Cryptocurrency Inventory Bank

Kyle Kirkpatrick

Capstone 1: STG-451

Grand Canyon University

Instructor: Dr. Isac Artzi

April 18, 2021

**ABSTRACT**

Cryptocurrency, gold and silver are constantly being sold and bought because of the consistent fluctuation of price per US dollar. Pawn shops allow customers to safe keep their precious metals, as well as provide a trade in value based on real time price. Cryptocurrency is volatile and people need a way control and manage their asset inventory (specifically crypto and precious metals), as well as maximize these assets. The tools used include Google sheets, MySQL server, MySQL Workbench, Rstudio, and powerpoint.

**TABLE OF CONTENTS**

Abstract ……………………………………………………………………………………………………………………………………………. 2

Capstone Proposal Form 4

Project Requirements 14

Design Plan 20

Developmental Phase 37

**Test Cases ……………………………………………………………………………………………………………………………………...**..**57**

**Final Project Completion…………………………………………………………………………………………………………………..58**

## 

## 

## **Capstone Project Proposal Form**

Retain this document throughout the development of the project. This form should be submitted as needed for instructor feedback.

**General Information**

Cryptocurrency Trader and Asset Bank

Kyle Kirkpatrick

September 21, 2020

**Project Overview and Project Objectives**

Cryptocurrency, gold and silver are constantly being sold and bought because of the consistent fluctuation of price per US dollar. Pawn shops allow customers to safe keep their precious metals, as well as provide a trade in value based on real time price.

**State the Problem**

Cryptocurrency is volatile and people need a way control and manage their asset inventory (specifically crypto and precious metals), as well as maximize these assets.

**Background**

This project is being undertaken because I feel that there is a market for people to trade cryptocurrency and precious metals. Having pawn shop experience, many people feel comfortable with storing their precious metals in a safe location. Allowing people to do the same with cryptocurrency and providing a way to grow these assets is a market untapped.

**Project Objectives**

Build an inventory management system (physical and virtual) that stores assets for customers

Build a database that holds customer information, their assets and all previous trading transactions

Build a program that analyses trends, market value and prediction models

Provide a way to keep assets secure (prevent attacks and hacks)

**Challenges**

Security of customers’ personal assets will be at utmost importance since people are trusting to keep these safe.

Relaying information between the customer database and inventory database and updating both accordingly.

The trend analysis program must use real-time values from websites to compare.

Getting customers to trust and understand the process will be challenging.

**Benefits and Opportunities**

Customers will benefit by keeping their assets in a safe location, as well as the opportunity to increase their assets. A pawn shop will benefit by brining customers into their store and increase the inventory. I will benefit by learning how to create a secure management system and stay up to date on necessary tasks.

To do this project, I will need to learn how to manage databases. I will also need to make connections between databases, information on websites and provide security to customers.

**Project Scope**

1. An inventory and customer database will be created to manage peoples’ precious metals and cryptocurrency, along with a program to increase their assets.
2. Use the template to list all known stakeholders and contacts, if applicable, including self (for some projects self may be the only name listed)

|  |  |  |
| --- | --- | --- |
| Stakeholder Name | Role(s) | Responsibilities |
| Kyle Kirkpatrick | Creator and Designer | Create and manage databases, trend analysis program and provide a way to keep assets secure. |
| Isac Artzi | Mentor | Help with design and creation |
| Travis Kirkpatrick (Dad) |  | Gives ideas and program necessities |

1. List the work breakdown required to satisfy the project objectives. Identify teams and other resources that may be required to successfully complete the project.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Work Breakdown Structure | | | | | | | | | | |
| ID | Task | Dependencies | Status (Not Started) | Effort Hours | Cost ($/hr) | Start Date | Planned Completion | Estimate to Completion | Actual Completion | Resource |
| 1 | Touch up/Re-learn SQL |  |  | 3 | 20 | 9/28/20 | 9/29/20 |  |  |  |
| 2 | Design Customer Database | 17 |  | 4 | 35 | 11/2/20 | 11/9/20 |  |  |  |
| 3 | Design Inventory Database | 17 |  | 4 | 35 | 11/2/20 | 11/9/20 |  |  |  |
| 4 | Design a trend analysis R program | 8, 9(?),25 |  | 3 | 35 | 10/12/20 | 10/19/20 |  |  |  |
| 5 | Research websites for asset worth |  |  | 1 | 20 | 10/5/20 | 10/5/20 |  |  |  |
| 6 | Revisit data scraping in R | 5 |  | 2 | 30 | 10/5/20 | 10/5/20 |  |  |  |
| 7 | Build R connection to real-time values (worth of assets) | 5,6 |  | 3 | 30 | 1/11/21 | 1/18/21 |  |  |  |
| 8 | Research/ think about algorithms 🡪 for trends |  |  | 4 | 35 | 10/12/20 | 10/12/20 |  |  |  |
| 9 | Implement algorithm in R | 4(?), 25 |  | 2 | 35 | 1/18/21 | 1/18/21 |  |  |  |
| 10 | Connect R program to databases | 11,12 |  | 1 | 35 | 1/25/21 | 1/25/21 |  |  |  |
| 11 | Create customer database | 2,3 |  | 5 | 35 | 1/18/21 | 1/25/21 |  |  |  |
| 12 | Create inventory database | 2,3 |  | 5 | 35 | 1/18/21 | 1/25/21 |  |  |  |
| 13 | Research and learn security measures for SQL | 11,12 |  | 3-5 | 25 | 10/19/20 | 10/19/20 |  |  |  |
| 14 | Implement security measures 🡪 this could be multiple steps depending on what is needed | 11,12 |  | 6-12? | 35 | 2/1/21 | 2/8/21 |  |  |  |
| 15 | R program receives and returns specific queries from database | 10,11,12,9 |  | 2 | 35 | 2/8/21 | 2/8/21 |  |  |  |
| 16 | Give interaction between both databases | 11,12 |  | 2 | 35 | 1/18/21 | 1/25/21 |  |  |  |
| 17 | Brainstorm with dad |  |  | 2-3 | 0 | 9/26/20 | 9/26/20 |  |  | My dad |
| 18 | R algorithm testing with real time values | 8,9,4,7 |  | 3 | 35 | 1/18/21 | 1/18/21 |  |  |  |
| 19 | Database to R program testing queries | 11,12,10,7 |  | 1 | 35 | 2/15/21 | 2/15/21 |  |  |  |
| 20 | Simple security measure testing | 14,11,12 |  | 3-5? | 35 | 2/15/21 | 2/15/21 |  |  |  |
| 21 | Design a “crypto calculator” for easy conversion | 17 |  | 3 | 30 | 10/26/20 | 10/26/20 |  |  |  |
| 22 | Build a “crypto calculator” | 7,21 |  | 3 | 30 | 2/22/21 | 2/22/21 |  |  |  |
| 23 | Implement tool (calculator) for pawn shop employees to use | 7,21,22 |  | 5 | 30 | 2/22/21 | 2/29/21 |  |  |  |
| 24 | Implement specific common queries in both databases | 11,12 |  | 3 | 35 | 1/25/21 | 2/1/21 |  |  |  |
| 25 | Revisit statistics and what can be used for algo |  |  | 2 | 25 | 10/12/20 | 10/12/20 |  |  |  |
| 26 | Create a crypto wallet inventory (physical and virtual) | 27 |  | 2 | 0 | 2/22/21 | 2/22/21 |  |  |  |
| 27 | Research good cryptocurrency practices |  |  | 2 | 0 | 10/5/20 | 10/5/20 |  |  |  |
| 28 | Build an inventory area in pawn shop | 11,12 |  | 2 | 25 | 2/29/21 | 2/29/21 |  |  | With help of dad |
| 29 | Design a relay system between developer and front-end | 17 |  | 3 | 25 | 11/9/20 | 11/9/20 |  |  |  |
| 30 | Build relay system | 29 |  | 4 | 25 | 3/2/21 | 3/2/21 |  |  |  |
| 31 | Test relay system | 29,30 |  | 1 | 25 | 3/2/21 | 3/9/21 |  |  |  |
| 32 | Design customer pitch | 17 |  | 2-3 | 25 | 12/14/20 | 12/14/10 |  |  | Dad will help |
| 33 | Build customer pitch | 32 |  | 3 | 25 | 3/9/21 | 3/9/21 |  |  | Dad will help |
| 34 | Give a full test | 11,12,22,30,23 |  | 4-5 | 50 | 3/9/21 | 3/30/21 |  |  |  |

Once I start diving into the project, more tasks may be added, and some tasks may be removed. A lot of research needs to be done when learning about new subjects, so I need to start earlier than later. Tasks may need to be split up with added details, depending on what is desired and how the process goes.

**Project Completion**

1. Describe what measures will be used to calculate project success.

The project will be a success if a customer can purchase/trade cryptocurrency and precious metals with the pawn shop inventory. Analysis trends are made with the R program and assets are correctly traded for maximization. Information can be easily relayed from customer to employees, employees to owner, and owner to developer (and vice-versa).

1. Use the template to list the project completion criteria.

|  |
| --- |
| Project Completion Criteria |
| 1 – A fully functional pawn shop inventory database (relies on 2) |
| 2 – Fully functional customer inventory database (relies on 1) |
| 3- An R program that analyzes precious metal and cryptocurrency trends/real-time worth to maximize assets |
| 4- A program that is able to convert value of cryptocurrencies and metals using real-time data |
| 5- A relay system to easily send new customers transactions between developer and pawn shop owner |
| 6- Customer pitch |

1. Use the template to list the project assumptions and constraints, if applicable. An assumption is an educated guess that a likely condition or circumstance is presumed to be true. A constraint is a limiting condition or circumstance that defines the project boundaries. Assumptions allow the project to succeed. Constraints restrict or limit the project execution.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Assumptions and Constraints | | | | | |
| ID | Description | Comments | Type | Status | Date Entered |
| 1 | There is an algorithm that utilizes real-time data and correctly analyzes trends |  |  |  | 9/21/20 |
| 2 | Websites will stay relatively the consistent when web scraping values | If sites collapse or change, the web scraping can be impacted |  |  | 9/21/20 |
| 3 | Only specific entries can be present in either customer or inventory database | Keep in mind while designing both |  |  | 9/21/20 |
| 4 | Security Measures will cause most constraint | This part is the most unknown for me, so I will be constrained by this the most-> could add many more tasks |  |  | 9/21/20 |
| 5 | Brainstorming | New tasks could arise while brainstorming with Dad on ideas |  |  | 9/21/20 |
| 6 | Crypto Calculator should be usable by anyone | The calculator will be able to be used by pawn shop owner/employees |  |  | 9/21/20 |
| 7 | Relay system will work accordingly | Information can be relayed quickly between pawn shop owner and developer |  |  | 9/21/20 |

Many assumptions are being made for project completion and a lot can change for a fully completed project. But at the end of the day, a complete project is the best one.

**Project Controls**

1. Use the template to define the risk and list the steps to prevent the risk from occurring or the steps to minimize the chances of it happening. The contingency plan describes alternative solutions to reduce the impact of the risk. An example of a contingency plan is to provide the customer a temporary web server if there are delays in delivery/completion.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Risk Management | | | | |
|  | **Risk Probability** | **Risk Impact** |  |  |
| **Event Risk** | **(high, medium, low)** | **Risk Mitigation** | **Contingency Plan** |
| What is the risk? | What is the probability? | What is the impact if the risk occurs? | What can be done to minimize the risk? | What can be done to minimize the impact of the risk? |
| Providing security could need a large portion of time to learn new practices, applications and techniques | high | Could impact time management and the number of hours needed | Do research early! | Don’t procrastinate |
| Trend analysis algorithm in R will need to be rebuilt | high | Make it difficult to work with the values needed for people to build assets | Spend time before learning how precious metals and cryptocurrency relates.  Manipulate and manage numbers to “predict” outcomes | Keep a change and edits log so backtracking can occur |
| The database system will not make the connections | medium | Database system would be unusable | Research SQL techniques thoroughly | Have a plan B in place to create a single database |
| Cryptocurrency calculator is unusable for pawn shop | low | Pawn shop could not get real-time conversions for the customers | Stay up to date on how it would be easier to implement with Dad | Google has many conversions that can be used |
| Websites go down or get changed | Low | Since the web scraper will be reliant on specific websites, could affect real-time data | Be picky on what sites are chosen | Have backup sites |
| Relay system doesn’t work | Medium | It will be important to relay new customer and inventory entries, so having a faulty system would defeat the customer interaction entirely | Brainstorm a good system that can easily communicate the needed information between developer and owner | Use a rudimentary way 🡪 email for example |

1. All projects have either anticipated and planned or unexpected changes. Describe any issues in management or change management due to the anticipated and planned or unexpected changes. Use the template to list anticipated and planned or unexpected changes.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Change Control Log | | | | | | | | | |
| **ID** | **Change Description** | **Priority** | **Originator** | **Date Entered** | **Date Assigned** | **Evaluator** | **Status** | **Date of Decision** | **Included in Rev. #** |
| 1 | One complete database can be made for both the pawn and customer inventory/information | 1 |  | 11/20/20 | 2021 | Kyle Kirkpatrick | Fixed | 12/15/20 | N/A |
| 2 | A single, robust trend analysis program cannot be made. It will constantly change and adapt based on customer/store/employee/owner/developer needs | 2 |  | 12/15/20 | 2021 | Kyle Kirkpatrick | Fixed | 3/18/21 | N/A |
|  |  |  |  |  |  |  |  |  |  |
| 3 | The relay system was changed to allow employees to instantly send necessary information to the developer. A transaction relay table in Google sheets was added. | 3 |  | 4/8/21 | 4/9/21 | Kyle Kirkpatrick | Fixed | 1/18/21 | N/A |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| 4 | Added a phone number entry to the customer table | 4 |  | 3/15/21 | 4/01/21 | Kyle Kirkpatrick | Added | 4/01/21 | N/A |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| 5 | Added US dollar in and out to the transaction table | 5 |  | 3/15/21 | 4/01/21 | Kyle Kirkpatrick | Added | 4/01/21 | N/A |
|  |  |  |  |  |  |  |  |  |  |
| 6 | No analysis of cryptocurrency vs precious metals | 6 |  | 4/9/21 | 4/18/21 | Kyle Kirkpatrick | Incomplete | 4/18/21 | N/A |
|  |  |  |  |  |  |  |  |  |  |
| 7 | No analysis of customer tendencies | 7 |  | 4/9/21 | 4/18/21 | Kyle Kirkpatrick | Incompete | 4/18/21 | N/A |

1. Use the template to describe how the end user is involved in the software development, if applicable. Include relevant information about meetings, reviews, presentations, etc.

|  |  |  |  |
| --- | --- | --- | --- |
| Roles and Responsibilities | | | |
| Name | Team | Project Role | Responsibility |
| Kyle Kirkpatrick | 1 | Developer | Design and build programs based on ideas given, build a customer pitch, meet with owner on relays |
| Travis Kirkpatrick |  | Pawn Shop Owner | Relay information from customer, meets with developer about tasks |

**Project Schedule**

I created my schedule based on Mondays being mostly free to work on Capstone. A

1. Create a project schedule after all project tasks have been defined and prioritized.

|  |  |  |
| --- | --- | --- |
| Task | Start Date | Planned Completion |
| Brainstorm with dad | 9/26/2020 | 9/26/2020 |
| Touch up/Re-learn SQL | 9/28/20 | 9/29/2020 |
| Research websites for asset worth | 10/5/2020 | 10/5/2020 |
| Revisit data scraping in R | 10/5/2020 | 10/5/2020 |
| Research good cryptocurrency practices | 10/5/2020 | 10/5/2020 |
| Design a trend analysis R program | 10/12/2020 | 10/19/2020 |
| Research/ think about algorithms à for trends | 10/12/2020 | 10/12/2020 |
| Revisit statistics and what can be used for algo | 10/12/2020 | 10/12/2020 |
| Research and learn security measures for SQL | 10/19/2020 | 10/19/2020 |
| Design a “crypto calculator” for easy conversion | 10/26/2020 | 10/26/2020 |
| Design Customer Database | 11/2/20 | 11/9/2020 |
| Design Inventory Database | 11/2/2020 | 11/9/2020 |
| Design a relay system between developer and front-end | 11/9/2020 | 11/9/2020 |
| Design customer pitch | 12/14/2020 | 12/14/2010 |
| Build R connection to real-time values (worth of assets) | 1/11/2021 | 1/18/2021 |
| Implement algorithm in R | 1/18/2021 | 1/18/2021 |
| Create customer database | 1/18/2021 | 1/25/2021 |
| Create inventory database | 1/18/2021 | 1/25/2021 |
| Give interaction between both databases | 1/18/2021 | 1/25/2021 |
| R algorithm testing with real time values | 1/18/2021 | 1/18/2021 |
| Connect R program to databases | 1/25/2021 | 1/25/2021 |
| Implement specific common queries in both databases | 1/25/2021 | 2/1/2021 |
| Implement security measures à this could be multiple steps depending on what is needed | 2/1/2021 | 2/8/2021 |
| R program receives and returns specific queries from database | 2/8/2021 | 2/8/2021 |
| Database to R program testing queries | 2/15/2021 | 2/15/2021 |
| Simple security measure testing | 2/15/2021 | 2/15/2021 |
| Build a “crypto calculator” | 2/22/2021 | 2/22/2021 |
| Implement tool (calculator) for pawn shop employees to use | 2/22/2021 | 2/29/21 |
| Create a crypto wallet inventory (physical and virtual) | 2/22/2021 | 2/22/2021 |
| Build an inventory area in pawn shop | 2/29/21 | 2/29/21 |
| Build relay system | 3/2/2021 | 3/2/2021 |
| Test relay system | 3/2/2021 | 3/9/2021 |
| Build customer pitch | 3/9/2021 | 3/9/2021 |
| Give a full test | 3/9/2021 | 3/30/2021 |

1. Set a programming schedule by implementing work breakdown and task time estimates. Create a timeline with dates for completion of key components of the project.

**Cost Estimate (if applicable)**

The only estimates are the cost of precious metals and cryptocurrency.

**Issue Log**

1. Use the template to identify and monitor project issues.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Issues Log | | | | | | | | |
| **ID** | **Issue Description** | **Project Impact** | **Action Plan/Resolution** | **Owner** | **Importance** | **Date Entered** | **Date to Review** | **Date Resolved** |
| 1 | What is the issue? | How will this impact scope, schedule & cost? | How do you intend to deal with this issue? | Who manages this issue? |  |  |  |  |
| 2 | Incorrect significant figures | Impact the validity of transactions | Fix each cell of the matrix to a specific significant figure | Kyle Kirkpatrick | High | 4-9-21 | 4-18-21 | In progress |
| 3 | Import html not working in Google sheets | Currency conversion matrix has errors not displaying the conversion | Give employees a source to convert currency | Kyle Kirkpatrick | Low | 4-8-21 | 4-8-21 | 4-8-21 |

## **Project Requirements**

**Use Cases**

**Multi-user experience -** The customer wants to exchange currency for a different type, specifically precious metals and cryptocurrency. An example experience would look as follows. The customer wants to exchange an ounce of gold for bitcoin. An employee converts the ounce of gold to BTC amount based on current pricing (currency calculator/converter). Once the conversion is specified, the customer exchanges the gold for BTC from the pawn shop. The employees add the gold to their physical inventory and will remove the cryptocurrency from the virtual inventory. Once the day is over, reports from the owner (dad) will be sent to the admin, and are entered into an inventory/customer database. An analysis (prediction model) of the trends for the day is also taken by the admin. Below is a simple five step plan of the requirements.

Five Step Plan/Modules:

1. Customer Pitch (For new customers)
2. Conversion Calculator
3. Relay System
4. Database Entry
5. Data Analysis (using R)

Diagram

Description automatically generated

**Top-Down Design**

Diagram, letter

Description automatically generated

Customer Pitch – Pitch to customers explaining service

Currency Converter – converts any currencies real-time

Relay System – Relays needed information for database entry

Database – stores all needed information

Trend analysis – analysis of world, store and customer trends

**System Logical Model**

Diagram, schematic

Description automatically generated

Diagram

Description automatically generated

**Technical Requirements**

1. Customer Pitch
   1. Brainstorm a persuasive pitch giving benefits and features of the service
   2. Create a lean canvas of the customer’s pitch
   3. Create an easy-to-read graphic poster of how to give the necessary information to customers – Must be one page!
   4. Give this tool to all pawn shop employees so they are familiar with the process and service
   5. Software – Microsoft PowerPoint
2. Conversion Calculator
   1. Must pull values from real-time, since cryptocurrency fluctuates so quickly
   2. Easy for pawn employees to input values and read what currencies are worth
   3. Software - Google sheets
      1. Matrix like design with each column and row as a currency
      2. Can be shared with all employees of the pawn shop
      3. Write a script/function to pull values from a trusted source
   4. Calculates a fee percentage
   5. The currencies will be initially be pulled per U.S. dollar based (BTC/$, ounces/$, etc.)
3. Relay System
   1. Software – Bravo (pawn shop service which holds inventory, customer information and past transactions
      1. Every pawn transaction is completed through this service
      2. End of day report relaying ONLY currency-based transactions
         1. Precious metals and crypto will be classified under a specific type of transaction
         2. At the end of the day, a “search all” for these can be made
         3. Export the file and send to developer
   2. All the necessary database information can be read from the export file
   3. Any other information can be found by signing into Bravo and giving a customer or inventory search
   4. Tasks, ideas and thoughts can be shared from owner to developer
4. Database
   1. Software – MySQL server and SQL database management studio
      1. Customer table (customer ID, name, phone number, email, currency inventory - both precious metal and cryptocurrency, wallet address and inventory location)
      2. Store table (store ID, inventory, wallet address, wallet id, inventory location)
      3. Transaction table (transaction number, currency added, currency subtracted customer ID, store ID, wallet address, inventory location)
      4. Needs a connection to R program (Rstudio) for extracting table information
5. Trend Analysis
   1. Rstudio
      1. Connection to database to receive table information
      2. Connection to currency converter, for real-time pricing
      3. Analysis of cryptocurrency vs precious metal values
      4. Analysis of customer tendencies
      5. Analysis of history of currency prices
      6. Prediction Model

**Reports**

An end of day or end of week report will be necessary for this project. Since the pawn shops have their own working program that stores information, a report will be needed from this to ensure database entry. The reports will also act as the relay system because the developer will use all the necessary information from the report.

**End of Day Report**

All cryptocurrency and precious metal transactions made

New customers that made one of these specific transactions

End of day store inventory

End of day customer inventory

All of this information will be used when entering in the database. It is difficult to show a mock report of how this looks because I am not sure how to report system works for Bravo (store program). I need to look into this further.

Another report will be specifically from the database. The table data can be mined and used for the R program, even though a connection between the database and Rstudio will be present. This report can be generated at any time. This report would mostly be to analyze inventory and any trends that have been occurring.

**Inventory Report**

Current Store Inventory (ex. 10BTC, 20 ounces of gold, $3,500)

Customer ID

Customer Inventory (based on customer ID)

This report will be extracted from the database. The information can then be used for further analysis using the R program, by looking at current/previous inventory.

**Screen Definitions and Layouts**

Since I am not making an application with a user interface, there are no requirements for a screen layout. However, the currency converter will be used by pawn shop employees. So, the converter needs to be easily understandable and function well for these employees. The best way to do this is through a shared google sheets. I want to make the sheets simple to use as well as quick/efficient.

Example Sheets Matrix:

Graphical user interface, application, table

Description automatically generated

The employees enter the amount that the customer has in the grey box on the corresponding currency. The amount is then displayed below or above for the corresponding currency. A small function pulls real time values from a trusted source to get the value for each currency.

For example, a customer comes in with $1,200 and wants to shop for a currency. That value is inputted into the specific gray box and the corresponding currency amount is displayed below. The pawn employees then know the exact amount to give the customer.

This is the only user interaction within this project would be this currency converter.

**Security**

Security is of utmost importance for this project since we are directly dealing with currency, assets and people’s personal information. Physical security is already handled since the pawn shop has procedures and strong safes to store products in (precious metals are the only physical component of this project). The database will need to be what is most secure. Below is a security matrix showing what role can view information from the tables:

A picture containing diagram

Description automatically generated

Now lets look at all the possible vulnerabilities that this system has and prevention techniques (most research).

1. Malicious attack
   1. SQL injection – be wary of this type of attack and know that people will try and steal information
   2. Encryption – any personal information should be encrypted to be as secure as possible
   3. Backups – the entire database should be backed up since currency information is stored there
   4. Customer information – keep reminding customer to keep their personal information safe, the database will not store customer personals such as passwords, wallet id, etc. Although this is mainly on the customer to keep their stuff safe, malicious actions against them could cause integrity issues within our database
   5. Bravo system – I assume that Bravo has their own security measures but would need to look more into that
2. Sloppy programming
   1. Building the database correctly will be important to prevent incorrect information, malicious attacks, or database crashes
   2. Pay attention to the details such as table columns, primary keys, foreign keys as well as how the tables are joined 🡪 this will make entering information into the database easier and less chance of problems
3. Hosting sites – this project relies on websites to not be down/change, database server to be running, and pawn shop programs to run correctly
   1. Keep backups – having backup databases, websites or file information is important in case of crashes or down sites
   2. Testing – testing the programs or database entry will make sure that everything is working properly

Overall this project is heavily security oriented, especially if the service grows. As more customers start to use it, the more secure it needs to be. Staying up on research and good security techniques will be important when moving forward to building this project.

## **Final Plan**

Prepared for Isaac Artzi and Travis Kirkpatrick

Cryptocurrency Bank and Trader

Prepared by Kyle Kirkpatrick

|  |
| --- |
| Design Planning Summary |

Cryptocurrency, gold and silver are constantly being sold and bought because of the consistent fluctuation of price per US dollar. Crypto is a fully virtual currency that just began being used a little over a decade ago. Pawn shops allow customers to safe keep their precious metals, as well as provide a trade in value based on real time price. Cryptocurrency is an asset that is volatile, and people need a way control/manage their asset inventory (specifically crypto and precious metals), as well as maximize them. Below are solutional modules:

Build an inventory management system (physical and virtual) that stores assets for customers.

Build a database that holds customer information, their assets and all previous trading transactions.

Build a program that analyses trends, market value and prediction models.

Provide a way to keep assets secure (prevent attacks and hacks).

Give customers a pitch on the service to inform them of its benefits and how they can use it.

|  |
| --- |
| Overview of Design Concepts |

1. Provide the high-level design of the proposed solution or business case with supporting narrative text. This design should include mock-up screen shots for the proposed user interface, pseudocode, or flowcharts that show the logic for the program, as well as the anticipated process flow. The purpose of the solution/business case design is to allow the stakeholder to approve the concepts before committing resources to the technical design.

Diagram

Description automatically generated

When a customer enters the store, the pawn employees give the customer pitch on our new service. This can be done based on the customer pitch poster or their own general knowledge. Next the customer shops assets to make a transaction. Based on the customer needs and current inventory, the employee uses the Google sheets currency converter to find what their assets are worth. A transaction is made through the Bravo pawn system. At the end of the day, a report is generated in a pdf format, sent by email to the developer. Any other questions, concerns or statements can be made over the phone. The developer then uses the SQL database management system to enter all needed information into the MySQL database. Now, trends can can be analyzed on Rstudio by using the R-database connection or exporting csv files.

1. Use the template to list the project deliverables.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Deliverable Acceptance Log | | | | | |
| ID | Deliverable Description | Comments | Evaluator (internal or external as applicable) | Status | Date of Decision |
| 1 | Customer Pitch Poster | Create a poster for employees to base their pitch on to new customers | Kyle Kirkpatrick | Completed | 4-18-21 |
| 2 | Currency Conversion | Tool to convert currency values in real-time | Kyle Kirkpatrick | Completed | 4-18-21 |
| 3 | Relay System | Reports to relay needed information to developer for database entry | Kyle Kirkpatrick | Completed |  |
| 4 | Database | Holds all customer, store and transaction information | Kyle Kirkpatrick |  |  |
| 5 | Trend Analysis | Analyze customer and store trends to make predictions | Kyle Kirkpatrick |  |  |

|  |
| --- |
| Detailed Solution Architecture |

1. Provide a detailed overview of how the proposed design fits into the overall solution/ business case structure. Create object model and use cases to depict the system. Use collaboration diagrams and/or sequence diagrams to show the workflows of components/packages/classes inside the component. Describe algorithms, if possible. Include detailed specifications for all screens, interfaces and integration points, processes, conversion, reports, and any required modification to existing systems. This section should also include any solution configuration changes that will be required to develop and implement the proposed solution. The purpose of the detail solution architecture is to provide sufficient information for a developer to produce the system.
2. Describe the approach and resources required to assure system security, if applicable, otherwise explain why security is not relevant.
3. Use the template to list the hardware and software technologies.

|  |
| --- |
| Hardware and Software Technologies |
| 1 – Microsoft PowerPoint – Customer Pitch |
| 2 – Google Sheets |
| 3 – Bravo (Pawn shop program) |
| 4 – MySQL Server |
| 5 – SQL Server Management Studio (SSMS) |
| 6 - Rstudio |
| 7 – Windows 10 PC with USB |

|  |
| --- |
| Revision and Signoff Sheet |

**Change Record**

|  |  |  |
| --- | --- | --- |
| **Date** | **Editor** | **Revision Notes** |
| 9/28/2020 | Kyle Kirkpatrick | Project Proposal |
| 11/20/20 | Kyle Kirkpatrick | Project Requirements |
| 12/22/20 | Kyle Kirkpatrick | Final Design Plan |

|  |
| --- |
| **Overall Instructor Feedback/Comments** |

**General Technical Approach:**

The cryptocurrency bank and trader will use a database server as well as a database management system to update information in tables. The table information should be updated every day based on customer transactions within the store. Since there are no users that interact with the database, the server side of MySQL is not entirely important. The main reason for the database is to mine the table data using data analytic techniques. A connection between the server and Rstudio should be made.

**Key Technical Design Decisions:**

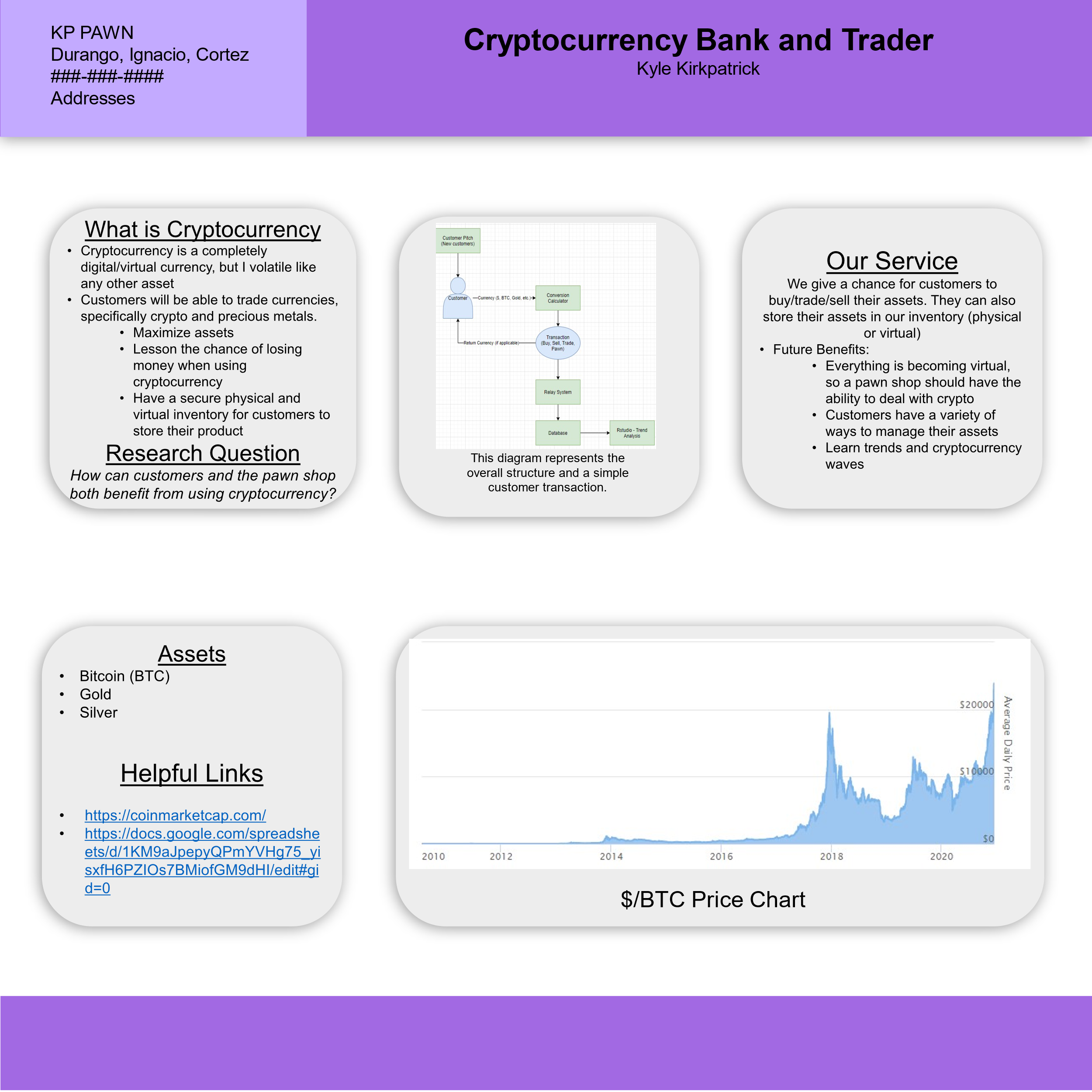
The main technologies used are Google sheets, MySQL server, SQL Server Management studio (SSMS), and Rstudio. The SQL server will hold the *banktrader* database and *store, customer,* and *transaction* information will be entered using the SSMS, based off the reports given by the Bravo Pawn System. MySQL was chosen because I already know how to connect its database to the Rstudio program. Rstudio has many analytical tools and models to visualize trends in the data, while also giving predictions to make conclusions. Google sheets is being used because it is a free service that can shared with anybody that has a Google account, so it is easy to have employees use the currency converter.

**Module 1 – Customer Pitch**

Initial brainstorming is made between developer and owner for the requirements of the customer pitch.

* What is cryptocurrency
* What is our service
* How does this service benefit you
* What assets can be traded/sold/bought
* Where are the assets stored
* Risk/Return

Here is an example customer pitch:



This can change based on what employees think is best. Since the employees will be using the customer pitch the most, it is under their discretion for what they want to say or show. If they know a lot about the subject, the customer pitch poster doesn’t have to be used. This is only a base for the pawn employees to get the customer interested in the service. Changes or recommendations can be made by reporting with the relay system.

**Module 2 – Conversion Calculator**

Example Conversion Matrix for BTC, gold, silver and the US dollar:

Graphical user interface, text, application

Description automatically generated

Each column represents what currency the customer brings in. This allows for people to make a straight trade of silver to BTC, for example. Each row represents the amount of currency that the customer will trade for. Each gray box is a spot that the employee can enter the customers’ currency amount. The store also has a small transaction fee (5% but should change to be competitive with other crypto trading services).

In the example above, a customer owns one BTC. This bitcoin is worth $23,519, ~12.56 ounces of Gold, or ~927.77 ounces of silver. However, the customer only gets 95% of its value because of the transaction fee, which is shown in the customer receives row.

Now the matrix uses a real-time ratio to calculate each of the currencies worth compared to each other. Below is an example of $/BTC as well as BTC/$:



These cell values are then used in the matrix to output the corresponding currency worth. These values are also pulled from a real-time trusted source. Here is an example google sheets function that populates the conversion cell based on the example above:

= DOLLAR(INDEX(IMPORTHTML(B2, “table”, 1)), where B2 is equal to the website cell

The html from the cite is imported and the first table value, which contains the $/BTC, is found and loaded into the Google sheet.

Some issues could arise with this system. The matrix completely relies on an internet connection, the trusted source to not be down, and no website changes are made. To combat this a spot price section in the matrix is added. This allows employees to add in their own spot price and make smart transaction decisions accordingly.

Another issue is that cryptocurrency and precious metals are constantly fluctuating in price throughout the day. Unfortunately, Google only updates their html import in ~30 minute intervals. The matrix does not get an exact second conversion, which is important when dealing with cryptocurrency. The best work around to this is giving the employees a website to cross reference. They are able to cross reference the trusted source, check the *current* value of crypto, and make the transaction accordingly. The owner will set in place a system for making a transaction, based on how close the matrix value is to the real-time value.

Here are the steps needed to build the converter (using Google Sheets):

1. Populate a cell with a ratio ($/BTC)
2. Create a table with columns and rows for each of the currencies
3. Provide an initial input for each currency (employee enters in)
4. The amount received is the input cell multiplied by the real-time ratio
5. Finally, the customer receives 95% of the actual value (this value can change)

A .csv file can be exported into Rstudio anytime for trend analysis.

**Module 3 – Relay System**

The relay system will use Bravo Pawn Platform end of day/week reports to give the developer the necessary database information. I am familiar with the Bravo system and know that these reports are exported as a pdf. So, all the information will be inputted into the database by hand.

Here is an example of how a report may look:

EOD 12/22/20

CUSTOMER NAME, DATE, TIME, CURRENCY IN, CURRENCY OUT, NEW STORE TOTAL, NEW CUSTOMER TOTAL

BILLY BOB, 12/22/20, 12:33, $1200, 0.051 BTC, $5200, 0.949 BTC

STAN MARLEY, 12/22/20, 1:44, 1 GOLD OZ, 0.398 BTC, 9 GOLD OZ, 0.551 BTC

GILLIE JOE, 12/22/20, 3:09, 0.1 BTC, $2000, 0.651 BTC, $3200

The report needs to contain information to populate the database. Another important part of the relay system is communication between the developer and owner. Since the developer will not be present at any store location, customer and employee needs will need to be relayed to the developer. Not only that, but trends that employees/owner see can be relayed to the developer for analysis.

The best method for this report is an email so it can be documented and referred to. The developer can quickly reply or make changes to the database based on what the owner is asking for. The email would also have the end of day pdf attached. Here is an example:

------------------------------------------------------------------------------------------------------

Subject: eod-12/22/20

Questions:

1. Why did so much BTC sell today?
2. Are there any customers that have lots of gold in their inventory? Gold prices are low right now and would like to offer people a chance to change their assets.
3. Should the store buy or sell a specific assets heading into the end of the week?

EOD.pdf

Travis Kirkpatrick

Lastly, more abstract ideas and service changes can be made through phone call. Not all information or store needs can be documented perfectly, and ideas/concepts can be bounced quickly through verbal communication. An end of day phone call can be made to deal with these times.

**Module 4 – Database**

Database Relational Schema:

**A picture containing diagram

Description automatically generated**

Example SQL Scripts:

CREATE SCHEMA IF NOT EXISTS `banktrader` DEFAULT CHARACTER SET utf8 ;

CREATE TABLE IF NOT EXISTS `banktrader`.`store`

( `storeId` INT(3) NOT NULL AUTO\_INCREMENT,

`goldOunce` FLOAT(8) NULL DEFAULT NULL,

`silverOunce` FLOAT(8) NULL DEFAULT NULL,

`btc` FLOAT(8) NULL DEFAULT NULL,

`walletAddress` VARCHAR(50) NULL DEFAULT NULL,

`walletId` VARCHAR(50) NULL DEFAULT NULL,

`inventoryLoc` VARCHAR(50) NULL DEFAULT NULL,

PRIMARY KEY (`storeId`))

CREATE TABLE IF NOT EXISTS `banktrader`.`customers`

( `custId` INT(11) NOT NULL AUTO\_INCREMENT,

`firstName` VARCHAR(50) NULL DEFAULT NULL,

`lastName` VARCHAR(50) NULL DEFAULT NULL,

`phone` VARCHAR(15) NULL DEFAULT NULL,

`email` VARCHAR(100) NULL DEFAULT NULL,

`goldOunce` FLOAT(8) NULL DEFAULT NULL,

`silverOunce` FLOAT(8) NULL DEFAULT NULL,

`btc` FLOAT(8) NULL DEFAULT NULL,

`walletAddress` VARCHAR(50) NULL DEFAULT NULL,

`inventoryLoc` VARCHAR(50) NULL DEFAULT NULL,

`lastIn` DATETIME NULL DEFAULT NULL,

PRIMARY KEY (`custId`))

CREATE TABLE IF NOT EXISTS `banktrader`.`transaction`

(`transId` INT(11) NOT NULL AUTO\_INCREMENT,

`goldOunceIn` FLOAT(8) NULL DEFAULT NULL,

`goldOunceOut` FLOAT(8) NULL DEFAULT NULL,

`silverOunceIn` FLOAT(8) NULL DEFAULT NULL,

`silverOunceOut` FLOAT(8) NULL DEFAULT NULL,

`inventoryLoc` VARCHAR(50) NULL DEFAULT NULL,

`btcIn` FLOAT(8) NULL DEFAULT NULL,

`btcOut` FLOAT(8) NULL DEFAULT NULL,

`walletAddress` VARCHAR(50) NULL DEFAULT NULL,

`storeId` INT(3) NOT NULL,

`custId` INT(11) NOT NULL,

PRIMARY KEY (`transId`)

FOREIGN KEY (`storeId`),

FOREIGN KEY (`custId`)

Data Dictionary:

The store table will each of the stores information such as current inventory, wallet information, etc.

|  |  |  |
| --- | --- | --- |
| store | | |
| **Field Name** | **Type** | **Description** |
| storeId (PRIMARY) | Int | Store identifier (currently three different stores) |
| goldOunce | Float | Current number of gold ounces in store inventory |
| silverOunce | Float | Current number of silver ounces in store inventory |
| btc | Float | Current amount of BTC in store inventory |
| walletAddress | String | Cryptocurrency wallet address (each store will have separate wallets) |
| walletId | String | Personal wallet ID number |
| inventoryLoc | String | Description of where physical/virtual inventory is located |

The customers table stores all customer information such as identifiers (name/number), current inventory, etc.

|  |  |  |
| --- | --- | --- |
| customers | | |
| **Field Name** | **Type** | **Description** |
| custId (PRIMARY) | Int | Customer identifier |
| firstName | String | Customer first name |
| lastName | String | Customer last name |
| email | String | Email of the customer |
| goldOunce | Float | Current number of gold ounces in customer inventory |
| silverOunce | Float | Current number of silver ounces in customer inventory |
| btc | Float | Current amount of BTC in customer inventory |
| walletAddress | String | Cryptocurrency wallet address for each customer |
| inventoryLoc | String | Description of where physical/virtual inventory is located |
| lastIn | Date | Stores when the customer was last in the store |

The transactions table stores all transaction information such as history, customer info and store info.

|  |  |  |
| --- | --- | --- |
| transaction | | |
| **Field Name** | **Type** | **Description** |
| transId (PRIMARY) | Int | Transaction identifier |
| storeId (FOREIGN) | Int | Store identifier (currently three different stores) |
| custId (FOREIGN) | Int | Customer identifier |
| goldOunceIn | Float | Ounces of gold that came into store |
| goldOunceOut | Float | Ounces of gold that left the store |
| silverOunceIn | Float | Ounces of silver that came into store |
| silverOunceOut | Float | Ounces of silver that left the store |
| btcIn | Float | BTC that came into store |
| btcOut | Float | BTC that left the store |
| inventoryLocation | String | Where inventory is located |
| walletAddress | String | Crypto wallet address for specific transaction |

The transactions will be the most important table to mine data from because it deals with all of the currency/assets being handled though the pawn shop.

The tables shown above are a base design on how the database should look and act. As the development phase proceeds, additions and changes should be made according to the demand of the service. If for example, customers want to start trading a different type of cryptocurrency, columns will be added accordingly so that no data is lost. These types if changes will be talked about between the developer, owner and employees. End of day reports are a great way to get the needs across to the developer so the service can stay running smoothly.

Database and Rstudio Connection

A live connection between the database and R program will make it much easier to mine data, create data frames and analyze the data.

Here is an example process of making this connection:

Using the dbConnect library in Rstudio allows for a connection to the specified database.

A screenshot of a social media post

Description automatically generated

Once the database is connected (make sure all ports are correct, database names are consistent, and any access points are allowed), we can start to pull information from the tables.

A screenshot of a cell phone

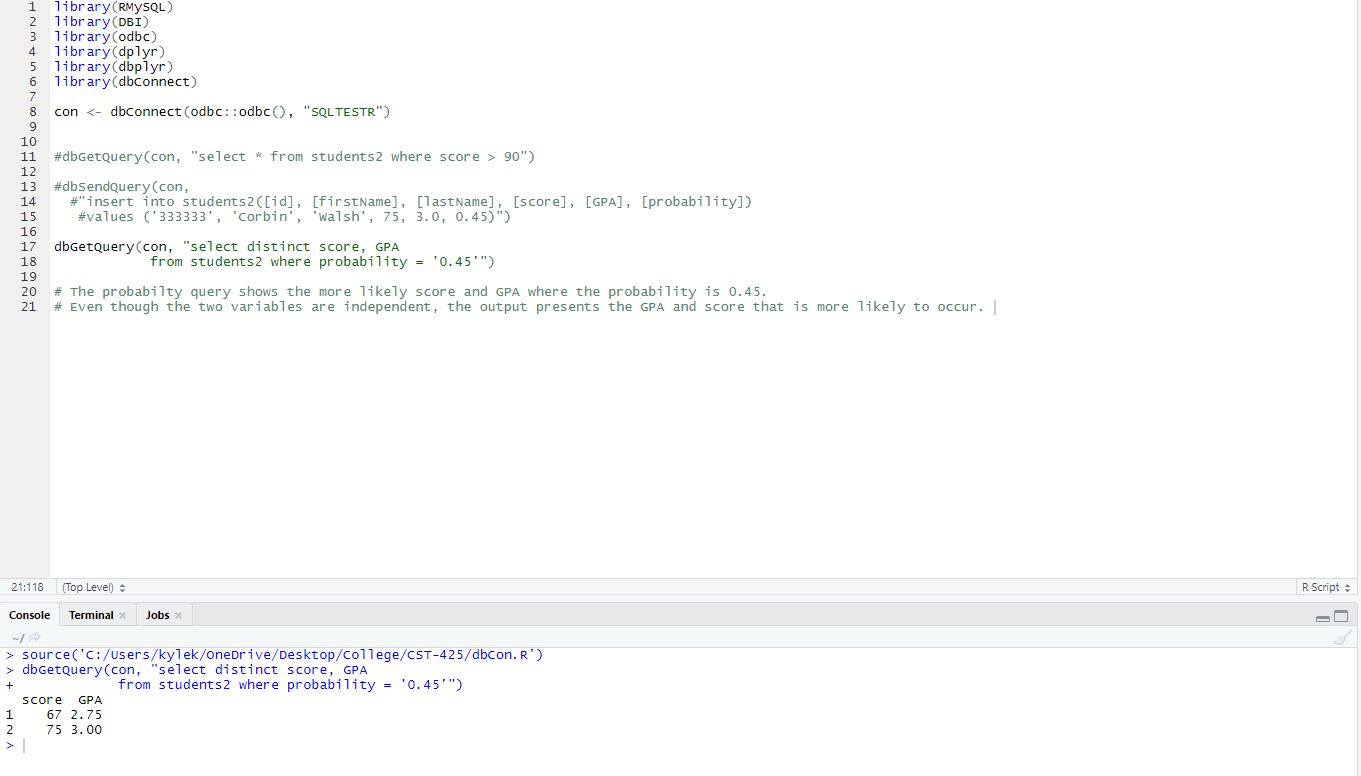
Description automatically generated

We can even add new records through Rstudio into the database.

A screenshot of a social media post

Description automatically generated

Finally, analysis tools can be used directly onto the database. Below is a simple probability query based on a student database.



**Module 5 – Trend Analysis**

Before analyzing trends of customer and store data, a comparative analysis will be made on cryptocurrency. This is because store and customer data does not exist yet, unlike the history of crypto pricing.

Cryptocurrency Price Trends/History

First, there are many sources for the history if cryptocurrency price data. Upon an initial Google search, many different .csv files can be found with crypto prices over time.

Step 0 – load in libraries that are needed to perform the analysis (this can be constantly added to based on the techniques used)

Step 1 – Find a cryptocurrency (one or multiple) data set to import into Rstudio

Step 2 – Preprocess/clean the data and load into a data frame

\*Step 2 is the most important part. All datasets are different and come with their own quirks, information, and type of data. Creating a clean workable data frame is the building block for a strong analysis\*

Step 3 – Start aggregating the data based on what is needed. In this case, each cryptocurrency has a daily open and close value. These daily values are looked at over time. The range can be a week, a month, a year, a decade, etc.

Step 4 – Find insights and visualize the data. There are numerous tools and libraries in R that can make a good observation. Box plots, bar graphs, line plots, scatter plots, correlation matrices, table statistics, summaries and many more statistical analysis tools can be used.

Step 5 – Apply machine learning algorithms for further insights and predictions. Many different algorithms can be used when building these models including linear discriminant analysis (LDA), classification trees, regression models, k-nearest neigbors (kNN), support vector machines (SVM), k-means clustering, random forest, etc.

Step 6 – Make predictions and conclusions.

This step by step process is just a general, chronological order on how to go about an analysis using R. There is no exact way to perform an analysis, but there are many tools, resources and examples that can help.

Customer and Store Trends

This type of analysis will use the same process as above, however will be using a much smaller, personalized dataset. The transactions table will be the most important because it has information on what currency is going in or out, current store inventory and what customers made transactions. Instead of going over a step by step process, I will give some theoretical examples on what could happen and my thought process of where to take an analysis.

1. Most customers make a cryptocurrency transaction later in the day/afternoon.
   1. How does crypto open/close amount affect the value of these transactions?
   2. Does the store gain more or less from afternoon transaction?
   3. Are customers more likely buying or selling crypto during this time? Why?
2. The first of each month are the highest traffic days for cryptocurrency.
   1. Does this have a correlation to the fluctuation of cryptocurrency pricing?
   2. Are customers looking to gain assets at the beginning of the month? Why? Do these customers sell near the end of the month? Why?
   3. Do customers prefer to trade or buy these assets? Why? Does it make a difference for the store or customer base?
3. Most common trade is BTC for gold.
   1. Do customers make or lose money from this?
   2. Is there any correlation between gold inventory and crypto inventory? If there is, how does that affect the store monetarily?

There are an infinite number of situations that can occur from the store and customer data sets. Therefore it is important to constantly be performing trend analysis, building insights, and making conclusions/predictions.

The biggest change (documented in change log) of this project is the design of the trend analysis program. I had initially thought that one specific R program could be made for all of the data being brought in from the store. But, this is the most difficult module to design due to the randomness of every situation and new data constantly being made. The analysis can change based off customer, store, employee, owner or developer needs. There is a general process when performing an analysis, but everything can change quickly, especially when dealing with something as volatile as cryptocurrency. End of day reporting becomes very important to make sure the developer stays on track, keep up with new store events and finalize any conclusions/predictions.

**Security Design:**

Although there are no user interactions with the MySQL database, it is still located on a server. This comes with security issues that need to be covered. Below is a list of good practices that I should follow to ensure security is at its highest when using the database.

1. Backup
   1. The database should be backed up in multiple different locations in case of lost information or losing the data. Locations to back up the base include local USB, local pc, store pc, owner pc, and cloud servers
   2. If only one database is present and data is lost, there is no way to restore the transaction inventory information. Even though the pawn shop has its Bravo system, the database is the only way to transfer the table data into the Rstudio program
   3. Cross reference customer and store actual inventory with database tables often
2. Authentication
   1. Create a secure admin password that only I know to login to the database
   2. This allows for only the developer to change and update the table preventing from possible fraud within the system
   3. The information populating the table is mostly monetary values, so I want to make sure everything is correct
3. Authorization
   1. The developer should be the only one to work on the database, so there is no reason to authorize other users
4. Encryption
   1. Secure sensitive data – most importantly the store wallet id
   2. A crypto wallet id is a very valuable piece of information because it holds the cryptocurrency
   3. Thousands of dollars in crypto could be lost if this is hacked or lost
5. Firewall
   1. Make sure all ports are correct
   2. Only give access to the specific server port
   3. A correctly implemented firewall prevents from database attacks such as SQL injection
6. Customer Info
   1. Important customer information is stored within the database but customers also have to take care of their own info
   2. No customers personal wallet id is stored in the database to prevent malicious use
   3. But, that means they have to be secure with their own information, so always tell them reminders and good practices

## **Developmental Phase**

**Functional Requirements**

|  |  |
| --- | --- |
| (Module 1 – Customer Pitch)   * What is cryptocurrency * Our service * What assets can we work with * Risk/Return | Complete (4/4)   * Cryptocurrency explanation * Our service * Lists the assets that can be worked with * Risk and return graph |

The functional requirements can be outlined in the customer pitch poster below.

Graphical user interface, text, application

Description automatically generated

|  |  |
| --- | --- |
| (Module 2 – Currency Converter)   * Pull values from real-time * Input cells for employees to change values * Calculates a fee percentage * Shared to all employees | Complete (4/4)   * = DOLLAR(INDEX(IMPORTHTML(B2, “table”, 1)), where B2 is equal to the website cell * Each input cell has a grey background so employees know exactly which cell * Multiplies the adjacent cell by a percentage fee (e.g. 0.95 for 5% fee) * Shared to each employee email |

Link to Google docs: <https://docs.google.com/spreadsheets/d/1KM9aJpepyQPmYVHg75_yisxfH6PZIOs7BMiofGM9dHI/edit#gid=0>

Table

Description automatically generated

Each column is a real-time value of the currency in dollars. The last column is the opposite. The sources are given so the employees can double check values.

Table

Description automatically generated

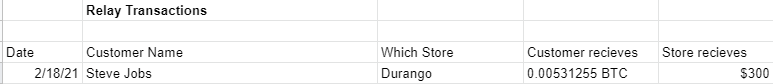
The input cells are highlighted grey to indicate which cells that the employees should input. Each corresponding row in is the exact conversion amount for the specific currency. The “Live Amount” column is the final amount of currency the customer receives after the transaction fee.

One issue that was brought up (documented in issue log) were the significant figures of the currency matrix. BTC and ETH are traded to exactly eight decimal places. Gold and silver are generally traded to three decimal places. Having the correct significant figures would prevent any numerical mistakes from happening, which is very important when dealing with people’s money and assets.

Another issue that arose (documented in issue log) was that the import html was incorrectly working for the silver source price, giving an error. This issue was anticipated to happen, and the employees can use their own spot price from the source given.

|  |  |
| --- | --- |
| (Module 3 – Relay System) \*\* CHANGE LOG\*\*   * Individual transaction relay * End of day report | Complete (2/2)   * Immediately after each transaction, the necessary information is inputted into a Google sheets table by employees * Information that isn’t on a time constraint will be added from the end of day report from Bravo |

Initially, all transaction, customer and store information was to be sent to the developer as an end of day report from Bravo systems. However, some data is very time sensitive and needs to be inputted quickly such as currency transaction, current store and customer inventory. A Relay Transaction table was added into the Google docs (documented in change log) so employees can instantly send all needed information to the developer. Here is an example of a transaction instantly relayed to me.



An EOD report will still be sent from Bravo systems (as a .pdf). Any other information will be added into the database including customer phone number, address, inventory location, etc. This allows employees quickly relay information, so the transaction can be made. This is important since cryptocurrency and gold fluctuate in price. A quick transaction means the least amount of fluctuation time is possible.

|  |  |
| --- | --- |
| (Module 4 – Database)   * Customer Table * Store Table * Transaction Table * Connection to R (Connects to module 5) | Complete (4/4)   * Created a customer table * Created a store table * Created a transaction table * Created an obdc connection with the correct host name and port number 🡪 “serverCon” |

Customer Table

Table

Description automatically generated with low confidence

Store Table

Table

Description automatically generated

Transaction Table

Graphical user interface, table

Description automatically generated

A relational schema diagram was generated for all the tables within the ‘assetbank’ database.

Diagram, table

Description automatically generated

|  |  |
| --- | --- |
| (Module 5 – Trend Analysis) \*\*CHANGE LOG\*\*   * Connection to database (connects to module 4) * Connection to crypto currency converter * Analysis of cryptocurrency price history * Prediction model * Analysis of cryptocurrency vs precious metals * Analysis of customer tendencies | Incomplete(4/6)   * A connection to the database is made: *con <- dbConnect(odbc::odbc(), "serverCon")* * Google sheets can export into a .csv file and loaded into Rstudio * History of cryptocurrency total market cap is charted for two separate timelines * A model was created based on market cap history * No crypto vs precious metal analysis was made * No analysis of customer tendencies was created since no real customer transactions have been made |

Chart, histogram

Description automatically generatedVisualizations of the cryptocurrency market cap (mid 2014 – mid 2020)

This representation is on a linear scale model.

Chart, line chart, histogram

Description automatically generatedThis representation is on a logarithmic model.

Chart, line chart

Description automatically generated

A trend line is visualized to predict the value of cryptocurrency in the future. Now, comparisons can be made for the predicted value on the rest of 2020 and what the crypto cap actually was.

**Chart, line chart

Description automatically generated**Visualizations of the cryptocurrency market cap (2021)

Logarithmic representation of cryptocurrency market cap for the first four months of 2021.

A trend line is visualized to predict the value of cryptocurrency in the future. Chart, line chart

Description automatically generated

Module 5 Incompletions

Requirement 4 reason - After initial research of analyzing cryptocurrency vs precious metals, and exploring more with the owner of the pawn shop, an analysis for this requirement was not made. On the surface, it seemed that these two currencies had no correlation, and due to time constraint further analysis was not completed.

Requirement 5 Reason – Due to time constraint and no real customer data, a customer trend analysis was not created.

Module Test Cases

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Test Case Name: Test Case 1** | | | | |
| **Priority: Low** | | | | |
| **Module: 1** | | | | |
| **Test Objective: Test if all information is presented by the customer pitch poster correctly** | | | | |
|  |  |  |  |  |
| **Step** |  | **Test Detail** | **Expected Results** | **Problem/Issue** |
| **1** |  | Customer understands what is cryptocurrency? | Pass | N/A |
| **2** |  | Customer understands our service | Pass | N/A |
| **3** |  | Customer understands which assets are used for trading | Pass | N/A |
| **4** |  | Customer understands risk/return | Pass | N/A |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Test Case Name: Test Case 2** | | | | |
| **Priority: Medium** | | | | |
| **Module: 2** | | | | |
| **Test Objective: Pull consistent real-time values from currency sources** | | | | |
|  |  |  |  |  |
| **Step** |  | **Test Detail** | **Expected Results** | **Problem/Issue** |
| **1** |  | Import specific table values from source html | Pass | Depends on service and consistent website |
| **2** |  | Refresh Google sheets to get new real-time value | Pass | Only updates ~30 min |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Test Case Name: Test Case 3** | | | | |
| **Priority: High** | | | | |
| **Module: 4** | | | | |
| **Test Objective: All tables within the database are working properly** | | | | |
|  |  |  |  |  |
| **Step** |  | **Test Detail** | **Expected Results** | **Problem/Issue** |
| **1** |  | Add a new customer entry | Pass | N/A |
| **2** |  | Change any customer information | Pass | N/A |
| **3** |  | Add a new store entry | Pass | N/A |
| **4** |  | Change any store information | Pass | N/A |
| **5** |  | Add a new transaction entry | Pass | N/A |
| **6** |  | Change any transaction information | Pass | N/A |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Test Case Name: Test Case 4** | | | | |
| **Priority: High** | | | | |
| **Module: 4** | | | | |
| **Test Objective: MySQL connection to Rstudio** | | | | |
|  |  |  |  |  |
| **Step** |  | **Test Detail** | **Expected Results** | **Problem/Issue** |
| **1** |  | Open the USBWebserver and start the MySQL server | Pass | N/A |
| **2** |  | Make the MySQL port 3307 | Pass | N/A |
| **3** |  | Open the OBDC Data Source Administration | Pass | N/A |
| **4** |  | Add a new User Data Source | Pass | N/A |
| **5** |  | Enter all necessary information (name, port number, connection type, etc.) | Pass | N/A |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Test Case Name: Test Case 5** | | | | |
| **Priority: High** | | | | |
| **Module: 5** | | | | |
| **Test Objective: Connect to ‘assetbank’ database through Rstudio** | | | | |
|  |  |  |  |  |
| **Step** |  | **Test Detail** | **Expected Results** | **Problem/Issue** |
| **1** |  | Open the USBWebserver and start the MySQL server | Pass | N/A |
| **2** |  | Import obdc library in Rstudio | Pass | N/A |
| **3** |  | Create a new connection with the name of the obdc | Pass | N/A |
| **4** |  | Run the program | Pass | N/A |
| **5** |  | Open any table information to confirm database has been connected | Pass | N/A |

Source Code Listing

Text

Description automatically generated

All of the necessary R libraries are imported into Rstudio.

Graphical user interface, text, application

Description automatically generated

A connection is made between Rstudio and the MySQL database.

Graphical user interface, text, application, email

Description automatically generated

A .csv file is read in that contains the cryptocurrency market cap history over an extended period of time. The data is mutated to fit what is being visualized. The x-axis and y-axis are labeled. A linear plot is produced as well as a logarithmic plot. The logarithmic plot will be used for the prediction model and trend line.

Graphical user interface, text, application, email

Description automatically generated

A new plot is visualized that shows the prediction line based on the linear model created. We can now use the trend line to predict the future of the cryptocurrency market cap. Since, the timeline is between between 2017 and 2020, we can compare our predictions to the actual market cap value at the time.

Text

Description automatically generated

The same process is being used for the first four months of 2021. A new trend line will be built based on the cryptocurrency market cap of 2021.

Graphical user interface, text, application, email

Description automatically generated

Implementation Plan

Step 1- Start presenting the customer pitch to customers that come in the store. This will get customers interested in the pawn shop service.

Step 2- Present the currency converter and relay system to the employees. The pawn employees can now begin to make transactions by converting currency in Google sheets and relaying information to the developer.

Step 3- Use the information and transaction entries to populate the database. Customer, transaction and store information can now be used in Rstudio for trend analysis.

Diagram

Description automatically generated

Test Cases



Final Project Completion

Github link: <https://github.com/kylekirkpatrick0kk/Capstone-Project.git>