

Testudo Bank Certificate of Deposit Feature

*Owners: Anthony Louie (alouie@terpmail.umd.edu)

Problem Statement

Customers of Testudo Bank are currently limited to only one source of return for leaving money in the bank in the form of interest after deposits. The interest rate is very low and so makes it difficult to convince customers to leave money with Testudo Bank. Customers would benefit from an option to invest money and get a higher return. This service would also encourage customers to leave more money with the bank and bring in new customers who are interested in the new service.

Solution Requirements

- Customers should be able to invest in a certificate of deposit (CD) using the account balance, and the appropriate amount should be decremented in the user's account balance.
- If the customer does not have enough in their balance to invest in a CD or is in Overdraft, the operation should not go through.
- Customers should have a place on the Testudo Bank application front-end to view the option of investing in a CD supported by Testudo Bank.
- Customers should not be able to go into overdraft while investing in a CD. This will reduce the likelihood of unhealthy investing habits like buying items using money borrowed from Testudo Bank.
- For now, customers will only be able to invest in a single CD at a time. So the guaranteed return is not abused.

Solutions Considered

One Account for All Approach

In this approach, customers will invest in CD's using the same account and account balance that the user currently uses for banking transactions.

Checking Account vs Investing Account Approach

In this approach, the existing customer accounts are re-classified as **checking accounts** (keeping all its existing features). Customers will also be eligible to open an **investing account** where the balance indicates the value of the customer's CD. Customers will be limited to one account and one CD per account.

Pro/Con of all approaches considered:

One Account for All Approach

Pros:

- Customer can directly use their existing account balance to invest in a CD. This makes it really easy and intuitive for customers to find and to start investing.
 - Also keeps customer front-end experience largely the same as before with the addition of CD and time left.
- Customer only need to track their existing balance and the current time for the CD. They don't need to worry about a separate Investing Account and managing an account for just a CD.
- Much easier to implement.
 - No new logic for transferring money into (and out of) a separate Investing Account.
 - Don't need to track another Investing Account balance for each customer in our DB. Just calculate the time left from the CD open date when the `account_info` page needs to be served to the user.

Cons:

- Depending on implementation, would require another table be added to database to keep track of customer CDs as rows. Or change to existing Customers table to include CD status as a new column.
 - Implementing a limit on number of CDs held at a time could be a future feature or a stretch goal.
- Very likely for this implementation to require changes if more investment options are offered besides this single CD option. It makes more sense to switch to the other approach

if there will be many investment options in order to separate the kinds of transaction between accounts.

Checking Account vs Investing Account Approach

Pros:

- Follows the Checking/Savings/Investing Account paradigm followed by most commercial banks. More intuitive for customers familiar with other banking applications.
- More flexibility for Testudo Bank to apply different rules and features to each account type to better serve and protect the customer.
 - This feature would safeguard the customer from impulsively investing too much money at one time on investment options that require long time commitments.
- Allows Testudo Bank to neatly encapsulate all investment activity in a logically-separate Investment Account environment. This will be very valuable when the investing side of Testudo Bank becomes more complex in the future with increased investment options.

Cons:

- Would require another table be added to database to keep track of customer CDs as rows, with different account IDs for the Investing Accounts that have to tracked as well.
- Customer has to transfer money from Checking Account into Investing Account each time they want to invest, which is tedious.
- Harder to implement and requires more time.
 - Testudo Bank will have to start maintaining records of each customer's Investing Account balance in addition to their regular balance, since it is possible for customers to put money in their Investing Account and not immediately buy CDs. This could add excessive entries in the transaction logs.
 - Testudo Bank will also need to provide new logic to transfer money from Checking Account to Investing Account.

Proposed Solution

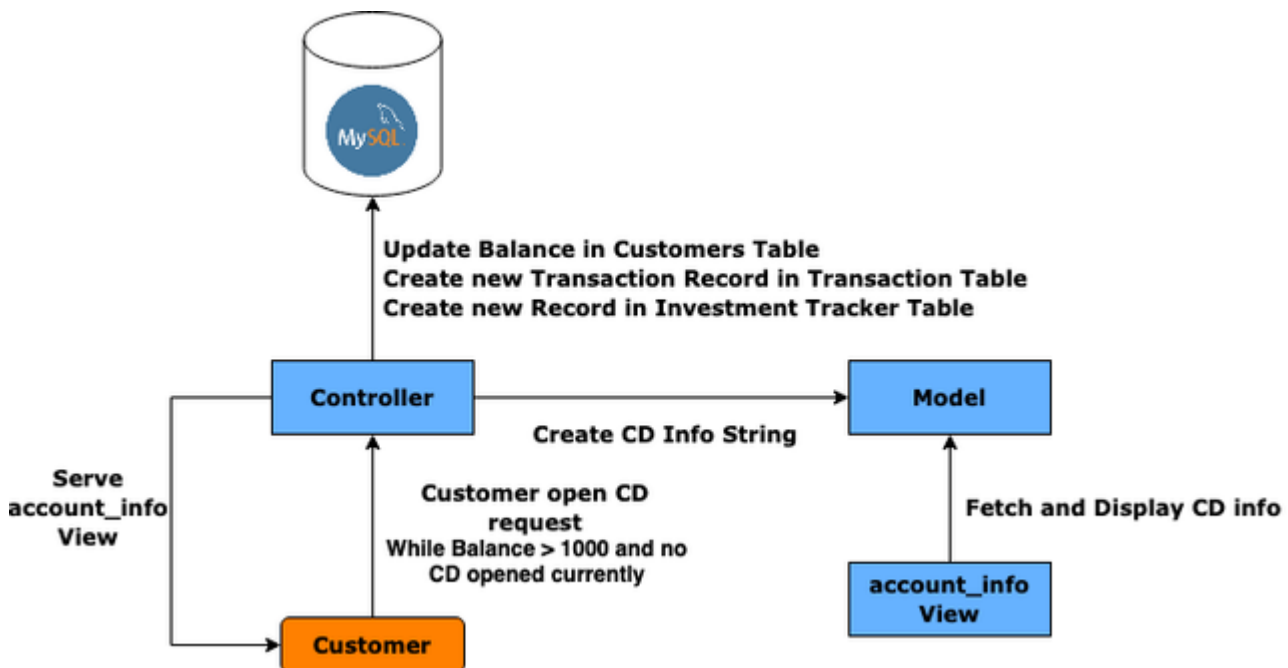
The proposed solution is the **One Account For All Approach** because it enables Testudo Bank engineers to quickly ramp up to a Minimal Viable Product (MVP) that can be quickly deployed to gauge customer interest. With this approach, Testudo Bank still has the option to move to the **Checking Account vs Investing Account Approach** in the future. New code and database

additions created from **One Account For All Approach** can be used, with some slight modification, in **Checking Account vs Investing Account Approach** if the need to switch arises in the future.

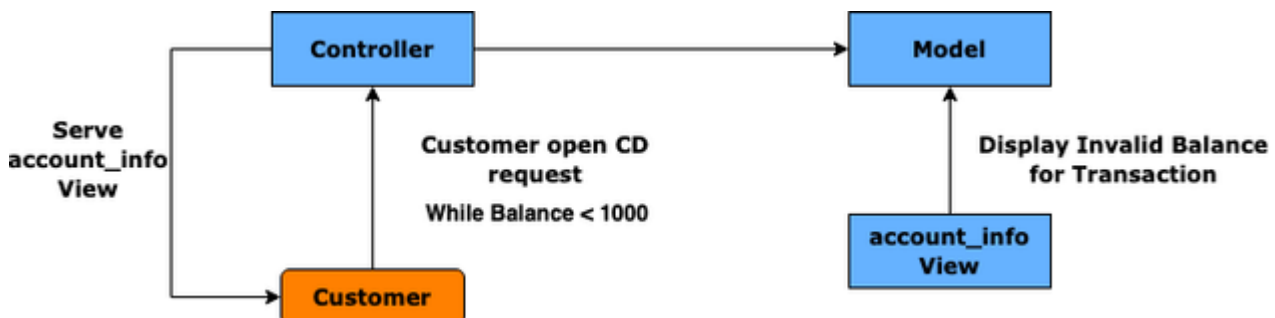
Technical Architecture

MVC Logic Diagrams

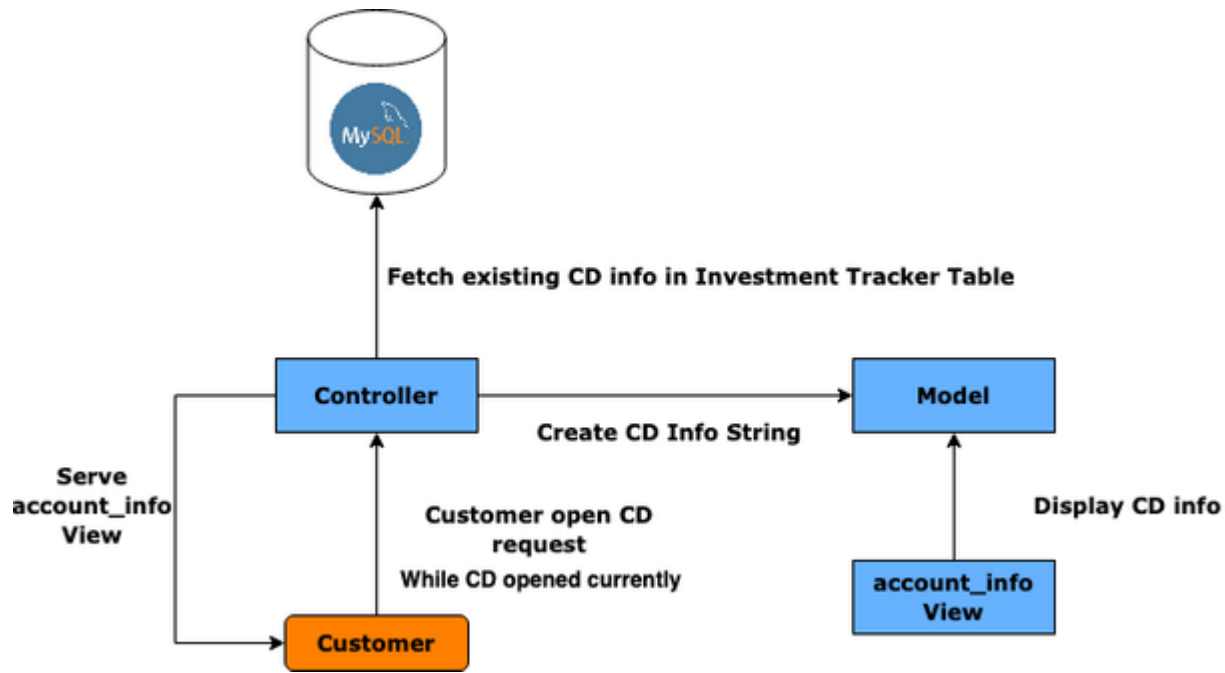
CD Invest Case



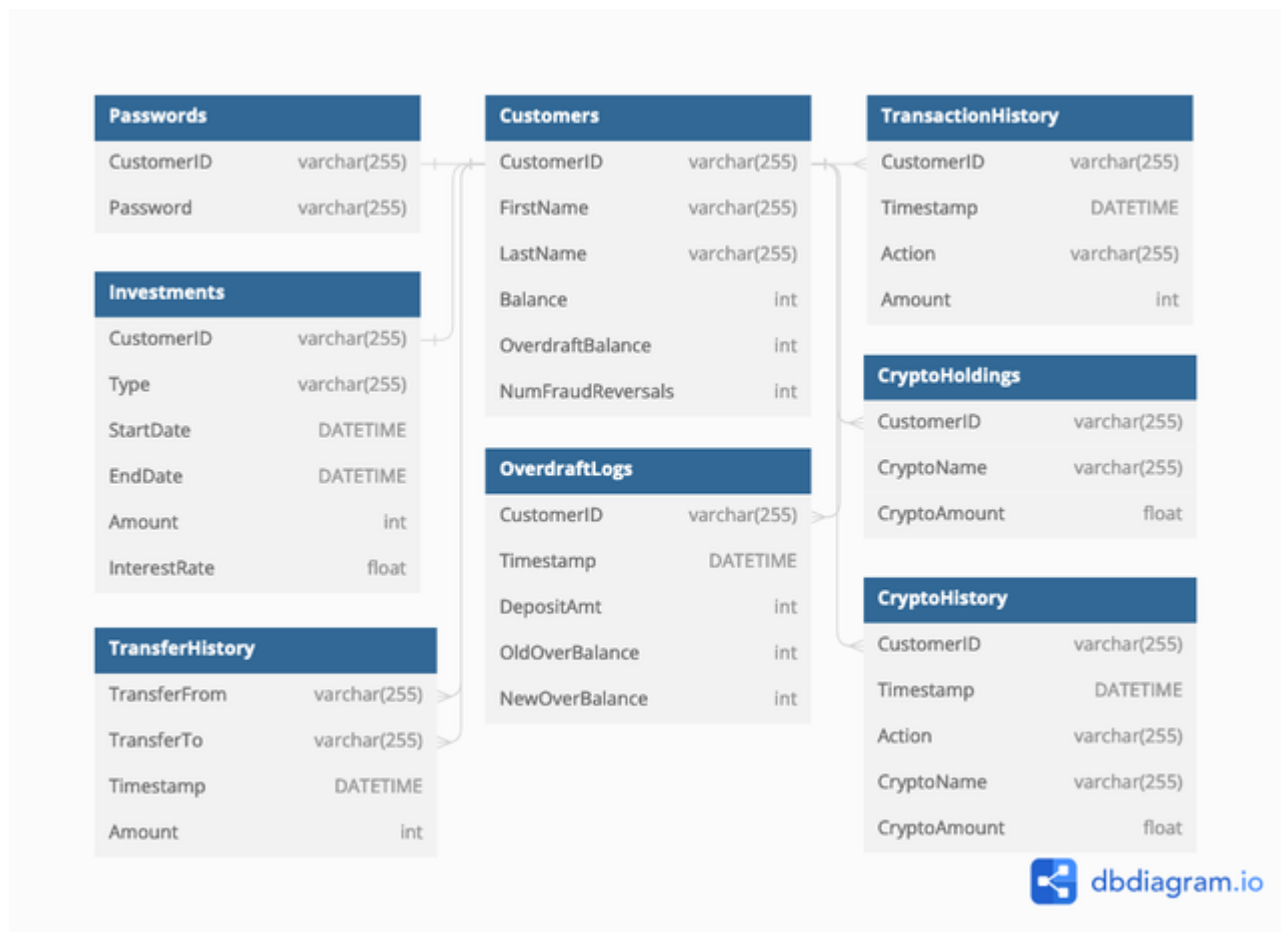
CD Invest Low Balance Case



Already Opened Account



MySQL DB Schema



DB Schema Notes

- CustomerID from Customers table has a **one-to-one** relationship with CustomerID in Investments table. This is because a single customer can have one CD at a time (eventually, we will expand beyond just CDs, so this will change to **one-to-many** in that case).
- These values will be fixed for now since we only offer one investment option
 - Type in Investments will be limited to just CD for now.
 - Amount in Investments will be limited to just 1000 for now.
 - InterestRate in Investments will be limited to just 0.05 for now.
 - Difference between StartDate and EndDate will always be a year.
- A new allowed Action values must be added for TransactionHistory: Invest. When a customer invests in a CD, the reduction in the customer's main balance must be reflected in TransactionHistory with a new Invest action record.

Simple, Error, and Edge Cases

Simple Cases

- A simple CD invest when the customer is not in overdraft, and the US Dollar amount for the opening of CD would not bring the customer into overdraft.
- Verify that after a year, the original investment amount of the CD would be added back to the customer's account with the interest.

Error Cases (return welcome.jsp page in all of these cases)

- Customer attempts to invest in a CD when the US Dollar amount for the opening exceeds their main balance. They should not be allowed to go into overdraft to invest in a CD.
- Customer attempts to invest in a CD while currently in overdraft.
- Customer attempts to invest in a CD while there is already a CD opened and linked to customer's account.

Edge Cases

- Customer invests in a new CD on the same day that an older CD is set to end. Verify the new CD cannot be opened until the database entry for the older one is gone.