

Settle Pot

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Abstract—In today's urban lifestyle, settlement of securities is absolutely necessary as it plays an important role in handling one's finances. The major priority here is to handle these finances using a safe and secure system. The problem at hand is that - among a group of people, it is tedious to keep track of the large number of uneven transactions carried out and it is a challenging and confusing task to manually settle the bills. To overcome this issue, we have to use a systematic approach to split the total cost of an event involving a group of people such that every member shares a proportionate amount with minimal transactions and least number of unfair splits. This eliminates the traditional "who owes who" concept which may create chaos and instead implements orderliness.

Index Terms—Introduction, Motivation, Existing System, Limitations of Existing System, Proposed System, Implementation, Methodology, Data Flow Diagrams, Design and Analysis of Algorithms implemented, Results, Conclusions, Acknowledgement and References.

I. INTRODUCTION

A lack of communication and planning can be costly among friends and family. It is much easier to sort out bills rather than reacting to a sudden crisis to make decisions. SettlePot is a user friendly, easy to operate, handy android application that organizes the budget and expenses of every event and allows consumers to split and manage the bill. This helps maintain a trade of balances between friends. Handling finances plays an important role in one's life and should not be disregarded. The major problem faced during a gathering is to split the bill in a fair manner without any ambiguity and considering all sorts of tips/discounts on the total amount. To solve this issue "SettlePot" has been developed. It is a mobile application where "Settling bills are made easier". It has a simple, user-friendly UI that allows users to enter details of payers and nonpayers in an event. This allows the algorithm to generate a list of minimum transactions to be made to settle the event.

Instead of making transactions between the members creating chaos, the transactions are made to and from the pot, an abstract centre that helps resolve bills easily. The user has the choice to enter subevents and their corresponding roles(payers/non-payers) to distinguish and mark boundaries between the various activities that take place during the entire event. He/she can settle the subevent or the entire event according to their will, performing safe and secure transactions with no debts. It is a simple and easy approach to group and organize bills under events that occur in one's life.

SettlePot also provides a new feature – the "RatioSplit" that helps the users split the bill in accordance to a given ratio. For instance, let's say an evening at a restaurant has a 15% discount on the entire bill. It includes 2 categories: 7 Alcoholic drinkers and 6 Non-Alcoholic drinkers. If the bill had to be split equally, the Non-Alcoholic drinkers would have to pay extra, amounting to an unfair split, which means that they would be paying for more than they consumed. To resolve this affair, given the highest pay per Alcoholic drinker (highest dish

price + highest alcoholic drink price) and the highest pay per Non-Alcoholic drinker (highest dish price + highest non-alcoholic drinks/extras price), the RatioSplit algorithm helps in splitting the total amount into the given prices' ratio and gives an approximate average of how much the split for each person in their respective category would be. Thus, this algorithm is much more efficient and just in such scenarios involving conflicting interests.

II. MOTIVATION

Money is an important conversation that needs to happen among people, otherwise it shall lead to bad financial decisions causing chaos in one's life. In today's world, handling bills and their corresponding transactions is an everyday task. Settling bills that are received during an event among a group of people is a tiresome process and involves unnecessary efforts. And when there are two different categories of activities, settling the bill equally causes one category to pay more than the resources used – resulting in an unfair split. Solving these problems that occur every day around us is the major purpose to develop SettlePot. Learning and implementing various aspects of object-oriented programming using kotlin and designing efficient algorithms to eliminate the given problem statement of unfair and unorganized splitting of bills is a great opportunity to develop SettlePot.

III. EXISTING SYSTEM

Splitwise - is a mobile application that allows users to split money among themselves. It lets users know “who owes who” which is an inefficient approach involving a large number of transactions causing unnecessary confusion among the members.

IV. LIMITATIONS OF EXISTING SYSTEM

- Incessant emails and transactions of immaterial amounts, passing money back and forth.
- Makes settling of bills way more complicated.
- Doesn't allow users to create events, subevents, roles.
- Lack of notes section for the user's convenience.
- No clear transaction list after closing an event.
- No RatioSplit feature for activities involving two different categories.

V. PROPOSED SYSTEM

- Allows users to login via phone or email or SettlePot account providing the users the choice to login via their medium of convenience.
- Optimized bill splitting algorithms with minimum transactions.
- Allows users to create events, subevents and roles such as payers and nonpayers for a given event or subevent.
- Notes section for every event created by the user allowing them to share information via the app itself.
- A clean transaction list of the members who have to pay to the pot and receive from the pot is displayed. This transaction list can be shared via pdf format for future reference.

VI. IMPLEMENTATION

SettlePot uses an efficient algorithm to perform fair bill splitting with minimum transactions and a user-friendly interface. The major features implemented include: creation and formation of events, subevents, roles such as payers/non-payers, displaying the final exchanges to be executed after the event/subevent is closed, side notes section to store information regarding an event, user's profile section to store user's information and downloading the settled budget as a PDF for sharing. The user can login from any device, anytime, anywhere according to their convenience which provides portability. Their information and corresponding events-subevents data is safe and secure as password protection is provided. Money management is every user's evolving need and hence the data structure used is scalable in the field of finance. Smooth transactions are performed without interruptions using an efficient algorithm to settle bills. The data is stored in a real time database and the app is developed in kotlin and is hence maintainable in the long run.

VII. METHODOLOGY

- The user can Sign-up or Login with a unique user ID and password via email/phone number/SettlePot account to view and edit their profile.
- Users are provided with an option to create individual events and add roles for each member (payer/non payer). The 'Payers' and 'Non-Payers' roles state that a particular member has paid or not paid during an event.
- Additionally, they are provided with an option to create various subevents under every individual event and their corresponding roles as well.
- Saving notes under a given event is provided as a feature for storing useful information regarding a particular event.
- The user can edit or view the data for every event, subevent and their corresponding roles (payers/nonpayers) as the data is stored in a real-time database (Firebase database).
- Payers and Non-Payers data is stored in the pot. While closing the event, the amount paid by the payers in the pot is split among the total number of people and the minimum number of transactions to clear out debts is displayed.
- These transactions to perform can be shared in the form of a PDF allowing the user to keep it safe for future reference.
- If a group needs to share the cost of a particular bill, SettlePot ensures that every user settles the amount with the least number of transactions and unfair splits. This service eliminates the need to keep receipts thus making it hassle free.
- The user can login later using their user ID and password and keep track of the expenses of the events and subevents to edit it later providing maintainability.

VIII. DATA FLOW DIAGRAMS

In Fig 1, we have represented the general main activity of the SettlePot application. The user can sign up or login once they launch the application. Their data is read from the Firebase Database and displayed in the homepage. They can update their profile page if required. The event activity is launched once the user clicks on an event. The RatioSplit feature can be used to split bills according to a given ratio to avoid bias when there are two categories under an event. The user can logout whenever required.

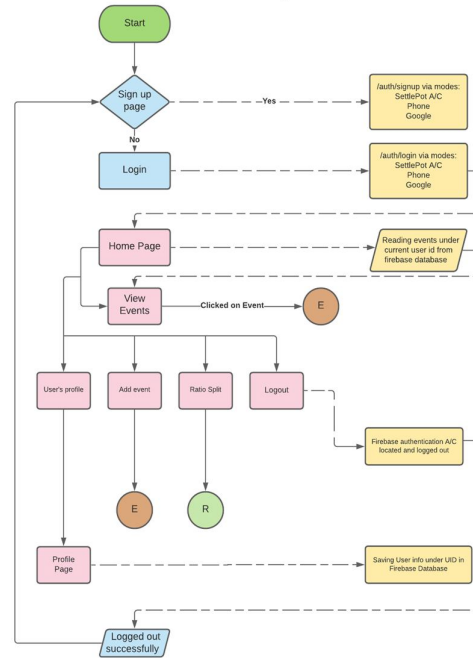


Figure 1. Main Activity

In Fig 2, the user is redirected to the event activity page, they can add roles (payers/nonpayers), notes and subevents, they can view the list of events, subevents, roles in real-time as the data is stored in a real-time database. The list of transactions to be performed is generated once the close event button is clicked.

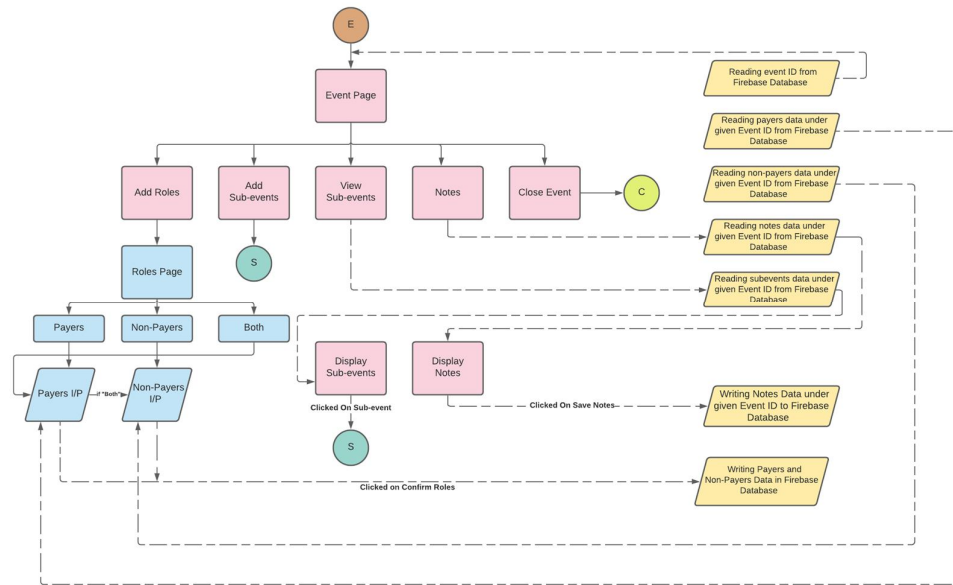


Figure 2. Event Activity

In Fig 3, the user is redirected to the subevent activity page, where they can add and view roles (payers/nonpayers). The list of transactions to be performed is generated once the close sub-event button is clicked.

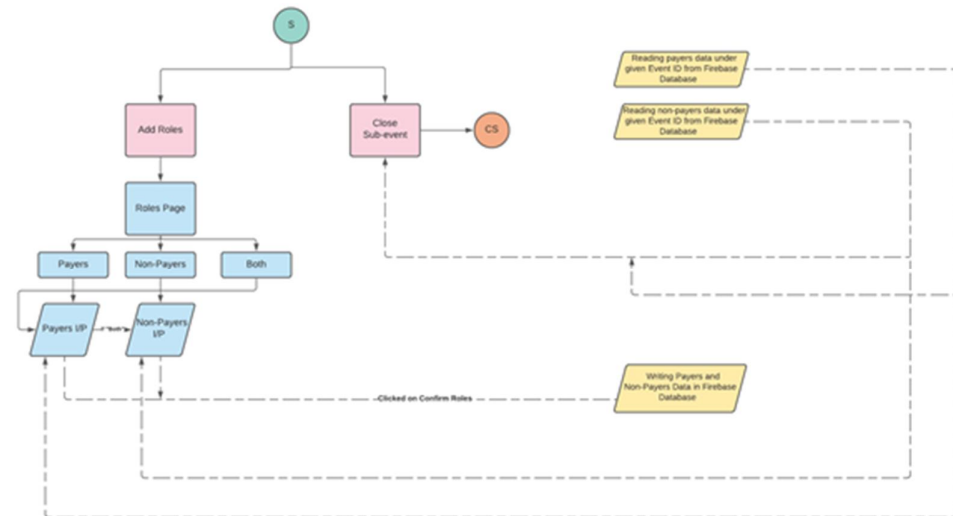


Figure 3. Sub-event Activity

In Fig 4, Once the close event or sub-event button is clicked, the transaction activity is executed. Here, the amount paid by the payers is added and is split equally among the respective event/sub-event members. The list of transactions to be performed is then displayed and an option of saving and sharing the settled bill as a pdf is provided.

In Fig 5, once the RatioSplit activity is launched, the user enters the number of people in each category and the highest amount of the two categories. This input is used in the ratiosplit algorithm to display the final amount to be paid by each category member.

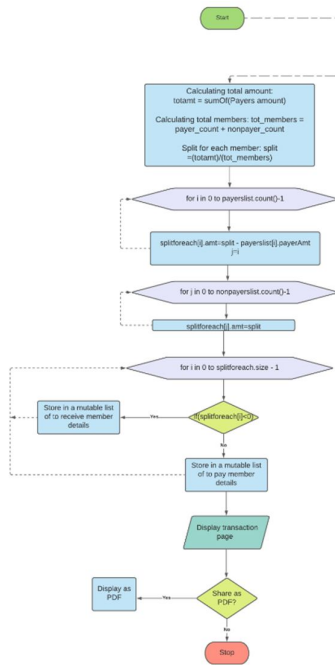


Figure 4. Transaction Page

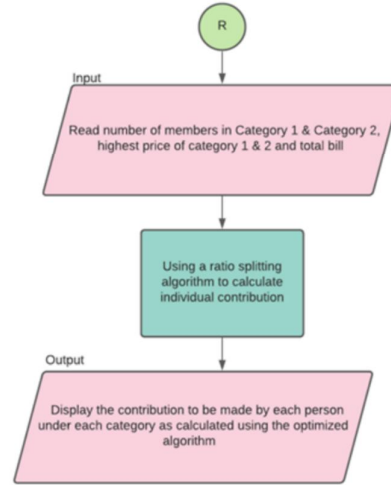


Figure 5. RatioSplit activity

IX. DESIGN AND ANALYSIS OF ALGORITHMS IMPLEMENTED

General Splitting Algorithm: The flow of this algorithm is mentioned in Fig 4.

Time Complexity: Basic Operation is calculating split for each which is iterating through a loop of size - number of members (say n). Hence, the time complexity is $O(n)$.

Space Complexity: Mutable List of size number of members (say n).

Hence, the space complexity is $O(n)$.

The time complexity of the given algorithm, that forms the basic use of the app, is as given above – $O(n)$ as the final splitting iterates through a for loop, which is of size n – the total number of members that have to pay or receive from the pot. This algorithm however needs to receive the total list of members under the events or subevents respectively and thus the basic operations while reading data from the Firebase Database for the subevent roles is a nested for loop, nesting first through all the subevents, and secondly, inside every subevent, through all roles – payers/nonpayers. Therefore, in the worst-case scenario the time complexity of the reading functionality is $O(n^2)$.

Ratio Splitting Algorithm:

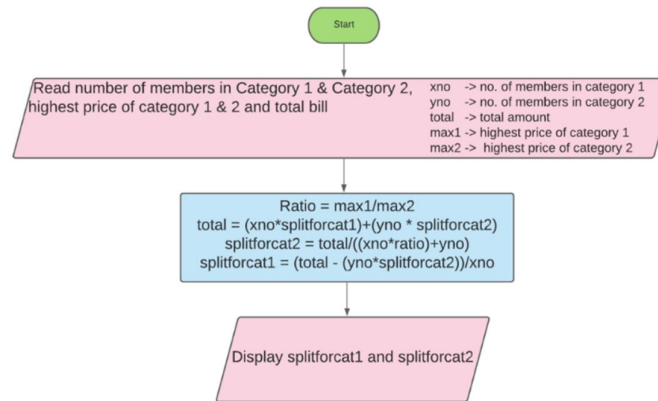


Figure 6. Ratio Splitting Algorithm

Time Complexity: Basic Operation is calculating the split between two categories using a linear equation for a given ratio.

Hence, the time complexity is $O(1)$.

Space Complexity: Amount for each category. Hence, the space complexity is $O(1)$.

X. RESULTS

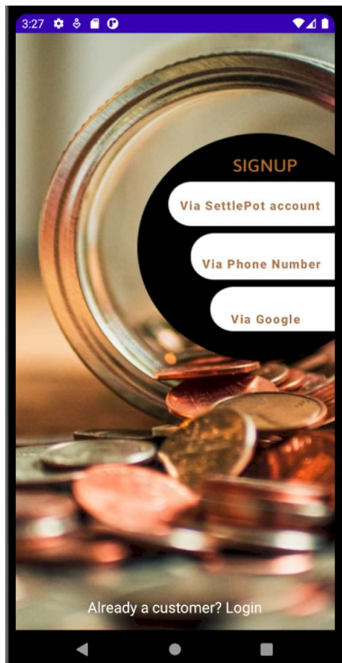


Figure 7. Sign up page

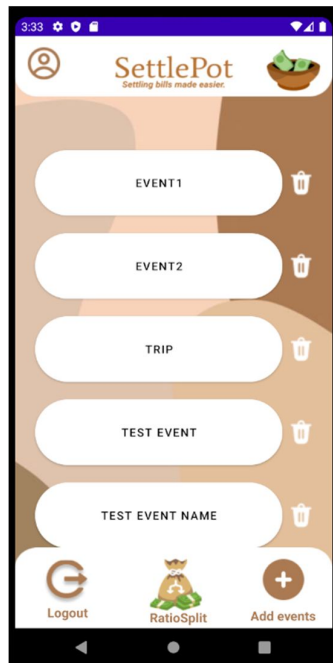


Figure 8. Home page



Figure 9. Profile Page

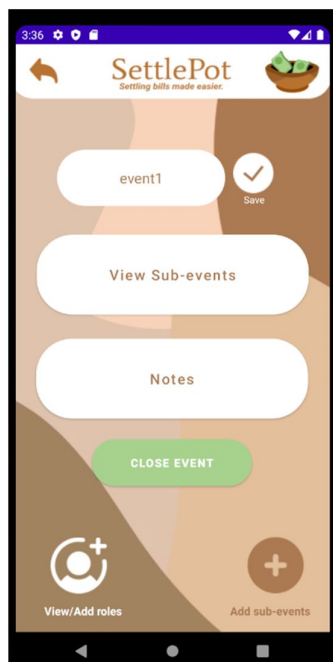


Figure 10. Event Activity

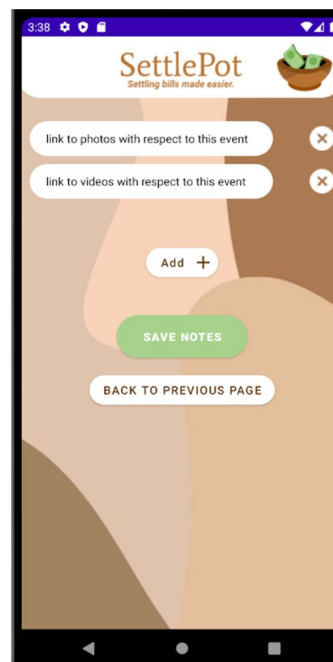


Figure 11. Notes section

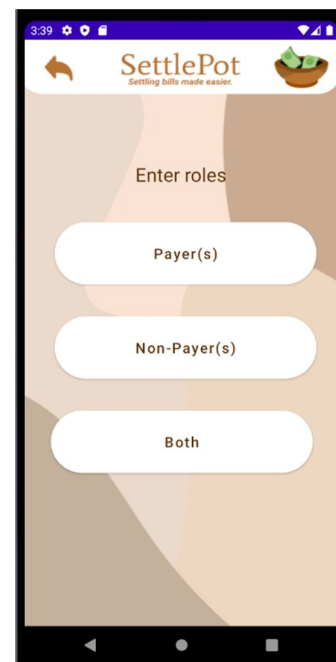


Figure 12. Enter Roles

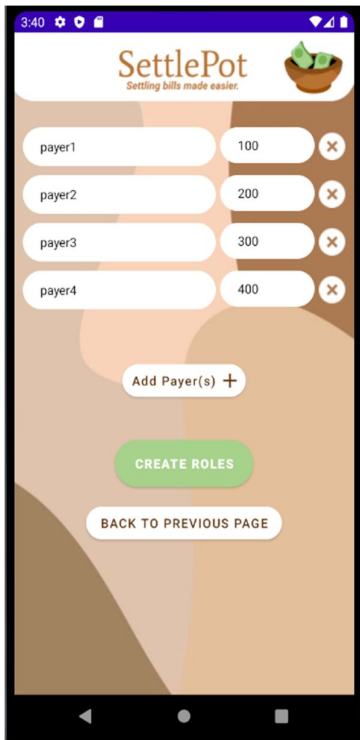


Figure 13. Payers

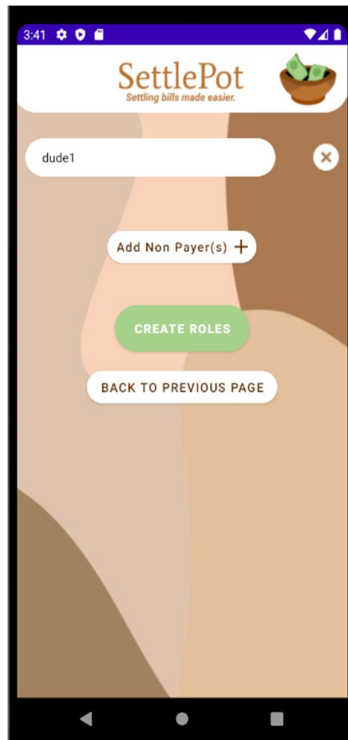


Figure 14. Non-payers

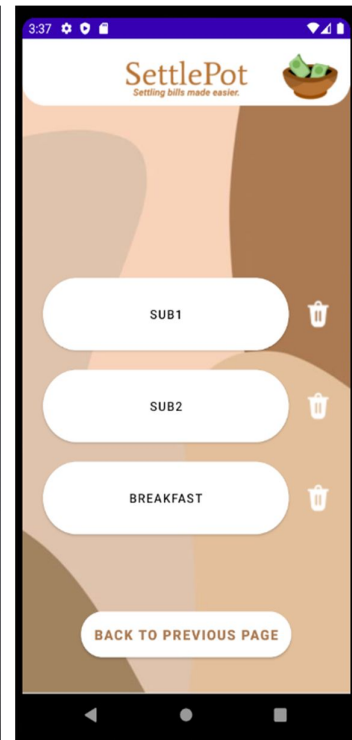


Figure 15. View Sub-events

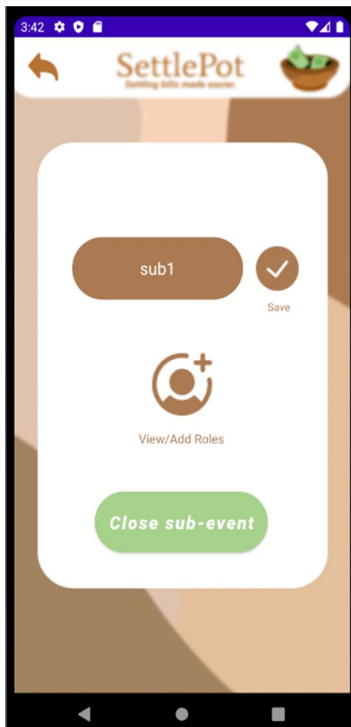


Figure 16. Sub-event activity



Figure 17. Transaction page



Figure 18. Share as pdf

XI. CONCLUSIONS

The SettlePot application is developed to solve a real-world issue where splitting of bills during an event is of general occurrence. The general splitting algorithm and the ratio splitting algorithm are used to solve this financial issue as mentioned in section IX. The application is developed in such a way that there is scope for further improvement and scalability.

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