VOT 75168

IDENTIFICATION OF CHARACTERISTIC FEATURES OF JAVA PROGRAMMING LANGUAGE FOR APPLICATION TOOL ON A LOWER END MOBILE PHONE

(MENGENALPASTI CIRI-CIRI KEMUDAHAN BAHASA PENGATURCARAAN JAVA UNTUK APLIKASI ATAS TELEFON BIMBIT TAHAP RENDAH)

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ABSTRACT

The usage of mobile phone among Malaysian has increased tremendously in the past few years. Looking at the trend of usage, it is beyond doubt that our life will be much dependant on the services and functionalities that it can provide. User of mobile phone has been offered the facilities of downloading new ring tones and games. Games that have been offered here in Malaysia are basically imported from other countries such as the United States and European countries. The applicability of games being offered is much dependant on the capability of mobile phone in use. Most of the games required a high end mobile phone as a platform. There are no tools or applications other than the native mobile phone services such as managing a phone book, watch and calendar available for lower end mobile phone. Even the number of tools available for a high end mobile phone is limited and there is no local developer for this kind of tools or applications in Malaysia. Since the majority of mobile phone owner only uses the ordinary or a lower end mobile phone, a potential user of an application for lower end platform is much greater than the one for a high end. There is a need for a tool on lower end mobile phone in the area where it is suitable to have a tool which are currently available only in Personal Digital Assistant(PDA) and high end mobile phone. The research will basically focusing on the capabilities of Java programming language on a lower end mobile phone and its hardware and software requirements.

ABSTRAK

Penggunaan telefon mudah alih oleh rakyat Malaysia telah meningkat dengan banyak dalam beberapa tahun kebelakangan ini. Melihat kepada pola penggunaannya, tidak diragui bahawa kehidupan kita akan banyak bergantung kepada perkhidmatan dan fungsi yang boleh ia berikan. Pengguna telefon mudah alih telah ditawarkan dengan perkhidmatan memuat turun nada dering dan permainan. Permainan yang ditawarkan di Malaysia kebanyakannya diimport dari negara lain seperti Amerika Syarikat dan Negara-negara Eropah. Kebolehsuaian permainan yang ditawarkan adalah banyak bergantung kepada kemampuan telefon mudah alih yang digunakan. Kebanyakan permainan yang ditawarkan memerlukan telefon mudah alih berkemampuan tinggi sebagai platform. Bagi telefon mudah alih biasa, tiada peralatan atau aplikasi lain selain aplikasi asas seperti mengurus buku telefon, jam dan kalendar. Malah peralatan yang ditawarkan untuk telefon mudah alih berkemampuan tinggi juga agak terbatas kerana tiada pembangun tempatan yang membangunkan peralatan atau aplikasi berkaitan di Malaysia. Disebabkan majoriti pengguna telefon mudah alih menggunakan telefon mudah alih yang biasa, potensi pengguna untuk aplikasi bagi telefon mudah alih biasa adalah lebih tinggi. Terdapat keperluan untuk peralatan bagi telefon mudah alih biasa, bagi peralatan yang biasanya terdapat hanya dalam Pembantu Peribadi Digital(PPD) dan telefon mudah alih berkemampuan tinggi. Kajian ini akan menumpu kepada keupayaan Bahasa Pengaturcaraan Java pada telefon bimbit biasa dan juga keperluan perisian dan perkakasannya.

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CHAPTER 1
INTRODUCTION

1.1 Introduction

With the emerging of a mobile phone, people have found is much easier to be in touch with others. Almost on any part of Malaysia for example, we will be able to be in touch with the rest of the community. As we have relied heavily on mobile phone, most of us will no longer be comfortable leaving home without one. The main use of mobile phone has always been making and receiving call although with the introduction of new services such as the Short Messaging System (SMS) and Multimedia Messaging Services (MMS), we started to expand the use of mobile phone. The same can be said for students in Institute of Higher Learning (IHL) where they use mobile phone mainly to get in touch with family and friends, by making call or sending a SMS or MMS. Mobile phone itself is a ‘computer’ in its own special form; it has the characteristic of one. Mobile phones have an input devices, output devices, and processor and are able to store persistent data.

Student main responsibility is to concentrate on their studies. For student with good results, they can always follow the plan laid by their faculty for them to complete their study. But for some students who have difficulties, they sometime need to make some adjustment in terms of what subjects to register. They need to be able to manage their study so that they will be able to get their degree or diploma like other student. In other words, the need to be able to analyze their current results, and make decision related to their study.

1.2 General Problem Statements

There are some common problems that student faced in keeping records and analyzing their exam results:

- Students need to have their examination result slips in hand to study their results.

- Simulation of grade needed for particular subject to achieve certain CPA has to be made on paper.
- Lecturer will have to look at students examination result slips before they can suggest what subject should the student register or drop.

1.3 Objective And Scope Of Study

This research work intended to accomplish the following objectives:

- To study whether lower end mobile phone can be used as a tool for students in managing their results.
- To identify the characteristics of Java programming language on lower end mobile phone platform
- To study the hardware and software requirements involves in using a lower end mobile phone as a platform.

To facilitate the research work, Nokia lower end mobile phone has been selected as the platform and the computer student result for Program Pengajian Diploma(PPD) of Universiti Teknologi Malaysia (UTM) will be used as the data for the application.

CHAPTER 2
LITERATURE REVIEW

2.1 Java Programming Language

Java programming language is one of the most talked about language in the past few years. “Write Once, Run Anywhere $^{\text{TM}}$” (WORA) is the tagline which means that a program written in Java would run on any platform supporting Java Virtual Machine (JVM) [1]. From the first version of Java, Java 2 Standard Edition (J2SE), it has evolved to the latest edition, the Java 2 Micro Edition (J2ME) which is designed for devices with limited memory, display and processing power such as the mobile phone or pager.

2.2 Java 2 Micro Edition (J2ME)

J2ME is a smart-client platform developed by Java Community Process (JCP), which includes major wireless mobile phone vendors. The J2ME specification defines the programming language, the virtual machine and programming Application Programming Interface (API) [2]. Due to the fact that a mobile device often has limited resources, it is not realistic to have the entire J2SE Application Programming Interface (API) available on it [1]. Thus, the J2ME can be seen as a subset of J2SE, but added with its own API suitable for mobile devices. J2ME as a platform will not fit in all mobile devices as mobile devices itself may have a range of capability. Mobile devices range from a mobile phone, pager and Personal Digital Assistant (PDA) among others has a number of separate categories which reflected their resources. For mobile phone alone, we’ll be looking at plenty of models, each with its own features and resources.

Due to that, two other important aspects related to J2ME are introduced. The configuration and the profile of each mobile device will determine which API suited a particular device. Configuration and profile are defined by open industry working groups utilizing Sun’s Java Community Process Program [3].

2.3 J2ME Architecture

J2ME architecture is designed to support the flexibility and customizable deployment of product demanded by user [5]. Designed to be modular and scalable to fulfill that needs, it is define as three layers built on top of the operating system for mobile device. The architecture of J2ME is as depicted in the following figure:-

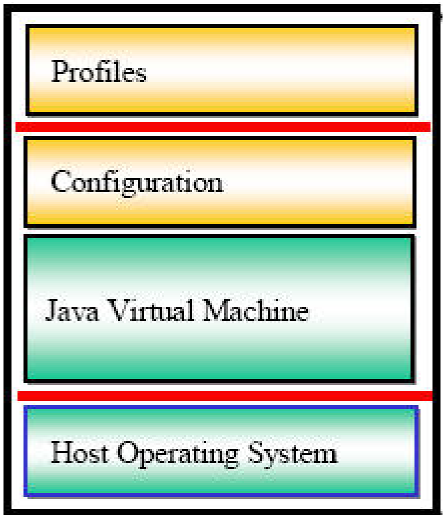


Figure 1: J2ME Software Layer Stack.

2.3.1 Java Virtual Machine (JVM)

This layer is an implementation of Java Virtual Machine that is customized for a particular device's host operating system and support particular J2ME configuration. The K Virtual Machine (KVM), is a highly portable JVM designed for small memory, limited resource, network connected devices such as mobile phones, pagers and personal organizers among others.

2.3.2 Configuration

Configuration defines a Java platform for a broad range of devices [1]. It defines the language characteristics and the core Java libraries of Java Virtual Machine (JVM) for that particular configuration. Each configuration are define based on characteristic of mobile devices. There are two currently define configuration [1]:-

2.3.2.1 Connected Limited Device Configuration (CLDC)

Devices under this configuration should have the following characteristics:

- 128 kilobytes memory for running Java
- 32 kilobytes for runtime memory allocation
- Restricted user interface
- Low power, typically battery powered.
- Network connectivity, typically wireless, with low bandwidth and intermittent access.

2.3.2.2 Connected Device Configuration (CDC)

Devices under this configuration should have the following characteristics:

- 512 kilobytes (minimum) memory for running Java
- 256 kilobytes (minimum) for runtime memory allocation
- Network connectivity, possibly persistent and high bandwidth

There are two versions of CLDC which are the CLDC 1.0 and CLDC 1.1. Most of mobile phone produced today only supports the use of CLDC 1.0 even for the mobile phone with high specification. One of the difference between CLDC 1.0 and CLDC 1.1 is CLDC 1.0 does not support the use of floating point data type. The CLDC has limited math, string and I/O functionalities as compared to CDC which supports a fully feature Java 2VM and therefore can take advantage of most J2SE libraries [4].

2.3.3 Profile

Due to the fact that devices are not easily fall within one configuration or the other, Sun introduced the concept of a Profile to the J2ME platform [1]. It acts as an extension of the configuration where it provides more flexibility as technology changes. Profile is the specification of the set of Java technology APIs found in a particular category of devices. Mobile Information Device Profile (MIDP) defines APIs for user interface components, input and event handling, persistent storage, networking and timers, depending on the resources available for a particular device. MIDP does not define how application does actually get on the device, and end to end security model and system specific application needs. As of the time of writing, there are two profiles available, which are the Mobile Information Device Profile (MIDP) 1.0 and Mobile Information Device Profile (MIDP) 2.0.

2.4 MIDlet

A MIDlet (Mobile Information Device) application is a Java application designed to be run on mobile device [1].

2.4.1 Hardware and software requirements

Any Mobile Information Device targeted to support the running of a MIDlet should meet the minimum hardware and software requirements as listed below [1]:-

Hardware Requirements

- Screen must support at least 96 x 54 pixels.
- At least one type of user input: one handed keyboard(telephone keypad), two-handed keyboard(QWERTY keyboard) or touch screen.
- 128 kilobytes of non-volatile memory to run MID components.
- At least 8 kilobytes of non-volatile memory for applications to store persistent data.
- 32 kilobytes of volatile memory to run Java
- Wireless network connectivity.

Software Requirements

- Native operation system must provide minimal scheduling, exception handling and processing of interrupts. There must also be sufficient capabilities to run Java Virtual Machine(JVM).
- Support writing of bitmapped graphics to the display.

- Able to use any of the three input types as listed in hardware requirements and pass it to the JVM.
- Support the writing and reading of persistent data to and from the non volatile memory.

2.4.2 Java Archive File (JAR)

The JAR file comprises of the Java classes, related file such images and other files. It acts like an executable file for a windows based application. The contents of JAR file for mResult are as follow:

```
Manifest-Version: 1.0
MicroEdition-Configuration : CLDC-1.0
MIDlet-Name: mResult_DDC
MIDlet-Vendor: PPD, UTM City Campus
MIDlet-1: mResult_DDC, /icon2.png, mresult.mResult_DDC
MIDlet-Version: 0.0.1
MicroEdition-Profile: MIDP-1.0
```

2.4.3 Java Application Descriptor(JAD) File

The JAD file is used to provide information to the application manager about the contents of a JAR. The Application will use the information to determine whether or not the MIDlet is suitable for running on the particular device.

The contents of JAD file for mResult are as follows:

```
MIDlet-Name: mResult_DDC
MIDlet-Version: 0.0.1
MIDlet-Vendor: PPD, UTM City Campus
MicroEdition-Profile: MIDP-1.0
MicroEdition-Configuration: CLDC-1.0
MIDlet-Jar-URL: mResult_DDC+v1.0.jar
MIDlet-Jar-Size: 64285
MIDlet-1: mResult_DDC, /icon2.png, mresult.mResult_DDC
```

CHAPTER 3
METHODOLOGY

3.1 Methodology

To study the characteristic of Java Programming Language on lower end mobile phone, an object oriented approach to the development of the application has been implemented. The application selected to be develop is a simple mobile application for student usage. It should be able to assist student in managing their examination results. As the requirement for the selected application to be developed is quite clear, the waterfall model has been chosen as the software process model. The waterfall model treat each phases in software development as separate and distinct phases. The model is as depicted in the following figure:-

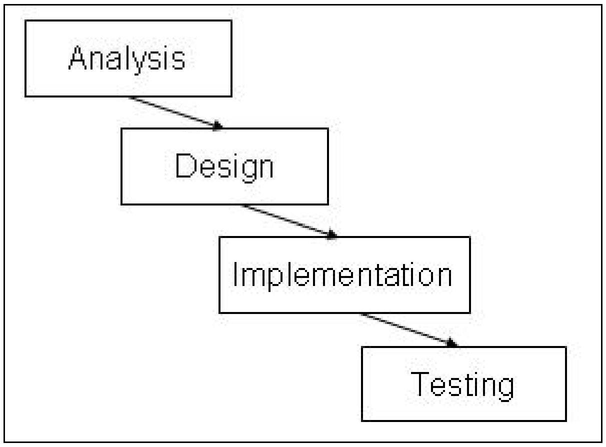


Figure 2: Phases in waterfall model.

3.1.1 Analysis

The requirement for the application was first studied to gather as much as information needed to develop it. Code name **mResult**, the application should be able to assist student in managing their result in term storing it, accessing it using the lower end mobile phone, and do some analysis or simulation on the results. Simulation means allowing the students to be able to enter grade for particular subject they have not taken, and the application should be able to show what is the Cumulative Grade Point Average (CGPA) they will get if they manage to get the targeted grades.

A Requirement Analysis (RA) document was produced during this phase. Its core element is the use case diagram for **mResult** as shown in the following figure:-

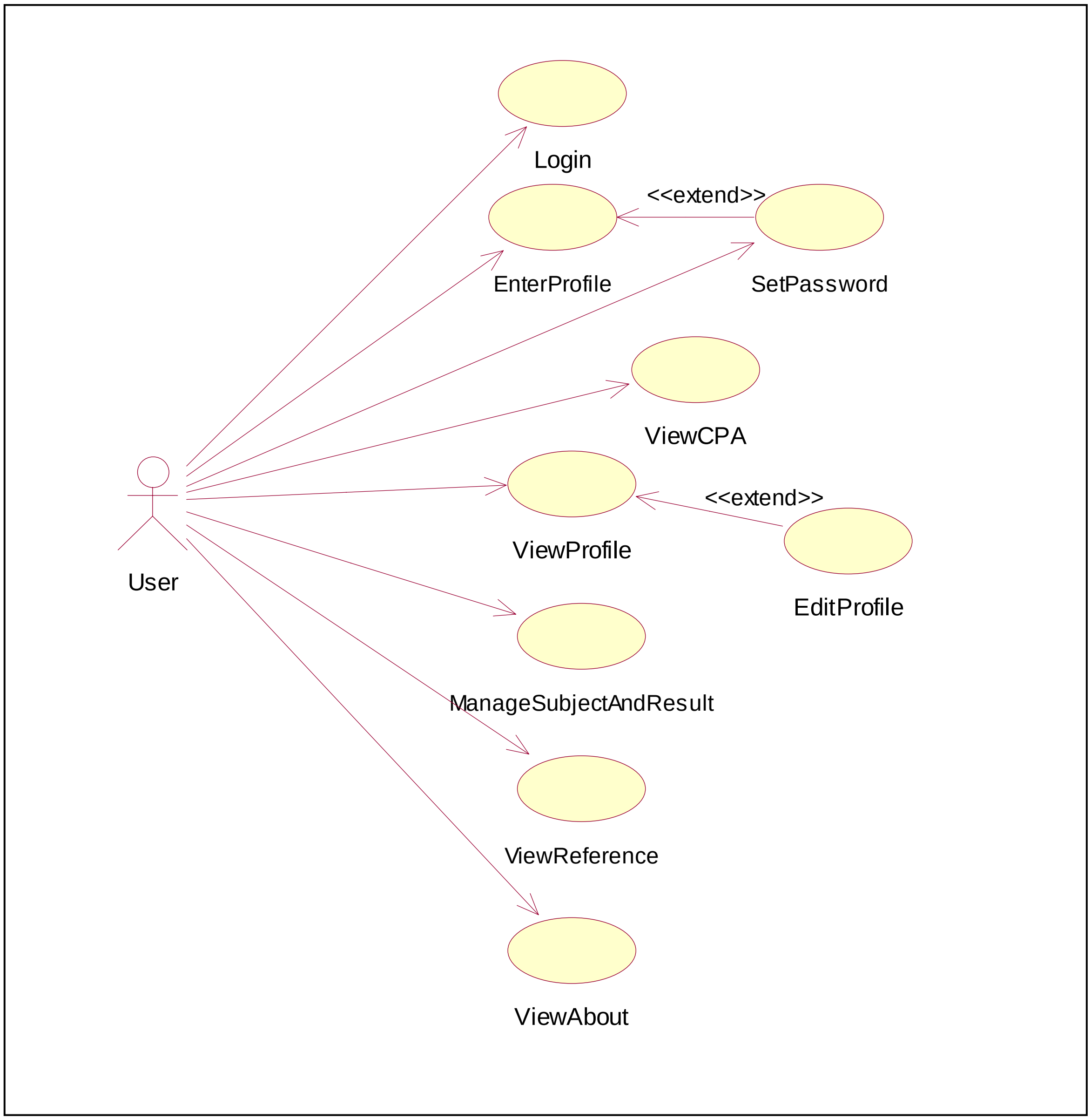


Figure 3: Use Case diagram for mResult.

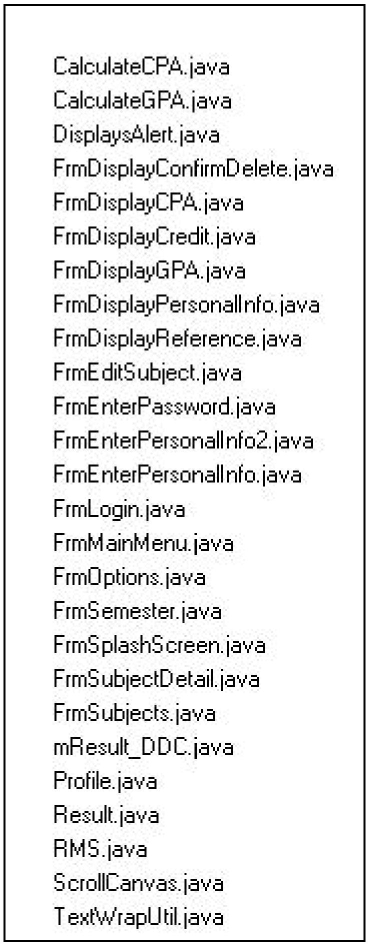
The most important use case for **mResult** is the Manage Subject and Result. The following table show detail requirement for that use case:-

Functional Requirement Number	**Requirement**	**Description**
75168/mResult/04/00	**Manage Subject and Result**	**User can select which semester's subject and view the subjects detail**
75168/mResult/04/01	Set Result/Grade	User can set the subjects result / grade
75168/mResult/04/02	Add Subject	User can add subject
75168/mResult/04/03	Delete Subject	User can delete a selected subject, but is limited to the minimum credit requirement for a semester
75168/mResult/04/04	Clear Result	User can clear all results for a selected semester
75168/mResult/04/05	View GPA	User can view the GPA for a selected semester

Table 1: Detail Requirement for Manage Subject and Result use case.

3.1.2 Design

The RA for **mResult** serves as a base for the next phase in the development which is the design phase. In the design phase, classes needed for the implementation of **mResult** were identified using the scenario based approach. Twenty six classes were identified based on the flow of events studied for the requirements. The following figure shows the list of classes in **mResult**.



CalculateCPA.java
CalculateGPA.java
DisplaysAlert.java
FrmDisplayConfirmDelete.java
FrmDisplayCPA.java
FrmDisplayCredit.java
FrmDisplayGPA.java
FrmDisplayPersonalInfo.java
FrmDisplayReference.java
FrmEditSubject.java
FrmEnterPassword.java
FrmEnterPersonalInfo2.java
FrmEnterPersonalInfo.java
FrmLogin.java
FrmMainMenu.java
FrmOptions.java
FrmSemester.java
FrmSplashScreen.java
FrmSubjectDetail.java
FrmSubjects.java
mResult_DDC.java
Profile.java
Result.java
RMS.java
ScrollCanvas.java
TextWrapUtil.java

Figure 4: List of classes for mResult.

The following are core classes in **mResult** with description of its responsibilities.

Bil	Class Name	Responsibilities
1	mResult_DDC.java	MIDlet class for mResult_DDC project
2	FrmSubjects.java	User interface for managing subject
3	Result.java	Struct for result
4	RMS.java	Handle persistent data

Table 2: Core classes for **mResult**.

3.1.3 Implementation

Borland JBuilder X Edition was used to develop **mResult**. It provides the facilities to write Java codes, compile, debug and along with the Nokia Developer's Suite for Java(TM) 2, Micro Edition (NDS), enable the testing of **mResult** either through the device emulator or the actual device itself.

The implementation phase for **mResult** was started as soon as initial requirements were identified and the first version of RA document was produced. Key issues in implementing **mResult** are as follow:

- Limitation of CLDC 1.0 which does not allow the use of floating point data
    - This is one of the key problems in implementing the mResult as it mean other way of storing and calculating student results need to be derived. The solution of this problem is will be discuss in the next chapter.
- The maximum size of 64kb for JAR file.
    - This has resulted in the application to be tailored to specific course such as for UTM Computer Students as it is not possible to have one solution for all the courses.

3.1.4 Testing

A test document for mResult was developed for the testing phase. The testing took place on the 13th of December 2005 at the development site. The test was based on the requirement from RA document. The following table show part of the test item for use case Manage Subject and Result:-

Manage Subject and Result **75168/mResult /04/00**	**User can select which semester's subject and view the subjects detail**	
	- Select button 'Select Semester'	- System will display list of semesters. -
	- Selects 'Options' and then 'View Subjects'	- System displays the selected semesters list of subjects.
	- Selects 'Options' and then 'Select Subject'	- System displays the detail of the selected subject - Default value for the grade is ' – '.
Set Result / Grade **75168 /mResult /04/01**	**User can set the subjects result / grade**	
	- At the 'Subjects' page, select 'Options' and then 'Select Subject'	- System displays the detail of the selected subject.
	- Select 'Edit'	- System will display the 'Edit Result' page, which consist of the subject code, name and grade - Subject code and name cannot be changed.
	- Select 'Options', 'Select' and then 'Save'	- System displays a success message, then displays the subject detail once again - This time, the grade should be the same as the one that the user had just selected.

Table 3: Example of test item for Manage Subject and Result use case

3.1.5 Deployment

The Nokia 3310(Figure 6) has been selected as it represents one of the lower end mobile phone available in the market. The output of the development phase is the source code for **mResult** and the Java Archive File (JAR). To deploy the **mResult** JAR to the selected mobile phone, the Nokia Developer's Suite for Java(TM) 2, Micro Edition Version 2.2 for Windows (NDS) was used. The NDS is a set of tools that help create Java content for Nokia devices. With NDS developers can create, test and deploy Java software to Nokia devices.

Figure 5 : Nokia 3310

Since the Nokia 3310 only support the Universal Serial Bus (USB) connection using the DKU-5/CA-42, JAR file created was deployed using the DKU-5 cable.

CHAPTER 4
DATA AND DISCUSSION

4.1 Output Analysis

We will discuss results for each hypotheses and research questions below:

4.1.1 Usage of lower end mobile phone as a tool for student in managing their result.

Based on the success of developing **mResult** and deploying it into a Nokia 3310 device, the research suggest that a lower end mobile phone such as Nokia 3310 can assist student in managing their examination result. It offers the following benefits to students:-

- Student can have the mobility to view their results from anywhere and anytime, because the application is virtually in their hand.
- Student has an unlimited access to the information with no subsequence charges.
- Student can manage their result effectively because they are able to store the results, simulate grade and see the final result.
- In terms of the privacy of their results, the application offers the option to activate password to enter the system.

4.1.2 Characteristics of Java Programming Language on lower end mobile phone.

Lower end mobile phones like the Nokia 3310 support the use of MIDP 1.0 and CLDC 1.0.

4.1.2.1 CLDC 1.0 Characteristic

Among the problem in CLDC 1.0 is the inability to define a floating point data type. As the application develop is related to student’s CPA, the usage of floating point data is very important. Nevertheless, an algorithm to calculate CPA by using an integer data type has been implemented successfully in **mResult**. Even though the result will be shown to the user as if it is in the floating point format, it is actually stored and manipulated as string data. The following are part of the Java code that handles the issue:-

```
void jbInit()
{
    ……

  if(totalValue==0)
  {
    cpa = 0;
    strTtlValue = "0000";
    strGpa = "0000";
  }
  else
  {
    strTtlValue = String.valueOf(totalValue);
    if(strTtlValue.length() == 4 && totalCredit > 9)
    {
      String temp = strTtlValue + "0";
      int totalvalue = Integer.parseInt(temp);
      cpa = totalvalue / totalCredit;
      strGpa = String.valueOf(cpa);
    }
    else if(strTtlValue.length() == 6 && totalCredit > 9)
    {
      cpa = totalValue / totalCredit;
      strGpa = String.valueOf(cpa);
      check2 = 100;
    }
```

Figure 6 : Code segment to handle the calculation of cpa.

4.1.2.2 MIDP 1.0

MIDP 1.0 offers two other important aspect and tools for application development on lower end mobile phone. It offer enough API's for creating user interface in the mobile phone and also the Record Management System (RMS), API's that support the reading, writing, sorting and searching a persistent data in mobile devices.

a. *User Interface*

API's for user interface are available through putting in the

```
import javax.microedition.lcdui.*;
```

in the class declaration.

The API's for user interface is best shown through the following figure:-

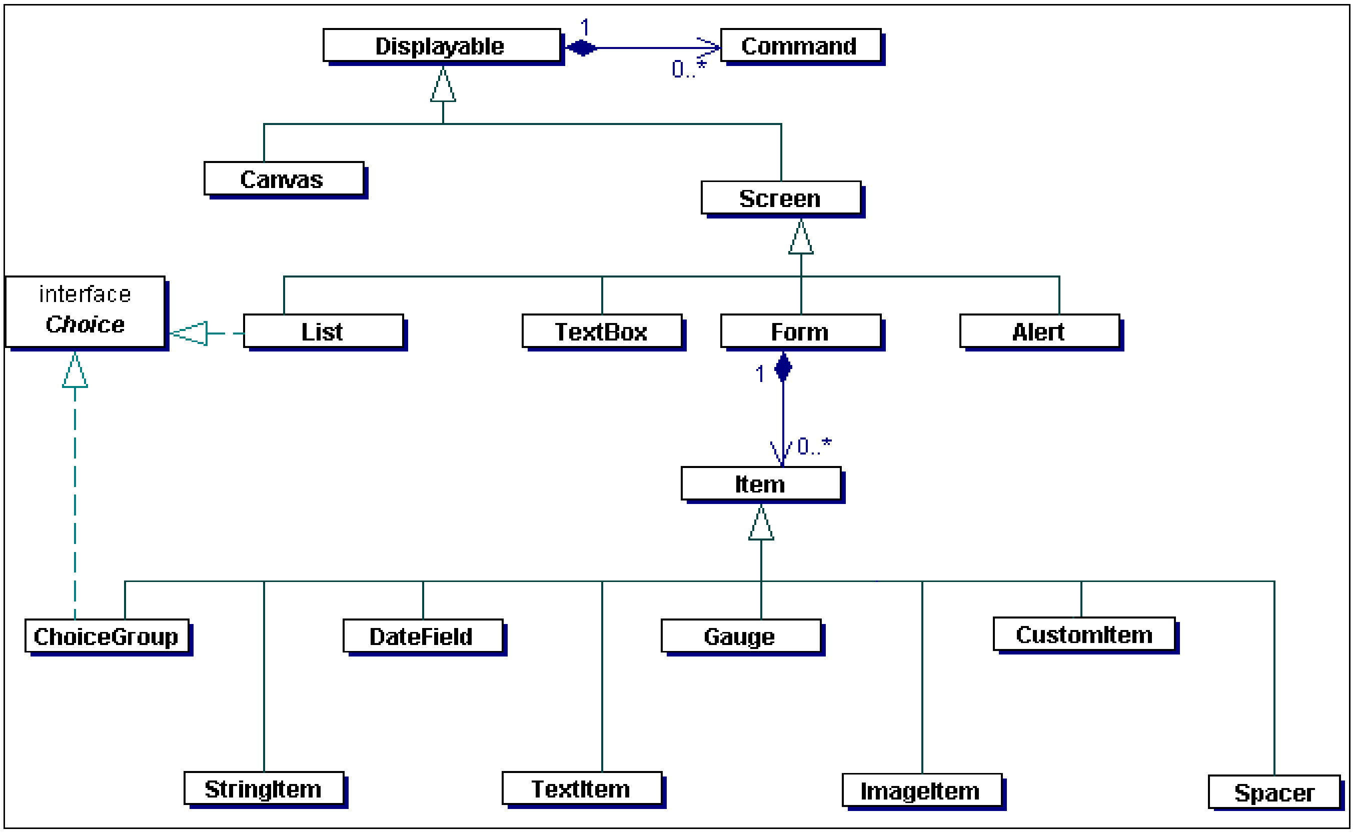


Figure 7 : Major MIDP User Interface Classes

The **mResult** use extensively classes available in the Displayable class and it's sub classes. An example of the use of Canvas class is in the **FrmMainMenu** class. The following are how the screen will looks like in the mobile phone and part of the corresponding Java code for the class:-

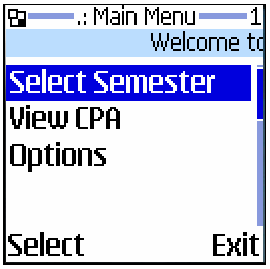


Figure 8 : FrmMainMenu in the mobile phone screen

```
package mresult;
import javax.microedition.lcdui.*;
class FrmMainMenu extends List implements CommandListener
{
  static FrmMainMenu instance;
  mResult_DDC midlet;
  FrmSemester semester;
  RMS rms = new RMS();
  Ticker ticker = new Ticker("Welcome to mResult v1.0");
  FrmMainMenu(mResult_DDC midlet)
  {
    super(".: Main Menu", List.IMPLICIT);
    this.midlet = midlet;
    setCommandListener(this);
    this.instance = this;
    jbInit();
  }
//------------------------------------------------------------
  private void jbInit()
  {
    //add list
    append("Select Semester", null);
    append("View CPA", null);
    append("Options", null);
    //add ticker
    setTicker(ticker);
    //add Command
    addCommand(new Command("Exit", Command.EXIT, 1));
  }
….
```

Figure 9 : Part of coding for FrmMainMenu.java

b. Record Management System(RMS)

Another important aspect in the **mResult** is the ability to store persistent data. MIDP 1.0 allows the management of persistent data through the RMS API's. RMS is a persisten storage environment within the MIDP. The record stored in the persistent data is very much dependant on the MIDlet that created it, if the MIDlet is removed from the mobile device, the record stores will also be deleted. As **mResult** need to store, read and edit a student results, the usage of suitable API's for the operations is needed. The following table shows some of the important methods with the description of its usage:-

No	Method's Name	Description
1	*openRecordStore*	Create or open a record store
2	*closeRecordStore*	Close a record store
3	*addRecord*	Add a new record in the record store
4	*setRecord*	Set or replace data in the record store
5	*deleteRecord*	Delete a record from the record store

Table 4: Core classes for **mResult**.

In **mResult**, the responsibility of handling persistent data is given to the RMS class. The following table segment show how Java handles the add, set and delete record in RMS:-

No	Method's Name	Part of Java Code

1	*addRecord*	`//insert the semester's status`
		`rs.addRecord("0".getBytes(), 0,`
		`"0".getBytes().length);`
		`for (i = 0; i < arrCode.length; i++) {`
		`//insert the code subject into the record store`
		`rs.addRecord(arrCode[i].getBytes(), 0,`
		`             arrCode[i].getBytes().length);`
		`…..`

2	*setRecord*	`rs = RecordStore.openRecordStore(strDbName, true);`
		`rs.setRecord(intID+2,result.grade.getBytes(), 0,`
		`                   result.grade.getBytes().length);`
		`…..`

3	*deleteRecord*	`rs = RecordStore.openRecordStore(strDbName, true);`
		`rs.setRecord(post, "0".getBytes(), 0,`
		`               "0".getBytes().length);`
		`…..`

Table 5: Example of RMS usage

4.2 Limitation Of The Study And Future Research

The research focuses on the usage of Nokia 3310 and has not been able to test on other mobile device except for limited number of models**.** Other brand of mobile devices was not tested whether it will support **mResult** or not. Future work should focuses on how to enhance the use of lower end mobile phone to make use of it's capabilities to receive and send a wireless messages.

CHAPTER 5
CONCLUSION

5.1. Conclusion

This study reveals that Java programming language is suitable to develop an application for lower end mobile phone. Although the Application Programming Interface(API) needed was very much depends on the configuration and the profile of the particular device, generally it supported the basic need for an application.

Java is capable of providing the user interface, tools for managing persistent data either through the Record Management System (RMS) or file routines, and processing ability in term of its arithmetic and logic facilities. Selected device, the Nokia 3310 shows the capabilities in supporting the application developed.

Although some other important element of a mobile phone such as the ability to communicate through Short Messaging System (SMS) has not been look into, the knowledge gains suggest that it’s possible to integrate the management of student result with the university current services, where UTM has already allow the student to request result through SMS.

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BORANG PENGESAHAN
LAPORAN AKHIR PENYELIDIKAN

TAJUK PROJEK : IDENTIFICATION OF CHARACTERISTIC FEATURES OF JAVA PROGRAMMING LANGUAGE FOR APPLICATION TOOL ON A LOWER END MOBILE PHONE.

Saya FAIZUL AZLI B ABD RIDZAB

(HURUF BESAR)

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☑ TIDAK TERHAD

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Nama & Cop Ketua Penyelidik

Tarikh : ________________

CATATAN : * *Jika Laporan Akhir Penyelidikan ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali sebab dan tempoh laporan ini perlu dikelaskan sebagai SULIT dan TERHAD.*

Program Pengajian Diploma(PPD),
UTM *City Campus*, KL

mResult

REQUIREMENTS ANALYSIS DOCUMENT
FOR
MRESULT

Version 1.0

Document Reference No: 75168/MRESULT/RA/1.0

CONFIDENTIAL

Revision History

Version	Status	Date	Change Description	Author
1.0	Draft	6 June 2005		Ahmad Aizuddin

mResult

Use Case:

1. Login
2. Enter Profile
3. Set Password
4. Manage Subject and Result
5. View CPA
6. View Profile
7. Edit Profile
8. View Reference
9. View About

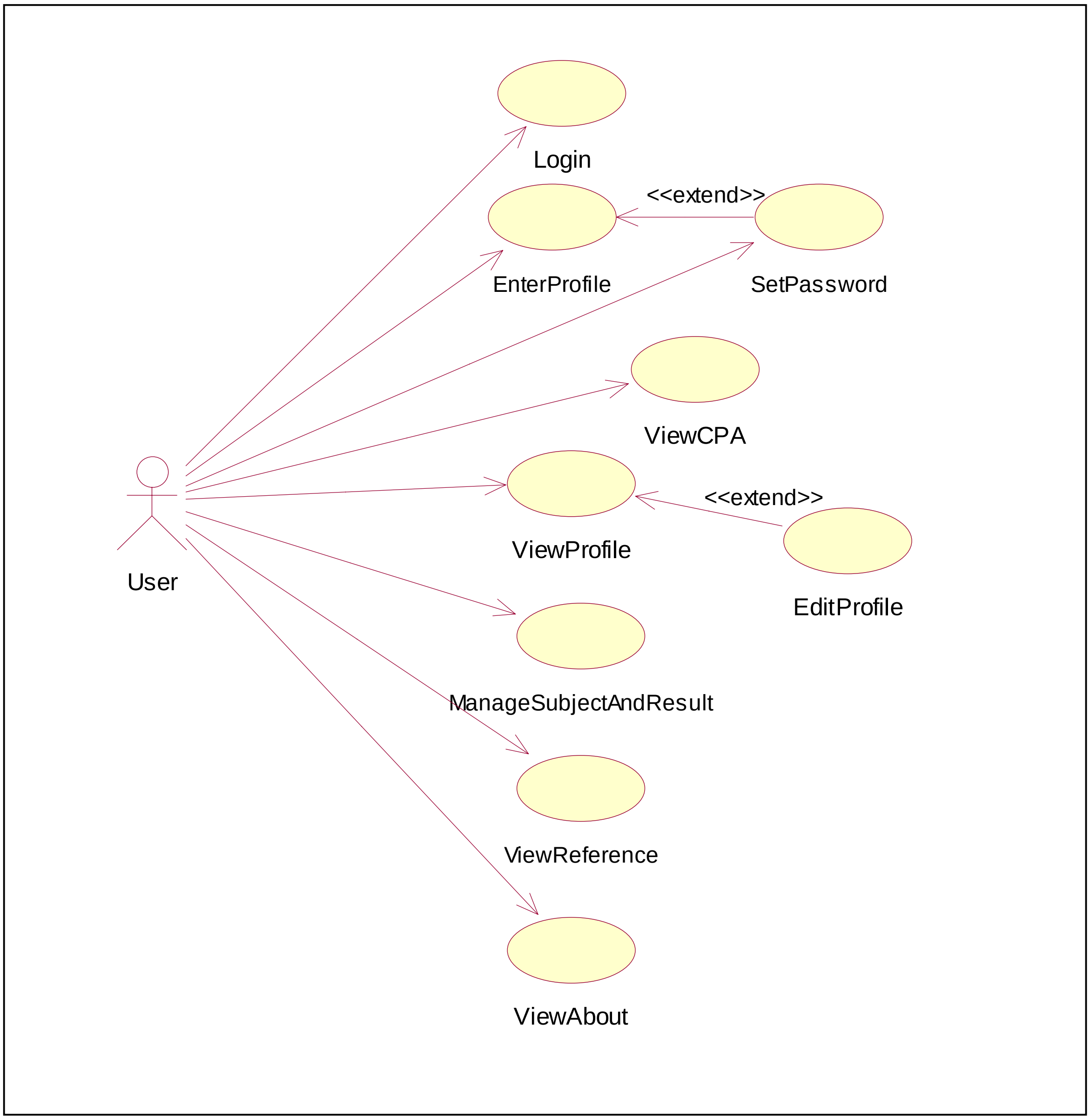


Figure 1.0 : mResult Use Case Diagram

FR No.	Requirement	Description	Status
75168/mResult/01/00	**Login**	**User login into the application**	
75168/mResult/02/00	**Enter Profile**	**User can enter their profile**	
75168/mResult/03/00	**Set Password**	**User can set their password**	
75168/mResult/03/01	Edit Password	User can change their password	
75168/mResult/04/00	**Manage Subject and Result**	**User can select which semester's subject and view the subjects detail**	
75168/mResult/04/01	Set Result/Grade	User can set the subjects result / grade	
75168/mResult/04/02	Add Subject	User can add subject	
75168/mResult/04/03	Delete Subject	User can delete a selected subject, but is limited with the minimum credit requirement for a semester	
75168/mResult/04/04	Clear Result	User can clear all results for a selected semester	
75168/mResult/04/05	View GPA	User can view the GPA for a selected semester	
75168/mResult/05/00	**View CPA**	**User can view the current CPA for his result**	
75168/mResult/06/00	**View Profile**	**User can view their profile**	
75168/mResult/07/00	**Edit Profile**	**User can edit their profile**	
75168/mResult/08/00	**View Reference**	**User can view reference that shows the pointer for each grade**	
75168/mResult/09/00	**View About**	**User can view the About form, which shows the backbone behind the implementation of this application**	

Program Pengajian Diploma(PPD),
UTM *City Campus*, KL

mResult

TEST DOCUMENT
FOR
MRESULT FOR MOBILE

Version 1.0

Document Reference No: 75168/MRESULT/TD/1.0

CONFIDENTIAL

Revision History

Version	Status	Date	Change Description	Author
1.0	Draft	6 June 2005		Ahmad Aizuddin

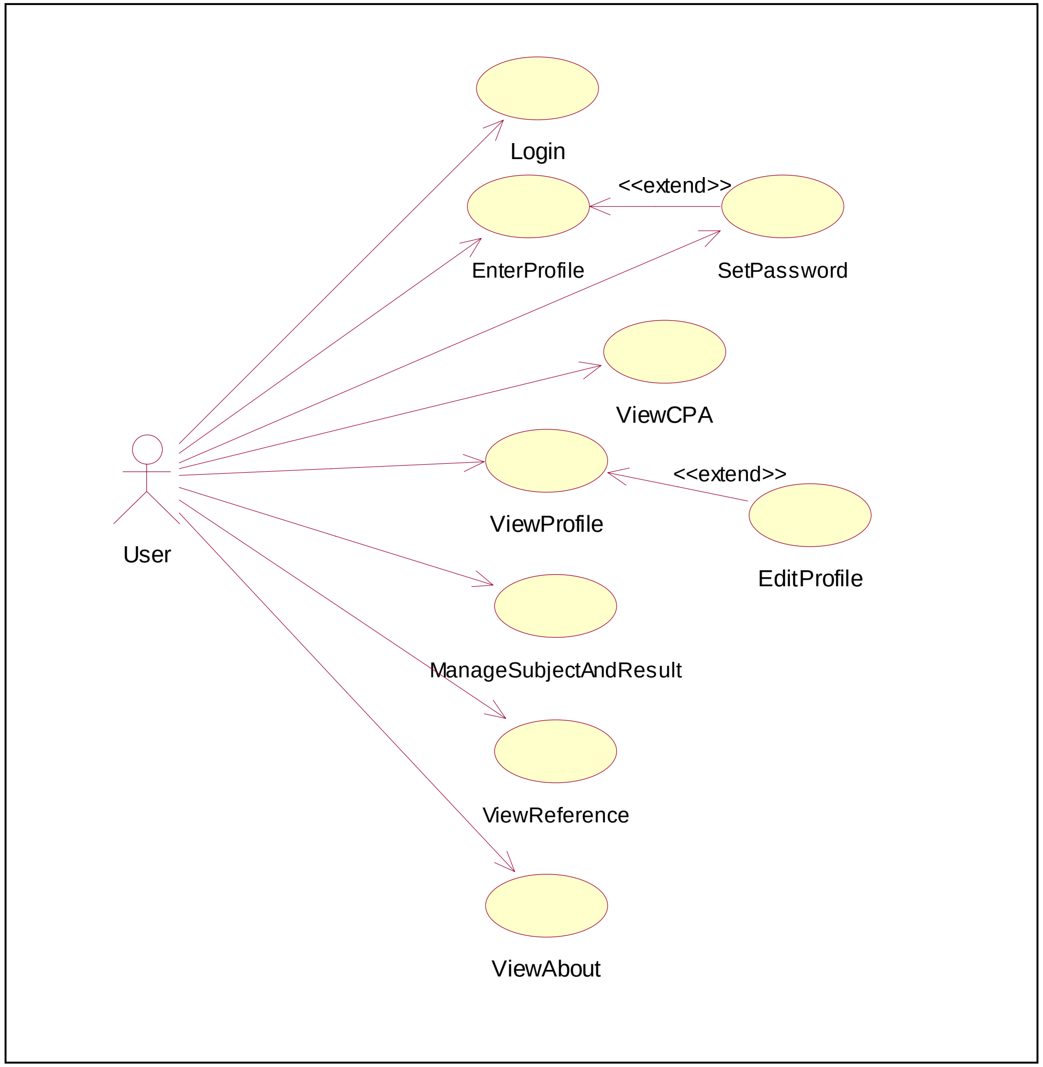


Figure 1 : mResult Use Case Diagram

mResult Test Item

Requirement / FR No.	Requirement	Expected Result	Test Result
Enter Profile **75168/mResult/02/00**	User enters their profile		
	- Select mResult icon from application folder	- System displays splash screen for 3 seconds, followed by a form for user to enter their profile (if first time) - System prompts user to enter these information :- • Name • Matric Number • Password enable / disabled	
	- Select ‘next’	- If user didn’t fill in all fields, an error message will apear - If password is enabled, system will display the password form - If password is disabled, system will display the intake form. After clicking the next button again, system will display a confirmation form consists of ‘yes’ and ‘back’. - If user click back, the intake form will be displayed. - If user click Yes, system will display a welcome message followed by the main menu.	

Login **75168/mResult/01/00**	User login into the system		
	- Select mResult icon from application folder	- System displays splash screen for 3 seconds, followed by Login form (if first time) - System prompt user to enter password if password is enabled, or enter login button if password is disabled	
	- Enter password / login button	- If password is incorrect, system will display an error message. - If password is correct, system will display success message, followed by the main menu - If there is no password, once user enters the login button, system will display welcome message and then displays the main menu	
Set Password **75168/mResult/03/00**	User can set their password		
	- Starts when user select 'Next' from 'Enter Profile' page and password is enabled	- System displays the password form - System prompt user to enter their password and then re-enter that password.	
	- Select 'Back'	- System displays the 'Enter Profile' form	

	- Select ‘Next’	- If any text field is empty, system displays error message - If password entered is less than 6 characters, system displays error message - If the re-entered password doesn’t match the password, system displays error message - If both password match, system displays ‘Intake’ form.	
Edit Password 75168/mResult/03/01	User can change their password	- If password is disabled, system displays text saying password is disabled - If password is enabled, system displays ‘change password’ form.	
	- Select ‘Change Password’ from ‘Options’ page		
	- Select ‘Options’ and then ‘Save’	- If any text field is empty, system displays error message - If old password doesn’t match the current password, system displays error message - If new password entered is less than 6 characters, system displays error message - If everything’s ok, system will save the new password in RMS. -	

Manage Subject and Result 75168/mResult/04/00	User can select which semester's subject and view the subjects detail		
	- Select button 'Select Semester'	- System will display list of semesters.	
	- Selects 'Options' and then 'View Subjects'	- System displays the selected semesters list of subjects.	
	- Selects 'Options' and then 'Select Subject'	- System displays the detail of the selected subject - Default value for the grade is ' – '.	
Set Result / Grade 75168/mResult/04/01	User can set the subjects result / grade		
	- At the 'Subjects' page, select 'Options' and then 'Select Subject'	- System displays the detail of the selected subject.	
	- Select 'Edit'	- System will display the 'Edit Result' page, which consist of the subject code, name and grade - Subject code and name cannot be changed.	
	- Select 'Options', 'Select' and	- System displays a success message, then displays	

	then 'Save'	the subject detail once again - This time, the grade should be the same as the one that the user had just selected.	
Add Subject 75168/mResult/04/02	User can add subject		
	- At the 'Semester' page, select 'Options' and then 'Add Subject'	- If selected semesters total credit is equal or more than 19, system displays info message, followed by the 'Add subject' page - System prompt user to enter these information :- • Subject Code • Subject Name	
	- Select 'Options' and then 'Save'	- If any field is empty, system displays error message - If the subject code entered is less than 7 characters or if the 7th character of the code is not numerical, system displays error message - If after adding the new subject, total credit of that semester is more than 19, system displays info message, then goes back to 'Semester' page - If total credit is below than 19, system displays success message, followed by the 'Semester' page back.	
Delete Subject 75168/mResult/04/03	User can delete a selected subject		

	- At the ‘Subject’ page, select ‘Options’ and then ‘Delete Subject’	- System will display a confirmation page which shows the code and name of the subjects that’s going to be deleted.	
	- Select ‘Yes’	- If after the operation, the total credit for the selected semester is lower than 12, system will display error message. - If not, system will display a success message, and then displays the list of subject back. This time, the subject that has been deleted should not show up in the list.	
Clear Result 75168/mResult/04/04	User can clear all results for a selected semester		
	- At the ‘Semester’ page, select ‘Options’ and ‘Clear Result’	- System will display a confirmation page, whether yes or back.	
	- Select ‘Yes’	- System will reset all results for the selected semester to the default value - System displays a success message, followed by the ‘Semester’ page back again.	
	- At the ‘Semester’ page, select ‘Options’ and ‘View GPA’	- System should display an error message saying there is no result in the record store.	

View GPA **75168/mResult/04/05**	User can view the GPA for a selected semester		
	- At the 'Semester' page, select 'Options' and 'View GPA'	- If there is no result yet, system will display an error message - If there is a result, system displays a page that contains these information :- • Which semesters GPA • GPA • Total Value Point • Total Credit	
View CPA **75168/mResult/05/00**	User can view the current CPA for his result		
	- At the main menu, select 'View CPA'	- If there is no result yet, system will display an error message - If there is a result, system displays a page that contains these information :- • CPA • Total Value Point • Total Credit	
View Profile **75168/mResult/06/00**	User can view their profile		

	- At the main menu, select 'Options'	- System will display 'Options' page.	
	- Select 'View User Profile'	- System will display the user profile, which contain these attribute :- • Name • Matric No • Course • Year Intake • Password Enable (true / false)	
Edit Profile 75168/mResult/07/00	User can edit their profile		
	- At the 'Options' page, select 'View User Profile'	- System will display the user profile, which contain these attribute :- • Name • Matric No • Course • Year Intake • Password Enable (true / false)	
	- Select 'Edit'	- System displays 'Edit Profile' page - User can only edit their name, matric number and whether password is enabled or not.	
	- Select 'Options' and 'Next'	- If password is marked enable, system displays page to 'Enter Password'	

		- If password is not marked enable, system displays a confirmation page.	
View Reference **75168/mResult/08/00**	User can view reference that shows the pointer for each grade		
	- At the 'Options' page, select 'Reference'	- System will display a reference table showing the value point for each grade that's been used by the system.	
View About **75168/mResult/09/00**	User can view the About form, which shows the backbone behind the implementation of this application		
	- At the 'Options' page, select 'About'	- System will display an 'About' page, that shows the programmer for this system.	

mResult Application

Version 1.0 for mobile platform.

User Manual

June 15, 2005

VOT: **75168**

PPD, UTM *City Campus*

Researcher:

Faizul Azli b. Abd Ridzab
Mohammad Ahmad b. Drs Nasrul

Research Assistant / Programmer:

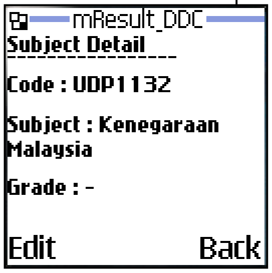
Ahmad Aizuddin b. Bahaman
Muhammad Firdaus b. Harun

1. Introduction

MResult v1.0 for mobile provides an easy to use UTM result management system, which can be accessed from anywhere via the mobile phone. It provides user with the power to manage their subjects and results , with an additional features like password for login and much more.

Subject Detail

Displays subject's code, name and grade.



Subject Detail

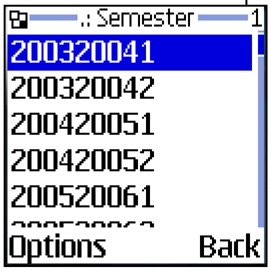
Code : UDP1132

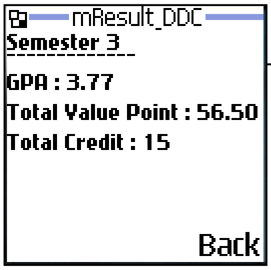
Subject : Kenegaraan Malaysia

Grade : -

List Of Semesters

Displays lists of semesters.





Semester 3

GPA : 3.77

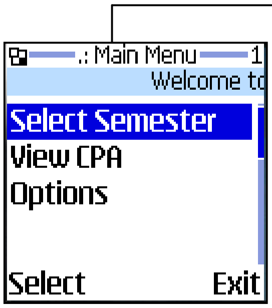
Total Value Point : 56.50

Total Credit : 15

Semester's GPA

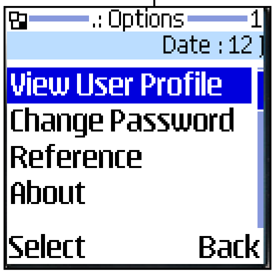
View a selected semester's

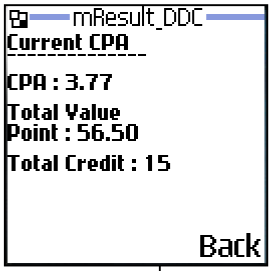
Main Menu



Options Menu

Displays options such as View Profile, Change Password and





Current CPA

CPA : 3.77

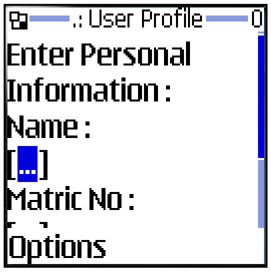
Total Value Point : 56.50

Total Credit : 15

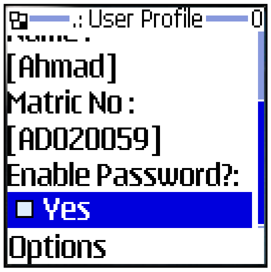
View all semester's result, CPA

View CPA

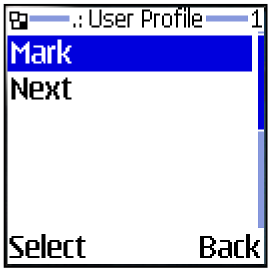
2. Enter Profile

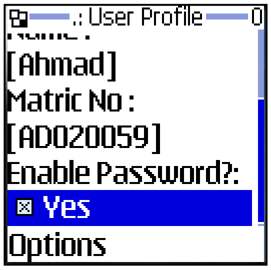


Enter Personal Information:
Name:
[...]
Matric No:



[Ahmad]
Matric No:
[AD020059]
Enable Password?:
□ Yes

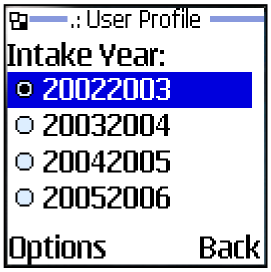




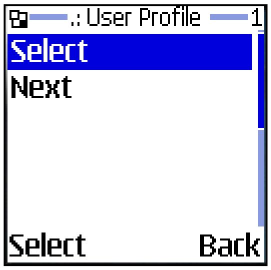
[Ahmad]
Matric No:
[AD020059]
Enable Password?:
☒ Yes

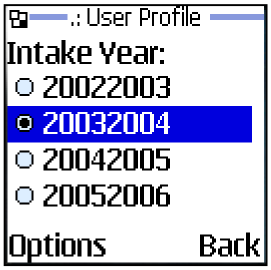
This event happens **only once** when user first time login into the system.

1. Select mResult icon from application folder. System displays splash screen for 3 seconds, followed by a form for user to enter their profile.
2. Select **Options** and **Edit** to enter name and matric number.
3. To enable password, set the highlight to the Enable Password check box, select **Options** and **Mark**.
4. The check box is now marked. Select **Options** and **Next** to continue.

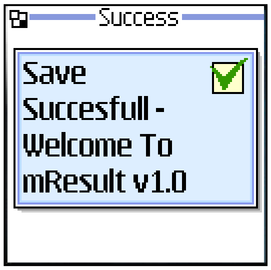


Intake Year:
● 20022003
○ 20032004
○ 20042005
○ 20052006





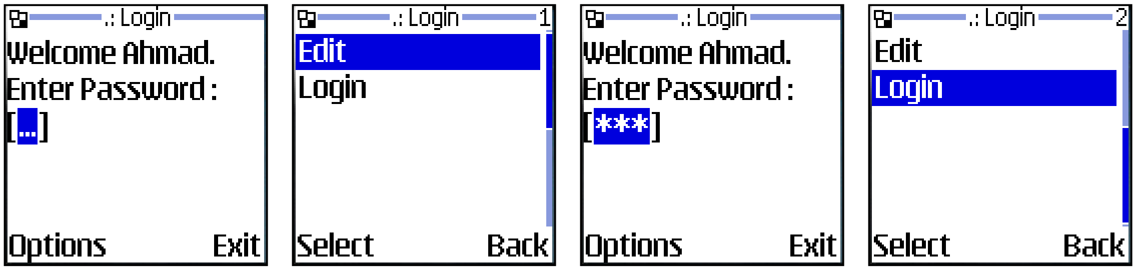
Intake Year:
○ 20022003
● 20032004
○ 20042005
○ 20052006



Save Succesfull - Welcome To mResult v1.0

5. System displays 'intake form' (If password is enabled, system will display 'enter password form'. Please refer to).
6. To change intake session, set the highlight to other intake session, select **Options** and **Select**.
7. The focus is now owned by the newly selected intake session.
8. Select **Options** and **Next**. System will display 'Confirmation' form. Select **Yes**. System will display success message followed by the main menu.

3. Login

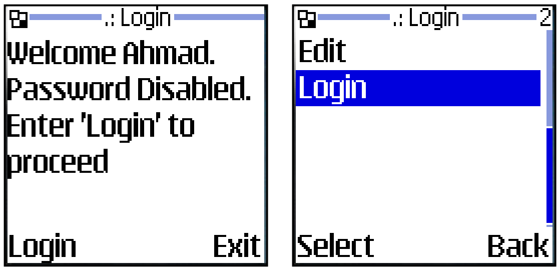


Welcome Ahmad.
Enter Password :
[...]

Welcome Ahmad.
Enter Password :
[***]

If password is enabled

1. Select mResult icon from application folder. System displays splash screen for 3 seconds, followed by a ‘Login’ form.
2. To enter password, Select **Options** and **Edit**.
3. Select **Options** and **Login** to enter the system.



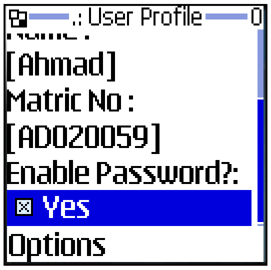
Welcome Ahmad.
Password Disabled.
Enter 'Login' to proceed

If password is disabled

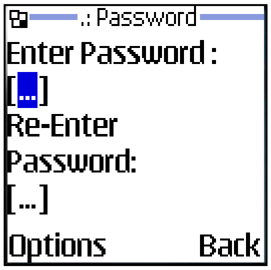
1. Select mResult icon from application folder. System displays splash screen for 3 seconds, followed by a ‘Login’ form.
2. Select **Options** and **Login** to enter the system.

4. Manage Password

4.1 Set Password



Name :
[Ahmad]
Matric No :
[AD020059]
Enable Password?:
☒ Yes

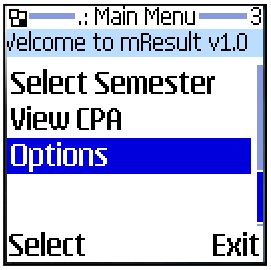


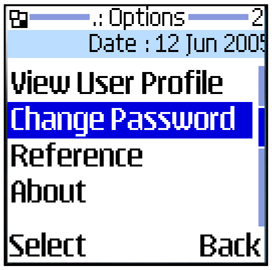
Enter Password :
[...]
Re-Enter Password:
[...]

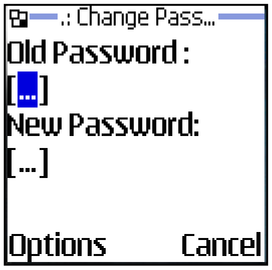
This event continues from the ‘Enter Profile’ event, when password is enabled

1. Select **Options** and **Next**.
2. System displays Password form. To enter password, select **Options** and **Edit**.
3. Select **Options** and **Next**.

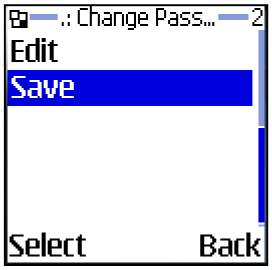
4.2 Edit Password





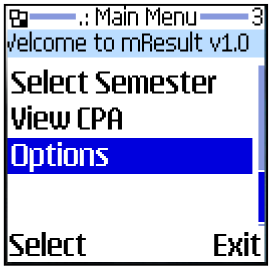


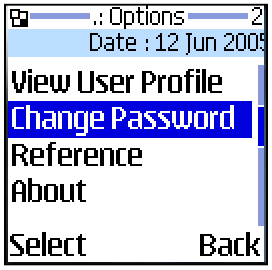
Old Password :
[...]
New Password:
[...]

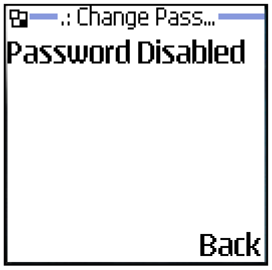


Edit password (password enabled).

1. At the main menu, select **Options**.
2. System displays ‘Options’ menu. Select **Change Password**.
3. Select **Options** and **Edit** to enter old password and new password.
4. Select **Options** and **Save**.







Password Disabled

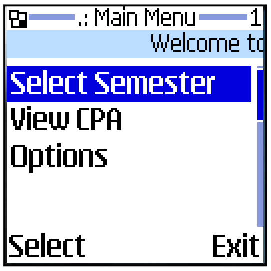
Edit password (password disabled)

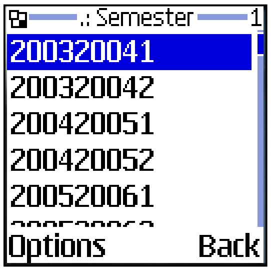
1. At the main menu, select **Options**.
2. System displays ‘Options’ menu. Select **Change Password**.

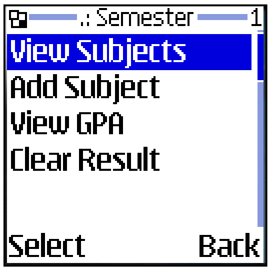
5. Manage Subject and Result

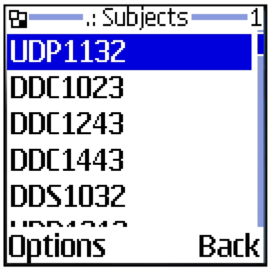
5.1 View Subject Information

User can select which semester's subject and view the subjects detail

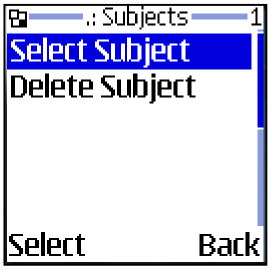


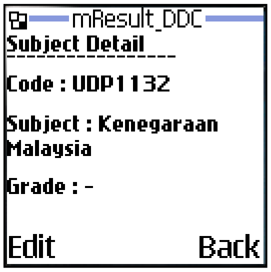






1. At the main menu, select **Select Semester**.
2. System displays list of semesters.
3. Select **Options** and **View Subjects**.
4. System displays list of subjects for that semester.





Code : UDP1132

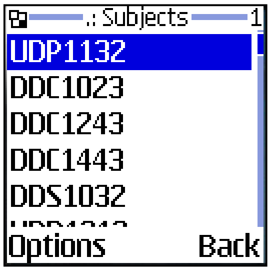
Subject : Kenegaraan Malaysia

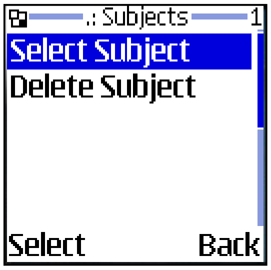
Grade : -

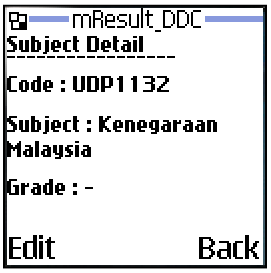
5. Select **Select Subject**.
6. System displays subject's information.

5.2 Set Result / Grade

User can set the subjects result / grade



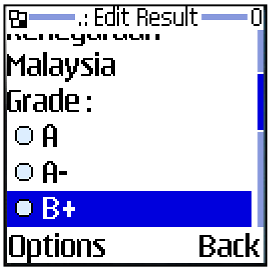




Code : UDP1132

Subject : Kenegaraan Malaysia

Grade : -



Malaysia

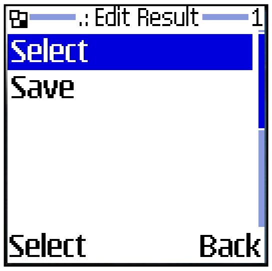
Grade :

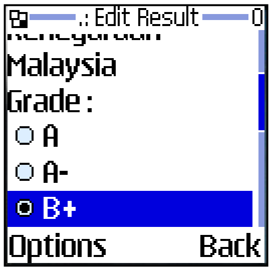
○ A

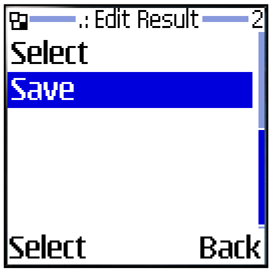
○ A-

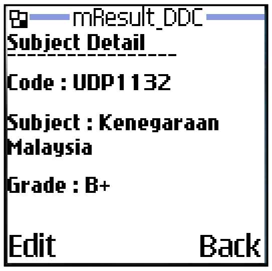
● B+

1. At the 'List of Subjects' form, highlight any subject.
2. Select **Options** and **Select Subject**.
3. System displays subject information. Select **Edit**.
4. Highlight the result / grade for the subject.









Subject Detail

Code : UDP1132

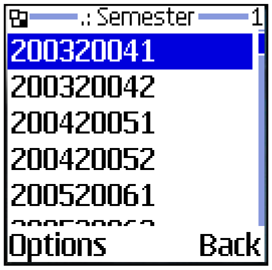
Subject : Kenegaraan Malaysia

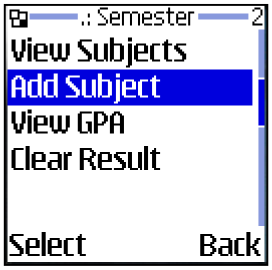
Grade : B+

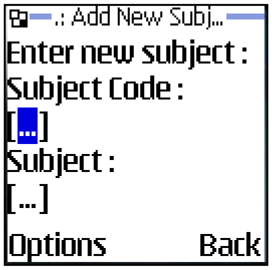
5. Select Options and Select.
6. Focus is now at the new grade.
7. Select Options and Save.
8. Subject's grade has been set to the new grade.

5.3 Add Subject

User can add subject







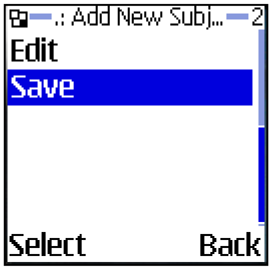
Enter new subject :

Subject Code :

[...]

Subject :

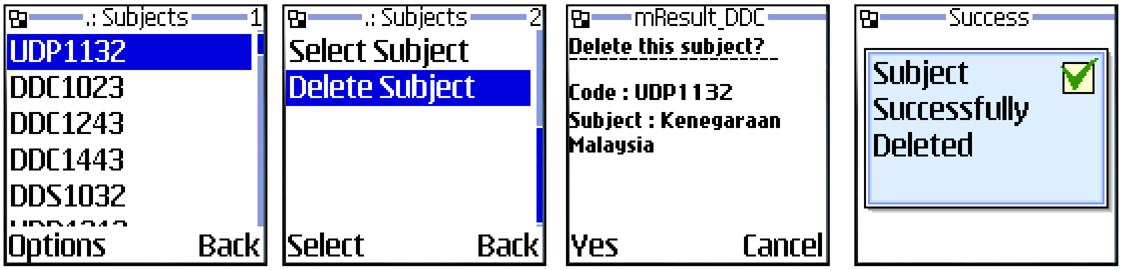
[...]



1. At the 'Semester' form, highlight any semester.
2. Select **Options** and **Add Subject**.
3. System displays 'Add Subject' form. Select **Options** and **Edit** to enter the new subject's information.
4. Select **Options** and **Save** to save the new subject.

5.4 Delete Subject

User can delete a selected subject



Delete this subject?

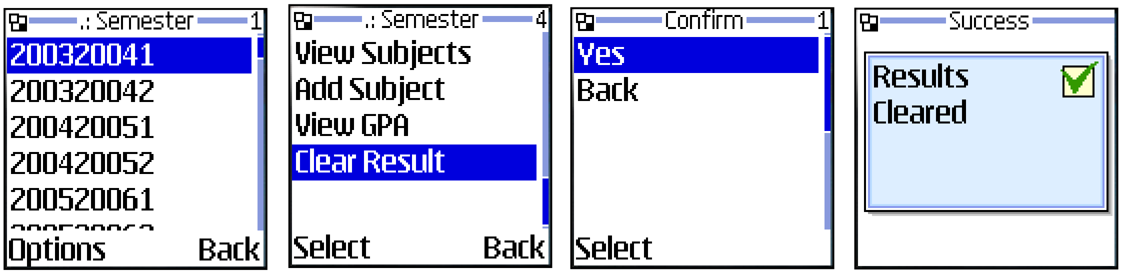
Code : UDP1132
Subject : Kenegaraan Malaysia

Subject Successfully Deleted

1. At the 'Subjects' form, highlight any subject.
2. Select **Options** and **Delete Subject**.
3. System will display a confirmation page.
4. Select **Yes**. Subject successfully deleted.

5.5 Clear Result

User can clear all results for a selected semester

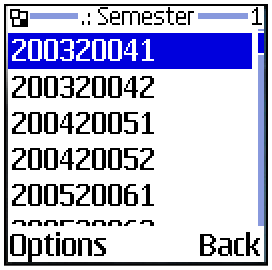


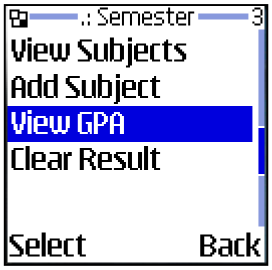
Results Cleared

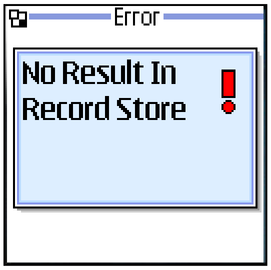
1. At the 'Semester' form, highlight any semester.
2. Select **Options** and **Clear Result**.
3. System displays confirmation form. Select **Yes**.
4. Results cleared.

5.6 View GPA

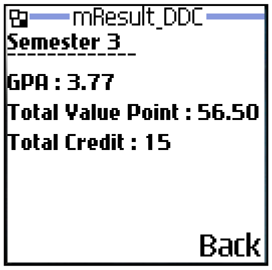
User can view the GPA for a selected semester







No Result In Record Store



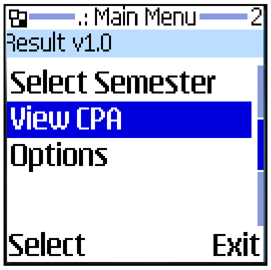
Semester 3

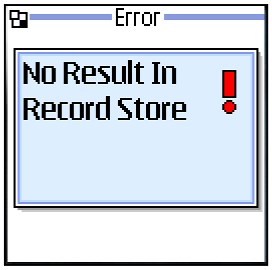
GPA : 3.77
Total Value Point : 56.50
Total Credit : 15

1. At the ‘Semester’ form, highlight any semester.
2. Select **Options** and **View GPA**.
3. If there is no result yet, an error message will appear.
4. If there is a result, system displays the GPA.

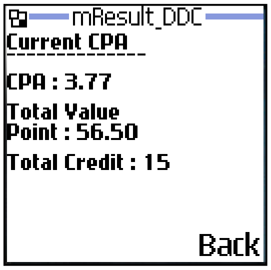
6. View CPA

User can view the current CPA for his result





No Result In Record Store



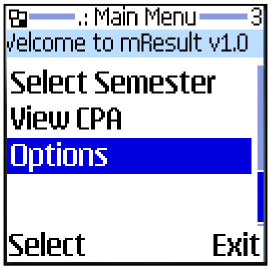
Current CPA

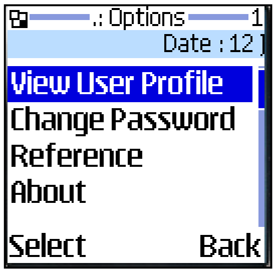
CPA : 3.77
Total Value Point : 56.50
Total Credit : 15

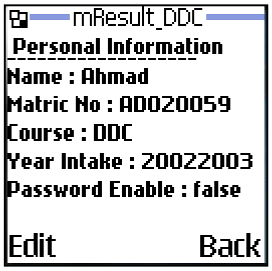
1. At the main menu, select **View CPA**.
2. If there is no result yet, an error message will appear.
3. If there is a result, CPA form will appear.

7. View Profile

User can view their profile





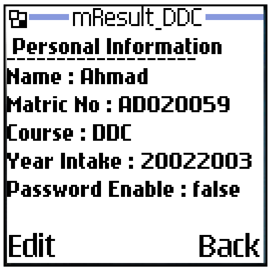


Personal Information
Name : Ahmad
Matric No : AD020059
Course : DDC
Year Intake : 20022003
Password Enable : false

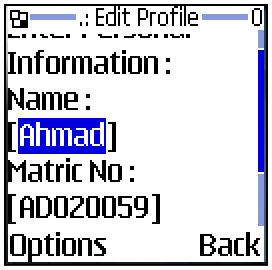
1. At the main menu, select **Options**
2. Select **View User Profile**.
3. User profile is displayed.

8. Edit Profile

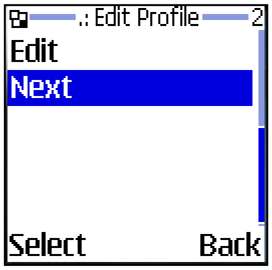
User can edit their profile

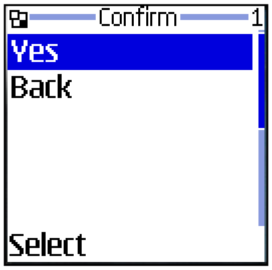


Personal Information
Name : Ahmad
Matric No : AD020059
Course : DDC
Year Intake : 20022003
Password Enable : false



Information :
Name :
[Ahmad]
Matric No :
[AD020059]

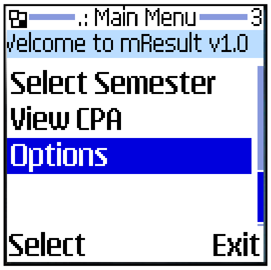


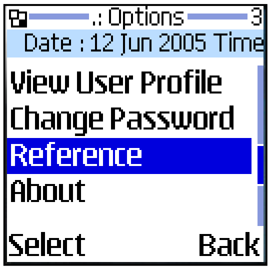


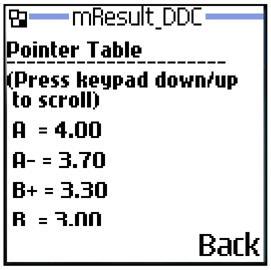
1. At the 'User Profile' form, select **Edit**.
2. Select **Options** and **Edit** to edit user profile.
3. Select **Options** and **Next**.
4. Confirmation page appears. Select **Yes** to save.

9. View Reference

User can view reference that shows the pointer for each grade






mResult_DDC

Pointer Table

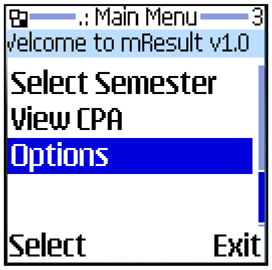
(Press keypad down/up
to scroll)
A = 4.00
A- = 3.70
B+ = 3.30
B = 3.00

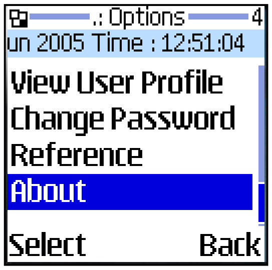
Back

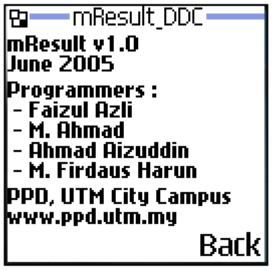
1. At the main menu,select **Options**.
2. Select **Reference**.
3. A reference table will be displayed. Select down / up to scroll the table.

10. View Reference

User can view the About form, which shows the backbone behind the implementation of this application






mResult_DDC

mResult v1.0
June 2005
Programmers :
- Faizul Azli
- M. Ahmad
- Ahmad Aizuddin
- M. Firdaus Harun
PPD, UTM City Campus
www.ppd.utm.my

Back

1. At the main menu, select **Options**.
2. Select **About**.
3. The 'About' form will appear.

mResult v1.0 for mobile

Introduction

MResult v1.0 for mobile provides an easy to use UTM result management system, which can be accessed from anywhere via the mobile phone. It provides user with the power to manage the subjects and results by their self.

Potential Users

- UTM students

Course's Available

- All course's from DDA to DDZ

Benefits & Special Features

Offers a number of benefits such as:-

- User can have the mobility to view their results from anywhere and anytime, because the application is virtually in their hand.
- Unlimited access to the information with no subsequence charges.
- Security and integrity of the information inside the application is guaranteed with the option to activate password.
- User can manage their result effectively, with an option to select their intake session.
- User friendly interface from the mobile application point of view.
- User can add and delete subjects prior to the subjects that they take.
- Very cheap.

Development Team:-

- Faizul Azli b. Abd Ridzab
- M. Ahmad b. Drs Nasrul
- A. Aizuddin b. Bahaman
- M. Firdaus b. Harun

of Program Pengajian Diploma(PPD), UTM *City Campus*, KL

GUIDELINES FOR CREATING A J2ME APPLICATION

1. Install Jbuilder.
2. Install Nokia Developer’s Suite. Integrate with JBuilder.
3. Install the SDK.
4. Install Nokia PC Suite.
5. In JBuilder, Create ‘New Project’
    i. Enter project name <next>
    ii. Change the JDK field to J2ME Wireless Toolkit <next>
    iii. Press finish.
6. Create New Class.
    i. Enter class name
    ii. Press ‘Ok’ button
7. Write code.
8. To compile project
    i. Go to Project > Make Project ‘.jpx’
9. Run project
    i. Run > New > Change type to MIDlet
    ii. Select main class
    iii. Press Ok
10. Click Run project as a Default emulator
11. Create Application Package
    i. Press ‘Generate’.
12. Test Emulator
    i. Choose application file
    ii. Choose emulator
    iii. Press ‘Emulate’ button
13. Open the file folder where the application installer is located
    i. Double click the installer
    ii. Activate the HP’s connection medium and install it on the HP
14. Application runs on HP