Cascade Secure POS

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Contents

1 Introduction

1.1 Abstract

Many stores use point of sale (POS) systems to manage their inventory and sales. These systems help store owners track sales and manage their inventory. These are often touch-operated devices that also give the option of using a mouse pointer or keyboard shortcuts. They consist of purpose-built machines running proprietary, often custom-built, software.

Due to this proprietary nature, these systems are often expensive and are costly and time consuming to update. This incurs higher maintenence costs on businesses ityand a higher workload on employees due to the unreliabile of outdated software and hardware.

1.2 Project Stakeholders

Potential project stakeholders would include any physical retailer with the desire to use this software. The goal is to design the software such that it can be adapted to be used in any setting, offering a decent amount of customization. Although, the main target audience, in the beginning, will be traditional storefront retailers.

2 Team Members & Bios

2.1 Calvin Tallent

Calvin Tallent is a computer science student at Washington State University interested in a wide variety of topics, from embedded automotive systems to machine learning. He has experience in a wide variety of programming languages and tools, including Python, Javascript, Rust, Java, C/C++, Kotlin, C#, Git, and general Linux administration.

2.2 Owen Moore

Owen Moore is a computer science student at Washington state University interested in machine learning, unique computer archetectures and configurations, and the intersection between music and computers. He has experience programing in C/C++, Java, Python.

2.3 Giovanni Munoz

Giovanni Munoz is a computer science student at Washington State University interested in software applications and machine learning. Also, systems to solve real world problems. He has experience in a variety of programming languages, including Python, Java, C/C++.

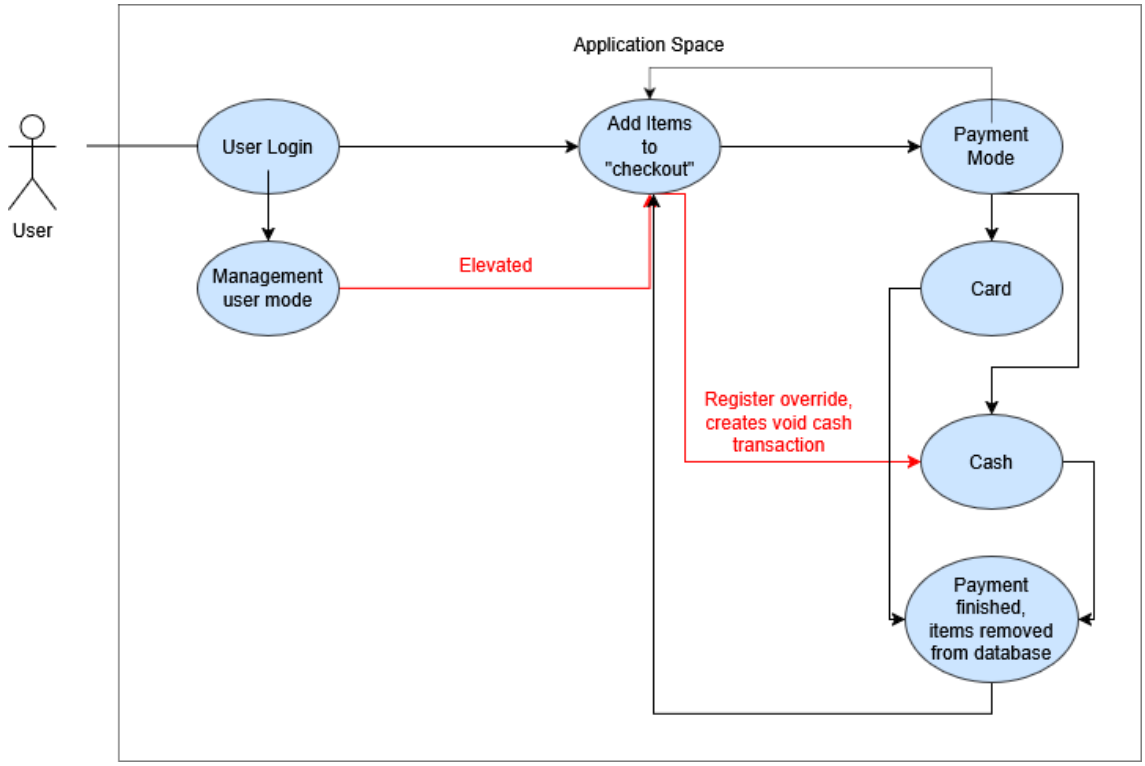
3 Project Requirements Specification

Include the following:

3.1 Use Cases

The major use cases of this software is to facilitate retail transactions at the point of sale. This requires secure interation with a backend database, requires of the frontend to support multiple input methods such as touch, pointer, and keyboard. Since the end goal of this project is to

be a near drop-in replacement for any existing point of sale system, we intend on using standard communication protocals between every component of the system. We also intend on implementing a form of administration privilages, that can be accessed by passcode on any frontend machine.



User Login

Pre-condition	Backend/frontend online and connected
Post-condition	User is logged in, given appropriate permissions, and is able to create a transaction
Basic Path	User types in username, password, presses enter/sign-in button
Alternate Path	
Related Requirements	Management user mode, Add items to "checkout

Management user mode

Pre-condition	User enters the username and password associated with an account with elevated permissions
Post-condition	Logged in user is able to acces options associated with managers such as the ability to create a void cash transaction
Basic Path	User enters username and password of elevated account in previous step
Alternate Path	
Related Requirements	

Add items to checkout

Pre-condition	Valid user is logged in
Post-condition	All items are added to the checkout list, and transaction is ready to progress into payment stage
Basic Path	Items are added by entering an associated UPC code into the system. Quantity is also a parameter. This is done either through the use of a barcode scanner or manual entry.
Alternate Path	Stage can be bypassed with manager permissions in order to create a void transaction.
Related Requirements	Payment Mode

Payment Mode

Pre-condition	All desired items added to checkout
Post-condition	Desired payment method is selected OR, payment stage is canceled, and state returns to item add stage.
Basic Path	User selects either a cash or a card transaction
Alternate Path	This stage can be bypassed if manager desires to create void transaction, as the payment option is implied
Related Requirements	Add items to "checkout", card, cash

Card

Pre-condition	Card payment is selected in previous stage
Post-condition	Payment process is handed off to card reader
Basic Path	Control is handed over to card reader terminal until that has reached its accepting state and control is turned back over to POS machine
Alternate Path	
Related Requirements	Payment finished, items removed from database

Cash

Pre-condition	User selected to either create void transaction or User selected for cash payment.
Post-condition	Change is made and traded by user.
Basic Path	Register is opened, user makes appropriate change, state ends when register is closed.
Alternate Path	
Related Requirements	Payment finished, items removed from database

Payment finished, items removed from database

Pre-condition	Previous transaction is completed
Post-condition	Current total for a given item is updated, state is moved back to add items to checkout stage
Basic Path	Frontend sends valid recipt to backend, backend updates current item counts of each listed item
Alternate Path	
Related Requirements	Add items to checkout state.

3.2 Functional Requirements

1. *Core Application Requirements*

Security

Description	The app must contain a system to verify users in a secure manner, and to process payments into the database without posing a security threat to the customer.
Source	Collaberatively decided properties of a point-of-sale system among the development team.
Priority	Priority 0: Core to functionality of application

Item Database

Description	The backend of the app must contain a reletively simple item database that keeps track of at least each item's UPC(universal product code), the price, and the quantity in stock. This database must be connected remotly to each instance of the frontend, with updates being sent both ways.
Source	Collaberatively decided properties of a point-of-sale system among the development team.
Priority	Priority 0: Core to functionality of application

Multi-headed frontend with privilage levels

Description	The frontend of the app must be able to have multiple instances running simultaniously, each sending updates to a central backend machine. This front end also must be able to make use of different privilage levels in order to support the level of employee organization that matches the environment this machine is designed to run in.
Source	Collaberatively decided properties of a point-of-sale system among the development team.
Priority	Priority 0: core to functionality of application

3.3 Non-Functional Requirements

Security
The ability for the system to be able to securely process transactions is highly important. Although the frontend will be a web-based implementation, the system deploying the frontend will remain offline, save for a secure connection to the backend which is what processes all the data.

Intuitivness
The goal is to create a User Interface that the user does not need to be told how to use. Labeled buttons and baking in support for multiple different common input standards is key to this operation.

Flexibility
Due to the web-based nature of the platform, the application should be able to be deployed on a wide variety of hardware, eliminating the need for expensive, proprietary point-of-sale machines.

3.4 Standards

We aim to be compliant with several standards:

- W3C WCAG, which regulates accessibility
- GDPR, which regulates consumer privacy
- PCI DSS, which regulates how to securely handle financial information

4 Software Design - Solution Approach

As this section as a whole is designed to be a more comprehensive overview of the software design, it is fitting to restate the project goals.

- Create an flexible, secure, web-based frontend, minimizing downtime due to updates.
- Create a secure backend, capable of frequently communicating with all frontend terminals over the air.

4.1 Architecture Design

4.1.1 Overview

The system that is created is one which accomodates the following functions:

- Inventory Management
- Payment Management
- Transaction Management

Following these requirements, the system will take on a Client-Server Archetecture, with the backend acting as a server, and the multiple POS terminals acting as its clients.

This system has many benefits, including

1. Safety. If multiple terminals all need to keep track of their own databases, in seperate instances, it increases the difficulty and risk of miscounting and other data errors. When numbers are centralizd, and updated in a queue, or other safe data structure, this risk decreases significantly.
2. Flexibility. Any number of these terminals can be added, with no downside.
3. Simplicity. A POS terminal does not need specilized hardware and software, only a network connection, and a modern internet browser. Updates can also be handled over the air, and updates to the software can be server-side.

To describe an example of an implementation, you could have a server, say a desktop running mongoDB through rust, communicating with many terminals, which could be android or otherwise, a lightweight linux locked down into a browser environment, which holds the frontend app, programmed in Svelte script.

This portion of the document will be updated with details further, as the project is built.

4.1.2 Subsystem Decomposition

This section explains how you decomposed your system into subsystems.

4.2 Data design

Describe all data structures (including the internal and temporary data structures), and the database(s) created as part of the application.

4.3 User Interface Design

Provide a detailed description of user interface. The information in this section should be accompanied with proper images of your software's GUI.

The emphasis of this section should be on the design decisions of your GUI rather than the final design. You will explain your final GUI in detail in section VI (Description of Final Prototype). Please avoid redundancy as much as possible in these two sections.

4.4 Constraints

Software engineering design is a process of devising a system, component, or process to meet desired needs and specifications within constraints. It is an iterative, creative, decision-making process in which the basic sciences, mathematics, and engineering sciences are applied to convert resources into solutions. Software engineering design involves identifying opportunities, developing requirements, performing analysis and synthesis, generating multiple solutions, evaluating solutions against requirements, considering risks, and making trade-offs, for the purpose of obtaining a high-quality solution under the given circumstances.

Constraints vary by project. Examples of possible constraints include aesthetics, codes, constructability, cost, ergonomics, extensibility, functionality, interoperability, legal considerations, maintainability, manufacturability, marketability, policy, regulations, schedule, sustainability, or usability.

5 Test Case Specifications and Results

5.1 Testing Overview

Include a summary of your test objectives and test plans.

Describe the overall approach to testing and provide the overall flow of the testing process. An example is provided in an Appendix.

Are you using Continuous Integration (CI) and/or Continuous Delivery (CD) in your testing? What tools are you using, what kinds of testing do they provide? Unit tests, integration, system, user interface, speed/non-functional requirement testing, user testing, etc.

In all of these major categories, include at least some material about your implementation, how it is currently executing, and/or what future work would be needed to ensure it happens for this project

- Unit testing
- Integration testing
- System testing

- Functional testing
- Performance testing
- Standards and constraints testing
- User acceptance testing

5.2 Environment Requirements

Specify both the necessary and desired properties of the test environment. The specification should contain the physical characteristics of the facilities, including the hardware, the communications and system software, the mode of usage (for example, stand-alone), and any other software or supplies needed to support the test. Identify special test tools needed.

5.3 Test Results

Include your prototype test results from your "Test Case Specifications and Results" document as updated with your current project status.

5.4

6 Projects and Tools used

Include a summary of the libraries, frameworks, and tools you used to implement your project. For example, you could have used some web frameworks, a database, a network message passing tool, graphics generation libraries, and various operating system platforms. Please list these out with a short one sentence note about what it was used to build/support in your project.

Tool/library/framework	Quick note on what it was for
Bootstrap	Generating layout and visual rendering on web interface
RabbitMQ	Intercommunication between our modules

As a quick survey, let me know what languages you wrote some of the project in. This is anything you wrote yourself, not just used in libraries. This includes both programming languages and markup languages.

Languages Used in Project			
C	C++	JavaScript	Erlang
Java	Python	PERL	Go
HTML5	LaTeX	BASH shell	

7 Description of Final Prototype

In this section provide a **detailed** description of your final prototype.

(If applicable) Include a brief user manual for your final software where you provide step by step instructions for using your system. Explain the major use case scenarios. You may include screenshots of the user interface.

Describe your final prototype implementation. Please format this section according to what you think is the best way to describe your prototype. The following is just a suggestion.

I recommend to include plenty of images and pictures of the following where appropriate:

- any diagrams/figures that visualize various features of your prototype;
- the screenshots of your user interfaces;
- the screenshots of your test programs;
- pictures of your team testing and debugging the devices, programs, etc.

A well-thought and clear diagram is better than long and descriptive text.

If your document starts to be very long due to screenshots and diagrams, please put at least some of them into an appendix to this document.

8 Social Responsibility and Broader Impacts

Social responsibility: identify informed judgements that you made for this project based on legal and ethical principles. Discuss if those judgements are in line with your responsibilities as a computing / software / cyber engineer. If not, what prompted you to make judgements that are contradictory to your professional responsibilities?

Broader impacts: highlight how your work aligns with the WSU EECS's goals of benefiting society and broadening participation in STEM. Describe not only how your project addressed a real-world problem (briefly state the problem) but also emphasized accessibility, inclusivity, and/or educational outreach. If you engaged with local communities through user testing and feedback sessions, mention that. If you collaborated with multiple teams from various departments or groups, mention that. If you documented your project and released it freely to support open-source missions, mention that. If your project outcomes contribute to technological innovation and provide a foundation for future student-led research, community-based applications, mention that.

9 Product Delivery Status

When was/will the project be delivered to your client? Was it demonstrated and who did you hand it off to?

Also include project location information here. This is for both the instructor and your client as future reference. This should include:

1) Source repositories

2) Equipment storage location - where did you leave any client or course materials

3) Any other materials needed to rebuild your project from the ground up

Ensure that either here or in your detailed description you include any instructions or where the instructions are to install and setup your project so future users know where to start.

10 Conclusions and Future Work

10.1 Limitations and Recommendations

Include a brief description of the limitations of your current prototype that you are aware of, and discuss possible solution approaches to overcome those limitations.

Please keep the discussion brief. 1 page text should be sufficient for this section.

Note that there might be overlap between the Limitations and Recommendations section and the Future Work section. "Future Work" should discuss the possible ways to extend the project, where as "Limitations and Recommendations" should be more detailed and should discuss the problems and missing features in the final prototype and should describe the possible solution approaches.

10.2 Future Work

Include a conclusion and discuss the future work. Future work should include discussion on how to extend this project. For those of you who are self or EECS sponsored, discuss commercialization possibilities.

11 Acknowledgements

Thank the people who have contributed to your project. Also thank to your sponsors.

12 Glossary

Define technical terms, acronyms, and anything else the reader might need to look up as they go through your document

13 References

Cite all your references here. For the papers you cite give the authors, the title of the article, the journal name, journal volume number, date of publication and inclusive page numbers. Giving only the URL for the journal is not appropriate.

Use either Chicago, IEEE, or ACM style citations

-- Note: you can find many articles on scholar.google.com, which includes a link for each article's citation in various formats.

14 Appendix A – Team Information

List your team members here and provide a team photo.

15 Appendix B - Example Testing Strategy Reporting

1) Identify the requirements being tested
2) Either link to available online test results and/or take screenshots of the various system testing results
3) User testing can be demonstrated via survey results or quotes and a discussion of the feedback received

16 Appendix C - Project Management

Describe your team's weekly schedule, i.e.,

- weekly meetings with the instructor/ mentor
- weekly meetings only with the team members
- other meetings and project related team activities.

Explain the purpose of each of the above activities and describe the routine agenda for each. Please comment on which team activities/meetings were the most beneficial to your team. Please include any planning documents you may have used. Examples could include:

- Gantt charts
- GitHub projects - Screenshots & a figure description
- GitHub issues - Screenshots & a figure description
- Notes on team tools used:
  - Email
  - SMS/IM
  - Slack
  - appear.in or other video conference tools
  - Trello
  - etc.