIS PROJECT REPORT DOCUMENTATION IS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE COMPLETION OF AN INDUSTRIAL ATTACHMENT AT DEFTEC

DECLARATION

We, the undersigned members of the project team for "IT Workshop Computer Maintenance System," hereby declare that this project report is the result of our collaborative work. The project was conducted as part of our industrial attachment at DEFTEC, under the guidance and supervision of Senior Sergeant OUCHO, from May to August (2023).

We affirm that the content presented in this report, including information, data, and references from external sources, has been properly cited and acknowledged. No part of this report has been copied or reproduced from any other work without due citation.

We take full responsibility for the authenticity and accuracy of the content presented in this report, and we acknowledge that it represents the culmination of our knowledge, skills, and efforts gained during the attachment period.

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We are deeply appreciative of the guidance and mentorship provided by Senior Sergeant Oucho, whose expertise and insights contributed significantly to the project's development. We would also like to extend our gratitude to the computer experts and programmers at DEFTEC, whose willingness to share their knowledge and offer assistance played a vital role in our journey.

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ABSTRACT

The "IT-Workshop Computer Maintenance System" is a comprehensive solution designed to streamline and enhance the computer maintenance processes at Defence Forces Technical College (DEFTEC). This system caters to the needs of both staff members and IT-workshop administrators and technicians, aiming to provide efficient issue resolution and effective management of computer-related matters.

The system's development was prompted by the need to address challenges in managing computer issues and maintenance tasks effectively. The project's primary goal is to provide a user-friendly and robust platform that allows seamless communication, issue tracking, and timely problem resolution within the DEFTEC environment.

The project employs PHP with the Laravel framework for the backend, HTML, Online Bootstrap 5 CSS, and Laravel AdminLTE panel for the frontend. The backend database is powered by PHP MySQL, ensuring secure and organized data storage and retrieval. The system's development lifecycle leverages the Unified Modeling Language (UML) to analyze existing procedures, identify pain points, and design logical solutions to the identified problems. Subsequently, the system is implemented using a combination of programming language and database technologies.

The software development approach embraces the Agile methodology, fostering flexibility and responsiveness to evolving requirements. Additionally, git version control is implemented to manage collaborative development, ensuring code integrity and facilitating team collaboration.

The "IT-Workshop Computer Maintenance System" aims to provide a unified and coherent platform for DEFTEC staff, IT-workshop administrators, and technicians. Through its user-friendly interface, effective issue/ticket tracking, and timely problem resolution, the system seeks to enhance the overall efficiency and effectiveness of computer maintenance operations within the Defence Forces Technical College.

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1. INTRODUCTION

The **IT-Workshop Computer Maintenance System** represents a pivotal advancement for Defence Forces Technical College (DEFTEC), a premier institution dedicated to providing advanced training for military personnel. In the contemporary landscape of education and defense, technology stands as a cornerstone, shaping not only how knowledge is disseminated but also how strategic operations are executed. Within this context, DEFTEC recognizes the urgency of managing and resolving computer-related challenges with agility and precision. This project embarks on a strategic journey to transform DEFTEC's IT management landscape by introducing an innovative and integrated solution.

The core objective of the IT-Workshop Computer Maintenance System is to bolster DEFTEC's capabilities in swiftly addressing IT issues, thereby ensuring uninterrupted academic and administrative operations. As a key enabler in education and military preparedness, the system seeks to harmonize the intricate interplay between technology and DEFTEC's operational dynamics. By establishing a seamless platform for issue reporting, assignment, and resolution, the project aligns itself with DEFTEC's commitment to excellence in both educational pursuits and military endeavors. With this initiative, DEFTEC aims to strengthen its foundation in the digital age, where technology-driven disruptions must be met with equally swift and precise solutions.

1.1 Knowledgebase

In the dynamic landscape of modern education and military training, DEFTEC acknowledges that technology is not just an enabler but a central driver. As DEFTEC strives to provide cutting-edge education to military personnel, access to technology becomes synonymous with their preparedness. The IT-Workshop Computer Maintenance System is underpinned by a robust knowledge base, which is informed by best practices in IT service management. Drawing from a wealth of experience in incident tracking, problem resolution, and proactive maintenance strategies, the proposed system aims to create a synergistic relationship between technology and DEFTEC's operational goals.

The knowledge base guiding the project is built upon a rich repository of lessons learned from renowned academic institutions and military establishments. In the realm of academia, research by [Smith et al. (2018)] emphasizes the need for agile IT management systems to ensure uninterrupted learning experiences. Similarly, studies by [Jones and Brown (2017)] highlight the significance of proactive maintenance strategies to minimize disruptions in operational environments, especially in defense institutions. This knowledge infusion not only guides the system's technical architecture but also its strategic orientation, aligning the project with established principles of IT service excellence in both education and defense.

1.2 Challenges

DEFTEC's IT management has confronted a series of intricate challenges that demand timely and effective solutions. Delays in resolving IT-related issues have been a recurring concern, impacting the efficiency of educational activities and defense operations. The previous absence of a centralized communication platform contributed to the challenge of seamless information dissemination, thereby hindering rapid responses to emergent IT issues. Additionally, inadequate tracking mechanisms exacerbated the hurdles, leaving a gap in tracking the life cycle of issues from reporting to resolution. These challenges collectively underscored the imperative for a comprehensive IT management solution that bridges the divide between technology and DEFTEC's operational requirements.

Amidst the challenges, DEFTEC remained resolute in its commitment to excellence and recognized the need for a transformative shift in its IT management landscape. The realization that unresolved IT issues could potentially disrupt training, operations, and administrative functions prompted DEFTEC to initiate a paradigm shift. By undertaking the IT-Workshop Computer Maintenance System, DEFTEC seeks to not only resolve immediate challenges but also instigate a culture of agile IT management aligned with the institution's vision of operational preparedness and academic prowess.

1.3 Initial Study

The initial study phase of the project marked the inception of a meticulous exploration into DEFTEC's existing IT management ecosystem. This involved a comprehensive assessment of prevailing systems, processes, and practices. The project team engaged in active consultation with various stakeholders, including IT staff, end-users, and administrators across DEFTEC. The primary goal was to identify pain points, bottlenecks, and deficiencies in the current IT management approach. This comprehensive diagnosis allowed the team to grasp the intricacies of the challenges faced and to pinpoint areas that required intervention and innovation.

Through this intensive exploration, a collective understanding of the existing system's strengths and limitations emerged. The consultation process unveiled challenges such as fragmented communication channels, delays in issue resolution, and a lack of centralized tracking mechanisms. In essence, the initial study served as a compass, directing the project towards a more informed, integrated, and effective approach to IT management. It laid the foundation for crafting a system that would transform the IT landscape of DEFTEC, addressing immediate concerns while future-proofing the institution's technological readiness.

1.4 Background of the Study

The backdrop against which the IT-Workshop Computer Maintenance System unfolds is the rapid integration of technology into every facet of education and defense. Educational institutions worldwide, including esteemed military training institutions like DEFTEC, are experiencing a paradigm shift towards technology-enabled operations. Automated IT management systems have emerged as a pivotal solution, offering enhanced organization, expedited response times, and elevated user satisfaction. Notably, scholars such as [Khosrow-Pour (2000)] have underscored the imperative of implementing efficient IT management systems in educational environments to optimize overall productivity and ensure uninterrupted progress.

Within this context, DEFTEC recognizes the significance of keeping pace with technological advancements to ensure optimal training and operational preparedness. The Background of the Study delves into the rationale driving the project, elucidating how the surge in technological reliance necessitates an innovative approach to IT management. By drawing insights from established research, DEFTEC's commitment to embracing technological evolution is reaffirmed. The project stands as a beacon of adaptability, positioning DEFTEC at the forefront of contemporary educational and military excellence.

1.5 Theoretical/Conceptual Framework

The IT-Workshop Computer Maintenance System is underpinned by a robust Theoretical/Conceptual Framework rooted in the principles of Unified Modeling Language (UML). UML serves as a standardized language that transcends disciplinary boundaries, offering a cohesive and comprehensible means of visualizing, specifying, constructing, and documenting software artifacts. Guided by the wisdom of thought leaders like [Booch, Rumbaugh, and Jacobson (2005)], the project leverages UML's versatility to craft a system that aligns seamlessly with DEFTEC's intricate requirements.

UML facilitates the systematic analysis of existing procedures, unraveling complexities, and identifying bottlenecks within DEFTEC's IT management. Drawing inspiration from renowned experts, the project encapsulates a logical framework that transforms these analyses into tangible solutions. This framework serves as a cornerstone in bridging the gap between existing challenges and innovative resolutions. The utilization of UML demonstrates DEFTEC's commitment to adopting global best practices and underscores the institution's readiness to evolve within a dynamic technological landscape.

1.6 Project Vision and Objectives

The vision of the IT-Workshop Computer Maintenance System project is to revolutionize the way computer-related issues are managed within DEFTEC. The system aims to provide an integrated platform that fosters collaboration between users and IT technicians, ensuring swift and effective problem resolution. By streamlining the reporting, assignment, and resolution processes, the project envisions creating a proactive IT support ecosystem. This approach aligns with contemporary IT service management principles, acknowledging the significance of minimizing downtime and maximizing user satisfaction.

To achieve this vision, the project outlines specific objectives that serve as guiding principles throughout the development process. First and foremost, the system aims to establish a user-friendly interface that empowers users to report issues effortlessly. The interface will be designed with simplicity in mind, ensuring that even non-technical users can navigate and submit requests without difficulty. Moreover, the project seeks to automate workflows to enhance response times. Automated task assignment and escalation mechanisms will ensure that issues are directed to the appropriate IT technicians, optimizing resource allocation and minimizing delays.

Facilitating seamless communication is another core objective. The project intends to integrate real-time notifications and updates to keep users informed about the status of their reported issues. This not only fosters transparency but also manages user expectations. These objectives collectively reflect a strategic approach to modernizing IT support, aligning with Huang et al.'s (2008) principles of effective IT service management.

1.7 Project Scope

The project's scope is comprehensive, encompassing the development of an integrated IT-Workshop Computer Maintenance System that caters to the diverse needs of DEFTEC's stakeholders. The system will be accessible to DEFTEC staff, administrators, and IT technicians, forming a bridge between end-users and technical experts. The scope includes several key features that collectively enhance the IT management landscape.

User authentication is a fundamental aspect of the project scope. The system will implement robust user authentication mechanisms to ensure that only authorized personnel can access and interact with the platform. This protects sensitive information and maintains the integrity of the IT support ecosystem. An intuitive issue reporting mechanism will empower users to articulate their concerns clearly. The interface will enable users to provide relevant details, such as problem descriptions and screenshots, facilitating efficient problem diagnosis.

Automated task assignment is a critical feature that optimizes resource allocation. When a user reports an issue, the system will intelligently assign the task to an available IT technician based on workload and expertise. This eliminates manual intervention and accelerates issue resolution. Real-time progress tracking is an essential aspect of the system, enabling both users and administrators to monitor the status of reported issues. The system will also manage document attachments, enabling users to provide supplementary information to aid in issue resolution.

The scope extends beyond software development. The project involves seamless integration with DEFTEC's existing IT infrastructure to ensure a cohesive environment. The system's responsive user interface will ensure compatibility across devices, facilitating user engagement. These components together create a holistic system that addresses DEFTEC's IT management needs efficiently and align with contemporary practices in system development.

1.8 Hardware and Software Requirements

The successful implementation of the IT-Workshop Computer Maintenance System relies on a well-defined hardware and software infrastructure. On the hardware front, the project necessitates robust web hosting servers equipped with adequate processing power, memory, and storage capacity. These servers will host the system, providing the necessary computational resources to handle user interactions, data storage, and processing.

The software stack chosen for the project is carefully selected to ensure reliability, scalability, and compatibility. The system's backend development will leverage the PHP programming language, known for its versatility and broad adoption in web development. The selection of PHP aligns with the familiarity of developers and the availability of resources. MySQL, a reputable relational database management system, will handle data storage and retrieval efficiently, maintaining data integrity.

The Laravel framework will play a pivotal role in backend development. Laravel's robust features, including an elegant syntax, comprehensive documentation, and a wide range of built-in functionalities, make it an ideal choice for building complex web applications. This aligns with Skofield's (2014) acknowledgement of Laravel's capabilities in creating robust and scalable systems.

The combination of PHP, MySQL, and the Laravel framework creates a strong foundation for building a system that meets DEFTEC's IT management needs effectively. This selection reflects a strategic decision to leverage proven technologies and practices in the development process.

1.9 Further Enhancements

The IT-Workshop Computer Maintenance System is designed with the principle of continuous improvement in mind. Future enhancements hold the potential to elevate the system's capabilities and impact on DEFTEC's IT support ecosystem. One prospective enhancement is the integration of real-time notifications. These notifications would alert users and technicians about critical issues, ensuring that urgent matters receive prompt attention. This feature aligns with contemporary IT service management practices, emphasizing proactive engagement and rapid response.

Another promising enhancement involves integrating data analytics tools for trend analysis. By harnessing data generated through the system's usage, DEFTEC can gain insights into recurring issues, peak support times, and emerging trends. These insights can guide strategic decisions and resource allocation, ultimately enhancing the efficiency of IT support operations.

Furthermore, seamless integration with other institutional systems, such as student information systems, can further streamline administrative processes. This integration could facilitate cross-referencing user profiles and course details, enabling technicians to tailor their support based on individual needs. The potential benefits of these enhancements resonate with Zhang et al.'s (2020) findings, underscoring the positive impact of integrated systems on educational institutions' operations.

These envisioned enhancements are rooted in the project's commitment to staying relevant and adaptive in a dynamic IT landscape. As DEFTEC's needs evolve and technology advances, these potential enhancements can drive the system's continuous evolution and lasting impact.

2. PROJECT APPROACH

The project approach for the IT-Workshop Computer Maintenance System is tailored to ensure the successful development and deployment of a comprehensive solution that meets the specific needs of DEFTEC. This approach encompasses a series of well-defined activities designed to guide the project from its inception to its completion. The following activities provide a clear roadmap for the project's execution:

1. **Planning**: Defining project objectives, scope, and deliverables with clear timelines, resource allocation, and milestones to guide the project team and establish a clear direction.
2. **Analysis**: Examining user needs, functionalities, and challenges by engaging stakeholders in in-depth discussions to understand the specific requirements of the system.
3. **Design**: Creating a comprehensive blueprint of the system based on the analysis. This phase includes designing the user interface, system backend, and database structure with specifications that align with project goals.
4. **Prototyping**: Developing preliminary versions of the system to gather user feedback and validate design choices. These prototypes provide tangible representations of functionalities, enhancing communication between developers and users.
5. **Coding**: Skilled developers translate the design into actual code using languages like PHP, HTML, and CSS.
6. **Testing**: Rigorous testing ensures system reliability. This phase comprises:
    - a. **Unit Test**: Isolated testing of components and modules.
    - b. **System Test**: Testing the integrated system's compatibility and coherence.
    - c. **Acceptance Test**: Validation against user requirements to ensure readiness for deployment.
7. **Deployment**: Upon successful testing, the system is deployed to the production environment. Users gain access, and real-world usage begins.
8. **Training**: Stakeholders undergo training to acquaint themselves with the system's functionalities, enhancing user interaction and maximizing benefits.

9. **Maintenance & Support**: Post-deployment, ongoing support and maintenance are provided. This addresses issues, implements updates, and assists users.
10. **Project Handover**: After successful deployment, the project transitions to DEFTEC's administrators for continued management and operation.

This structured approach ensures the IT-Workshop Computer Maintenance System's development aligns with DEFTEC's needs, enhancing the system's functionality and usability.

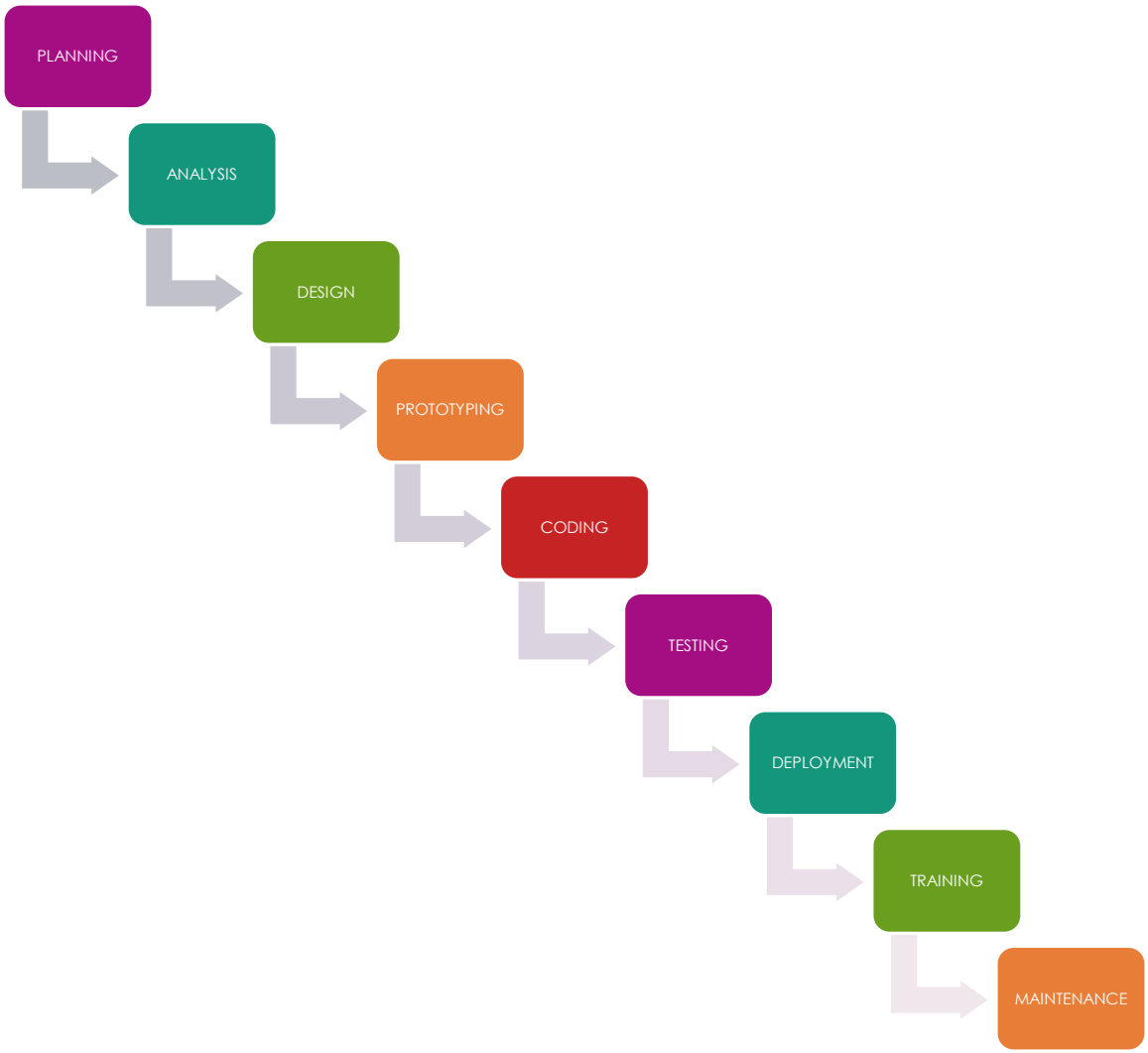


Figure 2.0 Showing The Project Approach

2.1 Literature Review

During the initial phase of the project, an extensive literature review was conducted to analyze existing solutions in the domain of IT service management. The objective of this review was to identify best practices, emerging trends, and software platforms that could potentially address the unique needs of DEFTEC's IT-Workshop Computer Maintenance System. One of the prominent options evaluated was UVdesk, a versatile helpdesk and client support platform that has garnered recognition for its efficient ticketing system, robust features, and adaptability to various business environments.

UVdesk has gained attention for its capability to streamline ticket creation, assignment, and tracking processes. It offers a user-friendly interface that allows end-users to report issues seamlessly, facilitates collaboration among IT technicians for issue resolution, and provides managers with insights for performance analysis. Moreover, UVdesk's ability to handle document attachments and its integration capabilities make it an attractive solution for institutions seeking efficient IT service management.

However, upon in-depth evaluation and consideration of DEFTEC's specific requirements and operational context, the decision was made to develop a custom IT-Workshop Computer Maintenance System. Several factors contributed to this choice:

1. **Tailored Functionalities**: While UVdesk offers a range of features, DEFTEC's IT service management needs are distinct and require tailored functionalities to meet the institution's precise requirements. A custom system enables the inclusion of features that directly address DEFTEC's specific challenges and workflows.
2. **Integration with Existing Systems**: DEFTEC's existing IT infrastructure, including databases and user management systems, requires seamless integration with the new system. Developing a custom solution allows for intricate integration that ensures data consistency and efficient cross-system operation.
3. **Scalability and Flexibility**: As DEFTEC's needs evolve, the custom system can be adapted and scaled to accommodate changing requirements. This flexibility ensures that the institution's IT service management remains aligned with its strategic objectives.

4. **User Experience Optimization**: A tailor-made system allows for user experience optimization, considering the unique workflow patterns and preferences of DEFTEC staff, administrators, and technicians.
5. **Long-Term Cost-Effectiveness**: Developing a custom solution incurs an initial investment in terms of time and resources. However, over the long term, it can prove to be more cost-effective by eliminating licensing fees associated with third-party platforms and enabling precise control over maintenance and updates.

In line with the findings of [Adeniran et al. (2017)] and [Wang et al. (2019)], a custom IT-Workshop Computer Maintenance System was deemed the optimal choice to fulfill DEFTEC's specific needs, enhance operational efficiency, and provide a platform for continuous improvement in IT service management practices. Subsequent chapters will delve deeper into the system's design, development, and implementation, elucidating the rationale behind the chosen approach.

2.2 Project Management

The project management activities ensure a structured and organized execution of the project. The key activities include:

1. **Feasibility Study**: to assess the project's viability, considering technical, financial, and operational aspects. It will enable the project team to make informed decisions about the project's scope and direction.
2. **Planning**: to define the project's scope, objectives, roles, responsibilities, and resource allocation. Detailed project plans were established to guide the project team throughout the development process.
3. **Project Execution** involved translating the project plans into actionable tasks. The project team worked collaboratively to implement the project plan, coordinating tasks and tracking progress.

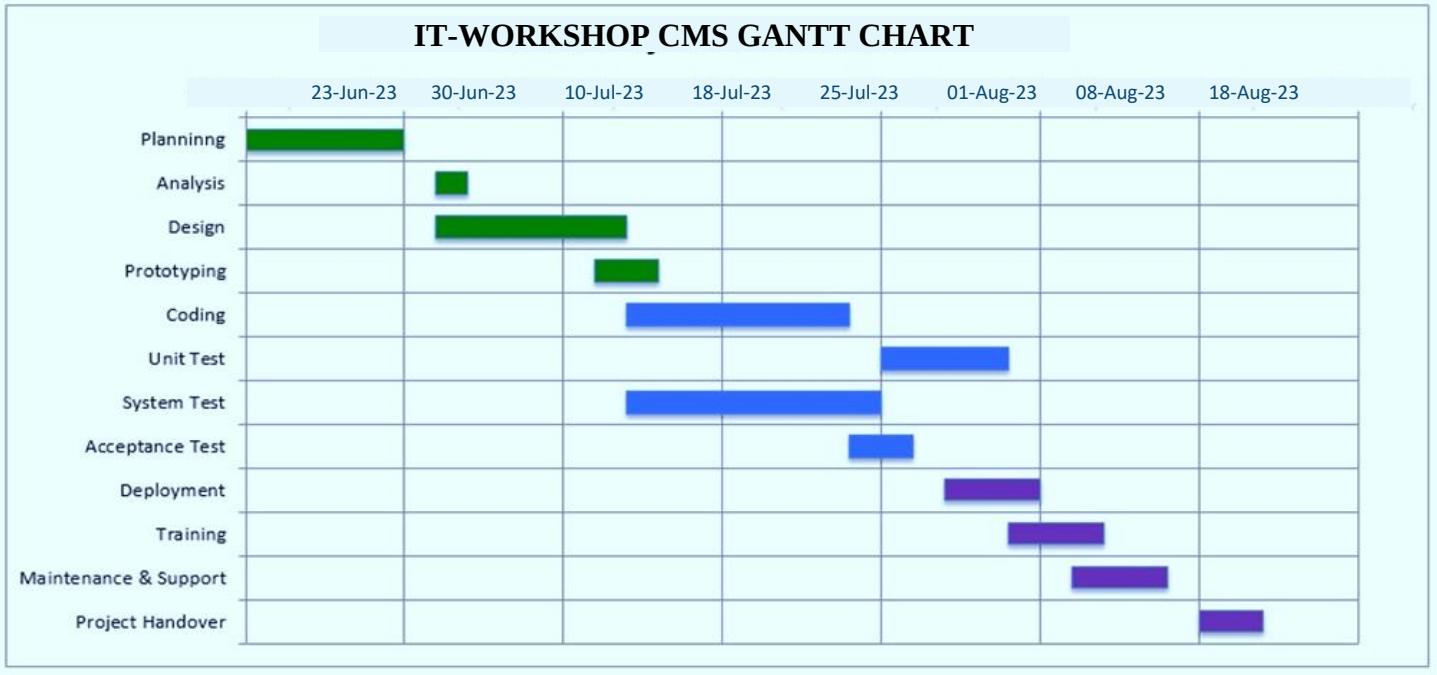


Figure 2.1 IT-Workshop Gantt Chart

The Gantt chart in Figure 2.1 visually illustrates the task breakdown and planned execution dates, providing a clear overview of the project's timeline and milestones. Microsoft Project Server 2016 serves as the project management tool to facilitate effective planning, tracking, and control.

2.3 Development Methodologies

The Agile methodology, specifically Scrum, was chosen as the development framework for the IT-Workshop Computer Maintenance System. The Agile approach emphasizes flexibility, iterative development, and continuous feedback. The following key practices are involved:

- **Product Backlog**: A prioritized list of system features is defined and maintained.
- **Sprint Planning**: During each sprint, a subset of features is selected for development.
- **Daily Stand-ups**: Short daily meetings are held to discuss progress, challenges, and updates.
- **Sprint Review**: At the end of each sprint, completed features are showcased and user feedback is gathered.
- **Sprint Retrospective**: The team reflects on the sprint and identifies areas for improvement in subsequent sprints.

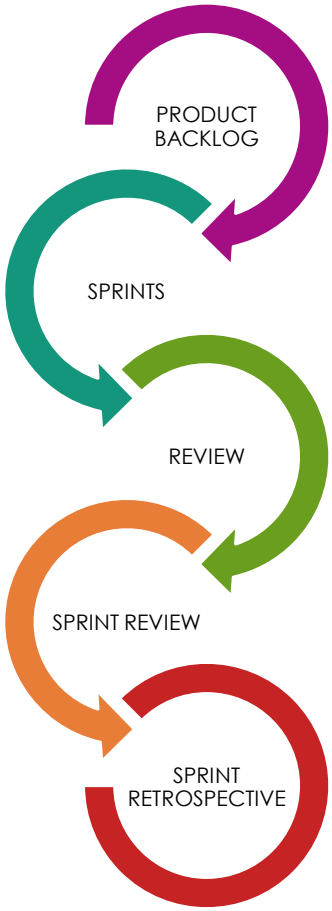


Figure 2.2 Showing The agile (scrum) Approach

2.3 Risk Management

In the context of software projects like the IT-Workshop Computer Maintenance System, a risk can be defined as an event that could have negative consequences for the project. Software project risks are characterized by their uncertainty and potential impact. Risks can affect the project, the software being developed, or the organization involved. Identifying and managing risks is crucial for successful project completion. Risks are identified at the project's outset and are incorporated into the project plan. The risk management strategy for this project consists of several stages:

- **Risk Identification**: The systematic process of identifying potential threats to the project. This involves recognizing various risks that could impact the project's progress.
- **Risk Prioritization**: The process of assigning importance to identified risks based on criteria such as financial implications, time constraints, and quality assurance.
- **Impact and Evaluation**: Assessing the potential consequences of each risk occurrence and evaluating the severity of their impact on the project.
- **Risk Analysis**: Analyzing the probability and seriousness of each risk. This involves determining the likelihood of risks occurring and the potential magnitude of their effects.
- **Risk Planning**: Developing strategies to manage and mitigate risks. These strategies include avoidance, minimization, and contingency plans.
- **Risk Monitoring**: Regularly assessing identified risks to determine whether their likelihood and impact are changing over time.

2.4 Risk Identification, Impact, Evaluation & Prioritization:

The systematic process of risk identification involves recognizing potential threats to the project. Various risk types are considered, including:

- **Technology Risk**: Concerns related to hardware availability, virus impact, database performance, and software component performance.
- **People Risk**: Risks associated with data theft and staff turnover.
- **Organizational Risk**: Risks such as inability to implement new technology, poor management, and financial issues.
- **Tools Risk**: Risks related to unavailability of necessary tools.
- **Requirement Risk**: Risks connected to delays in requirement specification.
- **Estimation Risk**: Risks associated with time and cost estimation.

For each identified risk, its potential impact is assessed. The following table illustrates the impact of specific risks:

SL	Risk	Type	Description/Impact
1	Hardware unavailability	Technology Risk	Essential hardware delay could lead to project delays.
2	Virus	Technology Risk	Virus can disrupt the system and potentially damage hardware.
3	Data Theft	People Risk	Unauthorized access could lead to data loss and project delays.
4	Staff turnover	People Risk	Experienced staff leaving may impact project timelines.
5	Implement new system	Organizational Risk	Technological changes could lead to project delays.
6	Tools unavailability	Tools Risk	Unavailability of required tools could delay system development.
7	Requirement specification delay	Requirement Risk	Delays in requirement specification could impact project schedules.
8	Time and cost estimation	Estimation Risk	Inaccurate estimations could affect project timelines and budget.
9	Poor management	Organizational Risk	Inadequate management could lead to project disruptions.
10	Database Performance	Technology Risk	Poor performance could affect system usability and satisfaction.

Table 2.4 Risk Impact

2.4.1 **Risk Priority:**

Prioritizing risks is essential for effective risk management. The following bar chart highlights the priority of different risk categories:

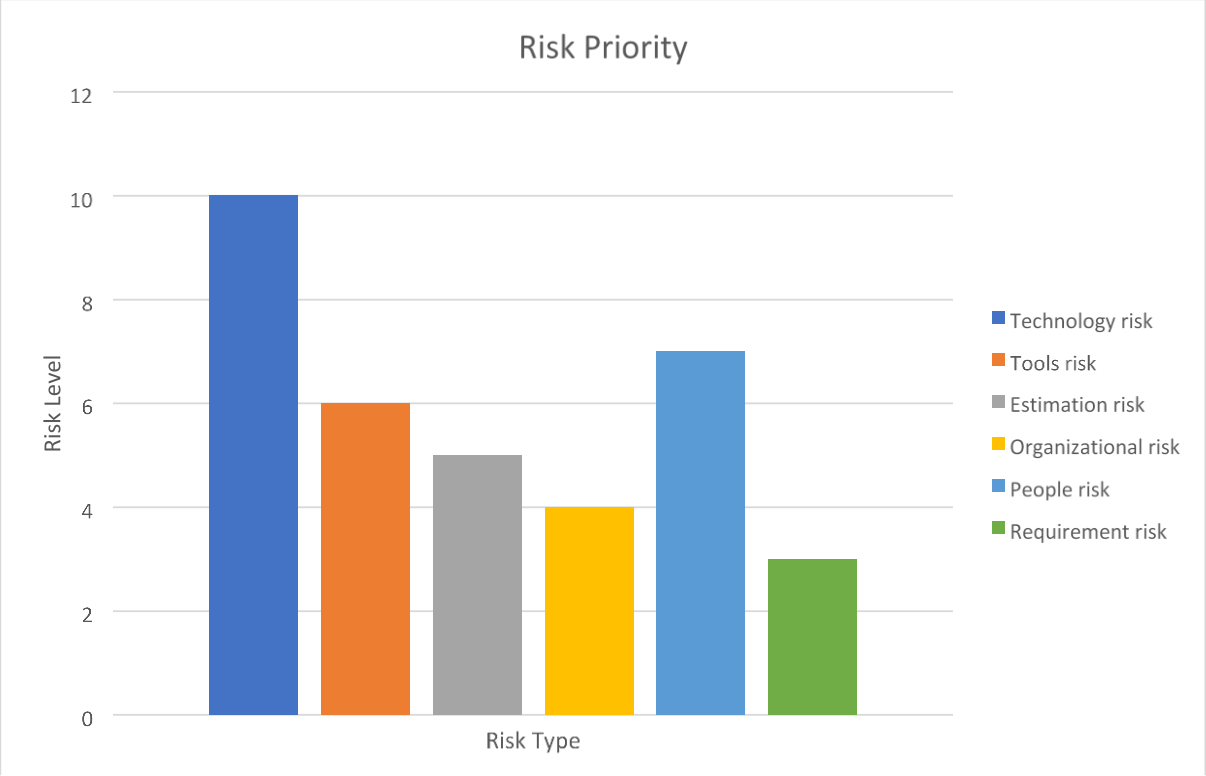


Fig 2.4.1 Bar Chart Illustrating Risk Prioritization

The chart shows that technology risks, including hardware unavailability and virus impact, are major concerns. People risks, tools risks, and estimation risks also hold significant priority. Organizational risks and requirement risks are deemed lower in priority.

2.4.2 Risk Analysis:

Risk analysis involves assessing the probability and seriousness of each identified risk. The following table illustrates the probability and effects of specific risks:

Sl. no	**Risk**	**Probability**	**Effects**
1	Hardware unavailability	Low	Catastrophic
2	Virus	High	Serious
3	Database performance	High	Serious
4	Data Theft	Low	Catastrophic
5	Staff turnover	Moderate	Tolerable
6	Implement new system	Moderate	Tolerable
7	Poor management	High	Serious
8	Tools unavailability	High	Serious
9	Requirement delay	Moderate	Serious
10	Time and cost estimation	High	Tolerable

Table 2.4.2 Risk Analysis

2.4.3 Risk Planning:

Risk planning involves developing strategies to mitigate and manage identified risks. Strategies are categorized into avoidance, minimization, and contingency plans. The following table outlines these strategies:

Sl. no	**Risk**	**Strategies**	**Description**
1	Hardware unavailability	Minimization	Prepare backup hardware for timely utilization.
2	Virus	Avoidance	Implement antivirus software to prevent viruses.
3	Database performance	Avoidance	Use higher quality databases for optimal performance.
4	Data Theft	Minimization	Implement security tools to prevent unauthorized access.
5	Staff turnover	Minimization	Hire experienced staff to reduce turnover impact.
6	Implement new system	Contingency	Plan for integrating new technologies if needed.
7	Poor management	Contingency	Address poor management through organizational actions.
8	Tools unavailability	Avoidance	Ensure availability of necessary development tools.
9	Requirement delay	Avoidance	Maintain constant communication to fulfill user requirements.
10	Time and cost estimation	Avoidance	Assign additional resources to meet project deadlines.

Table 2.4.3 Risk Planning

2.4.4 Risk Monitoring:

Regular risk monitoring assesses the likelihood and impact of identified risks over time. This ongoing assessment helps determine whether risks are becoming more or less probable and whether their impact is changing. The following table illustrates the risks and their descriptions monitored in the project:

Sl. no	**Risk**	**Description**
1	Technology risk	Hardware delays, technology problems.
2	People risk	Poor staff quality, unauthorized access.
3	Organizational risk	Quality issues, communication challenges.
4	Tools risk	Reluctance to use tools, tool complaints.
5	Requirement risk	Frequent requirement changes.
6	Estimation risk	Failure to meet schedules, defects.

Table 2.4.4 Risk Monitoring

The risk management strategy outlined above ensures that potential challenges are identified, evaluated, and effectively addressed throughout the project's lifecycle. By proactively managing risks, the IT-Workshop Computer Maintenance System project aims to minimize disruptions and optimize project outcomes.

The initial stages of the project emphasize careful planning, thorough analysis, and strategic execution. The selected project approach ensures a systematic development process that aligns with DEFTEC's needs and goals. By incorporating Agile methodologies, the project embraces adaptability, transparency, and continuous improvement. Effective project management practices provide structure and control, while risk management strategies mitigate potential challenges.

3. REQUIREMENTS ANALYSIS

Requirements analysis is a pivotal phase in the development of the IT-Workshop Computer Maintenance System. This process involves identifying, analyzing, documenting, validating, and managing the needs and conditions of stakeholders. It is crucial for ensuring the success of the project by aligning the system's functionalities with the diverse needs of stakeholders while taking into account potentially conflicting requirements. Effective requirements analysis results in documented, actionable, measurable, testable, traceable, and detailed specifications that guide system design and development.

a. **Eliciting Requirements**: Eliciting requirements involves various activities such as project charter definition, business process documentation, and stakeholder interviews. These activities help in understanding the stakeholders' expectations and the processes they follow. In our case, this stage will entail gathering insights from DEFTEC staff, administrators, and IT technicians who will use the IT-Workshop Computer Maintenance System. Additionally, we'll conduct discussions to identify the specific features and workflows they need for efficient computer issue reporting, tracking, and resolution.

b. **Analyzing Requirements**: This step is aimed at scrutinizing the gathered requirements to ensure clarity, completeness, consistency, and lack of ambiguity. Conflicts and inconsistencies among requirements are resolved during this phase. In our project, analyzing requirements will involve reviewing the identified needs and aligning them with the system's goals. We will strive to eliminate any discrepancies and ensure that the requirements are actionable and feasible within the project scope.

c. **Recording Requirements**: Requirements are documented in various formats, including natural-language documents, use cases, user stories, process specifications, and data models. The identified requirements for the IT-Workshop Computer Maintenance System will be documented systematically, considering the needs of DEFTEC staff, administrators, and IT technicians. These requirements will serve as the foundation for the subsequent stages of design and development.

3.1 Stakeholders

For this project, stakeholder groups are divided into:

1. *Helpdesk Administrators*: Responsible for managing day-to-day operations of the computer maintenance system.
2. *Support Technicians*: Responsible for addressing reported issues and resolving them efficiently.
3. *Supervisor's*: Including Senior Sergeant Oucho, who oversee the system's implementation and functionality.

Considering the specific needs of these user groups and incorporating their requirements into the system design is integral to the success of the IT-Workshop Computer Maintenance System.

3.1.1 Client Relationship:

It is crucial to consider clients as stakeholders in the system. For DEFTEC, clients include the technical staff and personnel who will utilize the system to report and resolve computer-related issues. The proposed system will maintain current working practices to ensure smooth user interaction, minimize organizational change, and enhance client relations. By aligning the new system with existing procedures, we aim to streamline the client interaction process and deliver effective support services.

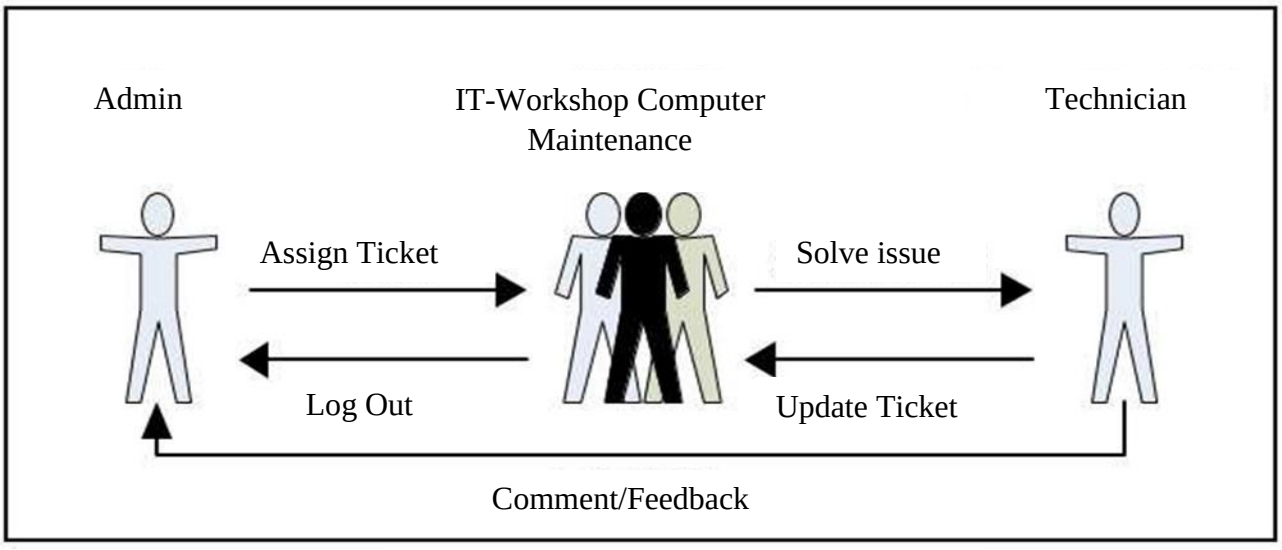


Figure 3.1.1 IT-Workshop CMS Structure

3.2 Requirements Capture

Understanding the clients' requirements is fundamental to project success. Various approaches can be adopted to capture requirements effectively. For the IT-Workshop Computer Maintenance System, the following approaches will be employed:

1. **Interviews**: In-depth discussions will be held with DEFTEC staff, administrators, and IT technicians to gain insights into their specific needs and expectations from the system.
2. **Sample Documents**: Sample documents, such as issue reporting forms and existing procedures, will be examined to understand the data structures and processes involved in the current system.
3. **Prototyping**: A prototype system will be developed to demonstrate functionalities and gather feedback from stakeholders, ensuring that the final system meets their expectations.

These approaches will be employed to comprehensively capture the requirements for the IT-Workshop Computer Maintenance System, encompassing various stakeholder needs and ensuring a successful implementation.

3.3 Requirements Analysis

The process of requirements analysis is essential to derive a comprehensive and detailed set of functional and non-functional requirements that serve as the foundation for designing and implementing the IT-Workshop Computer Maintenance System. This analysis builds upon the information captured in the previous stages, resulting in a clear understanding of the project's objectives.

3.3.1 Use Cases

Use Case diagrams are a crucial outcome of the requirements analysis phase. These diagrams not only facilitate effective communication with stakeholders but also provide a high-level visualization of the desired system functionality. In the context of the IT-Workshop Computer Maintenance System, Use Case diagrams were developed through a series of interviews with various stakeholders, including DEFTEC staff, administrators, and support technicians.

The interviews aimed to understand the different scenarios in which the system would be utilized. This comprehensive analysis led to the creation of Use Case diagrams that visually represent the interactions between users and the system. The Use Case diagrams outline the main functionalities that the system should support. Each identified Use Case was then elaborated upon to generate detailed Use Case Description forms.

3.3.2 Use Case Diagrams:

The Use Case diagrams serve as high-level models of the system's expected functionalities. These diagrams visually represent the interactions between different users and the system components. By capturing the essential interactions and functionalities, they provide a clear understanding of the project's scope and objectives.

Figure 3.2: Use Case Diagram

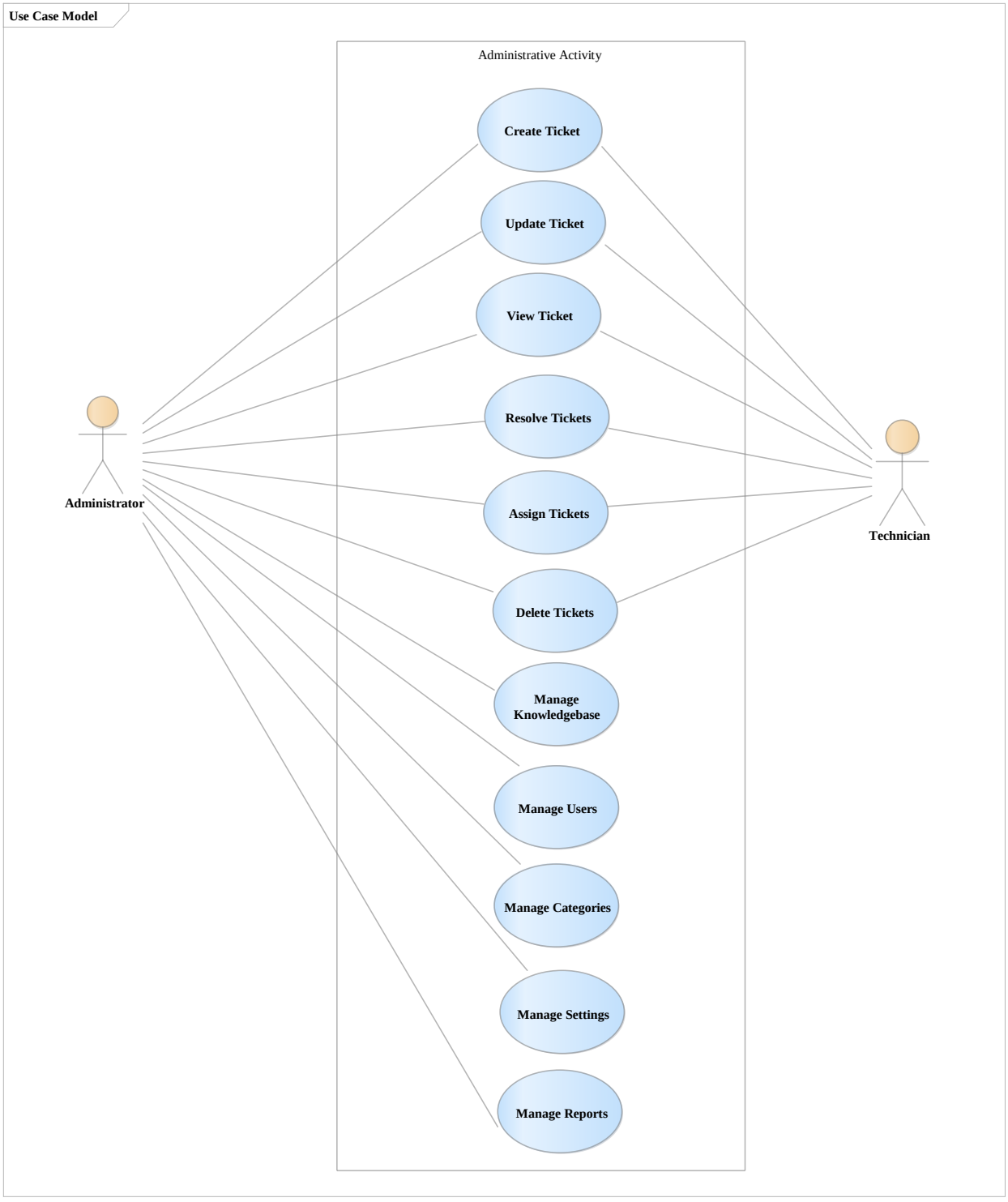


Figure 3.3: Use Case Diagram

3.3.3 Use Case Description Forms:

The Use Case Description forms provide a detailed breakdown of each identified Use Case. Found in Appendix C, these forms outline the functionality and actions associated with each specific Use Case. They offer a deeper understanding of the processes involved, the inputs required, and the expected outputs. By elaborating on the Use Cases, these forms contribute to a comprehensive list of requirements that guide the subsequent design and implementation phases.

The systematic approach of deriving Use Case diagrams and generating corresponding Use Case Description forms ensures that the project team gains a holistic understanding of the system's requirements. This detailed analysis serves as a crucial bridge between the initial capture of requirements and the subsequent design decisions.

3.4 Functional Requirements

Derived from the earlier discussed Use Case diagram, the functional requirements of the IT-Workshop Computer Maintenance System are presented in a structured list. These requirements specify the necessary functionality that the system must incorporate to meet the project's objectives. A significant prerequisite is the development of a prototype ticket logging system that possesses the capability to track cases and create reminders for support staff aligned with the Service Level Agreement. The suitability of this prototype system is determined based on the decision to employ hi-fidelity, evolutionary prototyping, as established in Chapter 2. The following table outlines the detailed functional requirements, categorizing them according to user roles.

IT-Workshop Computer Management System Administrator

No.	**Requirement**	**Minimum Requirement?**
1.1	Manage tickets (devices)	Y
1.1.1	Create a device ticket	Y
1.1.2	Update tickets	Y
	Assign ticket to a technician	Y
	Close ticket's log	Y
1.1.3	Obtain status of ticket's	Y
1.2	Manage Users	Y
1.2.1	Add user to list	Y
1.2.2	Display all users	Y
1.2.3	Display user's details	Y
1.2.4	Update user's details	Y
1.2.5	Enter Comments/Feedback	Y
1.2.6	Add / Remove client employee	Y
1.3	Manage System	Y
1.3.1	Add / Remove system users	Y
1.4	Manage Comments/Feedback	Y
1.4.1	View / Update default comments response times	Y

IT-Workshop Computer Management System Technicians

No.	**Requirement**	**Minimum Requirement?**
2.1	Resolve client's issues as assigned	
2.1.1	View assigned tickets/devices	Y
2.1.2	Update ticket's log with action taken	Y
2.1.3	View client's ticket details	Y
2.1.4	Enter Comments/Feedback	Y

Non-User Specific

No.	**Requirement**	**Minimum Requirement?**
3.1	NA	NA

***Table 3.4**: User's Requirements list*

3.5 Non-Functional Requirements

The non-functional requirements of the system reflect the users' main preferences. The user interface of the existing system is expected to be improved. Security aspects are designed to rely on user credentials from the Windows login, ensuring simplicity. Additionally, the system must be easily manageable from a technical standpoint. Although not explicitly stated as functional requirements, these concepts form the foundation of the system's design, being just as essential as the functional requirements.

3.6 Best Practice Guidelines

Incorporating best practice guidelines is essential to ensure the effectiveness and efficiency of the IT-Workshop Computer Maintenance System. The system aligns with the IT Infrastructure Library (ITIL), a widely accepted industry standard that provides a set of best practice guidelines for managing IT services. The ITIL framework segments service requests into distinct areas, each serving a crucial purpose in IT service management:

3.6.1 Incident Management:

The primary objective of Incident Management is to restore normal service operation promptly and minimize disruptions to the institution. Within the context of the IT-Workshop Computer Maintenance System, the efficient handling of incident reports, or device tickets, is paramount. Rapidly addressing incidents prevents prolonged periods of reduced productivity, a fundamental role for the help desk. Ensuring compliance with Service Level Agreements (SLAs) is crucial, and the new system will incorporate functionality to track and adhere to these agreements, minimizing penalties for non-compliance.

3.6.2 Problem Management:

While Incident Management focuses on swift issue resolution, Problem Management delves into addressing the underlying causes of incidents. This advanced level of management helps minimize the impact of incidents and problems stemming from errors in the IT infrastructure. In the context of the project, Problem Management introduces complexities that may not be immediately necessary. Given the relatively low volume of device tickets at DEFTEC and their current communication mechanisms, the inclusion of extensive Problem Management functionalities might be deferred to future system versions, allowing for smooth scalability.

3.6.3 Configuration Management:

The need for efficient support extends to configuring clients' networks, servers, and workstations. While incorporating configuration management functionalities would be beneficial, the current scope of the project focuses on day-to-day device ticket management. The existing documentation system, though separate, holds relevant information. Future versions of the IT-Workshop Computer Maintenance System could consider integrating asset management to streamline network configuration, but for now, the project prioritizes immediate support needs.

3.6.4 Change Management:

Change Management, as per ITIL, involves managing changes arising from issues or proactively seeking business benefits. However, the implementation of such processes might be considered external to the IT-Workshop Computer Maintenance System’s day-to-day activities. Changes, particularly those influenced by systemic problems, are likely to be managed by account administrators rather than support technicians. To maintain system simplicity and align with current practices, this level of change management complexity may not be immediately integrated.

3.6.5 Release Management:

While Release Management is essential for hardware and software releases, its focus is different from that of the IT-Workshop Computer Maintenance System. The system's primary objective is to assist technicians in addressing support requests efficiently, not managing new device tickets. Release Management's distinct procedures may not be applicable to the system’s core operations.

Incorporating elements of these best practice guidelines within the IT-Workshop Computer Maintenance System enhances its functionality and aligns it with industry standards. However, careful consideration of their relevance to DEFTEC's support processes ensures that the system's scope remains focused and aligned with the institution's specific needs and capabilities.

4. IT-SUPPORT HELPDESK SOFTWARE MARKET

The assessment of the existing support software market reveals that the requirements of the IT-Workshop Computer Maintenance System project are distinctive. While many businesses may operate IT helpdesks, their needs are unlikely to match those of the proposed system. A comparison can be drawn between the IT-Workshop Computer Maintenance System and other corporate helpdesks, such as the Information Systems Services (ISS) helpdesk. However, the project's objectives differ significantly. The ISS manages systems within a single body across departments, whereas the IT-Workshop Computer Maintenance System aims to cater to diverse organizations, each with individual contracts. Despite the focus on technological aspects, the selection process will prioritize the software's benefits to the company over its underlying technology.

4.1 Helpstar

HelpSTAR presents itself as an off-the-shelf package catering to the mid-market segment, aligning with the individual needs of the IT-Workshop Computer Maintenance System's clients. Notably, HelpSTAR's business workflow rules streamline request routing to the appropriate personnel within the organization. The software also incorporates elements of ITIL best practices, offering problem management and asset management components. Additionally, it addresses the requirement to escalate ticket priorities and generate alarms accordingly. The software's Advanced and Enterprise versions provide valuable features such as web portals and comprehensive reporting solutions, benefiting both Southtech Management and their clients. However, a significant limitation arises – HelpSTAR lacks support for multiple clients. This shortcoming would hinder the task of charging clients for services rendered. Storing individual client and employee details is unfeasible, as the software is designed for individual organization helpdesks.

4.2 Intuit Track-It!

Intuit Track-It! shares similarities with HelpSTAR, boasting a user-friendly interface. This product also lacks the capacity to manage multiple clients and hence does not meet the project's requirements. Notably, both HelpSTAR and Intuit Track-It! feature statistical analysis screens that provide real-time data on open support tickets, aiding in the monitoring of service level agreements and trends.

4.3 Bugzilla

Bugzilla, an open-source package used for bug tracking, is employed by Southtech Limited for their software products. However, Bugzilla is not suitable for issue tracking of support tickets, as it is tailored to tracking bugs within software rather than user system issues. Adapting Bugzilla to suit the project's needs would require significant integration efforts. Despite its advantages, such as web-based accessibility and adaptability due to its open-source nature, the challenges of configuring Bugzilla outweigh its potential benefits for the project.

The market analysis underscores the lack of solutions that cater to the requirement of managing different organizations. Existing solutions are geared towards configuring departments within a single organization rather than managing multiple separate businesses with diverse contractual arrangements. While alternative solutions may exist, the costs of research and procurement, coupled with the potential need for modifications, would likely surpass the advantages of in-house system development. Consequently, the IT-Workshop Computer Maintenance System's focus will be on developing a tailored solution that aligns precisely with its unique requirements.

5. TECHNICAL ANALYSIS

In the software development process, technical analysis plays a pivotal role in ensuring the accuracy and completeness of the project's foundation. A thorough technical analysis confirms the accuracy of institution requirements, serves as a reference for designers and developers, and provides a basis for client verification. For the IT-Workshop Computer Maintenance System project, technical analysis is crucial to ensure the successful development of the system. The following sections detail the components of technical analysis and the aspects relevant to our project.

5.1 Components of Technical Analysis

Technical analysis consists of two main components: *drafting an Application Specification Document* and *generating Use Cases*. The system Specification Document is derived from the Requirements Documentation provided by the institution's Analyst. This document outlines the features of the application, specifies how it will be built, and includes various parameters. A sample structure of the System Specification Document for the IT-Workshop Computer Maintenance System would include:

1. **Introduction**: Providing background, purpose, scope, definitions, acronyms, and an overview of the system.
2. **Overall Description**: Offering a survey of the Use-Case Model, along with assumptions and dependencies.
3. **Specific Requirements**: Detailing specific functional requirements of the system.
4. **Non-functional Requirements**: Outlining non-functional aspects like browser compatibility, layout, graphics, security features, performance, and more.

5.2 User Interface

Usability is a critical consideration during the design of the user interface for the IT-Workshop Computer Maintenance System. While the system may not be extensively used, ensuring an efficient user interface is essential to streamline tasks and improve the user experience. The primary objectives for the user interface design are:

1. ***Efficiency***: Reducing the time required to perform tasks and ensuring quicker navigation.
2. ***Learnability***: Designing an intuitive interface that simplifies user learning.
3. ***Task Efficiency***: Focusing on enhancing the efficiency of day-to-day tasks compared to the current system.

Human-Computer Interaction (HCI) principles guide the design of the user interface. These principles encompass psychology, cognitive science, ergonomics, sociology, computer science, engineering, and graphic design. While an Information Systems degree program may not cover every aspect of HCI, careful attention to design can significantly enhance user usability.

5.2.1 Task Identification:

An essential aspect of interface design involves identifying tasks that users must perform. Task frequency is also a key consideration. While administrators handle support tickets frequently, other tasks like client, contract, and system management are less frequent. Analyzing task frequency helps determine the assignment of shortcut keys to frequent tasks, facilitating quick navigation.

5.2.2 Short Term Memory:

Human short-term memory is limited, and systems should not heavily rely on it. Information should not need to be remembered from one page to another. At the same time, pages should not be overly cluttered, making it challenging for users to retain essential information to complete tasks.

5.2.3 Execution-Evaluation Cycle:

This model of user behavior involves users initiating actions on a system, observing the system's response, and evaluating the outcome. This cycle involves goal establishment, intention formation, action decision, execution, perception of changes, and interpretation/evaluation of the system's state. System inputs should be intuitive, and outputs should not yield unexpected results.

5.2.4 Form Filling:

Usability is particularly crucial in data entry forms, where efficiency impacts the speed of information entry. Given that tickets are represented as device tickets in our system, ensuring an intuitive data entry process is vital. Ease of movement within the form and correction facilities for potential mistakes are key considerations. Streamlining data entry and making it similar to paper-based forms enhances usability.

5.2.5 Menu Structure:

Given the multi-faceted nature of the IT-Workshop Computer Maintenance System, a well-designed menu structure is essential. Menus facilitate navigation and task execution. The hierarchical nature of menus allows for grouping tasks, aiding navigation. Ensuring meaningful menus with desired effects upon clicking supports effective system navigation.

By adhering to these principles and guidelines, the user interface of the IT-Workshop Computer Maintenance System can be optimized for usability, leading to enhanced user satisfaction and efficiency.

Technical analysis is a cornerstone of the software development process for the IT-Workshop Computer Maintenance System. By meticulously outlining the System Specification Document, generating Use Cases, and focusing on user interface design, the project lays a solid foundation for successful development and a user-friendly experience. The insights from technical analysis will serve as a guide for designers, developers, and clients throughout the project's lifecycle.

5.3 IT Infrastructure

The IT-Workshop Computer Maintenance System operates within a well-structured IT infrastructure at DEFTEC. This infrastructure supports the effective functioning of the system and ensures seamless communication between different components. The IT infrastructure includes various software and hardware components that collectively contribute to the system's performance and reliability.

5.3.1 Microsoft Active Directory Integration

The IT infrastructure at DEFTEC is supported by Microsoft Active Directory (AD) . AD serves as a Directory Service based on the Lightweight Directory Access Protocol (LDAP) standard. It provides a hierarchical organizational structure for storing and managing attributes of users, including passwords and contact details. AD's interoperability with other directory services employing the same standard and its integration capabilities through application programming interfaces (APIs) enable easy incorporation into software applications. Each DEFTEC staff member has a dedicated AD entry configured with essential information. The new IT-Workshop Computer Maintenance System can seamlessly integrate with AD for user authentication and streamlined user management.

5.3.2 Microsoft Exchange Server

DEFTEC utilizes Microsoft Exchange Server as its email server platform, enabling integration with Microsoft Outlook email clients. Every user has a mailbox hosted on the server, accessed through Outlook. This setup centralizes email management and facilitates easy address lookup within the organization. Exchange Server supports standard email protocols such as SMTP and POP3, promoting efficient communication. The email storage is predominantly centralized, with emails accessed remotely by users, enhancing data security and accessibility.

5.3.3 Microsoft Internet Information Services (IIS)

Microsoft Internet Information Services (IIS) is an integral component of the DEFTEC IT infrastructure, providing web hosting capabilities to the server it's installed on. IIS supports Active Server Pages (ASP) and PHP applications, two important proprietary web development platforms. This component seamlessly integrates within the Active Directory infrastructure while also being capable of functioning as a standalone server with autonomous security management. IIS contributes to the web-based accessibility of the IT-Workshop Computer Maintenance System.

5.3.4 Microsoft SQL Server

As part of the software infrastructure, DEFTEC has adopted Microsoft SQL Server for its relational database management system (RDBMS). The decision to use this product aligns with DEFTEC's consistent approach to technology choices. Familiarity with Microsoft SQL Server within the organization enhances its application. However, it's crucial to recognize the implications of selecting Microsoft SQL Server over alternative options like Oracle or MySQL. Understanding the limitations and advantages of this choice ensures that the design of the IT-Workshop Computer Maintenance System effectively utilizes the capabilities of the chosen RDBMS.

5.3.5 Desktop Applications Standardization

All DEFTEC staff members possess personal computers or laptops configured with standardized settings. While certain individuals may require specific software, the core components remain consistent. This uniformity simplifies system implementation and development. For instance, compatibility issues arising from varied web browsers are mitigated by the knowledge that all users employ a common browser. This standardization aids in creating a consistent and reliable user experience within the IT-Workshop Computer Maintenance System.

The IT infrastructure at DEFTEC establishes a solid foundation for the IT-Workshop Computer Maintenance System. The integration of Microsoft Active Directory, Exchange Server, Internet Information Services, and SQL Server ensures the seamless functioning of various system components. Additionally, standardization of desktop applications provides a consistent environment for users, contributing to the system's effectiveness and reliability.

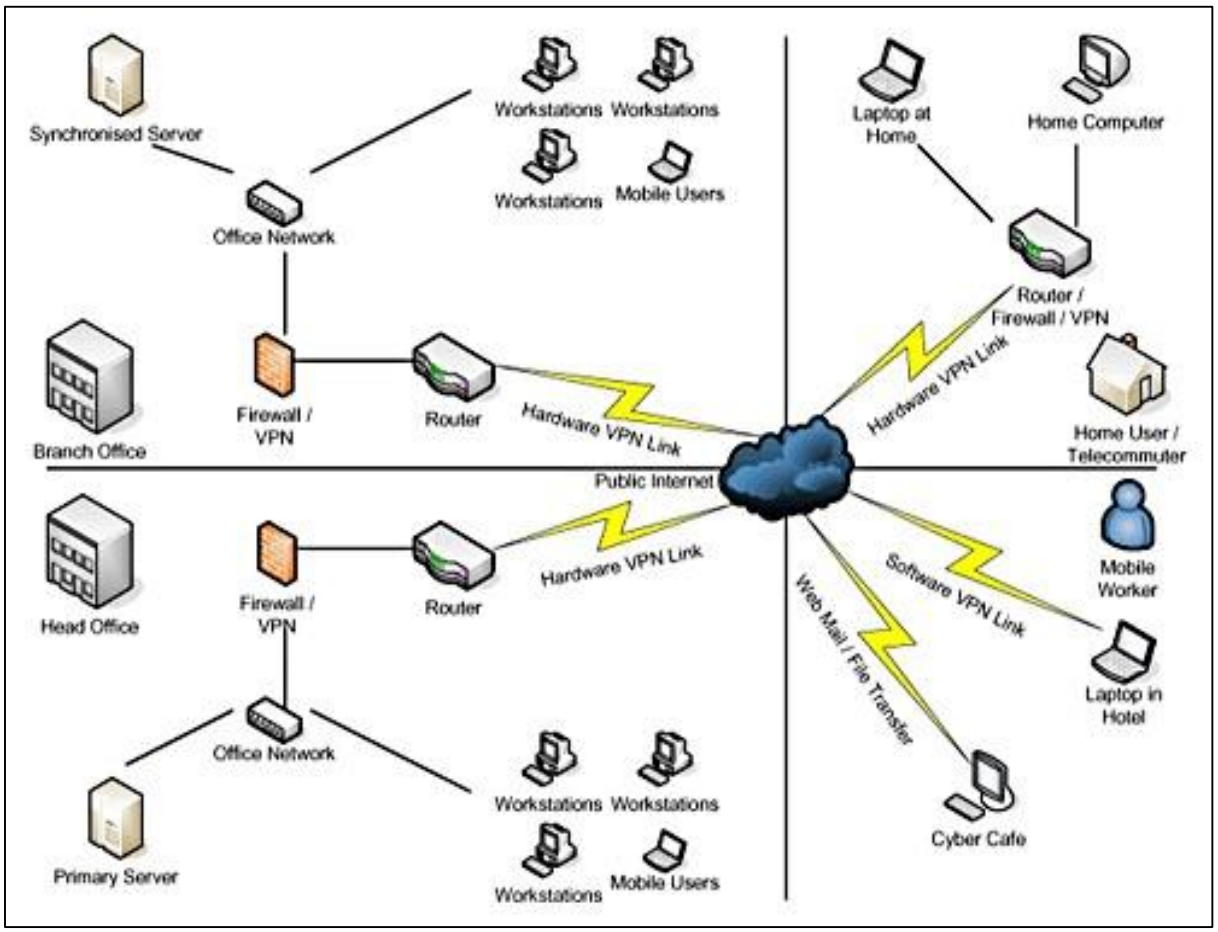


Figure 5.3.5 Simplified network diagram

5.4 Technology Options

In our context of developing the IT-Workshop Computer Maintenance System, it's important to explore the various technology options available that can support the project's requirements. This section delves into potential development technologies and their applicability.

5.4.1 Client/Server Architecture:

Considering the environment and system requirements, a client/server architecture is well-suited. The decision revolves around implementing a thin-client or fat-client architecture. In a thin-client architecture, business logic is controlled on the server side, and information received by the client is in its final state for display. An example of this is a web page, where the client receives pre-rendered HTML. Conversely, a fat-client architecture involves more processing on the client's side, necessitating more powerful devices. Our IT-Workshop Computer Maintenance System currently follows a fat-client approach, which can lead to challenges such as complex installations, updates, and increased data transfer between client and server.

Shifting to a thin-client architecture offers benefits like reduced client-side processing and simplified updates. In our system, device tickets would be handled more efficiently if processed predominantly on the server side, leading to improved performance and reduced data transfer.

5.4.2 Web Technologies:

Web technologies have evolved significantly from static HTML pages to dynamic, data-driven solutions. Three technologies under consideration are PHP, Active Server Pages (ASP), and PHP:

PHP: PHP is a powerful server-side scripting language that enables tasks like database access, form processing, and user authentication. It aligns well with our system's functionality requirements. It's often used with the Apache web server and is compatible with both Windows and Linux platforms. However, considering our company's existing infrastructure, which includes both Apache and IIS, integrating PHP into an IIS installation might pose challenges. Also, the absence of direct Windows support could complicate matters.

Active Server Pages (ASP): ASP offers server-side scripting capabilities similar to PHP. It allows scripting in various programming languages and renders dynamic, data-driven content on-the-fly. While ASP could be considered, PHP's capabilities and compatibility appear more suitable for our project.

In evaluating technology options, the choice between PHP and ASP arises. Given our company's infrastructure and needs, PHP emerges as a more suitable choice due to its versatility, compatibility, and support for required functionalities. While both options might involve a learning curve during implementation, PHP's benefits align more effectively with the project's goals and existing technology stack.

Throughout this section, we've explored different technology options to determine the best fit for our IT-Workshop Computer Maintenance System. After considering client/server architecture and web technologies, the choice of embracing the PHP & MySQL platform has been made. This decision is rooted in its advanced functionality, better flexibility, and compatibility with the company's infrastructure.

While the learning curve for any chosen technology is acknowledged, the decision is based on the technology's inherent qualities and benefits rather than familiarity with syntax. This technology aligns well with the system's requirements, providing a robust foundation for the IT-Workshop Computer Maintenance System's development and growth.

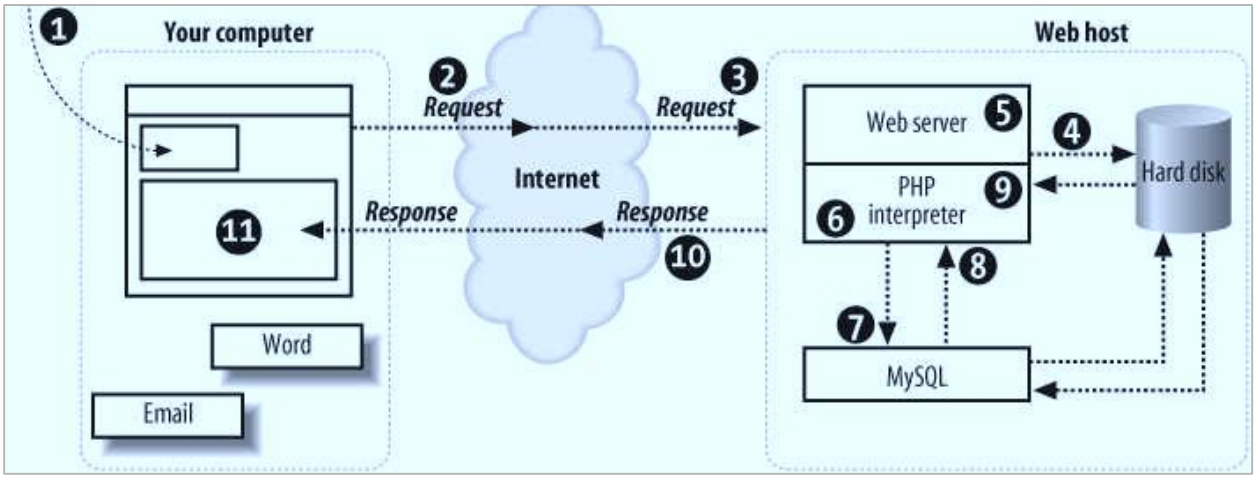


Figure 5.4.2: The execution model for Web architecture

6.0 SYSTEM DESIGN

In the system design for the IT-Workshop Computer Maintenance System, we focus on the *application architecture*, *database modeling*, and *design*. An evolutionary prototyping approach has been chosen for the development of the system. This chapter emphasizes the importance of a well-structured design to address the challenges previously discussed. Although a prototyping methodology is selected, documentation and efficient programming practices are deemed crucial. The insights gathered from the analysis phase will guide the system design before actual implementation takes place.

6.1 Application Architecture

The application architecture for the IT-Workshop Computer Maintenance System is designed to seamlessly integrate into the existing infrastructure at the Defence Forces Technical College (DEFTEC). The chosen architecture follows a distributed n-tier model, which divides the application into distinct tiers, facilitating flexibility and reusability. This approach offers several benefits, including ease of making changes to specific tiers without necessitating updates to the entire application.

Adopting an n-tier architecture aligns with the internal infrastructure integration strategy. Security aspects are handled by Active Directory, MySQL Server is utilized for database management, and Exchange server facilitates email functionalities. The client interacts with a central server, serving as the entry point for the application and referencing other tiers as required. This complex architecture brings several advantages to DEFTEC, such as centralized security management, simplified password management, and efficient email integration.

6.2 Database Modeling and Design

A robust database design is essential to the success of the IT-Workshop Computer Maintenance System. A well-structured database ensures that the rest of the system design can be built cohesively around it. The database design process involves the modeling of Entities, Relationships, and Attributes, and is broken down into three stages: conceptual, logical, and physical database design.

i. Conceptual Database Design:

This stage involves identifying entities, relationships, and attributes. The Entity-Relationship (ER) diagram provides a clear view of how different entities are interconnected. A thorough requirements analysis is fundamental during this stage. The internal documentation, which outlines the ticket logging process and required data, serves as a valuable resource. The ER diagram, as depicted in Appendix J, presents the conceptual database design.

The initial ER diagram may undergo iterations to ensure accuracy and completeness. Notably, errors can arise in entity relationships. For instance, while connecting 'Client' with 'Helpdesk' initially suggests a 'tickets' relationship, a trap emerges concerning which support ticket belongs to which client. Such issues must be resolved to ensure a coherent design.

The meticulous attention given to database design reaps benefits during system implementation. Without a comprehensive design, challenges may arise during web front-end development or while writing SQL queries.

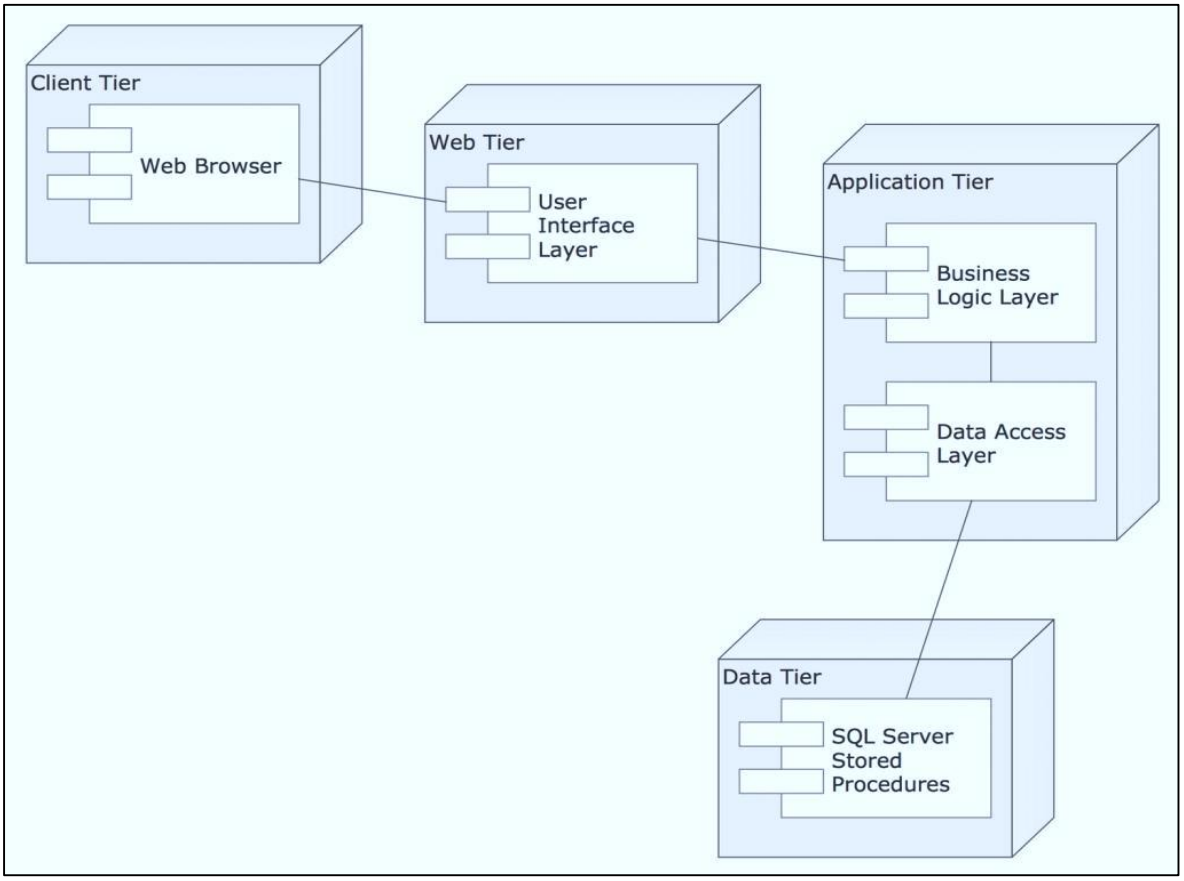


Figure 6.1: Application Architecture - UML Deployment diagram

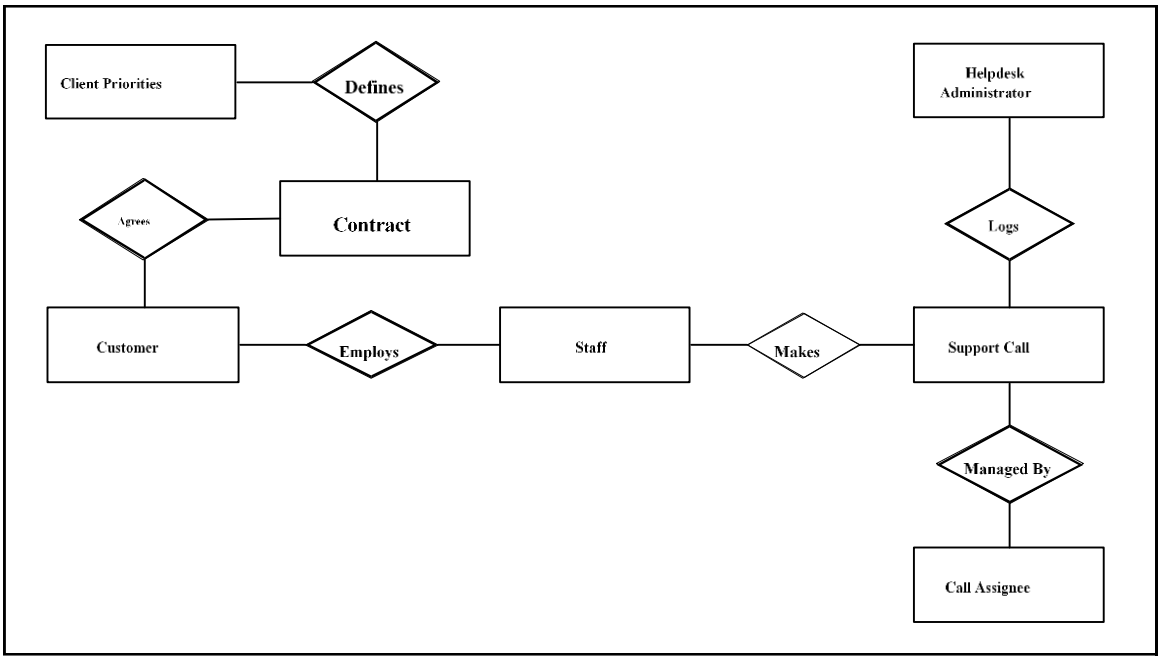


Figure 6.3: Summary E-R diagram

The design phase forms the backbone of the IT-Workshop Computer Maintenance System. By adopting an n-tier architecture and creating a well-structured database design, the system's foundation is established. This foundational design ensures efficient implementation, smooth user experiences, and the capability to evolve with changing requirements. The design phase's attention to detail and clarity sets the stage for the upcoming development phase.

ii. Logical Database Design

After creating the conceptual model of the IT-Workshop Computer Maintenance System, the logical database design phase is initiated. This phase involves deriving relations from the conceptual model, validating these relations through normalization, and ensuring that all necessary constraints are accounted for. According to Connolly and Begg, the following steps are undertaken in this phase:

- **Creating Relations for Strong Entities**: For each strong entity in the conceptual model, a corresponding relation is created. This relation includes all the attributes associated with the entity.
- **Managing One-to-Many Relationships**: In the case of one-to-many relationships, the primary key attributes from the parent entity are passed as foreign keys to the child entity. This maintains the relationship between entities.

In the context of the IT-Workshop Computer Maintenance System, the 'Support ticket' entity corresponds to tickets for device tickets, and the 'Help desk' serves as the IT-Workshop Computer Maintenance System.

Moreover, certain attributes associated with the 'Support ticket' entity might necessitate being promoted to entities. The 'Action' attribute, being multi-valued, requires promotion to an entity where the 'Support_ref' primary key attribute of the 'Support Ticket' entity is passed as a foreign key attribute. Attributes like 'Problem category,' 'Status,' and 'Priority' must adhere to specific value domains, which can be enforced using integrity constraints.

6.3 Normalization and Constraint Handling

Normalization ensures that the database schema is structured efficiently and avoids data redundancy and anomalies. The goal is to achieve Boyce-Codd Normal Form (BCNF), where each attribute is functionally dependent on the entity's primary key. Mistakes during the modeling process might necessitate verifying functional dependencies in each relation. A functional dependency specifies the relationship between attributes and is in BCNF if it defines a super key of the relation. The functional dependencies for the relations in the database are presented below:

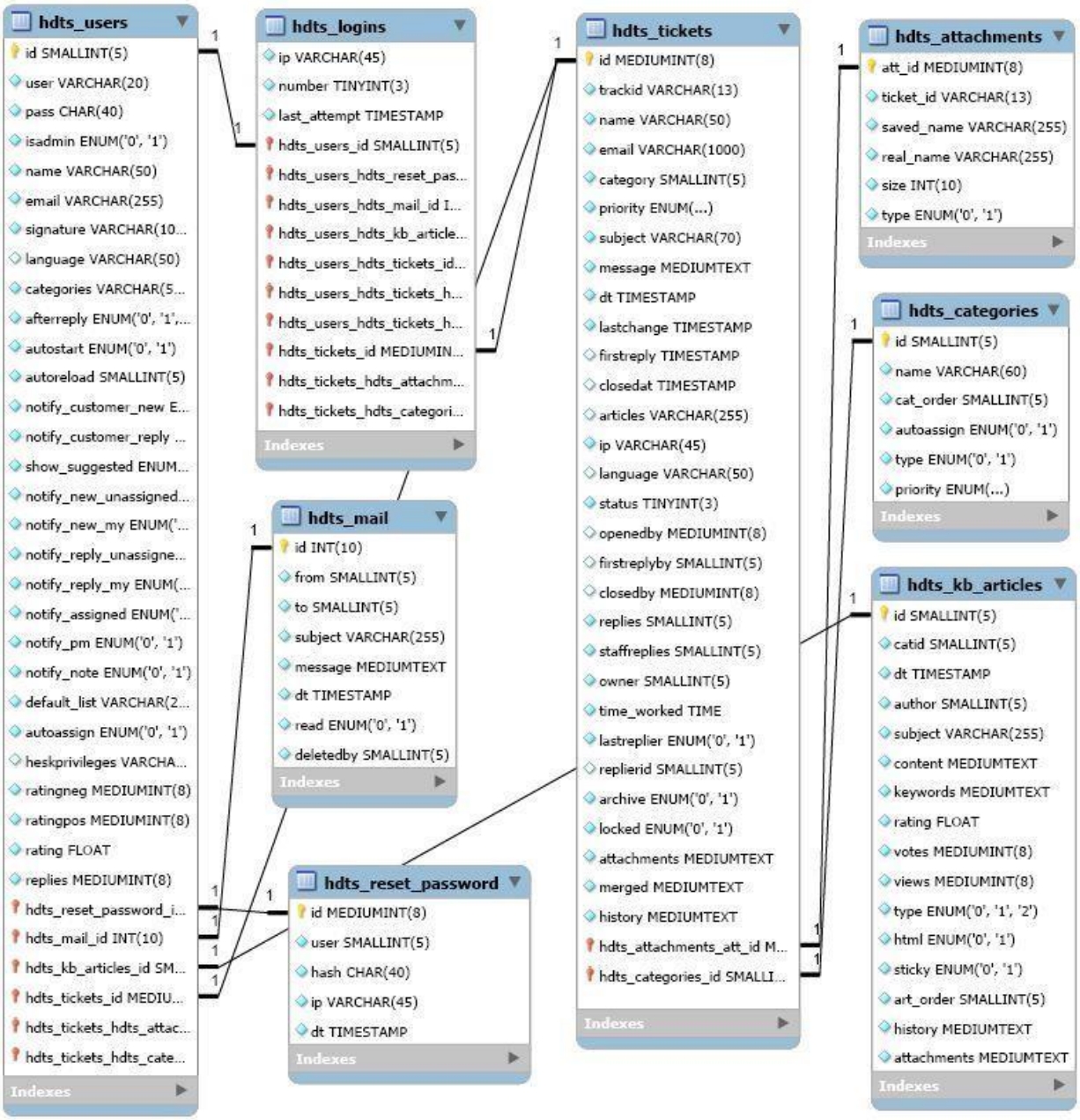


Figure 6.3: ER Diagram

6.4 Design Considerations and Improvements

Refining the logical database design involves considerations related to entities and attributes. To simplify the database schema, entities like 'Helpdesk Administrator' and 'Ticket Assignee' can be combined into one entity named 'Internal Staff.' This entity would have attributes like 'Username' and 'Role' to align with Active Directory integration for user authentication.

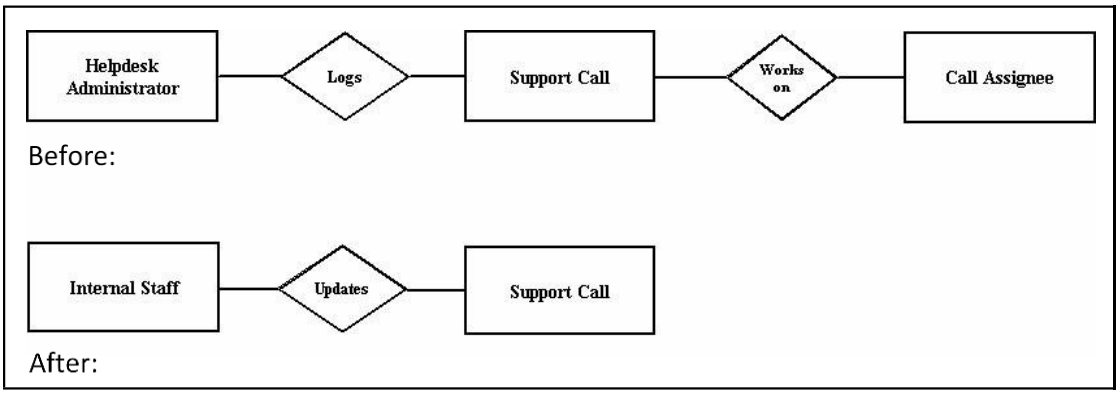


Figure 6.6: Before and after redesign

Data Dictionary and Data Structures

A Data Dictionary is a catalog that provides additional information about the system's elements, such as data flows, processes, and data stores. It's a record of data about data, serving as a common source of definitions for users and investigators. The Data Dictionary stores details like data elements, data structures, and their attributes, ensuring clarity about the format and context of data sets.

Data Elements represent the most fundamental level of data, defining data names, descriptions, aliases, lengths, and values. Data Structures, on the other hand, group related data items that collectively describe system components.

6.5 Conceptual Model to Logical Design Mapping

The transformation from the conceptual model to logical design involves converting entities, relationships, and attributes into corresponding tables, keys, and relationships in the database. This mapping ensures that the logical design accurately represents the conceptual model and maintains the integrity of data storage and retrieval.

6.6 Normalization and Optimization

Normalization is a critical process to eliminate redundancy, anomalies, and inconsistencies in the database schema. By adhering to normalization rules, the database achieves higher levels of organization and efficiency. However, over-normalization can lead to complex queries and slow performance. Therefore, optimization strategies, such as denormalization, indexing, and query optimization, are employed to balance the trade-off between normalized design and system performance.

6.7 Integrity Constraints and Validation

Integrity constraints ensure data accuracy, consistency, and validity within the database. These constraints define rules and limitations for data values and relationships, preventing the entry of incorrect or irrelevant data. Common constraints include primary key constraints, foreign key constraints, unique constraints, and check constraints.

6.8 Data Dictionary and Documentation

A comprehensive data dictionary is developed to provide an organized reference for all data elements, structures, relationships, and constraints within the database. This documentation serves as a valuable resource for developers, administrators, and users to understand the database's structure and functionality.

The logical database design phase transforms the conceptual model into a well-structured, normalized, and constraint-enforced database schema. This design forms the foundation for the physical database implementation, which involves translating the logical design into a format suitable for the chosen database management system.

6.9 Functional Design

The functional design phase outlines the processes required to implement the data structures modeled in the previous phase. While prototypes guide this design, the application's structure should be considered a flexible guide. The design is greatly influenced by the use case diagram developed during the requirements analysis phase (refer to Figure 3.2).

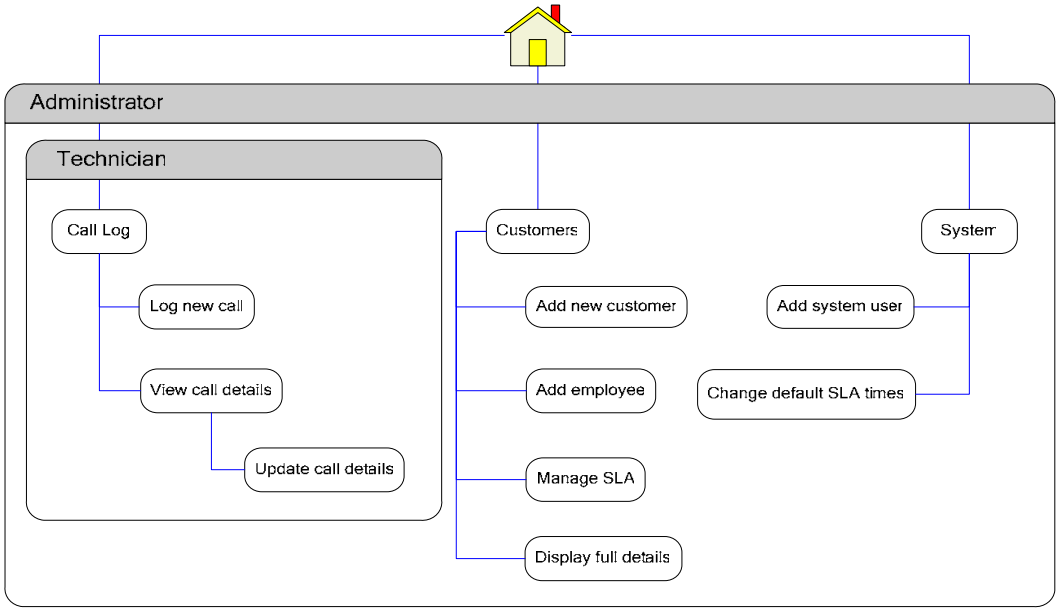


Figure 6.9 Site Structure

The primary user role in this system is the technician, and their main requirements include:

1. **Viewing Device Tickets**: Technicians need to access a page that displays the device tickets.
2. **Viewing Client Details**: Technicians should be able to view client details associated with a device ticket.
3. **Adding Actions to a device ticket**: Technicians must be able to log actions related to a device ticket.

In the system design, these use cases are consolidated under a single section ticketed 'Ticket Log.' Sub-pages within the ticket log section allow technicians to view ticket details and add actions to support tickets. Client details are displayed on the 'View Ticket Details' page to facilitate easy communication when dealing with a support ticket.

IT-Workshop administrators inherit technician functionality but have additional capabilities to manage the ticketing process. The system design caters to these additional features, aligning with the use cases relevant to administrators.

The client in contrast, has a unique use case labeled 'View Ticket Statistics.' While this functionality is not implemented in the initial prototype, it's outlined as a potential future enhancement. If incorporated, it would be a top-level page addition in subsequent versions, maintaining the system's adaptability.

Ticket Log

Central to the system is the ticket logging functionality, allowing users to filter and ticket new tickets. This page, illustrated in Figure 6.8, provides users with the capability to enter ticket details, further enriching the information associated with support requests.

Clients

Addressing the need to log tickets for multiple clients, the clients screen empowers administrators to add new clients and associate employees with them. This feature enables administrators to log tickets for clients and configure Service Level Agreements (SLAs). Clients can have SLAs configured either to default settings or customized contracts with the institution.

System Maintenance

The system maintenance screen facilitates the configuration and management of core system functionality. This includes settings like default SLA response times, priorities, and user authorizations within the organization's network.

6.10 User Interface

To ensure a user-friendly interface addressing Human-Computer Interaction (HCI) concerns, a page template has been developed using CSS and JavaScript. This template organizes components effectively without employing HTML mark-up. The main template, as depicted in Figure 6.9, comprises five distinct areas: header, menu bar, sub-menu, page options menu, and main content.

The header and menu bar remain consistent across the site, while the sub-menu and page options depend on the selected page. The main content area is tailored to the content of the selected page. This consistent structure enhances user navigation and provides a familiar experience.

Figure 6.10 Welcome Page of IT-Workshop CMS

6.11 Email Reminder

The Email Reminder is designed to send notifications to staff members responsible for assigned tickets. Given the need for continuous execution during business hours, a Windows Application running as a scheduled task is chosen to manage this service.

Defining rules for sending emails and reminders is essential. A configuration screen within the 'System' section of the site enables the customization of these rules over time.

The process of sending reminders involves:

1. Reading the database for ticket updates.
2. Identifying tickets with no updates and nearing SLA breach within X minutes.
3. Repeating reminders every Y minutes.
4. Sending a final email when SLA is breached.
5. Repeating the reminder process every minute during the defined working day, according to client SLA.

The outlined email reminder system ensures timely notifications to staff, enhancing the responsiveness of the IT-Workshop Computer Maintenance System.

7.0 SYSTEM IMPLEMENTATION AND TESTING

In this chapter, we delve into the practical aspects of implementing the IT-Workshop Computer Maintenance System and the comprehensive testing procedures that validate its functionality and reliability. The successful implementation of the system is a pivotal step toward achieving the envisioned goals and objectives.

7.1 System Implementation

The implementation phase involves translating the designed system into a functional application that users can interact with. This encompasses coding, database creation, and integrating various components to ensure seamless operation. The adoption of the Laravel framework facilitates efficient backend development, while HTML, Bootstrap5 CSS, and Laravel AdminLTE panel ensure an intuitive and user-friendly frontend interface. Additionally, the use of PHP and MySQL for the backend database aligns with proven industry standards [Skofield, 2014].

- ***Coding***: The application's functionalities are realized through the process of coding, guided by the design specifications. Modular coding practices enhance maintainability and allow for future enhancements. The integration of user authentication, ticket creation, assignment, and communication channels is meticulously executed to ensure a cohesive experience.
- ***Database Creation***: The system's database is structured to store user information, support call details, customer records, and configuration settings. Tables are designed to capture data accurately and efficiently, adhering to relational database principles.
- ***Integration of Components***: Bringing together frontend and backend components is a critical aspect of implementation. The Laravel framework seamlessly merges these components, enabling dynamic data interaction and responsive user interfaces.

7.2 Testing

Testing is a crucial phase to ensure the system performs as intended, meets user requirements, and is free from defects. The testing process encompasses various stages, from unit testing individual components to system-wide testing.

7.2.1 Unit Testing: Individual modules and components are subjected to unit testing to validate their functionality in isolation. This aids in identifying and rectifying bugs and errors at an early stage. For instance, the ticket creation and assignment modules are rigorously tested to ensure proper functioning.

7.2.2 System Testing: System-level testing evaluates the interaction between different modules and components to assess the overall functionality of the IT-Workshop System. Testing scenarios involve creating and managing support calls, assessing user authentication, and verifying communication channels.

7.2.3 Acceptance Testing: Acceptance testing involves real users interacting with the system to validate whether it meets their requirements and expectations. Test scenarios include creating tickets, assigning tasks, and tracking progress. Feedback from users informs any necessary adjustments before the system's full deployment.

7.2.4 Performance Testing: To ensure optimal system performance, various performance tests are conducted. These tests assess response times, load handling, and resource utilization under different conditions. The goal is to ensure the system remains responsive and efficient, even during peak usage.

7.2.5 Security Testing: Security is a paramount concern in any IT system. Rigorous security testing evaluates vulnerabilities, access controls, and data protection mechanisms. This prevents unauthorized access, data breaches, and other security risks.

7.2.6 User Interface (UI) Testing: UI testing ensures that the user interface is intuitive, user-friendly, and visually appealing. Usability tests involve real users navigating through the system to identify any UI-related issues or design flaws.

7.2.7 Regression Testing: As new features are added and modifications are made, regression testing ensures that existing functionalities remain unaffected. This iterative process safeguards against unintended side effects.

By comprehensively testing the IT-Workshop Computer Maintenance System, we ensure its reliability, functionality, security, and user-friendliness. These testing phases provide the necessary confidence to proceed with deployment and user adoption.

8.0 USER MANUAL

The User Manual provides a comprehensive guide for users to effectively navigate and utilize the IT-Workshop Computer Maintenance System. This section outlines step-by-step instructions for various tasks and features within the system, ensuring a smooth user experience. Please refer to the attached screenshots to visualize the process.

8.1 Logging In

1. Open your preferred web browser.
2. Enter the system's URL to access the login page.
3. Provide your registered username and password.
4. Click the "Log In" button to access the system.

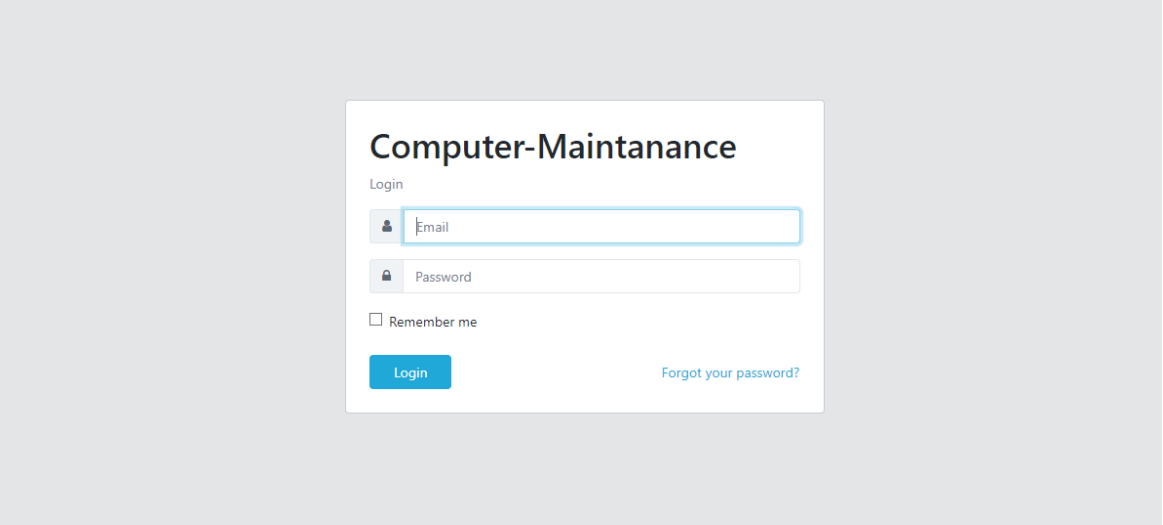


Figure 8.1 Log in page

8.2 Dashboard Overview

After successful login, you'll be directed to the dashboard. Here, you can find an overview of the available tickets: Total tickets in blue, Open tickets in green and Closed tickets in red

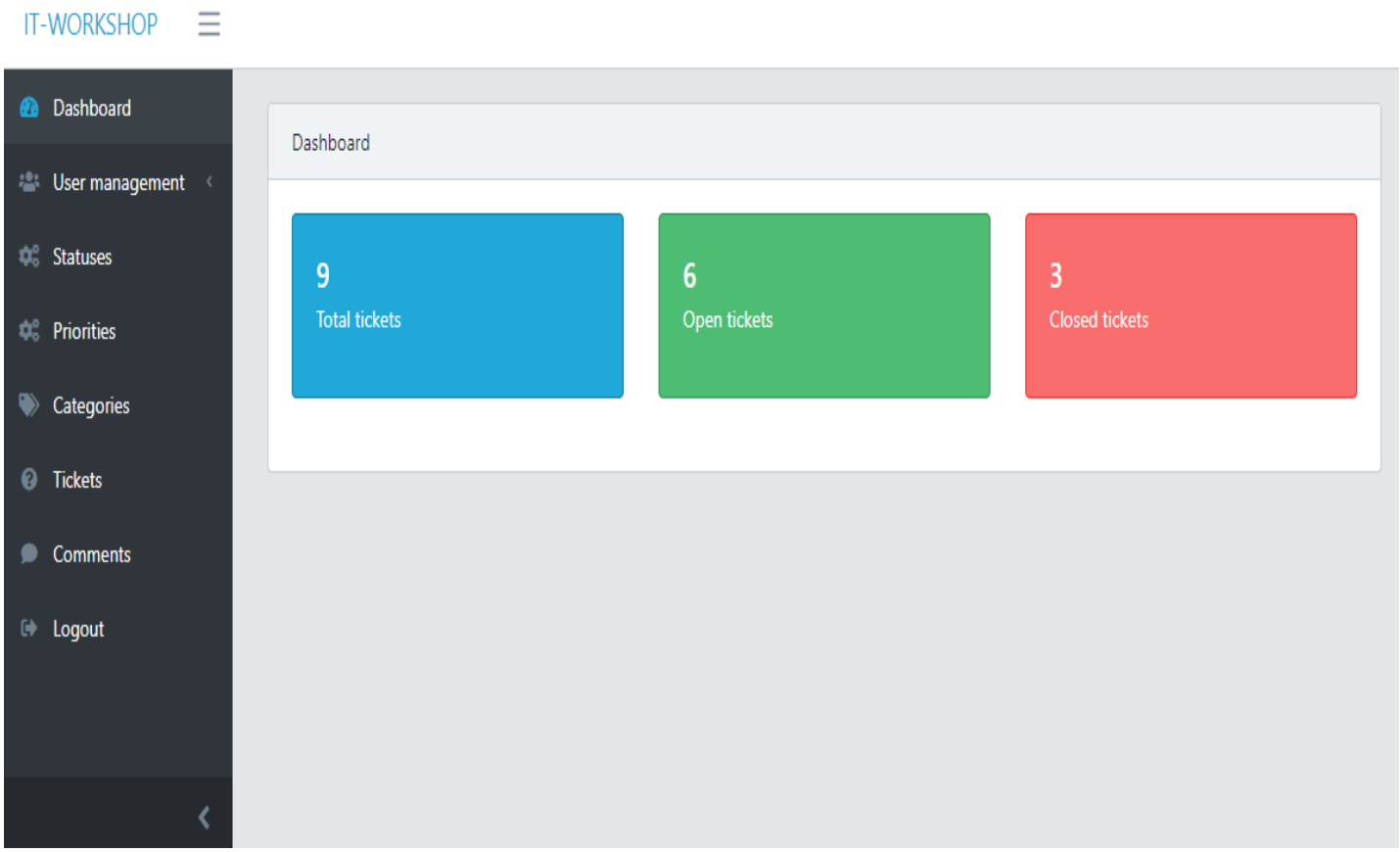


Figure 8.2 Dashboard page overview

8.3 Creating a Device Ticket

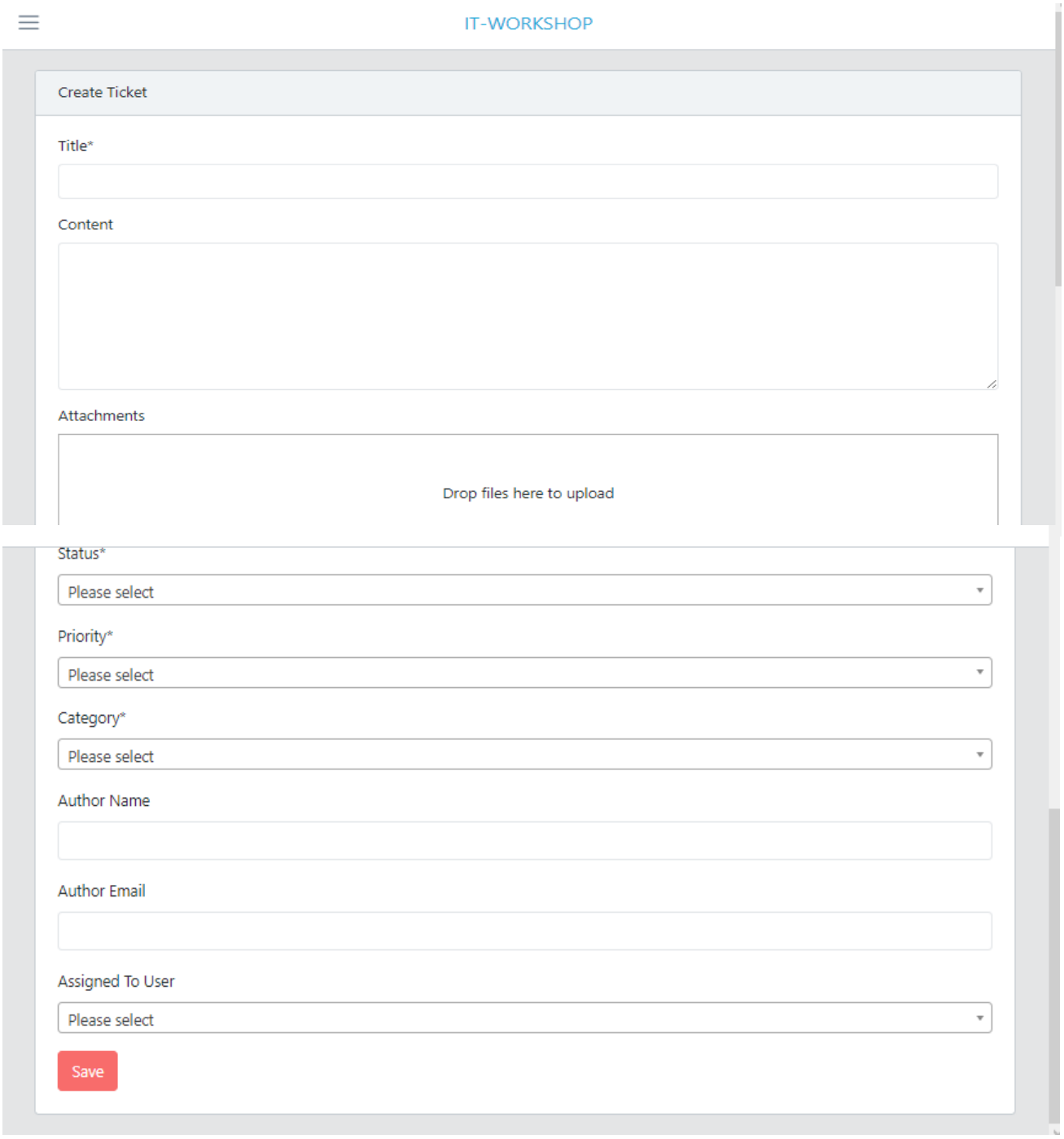


Figure 8.3 Creating Device Ticket

8.4 Viewing and Managing device Tickets

1. Access the "Tickets" section.
2. View a list of your submitted tickets.
3. Click on a ticket to view its details and current status.
4. Communicate with technicians and track progress through the comments section.

8.5 Creating a new User (Admin/Technician)

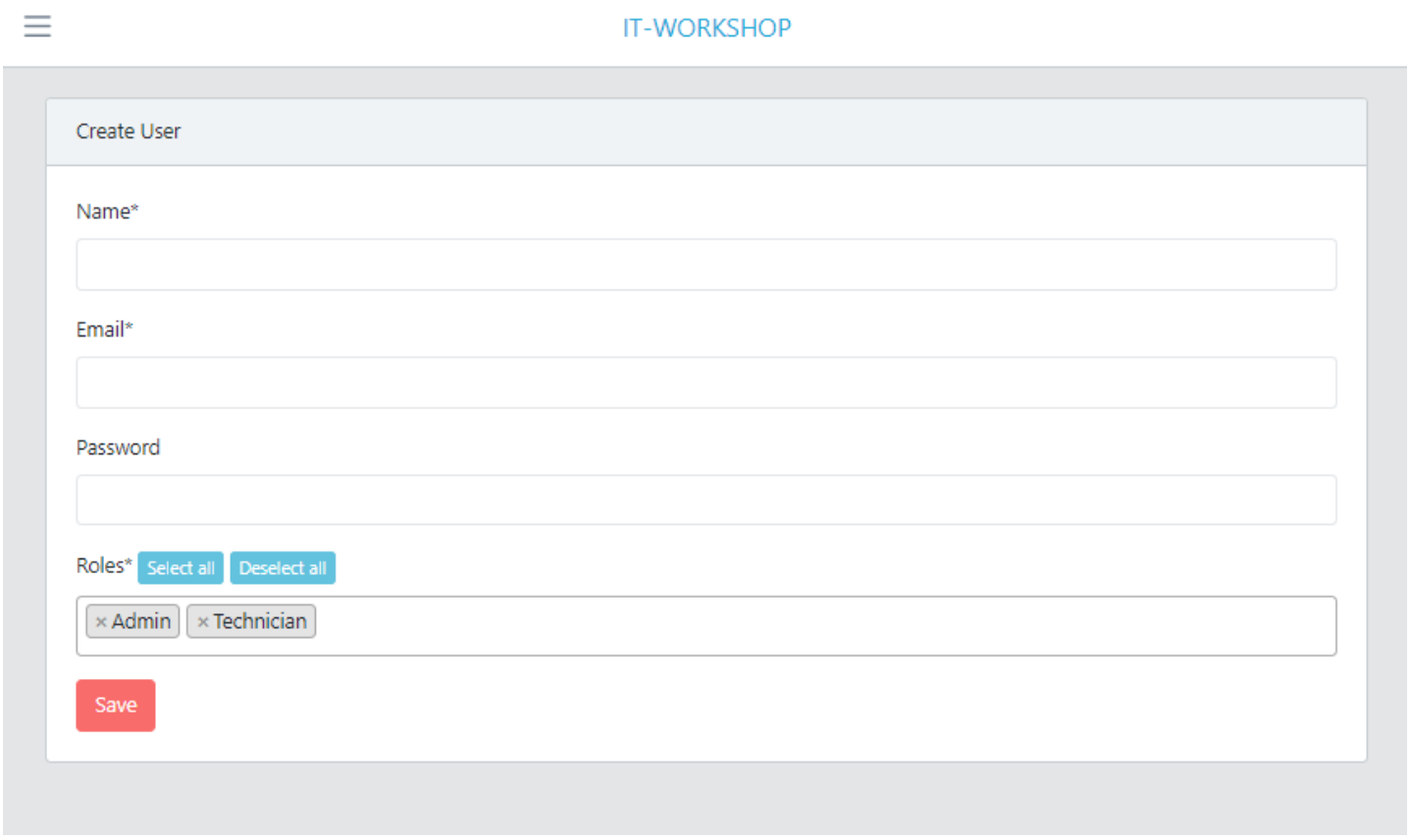


Figure 8.3 Creating a user

8.6 Technician Assignment and Resolution

1. Tickets are assigned to technicians based on expertise and workload.
2. Technicians will update the ticket status as they work on resolving the issue.
3. You'll receive notifications and updates on ticket progress.

8.7 Closing and Rating a Ticket

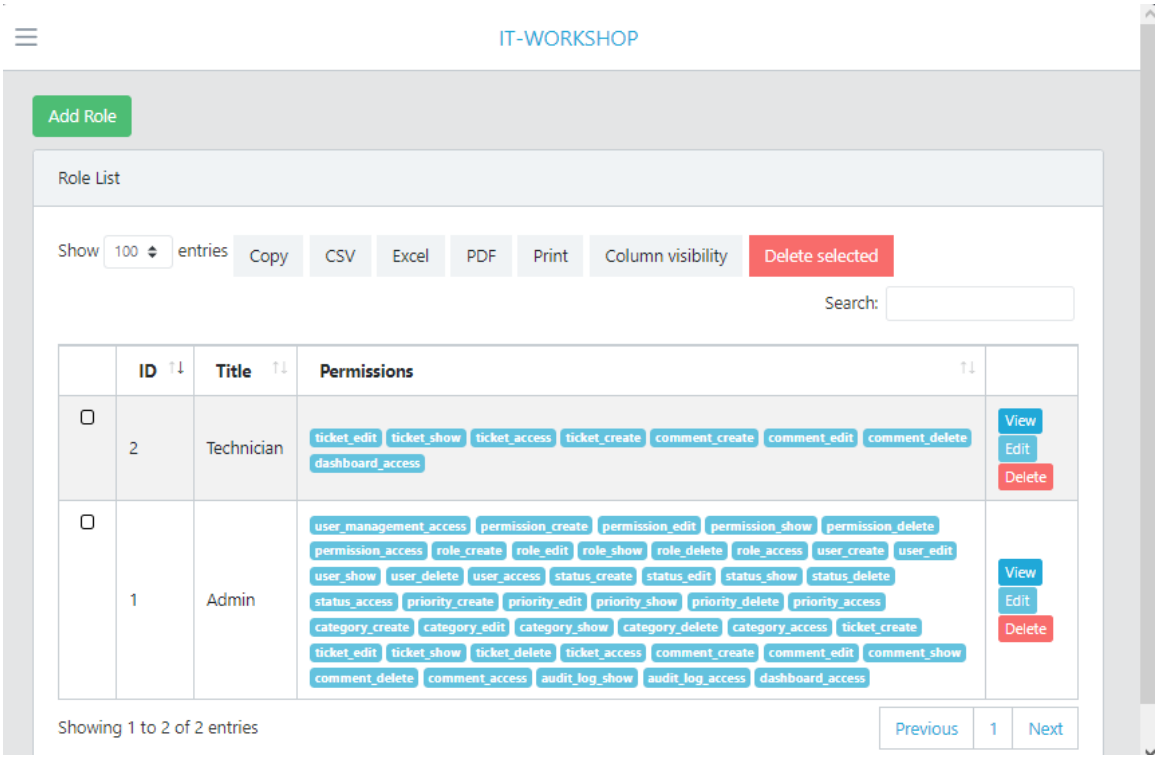
1. Once the issue is resolved, the technician will update the ticket status.
2. Confirm that the problem is resolved and rate the service quality.
3. Provide any additional comments or feedback.
4. Click the "Close Ticket" button.

8.8 User Profile and Settings

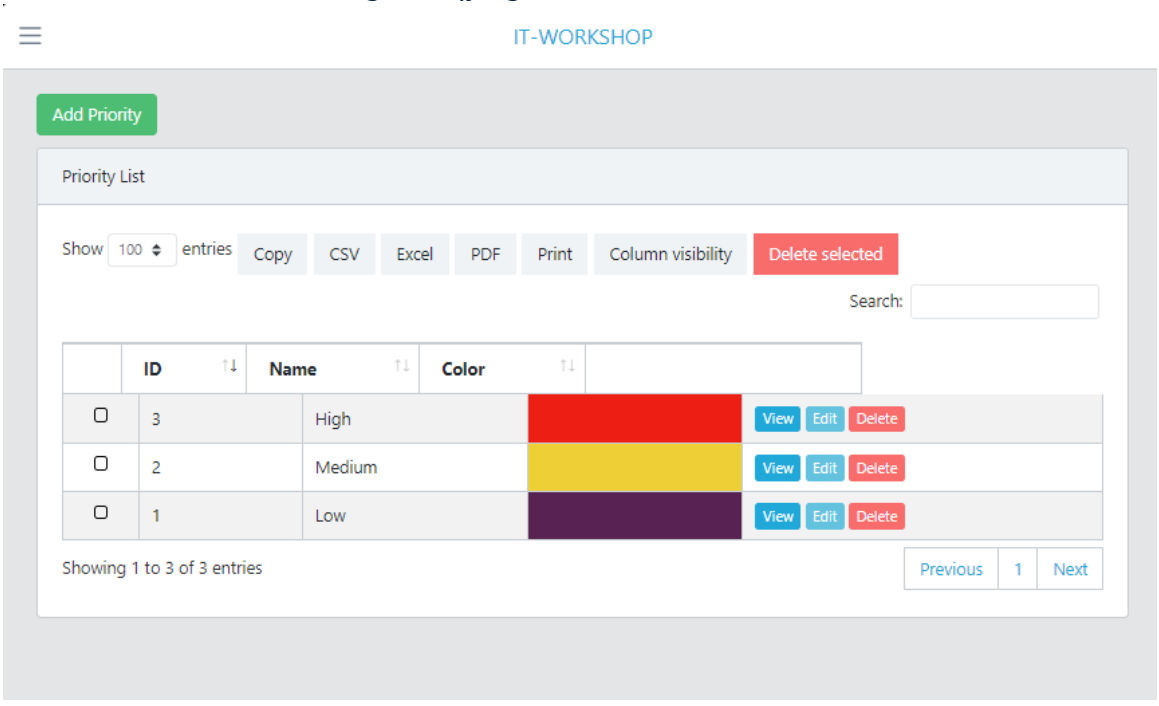
1. Access your user profile by clicking on your name or avatar.
2. View and edit your contact information, including email and phone number.
3. Adjust notification settings to receive updates via email or in-app notifications.

8.9 Other Screenshots

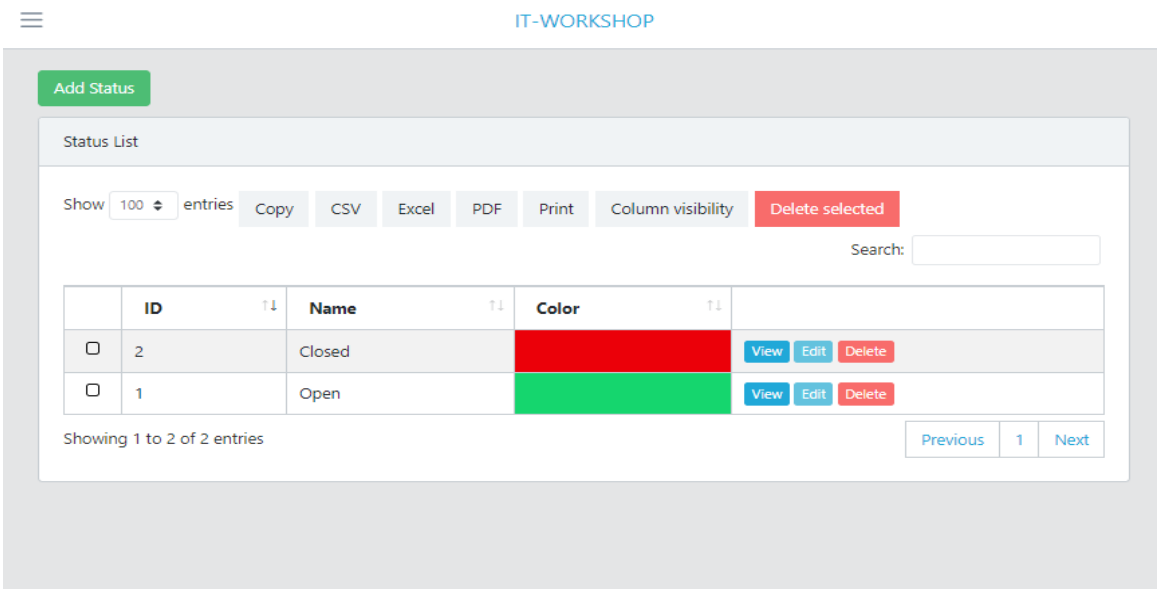
a. Adding User's Roles



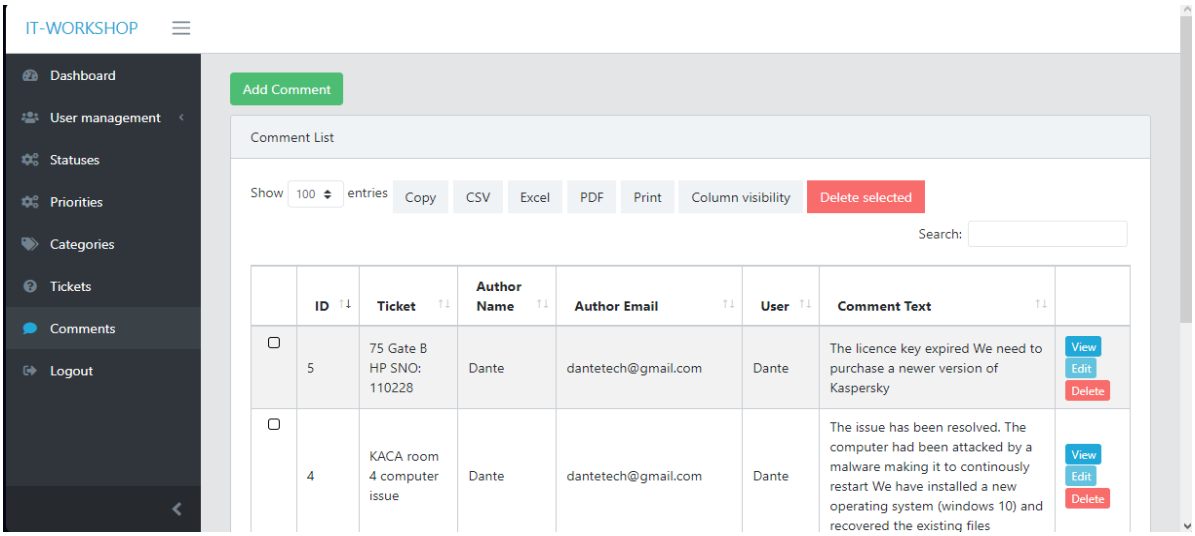
b. Adding/Modifying Ticket Priorities



c. Adding/Managing Ticket's Status



d. Adding Comments/Feedback



8.10 Logging Out

To log out, click on your name or avatar, Select the "Log Out" option to securely exit the system.

This user manual provides a basic overview of the key features and actions within the IT-Workshop Computer Maintenance System. For detailed assistance or specific queries, please contact our support team (*deftec attachees*).

9.0 FUTURE ENHANCEMENTS

The IT-Workshop Computer Maintenance System serves as a foundation for continuous improvement and growth. As technology evolves and user needs change, there are several potential enhancements that could be considered to further elevate the system's capabilities:

9.1 Real-time Notifications

Implement real-time notifications to alert users and technicians about critical issues and updates, ensuring prompt response and resolution.

9.2 Advanced Analytics

Integrate data analytics tools to provide insights into trends, common issues, and areas for improvement, enabling data-driven decision-making.

9.3 Integration with Student Information Systems

Seamlessly integrate the system with other institutional systems, such as student information databases, for enhanced efficiency and cross-functional collaboration.

9.4 Mobile Application

Develop a mobile application to allow users to create and monitor support tickets on-the-go, improving accessibility and user convenience.

9.5 Gamification for User Engagement

Incorporate gamification elements to encourage users to actively participate in the ticketing process, enhancing engagement and user satisfaction.

10.0 CONCLUSION

IT-Workshop Computer Maintenance System has significantly transformed and streamlined the way computer-related issues are reported, tracked, and resolved within the Defence Forces Technical College. The system's user-friendly interface, automated workflows, and efficient communication channels have led to improved efficiency, faster issue resolution, and enhanced user satisfaction.

The adaptability of the system to allow customization of terms as per the institution's principles ensures that it aligns with the unique needs and practices of the college. The inclusion of user service numbers, ranks, and departments further enhances the system's relevance and usability.

We, the DEFTEC Attachees, express our sincere gratitude to the institution for providing us with the opportunity to work on this impactful project. The guidance, resources, and support from the institution and the DEFTEC IT team have been instrumental in the success of the system. We look forward to the possibility of collaborating on more innovative projects in the future, contributing to the institution's ongoing technological advancements.

As the IT-Workshop Computer Maintenance System continues to serve as a cornerstone in IT management, we remain committed to the continuous enhancement and excellence of the system, ensuring that it remains at the forefront of technology-driven solutions within the institution.

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APPENDIX A - REFLECTION

Reflecting on this project, it becomes evident that effective time management is of paramount importance. Not only was it crucial for the successful completion of the project, but also for managing the demands of the industrial attachment. Balancing coursework commitments with project development was a challenge that required careful allocation of spare moments to steadily make progress. Incorporating even brief reading sessions during gaps in module commitments proved valuable in preventing last-minute rushes as deadlines approached.

The opportunity to return to my previous workplace played a significant role in shaping this project. It not only provided a platform to showcase my capabilities for future employment but also allowed me to base the project on real-world scenarios. This experience blurred the line between an employee and a third-party consultant, affording us the chance to cultivate professional relationships and acquire skills crucial for our career. Consequently, we're fortunate to have secured a promising employment opportunity upon post-graduation.

Throughout the attachment period, this project has been a unique opportunity to study a subject of genuine interest. Unlike earlier projects when the curriculum was predefined, the project offered the freedom to explore new technologies and delve into topics that captured our curiosity.

While the project has been enjoyable, it has also tested our collaborative and time management skills. It's imperative to acknowledge the substantial time required for each project deliverable. We've learnt to meticulously plan tasks, initiate work early, and minimize procrastination. These lessons have underscored the significance of effective project management and the necessity to prioritize tasks efficiently.

APPENDIX B – INTERVIEWS

Meeting with IT-Workshop System Administrators

The objective of this meeting was to outline the core objectives of the new IT-Workshop Computer Maintenance System. The purpose was to determine the fundamental requirements and features expected from the system.

Key outcomes of the meeting included:

The new system should:

- Allow logging of device tickets with fields for type and description.
- Facilitate tracking of device tickets.
- Enable ticket escalation with defined deadlines.
- Provide reporting capabilities for client's tickets.
- Assess the success of handling tickets within Service Level Agreements (SLAs).
- Monitor tickets against established SLAs.
- Capture details of ticket resolution.
- Include the possibility of real-time graphs for various statistics.
- Consider potential use on diverse devices, such as mobile phones, tablets, and PDAs.

The interview provided valuable insights into the core functionalities and expectations for the IT-Workshop Computer Maintenance System. These findings have been instrumental in shaping the design and development of the system to meet the organization's specific needs.

APPENDIX C – INTERNAL DOCUMENTATION

Support and Ticket Management Processes

1. ***Problem Logging*** When a user reports a technical issue or submits a device ticket through the IT-Workshop Computer Maintenance System, the help desk staff immediately classify the problem's impact on the user. The problem is then assigned to the most suitable technician based on their skills. For priority calls, a verbal confirmation is made with the assigned technician to ensure they have received the ticket. The ticket is logged in the system, capturing information such as the timestamp of the report, priority level, user's details (service number, rank, and department), assigned technician, and follow-up schedule. The assigned technician becomes responsible for resolving the issue.

2. ***Problem Appraisal*** Upon assignment, the technician reviews the ticket's description to assess the problem. The Service Level Agreement (SLA) guidelines are followed, and the ticket's status might be escalated or de-escalated accordingly. The technician decides on the appropriate action to take, which might involve troubleshooting, repair, or forwarding the issue to a specialized team. The ticket's status is updated to reflect the actions taken. Additionally, the nature of the problem (hardware, network, software, etc.) is identified.

3. ***Problem Confirmation*** As part of the SLA, when the technician investigates the issue, they contact the user to confirm the problem's details and scope. This confirmation serves as the second appraisal, leading to possible status changes. The ticket log is updated with the investigation's outcome and any actions taken. At this stage, if not already identified, the specific nature of the problem (hardware, network, software, etc.) is determined.

4. ***Issue Management*** All tickets are under the oversight of the DS Delivery Director, and escalations are made to this level as per the SLA. The ticket log is consistently updated at all levels, capturing every action taken, including those involving third-party contracts.

5. ***Impact Severity Levels*** To address the diverse impacts and issues covered by the IT-Workshop Computer Maintenance System, severity levels are categorized into three response times:

Severity Level	**Response Time**	**Description**
High	2 hours	The issue severely affects user operations or functionality, such as critical system downtime or total loss of functionality.
Medium	4 hours	The issue has the potential to disrupt operations but is not completely preventing them. This includes performance or functionality problems affecting mission-critical systems.
Low	8 hours	The issue causes minor inconvenience or marginal disruption, primarily affecting non-mission-critical systems.

6. ***Escalation Procedures*** While resolution is not always guaranteed; every effort is made to address customer issues under active support contracts. DS commits to responding to customers within the agreed SLA standards. A track record of successful issue resolution underscores our dedication to customer satisfaction.

These internal documentation processes ensure efficient problem management, effective communication, and adherence to SLA standards within the IT-Workshop Computer Maintenance System. Screenshots of these processes in action are provided in the user manual section

APPENDIX D - REPORTS

i. Categories Report

Computer-Maintanance

	ID	Name	
	18	Microsoft Outlook Mail	View Edit
	17	Internet Issue	View Edit
	16	Faulty Speakers	View Edit
	15	Antivirus	View Edit
	14	Ports	View Edit
	13	Faulty Fan	View Edit
	12	Unlocking	View Edit
	11	Drivers	View Edit
	10	Office 365 Installation	View Edit
	9	Productive Software Installation	View Edit
	8	Operating System Installation	View Edit
	7	Windows Activation	View Edit
	6	Motherboard	View Edit
	5	Display Problem	View Edit
	4	Software Issue	View Edit
	3	Technical question	View Edit
	2	Power Issue	View Edit
	1	Uncategorized	View Edit

ii. System Users Report

Computer-Maintanance

	ID	Name	Email	Roles	
	11	Timothy	timoh@admin.com	Admin	View Edit
	10	Jemutai	jemutai@gmail.com	Technician	View Edit
	9	Brian	brian@gmail.com	Technician	View Edit
	8	Dante	dantetech@gmail.com	Technician	View Edit
	7	Denah	denah@gmail.com	Technician	View Edit
	6	Robert	robert@gmail.com	Admin Technician	View Edit
	5	Isaac	isaaczachary18@gmail.com	Admin	View Edit
	4	Technician-3	tech3@it-workshop.com	Technician	View Edit
	3	Technician-2	tech2@it-workshop	Technician	View Edit
	2	Technician-1	tech1@it-workshop.com	Technician	View Edit
	1	Admin	admin@it-workshop.com	Admin	View Edit

iii. Ticket Logs Report

Computer-Maintanance

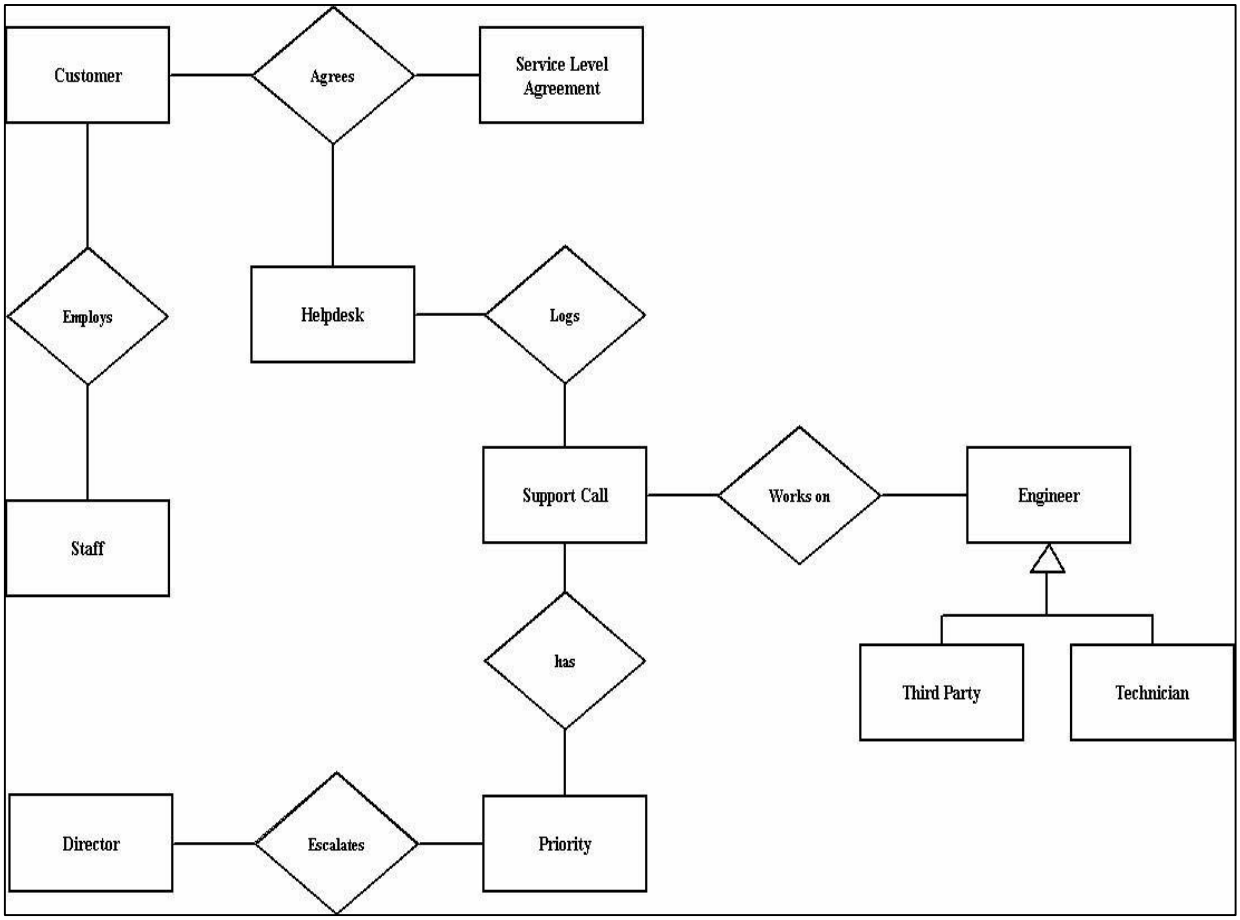
	ID	Description	Subject ID	Subject Type	User ID	Host	Created at	
	14	created	9	App\Ticket	5	127.0.0.1	2023-08-15T06:42:23.000000Z	View
	13	created	8	App\Ticket	5	127.0.0.1	2023-08-15T06:41:41.000000Z	View
	12	created	7	App\Ticket	5	127.0.0.1	2023-08-15T06:39:42.000000Z	View
	11	updated	6	App\Ticket	8	127.0.0.1	2023-08-15T06:11:55.000000Z	View
	10	created	6	App\Ticket	5	127.0.0.1	2023-08-15T06:05:29.000000Z	View
	9	created	5	App\Ticket	5	127.0.0.1	2023-08-10T11:50:43.000000Z	View
	8	created	4	App\Ticket	5	127.0.0.1	2023-08-10T11:35:53.000000Z	View
	7	updated	1	App\Ticket	5	127.0.0.1	2023-08-10T11:33:06.000000Z	View
	6	updated	2	App\Ticket	5	127.0.0.1	2023-08-10T11:32:31.000000Z	View
	5	updated	3	App\Ticket	5	127.0.0.1	2023-08-10T11:32:06.000000Z	View
	4	updated	3	App\Ticket	5	127.0.0.1	2023-08-10T11:26:12.000000Z	View
	3	created	3	App\Ticket	5	127.0.0.1	2023-08-08T07:58:28.000000Z	View
	2	created	2	App\Ticket	5	127.0.0.1	2023-08-08T07:51:06.000000Z	View
	1	created	1	App\Ticket	5	127.0.0.1	2023-08-08T07:50:07.000000Z	View

iv. Feedback/Comments Report

Computer-Maintanance

	ID	Ticket	Author Name	Author Email	User	Comment Text	
	5	75 Gate B HP SNO: 110228	Dante	dantetech@gmail.com	Dante	The licence key expired We need to purchase a newer version of Kaspersky	View Edit
	4	KACA room 4 computer issue	Dante	dantetech@gmail.com	Dante	The issue has been resolved. The computer had been attacked by a malware making it to continously restart We have installed a new operating system (windows 10) and recovered the existing files	View Edit
	3	Power Issue Airframes	Isaac	isaaczachary18@gmail.com	Isaac	There is need to replace the power supply	View Edit
	2	Library Faulty Machine	Isaac	isaaczachary18@gmail.com	Isaac	Issue resolved succesfully	View Edit
	1	Library Faulty Machine	Isaac	isaaczachary18@gmail.com	Isaac	Issue resolved succesfully	View Edit

APPENDIX E – FIRST DRAFT E-R DIAGRAM



APPENDIX F – SAMPLE CODE

App.blade.php

```
<!doctype html>
<html lang="{{ str_replace('_', '-', app()->getLocale()) }}">
<head>
    <meta charset="utf-8">
    <meta name="viewport" content="width=device-width, initial-scale=1">

    <!-- CSRF Token -->
    <meta name="csrf-token" content="{{ csrf_token() }}">

    <title>{{ config('app.name', 'IT-Workshop') }}</title>

    <!-- Fonts -->
    <link rel="dns-prefetch" href="//fonts.gstatic.com">
    <link href="https://fonts.googleapis.com/css?family=Nunito" rel="stylesheet">

    <!-- Styles -->
    <link href="{{ asset('css/app.css') }}" rel="stylesheet">
    <link href="https://cdnjs.cloudflare.com/ajax/libs/dropzone/5.5.1/min/dropzone.min.css" rel="stylesheet" />
</head>
<body>
    <div id="app">
        <nav class="navbar navbar-expand-md navbar-light bg-white shadow-sm">
            <div class="container">
                <a class="navbar-brand" href="{{ url('/') }}">
                    {{ config('app.name', 'IT-Workshop') }}
                </a>
                <button class="navbar-toggler" type="button" data-toggle="collapse" data-target="#navbarSupportedContent" aria-controls="navbarSupportedContent" aria-expanded="false" aria-label="{{ __('Toggle navigation') }}">
                    <span class="navbar-toggler-icon"></span>
                </button>

                <div class="collapse navbar-collapse" id="navbarSupportedContent">
                    <!-- Left Side Of Navbar -->
                    <ul class="navbar-nav mr-auto">
```

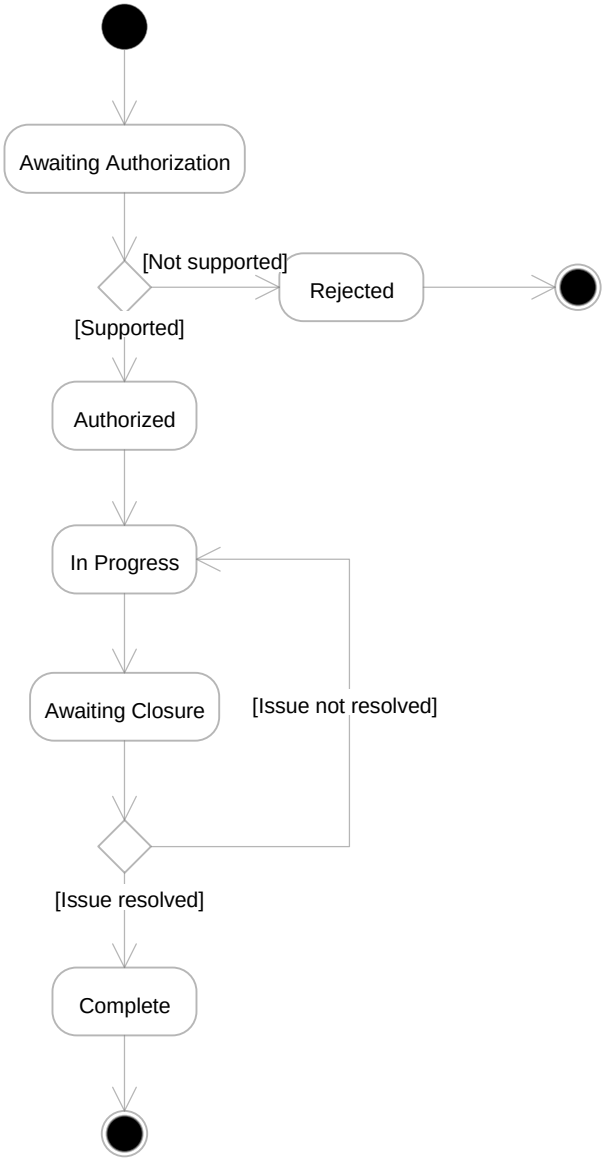
```
37.
38.                     </ul>
39.
40.                     <!-- Right Side Of Navbar -->
41.                     <ul class="navbar-nav ml-auto">
42.                         <!-- Authentication Links -->
43.                         @guest
44.                             <li class="nav-item">
45.                                 <a class="nav-link" href="{{
   route('login') }}">{{ __('Login') }}</a>
46.                             </li>
47.                             @if (Route::has('register'))
48.                                 <li class="nav-item">
49.                                     <a class="nav-link" href="{{
   route('register') }}">{{ __('Register') }}</a>
50.                                 </li>
51.                             @endif
52.                         @else
53.                             <li class="nav-item dropdown">
54.                                 <a id="navbarDropdown" class="nav-link
   dropdown-toggle" href="#" role="button" data-toggle="dropdown" aria-
   haspopup="true" aria-expanded="false" v-pre>
55.                                     {{ Auth::user()->name }} <span
   class="caret"></span>
56.                                 </a>
57.
58.                                 <div class="dropdown-menu dropdown-menu-
   right" aria-labelledby="navbarDropdown">
59.                                     <a class="dropdown-item" href="{{
   route('logout') }}"
60.                                        onclick="event.preventDefault();
61.                                                      document.getElementBy
   Id('logout-form').submit();">
62.                                         {{ __('Logout') }}
63.                                     </a>
64.
65.                                     <form id="logout-form" action="{{
   route('logout') }}" method="POST" style="display: none;">
66.                                         @csrf
67.                                     </form>
68.                                 </div>
69.                             </li>
70.                         @endguest
71.                     </ul>
72.                 </div>
```

```
            </div>
        </nav>

        <main class="py-4">
            @yield('content')F
        </main>
    </div>
    <script src="{{ asset('js/app.js') }}" defer></script>
    <script
src="https://cdnjs.cloudflare.com/ajax/libs/dropzone/5.5.1/min/dropzone.min.js"></script>
    @yield('scripts')
</body>
</html>

```

APPENDIX G – SUPPORT STATUS



UML State chart displaying ticket support status

APPENDIX H – DATA STRUCTURE

Filters

Containing the word:

Table	Rows	Type	Collation	Size	Overhead
audit_logs	14	InnoDB	utf8mb4_unicode_ci	16.0 KiB	-
categories	18	InnoDB	utf8mb4_unicode_ci	16.0 KiB	-
comments	5	InnoDB	utf8mb4_unicode_ci	48.0 KiB	-
media	0	InnoDB	utf8mb4_unicode_ci	32.0 KiB	-
migrations	20	InnoDB	utf8mb4_unicode_ci	16.0 KiB	-
oauth_access_tokens	0	InnoDB	utf8mb4_unicode_ci	32.0 KiB	-
oauth_auth_codes	0	InnoDB	utf8mb4_unicode_ci	32.0 KiB	-
oauth_clients	0	InnoDB	utf8mb4_unicode_ci	32.0 KiB	-
oauth_personal_access_clients	0	InnoDB	utf8mb4_unicode_ci	16.0 KiB	-
oauth_refresh_tokens	0	InnoDB	utf8mb4_unicode_ci	32.0 KiB	-
password_resets	0	InnoDB	utf8mb4_unicode_ci	32.0 KiB	-
permissions	44	InnoDB	utf8mb4_unicode_ci	16.0 KiB	-
permission_role	52	InnoDB	utf8mb4_unicode_ci	48.0 KiB	-
priorities	3	InnoDB	utf8mb4_unicode_ci	16.0 KiB	-
roles	2	InnoDB	utf8mb4_unicode_ci	16.0 KiB	-
role_user	12	InnoDB	utf8mb4_unicode_ci	48.0 KiB	-
statuses	2	InnoDB	utf8mb4_unicode_ci	16.0 KiB	-
tickets	9	InnoDB	utf8mb4_unicode_ci	80.0 KiB	-
users	11	InnoDB	utf8mb4_unicode_ci	32.0 KiB	-
19 tables	192	InnoDB	utf8mb4_general_ci	576.0 KiB	0 B

APPENDIX I – TEAM MEMBERS AND BIOGRAPHIES

This appendix provides brief biographies of the team members who worked on the development of the IT-Workshop Computer Maintenance System.

Team Members:

1. **Robert Ndeke**
    - University: SEKU
    - Course: BSc. Computer Science
    - Contact: 0746191110
2. **Duncan Zevai**
    - University: Daystar
    - Course: D.ICT
    - Contact: 0717126889
3. **Jemutai Faith**
    - University: KCAU
    - Course: BSc. IT
    - Contact: 0745937680
4. **Brian Nthuku**
    - University: Meru
    - Course: BSc. Computer Security & Forensics
    - Contact: 0741698380
5. **Anold Dena**
    - University: Catholic
    - Course: BSc. Computer Science
    - Contact: 0705073697
6. **Isaac Zachary**
    - University: KCAU
    - Course: BSc. Software Development
    - Contact: 0101029951
7. **Mishael Timothy**
    - University: KCAU
    - Course: BSc. IT
    - Contact: 0758405888

These team members collectively contributed their expertise and dedication to the successful development of the IT-Workshop Computer Maintenance System. Each member brought unique skills and perspectives, making this project a collaborative effort.