Department of Computer Science & Engineering
The University of Texas at Arlington

Project Charter
CSE 4316: Senior Design I
Fall 2023

Theater Ops
SETS

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Revision History

Revision	Date	Author(s)	Description
0.1	10.03.2023	Team	Document Creation
0.2	10.05.2023	Team	Complete Draft
1.0	10.06.2023	Team	Document Submission

CONTENTS

List of Figures

1 Problem Statement

Within contemporary healthcare settings, the unpredictability of surgical equipment availability poses a significant challenge. Surgical teams frequently confront scenarios where essential tools are misplaced or not immediately accessible, leading to potential delays in procedures and, in some cases, compromising patient safety. This predicament not only strains the healthcare providers but also affects the overall efficiency and effectiveness of patient care. Solving this problem would streamline surgical processes, elevate the standard of care, enhance patient safety, and potentially lead to financial savings by reducing prolonged procedure times and associated costs.

2 Methodology

For our senior design project, we intend to develop a Smart Surgical Equipment Management System. This system will harness the power of technology to address the prevalent issue of surgical equipment mismanagement in healthcare settings. Our solution revolves around the creation of a web-based platform that will offer real-time tracking of surgical equipment. Utilizing RFID technology, each piece of equipment will be tagged and its location monitored in real-time. Additionally, our platform will foster instant communication between different hospital sections, such as operating rooms and sterilization units, ensuring that equipment is promptly available when required. Through this approach, our project aims to drastically reduce equipment-related delays and enhance the efficiency and safety of surgical procedures.

3 Value Proposition

The Surgical Equipment Tracking System is designed to streamline and optimize hospital operations. For the hospital itself, the system provides a faster and more efficient way to locate and manage surgical equipment. This directly means quicker surgeries and fewer delays, enabling the hospital to handle more procedures in a day.

A significant cost-saving advantage is the reduction in lost or misplaced equipment. Every piece of surgical equipment is valuable, and with our system, chances of them going missing are drastically reduced. Also, by tracking how each item is used, the hospital can better maintain and extend the life of its equipment, leading to further cost savings.

From the patient's perspective, quicker surgeries mean reduced waiting times and potentially shorter hospital stays. This boosts patient satisfaction, and in turn, the hospital's reputation. For regulatory bodies, our system provides real-time data, allowing the hospital to showcase its improved efficiency and commitment to top-tier healthcare delivery.

The academic community, including our university and instructors, benefits from this project as it offers a live case study. It demonstrates how classroom knowledge can tackle real-world challenges. Our university can use the project's success to highlight its dedication to hands-on learning and innovation. For our sponsors, supporting this initiative positions them at the forefront of healthcare innovation, enhancing their brand image. It also reflects their dedication to advancing societal welfare through improved healthcare systems.

In essence, the Surgical Equipment Tracking System is a win-win for all involved. It promises a future where hospitals operate more smoothly, with tech and healthcare working hand in hand for the greater good.

4 Development Milestones

This list of core project milestones should include all major documents, demonstration of major project features, and associated deadlines. Any date that has not yet been officially scheduled at the time of preparing this document may be listed by month.

Provide a list of milestones and completion dates in the following format:

- Project Charter first draft - 09/23
- System Requirements Specification - 10/23
- Architectural Design Specification - 11/23
- Demonstration of the Hardware of the Tracking Devices - 11/23
- Demonstration of User Interface Integrated with Database - 01/24
- Detailed Design Specification - 02/24
- Demonstration of Back-end and Middleware - 03/24
- CoE Innovation Day poster presentation - 04/24
- Demonstration of a working website - 04/24
- Final Project Demonstration - 04/24

5 BACKGROUND

The modern healthcare system, a marvel of technological and medical advancements, still grapples with challenges that seem rudimentary yet have significant consequences - the efficient management of surgical equipment. Operating rooms, which are at the heart of surgical departments, are high-pressure environments. Every second count, and any delay, no matter how minute, can influence patient outcomes. In these critical settings, the seamless availability and organization of surgical tools are paramount.

However, conversations with healthcare professionals, coupled with research and field observations, have revealed a consistent pattern of inefficiencies. Surgical teams often report delays due to misplaced or unavailable surgical equipment. Such disruptions not only cause procedural delays but also escalate the stress in an already intense environment, potentially leading to errors and impacting patient safety.

The business case for addressing this problem is compelling. Operating rooms are expensive to run. According to a report by the American Hospital Association, the average cost per minute in an operating room can range from $15 to $20, meaning even a 10-minute delay can lead to losses of up to $200 for a single procedure. When you scale this across multiple surgeries and institutions, the cumulative financial impact is staggering. Beyond the direct monetary implications, there's the cost of reduced patient throughput, potential complications arising from delays, and reputational damage for the hospital.

Our project's genesis lies in these observations and the explicit need for a solution. Our primary customer, in this case, would be hospitals and healthcare institutions, particularly their surgical departments. They stand to benefit immensely from a real-time surgical equipment tracking system, not only in terms of operational efficiencies but also in improved patient care and safety. While our team currently operates independently without a direct relationship with a specific healthcare institution, our intent and design approach are rooted in universal challenges faced by many such entities.

Additionally, as computer science students, we bring a unique blend of tech-centric problem-solving skills. Our approach isn't just about creating a tool but introducing a paradigm shift in how surgical equipment is managed. In an era where technology is revolutionizing industries, our project aims to bring a slice of this innovation to operating rooms across the globe, ensuring surgeries are conducted more smoothly, efficiently, and safely.

6 RELATED WORK

State-of-the-Art: RFID-Based Hospital Equipment Tracking System Radio Frequency Identification (RFID) technology has been extensively studied and implemented in various fields, including supply chain management, retail, and healthcare. [4] Within the realm of healthcare, one of its primary uses has been for tracking medical equipments, ensuring its proper availability, and minimizing loss or misplacement.

Existing Solutions:

Academic Research: Numerous studies have assessed the benefits and challenges of implementing RFID in hospitals. A study by Wylie Wong demonstrated that using wireless communication to identify and track people and equipment, has been seen as a strong adoption in healthcare in recent years. The article elaborates the use of RFID to separate new born babies to ensure that their safety and prevent accidental switching that might occur. [4] RFID implementation has improved equipment visibility and reduced search times for medical staff. However, it also pointed out challenges like interference with other medical equipment and the need for periodic maintenance. RFID technology is very promising for the healthcare industry but, there are several risks or barriers that impede the implementation of this technology which includes economic, technical, organizational, and legal challenges. [3]

Enthusiast Prototype: Several tech enthusiasts have developed prototype systems using off-the-shelf RFID components. For instance, blogs or forums often discuss using Raspberry Pi or Arduino for

basic RFID tracking. [1]

Commercially Available: Commercial RFID solutions tailored for healthcare are also available. They offer comprehensive systems, often combined with other tracking technologies, to offer layered visibility solutions.

Integrated Systems: Some Hospital Management Systems (HMS) are now integrating RFID tracking as an additional module. For instance, systems like EPIC or Cerner have begun dabbling in offering tracking solutions, although they're not always as specialized as standalone systems.

Why Existing Solutions Might Not Be Adequate:

Cost Prohibitive: Some commercially available solutions are expensive, especially when considering implementation across large hospital chains. This is often due to the proprietary nature of the software or specialized hardware requirements. [3]

Lack of Integration: Many standalone RFID solutions don't seamlessly integrate with existing Hospital Management Systems, requiring manual data entry or transfer, leading to inefficiencies.

Performance and Reliability Issues: Certain RFID systems might suffer from interference in a hospital environment due to the presence of numerous electronic devices. This could lead to unreliable readings or misplacements.

Scalability: Some solutions might not be scalable or flexible enough to meet the growing demands or changes in a dynamic hospital environment.

In conclusion, while there are numerous existing solutions for RFID-based equipment tracking in hospitals, there's a gap in terms of cost, integration, performance, and scalability. [2] This presents an opportunity to develop a more robust, cost-effective, and integrated system tailored specifically for healthcare environments.

7 System Overview

Our solution seeks to merge the real-world actions of surgical procedures with digital oversight, ensuring that every movement, status change, and allocation of surgical equipment is tracked in real time. Here's a breakdown of how we're making that happen:

1. The Role of RFID Tags and Readers RFID Tags: Think of these as digital name badges for each piece of surgical equipment. Every instrument, no matter how big or small, gets its own unique tag. This tag is like the equipment's "voice," allowing it to "shout out" its identity and location.

RFID Readers: These are like "listeners" placed throughout the hospital, especially in operating rooms and equipment storage areas. Whenever an equipment (with its tag) passes by, the reader hears it and takes note of its location.

2. Middleware With all the "shouting" from equipment and "listening" by the readers, there's going to be a lot of noise. The middleware is the genius in the middle that sorts through this noise. It figures out which updates are important and which are repetitive or unnecessary. By doing this, it ensures that only the most critical updates get passed along to our main digital platform.

3. Web-based Management System Backend: This is like the brain of our digital platform. It receives the important updates from the middleware, processes them, and then updates our records in the database. It ensures that the digital representation of each equipment piece's location and status is always up-to-date.

Frontend: This is the window through which hospital staff can see into our digital command center. It's designed to be intuitive, so anyone, whether they're tech-savvy or not, can quickly find out where a particular piece of equipment is, or check the status of all equipment in a particular room or ward.

4.Database: Every movement, every status change, and every allocation is remembered here. It's a secure and organized storage system that can be queried at any moment to fetch historical data or generate reports.

5.How It All Comes Together: Imagine a surgeon needs a specific instrument immediately. A nurse would simply check the frontend interface to see its exact location, ensuring the instrument is available and sterile. If an instrument is moved from one room to another, the RFID tag and reader communicate this movement, the middleware processes the update, and the digital command center (backend) updates our digital memory (database). All of this happens in real-time, ensuring efficiency and safety are always maintained.

6.Diagram of Major System Components:

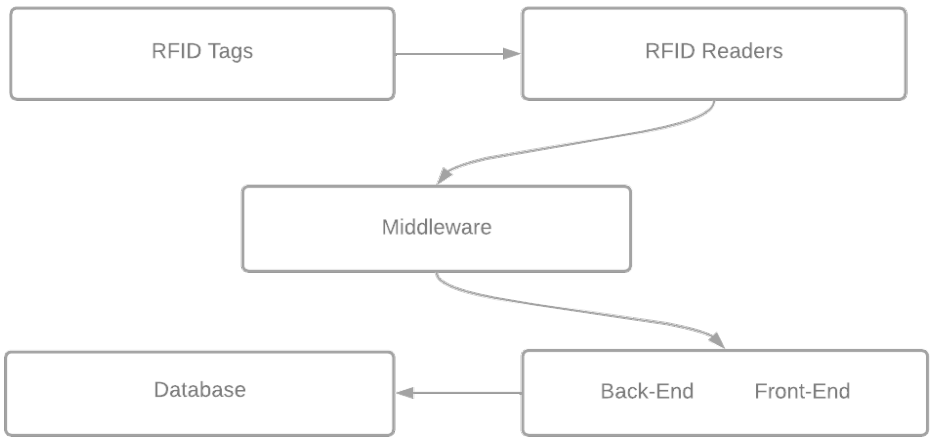

Figure 1: Architectural Design

8 Roles & Responsibilities

The development of the Surgical Equipment Tracking System is a multifaceted endeavor that hinges on the clarity of roles and effective engagement with stakeholders. Foremost among our stakeholders are Healthcare Institutions which serve both as users and evaluators of our system. It is vital that our solutions align with their operational ethos, technological infrastructure, and patient care paradigms. Surgical teams, consisting of surgeons, nurses, and technicians, bring forth the operational nuances necessary for refining the system, while patients represent the end beneficiaries. It is our aim to ensure enhanced surgical procedures and patient safety outcomes. In parallel, regulatory bodies provide the crucial framework to ensure the system's compliance with healthcare standards, and project sponsors offer strategic and financial support, looking ahead to the system's efficiency and scalability.

For seamless execution and alignment, our project relies on two primary points of contact: Adrian, Biomedical Tech Lead at Arlington Memorial Hospital, and Chris Conly, our Senior Design Instructor. Adrian will provide invaluable insights from the operational front of a surgical environment. Chris Conly will ensure the project not only meets academic rigors and standards but also ensure that we have the expected product ready to use. Their expertise and guidance will be instrumental in bridging the gap between academic objectives and real-world application. At the operational level, the project team is led by Rachana Pandey, the Project Manager. The team's composition includes Mujaddad Fazeel in frontend development, and Wasif Swapnil and Hanumath Ponnaluri in backend development, ensuring a responsive and reliable system, while Ammar Baig and Sonum in database management focusing on creating the database, maintaining data integrity and data security, in tandem with integrating RFID technology.

Our project strategy embraces the agile methodology, prioritizing adaptability and continuous feed-

back. Roles of Product Owner and Scrum Master, both crucial in an agile setup, will rotate among team members every sprint. This not only ensures that diverse perspectives shape the project's direction, but also fosters a sense of collective ownership and responsibility, aligning all efforts towards successful project completion.

9 Cost Proposal

This section contains the approximate budget for the project, where that money will come from, and any other support. This text should be replaced with a discussion and justification of major expenses, but not the actual monetary amounts (that will go in the preliminary budget section below).

9.1 Preliminary Budget

Components	Type	Cost
RFID tags	Hardware	$55.80 (200 pcs)
Clear Stream	Middleware	$50
RFID Readers (Hand-held)	Hardware	$500 x 1
RFID Readers (Access Points)	Hardware	$200 (2 pcs)
Frontend (React)	Software	——
Backend (NodeJS)	Software	——
Database (MongoDB)	Software	——

Table 1: Preliminary Budget

9.2 Current & Pending Support

Funding source	Institution	Amount
CSE Department	University of Texas at Arlington	$800

Table 2: Current & Pending Support

10 Facilities & Equipment

Required Infrastructure and Equipment for the Project: To develop and effectively test the RFID-based Hospital Equipment Tracking System, specific infrastructural and equipment needs must be addressed. Here's an outline of those needs:

Lab Space:

RFID Development Lab: An isolated space is essential to set up RFID readers, test equipment with tags, and assess the system's robustness without interference. It would serve as the primary development and testing ground for the system.

Testing Grounds:

Simulated Hospital Environment: A space mimicking a real hospital environment, complete with operating rooms, storage areas, and patient rooms. This will allow us to test how effectively the system tracks equipment in a real-world setting.

Makerspaces: Working Area: Given that the project may require tweaks to the hardware (like customizing RFID tag placements or reader setups), having access to a makerspace to work with the group will be invaluable.

Equipment Needed: Essential components of the system include RFID tags, Handheld Readers for RFID, and Fixed Readers for RFID. For the software, we will also be needing a license of Clear Stream.

Middleware Servers: These will host the middleware that processes data from RFID readers. **Acquisition:** If the development lab doesn't have servers, it might be necessary to purchase or lease them. Cloud options could also be explored for scalability.

Integration Systems: Computers or workstations to integrate RFID data with the hospital management system backend.

Network Equipment: To ensure seamless communication between RFID readers, middleware, and backend systems. **Acquisition:** Existing lab equipment can be used. However, for the simulated hospital environment, additional equipment might need to be leased or purchased.

Monitoring and Analysis Tools: Software and hardware tools to monitor and analyze the system's performance. **Acquisition:** Software licenses i.e. Clear Stream, can be purchased, while any specialized hardware can either be borrowed or leased, depending on the project's duration.

In Conclusion: A combination of a dedicated development lab, a simulated hospital environment, and access to a makerspace will be essential for this project. While some equipment is available in the lab, additional components, particularly specialized RFID tags and readers, will need to be procured. Budgeting and planning for these requirements early on will ensure the project's smooth progression.

11 Assumptions

- The team lacks experience with RFID tracking systems, so a significant portion of the project will be dedicated to understanding RFID.
- Given that no team members have prior experience with middleware, we expect a substantial learning period.
- It's crucial to order RFID tags in bulk, as initial tags might face compatibility or functionality issues.
- The app should have secure user authentication to ensure that only authorized personnel can access the tracking system.
- The application is anticipated to seamlessly integrate with the hospital's existing database systems, ensuring accurate equipment tracking and utilization records.
- Given the real-time tracking nature of the system, both the web app and the RFID infrastructure will likely require ongoing maintenance.

12 Constraints

Key Constraints Related to the Surgical Equipment Tracking System Implementation:

- **Implementation Deadline:** The foremost constraint is time. The system's successful deployment and integration at Smart Hospital (our potential partner) must be achieved by April 2024. This limits our development, testing, and refinement phases, demanding effective project management and timely decision-making.
- **Resource Availability:** Our system's design and deployment hinge on the hospital's technical staff's active involvement. Given their concurrent responsibilities, scheduling their time, gaining insights, and having their hands-on assistance during the project's key phases can be a challenge.
- **Hospital Access Limitations:** We're restricted in terms of when we can access vital areas within the hospital, such as operating rooms or ICUs. This narrows our window for on-site activities, including system setup and testing.

- **Budgetary Constraint:** Financial constraints always necessitate judicious allocation of resources. With an upper limit of 800 dollars for the system's complete lifecycle, from ideation to deployment, we need to be strategic in sourcing materials, managing manpower, and factoring in contingencies.
- **Data Privacy and Security:** Patient confidentiality and data security are non-negotiable in healthcare. While working with the hospital's system, we are bound by stringent data review protocols by the Data Privacy and Compliance Office. Moreover, to align with medical data protection guidelines, our tracking system is explicitly designed to avoid accessing or storing any patient data
- **Skill Set Limitation:** Our team's composition lacks a Computer Engineering student, presenting a gap in hardware programming expertise. This constraint might necessitate additional training or external collaboration to bridge this knowledge deficit.
- **System Performance Scope:** There are unanswered specifics regarding the system's performance metrics. This includes the exact count of RFID readers to be deployed, the time latency acceptable between an item's movement and its updated location in the database, and the potential number of simultaneous users for the web interface.

13 Risks

The following high-level risk census contains identified project risks with the highest exposure. Mitigation strategies will be discussed in future planning sessions.

Risk description	Probability	Loss (days)	Exposure (days)
Integration with Hospital Systems	0.60	25	15
Staff Resistance to New Technology	0.50	20	10
Inaccuracies in Real-time Tracking	0.40	15	6
Interference with Other Medical Devices	0.20	30	6
Data Security and Privacy Concerns	0.25	20	5

Table 3: Overview of highest exposure project risks

14 Documentation & Reporting

14.1 Major Documentation Deliverables

14.1.1 Project Charter

The project charter will be maintained and updated collaboratively by the entire team to ensure collective agreement and understanding. Any modifications to the charter will be made under specific circumstances, such as changes in deadlines, adjustments to logos, updates to descriptions, alterations in the tech stack, or shifts in the project budget. The initial version of the charter is scheduled for delivery on October 6, 2023. We anticipate delivering the final version in April 2024.

14.1.2 System Requirements Specification

The systems requirement specification (SRS) document will be maintained and updated collectively by the entire team, ensuring that all members are aligned with the changes. Updates to the SRS will occur under specific circumstances, notably when there are modifications to project deadlines or alterations in the system requirements. The initial version of the SRS is slated for delivery on October 24, 2023.

14.1.3 Architectural Design Specification

The Architectural Design Specification document will be maintained and updated collectively by the entire team, ensuring that all members are aligned with the changes. Updates to the Architectural Design Specification will occur under specific circumstances, notably when there are modifications to project deadlines or alterations in the system requirements. The initial version of the Architectural Design Specification is slated for delivery on November 17, 2023.

14.1.4 Detailed Design Specification

The Detailed Design Specification document will be maintained and updated collectively by the entire team, ensuring that all members are aligned with the changes. Updates to the Detailed Design Specification will occur under specific circumstances, notably when there are modifications to project deadlines or alterations in the system requirements. The initial version of the Detailed Design Specification is slated for delivery on February 28, 2024.

14.2 Recurring Sprint Items

14.2.1 Product Backlog

Items will be added to the product backlog from the Systems Requirement Specification (SRS) by extracting specific features, functionalities, and system requirements outlined in the SRS. Each item will be described in sufficient detail, ensuring that the development team understands the expectations.

Prioritization of items in the product backlog will be based on several factors, including business value and impact on end-users, technical dependencies between items, complexity and estimated effort for implementation, and feedback from stakeholders and potential risks associated.

The decision to prioritize and select items for development will be made by the product owner, who possesses a comprehensive understanding of the product vision and stakeholder needs. However, the product owner may consult with the team and occasionally opt for a group vote on contentious items to ensure collective agreement and buy-in.

For maintaining and sharing the product backlog, we will use Jira. These platforms offer real-time collaboration, transparency, and provide tools for backlog grooming, sprint planning, and progress tracking. They also enable easy sharing with both team members and stakeholders, ensuring everyone is updated on the project's status and priorities.

14.2.2 Sprint Planning

Sprint planning begins with a pre-meeting where the product owner reviews and prioritizes the product backlog. During the main planning session, which includes the product owner, scrum master, and development team, the most vital items from the backlog are presented and discussed. The team breaks these items into actionable tasks, estimates the required effort, and assesses their capacity for the upcoming sprint. A clear sprint goal is defined by the product owner with input from the team. After considering their capacity and the task estimations, the team commits to a set of items, forming the sprint backlog. The sprint's duration is established, often lasting two to four weeks, and potential risks are identified with appropriate contingency plans. Outcomes of the planning, including the sprint goal and backlog, are documented and communicated to stakeholders. Throughout this process, the scrum master ensures efficiency, focus, and that the team stays aligned on the sprint's objectives.

There will be 5 sprints each semester, making it a total of 10 sprints for this project. This could vary based on duration of the project.

14.2.3 Sprint Goal

The sprint goal is primarily decided by the product owner, who has a comprehensive understanding of the product vision and stakeholder needs. However, it's crucial that the goal aligns with both the team's

capacity and the product backlog's prioritized items.

To involve the customer in this process, regular feedback sessions or reviews can be held before sprint planning. This ensures that the product owner is equipped with the customer's perspective and priorities. Additionally, in some Agile frameworks, customers or their representatives can be invited to sprint review meetings, where they can see the completed work and provide immediate feedback. This direct involvement ensures that the sprint goal and the product direction align closely with the customer's expectations and needs.

14.2.4 Sprint Backlog

The product backlog items' inclusion into the sprint backlog is a joint decision. The product owner suggests the most critical items from the product backlog, while the development team evaluates their feasibility based on their capacity and technical aspects. The team's commitment is based on a realistic assessment of what they can achieve in the upcoming sprint.

For backlog maintenance, we will use JIRA. JIRA provides a comprehensive platform for Agile teams, allowing for efficient backlog grooming, sprint planning, and progress tracking. Within JIRA, a virtual "scrum board" will be set up, offering a visual representation of the sprint's progress, with items moving through columns such as "To Do," "In Progress," and "Done." This ensures clarity, alignment, and real-time tracking for the entire team.

14.2.5 Task Breakdown

All tasks from the sprint backlog will be assigned based on a collaborative approach. Team members are encouraged to select tasks that align with their individual strengths and expertise, ensuring optimal results and a sense of ownership of their work. The Scrum Master plays a vital role in this process by overseeing the task assignments and ensuring that the team members are on track and that the work being done is up to the desired standards. Their oversight ensures that the work done aligns with the goals set for the sprint and addresses any roadblocks or challenges that may arise. The Product Owner, on the other hand, is responsible for updating the product backlog based on the work completed. They will reflect on the tasks accomplished, ensuring that the overall product vision is being achieved in tandem with the team's efforts during the sprint.

14.2.6 Sprint Burn Down Charts

Sonum has stepped up to oversee the creation of burn-down charts for each sprint. To facilitate this, every team member is tasked with updating a shared Excel spreadsheet with both their anticipated and actual time spent on tasks. This spreadsheet will then be integrated with Microsoft PowerBI, enabling the automatic generation of the Burn Down charts for each sprint in a comprehensive dashboard.

14.2.7 Sprint Retrospective

The sprint retrospective will be handled as a group. Before presenting in class, we will have a meeting facilitated by the Scrum Master. The takeaways will be recorded in the presentation slides.

14.2.8 Individual Status Reports

Each team member will provide a status update during the daily Scrum meetings. These updates will cover the tasks they've worked on, their progress, any challenges or blockers they've faced, and their plans for the next day. They'll also highlight areas where they might need assistance and share any feedback or insights that could benefit the team. This routine ensures transparency and swift resolution of issues, fostering a collaborative environment and maintaining the momentum of the sprint.

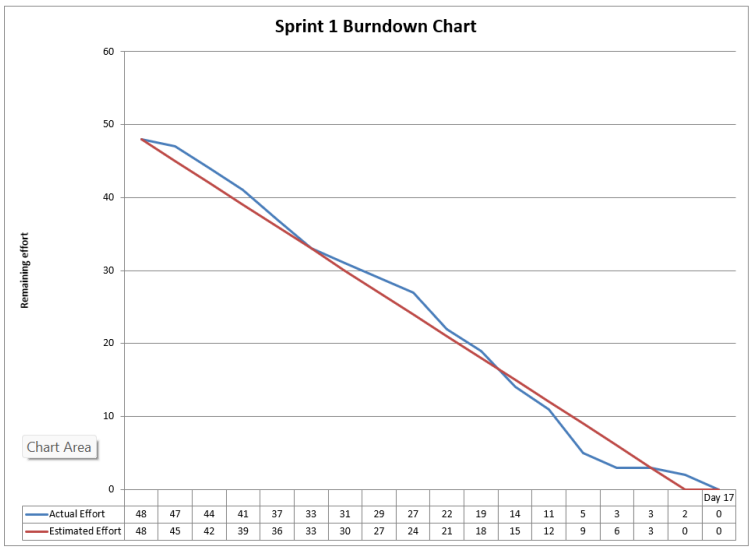

Figure 2: Example sprint burn down chart

14.2.9 Engineering Notebooks

The engineering notebook (ENB) will be updated by each team member at a minimum of once a week. For each weekly interval, team members are expected to complete a minimum of two pages detailing their contributions, findings, and reflections. To ensure accountability, the team will incorporate ENB updates as a standing agenda item during weekly review meetings, where members briefly discuss their entries. This not only keeps everyone informed but also promotes a culture of accountability. The Scrum Master will act as the "witness" and sign off on each ENB page, verifying the authenticity of the work recorded and ensuring consistent documentation standards across the team.

14.3 Closeout Materials

14.3.1 System Prototype

The final system prototype will encapsulate core functionalities representative of the proposed solution, including primary user interfaces, essential workflows, and key integration points. This prototype will be demonstrated in a designated area within a simulated hospital environment, ensuring a realistic testing environment. The demonstration is scheduled near the conclusion of the prototyping phase. We will also conduct a Prototype Acceptance Test (PAT) with our customer in this controlled setting. While all demonstrations will be on-campus, any off-site specific functionalities, if applicable, will undergo a subsequent Field Acceptance Test (FAT). Proper protocols will be observed given the healthcare context, ensuring safety and adherence to standards.

14.3.2 Project Poster

The project poster will visually encapsulate the Smart Surgical Equipment Management System. It will prominently feature the project title, associated logos, a brief overview, and a system diagram. The poster will highlight key features, showcase results through graphs or charts, and introduce the team members with their photos and roles. Acknowledgments and a QR code linking to further project details will also be included. The poster will measure 36 inches by 48 inches. Delivery is scheduled for a week before the project presentation, ensuring time for potential refinements.

14.3.3 Web Page

The project web page will offer an overview of the project, key features, and team details. Essential visuals like system diagrams and screenshots will be included. While the general public can access an overview, certain sections will be restricted for confidentiality reasons. The web page will be launched midway through the project and will receive updates as the project progresses. By the project's end, a complete web page summarizing the project will be available.

14.3.4 Demo Video

The demo video will provide a dynamic showcase of the Surgical Equipment Tracking System in action. It will open with a brief introduction of the project's objective and significance. Viewers will then be taken through the system's user interface, demonstrating real-time equipment tracking and management. Key features, such as the communication system and potential RFID/barcode components, will be highlighted. The video will also show actual users (healthcare providers) interacting with the system, emphasizing its ease of use and benefits. The video is projected to be approximately 5-7 minutes long, ensuring it's comprehensive yet engaging. Topics covered will include project overview, system features, user testimonials, and demonstrated results.

14.3.5 Source Code

The source code will be maintained using Git for version control and hosted on GitHub. The customer will be provided with both source code and binaries, delivered securely via a repository link or compressed archive. The project won't be open-sourced. If this stance changes, appropriate licensing (e.g., GNU, GPL, MIT) will be determined and detailed in the repository's 'README' and 'LICENSE' files.

14.3.6 Source Code Documentation

We'll employ JSDoc to generate consistent documentation across our MERN stack. The documentation will be available in both browsable HTML and PDF formats. Alongside this, a comprehensive 'README' file will be provided in the repository for an overview and setup guidelines.

14.3.7 Hardware Schematics

We will not be creating printed circuit boards (PCBs) or wiring components together for this project. Our focus is primarily on software development and its integration with existing hardware components. As such, there will be no applicable schematics related to PCB layouts or wiring diagrams.

14.3.8 CAD files

Our project does involve certain aspects of mechanical design. However, these elements will not necessitate 3D printing or laser-cutting. Consequently, there's no need for CAD files like STL, STEP, or OBJ, and we won't be generating such files in our design process.

14.3.9 Installation Scripts

The customer will be equipped with automated installation scripts to facilitate the software deployment for new installations. An installation guide will be provided for the graphical front-end and another for the back-end server software. Additionally, a user-friendly install program will be available for the interface components, ensuring straightforward deployment even for those less technically inclined. To supplement these tools, a succinct installation guide will be provided, detailing the step-by-step process and addressing potential troubleshooting scenarios. This holistic approach ensures a seamless and efficient deployment across various installations.

14.3.10 User Manual

The customer will receive both a digital user manual and a setup video for the Surgical Equipment Tracking System. A digital user manual offers flexibility, and easy search capabilities, and can be conveniently accessed on various devices. This manual will detail the software's functionalities, troubleshooting tips, and best practices. In addition to the manual, a setup video will be provided, offering a visual step-by-step guide for system installation and initial configuration. The video serves as an intuitive tool for those who prefer visual learning and can simplify the setup process by demonstrating actual actions. By offering both these resources, we ensure the customer has comprehensive guidance tailored to diverse user preferences, ensuring smooth system adoption and utilization.

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