CASH FLOW MINIMIZER

LOVELY PROFESSIONAL UNIVERSITY

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ABSTRACT

The Cash Flow Minimizer System, main objective of this project is to streamline and reduce the number of transactions between multiple banks across the globe, with each of the bank utilizing different payment modes. In the current global banking network , the lack of common payment methods among banks poses significant challenge. This results in multiple unnecessary and expensive transactions. This system addresses this issue by leveraging the World Bank as a central intermediary. The World Bank facilitates transactions between banks that do not share compatible payment methods (by acting as a mediatory), thereby optimizing the cash flow process. This report provides a comprehensive overview of the problem, the innovative design of the Cash Flow Minimizer System, the approach to resolve the issue and the results of its implementation, showcasing its effectiveness in minimizing number of transactions and enhancing efficiency in global banking operations.

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1.Introduction

1.1 Background

The global banking industry is comprises of numerous financial institutions and various banks, each operating with unique payment methods that aids to meet the diverse needs of customers and businesses worldwide. However, this diversity poses significant challenges when funds are to be transferred among banks with different payment methods. Intermediaries play a crucial role in bridging gaps between different banking systems. Involvement of such intermediates introduces complexity and increases both the time and cost involved in completing transactions.

The **Cash Flow Minimizer System** has been developed with the primary aim of simplifying interbank transactions by reducing the number of intermediary steps (transactions). This is achieved through advanced algorithms and strategic routing that minimize the overall number of transactions required to transfer funds between banks.

The use of the World Bank as a central intermediary is the key component of this strategic approach, this ensures efficient fund transfers even when banks do not share compatible payment methods. By leveraging the World Bank's neutral position and reliability, the system minimizes the need for multiple intermediaries, thereby streamlining the transaction process.

1.2 Objectives

- Reduce the total number of transactions among banks.
- Facilitate transactions using a central World Bank as an intermediary.
- Ensure compatibility between different payment modes.

1.3 Significance

The Cash Flow Minimizer System plays a pivotal role in transforming global financial operations by optimizing transactions globally. This is achieved by simplifying and reducing

the number of intermediary steps involved in fund transfers, the system offers several significant benefits to the banking industry.

Firstly, it contributes to by reducing the costs involved in fund transfers by various institutions globally. By minimizing the number of transactions involved in transferring funds between banks, the operational costs associated with intermediary fees, processing times are drastically reduced.

Secondly, the system enhances the efficiency of international banking transactions. By streamlining the transfer process, banks can achieve faster settlements, thereby improving reducing the time customers wait for their transactions to be processed.

The implementation of the Cash Flow Minimizer System represents a significant advancement in the banking sector. By improving operational efficiency, reducing costs, and time in international transactions.

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2. Problem Definition and Requirements

2.1 Problem Statement

The primary challenge lies in minimizing the number of transactions required among multiple banks that operate with different payment modes. In instances where banks share a common payment method, the process is streamlined and efficient. However, complications arise when there is no common ground in payment methods across participating banks.

This lack of compatibility demands the involvement of multiple intermediaries to facilitate transactions. These intermediaries add increase transaction costs, and introduce potential delays, particularly in international transactions.

To address these challenges, the focus is on developing a system that optimizes transaction processes. The strategy is to utilize a central entity, such as the World Bank, to facilitate transactions where direct compatibility between banks' payment methods is absent. By leveraging advanced algorithms and strategic routing, the system aims to minimize the dependency on multiple intermediaries and optimize transaction routes.

2.2 Software Used

- C++ Compiler
- Standard Template Library (STL)

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3. Proposed Design / Methodology

3.1 File Structure

The system uses a **directed graph** to represent transactions among banks. Each bank is a node, and directed edges represent the amount owed. The World Bank acts as a hub that supports all payment modes.

3.2 Methodology

Net Amount Calculation:

- The first step is to calculate the net amount for each bank. The net amount represents the difference between the total credits received and the total debits sent by each bank. This value is crucial for determining the minimum number of transactions required to settle all interbank obligations.
- The formula for calculating the net amount is given by:

$$\text{net amount} = \sum \text{credits} - \sum \text{debits}$$

- In other words, the net amount for each bank is the sum of all incoming funds (credits) minus the sum of all outgoing funds (debits).
- Store the values corresponding to each of the bank , in ascending order in a list.

Identify Key Banks:

- o Determine the bank with the minimum net amount (maximum debtor). This bank owes the most money compared to what it is owed.
- o Identify the bank with the maximum net amount (maximum creditor). This bank is owed the most money compared to what it owes.
- o Ensure that these two banks share a common payment mode to facilitate a direct transaction between them. This step is crucial for streamlining the transaction process and avoiding the need for multiple intermediaries.

Calculate Transaction Amount:

- o Compute the minimum absolute value of the net amounts of the maximum debtor and maximum creditor. This value represents the maximum amount that can be settled in one transaction without causing either bank to go negative in their net balance.
- o The transaction amount is the lesser of the debtor's owed amount and the creditor's owed amount. This ensures that at least one of the banks' net amounts will be zeroed out in the transaction.

Perform the Transaction and Update Net Amounts:

- o Execute the transaction by transferring the calculated amount from the debtor bank to the creditor bank. This direct transfer reduces the complexity and number of transactions required.
- o Update the net amounts for both banks: subtract the transaction amount from the debtor's net amount and add the transaction amount to the creditor's net amount. This keeps the net balance accurate for further calculations.

Remove Settled Banks:

- o After the transaction, check if any bank's net amount has become zero. If so, mark that bank as settled and remove it from the list of active banks requiring further transactions.

- Repeat the process for the remaining banks, continuously identifying new maximum debtors and creditors, calculating transaction amounts, performing transactions, and updating net amounts until all banks are settled.

Results:

Input for the program

Banks and Payment Modes

- **Bank_of_America** 2 Google_Pay, AliPay, Paytm
- **Wells_Fargo** 2 Google_Pay, AliPay
- **Royal_Bank_of_Canada 2** AliPay
- **Westpac** 2 Google_Pay, Paytm
- **Goldman_Sachs** 2 Paytm
- **National_Australia_Bank** 2 AliPay, Paytm

Note: The first bank entered is considered the **world bank** and the number of payment modes it has access to is declared the maximum number of payment modes for any bank. (This ensures world/ central bank can access all payment modes.)

Transactions

Debtor Bank	Creditor Bank	Amount
Goldman_Sachs	Bank_of_America	Rs 100
Goldman_Sachs	Wells_Fargo	Rs 300
Goldman_Sachs	Royal_Bank_of_Canada	Rs 100
Goldman_Sachs	Westpac	Rs 100
National_Australia_Bank	Bank_of_America	Rs 300
National_Australia_Bank	Royal_Bank_of_Canada	Rs 100
Bank_of_America	Wells_Fargo	Rs 400
Wells_Fargo	Royal_Bank_of_Canada	Rs 200

Debtor Bank	Creditor Bank	Amount
Royal_Bank_of_Canada	Westpac	Rs 500

Fig 1: Initial Cash Flow In the System
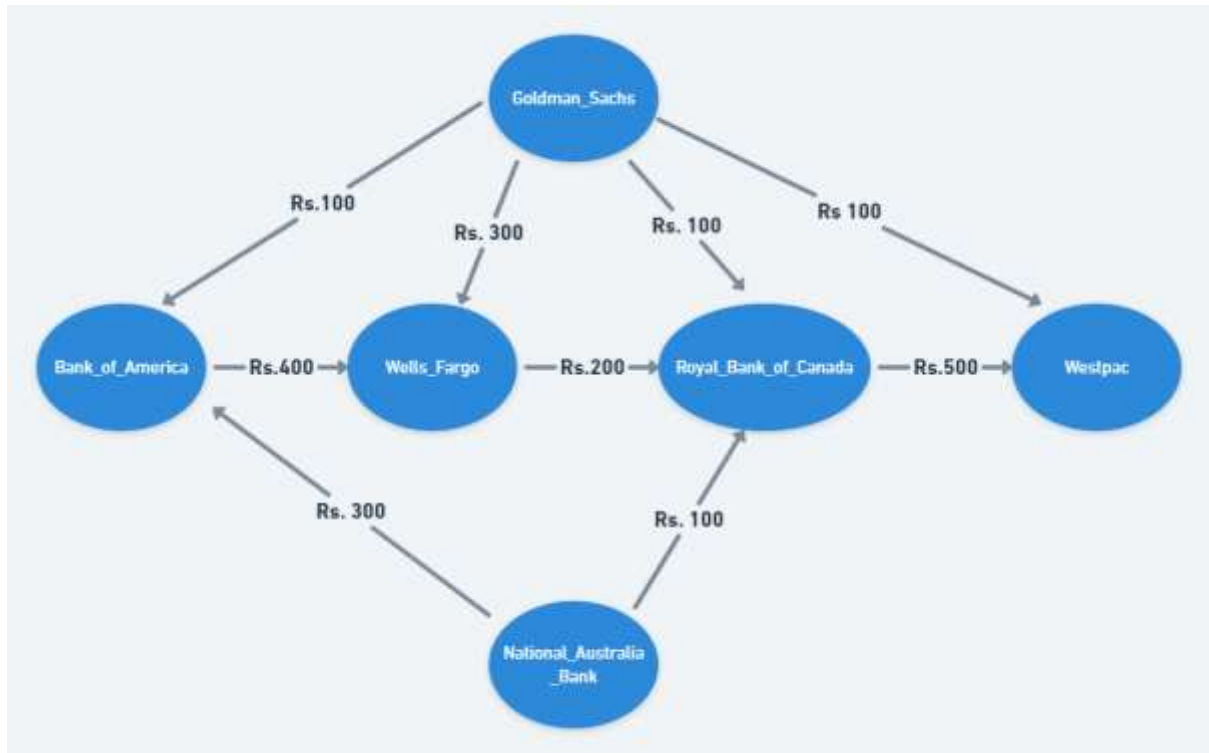
Initial Graph of the Flow:

	Goldman Sachs	Bank of America	National Australia	Bank of Canada	Westpac	Wells Fargo
Goldman_Sachs	0	100	0	100	100	300
Bank of America	0	0	0	0	0	400
National Australia	0	300	0	100	0	0
Bank of Canada	0	0	0	0	500	0
Westpac	0	0	0	0	0	0
Wells Fargo	0	0	0	200	0	0

Minimizing Transactions

- **Step 1**: Identify max debtor and creditor with common payment mode.
- **Step 2**: Perform transaction and update net amounts.
- **Step 3**: Remove settled banks and repeat.

Fig 2: Final Cash Flow In the System
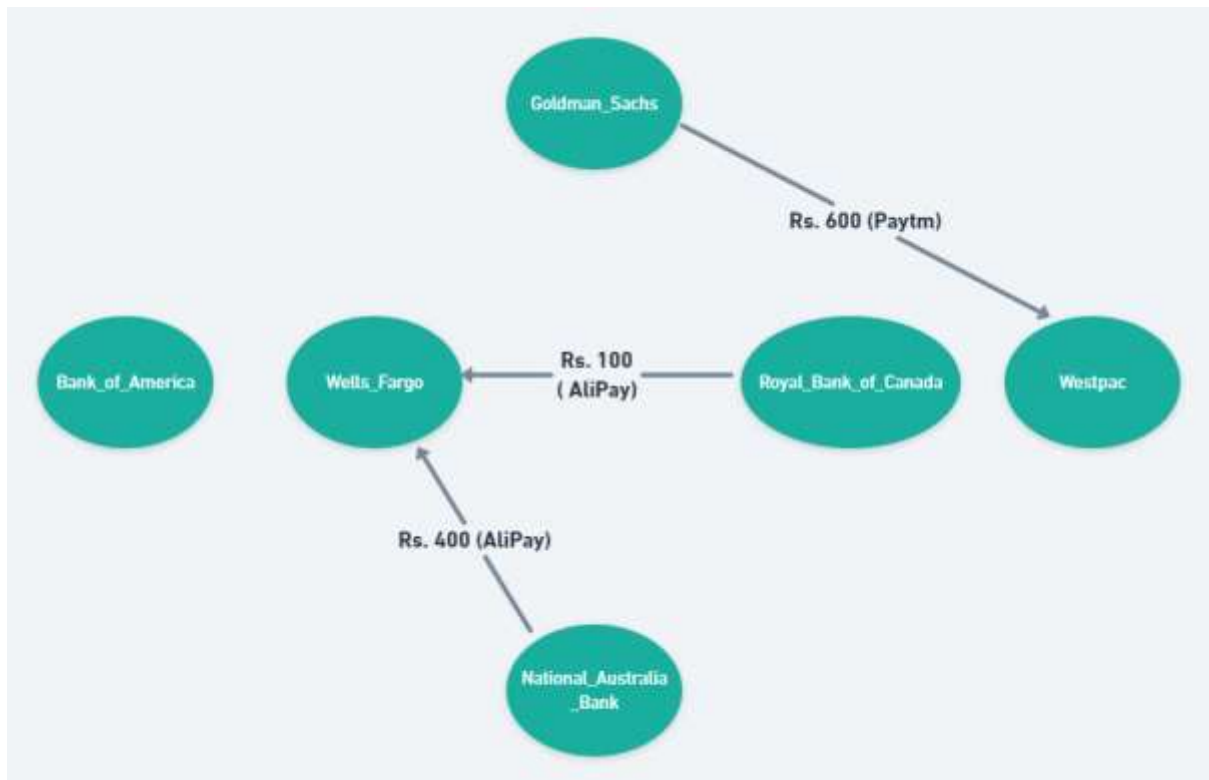
Final Graph of the Flow

|	Goldman Sachs	Bank of America	National Australia	Bank of Canada	Westpac	Wells Fargo
Goldman_Sachs	0	0	0	0	600	0
Bank of America	0	0	0	0	0	0
National Australia	0	0	0	0	0	400
Bank of Canada	0	0	0	0	0	100
Westpac	0	0	0	0	0	0
Wells Fargo	0	0	0	0	0	0

ssMetrics
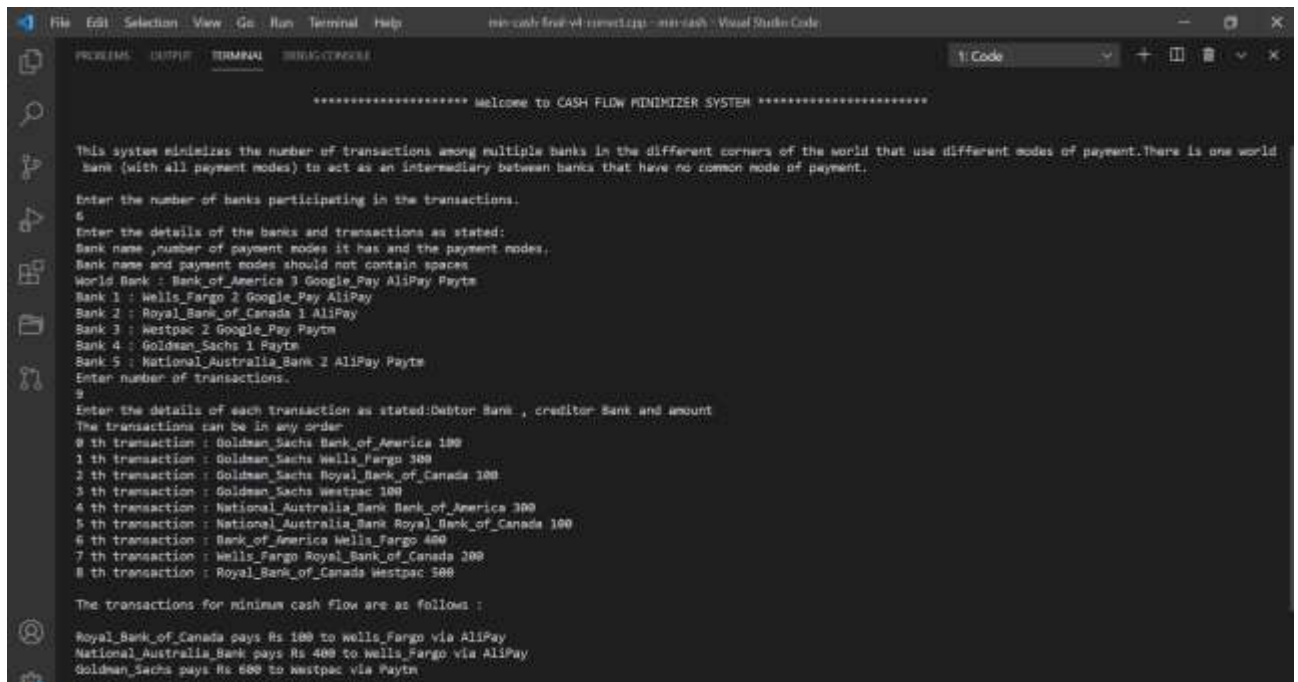
Initial Number of Transfers: 9

Final Number of Transfers: 3

Number of Transactions Reduced: 6

Snapshots

Conclusion

The Cash Flow Minimizer System represents a significant advancement in global banking operations, deals with the critical issue of incompatible payment methods among banks. By leveraging the World Bank as a central intermediary, the system successfully streamlines and reduces the number of transactions, resulting in cost savings and time. This also helps minimize unnecessary and expensive transactions. The comprehensive analysis and results presented in this report demonstrate the effectiveness of the Cash Flow Minimizer System in optimizing financial transactions, making it a valuable tool for the global banking network.