

**Context-Awareness in Android Application:  
Context-Aware Personal Financial Assistance (CAPFA)**

by

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**CERTIFICATION OF APPROVAL**

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A project dissertation submitted to the

Business Information System Programme

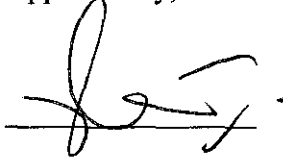
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**TRONOH, PERAK**

**September 2011**

## CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.



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## ABSTRACT

This report describes system that examines and reacts to an individual's changing context which can be computer context, user context, or physical context. The author defines mobile computing, context-awareness and financial goals. Integration between these three concept leads to the idea of developing *Context-Aware Personal Financial Assistance (CAPFA)*. This report summarizes the reasons why people fail to achieve their financial goal(s) and how the proposed solution, CAPFA can helps to minimize the rate of failure. CAPFA, an Android context-aware application supports users in managing their financial goal(s). It ensures that user will commit to the financial goal(s) set. The objectives of developing CAPFA are to study how context-aware can be applied in personal financial assistance tool and to develop a context-aware personal financial assistance tool for assisting user in achieving financial goal(s). Software Engineering Process will be the project development guidance from the very beginning to the very end of developing CAPFA. This report describes the hardware and software used, architecture implemented, and functions available.

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# **CHAPTER 1**

## **INTRODUCTION**

### **1.1 BACKGROUND OF STUDY**

In Sawyer's point of view, in today's world of fast-paced communications, the need to access data while physically away from the workplace or home has greatly increased. This has given rise to the practice of mobile computing. Mobile computing devices emerged as a new application device that allows people to work with a computer while moving. It integrates part of people life and provides the ability to access information anytime and anywhere. One challenge faced by mobile computing is to exploit the changing environment with a new class of applications that are aware of the context in which they are run (Schilit, et al., 1994). This leads to the evolution of context-awareness, which is used provide task-relevant information and services to a user, whenever they may be. Context-aware mobile computing adapts according to the location of the user, the collection of nearby people, hosts, and accessible devices, as well as to changes to such things over time.

There are many context-aware applications we can find lately, including financial assistance tools. Every year, people start to set up some financial goals to be accomplished on that particular year. Financial goals are short-, intermediate-, and long-term results that an individual wants to attain, such as buying a home, starting a business and retiring early (Gitman and Joehnk, 2002). Without a proper tool for tracking the financial goals, one might not being serious with what he has aimed for.

## 1.2 PROBLEM STATEMENT

Fabulously Broke (2010) once said “It can be difficult to stick to financial resolution throughout the year, even with the best intentions”. Based on project research conducted, there are a number of reasons why a person fails to achieve his financial goals. Those are:

- i. **Unrealistic Resolutions:** Some people set a goal which is too far out of reach, thus they have no motivation to push themselves hard and reach it.
- ii. **Picking the Wrong Goal:** An example of wrong goal is to buy a Mercedes-Benz SLS AMG, but only earns RM2000 per month.
- iii. **Not Setting Firm Guidelines:** Goal like ‘to pay off credit card this year sometime’ does not provide a clear sign.
- iv. **Ignoring Progress:** Some people are not committed to the financial goals established.

## 1.3 CONTEXT-AWARE PERSONAL FINANCIAL ASSISTANCE (CAPFA)

By definition, context is a condition or circumstances in which something happen (Crowther, 1995). Context also can be interpreted as an information use to illustrate interaction between people or user with system software, as well as the environment where such interaction occurs (Ceri et al., 2007). According to the author in *Personal Development @ Suite 101*, awareness means the user is notified of something around him like the absence of an object. Context-awareness is information that can be used to characterize the situation of an entity. An entity can be a person, place, or object that can be considered relevant to the interaction between a user and application (Dey & Abowd, 2000). *The Free Dictionary by Farlex* defines personal as something related to a particular person, financial as something that involved financial matters or fiscal responsibility, and assistance as an aid, help, support, or direction.



Based on each word definition, CAPFA means the system can notify user the information of his personal financial goals, credit card, and loans based on his preferred style and context. CAPFA will be developed for Android smartphones. CAPFA tracks a person's financial goals to make user the user attains his financial goals on time. This system will be connected to user's bank account where the user applies his credit or debit card to. It is important for the system to extract the transaction records from the bank account in order to track the financial goals' progress. The important inputs to be pulled from the transaction records are Date/Time, Credit, Debit, and Balance. Besides that, the other three important inputs required from user regarding the financial goals are title of the financial goal, amount of money needed, and date to achieve financial goal. For example, user sets a financial goal which is to buy Samsung Galaxy Tab that costs RM1650 by June 12<sup>th</sup>, 2012 from the current date, which is December 12<sup>th</sup>, 2011. Based on these information, CAPFA will ensure that user will secure at least RM275 (RM1650 / 6 months) in his bank account, every month. If he did not secure that amount, CAPFA will send a notification to the user. CAPFA is also capable to handle more than one financial goal.

Other than that, CAPFA also provides a reminder. User may use this reminder for bill reminder, or loan payment reminder. CAPFA is a personal financial assistance; therefore the financial calculators are provided to be used when dealing with personal financial tasks. Those calculators are:

- i. **Loan Payment Calculator:** To calculate the amount of monthly loan payments, and assumes that the loan will be paid in equal monthly installments. This calculator can be used before applying for a credit card.
- ii. **Credit Card Payoff Calculator:** To calculate the monthly payment or number of months to pay off a credit card debt using the remaining balance and interest rate.

- iii. **Car Loan Payment Calculator:** To calculate how much user needs to pay every month when buying a car on credit. The variables for this calculator include car purchase price, down payment paid, interest rate, and repayment period in months.
- iv. **House Loan Payment Calculator:** To calculate how much user needs to pay every month for home mortgage. The variables for this calculator include property price, margin of finance, loan term, and interest rate.

In developing CAPFA, some assumptions will be taken into consideration. Those are:

- i. CAPFA assumes the target user owns at least one credit or debit card, and all his transactions will be using one of these cards. CAPFA is not applicable for activities that involve cash. It is because CAPFA will extract transaction records directly from users' credit or debit card bank account.
- ii. CAPFA assumes that information can be pulled and user has agreed for that. Since CAPFA extracts transaction records from users' credit or debit card bank account, it assumes that user has willingly allow the system to access his transaction record.
- iii. Security is not the considered. CAPFA is developed just to prove the concept that context-aware application can be used to track one's financial goals, to remind user to pay bill, credit card and loan payments on time, and to assist user when dealing with house or car loan, and issuing a credit card.

#### **1.4 SIGNIFICANCE OF THE PROJECT**

*Context-Aware Personal Financial Assistance (CAPFA)* is a context-aware Android application that is used to track user's financial goals. Besides, it is a financial assistance

that provides some personal finance calculators and reminders that can notify the user to pay bills, car loan, etc on time. The significances of developing *CAPFA* are:

1. To help user to manage their financial goals. *CAPFA* will make sure that user has spare money for his particular financial goals. This way, user can achieve his financial goals within the time targeted.
2. To avoid being tricked by salesman. *CAPFA* provides user with calculators that can aid user when dealing with salesman or when applying for a credit card. Instead of giving the salesman 100% priority to calculate the amount to pay, user can do it on his own with these calculators, to make sure the salesman did not give a fault total amount.
3. To avoid case where the user missing a bill, credit card or loan payment. Some agencies will charge a late fee.

## **1.5 OBJECTIVES**

The objectives of developing *CAPFA* are:

1. To study how context-aware can be applied in personal financial assistance tool.
2. To develop a context-aware personal financial assistance tool for assisting user in achieving financial goals.

## **1.6 SCOPE OF STUDY**

Android is still new and is currently making a big step into smartphones market, while context-aware helps the system to interact with user. Developed based on such technologies, *CAPFA* is aimed to help user to track financial goal(s) anywhere and anytime. Scopes of study for *CAPFA* are:

- i. Malaysian as the potential user because the system will be using only MYR as the currency.
- ii. Implementation of context-aware concept into CAPFA.
- iii. Financial studies of credit card, debit card, and loans for developing reliable personal finance calculators.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 SMARTPHONES**

Smartphone are handheld devices, capable of providing wireless voice communications along with support for other application. Data applications typically include messaging (text and multimedia), E-Mail, audio players, and web surfing via a Graphical User Interface (GUI)-based browser. Another trait of smartphones is a built-in camera for taking snapshots, with some smartphones able to capture video clips. An important feature is docking with a computer via a USB connection or wireless connection for uploading and downloading data like photos, music, and data files that are used in office application suites. An important function of office applications is the capability of synchronizing data entries for contacts (phone/address book), calendars, and to-do lists. Smartphones are famous for their versatility – in a single day a smartphone may be a contactless wallet (PCMAG.com), a barcode reader, a satellite navigation system, an E-Mail or social network client, a WiFi hotspot, and be used to make a phone call.

#### **2.2 MOBILE OPERATING SYSTEM**

There are many mobile Operating System (OS) available like Android OS, Symbian OS, iOS (iPhone), and RIM (Blackberry) OS. The two most promising platforms are Android and Symbian because of the popularity, high usability, integration, and available sensors (The Guru, 2010).

##### **2.2.1 Android**

Android is a platform developed by Google. It provides a complete set of software development: operating system, tools and APIs necessary to begin developing applications (Sukaphat, 2009). The java-based programming makes Android widely

used in developing mobile application. According to research done by Gartner, Inc. (world's leading information technology research and advisory company), Android's market share grew from 3.9% in 2009 to 22.7% in 2010 and moved to the second position, after Symbian (See table 1). Android sales in the fourth quarter of 2010 continued to be driven by broad availability of many high-end products from HTC (Desire range, Incredible and EVO), Samsung (Galaxy S) and Motorola (Droid X, Droid 2). The Android platform has good support for developing context-aware systems and is regarded as one of the best choices for mobile application development (Hall and Anderson, 2009).

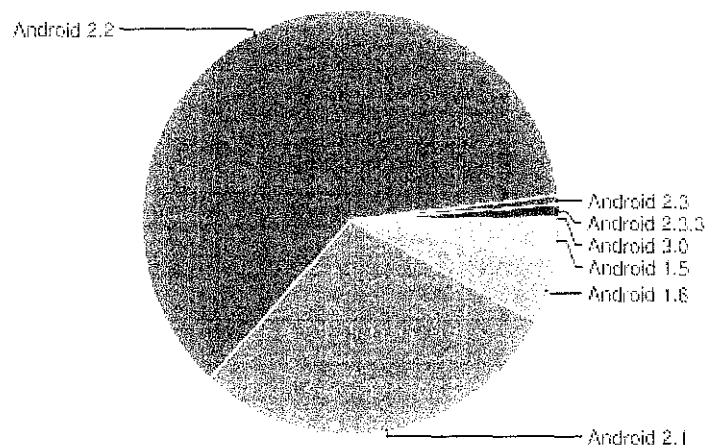
Company	2010 Units	2010 Market Share (%)	2009 Units	2009 Market Share (%)
Symbian	111,576.7	37.6	80,878.3	46.9
Android	67,224.5	22.7	6,798.4	3.9
Research In Motion (RIM)	47,451.6	16.0	6,798.4	19.9
iOS	46,598.3	15.7	24,889.7	14.4
Microsoft	12,378.4	4.2	15,031.0	8.7
Other OS	11,417.4	3.8	10,432.1	6.1
<b>Total</b>	<b>296,646.60</b>	<b>100.00</b>	<b>172,376.10</b>	<b>100.0</b>

Table 1  
Worldwide Smartphone Sales to End Users by Operating System in 2010  
(Thousands of Units)  
Source: Gartner (February 2011)

Android OS is available in several versions and named based on a dessert item. The most recent released versions of Android OS are:

- i. 2.1 (Eclair) which revamped the user interface and introduced HTML5 and Exchange ActiveSync 2.5 support.
- ii. 2.2 (Froyo), which introduced speed improvements with just-in-time optimization and Chrome V8 JavaScript engine, and added Wi-Fi hotspot tethering and Adobe Flash support.
- iii. 2.3 (Gingerbread), which refined the user interface, improved the soft keyboard and copy/paste features, and added support for Near Field Communication.
- iv. 3.0 (Honeycomb), a tablet-oriented released which supports larger screen devices and introduces many new user interface features, and support multicore processors and hardware acceleration for graphics.
- v. 4.0 (Ice-Cream Sandwich), a Honeycomb version for smartphones with added new features like facial recognition unlock, network data usage monitoring and control, unified social networking contacts, photography enhancements, offline email searching, and information sharing using NFC.

Google's statistics on March 15, 2011 have concluded that 61.3% of Android users have installed version 2.2 (Froyo) on their smartphones. Figure 1 shows the number of Android devices that have accessed Android Market within a 14-day period ending on March 15, 2011.



<b>Platform</b>	<b>Distribution</b>
Android 1.5	3.0%
Android 1.6	4.8%
Android 2.1 (Éclair)	29.0%
Android 2.2 (Froyo)	61.3%
Android 2.3 (Gingerbread)	0.7%
Android 2.3.3	1.0%
Android 3.0 (Honeycomb)	0.2%

Figure 1: Android Platforms and Distribution

### 2.3 CONTEXT

Context is information that can be used to characterize the situation of an entity. An entity is a person, place, or object that is considered relevant to the interaction between a user and an application, including the user and applications themselves (Abowd, et al., 1999). The use of context is to provide task-relevant information and services to a user, whenever they may be. Information can be assumed as a context as it can be used to distinguish the situation of a participation in an interaction. Three main categories of context are (Schilit, Adams & Want, 1994):

- i. **Computing context:** Computing context includes network connectivity, communication bandwidth and communication cost, and nearby resources like server or printer.
- ii. **User context:** Examples of user context are user's profile, location, people nearby and the current social location.
- iii. **Physical context:** Physical context is where physical condition is being considered such as lighting, noise levels, humidity, and temperature.



## 2.4 CONTEXT-AWARENESS

Context-awareness can be defined as a system that uses context to provide relevant information and/or services to the user, where relevancy depends on the user's task (Abowd, et al., 1999). A system can be considered as context-aware application when context elements are used either for delivering context or for performing system adaptations (Ceri, et al., 2007). According to Dey and Hakkila (2008), context-aware features include using context to:

- Present information and services to a user.
- Automatically execute a service for a user.
- Tag information to support later retrieval.

There is a strong demand for context-awareness application system as the growing interest in the use of context-awareness as a technique for developing pervasive computing applications that are flexible, adaptable and capable in acting autonomously on behalf of user (Karen et al., 2005). There are two types of context-aware computing which are passive and active context-awareness (Schilit et al., 1995).

- i. **Active context-awareness:** Changes of application's behavior will help the application automatically adapt to discovered context.
- ii. **Passive context-awareness:** Present context is updated to the user and let the user specify how the application should change.

Is smartphones ideal for developing context-aware application? Yes. It is because they are relatively powerful and contain various sensors (Hall and Anderson, 2009). A number of mobile context-aware applications have been built since context-aware application been introduced. The first context-aware applications is Active Badge location system which using infrared-based badges and sensors to determine the location of workers in an indoor location (Want et al., 1992). Other common mobile context-

aware applications include: tour guides (Abowd et al., 1997; Cheverst et al., 2000) and reminder systems (Dey & Abowd, 2000; Lamming & Flynn, 1994).

aware applications include: tour guides (Abowd et al., 1997; Cheverst et al., 2000) and reminder systems (Dey & Abowd, 2000; Lamming & Flynn, 1994).

## 2.5 FINANCIAL GOALS

Financial goals are short-, intermediate-, and long-term results that an individual wants to attain, such as buying a home, starting a business and retiring early (Gitman and Joehnk, 2002).

## 2.6 PERSONAL FINANCIAL PLANNING

Personal financial planning is a planning that covers the important elements of an individual's financial affairs and is aimed at fulfilling his or her financial goals (Gitman and Joehnk, 2002). The financial planning process translates personal financial goal into specific financial plans, and then implement those plans through financial strategies. This process, as illustrated in Figure 2, involves five steps (Bajtelmit, 2006):

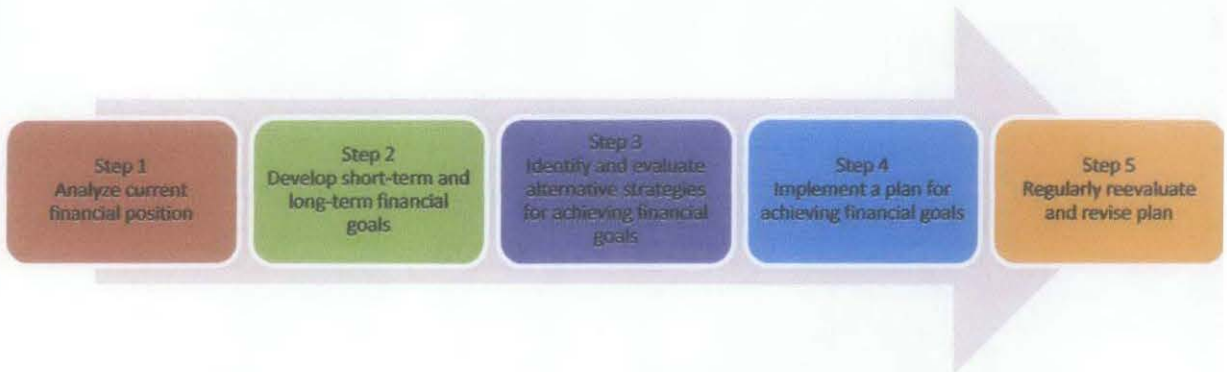


Figure 2: Financial Planning Process

CAPFA is implementing *computing context awareness* because the system will automatically do calculation in order to determine the amount that the user needs to save for a certain period chosen. Besides, it is an *active context* because the system will

automatically retrieve transaction records directly from user's bank account, and track the financial goals based on the transaction records and financial goals' details. User will be given a notification should the amount of money that should be spared is spent. *Passive context* is also applied when user updates the current financial goals or reminder.

## 2.7 CONSUMER CREDIT

Credit allows the consumer to acquire money, goods, or services on the basis of agreement with the lender in the form of a loan for a specified period of time with a specified rate of interest (Boone et al., 2005). Consumer credit is credit used for personal needs other than home purchases (Bajtelmit, 2006). Consumer credit can be divided into two broad categories: close-end credit and open-end credit.

- i. **Close-end credit:** A credit that a lender approves for a specific purpose (e.g., the purchase of a television or a car). It must be paid back with interest either in a single payment or according to an installment agreement, with equal payments per period ending at a specific time (Bajtelmit, 2006).
- ii. **Open-end credit:** Also called revolving credit, is a form of credit that enables consumers to make a number of different purchases up to a credit limit, specified by the lender (Boone et al., 2005). Credit card is a familiar type of open-end credit.

### 2.7.1 Credit Card

The term credit card is used to cover a variety of types of cards, some of which actually don't involve credit. Bank credit cards and debit cards are the common types of credit cards (Bajtelmit, 2006).

#### Bank credit cards

A bank credit card allows the holder to make purchases anywhere the card is accepted.

### Debit cards

A debit card allows the holder to subtract the cost of purchases from his checking or savings account electronically.

## 2.8 RELATED WORKS

This section will discuss the works that are available in Malaysia only.

### 2.8.1 The Goal Saver

The Goal Saver helps user in organizing, tracking, and reach individual or organization goals. It can automatically download user's account balances from bank, or manually manage balances without having the user to enter his bank information. Figure 3 shows the bar graph that portrays user's financial goals. The system can handle more than one financial goal simultaneously.

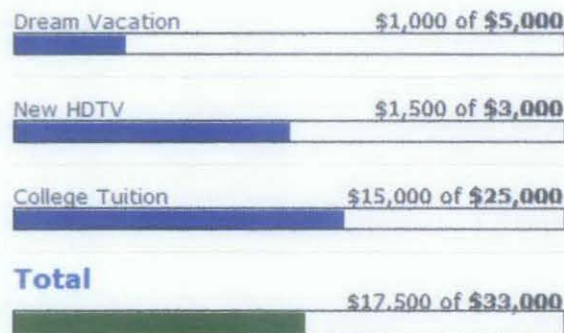


Figure 3: The Goal Saver

CAPFA, which provides financial goal tracking system has added value because CAPFA ensures that user will allocate money for his financial goals set, through context-awareness. This helps user to reach his financial goals on time. Besides, CAPFA has the ability to track users' financial goals and send notification system at the same time.

## 2.8.2 MoBill Bill Reminder

MoBill Bill Reminder is a mobile phone application that helps user to keep track of their bills. It allows user to set reminder for bills. From there, user can track which bills have been paid and which is not. Figure 4 show a form used to edit the current reminder. Here, user can reset the current description, amount, due date, reminder date and time, and its recurrence. Figure 5 shows the main page of MoBill Bill Reminder. Icon ✓ verifies that the bill has been paid, while icon ✗ means the bill has not been paid. Besides, from this page, user can add new reminder, change the current system setting, and see outstanding bills amount, too.



Figure 4: Edit Reminder Form



Figure 5: Main Page

CAPFA also has a reminder tool which serves just like what MoBill Bill Reminder does; keep tracking of user's bills. But CAPFA will ease the task of setting the reminder as CAPFA provides a drop down menu for bill types (credit card, mobile phones, bank loan, car, house, stationeries, and groceries). One thing that gives credit for CAPFA rather than The Goal Saver and MoBill Bill Reminder is the ability for the system to track users' financial goals and have the notification system at the same time. Besides,

CAPFA also has four calculators which may guide users when dealing with salesman or bank staff. This all-in-one package eases users because they do not have to install number of systems or application.

## **2.9 DEVELOPMENT TOOLS**

### **2.9.1 Android 2.2 (Froyo) Smartphone**

CAPFA will be developed on Android 2.2 (Froyo) smartphones as it is compatible with other versions later than Froyo which are 2.3 (Gingerbread) and 3.0 (Honeycomb). The increasing number of Android 2.2 (Froyo) smartphone distribution is also the contribution factor of choosing Android 2.2 (Froyo). Therefore, more and more users can utilize CAPFA in their daily life.

### **2.9.2 Android SDK Tools**

Software Development Kit (SDK) Tools is a downloadable component for the Android SDK. It includes the complete set of development and debugging tools for the Android SDK. Until October 2011, Google has released 15 revisions of SDK Tools.

## **2.10 IMPLEMENTATION ISSUES**

Implementing context-aware Android application will also bring a series of issues. Lanwin (2002) states some of these issues. This section only discusses those relevant to CAPFA including privacy and security, and malware in mobile devices.

### **2.10.1 Protecting Privacy and Providing Security**

Privacy and security are the most significant concerns user has about CAPFA since it involves users' bank account. The general fear is that their bank account details will be traced, when CAPFA accessing user's transaction records. To encounter the problem,

CAPFA uses 128 bit SSL encryption and stores all sensitive data like account number in an encrypted format. Besides, CAPFA implements CAPTCHA, an abbreviation for “*Completely Automated Public Turing Test to tell Computers and Humans Apart*”. It is a program that can generate and grade tests that most humans can pass, but current computer programs can’t pass (Ahn et al., 2003). A common type of CAPTCHA requires user to type letters or digits from a distorted image as shown in Figure 6.

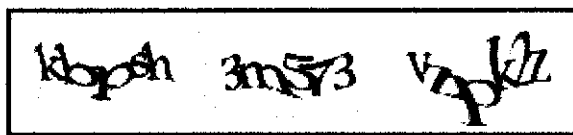


Figure 6: Example of CAPTCHA

### 2.10.2 Malware in Mobile Devices

Most people are aware that malicious software (malware) is an ongoing widespread problem with Internet-connected devices (Zhang et al., 2008). Since 2004, malware has been observed to spread among smartphones and other mobile devices through wireless networks. According to F-Secure, the number of malware known to target smartphones is approximately 100 (Hypponen, 2006). However, some believe that malware will inevitably grow into a serious problem (Dagon, Martin, & Starner, 2004). To prevent, detect, and remove malwares, users may install antivirus into their mobile devices. For Android users, they can download antivirus from Android Market which offers more than 600 antivirus softwares for free and paid.



## CHAPTER 3

### METHODOLOGY

#### 3.1 SOFTWARE ENGINEERING PROCESS



Figure 7: Software Engineering Process

The software engineering process of the system as depicted in Figure 7 was adopted from Context Modeling Language (CML) Model (Henricksen and Indulska, 2005). The process is suitable for developing context-aware system. Figure 8 shows the Gantt chart in developing CAPFA.

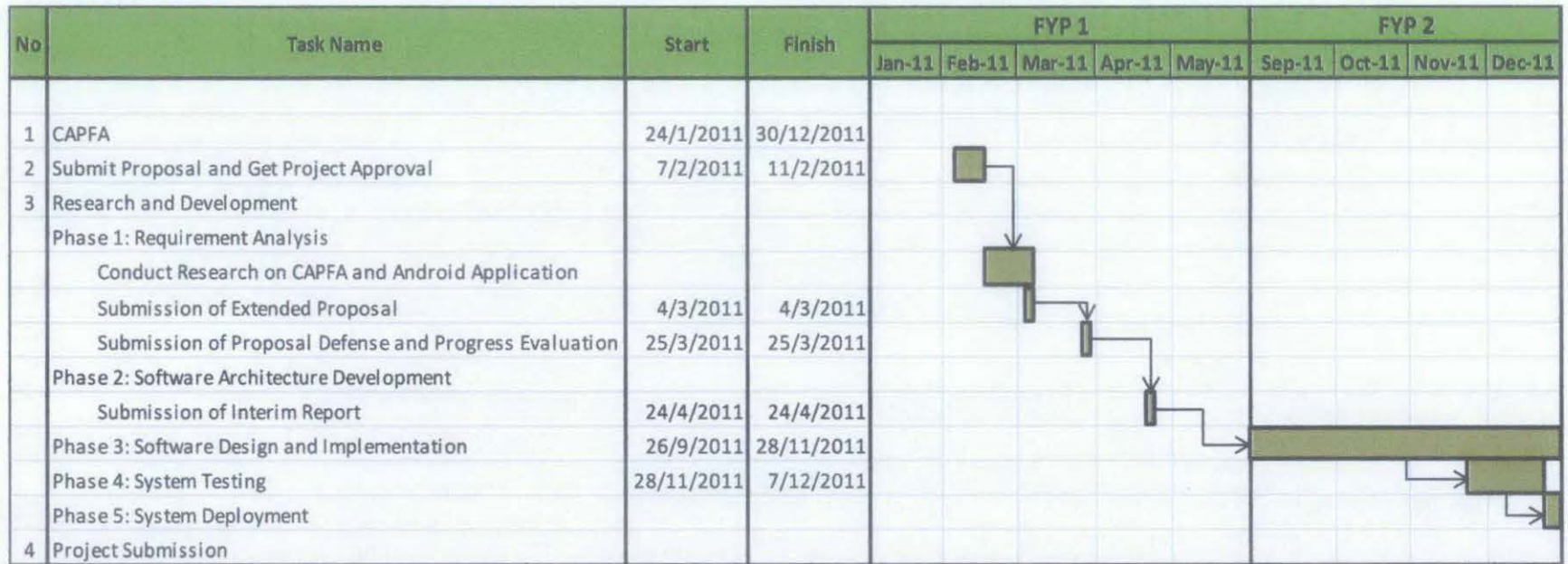


Figure 8: Gantt Chart

### **3.1.1 Requirement Analysis**

During the requirements phase, it is important to define exactly what the problem is or what the system will be required to do. Gathering information by asking pertinent questions of all concerned parties is paramount to a smooth development cycle during the software engineering process. Problem analysis is often blended with information gathering so that a complete understanding of the requirements can be obtained (Crater, 2011). In this phase, research on financial goals and how context-aware can be implemented into CAPFA will be conducted.

### **3.1.2 Software Architecture Development**

This architecture includes a complete set of design documents that outline how a software application will interact with hardware, networks, and other components of an enterprise (Crater, 2011).

Once the requirements have been outlined, the author will start to develop the architecture of CAPFA. Platform, hardware and network to be used will also be outlined during this phase. CAPFA will be developed on smartphones as it provide portability and worldwide connectivity with its wireless connection enabled.

### **3.1.3 Software Design and Implementation**

When the requirements of the software have been finalized, a number of design processes must occur. Issues such as inputs, outputs, functionality, algorithm design, software architecture, and module integration are addressed during the design phase. After the software has been designed, it must be implemented. This is accomplished by programming or coding the design specifications into files called source code (Crater, 2011).

This phase is divided into two subdivisions; system design and system implementation. During system design, the interface of CAPFA will be designed thoroughly based on research conducted in the Requirement Analysis phase. This includes the input form for user to fill in, the setting page, and the main functions of CAPFA page. Once the design has been finalized, system implementation where the programming or coding process steps in.

#### **3.1.4 System Testing**

When the program has been developed, it is important for the developer to make sure that it runs and functions correctly. The testing phase of the software engineering process ensures that the program meets quality standards and functional criteria. Once testing is complete, the program can be given to users (Crater, 2011).

As for this stage, CAPFA will be tested into smartphone, to ensure the system generated the desired output for each input.

#### **3.1.5 Deployment**

During the deployment phase of the software engineering process, users might need to be trained. Documentation must also be created so that users can utilize the program properly (Crater, 2011).

In this stage, CAPFA will be handed to user and an acceptance test will be conducted. Acceptance test gives the users the confidence in using CAPFA and achieving their financial goal(s). This stage also will determine whether CAPFA has met its objectives which are to help user manage their financial goal(s) effectively, to avoid being tricked by salesman, and to avoid miss bill, credit card or loan payment.

### 3.2 KEY MILESTONE

No	Progress	Task Name	Duration (Days)	Start	Finish
1	✓	Planning	18	24/1/2011	11/2/2011
2	✓	Analysis	67	12/2/2011	20/4/2011
3	✓	Ordering Tools	12	10/5/2011	22/5/2011
4	✓	Project Report	79	4/3/2011	22/5/2011
5	✓	Development	63	26/9/2011	28/11/2011
6		System Testing	9	28/11/2011	7/12/2011
7		Re-development (If needed)	13	8/12/2011	21/12/2011

Figure 9: Key Milestone

Figure 9 is the project milestone for CAPFA. This milestone starts with planning phase where the idea of developing a system is created. The next phase which is an analysis phase, a research or fact finding is conducted to find all the related information for CAPFA. By the end of this phase, a close view to the actual system can be seen. Development phase is when the developer starts coding and program CAPFA. Once successfully developed, a system testing will be conducted. CAPFA takes 10 months to be completed.

### 3.3 SYSTEM FLOW CHART

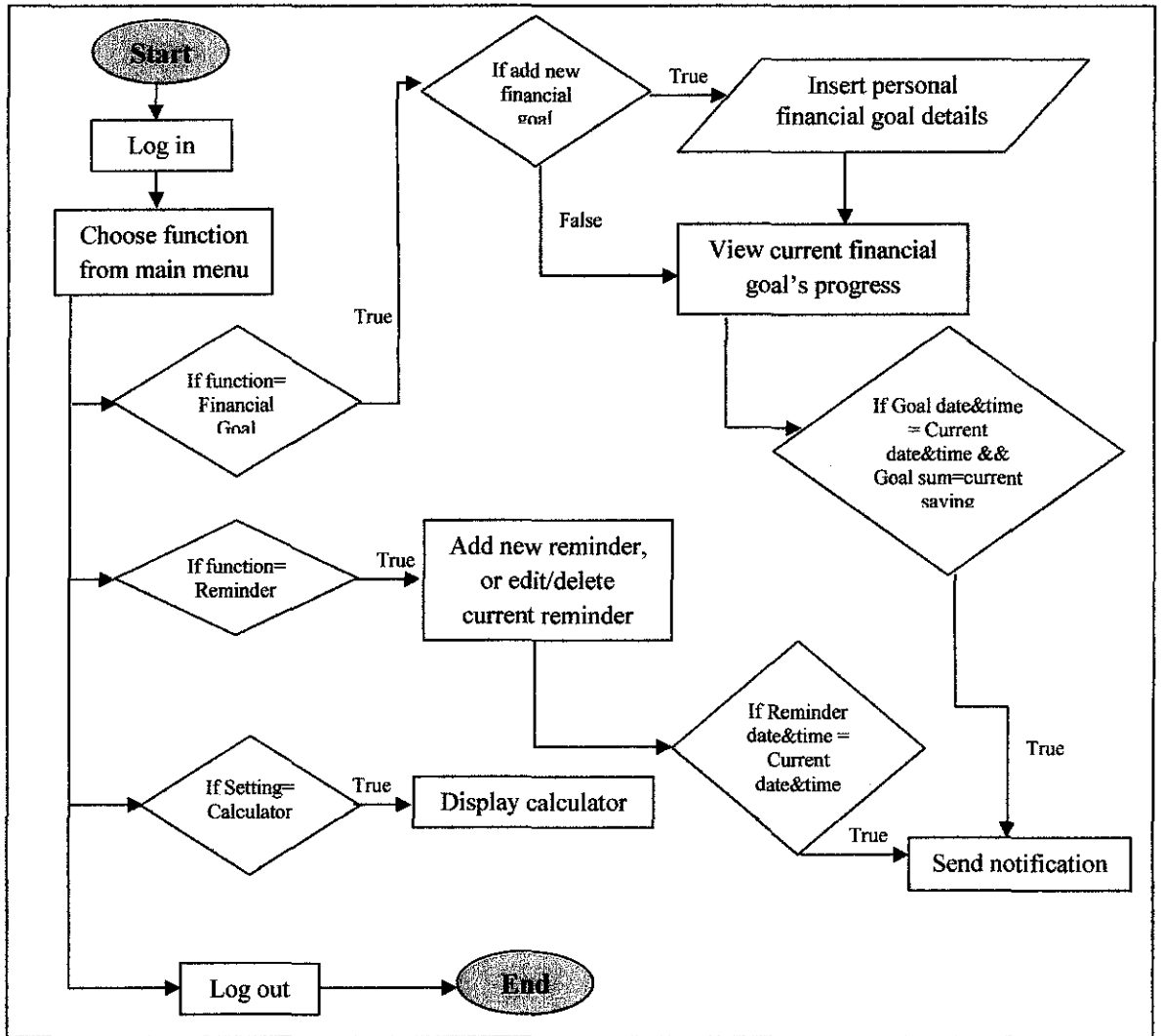


Figure 10: CAPFA Flow Chart

According to Wikipedia, flow chart is a type of diagram that represents an algorithm or process, showing the steps as boxes of various kinds, and their order by connecting these with arrows. Figure 10 shows the flow chart for CAPFA, starting with user login and ends with user logout. Once login, user can select one of the functions available to perform. Those are Financial Goals, Reminder, or Calculator. In Financial Goals and Reminder sections, user may choose to add new financial goals and reminders, or to edit

or to delete the current financial goals and reminders. For Calculator section, user will have to select what type of calculator to use. There are four types of calculators available which are Loan Payment Calculator, Credit Card Payoff, Car Loan Payment Calculator, and House Loan Payment Calculator. CAPFA ends when user logout from the system.

### 3.4 SYSTEM ARCHITECTURE

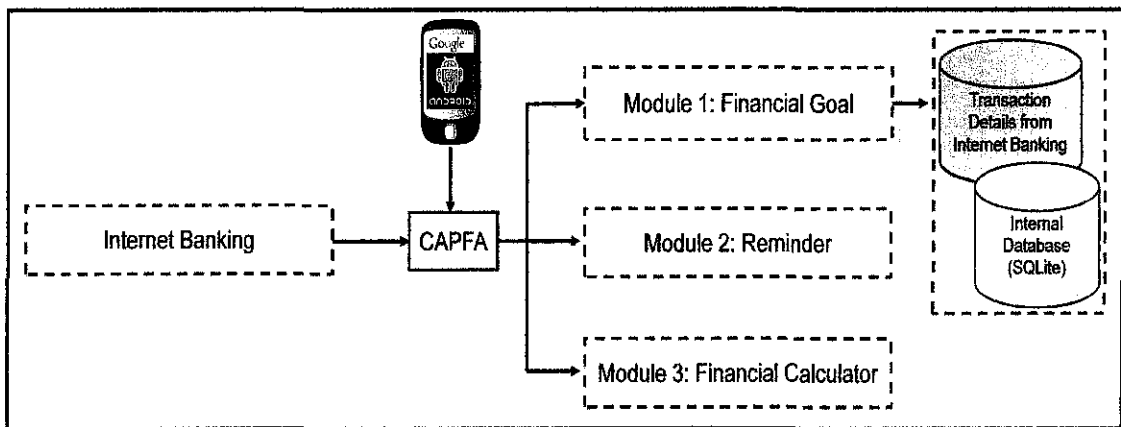


Figure 11: CAPFA System Architecture

Architecture relates to how the system is going to interact with other components. Figure 11 shows the system architecture for CAPFA. CAPFA first establishes a connection with credit and debit cards' Internet Banking server, in order to extract the transaction records made by the user. Once established, user may choose whether to go to Financial Goal, Reminder, or Financial Calculator. For Financial Goal, CAPFA will extract information from two databases; transaction details from Internet Banking and SQLite database that stores financial goals' details. CAPFA will not take security into consideration as it assumes that user willingly allows CAPFA to access his credit or debit card transaction records. Development of this system is just to prove that context-aware application can be used to track one's financial goals, to assist user in his personal finance aspects such as when dealing with property and car salesman, or when applying for a credit card, and to avoid user miss bill, credit card or loan payment.

### 3.5 USE CASE DIAGRAM

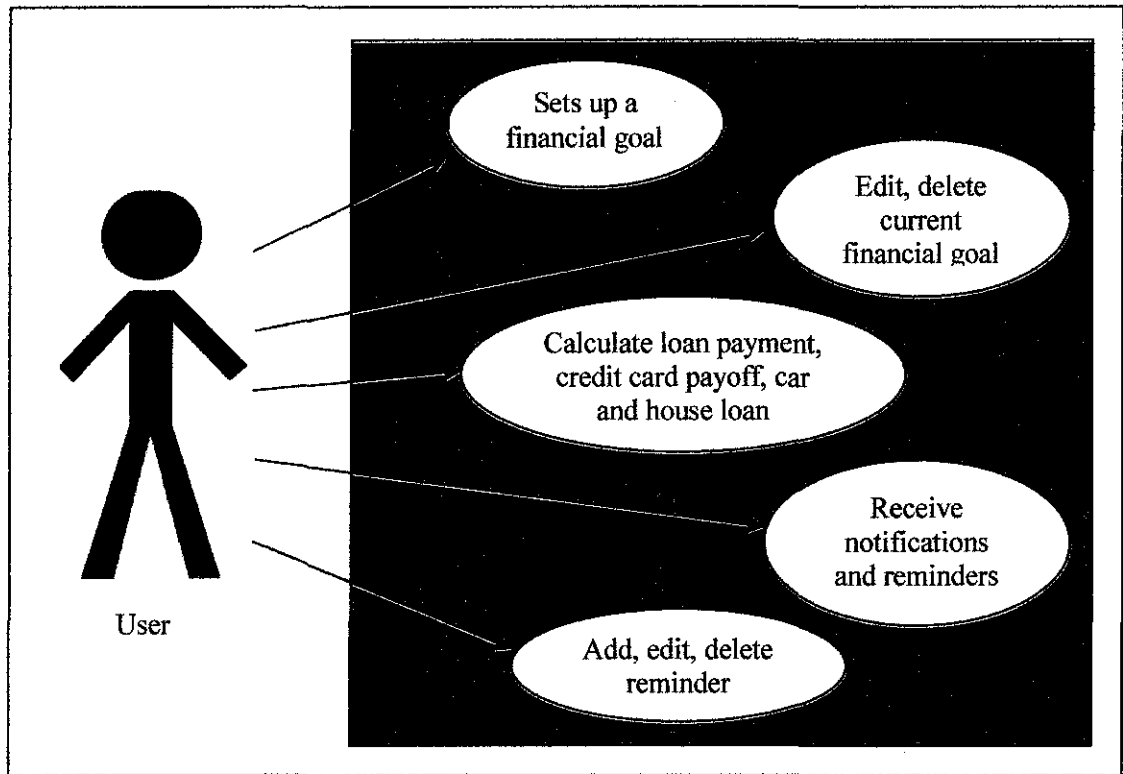


Figure 12: Use Case Diagram

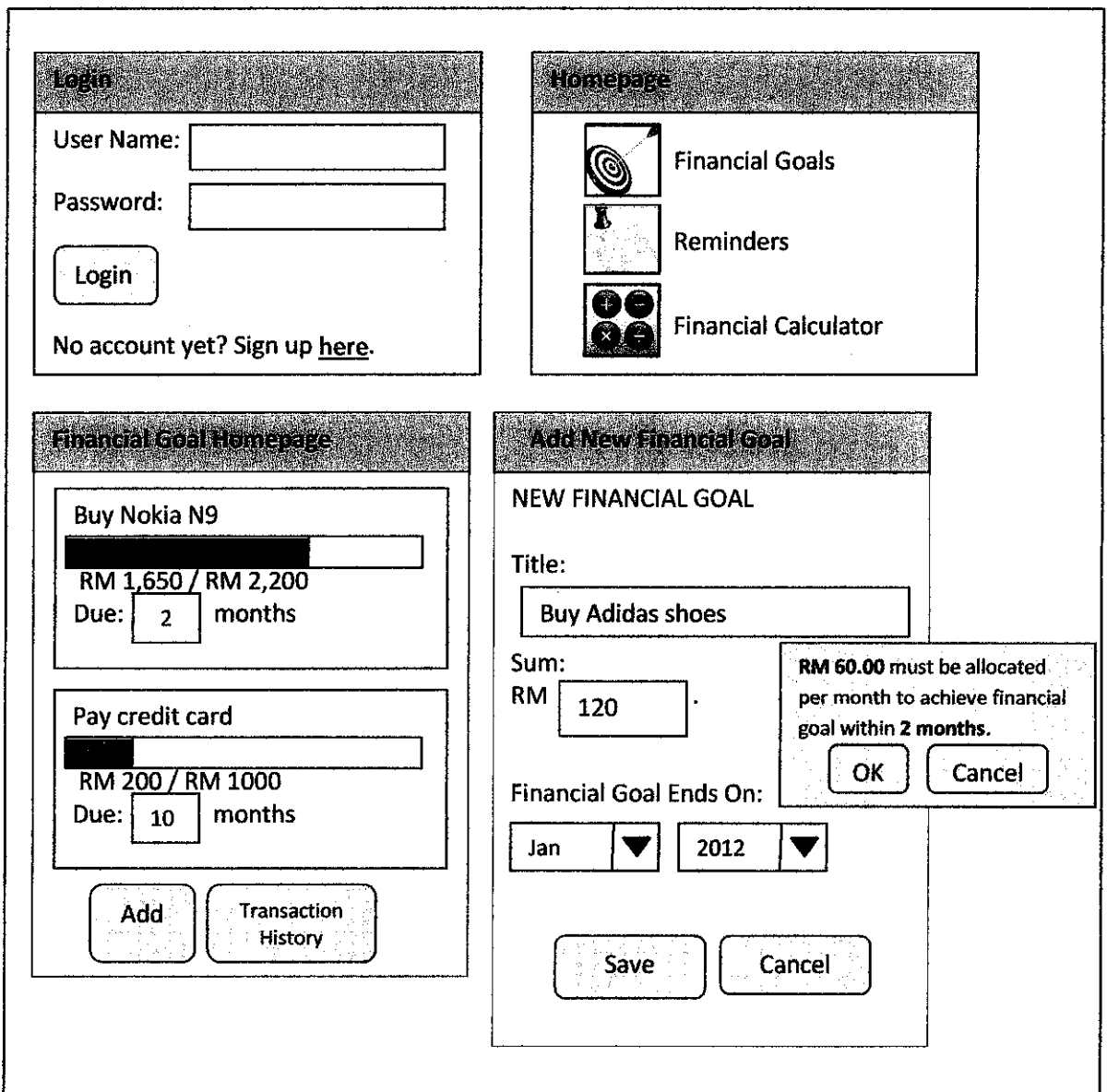
A use case is a set of scenarios that describing an interaction between a user and a system, CAPFA. Figure 12 show that CAPFA involves only one type of system user which is the user himself.



## CHAPTER 4

### RESULTS AND DISCUSSION

Phases that have been completed thus far are Phase 1 (Requirement Analysis) and Phase 2 (Software Architecture Development), while Phase 3 (Software Design and Implementation) and Phase 4 (System Testing) are still in the progress. In the early of Phase 3, a storyboard is drafted and be treated as a guideline throughout the process of developing the system. It is as portrayed in Figure 13.



**Edit Financial Goal**

EDIT FINANCIAL GOAL:

Title:

Sum:  
 RM  .

Current Saving:  
 RM  .

Financial Goal Ends on:  
 ▼  ▼

Duration Left:

Created On:  
 ▼  ▼

**RM 272.00** must be allocated per month to achieve financial goal within **9 months**.

**Transaction Records from CIMB Bank**

Date/Time	Ref/Cheque No.	Description	Debit	Credit	Balance
17-Oct-2011 17:13:57		ATM WITHDRAWAL		60.00	440.00

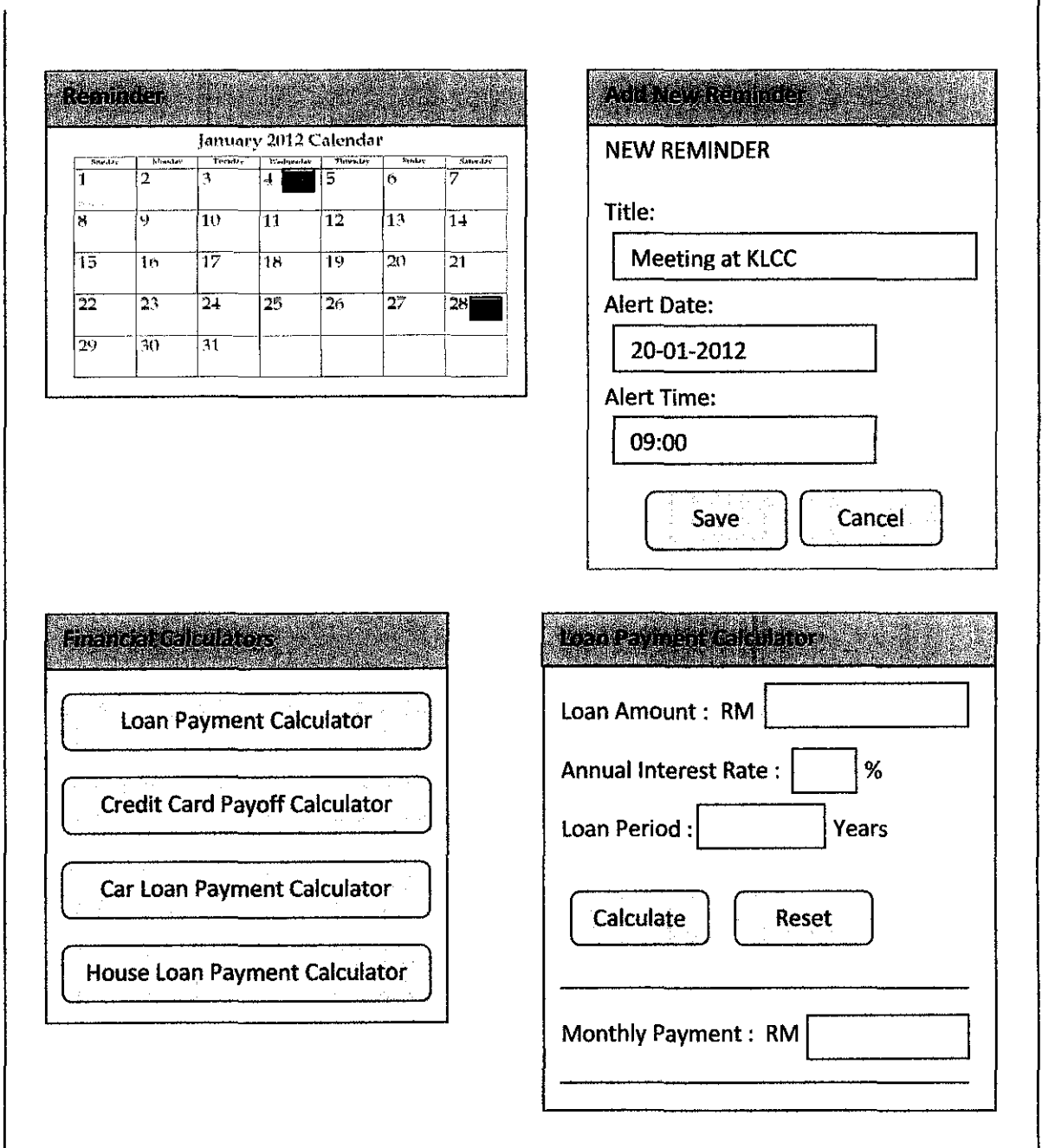


Figure 13: CAPFA Storyboard

As for the purpose of Final Year Project, there are some functions that are developed in different ways. The first one is the financial goal's progress. It is suppose to be displayed in a bar graph, for a better user experience. However, for implementation wise, the progress will be displayed in fraction, for example RM1,650/RM2,200. RM1,650 is the

current saving for the particular financial goal, while RM2,200 is the total amount for that financial goal. The reason for not using bar graph is due to the API and time constraint.

The second part is for the transaction records. The actual CAPFA will extract transaction records automatically from the Internet Banking, thus requires the smartphones to be connected to the Internet all the time and CAPFA has to run all the time as well. It is important in order for CAPFA to update the transaction records, whenever there is a change on it. This is where context-aware takes place. However, at the moment, an internal database is established using SQLite where all the transaction details are stored. Therefore, there are currently two databases available internally; transaction records and financial goals. CAPFA has to run all the time, thus a *service* is used.

According to Android Developers, a service is an application component representing either an application's desire to perform a longer-running operation while not interacting with the user or to supply functionality for other applications to use. In short, service allows the system to run in the background without interfere the other functions. The current CAPFA exits when user clicks on the *Logout* button. It does not implementing *service* functions.

## CHAPTER 5

### CONCLUSION AND RECOMMENDATION

#### 5.1 CONCLUSION

Context-aware mobile application is a new form of mobile computing. It can detect their users' situation and adapt their behavior in appropriate ways. Despite more usability risks as compared to traditional mobile applications, context-aware applications have more benefits to be offered to the end-user especially its portability and integration with Internet. In this thesis, the author has described context-awareness mobile financial application and some issues involved in building the applications. *Context-Aware Personal Financial Assistance (CAPFA)* is a context-aware mobile application is aimed to help people to manage their financial goal better. Financial goals lead to a better personal financial planning. With this function embedded in CAPFA, users can make their financial goals into a reality. Assuming users use credit or debit card in every transaction that involve monetary value, CAPFA will extracts transaction records from the credit or debit card bank account. The system assumes that user has agreed to allow CAPFA to extract the transaction history from their credit or debit bank account. It is now proven that context-aware concept can be applied in developing personal financial assistance, and can assists some user in managing finance.

#### 5.2 RECOMMENDATION

CAPFA is believed to be a better system if more financial functions are available for it. The author hopes that CAPFA will be a financial hub application one day. Currency converter, stock markets, real estate markets, more financial calculators, and retirement planner would be good choices for financial functions. Besides that, a better user interface would also make greater user experience and be more users friendly.

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