

Implementation Of Real-Time E-Learning Mobile Application In Tertiary Institutions-A Study Of Federal University Wukari, Nigeria.

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Abstract: This paper elucidates e-learning as a better teaching/learning technique than the traditional in-person classroom teaching/learning as experienced by students, it investigates the lapses of the traditional in-person classroom learning and rectifies them via the implementation of a real-time e-learning mobile application for tertiary institutions, using a case study of Federal University Wukari, Taraba State, Nigeria. The instigation of this study is pegged to the current trend in technological advancement where learning is no longer confined to classrooms, but rather blended learning has evolved as the better alternative and in optimal cases pure E-learning has been incorporated. Electronic learning is primarily facilitated using communications networks, the internet, computer gadgets - smartphones, and Personal Device Assistants (PDAs). This study further demonstrates the efficacy of E-learning as opposed to the conventional learning system of students of Federal University Wukari, particularly during the recent covid-19 pandemic. A Real-time e-learning mobile application was used to implement the learning model using Java programming language, Firebase Real-time database for creating database tables, authentication, and storages, android studio editor for the design of UI (user interface) and editing of source codes, and the Java Development Kit (JDK) for software compilation. The result/outcome achieved i.e an e-learning mobile app was demonstrated to overcome the challenges of traditional classroom learning such as distance, drudgery, errors in assessments, poor record management, and ultimately promoting quick and efficient dissemination of educational resources.

Keywords: Real-time, E-learning, Mobile Application, Personal Device Assistance, Java programming language, Educational resources, Java Development Kits.

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I. Introduction

E-Learning is an essential knowledge-gaining system that employs electronic technologies to access educational curricula outside of a conventional classroom. In most cases, it refers to a course, program or degree delivered completely online (ElearningNc, 2018). FAO-UN, (2011) emphasized that it encompasses the use of computer and internet technologies to convey a wide array of solutions to enable learning and improved performance. This viewpoint is equally supported by Horton (2005), who explained that e-learning adopts the use of digital technologies to create experiences that educate humans; E-learning uses electronic applications and processes to learn on a computer, but the recent evolution of E-Learning to mobile learning illustrates that it is the use of network technologies to create, foster, deliver, and facilitate learning at anytime, anywhere, and at userspace. In essence, E-learning is a computer-based educational tool or system that enables learners to gain knowledge where the instructor has the privilege to develop a course syllabus, objective, create learning exercises/quiz and examinations via the internet using electronic devices such as PC- Personal Computer, IDs- Internet Devices and PDAs- Personal Digital Assistants. Thus, for the system to be effective, the instructor should have the required assistance, necessary software, and technological devices needed to deliver online courses without hitches.

Jay (2015) outlined that the word E-learning was coined by Elliott Masie in 1999 at his TechLearn Conference at Disneyworld. However, the principles behind E-learning have been well documented throughout history, and there is evidence that suggests that early forms of e-learning existed as far back as the 19th century (Adit, 2020).

The practice enables the sharing of knowledge, experiences, and skills, conducting webinars- live online classes and interacting with researchers (Wang, 2006). This plethora system enables the incorporation of blended learning in the educational system which allows courses to be delivered completely offline and online.

In this 21st century, learners are well versed in the use of smart electronic devices, text messaging and the use of the internet, so participating in and running an online program has become a simple affair (E-Learning, 2014). Discussion boards, social media, and various other means of online communication allow learners to keep in touch and discuss relevant course-related matters, whilst providing for a sense of community.

In the fast-paced world of E-learning, the available technologies required to make a course exciting are always changing due to innovations in the Information Technology industry, and course content should be updated quickly to give students/employees the very latest information (Elearning, 2014). This is very important if the e-learning training is given recognition in an institution where keeping up-to-date on productiveness and developments is of utmost significance; the ultimate reasons why many nations are offering training via e-learning or virtual learning platforms for low costs effectiveness and the ability of students to carry out their tasks at their own convenient time and place.

Students in tertiary institutions of learning in Nigeria face a lot of setbacks due to the primitive system of learning in use which is instigated by limited teaching facilities, limited spaces to cope proportionately with the increasing population of potential students and above all, a limited number of good mentors in the owners of the institutions (Ademola et al, 2014). Consequently, these lapses have immensely contributed to putting the educational sector on a halt for almost a year in relation to the COVID-19 pandemic thereby further lagging; and in addition to the following factors: most Nigerian students don't have access to global information hence lack a huge knowledge of what is attainable in the society; the libraries are not adequately equipped with good books; lack of well-equipped classrooms to accommodate students and inadequate internet facilities; distance has constrained the aspiring students in Nigerian institutions; the inadequate level of computer literacy among teachers and students; poor awareness on the importance and usage of e-learning has posed a major setback to the adoption of eLearning in Nigerian tertiary institutions.

II. Real-Time Elearning

E-learning technology has become a new model and idea in tertiary institutions with a mission to serve as a development platform for the contemporary society based on knowledge which is in a different form; virtual learning, distance education, Computerized Electronic Learning-CEL, internet learning, mobile Learning and many others which incorporate virtual and digital collaboration (Olatokunbo, 2011). Jegede, (2004) mentioned that electronic learning deals with the presentation and dissemination of educational resources using the electronic media, while Georgiev et al (2004) averred that M-learning is a natural consequence of the E-learning evolution that intersects mobile computing.

eLearning, (2018) explained that E-Learning is not a course programme delivered via a DVD or CD-ROM, videotape, or over a cable network rather a real-time interactive forum in which communication is delivered live, thusly the instructors require a thorough knowledge of the main components of on-line teaching and learning but Khan (1997) identified the critical components of online education, content development, multimedia component, internet tools, computers storage device service providers, authoring programs, servers, browsers, and other applications.

E-learning is channeled through an online LMS- Learning Management System or video conference system which stimulates remote exchanges, collaboration, empowers the learner in every situation and is based on reliable technology and pedagogy which offers effective instructional methods, such as practicing with associated feedback, combining collaboration activities with self-paced study, personalizing learning paths based on learners' needs and using simulation and games. Stefan (2008) outlined E-Learning activities as Synchronous and Asynchronous; In a synchronous setting, events take place in real-time between two people that require both participants to be present like a chat conversation and audio/video conferencing. While in an asynchronous setting, events are time-independent e.g. a self-paced course is a perfect example of asynchronous e-learning because it takes place at any time just like in Email or discussion forums. He also mentioned that the tractability of Internet technology creates great areas around the concepts of synchronous and asynchronous electronic learning. For example, video and audio sessions can be recorded and made available for learners who cannot attend a live event.

E-learning content requires resources and models necessary for effective online learning which encompasses Interactive e-lessons, Modest Learning Resources, Electronic simulations, E-tutoring, e-coaching, e-mentoring, Collaborative learning, Online discussions, Collaboration, Virtual classroom.

III. Trending Elearning/Mobile Learning Platforms

There are a lot of E-learning platforms that have been developed and currently used in disseminating knowledge-based resources via which professional skills could be acquired without attending conventional classrooms. Examples of these platforms include edx (www.edx.org), udacity, udemy among others. The lack of incorporation and implementation of the electronic technique of learning in the Nigerian Tertiary Educational System has impaired the education advancement which constraint Learning to a four walls classroom, whereas this task focuses on developing a mobile phone android application which is flexible, convenient, and ameliorates the problems associated with conventional classroom learning.

IV. Lapses Of The Conventional Learning Platform In A Majority Of Nigerian Tertiary Institutions

Several challenges associated with the conventional in-person learning systems include:

- i. Participants/students must be physically present to undertake the learning activity i.e distance learning is hardly achievable
- ii. Drudgery in resource dissemination
- iii. errors in assessments,
- iv. poor record and attendance management.

In a majority of Nigerian Universities, there are typically inadequate lecture rooms made available for students to receive lectures and this always results in the clashing of lecture time because most and if not all of the teaching and learning activities take place in the lecture room, and also most information is passed across to students in the lecture room. Thusly, this:

- v. Places students in an inactive rather than an active role, which mitigates learning.
- vi. Encourages a one-way communication system which has a negative effect on the learning process.
- vii. Requires students and lecturers to be present at the lecture venue at the fixed lecture time. Failure will result in missing the authentic lecture delivered by the lecturer.

Hence, the adoption and incorporation of real-time E-learning by Nigeria's Tertiary institutions proffers the chance to facilitate exceptional performance and effective interaction in the learning community.

V. Methodology

The waterfall methodology was deemed best for developing the eLearning mobile application primarily because it properly captures the phases of requirements, design, implementation, testing, and deployment/maintenance which are essential in facilitating the ELearning application in this context; the waterfall model typically encompasses the following ordered stages as proffered by Nils et al (2020):

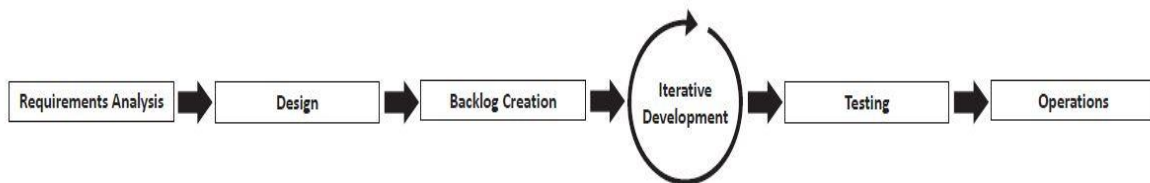


Diagram (1) The Waterfall Model. Source: (Nils et al, 2020).

In addition to the waterfall model, the Object-Oriented Design and Analysis Methodology- OODAM was used for the design and implementation of the eLearning model – grouping the categories, departments, and personnel as classes; and functionalities as methods of the classes with abstract classes and interfaces properly synchronized. The proposed system is structured such that there are virtual classrooms corresponding to each lecture, accessible to participating students and tutors/lectures; attendance is automatically carried out using the login logs; course contents are streamed live or uploaded as video clips, pdf, PowerPoint presentation, etc; the Real-Time Virtual-RTV classroom facilitates remote quizzes and assessments sessions. The system is equally flexible to be switched into a blended learning mode if desired. Additional features are incorporated into the system such as seamless access to learning resources, self-paced learning, automated assessment/evaluation, flexibility, portability, and convenience. The experimental data used for modeling and testing the system were collected using both primary and secondary sources including in-person dialogue with volunteer students, online resources, and repositories, and an evaluation of forums was conducted to obtain primary information about the knowledge gap. The structure and functionalities of the modeled system are shown by a series of steps/functions summarized and shown in the flowchart depicted below:

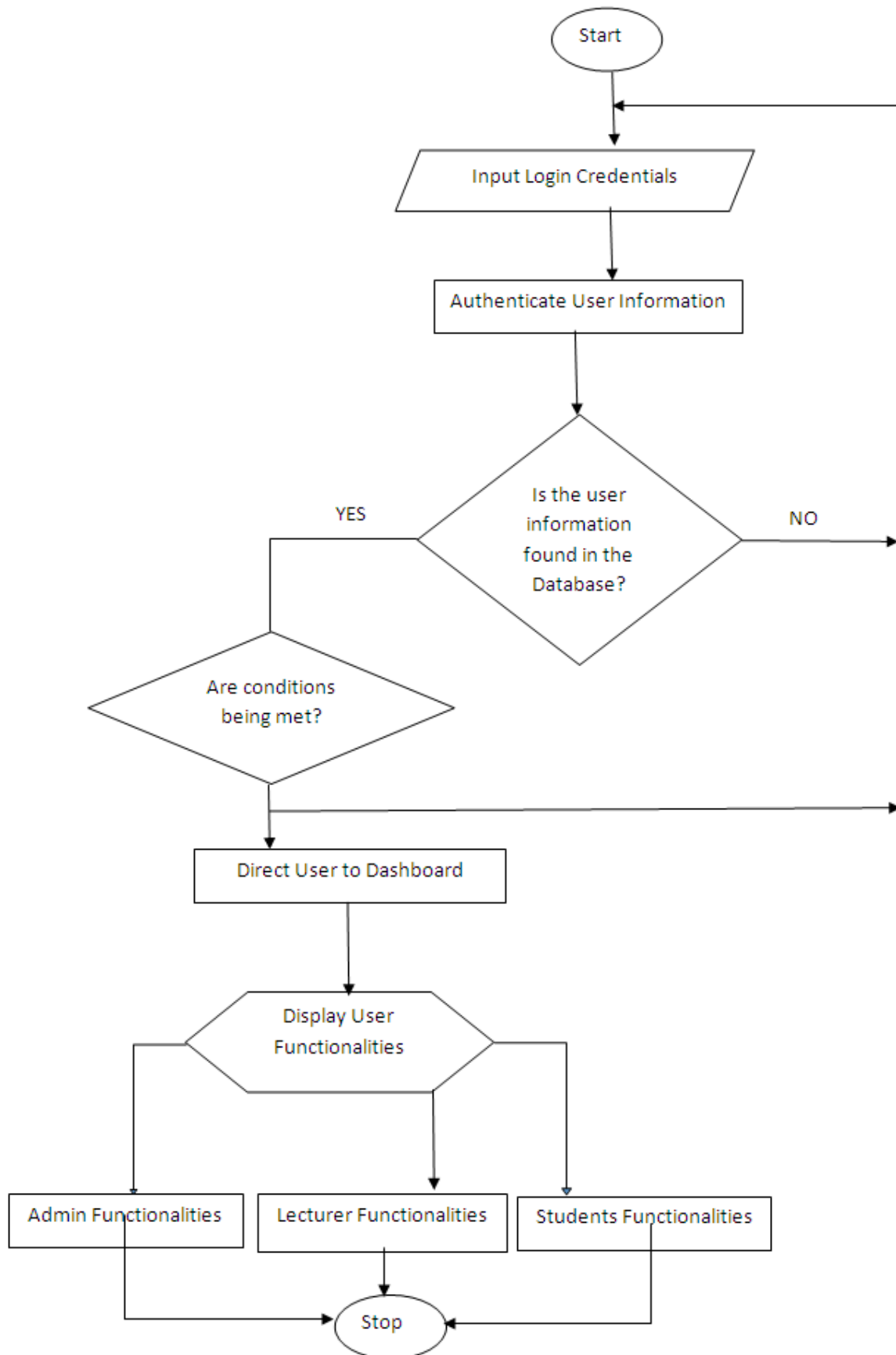


Diagram (2) Flow Chart for the system

Technological Tools Used And Activities

The tools used for developing the system include Firebase database server managed by Google for persistent data storage, Android-studio version 3.1.3 made by IntelliJ Idea (JETBRAIN) Company, Video IO Application Programming Interface (API- used for the app virtual environment module). The app contains classes that represent activities, and each class loads a layout using an XML file. Each XML file contains activities such as Login activity, Lecturers activity, Admin activity, Students activity, Course activity, Virtual learning activity, and a dashboard for each respective user's activity among other activities. The Program Module includes Users Login Module, Admin Module, Lecturer Module, and Student Module.

VI. Results And Discussion

After a careful illustration of the methodology and design of the system, it is therefore paramount to look into how the system works, that is, does it meet the purpose for which it has been created, and does it effectively solve the problem encountered by the conventional system. How do we ascertain this? It is purely by installing the program and testing to see how it works and its functionalities. The functioning application with description can be accessed via <https://github.com/Maihanks/E-LearningApplication>.

Some of the demos of the system in usage in real-time for various activities, functions, and operations are illustrated in the appendix section; these include:

Whenever the App is launched, the user is prompted with a flash screen which will last for ten (10) seconds, then the login page pops up as shown in appendix 2. The user is required to provide a registered and valid email address and password to have successful access, and only users who have been registered by the admin will have a successful authentication else an error message will be toasted to the device screen showing authentication failed.

These registration activities are found on the admin dashboard's menu named "Add Student", "Add Lecturer" and "Add Admin" respectively as can be seen in the appendix. Only the admins have the privilege to add or register new users on the e-Learning platform. All the form fields are required and must be validated for a successful registration.

This activity can only be displayed only if the user clicked on the "Forgot Password" button on the login activity. The forgot password activity is meant for users who might have forgotten their password and wish to retrieve or change to a new password.

On successful authentication, if the user's role corresponds to that of an Admin, the user would be redirected to the Admin's Dashboard. The admin has the privileges to carry out the following functionalities:

- i. View all the registered Lecturers and Students.
- ii. Delete malicious users or users who are not required to make use of the platform any longer.
- iii. Add new users such as Registering Students, Lecturers, and other admin users.
- iv. Updating and Deleting Notifications among others.

On successful authentication, if the user's role corresponds to that of a Lecturer, the user will be redirected to the Lecturer's home page. On the Lecturer's dashboard, the list of all courses added by the lecturer is displayed on the homepage, and on the drawer menu, the lecturer has the following functionalities as shown in the appendix:

- i. Deliver lecture in real-time to students via the virtual classrooms provided
- ii. Add, update, remove, course materials
- iii. Stream and download uploaded course videos
- iv. Create a discussion board for students to discuss issues pertaining to the course.
- v. Send Notification across to students on any update

On Successful login to the Student Dashboard, displayed on the home page are all the courses added by lecturers. The student will have access to all the resources uploaded to the platform, access to the RTV classrooms for their lectures, as well stream and download uploaded course videos and files and see all notifications posted on the platform. Added features are the ability to edit and update their profile details all found in the dashboard menu.

New System Requirements: The Hardware Requirements comprises Android mobile phone version 4.3 and above with at least 500MB RAM; 1GB hard disk; PC and 3G or WIFI internet device while Software Requirements comprises of; Installation of Android Studio version 3.0., Java SDK and JDK9; Connect to Firebase Database server; Install Android Emulator version 4.3 and above; Windows Operating System; 3G or WIFI internet Connection; Enhanced Keyboard; Add Vidyo IO SDK API and Token to the app library.

Program Development: The e-Learning Mobile app modules consist of several interacted activities with the possible transition between these activities. In the end, the various modules were integrated to perform the targeted task using an android Virtual Emulator as a simulator for testing the app at various levels of development using Java programming language SE 8 for the logic and control of the app.

In the process of developing this app, JAVA SE 8 and Firebase database server was used, the justification for the selection is that Java is Modular in nature; the Inclusion of Lambda Expression in Java SE 8 has reduced stress in brainstorming on how to articulate some functions; Graphical Oriented; Firebase query is excellent in handling database; It makes the program to be user friendly and fun when you are on the right path coding.

System Testing: The system was tested at different levels of the developmental process to ascertain the quality and workability of the developed application. Normally, the quality and workability of software are constrained to Correctness, Completeness, Usability, Capability, Compatibility, and Security as technical requirements designated under the ISO standard ISO 9126.

System Conversion: After the software development and testing stage, the app has to be deployed by converting the source code program to an android apk file which could be copied to any android phone of version 4.3 and above to be installed, and after the installation, app permission settings for CAMERA, SPEAKER, and INTERNET must be enabled for effective usage.

System Security: The system's security is guaranteed as the programming language used is JAVA Programming managed by Oracle Inc. as one of the highest-rated in terms of security. Also, a cloud database is used - Firebase Database managed by Google which has google analytics that reports to the owner on the app usage, number of users, and error reporting message while using the app.

Training: The simplicity of the app UI and consistency in the design and development of various activities and modules of the app has taken much of the training aspect of the app developed. The users are given orientation on how to navigate to various features and the importance of making judicious use of the app.

Documentation: The functioning application with description can be accessed via <https://github.com/Maihanks/E-LearningApplication>. Steps on how to make use of the Application include; copying or downloading the APK file; Installation of APK file on an Android phone version 4.4 and above; Navigate to Settings on the android device >>apps>>fuwElearning app>>enable all the permission settings; Click the app icon on the device home and Login with valid registered credentials.

OR

Get a complete computer system of Ram 4GB and above; Install Java JDK 9; Install Android Studio version 3.0.3 and also install SDK when installing the Android studio IDE; Import the project folder into the android studio; Connect your computer to the Internet; Synchronize the project to download all the dependencies; Connect the app ID to Firebase database server; Build the project; Install a virtual emulator; Run the project by choosing the virtual emulator; Wait until the build finished, APK installed and possibly launched; Then log in with valid registered credentials.

VII. Conclusion And Recommendation

E-learning has become an indispensable tool in thriving educational systems today, its relevance in this digital age cannot be overemphasized as it has been demonstrated in this study to serve as a suitable alternative to the in-person traditional learning model or can be integrated with the latter as blended learning facilitating efficiency, convenience, integrity in assessments, reliable record-keeping and high automation.

The final application developed employed Vidyo io API and web services to build an e-learning system, the package allows users to use the e-learning system via the Internet without imposing any restrictions on time and place and allows system developers to avoid incompatibility of data formats caused by different development platforms and programming languages, achieving the integration of heterogeneous software components. The System is integrated with wireless technology so that users would be able to access the e-learning app using their smart electronic devices, it does not only provide automation, it has also replaced the

traditional cabinet file storage method that deals with a lot of paperwork thereby, allowing ease in the storage, handling, and retrieval of data and dynamic delivery of lectures.

Although the developed model is efficiency-oriented and has optimal performance, some key components of the typical learning environment were not captured or perhaps were traded for efficacy. These components include:

- (a) The Elearning application facilitated a drastic drop in interpersonal relationships between participants(students/staff).
- (b) Students had challenges in comprehension and difficulty in effectively sharing their problems during the virtual delivery of practical lab sessions as opposed to the traditional in-person teaching.
- (c) Impersonations in assessments were observed to be carried out with little or no detection.
- (d) Modules that comprise major practical components could not be conveyed effectively due to the missing visceral interactions, access to tools and gadgets, and personal interaction during delivery.

The aforementioned lapses are the key challenges associated with the model developed in this study and hence recommended for researchers to tackle to improve this model(app) such that it serves as the ideal solution.

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APPENDIX 2: APP DISPLAY

Image A: The Login Activity

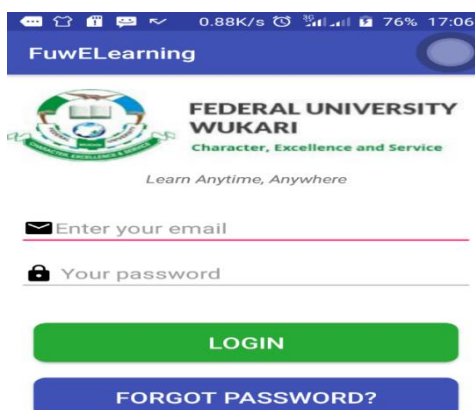


Image B: Student, Lecturer and Admin Registration Activities

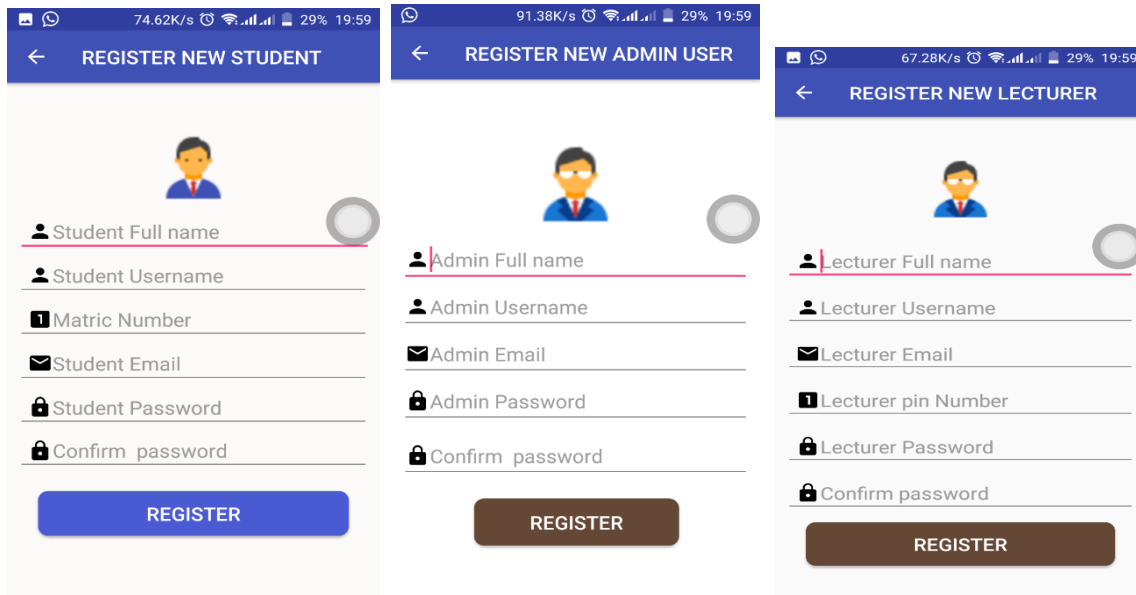


Image C:Forgotten Pasword Activity

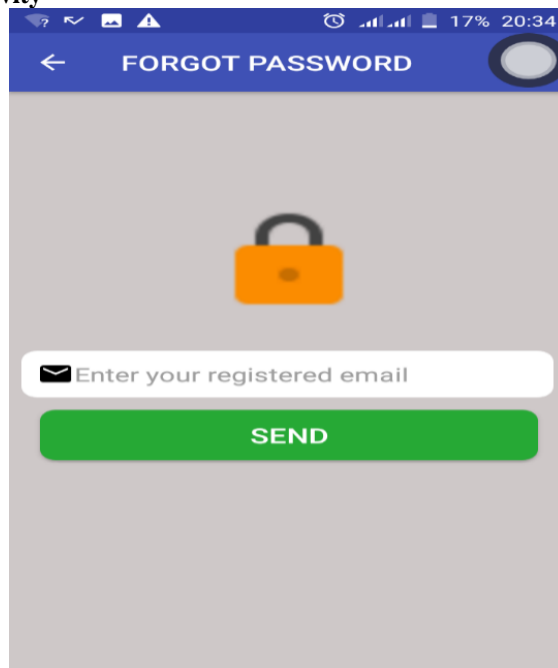


Image D: The Admin Dashboard Activity

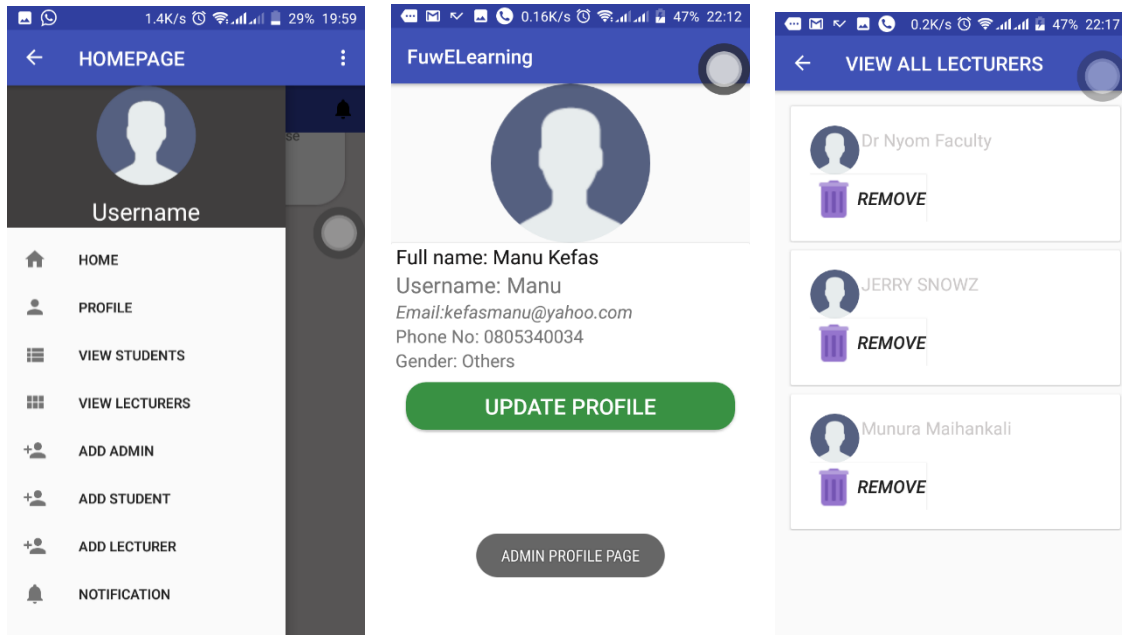
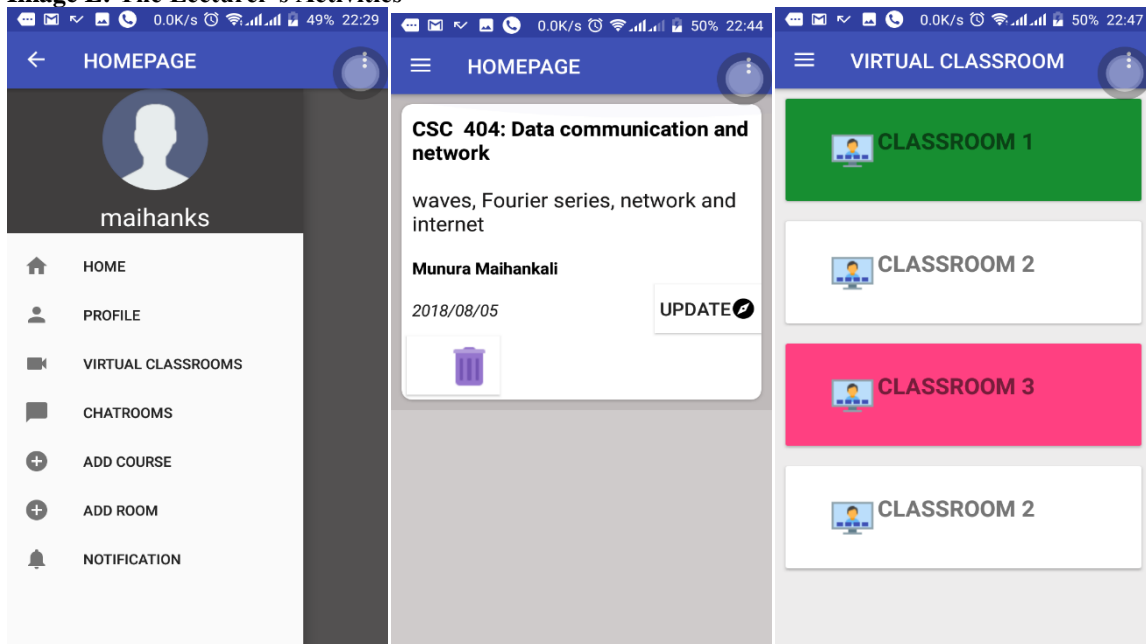
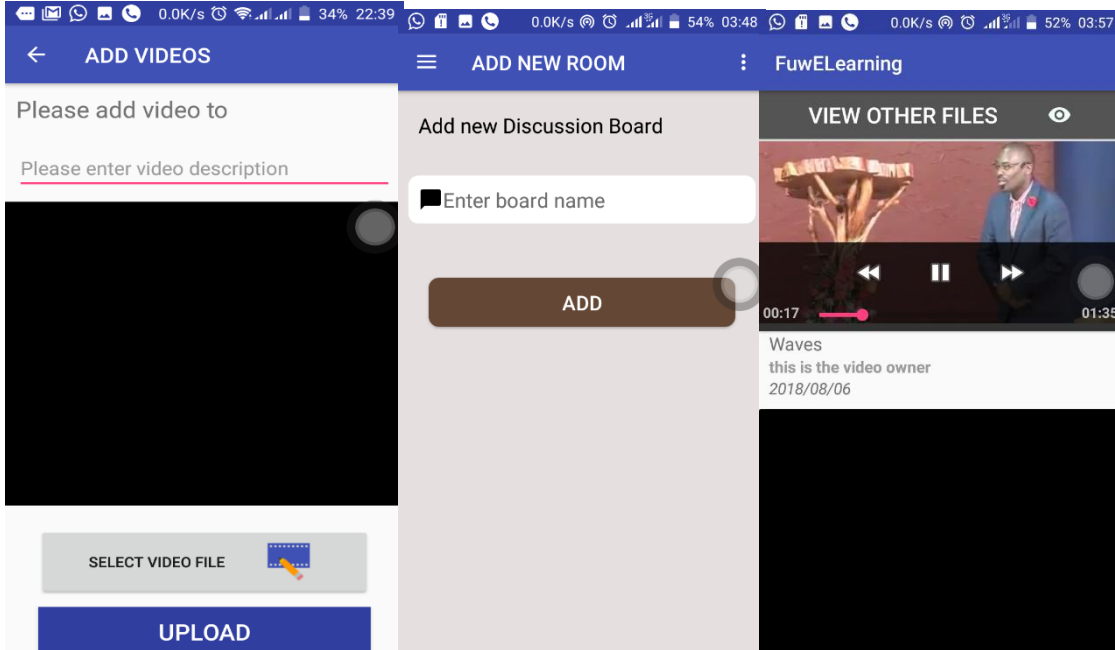


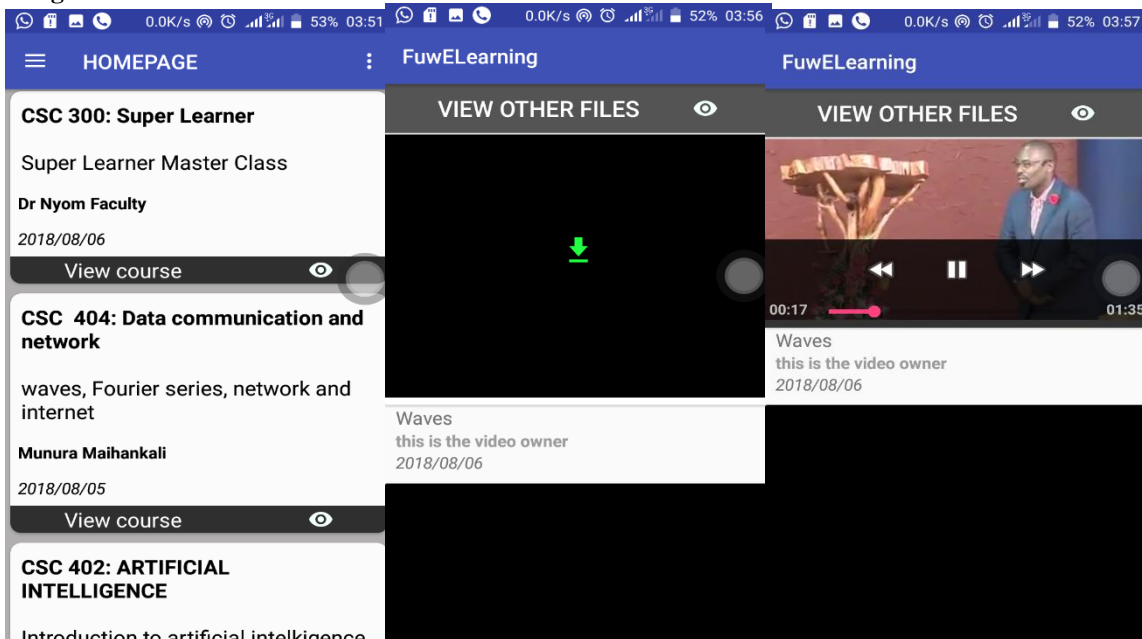
Image E: The Lecturer's Activities





Lecturers Activities

Image F: Student Activities



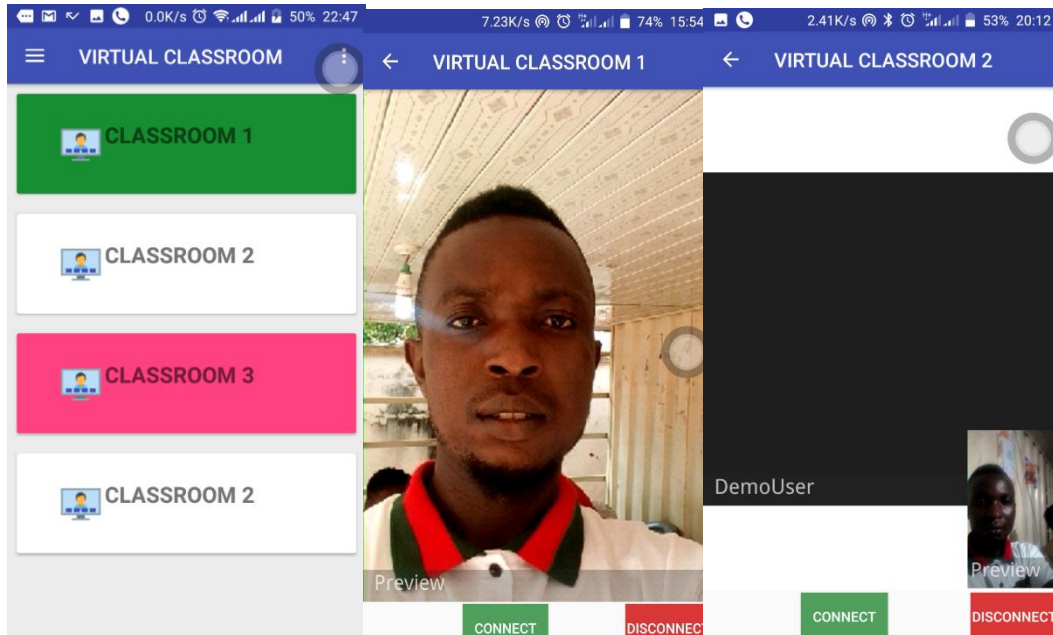
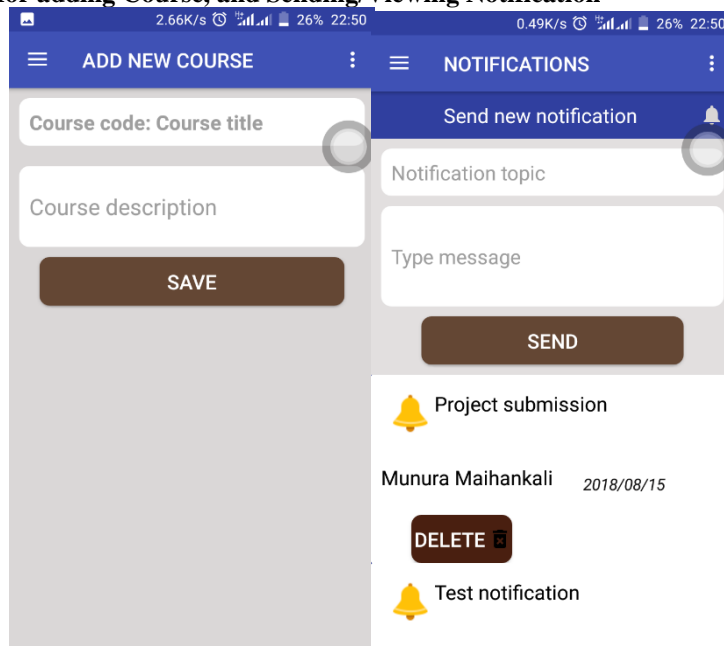


Image G: Activities for adding Course, and Sending/Viewing Notification



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