

RewardWallet

School of Engineering Science | Burnaby, BC · V5A 1S6
<https://github.com/RewardWallet>

January 31, 2018

Dr. Andrew Rawicz
School of Engineering Science
Simon Fraser University
Burnaby, British Columbia
V5A 1S6

Re: ENSC 405W Project Proposal for a Dynamic Reward Allocating POS Add-On

Dear Dr. Rawicz:

Attached you will find our ENSC 405W project proposal for a Dynamic Reward Allocating Point-of-Sale (POS) Add-On system. We developed this idea with the intent of adding an embedded system, that would work as an add-on to any existing POS system. Its purpose would be to extend functionality to make digital reward allocation easy and affordable for any business.

Detailed in this proposal is an overview of our products design, market rational and competition, methods of sourcing funding for a prototypes budget, in addition to a scheduling breakdown on how we plan to bring this prototype to fruition. We also explore how various improvements to increase market potential, could be made for expanded features and usability.

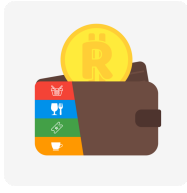
From all of us here at RewardWallet: Molly Bin, Wilson Chan, Nathan Tannar, Jia Hui (Mandy) Xiao, we want to thank you for considering our proposal. We hope it excites you as much as it excites us. Should you have any questions or concerns, please feel free to reach out to myself at (604) 355-6292 or ntannar@sfu.ca

Sincerely,

A handwritten signature in black ink that reads "Nathan". The signature is written in a cursive, flowing style.

Nathan Tannar
President and CEO
RewardWallet

Enclosure: *Proposal for a Dynamic Reward Allocating POS Add-On*



RewardWallet

Proposal for a Dynamic Reward Allocating POS Add-On

Proposal for a *DYNAMIC REWARD ALLOCATING POS ADD-ON*

Project Team:

Molly Bin
Wilson Chen
Nathan Tannar
Jia Hui (Mandy) Xiao

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Submitted to:

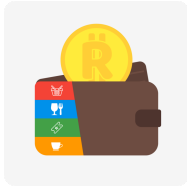
Dr. Andrew Rawicz - ENSC 405W
Steve Whitmore - ENSC 405W
School of Engineering Science
Simon Fraser University

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January 31, 2018

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1.0



RewardWallet

Proposal for a Dynamic Reward Allocating POS Add-On

Executive Summary

Imagine yourself standing in front of two cafes. Both shops sell coffee for the same price, have friendly baristas and comfortable chairs to sip your morning cup of joe. The only difference between the two is the one of the left will give you reward points for your purchase which you can later redeem for a free cup of coffee. You also know from their app that they have a special promotion just for you. Which café is more often the popular choice?

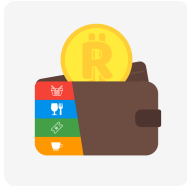
This scenario is quite prominent nowadays as large corporations like Starbucks, McDonald's and Tim Hortons, try to encourage customers to buy from them by giving them reward points and/or coupons. Many would rather shop at businesses that give them something in return for being a valued customer [1]. While this type of system is possible for these larger companies who have the resources to develop their own apps, for the smaller Canadian businesses and chains it's just not feasible.

Receiving a reward for a transaction is more less standard in our culture. Credit card companies have been competing for decades over offering points for travel, cash back and many other perks, in the hopes that their card might viewed as a higher value to a customer [2]. This is where we want RewardWallet to be helpful for any businesses. With RewardWallet, our system keeps track of the transaction details for the business and can allocate rewards to customers based on the business's reward distribution model. This makes for an incredibly dynamic system that can work in cafes, restaurants, supermarkets and more.

"All good businesses are personal. The best businesses are very personal." - Mark Cuban

The goal of this solution is to equip businesses with a tool that can add value to a customer's purchase. By providing reward points customers are more likely to return and build up points to one day redeem for a free item. Furthermore, businesses can view a history of customers who stopped by and send them personalized coupons or promotions to increase their own sales. This adds a more personal touch to marketing that can be more impactful than generic coupon flyers.

The Computer Engineering undergraduate students behind RewardWallet can deliver this system with their combined knowledge in embedded system design, network protocol design and software engineering. We propose a 10-week development period to design and build a prototype, delivered on April 8, 2018. Our estimates predict that this prototype will cost \$600 which we intend to be earned from the Engineering Student Society Endowment Fund and IEEE grants.

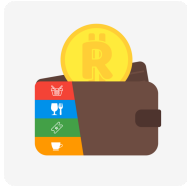


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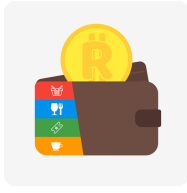
2 INTRODUCTION

Over the last 30 years the internet has grown at a rapid pace, changing the market for the better and worse. The rise of ever increasing computational power leads users to expect lightning fast speeds and instant gratification for their actions. As an example, Amazon's Prime service allows online shoppers to purchase and receive an online purchase in the same day [3]. They have disrupted the way people shop forcing many businesses to change their model to survive. However, some smaller businesses cannot keep up with the increasing technical implementations required to stay afloat and keep their customers around. RewardWallet believes this area of the market, small to medium sized businesses, needs a new tool to revolutionize their business.

In the last few years companies have poured millions of dollars into creating their own mobile apps that allow their customers to collect rewards and/or redeem coupons. Collecting a reward for purchasing an item is an example of instant gratification and draws customers to revisit or prefer a business [2]. This leaves smaller businesses behind as they do not have the resources to build their own reward system [1]. Our product is designed to be this very system. By providing a low-cost solution, businesses can be empowered with a system that is customizable to their needs which delivers instant gratification to their customers.

The objective is to build a system that is easy for a business to add to their current setup. This is done by creating three key elements, none of which is the business required to maintain at any time. This proposal documents our intent to build an embedded system that acts as an add-on to the businesses current POS system. With this simple and low-cost add-on transactions can be synchronized between our cloud system and the users mobile phone. By creating these tools, we can provide a high-tech solution that requires no maintenance by the business, allowing them to focus on who matters - the customer.

Detailed in this proposal is an overview of this systems architecture and design, risk analysis, budget and resource funding, scheduling and profiles on all our passionate employees. While some alternate solutions do exist/have existed, we later analyze the differences on why others have failed where we can succeed.



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3 SYSTEM ARCHITECTURE

The solution we are proposing shall consist of three primary elements: an embedded system, cloud system, and mobile app client. The embedded system acts as a bridge between the businesses current POS system, our cloud system and the users phone. It can create transaction records which are received by the user's phone through NFC. Should the user not have a phone with NFC capabilities, the embedded system can assign a transaction to a user by scanning a QR code on the user's phone. Our cloud system then verifies transactions, records a history and allocates rewards to the user. Below in Figure 1: High Level Data Flow Model *Figure 1* you will see a high-level overview of this architecture.

High Level Data Flow Diagram

Shown here is a high level abstraction showing the way in which data flows between the cloud server, embedded system and a mobile phone.

(a): End User has a phone with NFC capabilities

(b): End User has a phone without NFC capabilities

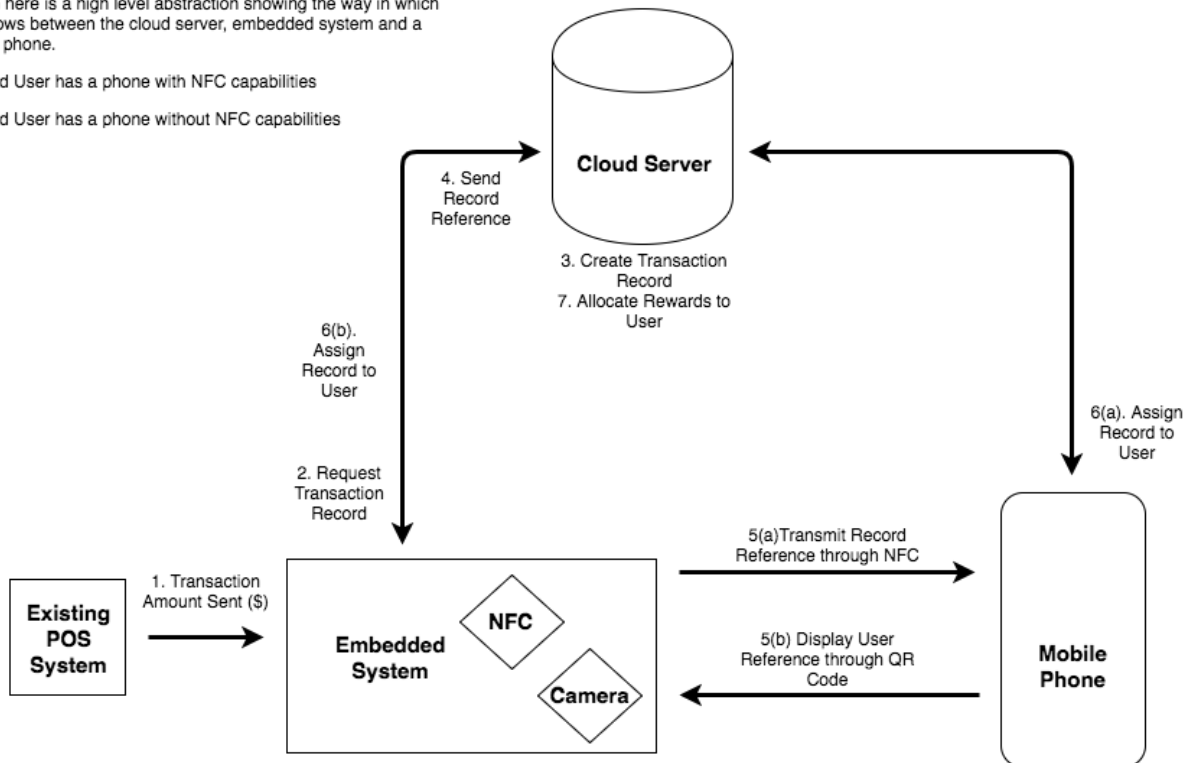
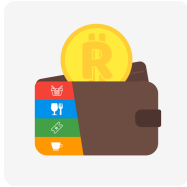


Figure 1: High Level Data Flow Model

The embedded system itself will act as a finite state machine that awaits inputs from the POS system and responds accordingly. An LED on the device will indicate to the users if the device is waiting for an input, processing an input and ready to assign a reward to a user. The finite state model is shown in *Figure 2*.



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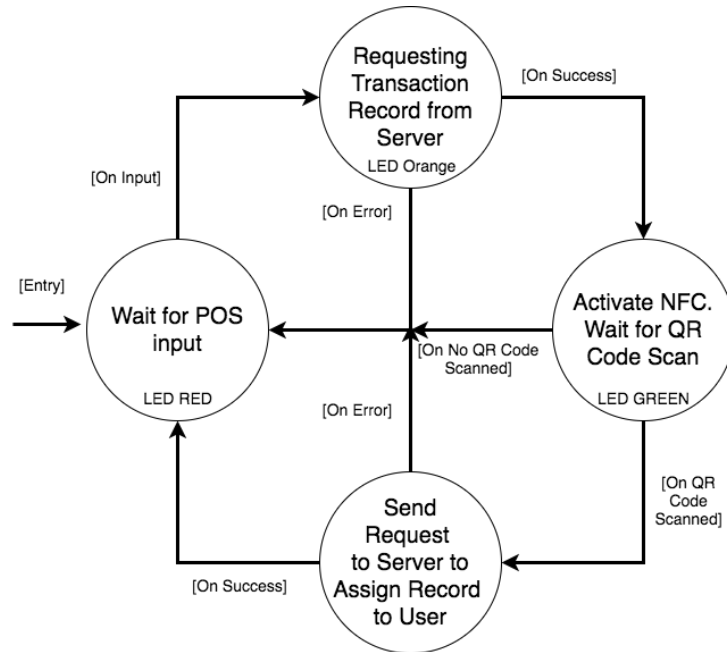
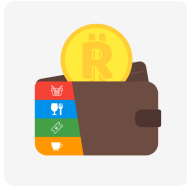


Figure 2: Embedded System Finite State Machine Model

The cloud system will meanwhile be multithreaded such that it can accept requests for any of the actions previously listed and create/edit the appropriate objects in the database. The purpose of this is to keep the main computational loads on the server such that the embedded system can be of low computational power to keep its costs low. Similarly, the mobile app client will just display and send data to the server for processing.



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4 EXISTING SOLUTIONS AND MARKET RESEARCH

4.1 MARKET RESEARCH

From our market research it has been found that businesses without a loyalty program are at a huge disadvantage. According to an online survey done by more than 30,000 customers, 72% of them agree they would buy from a retailer that offers a loyalty reward over one without. 67% of the participants also agree that retailers who offers loyalty program will make them visit more frequently and spend more [4].

Canadian consumers are no exception. In 2017, Canadian consumers enrolled in 175 million customer loyalty program memberships, averaging out to more than 5 per capita. This presents a 35% rise of memberships from 2015, when overall Canadian memberships were at a total of 135 million [5].

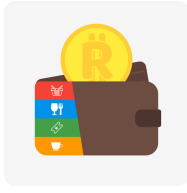
These numbers show that there is a demand for reward programs. Additionally, the online surveys conclude that customers prefer to shop at businesses with loyalty reward perks. Small businesses just need an easy way to provide such a program. With RewardWallet, customers can be provided with an access point to collect rewards at multiple individual businesses.

4.2 COMPETITION

Currently there are three providers that offer businesses a reward system as a service. Belly, a small start-up that is on the decline due to lack of functionality and a high subscription fee. FiveStars, a premium system that is far too expensive for most businesses but offers good POS integration support. And Square Loyalty, which while affordable to most requires that the business already be using Square as their POS system and is only available in the United States. We believe these solutions lack the competitive edge which is why there is still an opening in the market for RewardWallet.

According to Belly's website, they have 7 million customers with more than 8,500 locations across 2,500 cities [6]. However, some major brands, such as 7-11, discontinued their contract with Belly in favor of rolling out their own rewards program [7]. Belly works via an iPad app that only records visits via QR code to collect points. Pricing starts at \$159 per month with higher price points offering POS integration and targeted customer marketing. Even though Belly is an easy to use app for store owners, collecting visits alone does not offer owners with a flexible enough reward distribution model.

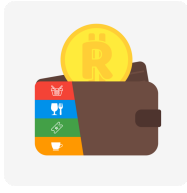
FiveStars has POS integration to most systems and offers a full suite of features. However, customers can only collect rewards by scanning a card as there is no mobile app. It also has the option to link a phone number to the card and the customers can still earn rewards even when they forgot to bring their card by providing their phone number. However, with the starting price of \$279 per month, it is a huge burden on small and medium businesses [8].



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Square Loyalty works with an existing Square mobile payment system. For \$25 per location per month, it is excellent for small businesses who are using Square. Customers can simply tap their phone using the Square app or provide their phone number to collect rewards based on visits, amount spent, or category of item. The downside is that if a business were to adopt Square they would have to ditch their existing POS system. Their app also does not provide listings of all the businesses nearby that uses Square Loyalty and therefore provides less visibility to potential customers [9]. Square Loyalty is currently only available in the United States and has not publicly announced if they will add the service to Canadian Square merchants.



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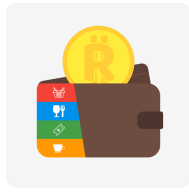
5 OUR PROPOSED SYSTEM

With our proposed solution, RewardWallet, the business owners are relieved from needing to know the technical jargon. All it takes is a small add-on to their existing POS system and our cloud system and mobile app takes care of the rest. While some competitors charge upwards of \$159 per month, we can offer our system at a fraction of the cost by making it customizable and scalable to any business such that we widen our market.

Unlike solutions like Belly that work by allocating a reward point for each visit, RewardWallet can be custom tailored to for each business by allowing them to choose their own distribution model. Models such as 5% points for every dollar spent, or a static 10 points for each transaction. RewardWallet gives freedom of choice to businesses and acts as the middleman between transactions.

The mobile app that customers use to collect points not only acts as a platform to discover new businesses but also as a marketing tool for RewardWallet subscribers. Unlike our competition, we aim to bring a more personalized experience to customers. With a mobile app, businesses can send targeted marketing via push notifications to inform customers of promotions to improve customer retention. Exploration of future possibilities have included adding mobile ordering to select businesses that pay a premium; however, due to time constraints that feature was tabled for a later version and not the current prototype design.

For our ENSC 405 project we are the primary constraints are time and funding support. Within the 10-week development cycle we will work to develop the core architecture of our system in addition to perusing different avenues of funding. Focus will be on the embedded system that can communicate with the server and send information to a customer's phone over NFC. With more time and funding, we would be able to expand the features on the mobile app and cloud system. These features include targeted advertising, mobile ordering and other features a business might find useful.



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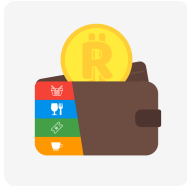
6 RISK ANALYSIS

Table 1: Scale of Risk Level

5 Severe	If a risk event occurs and has this rating, there will be a severe impact on the progress of the project. One or more of the critical outcome objectives will not be achieved.
4 Significant	If a risk event occurs and has this rating, there will be a significant impact on the progress of the project. One or more stated outcome objectives will fall below acceptable levels.
3 Moderate	If a risk event occurs and has this rating, there will be a moderate impact on the progress of the project. One or more stated outcome objectives will fall below goals but above minimum acceptable levels.
2 Minor	If a risk event occurs and has this rating, there will be a minor impact on the progress of the project. One or more stated outcome objectives will fall below the goals but well above the minimal acceptable levels.
1 Minimal	If a risk event occurs and has this rating, there will be a minimal impact on the progress of the project. There will be little or no impact on achievement outcome objectives.

Table 2: Risk, Severity, and Likelihood of Occurrence

Severity	Risk	Likelihood of Occurrence
3	<u>DELAYS TO REQUIRED INFRASTRUCTURE</u> Delays to infrastructure such as hardware or software	35%
5	<u>FAILURE TO INTEGRATE WITH SYSTEM</u> The risk that our product will fail to fit into the existing system	30%
2	<u>TESTING TAKES MORE TIME THAN EXPECTED</u> Identify the risk that specific testing need to be done before implementing the next feature	50%
4	<u>CHANGE FUNCTIONALITY OVERLOAD</u> A large number of change requests dramatically raises the complexity of the project and distracts key resource	25%
1	<u>UNDERESTIMATING THE BUDGETS</u> Identify the risk of inaccurate cost estimates and forecasts	20%
2	<u>VULNERABILITIES AND MALWARE</u> Consider the risk that new functionalities always come new threats	10%
3	<u>MARKET VIABILITY</u> Through market research a need for such a system as this is believed to be wanted; however, the success will depend on businesses enrolling	35%



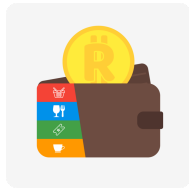
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RewardWallet is determined to design and deliver POS add-on services. As a company, providing reliable quality solutions, and identifying/mitigating risks will be an essential part of our project. Table 1 provides a scale that is used to determine the severity of risk and Table 2 illustrates possible risks involved in the project.

One biggest risk is implementing the embedded system with NFC capabilities that can integrate to existing POS system. Because the system requires high demand of accuracy for each transaction amount received, we will test it with many records to ensure the accuracy of each transaction amount received by the users. Another risk that cannot be ignored is vulnerabilities and malware attacks to our system. Ensuring transaction record and reward information that are safe and secure is important to our customers. We will mitigate the risk by adding passwords protection for users and reducing exposure of our servers and domain name.

We also consider the risk that testing will take longer than expected. This can impact our other part of development. Prioritizing tasks and continue to track progress are the key to minimize the risk.



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7 COST CONSIDERATION

7.1 BUDGET

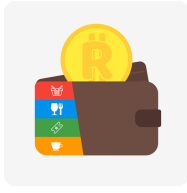
Table 3: Prototype Budget Chart

Equipment List	Qty	Unit Price
Texas Instrument Target Board w/ NFC	1	\$30
PN532 NFC/RFID controller breakout board	1	\$40
Raspberry Pi 3 Model B	1	\$50
Raspberry Pi 3 starter kit	1	\$60
Server fee	6 months	\$10/month
Raspberry Pi Zero W	1	\$56
Camera Module	1	\$30
iOS Developer Fee	1	\$140
Miscellaneous Wires, LEDs and Resistors		\$20
Estimate Shipping Costs		\$80
Total		\$ 566

Table 3 outlines some materials and tentative budget for the prototype. For simplicity, some parts have been grouped together into Raspberry Pi 3 starter kit, including LED lights, wires, jumpers, switches, etc. The budget also accounts for the appropriate 15% of contingency for any additional components that may be needed during development. Electronic parts and licenses will be sourced from Adafruit, Texas Instruments and Apple.

7.2 FUNDING

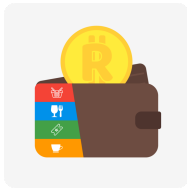
The initial cost in the design and implementation of this project may vary with the volume of development, and it is important to note the initial capital required will greatly exceed the cost of the finalized product. To ensure the success of the project and to achieve goals, it is necessary to seek early stage funding sources. We will prepare a presentation of our project to the Engineering Student Society Endowment Fund (ESSEF) and submit application to IEEE Canadian Foundation for Special Grants.



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Furthermore, RewardWallet plans to minimize the production costs. Some tools and components that are needed for the prototype come from previous lab kits. For the condition of our funding which does not cover all the costs, all team members agree to equally share the extra costs to ensure the success of our product.



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8 SCHEDULE

Figure 3 is a Gantt Chart detailing our project planning. Tasks regarding documentation and presentation are indicated in green while tasks regarding prototype development are indicated in yellow. Furthermore, any task dependencies are linked using arrows. The leftmost column shows progress of each task. A green tick mark indicates that a task is Completed, a green dot marks a task as On Schedule, and a yellow dot marks a task as Behind Schedule. When a task has been started, a progress bar appears inside its timeline. The progress bar shows the completeness, based on percentage completed, of the specific task.

Figure 4 is a milestone chart documenting major milestones of the project. The milestones include those for various documentations and at different stages of project increment.

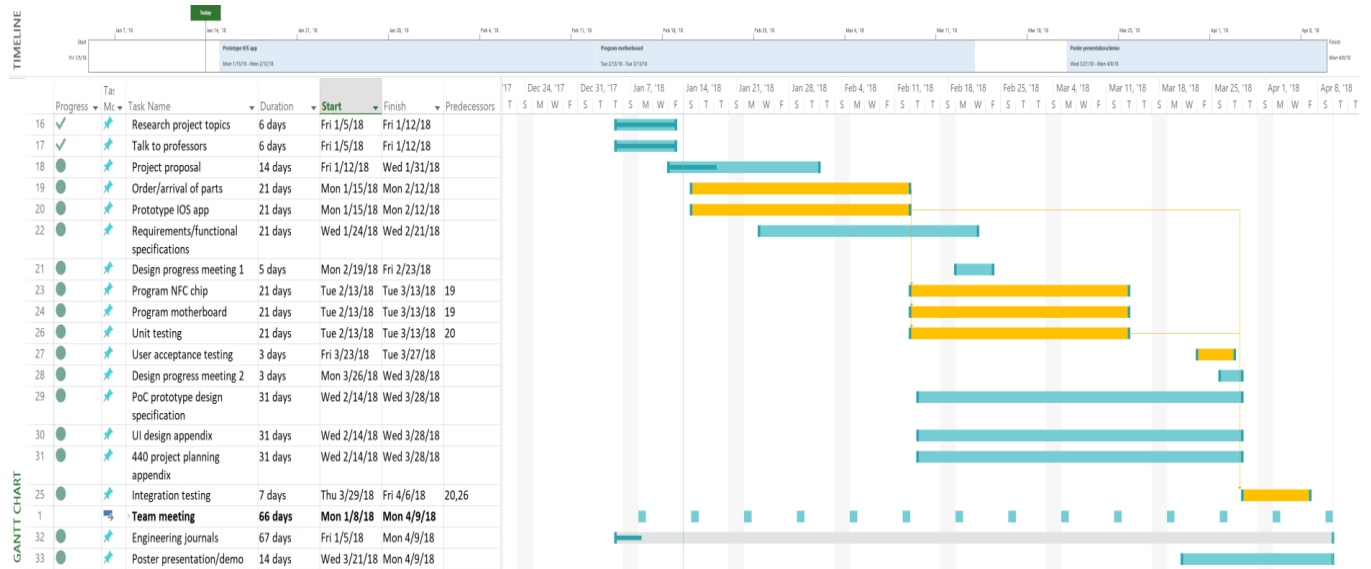
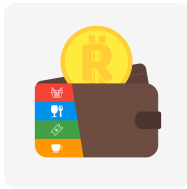


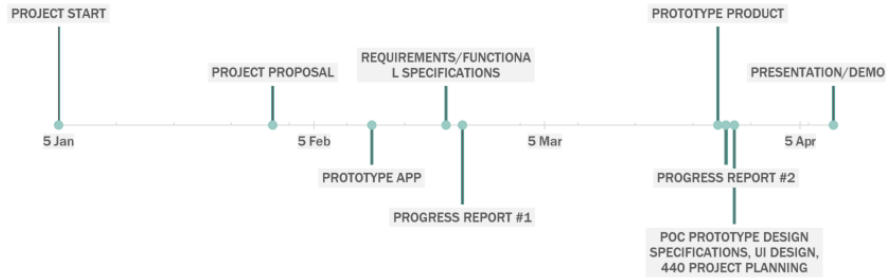
Figure 3: Gantt Chart



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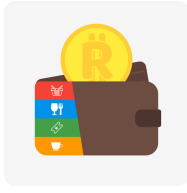
PROJECT MILESTONES



DETAILS

DATE	MILESTONE	POSITION
5-Jan	Project Start	25
31-Jan	Project Proposal	10
12-Feb	Prototype App	-10
21-Feb	Requirements/Functional Specifications	10
23-Feb	Progress Report #1	-20
27-Mar	Prototype Product	25
26-Mar	Progress Report #2	-10
28-Mar	PoC Prototype Design Specifications, UI Design, 440 Project Planning	-25
9-Apr	Presentation/Demo	10

Figure 4: Milestone Chart



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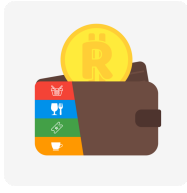
9 TEAM ORGANIZATION

RewardWallet consists of four dedicated Engineers. Namely, Nathan Tannar, Molly Bin, Wilson Chen and Jia Hui (Mandy) Xiao. Team members will provide equal contributions to the project. Tasks assignments are designated to each member based on their strengths and interests.

Nathan, the Chief Executive Officer, is responsible for overseeing the organizational details of the company and facilitating communication between team members and shareholders. Molly, the Chief Finance Officer, is responsible for budgeting and spending. Furthermore, she will also provide cost estimations for the project. Wilson, the Chief Technology Officer, is responsible for system integration between the three different elements of the proposed system. As CTO, he will also be liable for researching market competitions and providing an ideal product for potential customers. Mandy, the Chief Operating Officer, oversees the technical operations of the project. She will foresee all milestones and deadlines of the product and make sure that all technical issues are dealt with accordingly.

Communication is an important aspect for team members in RewardWallet. Meetings will be held at least once a week on Monday mornings for at least two hours. Additional meetings and programming sessions are scheduled throughout the week as required. Meeting minutes are taken at each meeting detailing the points discussed and agreed on action items. They are shared amongst team members in real-time for easy access.

With the aforementioned organization details of the company, team members will put in their best efforts to deliver an outstanding product through collaboration. In addition, members in the company will emphasize on communication and respect for one another to achieve desirable team dynamic.



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10 COMPANY PROFILE

Nathan Tannar - Chief Executive Officer

I am a 4th year Computer Engineering undergraduate student with a passion for technology and the empowerment it brings to the world. While on Co-Op at SAP as a System Support Engineer, I worked on many personal projects to extend my knowledge to backend and iOS engineering. I bring the knowledge and experience from setting up cloud based computing systems to designing and implementing an iOS app to communicate with said cloud system. Most importantly, however, I bring focus to developing positive company culture to improve communication and knowledge transfer between teams and individuals.

Molly Bin - Chief Finance Officer

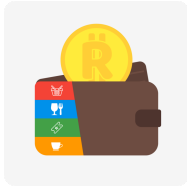
I am a 4th year Computer Engineering student at Simon Fraser University. I have experience in Internet of Things and Networking solutions through a co-op software test developer position at Sierra Wireless in Richmond. I also have experience in iOS development in Swift, embedded development using C/C++, and python in a Linux development environment. On top of my technical skills, my ability to work well in a team environment makes me a great fit for Financial Officer at RewardWallet.

Wilson Chen - Chief Technology Officer

I am a 5th year Computer Engineering student at Simon Fraser University with a year of co-op experience at Defense Research and Development Canada. With experiences in robotics using ROS, Python, and C++ to integrate drones, autonomous systems, and sensors, my strengths lie in integration and data fusion between multiple sensors and the robot to execute the desired mission and collect valuable data.

Jia Hui (Mandy) Xiao - Chief Operating Officer

I am a 4th year Computer Engineering student at Simon Fraser University. I have experiences in building applications using C#, XAML and web application REST API as well as database testing during my previous co-ops. I also possess organizational and communication skills that will aid my success as the Chief Operating Officer at RewardWallet.



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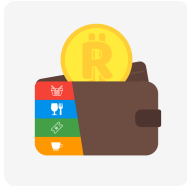
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11 CONCLUSION

RewardWallet can revolutionize small and medium businesses by providing them with state of the art technology to launch their own, highly customizable rewards point system. This innovative solution will give them an edge in competition with large franchises who already spent enormous efforts into creating their custom reward systems.

In the next eight months, the development team at RewardWallet will dedicate their full efforts in producing a POS add-on embedded system that is reliable and low costing. It will allow businesses to flourish by awarding their customers with store points as well as updating their customers on current store promotions and personalized rewards. All these benefits are accomplished as a simple add-on to their current system, allowing businesses to invest minimally.

The Scheduling and Company Profile demonstrated RewardWallet's capability to complete this product within the allocated time. Team members from the company are responsible and experienced. They are guaranteed to produce a useful product that exceeds their customer's standards.



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12 GLOSSARY

POS: Point-of-Sale, referring to the instance a transaction takes place between a business and a customer

Cloud Server: A logical server that is build, hosted and delivered through a cloud computing platform over the internet

Embedded System: Combinations of hardware and software that perform a specific function within a larger system

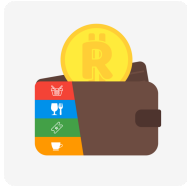
Finite State Machine: A mathematical model of computation that can be in exactly on of a finite number of state at any given time

LED: a two-lead semiconductor light source

NFC: Near-field communication is a set of communication protocols that enable two electronic devices to establish communication by bringing them closer of each other

Prototype: A first preliminary model of something

QR Code: the trademark for a type of matrix barcode that is a machine-readable optical label contains information about the item



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