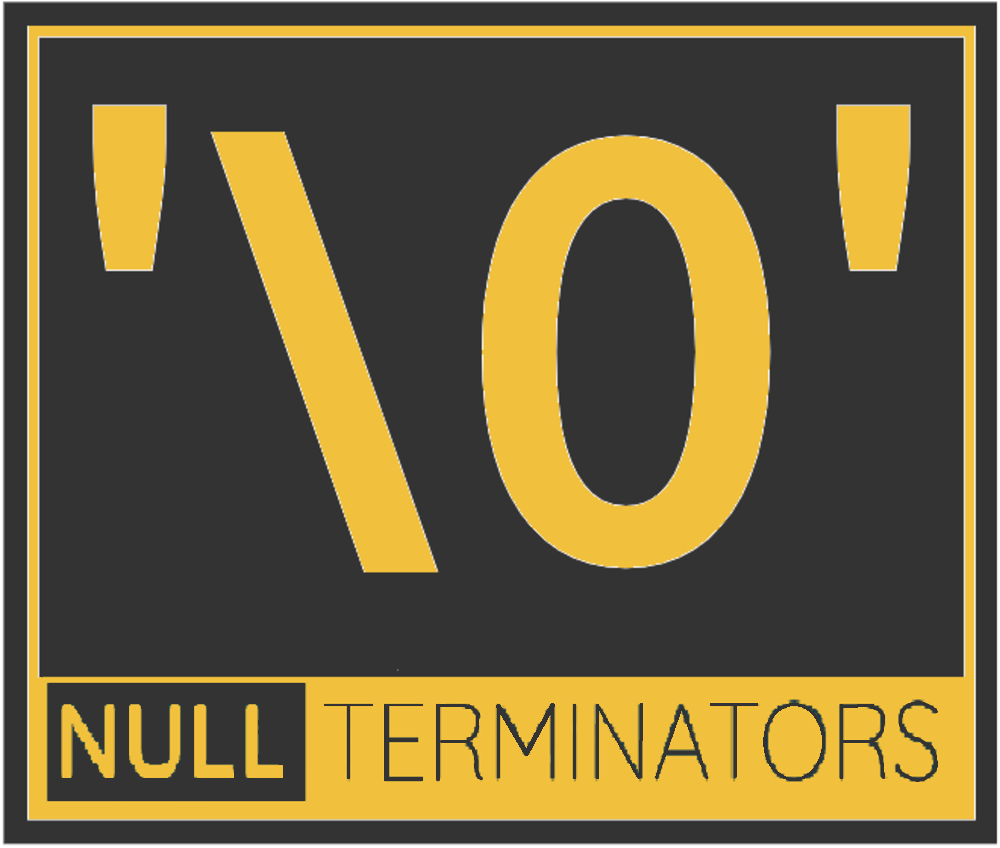
ATICS-

Automated Toolbox Inventory Control System

Project Plan

Null Terminators

Version 2.1





Senior Project Plan

CptS 421/423

WSU Tri-Cities

1710 Crimson Way, Richland, WA 99354

**Title:**

Automated Toolbox Inventory Control System

**Project Team:**

Null Terminators

**Participants:**

Reem Osman (leader)

Caitlyn Powers

Steven Pixler

Navin Sabandith

Caleb Thomas

**Client:**

Troy Stokes, HiLine Engineering

**Client Technical Contact:**

Andrew Tolman, HiLine Engineering

**Supervisor:**

Dr. Neil Corrigan, WSUTC

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# Glossary

WSU Washington State University

WSUTC WSU Tri-Cities - branch campus of WSU located in Richland, WA

HiLine HiLine Engineering - Mechanical Engineering firm located in Richland, WA

RFID Radio Frequency IDentification - technology used by HiLine for employee badges

MVP Minimum Viable Product - the smallest set of features required in a final product

UI User Interface - an interface through which users interact with a system

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# Revision History

2.1 - 04/27/2024 Updated Gantt Chart Link auth. Reem Osman

2.0 - 11/16/2023 First version presented to HiLine auth. Caleb Thomas

1.1 - 11/15/2023 Revise scope wording auth. Caleb Thomas

1.0 - 11/13/2023 First published version auth. Caleb Thomas, Caitlyn Powers

# 1.0 Introduction

As a condition of graduation, Washington State University (WSU) requires bachelor’s students in their final year to complete a “Senior Design Project” showing mastery of the course material covered throughout the program. For students in the Computer Science program, this takes the form of a yearlong project where students form a team and act as a small development firm given the responsibility of completing a software development project for a commercial sponsor.

This document details the project plan for the senior design project being completed by the Null Terminators - one of this year’s teams of students. This project will be completed over the period from September 25th, 2023 to May 3rd, 2024, with pauses for university breaks and holidays. HiLine Engineering of Richland, WA (hereafter referred to as *HiLine* or *client*) will be the customer and commercial sponsor for this project, with HiLine President Troy Stokes serving as the primary point of contact. Dr. Neil Corrigan of WSU Tri-Cities will serve as project supervisor and is responsible for verifying the completed project meets university requirements for graduation. In order for the students to receive passing grades, both Mr. Stokes and Dr. Corrigan must be satisfied with the final delivered project.

The sections included in this document are the scope, the approach, and the estimate. The scope contains information about the purpose of the project as well as the environment for the development and operation of the application. It also details what HiLine Engineering is responsible for, and what the Null Terminators are responsible for developing. The approach section details the software engineering approach we will be using. The estimate section details the timeline for the project, using a Gantt chart. All acronyms referenced in this report as well as software engineering-specific terms will be defined in the glossary at the beginning of this document.

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# 2.0 Scope

**Items as described in this scope may need to be changed subject to the level of tool recognition accuracy determined to be possible during the research and experimentation phase(s). Any changes or modifications will be explicitly noted in the Requirement Specification document and all stakeholders will be able to approve the final requirements at that time.**

| **Project Scope** | |
| --- | --- |
| **Title** | Scope document |
| **Project Manager** | Reem Osman |
| **Purpose Statement** | To develop a toolbox accountability system triggered by RFID badges and utilize video image processing to identify tools checked out by employees |
| **High-Level Requirements** | * Take RFID trigger * Process video footage to detect tools checked out and checked in by employee * Store events in database * Record what drawer was opened, which employee checked out a tool, and the time at which the tool was taken/returned * Make note of events that have a tool check-out and do not have a corresponding tool check-in * Include a way to add new tools, add new drawers/toolboxes, as well as update a tool’s position within a drawer |
| **In scope**  **(MVP required features)**  **In scope** | * One drawer * Partially open drawer * Recognizable tools   + Screw drivers     - Philips     - Flat Head   + Crescent Wrench   + Hammers   + Ratchet   + Pliers   + Sockets * Object detection/template matching   + Research both, determine which method or combination of methods is most effective * Database fields for:   + Record     - Record number     - Employee ID     - Date/time of login     - Action/s       * Take tool/s         + What tool/s was taken       * Return tool/s         + What tool was returned       * What drawer/s were opened         + When was each opened         + When was each closed       * Error/s         + If an extra tool is detected         + If a tool is misplaced         + If a drawer was not closed all the way     - No action       * Still record event     - Date/time of logout   + Tools database     - Image data     - Bounding boxes     - Other data items for object detection\*     - Tool information     - Tool location       * toolbox       * drawer       * position in drawer     - Tool status     - When the tool was checked out     - Who checked out tool * Footage during trigger event   + When “-record” flag is set, Retain footage of tool being checked out until the tool is returned or up to 1 month, whichever is longest * Configured by editing config file(s) * Method to maintain system & add new tools and tool categories * Select camera and demonstrate functionality.   + During research phase, determine the following:     - minimum camera specifications     - if camera requires dedicated light source     - placement requirements for where the camera is attached to the toolbox |
| **Out of scope** | * Employee Facing User interface   + No input from employee that is checking out tools * Generating end of day report email listing missing tools * Pushing Alerts/notifications * Doubling as a CCTV camera   + Camera will not be part of, nor interact with any other camera system * Recording Footage during idle time * No estimated return date field for checked out tools |
| **Assumptions** | * HiLine will handle   + RFID badge lock/unlock system   + the event trigger   + camera installation * HiLine will have to write script that will interact with our database to pull information for emailing or audit purposes * Per our specification, HiLine will create a restfulAPI that does the following:   + Interface with RFID badge access control system   + sends trigger to tool detection system     - Trigger includes the ID# of the employee who is authorized to check out tools   + When session is done, send trigger to notify toolbox is locked and employee is “logged out” * HiLine will have a server to host database * Operating System and programming languages agreed upon in the requirement specifications * HiLine has an NTP server which the database will synchronize with * The login time and logout time records will be the system time at which the RFID triggers for start/end were sent * Don’t have to worry about computational expense * The drawer will have some symbol visible to the camera in which the program can use to recognize the drawer * HiLine will ensure tools are laid out in a “shadowbox” format that ensures each tool has a permanently defined home |
| **Constraints** | * Camera needs to capture image for processing AFTER the employee grabs a tool * If using template matching: Tools need to be placed back somewhat precisely * If using object detection: May be hard to detect different sockets or similar looking tools |
| **Scope Extension Prospects** | * Update tool locations inside drawer * Audit function   + UI to view audit results * Multiple drawers |
| **Revision History** | [04/27/24] Updated Gantt Chart Link - Reem Osman  [11/16/23] Revise scope per recent meetings; clarify wording - Caleb  [10/27/23] Update Info from Try email – Caitlyn Power  [10/23/23] Project scope update after email from Troy - (Caitlyn, Caleb, Reem, Navin)  [10/20/23] Meeting clarification – Navin Sabandith  [10/19/23] Initial Version – Navin Sabandith |

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# 3.0 Approach

For the software development approach, the team and HiLine have developed a list of features that are required in a Minimum Viable Product (MVP), as well as a list of additional features for possible scope extensions. These features are listed in the Project Scope subsection titled “In Scope”. Null Terminators commits to delivering a software solution that includes every feature listed in the MVP, and will be extensible enough to allow HiLine to add the remaining additional features at a later date. Each required feature has been listed as a task on the Gantt chart included in the following section of this report, and each of these tasks has been assigned one or more “sprints”. These sprints correspond to one or more calendar weeks where students will be working on completing the corresponding project task. Students may work on the task at any time they choose during the sprint, as long as the task is completed or the expected milestone is reached by the next meeting. Several of the tasks are large or could take a variable amount of time to complete. For these tasks, the meetings serve as opportunities to update the project supervisor as well as the customer on the development team’s progress.

The Null Terminators will meet every Monday, Wednesday, and Friday (except for university holidays and breaks) with limited exceptions as required. One meeting is currently scheduled with project supervisor Dr. Corrigan every Wednesday, and every Friday the Null Terminators will meet with HiLine Engineering to update staff on the week’s progress and collect feedback. Every Monday, the students meet as a team to coordinate planned work. These meetings may be canceled or postponed according to participants’ schedules, and additional meetings may be added as needed, but the Null Terminators commit to reserving these dates for in-person communication with stakeholders. In the event meetings need to be canceled, Null Terminators and all other parties are expected to provide 24 hours of written notice - delivered via email - except in rare and truly unforeseen circumstances.

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# 4.0 Estimate

An up-to-date copy of our Gantt chart may be accessed here: [ATICS Gantt chart](https://docs.google.com/spreadsheets/d/1fBoJMyTy8wgcZmD-ZIM3RnxHscF5gJhqCXe2SXHdl_0/edit#gid=1115838130)

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