Automated Cost Reduction while Using Multiple SIMs in a Single Mobile Device

Partha Chakraborty[1], Salsabil Arabi[2], Ayesha Siddiqua[3], Tahrina Tasnim[4],
Md. Sazzad Hossain[5], Ishtiaque Ahmed[6], Shantanu Dutta[7], Alvi Md. Ishmam[8],
Tarik Reza Toha [9], and A.B.M Alim Al Islam[10]
Department of CSE, Bangladesh University of Engineering and Technology,
Dhaka-1000, Bangladesh
Email: {[1]1305117.pc, [2]1405108.sa, [3]1405049.as}@ugrad.cse.buet.ac.bd
{[4]tazreentasnim, [5]sazzad.cse.88}@gmail.com,
{[6]1205094.ia, [7]1405092.sd, [8]1305092.am, [9]1205082.trt}@ugrad.cse.buet.ac.bd, [10]alim_razi@cse.buet.ac.bd

***Abstract*—According to statistics, the number of active Android device user is approximately two billion and 25% of Android devices are dual SIM(Subscriber Identification Module) supportive throughout the world. For this huge number of dual SIM users, it is quite difficult to remember which SIM package offers the cheapest rate for calling. In this study, we propose an automatic cost reduction application which assists in reducing cost of outgoing call by selecting the best available SIM. This app selects the best cost-effective SIM and automatically transfers call to the particular SIM. If the selected SIM does not have enough money for calling, the call is automatically transferred to the other SIM. Our app is an approach towards saving the additional amount of money that is being spent by the dual SIM users. User evaluation of partial implementation of our system confirms around 45 percent saving of money while using this app.**

I. Introduction

The number of mobile phone users has reached at a prominent phase throughout the world since the cost of the device and call is reduced to a great extent. The number of mobile device users is also increasing in full swing in developing countries. Recently, a large number of mobile phone users have started using dual SIM supportive mobile phones [1], [2]. The SIM companies are launching a large number of available packages for the satisfaction of the users. Different packages offer different call rates for different operators at different period of the day. However, it is often difficult to remember and choose the cheapest rate package for calling at different time. Often we choose wrong package for calling and waste our balance. Since a large number of people are using dual SIM supportive mobile phones, their small wastage apparently become a large amount of money from the country perspective. There can be three possible scenarios when people use dual SIM enabled phones:

1) Two slots have SIMs of same operator having different packages
2) Same operators and same packages
3) Different operators

In all three cases, choosing the best SIM for calling is not always an easy task. Many factors are responsible to make a SIM best for using or we can say that often it is difficult to calculate which SIM will cause less cost. It requires a good amount of time to do these lot of calculations. Often users are in a hurry, so it is difficult for them to do these much calculation to choose the right package. We have tried to develop such an app that does all calculation for the users in a second and chooses the best SIM for calling.

When we choose a particular SIM for making call without any inspection, there is 50 percent possibility that the user will choose the wrong package and waste money. For example, if we waste 0.25 BDT per minute, we actually waste 4 BDT after 10 minutes. Thus, 10 million users will waste 40 million BDT. As of 2017, 5.2 percent Bangladeshis are using dual SIM smartphones and the number of people is 8,578,000 and counting [3]. From this statistics, we can easily realize the catastrophic effect of the mentioned problem.

The development of android app is getting more popular as it is available to most of the people and they feel convenient while using apps. However, very few apps have been developed especially for dual SIM supported mobile phones [4], [5]. Those apps mostly focus on adding extra features such as Photo Editor, Fun Games, Fortune Teller, etc. and most of them are highly customized for some particular phone set [6], [7]. There is no such type of app that can solve the mentioned problem in a large scale. However, we can not leave this problem unsolved.

In order to solve the above mentioned problem, we plan a new system. It is an automated cost reducing application for dual SIM users. When a call is made, our proposed app selects the cheapest rate offered by the available SIMs and automatically passes the call to that particular SIM. It does the necessary calculations to identify which SIM is more cost saving.

On the basis of our work on the app, we make the following contributions in this paper:

- We present a design of the system in detail in this paper. We discuss the functionality and working principal of different subsystems of our app.
- By implementing our app, we perform user evaluation to know what the users are thinking about the app.

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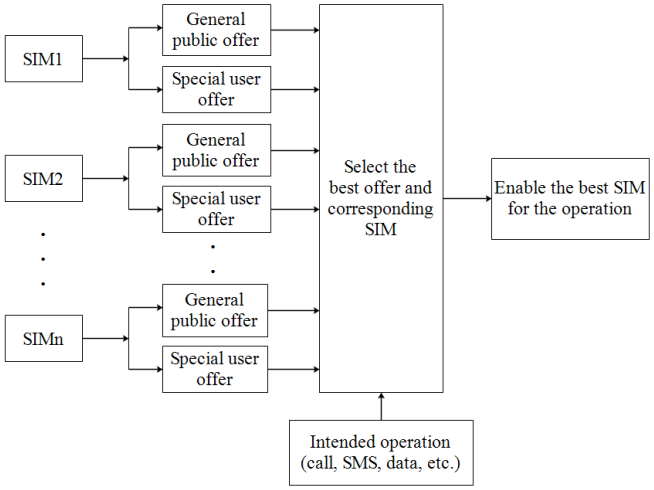

Figure 1: Block diagram of our proposed framework

II. Related Work

Many apps have been developed for dual SIM [7] and android phones [6]. However, developers are not intended to solve the discussed problem.

There is a dual SIM Selector App in play store [4]. It allows selection of SIM-card when making a call from a third-party dialers. SIM is automatically selected based on the rules and rules are based on phone masks and association with contacts. However, it does not ensure cost reduction of calls. Various systems have been developed for avoiding call failures in dual SIM devices [15]. A method is introduced for optimizing cell selection in a dual sim dual standby device [16]. So far, no app is built for the purpose of reducing cost of call of dual SIM phones. As a result, we started considering the necessity of an app that can solve the mentioned problem.

III. System Design

In our proposed Automated Cost Reduction app, there are four subsystems. They are Selecting Attributes, Choosing the Best Offer, Updating Database and Operation via the Best SIM. Figure 1 shows the block diagram of our app. In this section, we discuss the functionalities of the subsystems briefly and give their descriptions and features in subsequent sections.

A. Selection Attributes

In this subsystem, we implement functions where users will select the following components:

1) Phone set and SIM
2) FnF(Friends and Family) and active package
3) The number that user wants to call

Based on these selections, our app determines which SIM is more cost-effective. These information could have been fetched automatically, however right now our app is not developed completely. In near future, we will complete our app and hope to skip this part.

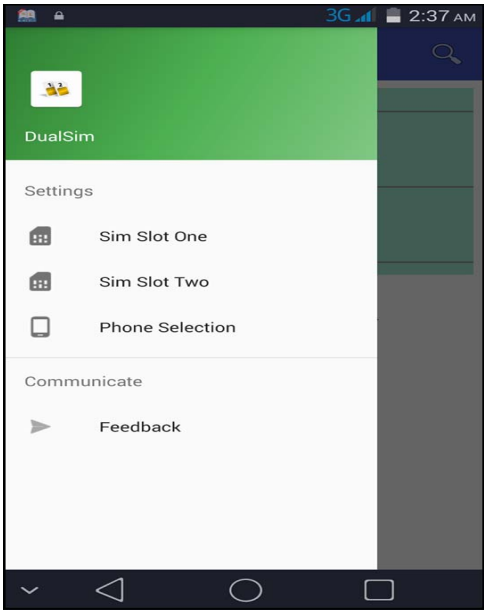

Figure 2: App interface for SIM selection

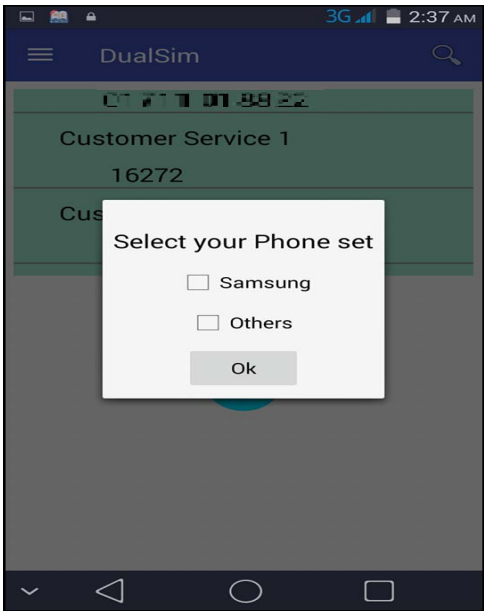

Figure 3: App interface for phone set selection

1) Set and SIM Selection: Due to some reasons, we have phone set selection option where user needs to set the type of the phone under use. To make a choice of the perfect package for call, we need to know what types of SIMs the user is using. So we also implement function of SIM selection of two types. The interface of SIM and Set Selection are shown in Figure 2 and Figure 3.

2) FnF and Offer Selection: Every SIM has unique FnF numbers that are actually selected by the user. Call rate for these FnF numbers is less than other numbers. We have FnF selection option. Firstly, caller updates these FnF numbers by FnF selection button. There are many available packages

and offers in different SIM. User has to select his desired package for both SIMs. User has to update packages manually when user changes the package or receive new package. The interface of FnF and Offer selection are shown in Figure 4

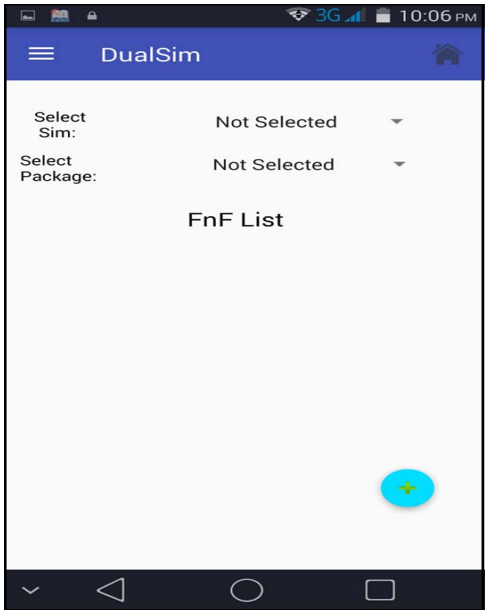

Figure 4: App interface for FnF and package selection

3) Dialing Number Selection: For calling, the user needs to insert the number that is going to be called. Our app can directly read the contact list. User can select any name from his phonebook to activate call. User can also simply insert a number using keypad. The app interface of Dialing number is shown in Figure 5.

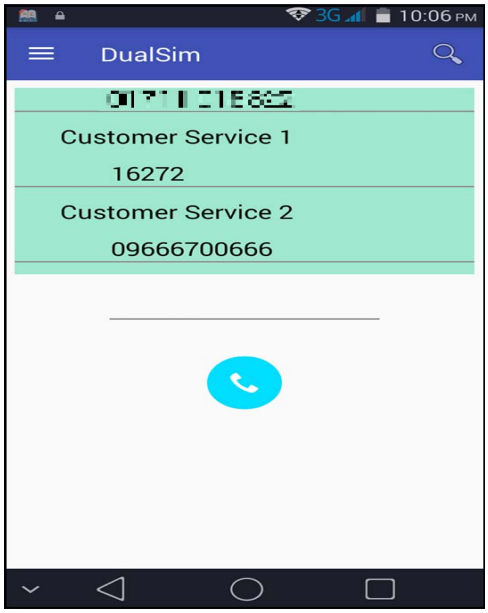

Figure 5: App interface for dialing number selection

B. Choosing the Best Offer

When a call is made, our proposed app chooses the particular SIM that offers cheapest rate of cost for the specific call. Users need to select the SIMs and packages before making calls. They also need to insert their FnF numbers. Our app fetches the call rate information, pulse information, FnF number call rate etc from the database of both SIMs and calculates the cost of call for both SIMs for a particular dialed number. These offers vary from time to time and each time those so many calculations are done by the app. The SIM that costs less for a specific number is used to make call.If its balance is not sufficient for the call, the call will be automatically made by the other SIM. It chooses the best offer so that the money of the users is not misused.

C. Operation via the Best SIM

After all selections are made, the app is ready to make call automatically. For making call we have used default call apps layout. If the SIM that is selected for best package has no balance than the app will pass the call to the other SIM.

D. Updating Database

It is the most important part of our proposed system. The information of the different packages of different SIMs are stored in the system database. These information change frequently. So our database needs to be updated automatically with the update of the packages.

It is also the most challenging part of the app. Each time the SIM companies update or add or delete any of their packages, that information need to be saved into the systems database. An efficient data manager is needed for this purpose. If we can come to some agreements with the SIM companies, this task can be a little easier for us. Otherwise, we will need efficient manpower to update database and this may increase the maintenance cost.

IV. System Implementation

Our goal is to implement a common platform for all dual SIM android phone users where they can make calls at the least possible cost. To develop this app, we have used Android Studio IDE. We need to store the information of different packages of different SIMs to calculate the cost. For this purpose, android SQlite database is used. This app will require android 4.0.4 (ice cream sandwich) or higher to run on the device.

Currently, we can only make calls by this app. When we choose to call someone, the app forwards the call automatically to that SIM which costs least. We have used android call service to make the calls automatic. If the SIM chosen for making call lacks balance, the call will be transferred to the other SIM.

The keypad used in this app is actually the android built-in keypad. User can insert dialing numbers from the contact list. There is also option for typing number from keypad.

We have many other implemented functions in the app to get required information from user. Firstly, we take user input

Table I: Comparison Between Nishchinto [9] and Bondhu [10] Done by Our App

Dialed Number	Duration (seconds)	SIM selected by app	cost (BDT)	cost (if other SIM was selected)	save (BDT)	Remarks
01744-521232	300	SIM2	1.65	6.3	4.65	This number was super FnF for SIM 2
01710-642251	180	SIM1	3.78	4.95	1.17	Flat rate (this number was not in SIM2's FnF list)
01918-462644	430	SIM2	4.95	9.03	4.08	Number was SIM 2 FnF list

of the phone set type and SIMs from the user. We need to update FnF numbers by the FnF selection option .

There is also SIM and package selection option in the app. As there are many packages of various types of SIM, user has to update his SIM packages manually when user changes the package or receive new package. Figure 6 shows the flowchart of the system.

V. Features of our proposed system

There are many reasons to the users for using our app. Our app offers the users an easy platform to save their money with the least effort. People will be greatly benefited by using this app as it will save their money. So far, we have not seen any similar app such as this one. All classes of people including local and global can use this app. As it is global, supported language will be English. We can also provide a special version for local users that support Bengali language. As our main target is to help all classes of people, the app will be available with one time pay. When the user is online, we can advertise for additional income. This app might be very attractive to mobile companies because it will promote their sale. Every good system has some drawbacks. Our app also has some currently existing problems. Each time user makes a call, needs to choose SIMs user is using in the phone which can easily irritate the user. User also needs to choose the FnF numbers and running package before making call which is disturbing and may irritate the user at the time of emergency. For loading package information from database, the app will need internet access. However, it is often difficult for mobile users of developing countries to keep internet balance always. However, there is also news of hope in this case. According to BTRC, the total number of Internet subscribers in our country has reached 73.347 million at the end of June, 2017 [9]. So, we can expect that most of the users will be able to bear the internet expense needed for this app. Moreover, for storing package information, we need to keep updating database which will increase the maintenance cost of the app. The UI(User Interfaces) design and decoration of the app is not that much attractive. This may not attract the users. However, in spite of having all these faults there is a hope that, we are trying to overcome these problems as soon as possible. Hopefully, we will solve them in the upcoming future.

VI. User Evaluation

In this work, we have partially implemented our app and launched this app to social media to collect the reviews from users. We have tested our app through different groups of people in social media. They have different types of opinions, however most users have appreciated our app. According to an user, using this app for per day 20 minutes saved approximately 41BDT in seven days using two different operators Robi Noor and Teletalk Agami.
The experimental data of a Bangladesh based telecommunication operator, Grameenphone [8] done by our app is presented in Table I. In both slots We have used Grameenphone SIMs with different packages. We have used package Nishchinto [9] for SIM1 and package Bondhu [10] for SIM2. This table shows that a good amount of money can be saved if we use this app.

We have also tested our app by using two different telecommunication operators - Banglalink Desh [11] as SIM 1 and Robi Anonna [12] as SIM 2. The findings for the two sample calls are shown in the Table II. It shows that if we can choose the perfect SIM for calling, we can save our valuable money.

During performing experiments, some users have reported that it crashes in Meizu m3 note. It is possible because this model does not give permission to read contacts. Additionally, it crashed in Symphony Oneplus X as our app can not use " android: backgroundTint " in Lollipop (5.1.1) and High resolution Logo. We hope to optimize our app and make it more user friendly and flexible in future.

VII. Future Work

So far we have developed the basement of the app. Our plan to extend its functionality and make it more attractive to the wide range of users in future. We will develop our customized keypad. As this application is intended to provide users with the experience of the call application of the mobile, we will include 'Call Logs' in future. Users will then be able to select numbers from 'Call Logs' and call automatically through our app. We will try to develop our app in such a way that it can automatically select the existing SIM's type of that device in which it is working. This will make the app more user friendly. In future we will automate the selection of

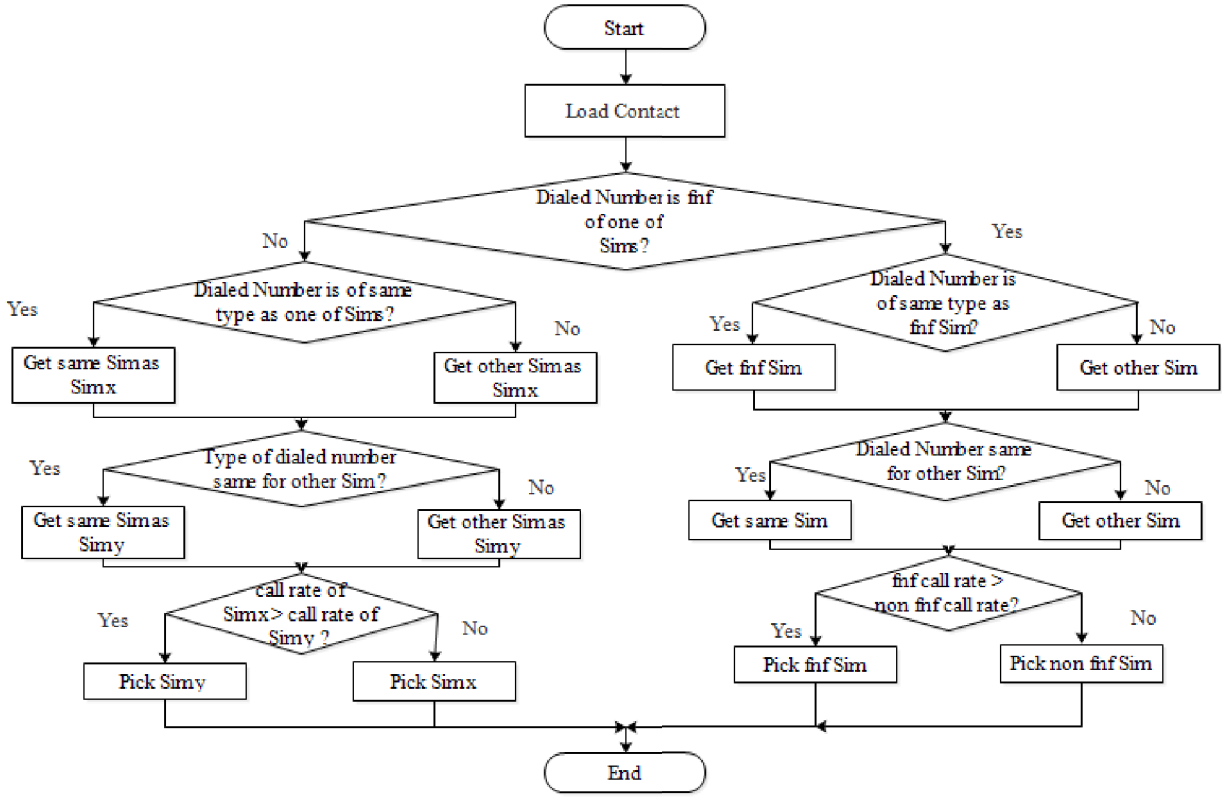

Figure 6: Flowchart of our proposed system

Table II: Money saving by our app for Banglalink Desh [11] and Robi Anonna [12]

Dialed Number	Duration (sec)	SIM selected by our app	Total cost (BDT)	Total cost (If other SIM was selected by user)	Save (BDT)
01744521232	160	SIM 2	2.72	4.64	1.92
01926139052	330	SIM 1	3.30	5.61	2.31

the FnF numbers for both SIMs as like, our app will get the info directly by reading the contacts and other settings of the phone. It will lessen the work of users and save their valuable time. We intend to develop our system so that each time user makes a call, the system can select the active packages of both SIMs automatically by itself. So far we have focused only on reducing calling cost of dual SIM supported mobile phone. However using similar strategy, cost of sending SMS(Short Message Service), MMS and mobile data can also be reduced. We are determined to develop the above mentioned features in future. So far this app is being developed focusing the mobile packages of Bangladesh only. In future, we want to add different country's mobile packages in the app. Users from different counties will be able to use the app efficiently. For the first time implementing this app, we were trying to focus on service only. We will add sms cost reduction and we will define specific cost calculation algorithm for both call and sms. We will also parse data from the live websites of the network operator and add updating facility to the app. We will also take user review and add crash analytics for tracking device compatibility. We will track the power consumption and try to minimize it.

VIII. Conclusion

The number of dual SIM user is increasing day by day. Most of them are totally unaware of the fact that their little awareness can save a large amount of money. However at the same time it is also true that to save their money, they will have to spend a good amount of time to select the perfect package and sometimes it becomes much difficult to do it manually. Our app is an approach towards solving the problem. Our developed cost reducing app for dual SIM users will help the common people to save their valuable money and time. This app is extremely easy and user friendly. We are trying to save the money of the dual SIM users without taking much of their time.

We have partially implemented the cost reducing system. We plan to make it fully automated. We want to make it more robust in such a way that it can fetch all the information of SIMs and packages by itself without causing the users to select

them. This will save the time of the users and make our app more satisfactory to the users.

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