Smart Kitchen Mate

A Home Budget Management System for Food Items

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Abstract - As a result of the current economy crisis many people are struggling to stick with their budget plan. There are other reasons for this situation, such as wasting food and money are major issues. This incident mostly occurs due to the busy life style and wrong planning criteria of the people. There are lots of home budget management applications in the internet but they do not provide exact user friendly solution. Most of them are getting inputs from user and show statistics. However these applications are not much user friendly for Sri Lankans because they are developed for other countries. Application helps user to manage their budget on food items and forecasting the next month budget. Forecasting helps users to make pre decisions and have more control on their budget. The system will suggest the cost effective supermarket when user select food items that they want to buy and their budget. Forecasting algorithm returns personalized and up-to-date forecasting on next month budget. The system tracks user’s monthly expenses on food items and item quantities in order to provide personalized budget management system. The system helps user to manage their money on food items while saving their time. This application is an Android application. The results of this research helps to develop a full version of home budget/finance management system and more personalized forecasting systems.

Keywords - Home budget management; Budget management application; Android; Forecasting; User preferences; Data analysis; Personalization ; C#; Web Service

I. INTRODUCTION

There are so many home budget management applications in the internet. But they are not much helping for the people to manage their budget plan. Any how these applications are not much user friendly for Sri Lankans. Therefore we looked at this problem in a different angle and the team decided start with food items which are getting the first priority of human needs.

The smart Kitchen Mate application contains three elements or separate systems that interact with the user to provide the best possible user experience. Once the three systems are joined together it is possible to identify the combination as the Smart Kitchen Mate application. Therefore the three required systems can be recognizing as the Smart Kitchen Mate mobile application, Smart Kitchen Mate web service and the administrator website.

The Smart Kitchen Mate mobile application and the web service are the core of the system and therefore it provides the most of the functionalities of the system. Smart Kitchen Mate mobile application allows users to select their item list, view statistics and view suggestions/notifications/alerts to the user with the collaboration of the web service. A Web service is used to store user data and analyze. Web service/server uses two algorithms to analyze, one algorithm will analyze user budget and other algorithm will analyze the item quantity of the user’s purchases. These analyzed user data will be used to give suggestions/predictions and alerts to the user. Smart Kitchen Mate administrator website is basically used to get the supermarket pricing list.

Smart Kitchen Mate application is to help the end user to manage their grocery budget. In order to satisfy the end user and to provide the full benefits system has to keep the records of the user’s grocery buying records. Users can select the grocery items and the quantities that they need and send a request to find the cost effective supermarket to buy their grocery. Through this function, system record data of the user’s purchases, so user doesn’t have to worry about entering to the system. System implicitly creating the grocery list to the user which they can refer when they go to the supermarket. When user comes to enter the budget (expected money to spend on their current grocery purchasing) predicted monthly budget and the current expenditure will be shown.

Forecasting algorithm returns personalized and up-to-date forecasting on next month budget. The system tracks user’s monthly expenses on food items, purchased item quantities and use current item prices to provide personalized budget forecasting. Using these forecasting results, users can have more control on their budget plan. So that anyone can quickly and easily take control of their home finances.

When user comes to enter the quantity of their buying the predicted monthly quantity and the current bought quantity will be shown to help the user to make their decision. System notifies the user when they try to exceed the budget or the quantity. Users can view the statistics of their purchases to make future decisions.

Objectives

- To forecast the monthly budget on grocery items for a person
- To develop home budget management system for Sri Lankans.
- To provide personalized user friendly solution.
The system is designed for Sri Lankan users. System currently supports Sri Lankan leading supermarkets. System can be adapted to use in foreign countries also.

In this research paper the reader will find how this project is carried out and what are methods and metrologies, literature is reviewed.

II. LITERATURE REVIEW

As a result of the busy life style of current generation, they avoid spending unnecessarily on items and services that do not contribute to achieving user budget. If users are working with limited resources, budget makes it easier to make ends meet. It clearly says like this, a result of new technology there is a new product always appears to buy or test for people, so saving money does not no more easily. Some people think twice and won their budget throughout next, but majority is failed [1].

From most of the budget exceeding items, unexpected Food expenses are on the top most level. This statement show it clearly (this is a kind of survey). In day to day life we are unable to plan exact amount of food for the next week or month, but when the food wasted or spoils, our money surely down the drain. Draw a plan for our food items will help a lot, as does knowing the time our food keep fresh on the shelves or in the refrigerator. But at last all it takes little attention on waving strong war on food items [2]. Most of the food items waste due to above situation, but people are unable to manage this properly. If they do so on for several days, but they are fail to continue and maintain it properly. So when this happens, people faces to a huge problem to spend their whole month with a less budget.

To overcome this problem many solutions are implemented all over the world. Such as web articles (50 ways to save money), [3] mobile applications (MyBudget free Android based mobile application), and web applications (Mint) and so on. There are some famous solutions of example which are deployed by now.

- “MyBudget free” is an Android mobile application that have following functionalities;
  Password to protect data, Multiple budgets, Cost/income tracking, Unlimited categories, Transaction viewer and editor, Warning for limit of debt, Customizable data filtering, Monthly, weekly and daily report, Database backup/restore and Export to Excel [7].

- “My Budget Book” is another Android mobile application that have following functionalities;
  No registration. Also optimized for tablets, Available in 10 languages: English, Deutsch, Espanola, Portuguese, François, Italian, Nederland’s, Easy access, More than 100 currencies and No internet connection required [8].

- “Level Money” is an Android mobile application that have following functionalities; Spendable, Save for things, Eliminate the need for antiquated budgets and Money is still safe in your bank [9].

- My Weekly Budget, Expense Manager, Good budget (EEBA Budget), Budget Book/Home Budget with Sync, Home Budget Manager, Budget Calendar and Quick Money Recorder – Finance.

Above android and web applications are categorized on Budget Management. They are user friendly, well planned. The developers are tried out their level best to give a better output. Most of the applications are taking user inputs, not process done inside, no tracking, no prediction notices are given done. Only they show statistics, graphs, deducted values etc. That is much better according to some limitations. But it should be develop rapidly more effectively. So these applications are not commonly used.

III. METHODOLOGY

Smart Kitchen Mate is a research project which creates the need to use the prototype software development lifecycle. The prototype SDLC is designed specifically to handle risk-intensive projects. Smart Kitchen Mate is risk intensive considering the fact that the system has to analyze previous data, user preferences and forecast budget to the user. Also mobile application like Smart Kitchen Mate has not implemented yet in Sri Lanka. It is possible to achieve excellent out come through prototyping by evaluating prototypes. Figure 1 shows the System overview.

As shown in the system overview in figure 1 system consist of a mobile application web server and a database. Mobile application supplies the UI to communicate with the web server. Mobile application will save user personal data to improve the system performances. Web server consist of three main components. Those are budget analyzer, quantity analyzer, cost effective supermarket selector.

Project started with reviewing the literature, studying current existing systems and studying research papers. Most of the existing systems are getting the inputs from the user and show statistics. They were not designed for Sri Lankans.
We conducted an online survey to identify the current usage of these types of applications in Sri Lanka and potential need of this kind of application in the society. Survey results shows that most of the people are not using a budget management application since they are not user friendly and not designed for Sri Lankans. They were happy to use a budget management application with Budget Forecasting and automatically get select a Low Cost Supermarket for them. Figure 2 describes the overview of the budget forecasting algorithm overview. Figure 2 shows the Forecasting Algorithm overview.

Figure 2: Forecasting Algorithm overview

Budget forecasting algorithm uses user item purchasing history, user preferences, and current pricing list as inputs to return the personalized budget forecasting. Tracking user purchases are most important to identify and analyze the user behaviors on item purchases. Budget is highly depends on users item purchasing. System records the item and the quantity of the item and other important data to maintain user purchasing history. Different supermarkets have different pricing list, identifying user’s preferred supermarket is most important part in making personalized budget forecasting. Budget forecasting helps users have more control in on their budget.

Budget forecast algorithm is developed using linear regression as its base theory. It can provide the height of the best fit regression line at the specific value. System uses its own table modeling to feed the customized data set to the linear regression algorithm. In this table model there is a table to store user’s item purchasing information, supermarket pricing list for each item, item list of the supermarket and the other tables to store relevant data. System calculates the monthly budget using their preferred supermarket and its up-to-date pricing list to create the personalized and valid dataset for the analysis. The linear regression equation is shown below.

\[ Y = a + bX \]

\[ b = \frac{N\Sigma XY - (\Sigma X)(\Sigma Y)}{N\Sigma X^2 - (\Sigma X)^2} \]

\[ a = \frac{\Sigma Y - b\Sigma X}{N} \]

Following steps are followed to do the forecasting on budget.

1. Get users mostly used supermarket.
2. Calculate monthly expenses using that supermarket pricing list.
3. Discard the current month expenses from the array.
4. Feed the data set to linear regression algorithm.
5. Get the forecasting value for current month.

Low-cost super market selection algorithm overview is described by the figure 3. Lowest Supermarket selection Algorithm uses the Item names and relevant Quantities which are entered by the user through their Android device. In the server side Item names convert to item IDs and check relevant IDs in each and every Supermarket, then this algorithm creates a unique Bill according to item IDs and Quantities stored as the per unit price basis in the server. It creates bills for each and every Supermarket. Finally select a lowest Cost supermarket for the user. Real time, up to date Administrative control panel from the server side is very much helpful to these calculations. Figure 3 shows the Lowest Cost Supermarket selector Algorithm overview.

Figure 3: Lowest Cost Supermarket selector Algorithm Overview
IV. RESULTS AND DISCUSSIONS

Following are the most important screen shots of Smart Kitchen Mate application. Figure 4 shows the Administrative Login interface.

![Figure 4: Administrator Login](image)

This interface gives the functionality for Login to the Smart Kitchen Mate Administrative panel. Then Administrator can easily do the relevant updating for the items which are in the database.

![Figure 5: Control panel](image)

In this Smart Kitchen Mate application developers are mainly focused to having an Administrative control panel (Figure 5). So it is very useful for keep track on real updated pricing lists for each and every supermarkets stored in the database. When the Administrator logged in to the panel he/she can add new items/edit existing prices and remove unwanted items. This function operates properly.

![Figure 6: Main Menu](image)

Figure 6 show the main menu of the mobile application. Start shopping will open up the item list for the user then user can select the item list they want to buy. After completing the item selection system will select the low cost supermarket for user.

![Figure 7: Budget Information](image)

Figure 7 shows the interface that user get after they submit their item list. This interface shows the lowest supermarket to get those items, user’s profile details (income, allocated grocery budget), system grocery budget forecast, cost of this purchase and the summary message.

“Smart Kitchen Mate” is having main three algorithms. Budget Analyzer, Quantity analyzer and Lowest cost supermarket selector. Budget Analyzer and Quantity analyzer combined with Budget forecasting algorithm. It use the user’s item purchasing history, user preferences, current pricing list as inputs to return the personalized budget forecasting. The accuracy of the system is depends on usage of the system. Accuracy level increases as the amount of monthly data is fed to the system. In the first month it cannot give any prediction but when the number of months increases accuracy increases. This allows users control own budget easily.

From Lowest cost supermarket selector give the Cost effective supermarket according to user’s items list given that item pricing list is up-to-date.
“Smart Kitchen Mate” provides a best home budget management system on grocery items. It is very useful and user-friendly application for Sri Lankans since it is designed to provide the potential needs of the Sri Lankan people. User can select their grocery items and system selects the lowest cost supermarket for them. The application has up-to-date data on leading supermarkets in Sri Lanka to get best selection behalf of the user. Smart Kitchen Mate forecasts on the user’s grocery budget to allow the users to make decisions on their budget plan of the month. Budget forecasting algorithm returns a personalized and up-to-date forecasting to the user so that forecasting algorithm make sure that the user gets the suitable budget plan for their grocery item purchasing behavior.

Smart Kitchen Mate is ideal grocery budget management application for the people who go to super markets to buy their grocery items as bulks. Application provides the effective budget management solution for the people who have busy life style.

The budget forecasting algorithm of this application is focused on the user’s item purchasing behavior to predict the budget but if the algorithm considers more conditions like user’s family information and other important conditions it can produce much accurate and useful predictions. The budget forecasting algorithm of this application is focused on the user’s item purchasing behavior to predict the budget but if the algorithm considers more conditions like user’s family information and other important conditions it can produce much accurate and useful predictions.

Smart Kitchen Mate currently supports for Android platform. It is possible to develop this application to support multiple platform (cross platform). The application focused on managing the budget on grocery items but it can be expanded to provide a full solution for home budget management system.

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Low supermarket section algorithm currently consider about the cost of the item list if it consider the user’s current location and the closest supermarket to suggest the supermarket to the user it would be very useful to the user. Currently system does not consider about availability of the items in each Supermarket. Algorithm can be improved to handle this type of situations.

V. CONCLUSION AND FUTURE WORKS

REFERENCES


