Coinz

Infomatics Large Practical

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Coinz Game Specification

Coins are displayed on a map. Players move around the map (physically with their mobile phones), and if they move within 25 meters of a coin, the coin is collected. A new map is released every day, with each map having 50 coins. Each player has the chance to collect every coin. That is, if one player collects a coin, it is still available for all other players to collect on their devices.

Collectable coins are one of four (fictional) crypto-currencies: Penny, Shilling, Quid and Dollar (denoted PENY, SHIL, QUID and DOLR). They fluctuate daily with respect to a fifth crytocurrency: GOLD. The collectable coins have a value of greater than zero and less than 10.

On the map, the coins are colour coded accordingly - PENY: Red, SHIL: Blue, QUID: Yellow, DOLR: Green. The approximation of the value of the coin is displayed on the coin marker (rounded down).

When coins are collected, they are saved to the players ‘local wallet’. Their wallet might look something like this if they have collected four coins:

Type	Value
PENY	9.34522
DOLR	1.12432
DOLR	8.91342
QUID	5.24221

Each player also has a bank account with the ‘central bank’. Players can transfer a maximum of 25 collected coins into their account per day. The player can select which coins they want to transfer in. Once the coins are transferred into their bank account, they are automatically converted to GOLD. Players are encouraged to check the exchange rates for that day, and select a combination of coins which will give them the most amount of GOLD. Their bank account will show the history of coins paid in, along with the value (in GOLD) they were worth at the time. **The aim of the game is to maximise the amount of GOLD coins in your bank account**.

The remaining coins (i.e. ‘spare change’) will sit in a players local wallet until the end of the day. Until that time, the player is able to send their spare coins to their friends. Again, they can choose which coins they want to send. Once the selected coins are sent, they are removed from that players local wallet, and placed in their friends local wallet. Each players local wallet will be separated in two – spare change which they have collected, and spare change that they have received from friends. Players are allowed to transfer an unlimited amount of coins which they have received from friends into their bank account. This creates the opportunity to negotiate with fellow players, since **all** spare change will disappear at the end of the day.

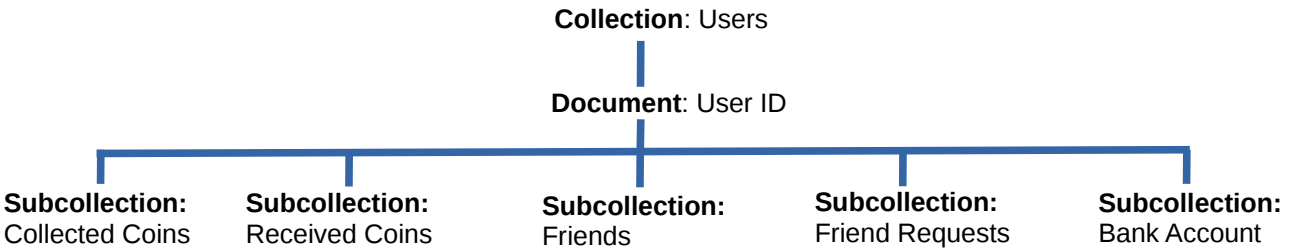
Bonus Features

Race Against The Clock Bonus – Once a day, each player has the option to start a 120 second timer. Once the timer starts, all coins in the map double in value (only for that player!). The player then attempts to collect as many coins as possible during this period, after which the coins return to their normal value. The double value coins are collected and stored in the players local wallet in the exact same way as specified above. If the player decides to send the double value coins to a friend rather than transferring them to their own bank account, the double value is retained. This feature creates an exciting reward for the players, making the game much more interesting to play.

Leaderboard – A leaderboard will be displayed to show every player ranked in order of how many GOLD coins they have in their bank account - the player with the most amount of coins being at the top of the leaderboard. This adds competitiveness to the game, making it more interesting and encouraging players to play it more often or for longer sessions.

Implementation of Features

The above specification gives rise to a number of features. The features listed below can be viewed as the sub-tasks, or milestones, required to complete this project. For each feature, I have included a brief summary of how I intend to implement it. However, these features, along with their intended implementation, may be subject to change as the project progresses. Below shows the proposed database structure within firebase, which will be described through the feature descriptions.



User accounts

The user will be able to create an account with an email address, user name and a password, and log in with the account in the future. The application will make use of Firebase Authentication to ensure user data is securely stored and identified. The user will be able to achieve this through the applications Register and Log In activities. When the user creates an account, they will be allocated a unique user ID which will be stored as a document within the collection called “Users”.

Map data retrieval and rendering

The document “User ID” will contain a field that states the last saved date. When the app is booted up, it will check the current date and the saved date. If the current date is equal to the saved date, it retrieves map data from the users internal storage. Otherwise, the current date will be written to firebase, and the map data is retrieved from an Informatics server. The map data will then be saved to the devices internal storage (overwriting previously stored map data if it exists). The application will check the collected section of the users wallet and remove these coins from the map data. The map will then be rendered with the updated data using the MapBox API.

User location and coin collection
The application will use the Android LocationManager to determine the users position. The users position will be displayed on the map, along with the markers of the coins. The application will be able to determine if a user is within a 25 meter radius of any collectable coin, and subsequently collect the coin if this is the case. When a coin is collected, it will be removed from the map, and then placed in the 'collected' section of the users wallet.

Local wallet
The users local wallet is made up of the subcollections "Collected" and "Received", each of which store coins as documents. These documents will detail the coins value and currency. Upon bootup of the app, when the dates are being checked, the users local wallet will be cleared if a new day has begun. Otherwise, the application reads the data from the two subcollections and the UI will display the collected and received coins.

Friend adding
A user can add a friend via their email address. When one user sends a friend request to another user, they will be added to that users "Friend Requests" subcollection as a document. The "Friends" subcollection will store the users friends as documents. The UI can then display a users list of friends on their device, plus a list of friend requests. If a request is accepted, the requester will be added to the users friends list, and the user will be added to the requesters friends list.

Coin sending
Users can send coins to anyone in their friends list – either coins that they have collected themselves or coins which they have received from another friend. When a user selects the coins they wish to send to a friend, these coins will be removed from the users local wallet (from the appropriate section) and placed in the friends local wallet (in the received section).

There is no restriction on a user having duplicates of a coin. That is, if three players all collect the same coin, and player one keeps the coin in their local wallet, whilst players two and three both transfer the coin to player one, then player one can have one version of the coin in their collected section, and two versions of the coin in the received section. Player one can also transfer all three of these coins into their bank account. To overcome the duplicate coin ID's in the "Received" subcollection, those documents will instead be allocated a random unique ID (whilst the documents in the "Collected" subcollection will just be named after the Coins ID).

Bank account
The quantity of GOLD a user has will be stored as the value of a field within the UserID document. The "Bank Account" subcollection will store a history of transactions (as documents), with the name of each document being the timestamp of when the transaction occured. A transaction is defined as a collection of selected coins being transferred from a users local wallet to their bank account. Each transaction will detail the quantity of GOLD that the collection of coins added to the bank account.

This section of the application will handle the conversion of collectable coins to GOLD via the exchange rates, and will also display the exchange rates to the user. The bank will ensure that no more than 25 coins from a users "Collected" coins can be transferred into their account (but there is no restriction on the amount of coins that can be transferred from the "Received" subcollection into the users account).

The bank will take each of the selected coins in turn and convert them into GOLD using the corresponding exchange rate, and the quantity of GOLD coins will be updated in firebase. The coins will then be removed from the appropriate section of users wallet. The bank will record the timestamp of the transaction and the total value of GOLD that was added, and add this to the users “Bank Account” subcollection as a document.

Race against the clock
When the dates are checked, if a new day has begun the app will enable a timer bonus button. The application will use a Timer class to measure the period of time (120 seconds) over which coins are doubled in value for. The game will be played as normal, but if a coin is collected while the Timer is active, its value will be doubled on the users device locally, and subsequently stored in the users local wallet. Once the timer is finished, coins return to their original value and the timer bonus button will be disabled (as the player can only use the bonus once per day).

Leaderboard
The leaderboard can display a ‘global’ leaderboard which will display every players score, and can also display a ‘friends’ leaderboard in which the user will only see their friends scores (score is just the amount of GOLD in a users bank account). The application will display the appropriate list of users with the amount of GOLD coins they have in ranked order.

Language Choice

For this project, I have chosen to write the software in Java as opposed to Kotlin. Kotlin appears to be a great language that has gained a lot of support from the Android community recently. I think the main benefit in comparison to Java is its conciseness – Kotlin can reduce the amount of boilerplate code required in Java, which is relatively verbose compared to other languages. This decreases the opportunity for errors and bugs. Kotlin also has null in its type system, which mitigates the large null-unsafety problem with Java.

However, Kotlin is still relatively new in Android development. I believe it will grow to become very popular in the next couple of years, but for now the Kotlin development community is still small. Due to the fact that this project is a prototype which will be passed on to a team of developers who will maintain and develop it further, I think it is crucial to write this software in a language that the vast majority of development teams use – Java.

It would be difficult to find a team of Kotlin developers, and even more difficult to find a mentor for the team that is actually experienced with Kotlin. Most teams will be comprised of Java developers, and it would be a challenge to switch entire teams over to Kotlin. Furthermore, switching a team over to a new language increases the risk of errors and bugs appearing in code.

The Java development community is one of the largest in the world, boasting over 1.37 million questions on Stackoverflow. The Kotlin community pales in comparison, with around 8000 questions on Stackoverflow. I would like to have plenty of resources and a stong support network to ensure that my application is well-engineered, and I want the team of developers who will further develop my application to share this support. Furthermore, applications built in Java are much more compact, as Kotlin has a bigger runtime size when compared to Java. Applications written in Java also benefit from accelerated assembly within Gradle, making the build process much quicker.

Timeline

Below is a brief timeline of when I hope to complete the above tasks. Throughout the development of this project, I will test the application continuously and thoroughly using J-Unit testing, and I will continuously document my progress in a report. I intend to consistently follow a coding style guide and continuously review and refactor my code.

Some tasks are larger than others, so I have tried to allocate a full week to larger tasks and a few days to smaller tasks. Each week is considered as the end of the week i.e. I want to complete each of these tasks by the end of the week specified.

Week	**Task**
2	Create list of potential bonus features; begin dealing with underspecification; write out draft of Project Plan
3	Have complete specification of game design including two bonus features; complete Project Plan
4	Review and submit Project Plan. Create required fields in firebase database. Implement login and sign up. Start implementation of map data retrieval and rendering
5	Complete map data retrieval and rendering, implement user location and coin collection
6	Implement UI and data retrieval for local wallet. Begin implementing friend adding functionality
7	Complete adding friends feature and implement ability to send coins between friends
8	Begin implementing functionality of central bank, including exchange rates, transferring from local wallet to bank account and storing transaction history
9	Complete full bank functionality and test thoroughly. Begin implentation of bonus features
10	Complete bonus features
11	Thoroughly test full application – write additional unit tests where required
12	Complete report
13	Review and submit