April 1st, 2023

Dr. Mike Hegedus
School of Engineering Science
Simon Fraser University
8888 University Drive
Burnaby, BC, V5A 1S6

Subject: ENSC 405W Project Proposal for CashGrab

Dear Dr. Hegedus,

The following document provides a high-level overview of the CashGrab project development. CashGrab is an automated point-of-sale device that aims to resolve the challenges associated with cash transactions such as theft, human error, and cross-contamination in the street food industry.

This document will first delve into the background and purpose of the project. The document will then go into depth regarding the scope of the product, the current state of the market, potential benefits and risks that could arise during product development, and important company details. Finally, the document covers some important considerations regarding cost for the development of CashGrab.

Payment Peers consists of six engineering students: Jacob Forrest, Chris Rosenauer, Dakota Crozier, Abdul Khan, Jaydon Vanloo, and Jeremy Ang specializing in computer, electronics and systems engineering. Our diverse group of skills and experiences has enabled us to develop an innovative product.

On behalf of Payment Peers, thank you for taking the time to review our project proposal document. For any questions or concerns, please do not hesitate to contact our Chief Communications Officer, Dakota Crozier at *dakotac@sfu.ca*.

Sincerely,

Jacob Forrest
CEO
Payment Peers

Project Proposal

Company 07

Partners:

Jacob Forrest	CEO
Dakota Crozier	CCO
Abdul Khan	CIO
Jeremy Ang	COO
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Issue Date:
April 1, 2023

Abstract

CashGrab by Payment Peers is a point-of-sale device that provides a secure solution for handling cash transactions in the street food industry. The device uses computer vision algorithms to detect and verify bills. By removing the cashier interaction from cash transactions, CashGrab reduces the risk of errors and theft. Additionally, it minimizes the potential for cross-contamination caused by kitchen employees handling cash. CashGrab has three major subsystems: the cash transport system, the image processing system, and user-facing software applications. The interactive web application provides a user-friendly interface for managing transactions and tracking sales. By integrating these subsystems, CashGrab offers an efficient and reliable method of handling cash transactions while also improving the customer experience. Overall, CashGrab is an innovative solution that offers food truck owners peace of mind and a convenient environment for both employees and customers.

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Glossary

Term	Definition
FLANN	Fast Library for Approximate Nearest Neighbors (FLANN) is an open-source library for performing fast approximate nearest neighbor searches in high-dimensional spaces [2].
Hasp	A slotted hinged metal plate that forms part of a fastening for a door or lid and is fitted over a staple.
LCD	Liquid Crystal Display (LCD) is a form of flat panel display that primarily uses liquid crystals to activate pixels
OpenCV	An open source computer vision and machine learning library.

PLA	Polylactic Acid (PLA) filament is a recyclable, natural thermoplastic polyester that is derived from renewable resources such as corn starch or sugar cane
Plexiglass	A transparent thermoplastic material often used as a lightweight and shatter-resistant alternative to glass.
PoS	A Point of sale (PoS) system is a computerized network used to process transactions and record sales in retail stores and other commercial establishments.
Raspberry Pi	A small, affordable, and versatile computer that can be used for a wide range of projects and applications.
SIFT	Scale-Invariant Feature Transform is a feature detection algorithm that is robust with respect to scale, illumination, and rotation [1].
Staple	A tough, steel loop that's firmly bolted or screwed in place. The staple mates with a slot in the hinged hasp that fits over it. A padlock is then typically used to secure the hasp in position.

1.0 Background

CashGrab is an innovative solution developed by our team at Payment Peers that addresses the common issue of employee theft and cash handling errors in the food truck industry. Each year, Canadian businesses lose an alarming $1.4 billion due to employee theft, with the average employee stealing $2,500 before getting caught [1]. However, with CashGrab, food truck owners can rest easy knowing that their transactions are secure and free from the risk of human error or theft.

One of the key advantages of CashGrab is its advanced technology that enables customers to make transactions without coming into contact with cashiers, eliminating the potential for cash theft or errors. In addition, CashGrab's design takes into account the unique constraints of the food truck industry, making it highly portable and compact. This makes it an ideal solution for food truck owners who need to move their operations frequently and have limited space to work with.

Furthermore, CashGrab hygienic design is highly beneficial for food trucks as it minimizes the risk of cross-contamination caused by employees handling cash and then handling food without proper hand washing [2]. By providing a secure and hygienic environment for employees and customers, CashGrab ensures that businesses can maintain a high level of trust and satisfaction with their customers.

In summary, CashGrab is an innovative solution that offers food truck owners peace of mind, increased efficiency, and a more secure and hygienic environment for both employees and customers. With CashGrab, food truck owners can minimize the risk of theft and human error while maximizing their revenue and customer satisfaction.

2.0 Scope

CashGrab encompasses the following functionality:

1. Currency detection
2. Currency insertion
3. Currency storage
4. Recording of financial transactions

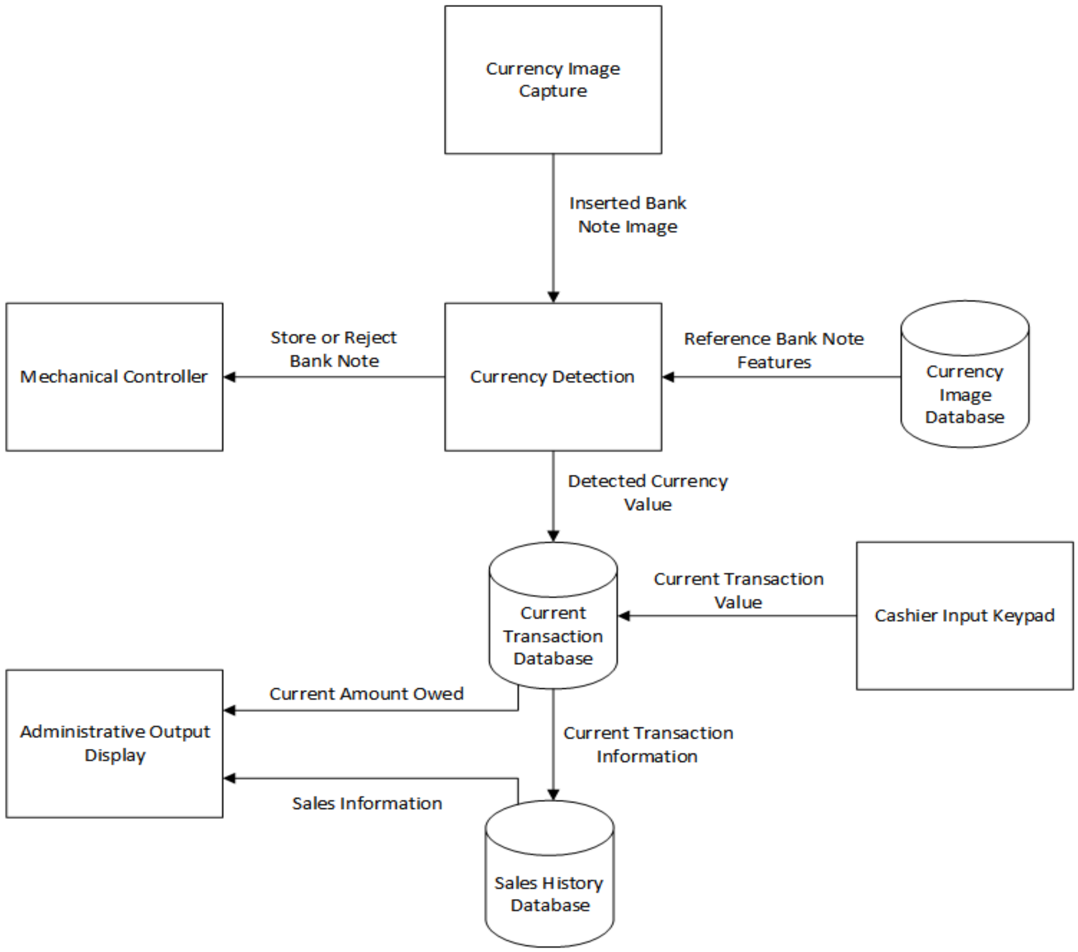

Figure 1 - Block Diagram of CashGrab's Subsystems

Currency detection identifies the value of the inserted banknote and if the inserted is a valid banknote. The value of the banknote is communicated to the rest of the system to update the amount owed in the current transaction, and the cash stored in the device.

Currency insertion mechanically transfers the inserted banknote from the customer's banknote insertion point, transfers the banknote through the device to a camera where the value of the banknote can be identified, and transfers the banknote to the cash storage. Additionally, the currency insertion returns undetected inserted objects.

CashGrab includes secure built-in currency storage. Accepted currency is moved and stored to a locked deposit box. Managers and other administrative staff can unlock the deposit box to retrieve stored cash.

CashGrab will record records of all transactions performed on the device. Managers and other administrative staff can use the device's web interface to observe and export cumulative revenue and transaction history.

CashGrab is designed to primarily fit the needs of the food truck market. Considerations have been made for the size of the device, and latency of currency detection and acceptance.

3.0 Risks and Benefits

3.1 Risks

3.1.1 Market Share of Cash Transactions

CashGrab is designed specifically for facilitating cash transactions. In the case where cash transactions become infrequent, CashGrab as a product may not be worthwhile for food truck owners.

3.1.2 Accuracy of Currency Detection

The utility of CashGrab in part relies on the accuracy of its ability to detect inserted currency. The computer vision-based approach to currency detection will need to be sufficiently accurate to be viable without sizable design changes. Additionally, computer vision may be insufficient for detecting counterfeit currency.

3.1.3 System Latency

CashGrab will need to process cash with sufficient speed to be a non-hinderance to customers and businesses. The need to provide currency detection, mechanical transportation, and record storage with sufficient latency may force the system to require more expensive computer hardware.

3.1.4 Mechanical Reliability

The cash moving mechanics of the system could be a point of failure. If the system were to jam frequently the system would prove a hindrance to the customer and the business.

3.2 Benefits

3.2.1 Cross-Contamination

A single foodborne illness outbreak can cost an individual restaurant up to an estimated $1.9 million [3]. Employee contact with currency in specific is a potential cause of food contamination in a restaurant setting. [4]. CashGrab circumvents the need for employees to physically interact with cash, which prevents food contamination due to contact with currency.

3.2.2 Employee Error

Automatic currency detection and depositing prevents employees from improperly recognizing received bank notes. This guarantee of recognition will reduce unnecessary losses as the employee cannot mistakenly over-valuing a received banknote, and customers will not be needlessly angered by their banknote being mistakenly undervalued. Additionally, future iterations may see CashGrab performing change dispensation, and as such will prevent employees from mistakenly over or under returning change.

3.2.3 Employee Theft

Through CashGrab, employees are not able to interact with cash during the transaction, and unauthorized employees are unable to access the cash storage. Without physical contact with cash and limited access to cash storage, employees are inhibited from stealing cash during or after the transaction.

3.2.4 Transactional Recording

CashGrab provides automatic recording of transaction details. Through this, managers can easily track revenue, sales records, and count cash stored in the point of sale device. Additionally, managers can quickly generate records for auditing purposes.

3.2.5 Applicability to Other Markets

CashGrab was designed to meet the needs of the food truck market. However, the ability to prevent employee theft, reduce transactional errors, and easily obtain transactional and financial records are needs which are applicable to most brick and mortar stores. CashGrab could be iterated upon to meet the general needs which occur from cash transactions in brick and mortar stores.

4.0 Market/Competition/Research Rationale

The market that our company aims to address is food trucks businesses. Food trucks can be commonly found in business districts, street food markets, and music festivals [5]. These trucks are popular in business districts because they are able to serve busy customers in a timely manner [5]. Street food markets are another common place to find food trucks as visitors are already looking to buy food from a food truck, reducing marketing effort and expenses [5]. Music festivals are yet another popular location for food trucks as customers attending these events do not have any other dining options [5].

Globally, the food truck industry is estimated to be $3.93 billion USD and is expected to expand at a compound annual growth rate (CAGR) of 6.8% [6]. In the US, The size of the food truck market is estimated to be $1.48 billion USD in the US in 2022 [5]. The American market has a total of 36,324 food truck businesses in 2023 [7]. This is a 9.9% increase from the previous year [7]. California has the most food trucks compared to any other state (883), followed by Texas (744), and Florida (725) [7]. Additionally, this sector employs a total of 43,601 individuals [402]. Some of the highest expenses for food truck businesses include wages (27.3%), Purchases (43.1%), and Rent & Utilities (6.3%) [7].

In Canada, the food truck industry is estimated to be $228 million USD in 2022 [8]. There are a total of 2,622 food truck businesses in Canada, employing a total of 3,423 individuals [9]. The average food truck in Canada generates a total annual revenue of $155,600 CAD [10]. However, the average food truck spends $68,400 CAD to cover direct expenses such as wages, benefits, and purchasing and $71,200 CAD to cover indirect expenses such as rent, utilities, repairs, and maintenance [10]. This translates to a net profit of $16,100 CAD for the average food truck business in Canada [10]. Additionally, 78.4% of food trucks in Canada are profitable [10].

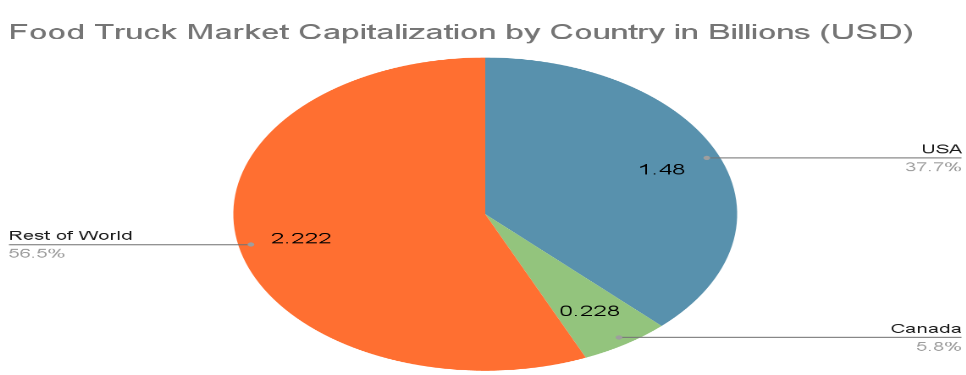

Figure 2 - Food truck market capitalization of select countries in 2022

Currently, despite the multitude of PoS systems available, many of these systems are only capable of accepting credit or debit cards as payment. Systems capable of accepting cash, credit, and debit are often too large to fit inside a food truck, not readily available, and expensive to purchase. Purchasing a PoS device involves various installation, hardware, and software costs in addition to payment processing fees. The total cost for installation and hardware can be up to $2,000 per device while software costs can be up to $150 per month [11]. Also, a payment processing fee of 2-3% is usually added to each transaction [11]. Some competitors that produce PoS systems for food trucks include Sesami, Clover, and Aptito. However, their products do not fit easily within the limited space of a food truck and are expensive to purchase.

Sesami produces a family of self payment devices that are compact and secure. One of these self payment devices that they produce is the SafePay Collect Sealbag (SB) [12]. This device can accept multiple currencies, return cash to the customer, and is fairly compact (328mm x 401mm x 624mm) [12]. However, the largest disadvantage of the SafePay Collect Sealbag is its weight of 113 kg [12]. The product's weight may not be an issue for brick and mortar retail stores and restaurants, however, weight is not negligible for food trucks as it leads to higher fuel consumption.

Figure 3 - SafePay Collect Sealbag [12]

Clover and Aptito are two other companies that produce compact point of sale systems specifically for food trucks. Both companies boast quick, seamless integration with mobile devices to track daily sales, update menus, and report financial data [13][14]. However, both devices do not autonomously accept cash payments from the customer [13][14]. Instead, cash must be deposited in the cash register by a cashier, which could lead to human error and theft, a problem that our device hopes to solve.

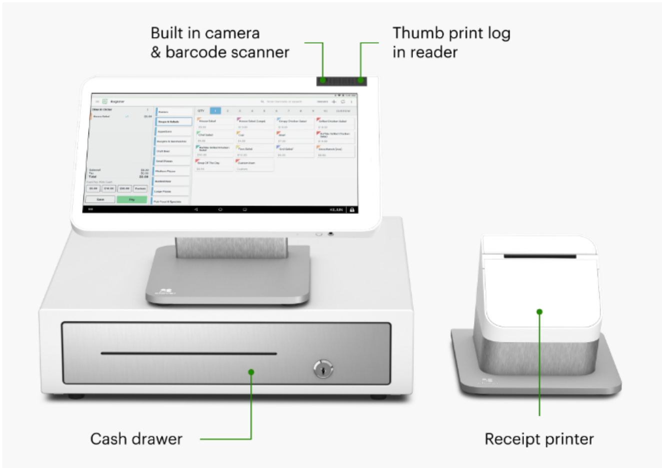

Figure 4 - Clover Station Solo [13] on the left and Aptito Mobile PoS [14] on the right

5.0 Company Details

Payment Peers was founded in 2023 by a team of six engineering students with a shared passion for exploring the practical applications of computer vision technology and supporting small businesses such as independent restaurants. Payment Peers is currently working on the development of their first product, CashGrab, which is an automated cash point-of-sale device. The proof of concept of the CashGrab device is expected to be completed in April of 2023.

5.1 Team Members

Jacob Forrest - Chief Executive Officer

Jacob is a fifth year computer engineering student at Simon Fraser University. He has one year of industry experience in software development and testing at Sierra Wireless. Jacob's development skills can help guide the software development and testing procedures for the CashGrab code. As the CEO of Payment Peers, Jacob will be responsible for delegating tasks to various members of the team.

Dakota Crozier - Chief Communications Officer

Dakota is a fifth year computer engineering student at Simon Fraser Engineering. He has completed an 8 month Research Co-op working on SIMT-X, a project to combine Out of Order Processing and Simultaneous Multi-Threading. Dakota has also completed a 4 month co-op at Algo Communications as an Electro-Mechanical Assembler. He is primarily responsible for integration of software and electrical components.

Abdul Khan - Chief Information Officer

Abdul is a fifth year computer engineering student at Simon Fraser University. He has completed an 8 month co-op term at Change Healthcare as a Software Test Engineer where he tested medical software applications. Abdul has also completed an 8 month co-op term at Design IT as a Software Developer where he contributed to developing software solutions. He is primarily responsible for the development of the web interface that will be used.

Jeremy Ang - Chief Operating Officer

Jeremy is a fifth year systems engineering student who completed a 8 month co-op at BGC Engineering as a software quality assurance tester where he learned best practices for testing, documentation, and working in a team. Jeremy has also completed a 8 month co-op at Verathon Medical as a test engineer co-op where he received experience in mechanical design using Solidworks and 3D printing. He primarily assists the team with the design of mechanical components.

Jaydon Vanloo - Chief Financial Officer

Jaydon is a fifth year electronics student engineering student at Simon Fraser University.
He has a year worth of electrical/control system experience working at Greenlane Biogas and four months at SFU's AML lab. Jaydon has experience in AutoCad Electrical, ePlan, Siemens Tia portal,solidworks,3D-printing, and Rockwell Studio 5000. He is primarily responsible for mechanical design and electrical components.

Christopher Rosenauer - Chief Technology Officer

Chris is a fourth year computer engineering student at Simon Fraser University. He has one year of industry experience working with real-time software systems, and academic experience with computer vision, embedded systems, and 3D printing. Chris is primarily responsible for currency detection, and overseeing the manufacturing of the 3D printed components used to develop the proof-of-concept.

6.0 Project Planning

Task Name	Duration	Start	Finish
Initial Proposal Document - Predicted	7 days	Wed 23-01-18	Thu 23-01-26
Initial Proposal Document - Actual	6 days	Thu 23-01-19	Thu 23-01-26
Requirements Specification Document - Predicted	4 days	Wed 23-02-08	Sun 23-02-12
Requirements Specification Document - Actual	7 days	Sun 23-02-05	Sun 23-02-12
User Interface and Appearance Design Document - Predicted	6 days	Thu 23-02-23	Thu 23-03-02
User Interface and Appearance Design Document - Actual	4 days	Mon 23-02-27	Thu 23-03-02
Design Specification Document - Predicted	7 days	Sat 23-03-04	Sun 23-03-12
Design Specification Document - Actual	11 days	Sat 23-03-04	Fri 23-03-17
Phase 1: Shop Training Completion - Predicted	6 days	Thu 23-02-09	Thu 23-02-16
Phase 1: Shop Training Completion - Actual	1 day	Thu 23-02-02	Thu 23-02-02
Phase 2: Shop Project Material is Cut - Predicted	6 days	Fri 23-02-24	Fri 23-03-03
Phase 2: Shop Project Material is Cut - Actual	1 day	Mon 23-03-06	Mon 23-03-06
Phase 3: Machine Shop Project Completion - Predicted	6 days	Fri 23-03-10	Fri 23-03-17
Phase 3: Machine Shop Project Completion - Actual	5 days	Mon 23-03-06	Fri 23-03-10
Final Proposal Document - Predicted	10 days	Fri 23-03-17	Thu 23-03-30
Final Proposal Document - Actual	8 days	Tue 23-03-21	Thu 23-03-30
Proof-of-concept Poster Presentation and Demo - Predicted	6 days	Wed 23-04-05	Wed 23-04-12
Final Video Demonstration - Predicted	5 days	Sat 23-04-08	Thu 23-04-13
Milestone 1: Planning - Predicted	11 days	Wed 23-02-01	Wed 23-02-15
Milestone 1: Planning - Actual	19 days	Wed 23-02-01	Mon 23-02-27
Milestone 2: Documentation - Predicted	18 days	Thu 23-02-16	Sun 23-03-12
Milestone 2: Documentation - Actual	22 days	Thu 23-02-16	Fri 23-03-17
Milestone 3: Purchase Materials - Predicted	12 days	Fri 23-02-24	Sun 23-03-12
Milestone 3: Purchase Materials - Actual	22 days	Sat 23-02-18	Sun 23-03-19
Milestone 4a: Building / Assembling - Predicted	10 days	Sat 23-02-25	Thu 23-03-09
Milestone 4a: Building / Assembling - Actual	18 days?	Tue 23-03-07	Thu 23-03-30
Mechanical Design	18 days	Tue 23-03-07	Thu 23-03-30
Fabrication	18 days	Tue 23-03-07	Thu 23-03-30
Assembly	15 days	Sat 23-03-11	Thu 23-03-30
Milestone 4b: Software Programming - Predicted	10 days	Sat 23-02-25	Thu 23-03-09
Milestone 4b: Software Programming - Actual	39 days	Mon 23-02-06	Thu 23-03-30
Web Application	21 days	Mon 23-02-27	Sun 23-03-26
Curreny Detection	39 days	Mon 23-02-06	Thu 23-03-30
Servo Motor Control Software	1 day	Mon 23-03-20	Mon 23-03-20
Milestone 5: Testing - Predicted	7 days	Fri 23-03-10	Mon 23-03-20
Milestone 5: Testing - Actual	18 days	Tue 23-03-07	Thu 23-03-30
Milestone 6: System Integration - Predicted	11 days	Mon 23-03-20	Sat 23-04-01
Milestone 6: System Integration	8 days	Tue 23-03-21	Thu 23-03-30
Integrating Software Systems	8 days	Tue 23-03-21	Thu 23-03-30
Electrical Integration	3 days	Fri 23-03-24	Tue 23-03-28
ENSC 440 - Milestone 7: Structural Refinements - Predicted	11 days	Mon 23-04-17	Sun 23-04-30
ENSC 440 - Milestone 8: Software Refinements - Predicted	11 days	Mon 23-04-17	Sun 23-04-30

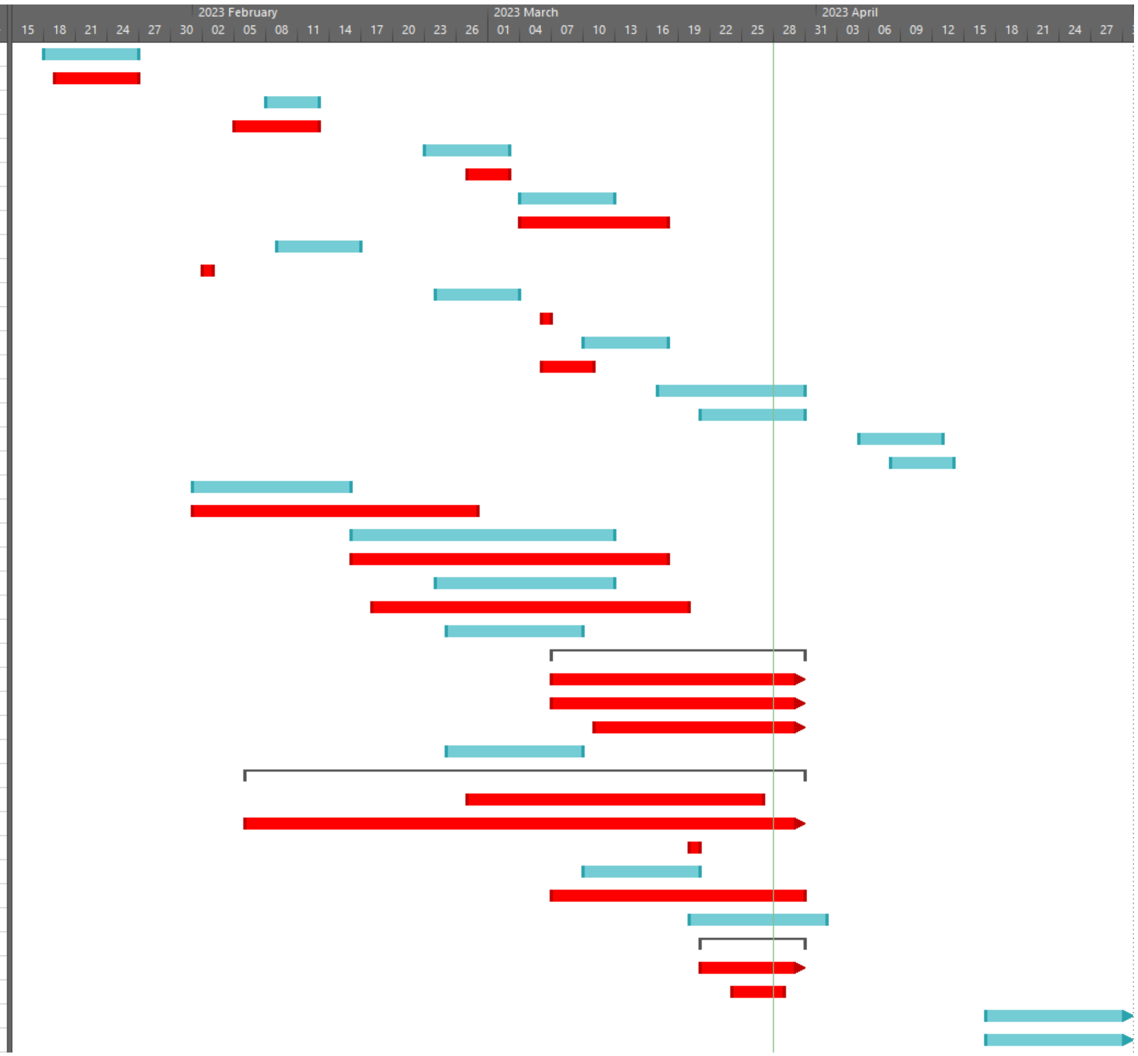

Figure 5 - Gantt Chart showing Expected Duration (Blue) and Actual Duration (Red) for Project Tasks

The fundamental processes of the CashGrab project that have been in development are the currency detection system, the cash transportation system, and the web application. Throughout the development of these processes, revisions have been made to the original plans in order to incorporate design modifications and changes to the project scope. The primary goal of the currency detection system has been to classify bank notes that are captured via a camera. The primary goal of the currency transportation system has been to reliably transfer banknotes through the CashGrab device. The web application has become the central hub for user interactions and management. As indicated by the arrows in the above gantt chart, development and integration of the currency detection system, and the mechanical aspects of the project are still ongoing.

6.1 Documentation

The company team members created four primary documents to provide a comprehensive understanding of the project's scope, objectives, and implementation details: the project selection document, the requirements specification document, the user interface and design document, and the design specification document. These documents were written in parallel with the development of the project and therefore reflect the ongoing modifications to the project scope and design details.

The project selection document outlined the original reasons behind choosing the CashGrab project by providing an overview of the target problem, and the proposed solution. Originally, the target market for CashGrab consisted of any business that deals with direct customer transactions. This market was deemed too broad and was subsequently narrowed to directly focus on the needs of businesses in the street food industry.

The requirements specification document provided a detailed description of the functional and non-functional requirements of the project. This document outlined the characteristics that the CashGrab device needed in order to meet the project objectives and the needs of businesses in the street food industry. The requirements specifications were broken down into subsections to cover the various hardware and software components of the system.

The user interface document provided a detailed description of the user interactions with the CashGrab device. This document included information about the user interface layout, navigation, and features. In this document, we envisioned the web application as being a discrete component of the system and that the visual elements of the customer interface would be in the form of small LCD displays.

However, as progress was made on the web application, it was apparent that a more robust interface could be achieved by integrating the web application directly into the overall system design and interface.

The design specification document provides a detailed description of the architecture and design of the CashGrab system. This document outlines the various components of the system and their interactions. The design specification document also includes information about the programming languages, and libraries that are used in the development of the system.

6.2 Currency Detection

Computer vision was chosen to facilitate currency detection early on in development. Currency detection initially used Harris Corner detection. A Harris Corner-based approach would have been greatly computationally performant and would have allowed the device to function with low latency on inexpensive and low-specced hardware. However this method did not provide the desired accuracy.

The second, and current iteration of currency detection uses SIFT feature descriptors and FLANN feature matching. The detected features on the inserted object are compared to reference valid bank notes stored on the device. The value of the inserted object is determined using the number of matches between the features of the inserted object and the reference valid bank notes. Thresholding is used to reject the inserted object in the case of weak matches. The SIFT FLANN based approach provides robust and accurate currency detection, with the drawback of having high computational overhead.

6.3 Currency Transportation

Originally, we decided to use a 3D printed ramp to transport bank notes through the PoS system. One advantage of this method is that it does not require any motors to transport the bank notes, instead, bank notes are transported via gravity. Additionally, this method saves us both cost and implementation time. This ramp would come immediately after the two insertion rollers and transport the inserted bank notes from the insertion point to the currency detection platform, where the denomination of the bills are identified. The length of the ramp would be fairly short (151 mm) and the angle of the ramp is fairly steep (39.5°) allowing bank notes to be transported through the system quickly. However, this method was not pursued due to several disadvantages. One disadvantage of using this method is that there will be difficulty keeping folded and crumpled bills flat. Another disadvantage of this method is that the system does not have complete control over the motion of bank notes, but the motion of the banknote is dictated by the force of gravity.

To reject bills, we originally decided to use an additional return ramp connected to a return slot accessible to the customer. If the inserted bank note was determined to be fraudulent, the banknote would be channeled to the return ramp, and returned to the user. We decided against proceeding with this design because it would have involved additional implementation time and occupy more space within the device housing.

Currently, our implementation utilizes cylindrical rollers and rubber belts as the mechanism for propelling inserted bank notes through the system. The rollers are rotated via servo motors that are directly connected. To ensure that the bank notes remain flat while capturing images for processing, a small sheet of plexiglass will be placed above the cash transport mechanism

6.4 Web Application

The web app we are building will be an integral part of the system in terms of providing an intuitive interface for users to manage their earnings. This will be realized by providing a user interface for executing and monitoring transactions, illustrating transaction statistics, and allowing for the withdrawal and depositing of cash. The initial plan for the web interface was to be strictly used as a tool for viewing transaction history and statistics, however we decided to integrate it into the transaction process so that it can be used to display transaction information to the customer.

The app will be designed through the MERN stack, a popular web development framework that consists of MongoDB, Express.js, React, and Node.js. The backend of the app will be responsible for communicating with the Raspberry Pi-controlled device and the MongoDB Atlas database, which will store all transaction and income related data.

The frontend of the app will be built using React, which is a powerful and popular JavaScript library for building user interfaces. We will also be using TypeScript, which is a strongly-typed version of JavaScript that allows for robust code, leading to fewer bugs.

The app's UI will be designed to be intuitive and user-friendly, with features like graphs and charts to help users visualize transaction data and history. Additionally, we will be implementing security measures such as user authentication through Google and encryption of sensitive data to ensure the safety and confidentiality of user information.

6.4 Future Refinements

Refinements for currency detection will aim to improve the performance of currency detection. The device will also undergo further testing to discover currency detection corner-cases. Such cases will be addressed during this refinement period. Finally, counterfeit detection will be considered, given the feasibility of the task on the current hardware.

7.0 Cost Considerations

7.1 Estimate of Project Costs

The following table provides an estimate of the cost for each part of the CashGrab machine including both 3D printed and pre-assembled parts. It is roughly three cents per gram of PLA filament.

Part	Estimated Cost (CAD)
3D printed cylindrical roller and servo motor housing	$10.00
Cash insertion slot	$5.00
Conveyor belt system	$20.00
DS04 servo motor	$17.00
Feetech servo motor	$12.50
3D printed plexiglass holder	$2.00
Cash deposit box	$5.00
Hasp latch lock	$13.00
Padlock	$10.00

ASUS Webcam C3	$70.00
Acrylic sheet clear plexiglass	$14.00
Raspberry Pi Model 3 B	$200.00
Swiveling monitor stand	$13.00
LCD monitor	$100.00
Total Price	$491.50

Table 1 - Estimated Cost of Parts

7.2 Potential Funding Sources

One potential source of funding for our project is the Wighton Development Fund. The Wighton Development Fund provides funding for engineering projects that pass an evaluation process that is administered by an ad hoc committee [15].

Another potential source of funding for our project is the engineering science student endowment fund (ESSEF). The CashGrab project proposal would fall into category C of the endowment fund which is reserved for projects that originate from an Engineering Science class or special projects laboratory. The rating criteria for projects in category C includes 'originality', 'usability', and 'team oriented' [16].

In the event that these sources are unable to be claimed or provide insufficient funding to cover all of the project expenses, the company will rely on personal funding from each of the team members. The expected maximum contribution from each team member will be $100 CAD which would result in an additional funding pool of up to $600 CAD.

8.0 Conclusion

In conclusion, Payment Peers aims to solve the problems associated with cash transactions, such as employee theft, human error, counterfeit currency, and cross-contamination. The CashGrab project represents a comprehensive effort to design and implement a point-of-sale (PoS) system that provides accurate currency detection and secure cash transportation, integrated with a web application for managing user interactions. Through the development of four primary documents, including the project selection document, the requirements specification document, the user interface and design document, and the design specification document, the project objectives and design details were established and refined. The currency detection system, which uses SIFT feature descriptors and FLANN feature matching, provides robust and accurate detection, while the currency transportation system was designed to rely on a motorized conveyor belt system to transport bills. The web application acts as the central hub for user interactions and management. Future refinements will aim to improve the performance of the currency detection system and potentially incorporate counterfeit detection.

9.0 References

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