Offline Mobile Learning Application for National Open University of Nigeria.

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ABSTRACT

This study developed an offline-first android study application for NOUN MSc Information Technology students as a tool to promoting mobile learning. The need to promote mobile learning for Open and Distance Education students was discussed and the possible application of this form of study for NOUN students specifically. An Android application that provides offline access to MSc Information Technology courseware was developed with Android Studio version 3.2.1 and Java SE development kit (SDK) 11.0.1 64 bit and successfully installed and tested in an Infinix Note 4 Pro android GSM phone running Android Os 7.0 (Nougat). All the MSc Information Technology courseware available on the National Open University website as at December 2018 are incorporated into the App as well as hyperlinks to other extra study material. This app was developed with Java which is the official language of Android development while XML mark-up language was used to design the graphical user interface of the various activities displayed in the app. There is a logical sequence of activities from the welcome screen to the final courseware content screen for the various courses. The Ebooks displayed by the app are read only and cannot be edited or printed out. However, the user can download the Ebooks in PDF format from the hyperlinks provided and print or transfer these copies in accordance with the copyright license of the National Open University of Nigeria that apply. The researcher not only proffers this app as a response to the identified need for indigenous "native" technology but also recommends the development of more applications for offline and online study in tertiary institutions in Nigeria. There is also a need for future studies to translate the android app developed in this research project to the iOS or MS Windows platforms to make it accessible to more students.

Keywords: Mobile Learning, Application, Students, National Open University of Nigeria, Teaching, App, E-Books.

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1. BACKGROUND TO THE STUDY

The broad all-inclusive term eLearning (or E-learning) covers the general idea of computer-based learning methods. A learning system based on formalised teaching but with the help of electronic resources is known as E-learning. While teaching can be based in or out of the classrooms, the use of computers and the Internet forms the major component of E-learning (The Economic Times, 2019). At National Open University of Nigeria - NOUN - where the open and distance learning method is used, nearly all the aspects of eLearning are exhibited including the fact that learning can take place at great distances and students and "tutors" may never meet, and tests are conducted "on-line". This trend is widely practiced in many countries and has made higher education more readily accessible for more people from various backgrounds. Although ongoing research, shows that there is still a need to measure the actual effects and benefits of eLearning when compared to the traditional methods of teaching (Cochrane, 2012), Alasoluyi (2015) discovered that the use of CAI in teaching of Economics in senior secondary schools enhances students' performances.

They tend to score higher in tests administered to them using CAI teaching method than those students taught using traditional method of teaching Economics. This explains why students with access to online forums tend to be better informed and better prepared to tackle the coursework required in Open and Distant Learning methods. Hence, there is a need to integrate technology-based learning such as the use of mobile devices into all aspects of education. Mobile devices which include mobile phones, tablets, e-book readers and various other handheld technologies have become quite common all over the world. In this country mobile devices are even more widely used than computers, specifically mobile phones, and especially among young people. A 2012 Nigerian Bureau of Statistics survey revealed that over 95% of Nigerians lack access to a Personal Computer while conversely the Nigerian Communications Commission (NCC) shows that of the over 100 million active phone connections in Nigeria, over 90% of them have mobile phones.

Mobile phones are used to 'make phone calls, send text messages, check email and browse the Internet. Moreover, they are readily available and more affordable now than over a decade ago when they first appeared in this country. It is not uncommon to find people of different age groups with heads bowed while they browse, chat or text. It may well be that, coupled with our dwindling educational system which needs to be revived as well as reformed - injecting new learning styles could encourage learners and teachers alike. The ability to explore some of the available options in mobile applications for educational purposes may just be part of the transformation needed for the falling standards of education.

Research has shown over and over that there are advantages to the world of learning with technology. Jacob and Issac (2008) stated that the flexibility, instant connectivity, mobility associated with mobile learning has given rise to new delivery platforms for teaching and learning. Their studies led to the confirmation that there are improvements to be seen in the learning environment including the widespread, universal access to learning, the access students have when using the same kind of devices and software that faculty members use, the huge cost savings in having wireless networks and laptop computers instead of desktops.

This is an inspiring idea for a mobile application (app) for National Open University of Nigeria, (NOUN) students. Presently, materials for all the courses are available online for download, and hard copies are also supplied when students register (subject to availability). Students are generally encouraged to study hard, attend tutorials where possible, form discussion groups, complete their Tutor-Marked Assessments (TMAs) and prepare for exams. Since most students of NOUN are part-time students, civil servants, business owners, or employees (who make good NOUN's motto Work and Learn) finding ways to utilize the precious hours of study can be a hurdle. For those with regular online Internet access, the task is made easier. However, with the increasing number of students owning smart phones but the sadly relatively slow and expensive internet facilities presently available in Nigeria it is very advantageous to explore options in promoting the use of offline mobile phone devices in E-learning solutions for NOUN students. The app developed in this case gives an initial stage to the thought by providing offline access on the phone to materials made available online by NOUN for Masters Students in Information technology. Students can thus have fully mobile access to course materials.

1.2 Statement of the Problem

Students generally encounter difficulties in the course of studying such as lack of sufficient reading materials, inadequate facilities such as libraries for studying and insufficient levels of facilitation including regular access to supplementary audio and video courses and ubiquitous power outages. These various limitations are a major deterrent to proper performance. The extent to which students have opportunities to study beyond the bare minimum is the extent to which they will be able to properly comprehend the content of courses being studied. One obvious remedy is the convenient interaction made possible by the Internet. Sadly, frequent and sporadic power outages mean that even when students have access to printed study material or Laptop/Desktop computers, they cannot study.

2. REVIEW OF LITERATURE

The research and literature surveyed revealed the endless possibilities of the use of mobile devices as a tool to distance learning. The necessity of such devices and the importance of promoting their use cannot be over-stressed. The micro contributions of research studies such as this one will also help fill the gap in the knowledge of options and applications available. There is a growing need to make ample use of the ubiquitous nature of mobile applications and devices. As such, one cannot over-emphasize the development of computer assisted instruction and M-learning. It is however necessary to realize that there are limitations to the application of computers and mobile devices to learning. There are still academic disciplines that require the traditional teacher and classroom setting.

3. METHODOLOGY

3.1 Introduction

It is pertinent to note that at the time of this research such an application for NOUN is not available. The NOUN iLearn application – which is a fully web-based application – though a good starting point for m-learning, has the disadvantage of being Internet dependent. In this project we develop an offline first variation of the existing NOUN E-book study portal, still with the aim of advocating the many opportunities available for mobile devices as learning platforms. Mobile learning systems are a means to enlighten a largely mobile group of individuals as well as encourage judicious use of time. Many students of distance learning programs can snatch a few minutes every now and then to revise materials, to review test questions and to read up on topics for assignments. All this can be done while on the move. A little here, a little there and the brain keeps (actively) taking in what is given. All the NOUN course materials are readily available online (www.nouedu.net) in PDF format. This is in addition to the actual booklets supplied when students register for courses. Any serious student can therefore have access to materials even before the semester begins and start studying on his or her own. It was with this in mind that a mobile application was to be developed so that students have the materials easily accessible on their mobile devices without having to download the material on a stationary desktop or even a laptop, even though the option of a fixed point is appealing. This chapter details the resources and methods that will be used to create an offline-first android study application.

3.2 Application Design.

A simple design would hopefully encourage the actual use of mobile devices as opposed to laptops and desktops which are also commendable but stationary.

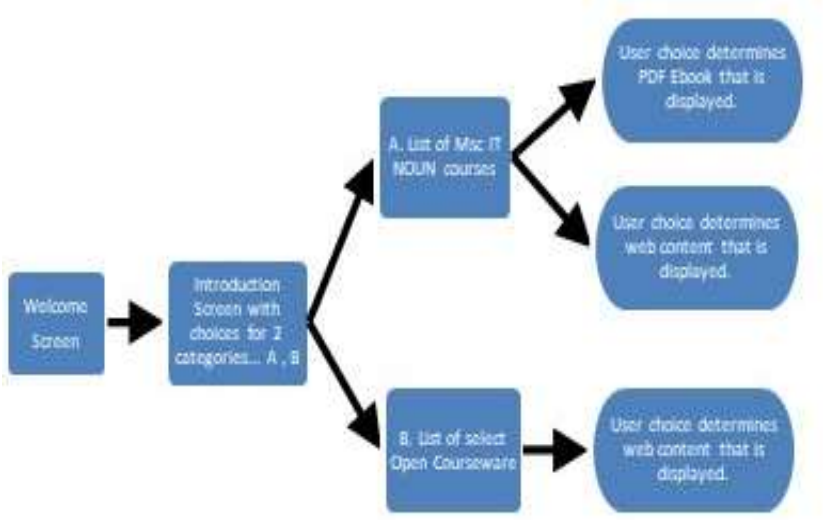

Figure 3.1 Basic Application Design.

At the start of the app would be a basic welcome screen. This would be followed by an introduction screen which would present the user with a choice of courseware or extra study materials. The selected choice would then determine which list of Material is made available to the user from which any option selected would further lead to a fourth screen displaying the course outline and the further option to study the course E-book offline. The app would have a built-in PDF reader so that it can be installed "stand-alone" without need to download any other E-book reader.

3.3 Application Development

3.3.1 Software Requirements

Ordinarily mobile applications running on android devices are developed using mainly Java but also require Ruby, PHP or Python for remote data-storage and provisioning of servers. Java is the best option for android devices because it enables full use of the built-in functions the device has, for example the camera. Apps developed on this platform however, will not run on any other mobile operating system. Sometimes the interfacing between these different platforms can be quite complex. One graphic attempt to describe the links and interfacing needed for mobile apps is given in Fig 3.2 (Brady, 2012).

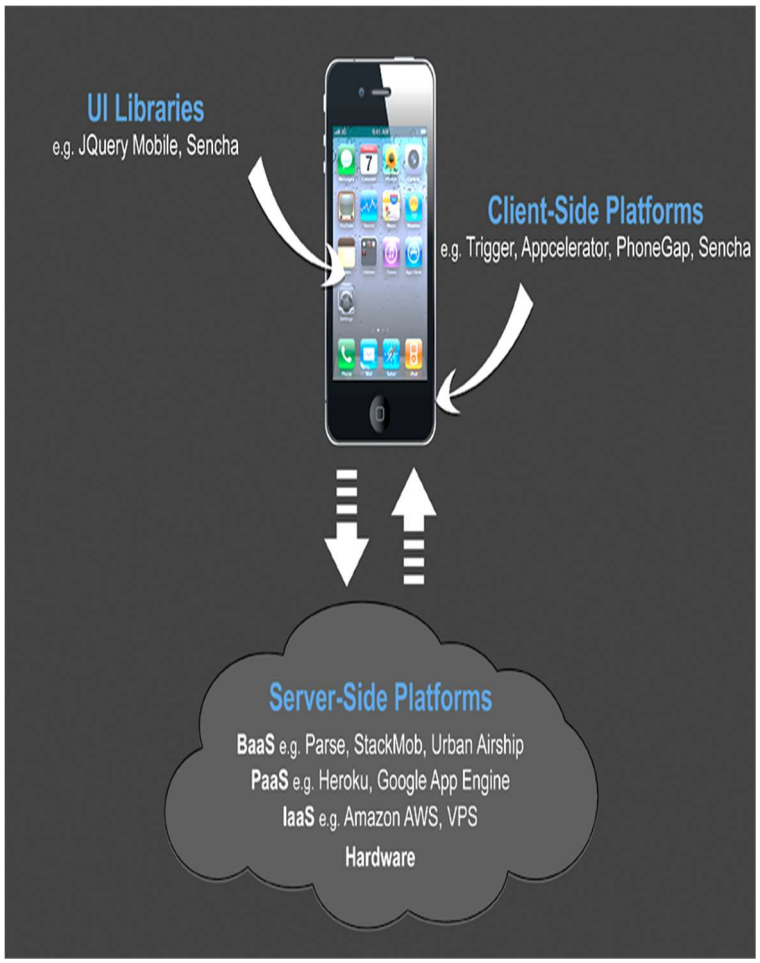

Figure 3.2 Mobile Development Platforms

The difficulty mobile a developer faces is the choice to make when one considers the different options each mobile operating system displays. There are different tools and environments on which to develop apps, and applications for one operating system may not work on another. One could develop a web application for mobile devices using HTML, CSS and JavaScript. Such applications would not be too different from websites, and would require constant re-direction to a browser link in order for the user to have access. Another disadvantage is that the app would not be able to launch with its own specific app icon. In addition it would not be able to use the device features like the camera, and the user interface would not look like an app. (Brady, 2012). Android studio version 3.2.1 was used to develop the app for this project and the required Msc InfoTech Ebook courseware was downloaded from the NOUN website in PDF format. The Android studio was installed on a Windows 7 64bit Operating System.

3.3.2 Hardware Requirements

Recommended:

- 3 GB RAM minimum, 8 GB RAM recommended; plus 1 GB for the Android Emulator.
- 2 GB of available disk space minimum, 4 GB Recommended (500 MB for IDE + 1.5 GB for Android SDK and emulator system image).
- 1280 x 800 minimum screen resolution.

Considering the stated hardware requirements, a HP G42 Notebook with Pentium Core i5 processor, 620 GB Hard disk and 6 GB Ram was used in app development.

3.4 Implementation

3.4.1 An Android Project

Several hours were spent viewing and reviewing the necessary background stages required, as well as downloading the packages involved. Android Studio is freely available on the Google Android Developer website. Android Studio is a very large program, approximately 1GB (Android Studio, 2018) and therefore requires a fast internet connection to download. It also needs to be updated on different fronts, particularly the Android SDK tools. The android developer website has a series of guides and references and documentations and even a training manual (android.com/documentation, 2019). Other tools needed were the Java development Kit (JDK). This was available as open source on the Oracle website. There are different versions to consider as well as the fact that the JDK is a superset of the JRE, and as such they are not the same thing.

In creating an android project, which contains all the files needed for the android app, it was useful to follow the guidelines on the android developer website (www.developer.android.com). This has a detailed outline of the process to be duplicated whenever an android project is setup. The project being the name given to the whole application and all the files and folders required for it to run successfully.

Even with the widespread use and acceptance of android devices, there is also the recommendation that apps are developed to target a wide range of android versions. This is because the android operating system itself is continually being updated and devices that start out with one version can be updated every now and then. Table 3.1 is a helpful “dashboard” which gives the breakdown of users and respective versions. This is to enable app developers to target the more common versions. For this app a minimum API of 15 was selected and a maximum of API 28. This ensures over 95% of devices can run this app.

Table 3.1 Percentage Distribution of android devices accessing Google PlayStore - October 2018.

Version	Codename	API	Distribution
2.3.3 - 2.3.7	Gingerbread	10	0.2%
4.0.3 - 4.0.4	Ice Cream Sandwich	15	0.3%
4.1.x	Jelly Bean	16	1.1%
4.2.x		17	1.5%
4.3		18	0.4%
4.4	KitKat	19	7.6%
5.0	Lollipop	21	3.5%
5.1		22	14.4%
6.0	Marshmallow	23	21.3%
7.0	Nougat	24	18.1%
7.1		25	10.1%
8.0	Oreo	26	14.0%
8.1		27	7.5%

Data collected during a 7-day period ending on October 26, 2018
Any versions with less than 0.1% distribution are not shown.

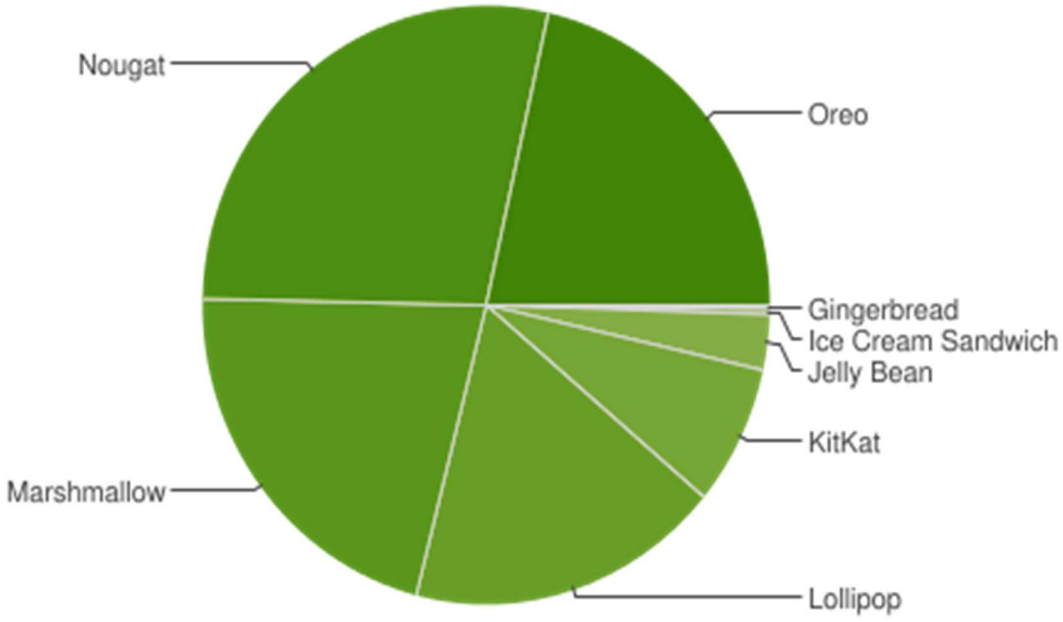

Figure 3.3 Percentage Distribution of android devices accessing Google PlayStore - October 2018 (https://developer.android.com/about/dashboards - Accessed February 9, 2019)

3.4.2 The Graphical User Interface

XML files control the graphical presentation of the different app screens. Each XML file is tied in with its corresponding Java file. The Java files are where the actual program coding is housed. For instance, because the android app responds to user selection on the touch screen, there has to be feedback or response from the app when a user makes a selection. The Java code is what makes that happen. (Key files containing the source code for the app are in Appendix A). The accompanying documentation is in Appendix B. Android Studio regularly reminds users of updates available for download but the version was not updated to prevent unexpected errors as version 3.2.1 was stable at the time. It had been released in beta stages for several months prior to the inception of this research. The android application developed in this project is fairly straightforward. It has two (2) preliminary screens starting with a simple welcome page. The screen shots from the app are presented in the following figures.

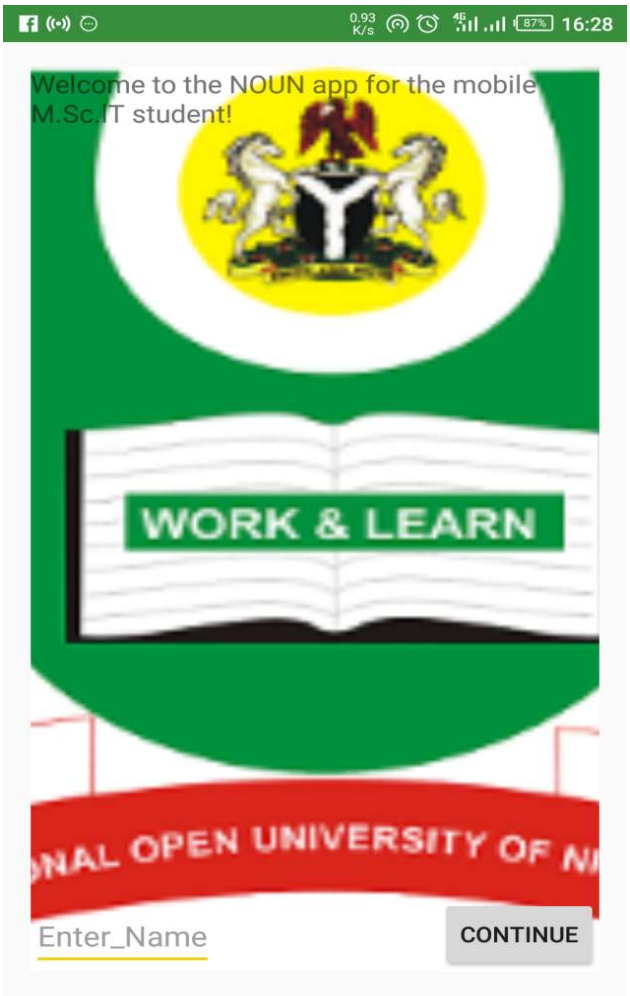

Figure 3.4 The *Welcome* Screen

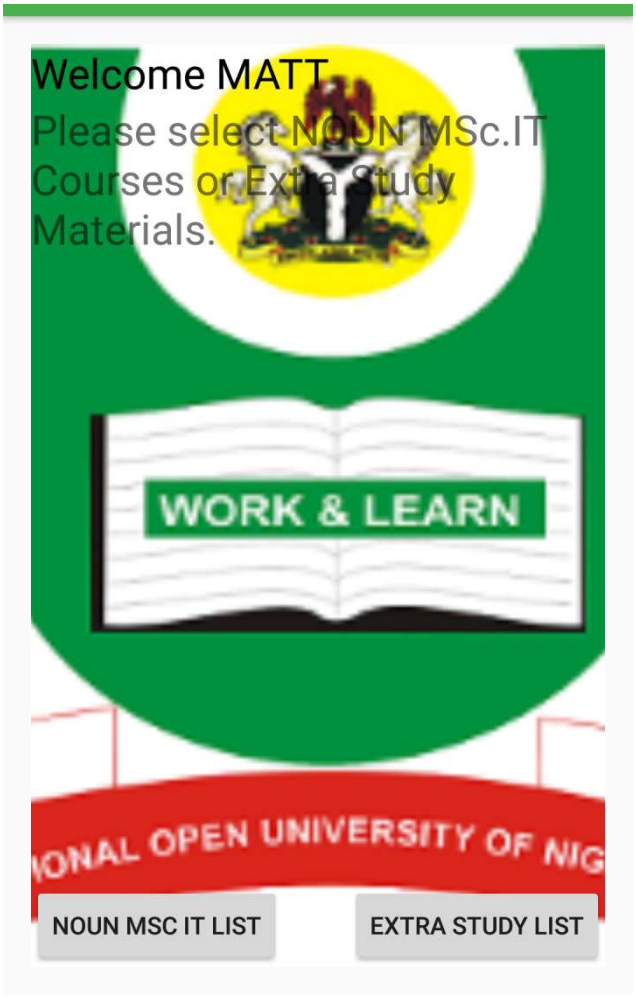

Figure 3.5 The *Study Option* Screen

The next screen shows the user name input in the first screen and two (2) optional study material lists. At this point, the user selects the option indicating which category of study material he or she desires. Option one (1) will open the NOUN MSc IT courses list screen (Figure 3.5), while option two (2) will open the Extra Study List screen (Figure 3.9).

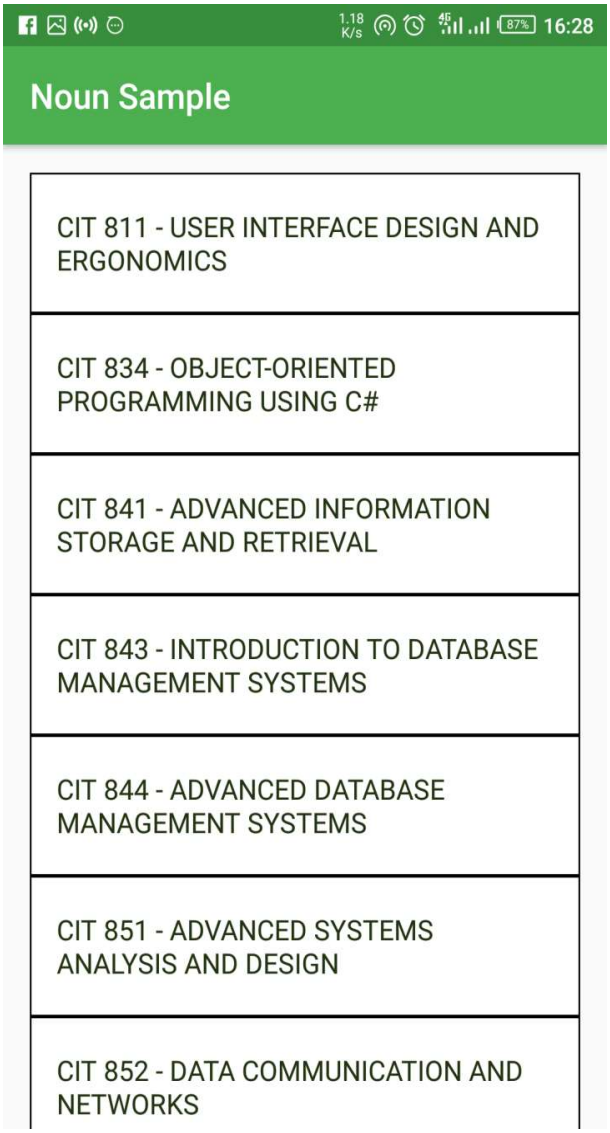

Figure 3.6 The NOUN MSc IT Courses List Screen

Selecting any option in the NOUN MSc IT Course List will take the user to a new page with a brief synopsis of the course and a clickable button that opens the courseware as an Ebook (Figure 3.7 & Figure 3.8).

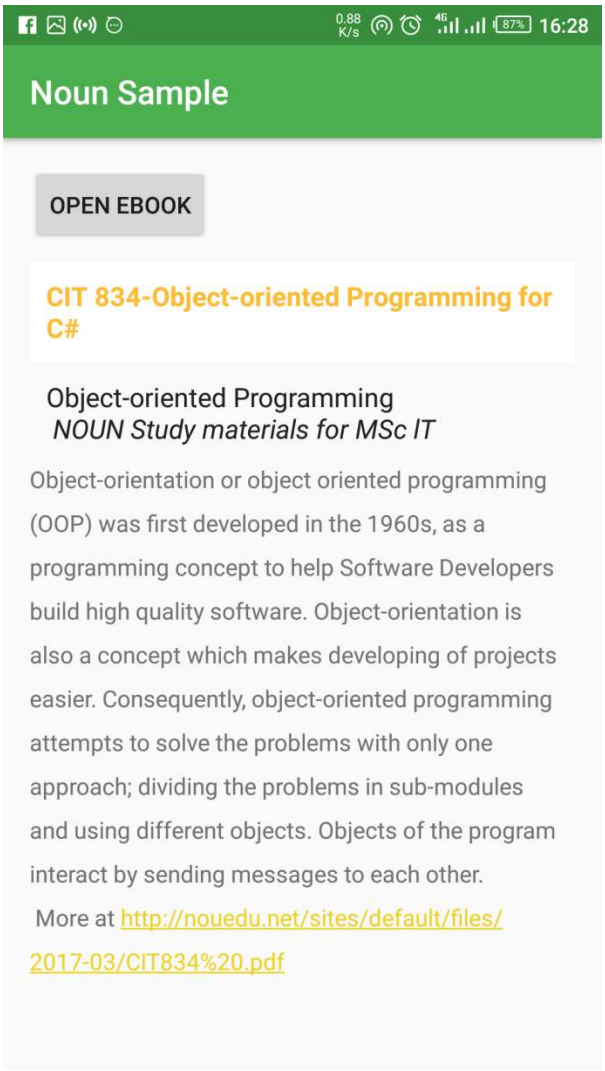

Figure 3.7 Object-Oriented Programming Using C# Screen

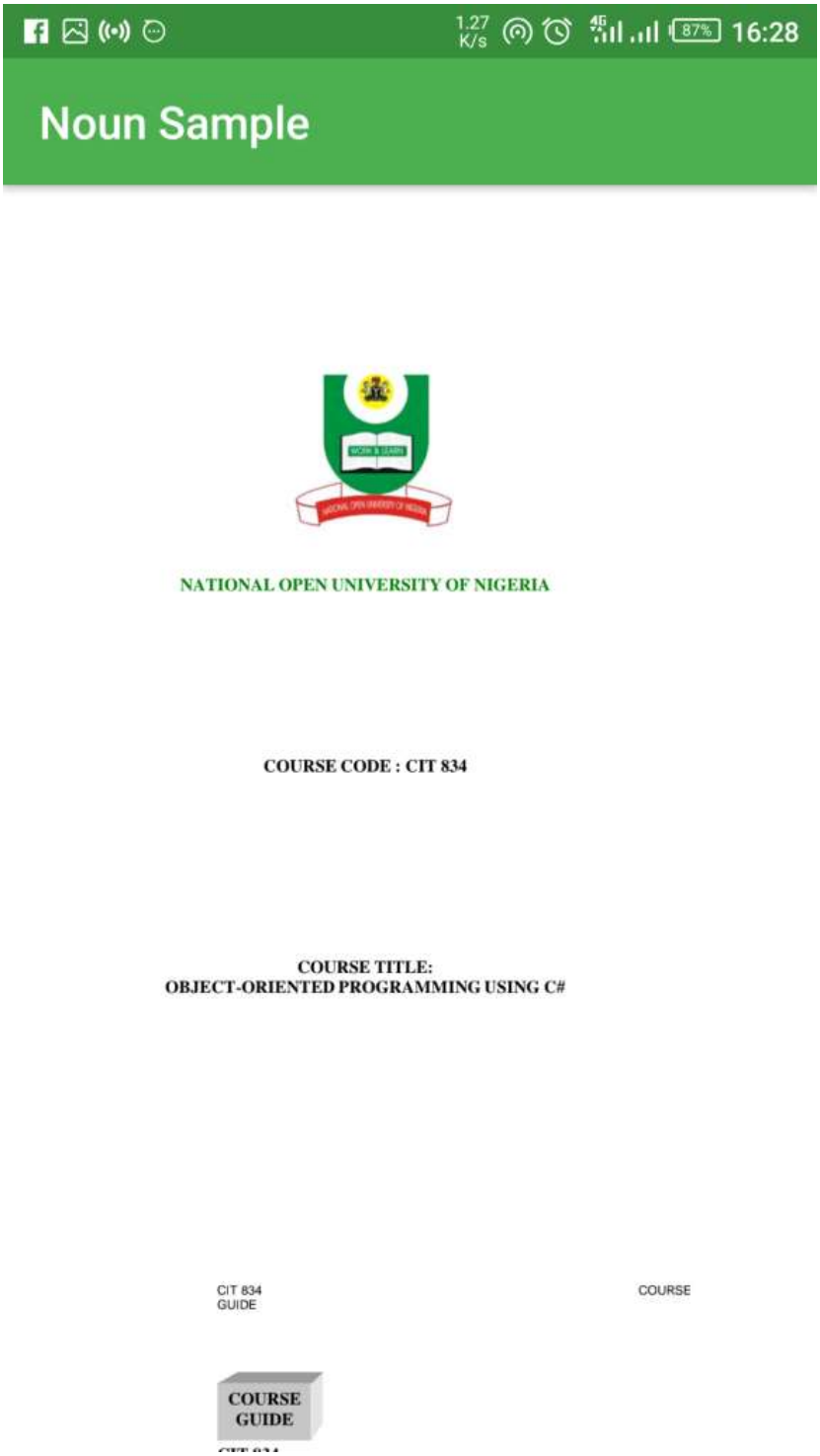

Figure 3.8 Object-Oriented Programming Using C# Ebook Screen

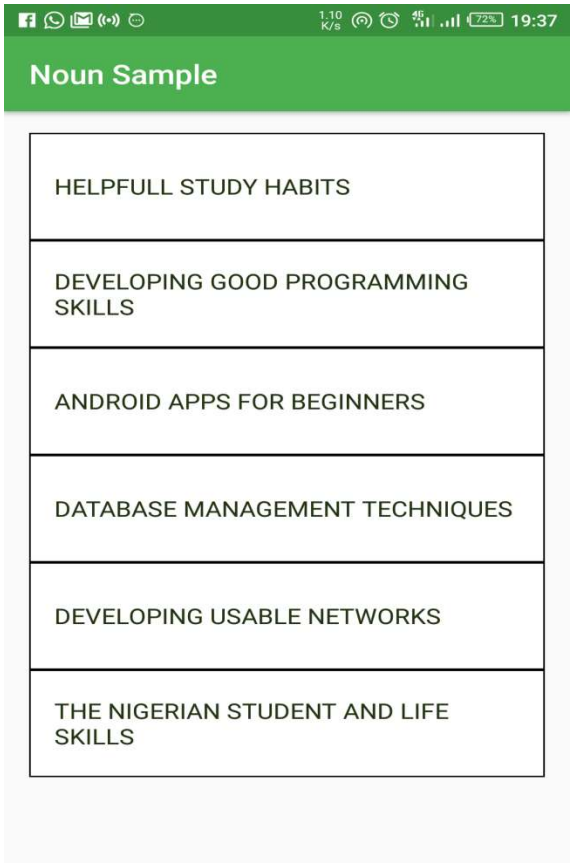

Figure 3.9 The *Extra Study List* Screen

Selecting any option in the Extra Study List will take the user to a new page with a brief synopsis of the course and a link to the online resource material in PDF format.

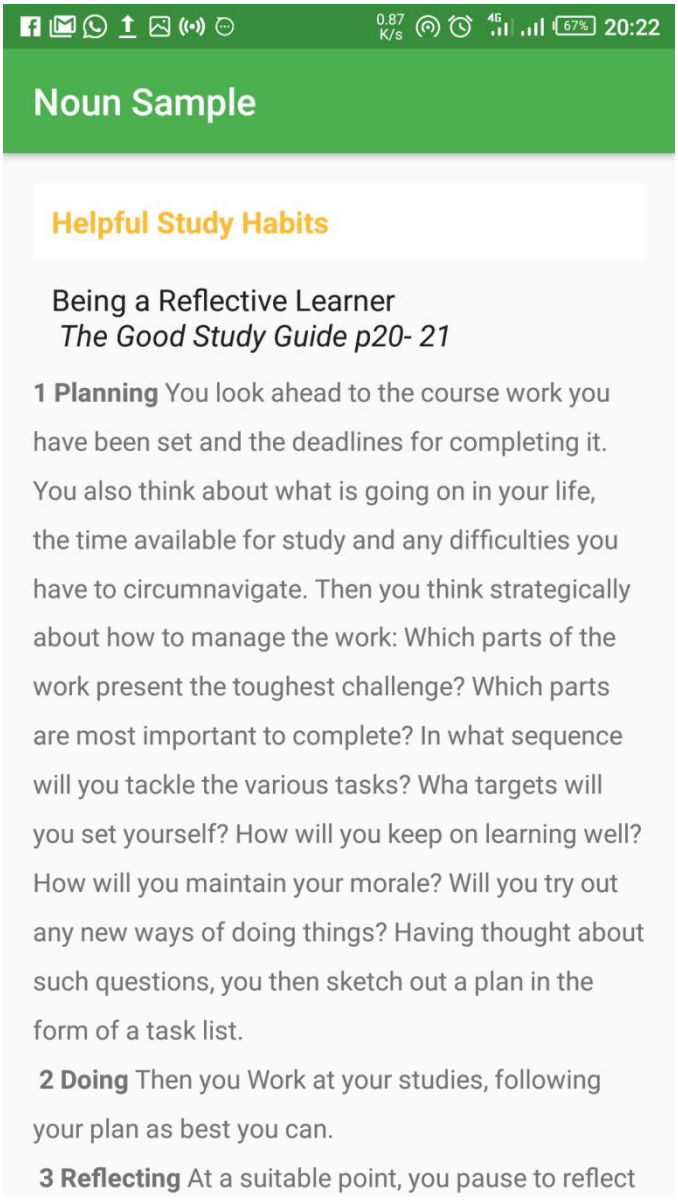

Figure 3.10 Developing Good Programming Skills Screen

It should be noted that the app and the NOUN learning content it is tied to are not restricted in their use. All course materials for NOUN courses are freely available on the Internet (www.nouedu.net). The app does not allow editing of the study materials, just viewing and referencing. For the purpose of this study it is enough that the user is able to access the material for studying. This is one of the aims of mobile learning. Considering that it is not very easy to type in notes even on a touch screen, it is likely users will want to have access to reading material and a few pointers, but not very long sessions of using the phone's keyboard. This simple design of the mobile app will hopefully create awareness of the possibilities of mobile learning for NOUN students. When considering all that would be required in downloading material, the advantage of the app is that once it is installed in the host device, study is easily carried out without use of internet data.

4. FINDINGS AND DISCUSSION

4.1 Results

The Android app developed was basically to make course content readily available at anytime and anywhere to students in the Faculty of Science studying for a Masters in Information Technology who have access to an Android powered mobile device. The preliminary study that had to be done in order to actually understand the different components involved in developing an app delayed the initial app development process. The app was successfully installed in an Infinix Note 4 Pro running Android 7.0 Nougat and worked as specified. One of the crucial areas was finding a way to write the code in the app to display a PDF file that would show the course contents without the need for a separate PDF Reader app. Several code snippets were tried but were unsuccessful. In some cases it would show the screen but not the page content.

This resulting app will require a measure of use to provide feedback from users as to the effectiveness and advantage of this form of mobile learning to NOUN students who already have access to mobile phones and want to take advantage of any downtime in their busy schedules. For the mobile student the mobile app is one sure way to continue the learning process when in transit and whereas there are those who would argue that work done on the move is not as satisfactory, the many online course providers who are themselves developing mobile apps for their course content show that this study format is warranted and has a place among the more established forms of academic study.

The use of mobile devices is clearly one of the ways that technology can serve the diligent student. The availability of study material not being dependent on location, time and internet connectivity with smart phones is part of the motivation that makes mobile applications an outstanding solution. There are immensely positive outcomes to having an app like the MSc IT NOUN app. Mobile devices provide a ready means to alternate study habits. Having an app like this one cuts through the time taken to browse, select and download the material. It makes it possible for other students to realize the benefits of mobile learning and for NOUN to key into this medium of academic information dissemination. Android devices worldwide have crossed the 1 billion mark since 2014 and this shows there are career opportunities for app developers.

5. CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Mobile devices, as has been discussed in this study, provide a ready means to encourage learning. They are widespread in many tertiary institutions and the number of users is growing astronomically. Internet access is ubiquitous but the cost of data is at times prohibitive. This research shows however that an offline-first app can solve this problem. The advantages are shown to be numerous. The opportunities for the implementation of this app in NOUN across the departments and faculties are exciting and the continued need for research into developing apps as learning tools at various levels of tertiary education is also apparent.

5.2 Recommendations

There is a need to greatly encourage the development and use of "native" technology. Only then can we truly move forward and develop as a country. There is a need to create opportunities and take them, not just wait for other nations to export ready-made apps and technology. The Nigerian education system clearly needs an overhaul that technology can readily and quickly help advance. Timely use of mobile devices to promote learning cannot be overemphasized. The researcher recommends that future studies can "port" the android app developed in this research project to the iOS or MS Windows platforms. Another recommended area of further research is the re-coding of the existing app for use with other NOUN departmental courseware to achieve a truly universal study app.

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