



A Notepad and Calculator for University Students

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Abstract. COVID-19 compelled many to innovate. This paper presents a notepad and a calculator app to enable students to do their work on a mobile device and submit their assignments using the mobile device. This means that they did not need computers at all. It also means that they did not need to be in a specific location. This app can be used in all disciplines to submit assignments for Engineering, Physical Sciences, Computer Sciences, Social Sciences, and many other fields. It can also be used to take notes in a meeting. Basic text-based information can be written and submitted using Email or WhatsApp or Telegram or any other file transfer capability on the mobile device. There are several benefits that can be derived from this solution. These benefits include no need for a computer or pen or paper or even a calculator. Nowadays, students spend the most part of their life on their phones and tablets. They may also be able to use this app while they are in transit in a taxi or bus or train. Once an assignment has been completed, it can be sent immediately. On the other side, the lecturer can receive a soft copy of the assignment on his or her device. He can mark it online and file it for future reference. There is no need for network availability. In this paper, different examples are explored in detail. Procedures and processes are also presented concisely in order to equip the user with the necessary skills to operate the App easily.

Keywords: App, Elec Eng, Calculator, Electrical Engineering, Software Design, Notepad, Assignment, Arithmetic, Complex Numbers, Android Device.

1 Introduction and Background

1.1 Introduction

The inspiration for the app was the quest to use technology in teaching and learning environments, especially during the COVID-19 season and going forward. Improving the quality of teaching lies in innovation and the continual generation of new ideas. Once these ideas have been identified they can be used to develop applications and systems which are beneficial to society, particularly students, lecturers, and generally ordinary users. In the context of this paper, one can ask questions such as:

1. Is it possible to isolate the lecturer and students by disallowing them from exchanging items such as test scripts, pens, phones, or any tangible items for that matter?

2. Is it possible to have a tool or application that is both a notepad and a calculator in one?
3. Is it possible to write an assignment or assessment and submit it to the lecturer without exchanging anything tangible?
4. Can such an application be used in various other fields including taking personal notes in meetings and elsewhere?
5. What about data?
6. What else can the app do?
7. Can a mobile device be used to achieve some of the above tasks?

This paper attempts to answer these questions. In the context of distance education, researchers [1] have attempted to understand how students use emerging mobile technologies to enhance and integrate them into the teaching and learning process. So, social media platforms add value and advantages to the way information is processed in the education environment. These advantages are envisaged to improve communication among lecturers and students. This may of course not always be the case. For instance, a one-to-many relationship form of communication between a single lecturer and many students may derail the purpose for which it was designed in the first place. Depending on the student discipline levels, disrespect, inundation of the lecturer by messages, and the channel can be rendered irrelevant if there are rules in place. But in general, [2] argues that these web-based applications improve communication.

To have a one-stop-shop tool, viz. a notepad, calculator, and file transfer device all in one is a major advantage of the app. This implies the lecturer and or the student does not need to have a pen, a paper, or a calculator as separate entities to work on an assignment but everything is organized as one in the app. This is a great convenience for both parties. In the first place, at his disposal, a tool to keep such a record elegantly and seamlessly.

Online learning seems like a new normal in the education space. When this becomes inevitable then writing and submitting assignments online will be the new normal in which case innovative ways of doing business will accelerate paving the way for a technology-savvy society. Researchers [3] in their article titled "Is There an App for That", seem to have captivated the audience with such a title. This is a very good question that is also posed as well as addressed in this paper.

Since this is a notepad, its use is not limited to a specific field like science and engineering but can also include other areas like social sciences and management sciences.

Due to their affordability and technological capabilities, mobile devices, such as laptops, tablets, and smartphones, are becoming more and more common on college campuses [1] [2] [3]. Teachers are aware of how this has changed how students behave and interact with their surroundings. As a result, higher education undergoes a transition that gives rise to the "m-learning" idea, which is a teaching and learning strategy based on the mobility of students. This makes it easier to create and use active teaching methods in the classroom. At many levels of higher education, utilizing mobile services in the form of mobile learning is an innovative method [4]. Elec Eng is an application that could be used as a writing pad as well as a calculator for engi-

neering assignments, and exams. It features fundamental tools including phasors, the engineering pad, and complex number calculation capabilities. The growing use of mobile technology in higher education suggests the future of the classroom, including learning activities as well as research. Elec Eng allows the hybrid model of teaching where some lessons could be taught in person and assignments are completed online, hence educational apps are helpful in making learning easy, fun, and convenient and keeping students engaged [5]. This app will enable the students to write assignments or practical reports, and calculations included in reports, and the students' work can be shared through social media (WhatsApp), messages, and emails. Moreover, the lecturer would be able to create digital sets of study guides and assignments as paper notes are becoming more and more obsolete in the digital world.

1.2 Background

The app is developed using the Android Programming environment. There are various platforms that can be used such as Python, Java Script, and many others. The app is deployable in Google Play Store. However other platforms like App Store could host such an app. Simple notes, basic arithmetic, and more advanced calculations can be performed in the application. The computational functionality is available from the toolboxes and allows basic arithmetic to complex number calculations.

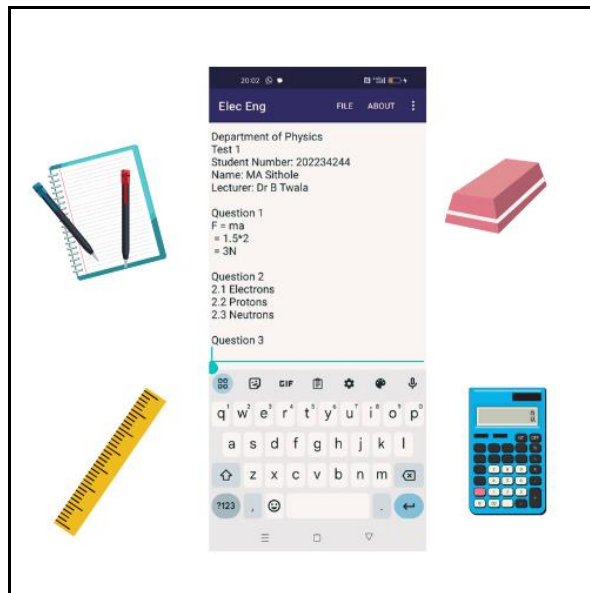


Fig. 1. A notepad and Calculator App – A One-Stop-Shop App.

Fig. 1 shows the overall concept of a one-stop-shop app that replaces paper, pens and pencils, erasers, and calculators. The app can be connected to the internet only during the submission of an assignment therefore there is minimal usage of data.

2 Literature Review

2.1 Benefits of Using Apps in Teaching and Learning

In order to improve the delivery of instruction, most of the apps are used to record video and camera footage of the student's collaborative work. In general, it is assumed that in lessons where students use iPads, they will be more motivated to participate. Students learning and performance would be improved if a classroom set of iPad2 devices were provided, seven out of eight respondents agreed or expressed their strong opinion [6] [7]. Educational Apps are making things easier for both students and lecturers. The drudgery of lecturers marking a huge bunch of papers in front of them had to be put to an end, simply by having Apps in the place of teaching & learning. The life of everyone related to the ecosystem is now simple and functional, more efficient. Apps and websites have been created to help reduce the gap between students and educators.

The study goal was to evaluate the relationships between various IQ indexes and levels and various elements of school success. When high school performance in language and math were analyzed simultaneously in a multivariate analysis, the major conclusion revealed that high IQ level in the "general index of intelligence" was substantially associated with high school success in language and arithmetic [8]. With every class, job, club, project, or other obligation to add to a to-do list as a college student, keeping notes and self-organization might grow harder. Those disorganized Google documents, that stack of sticky notes on one's desk. Disorganized notebooks may not be enough to help one keep track of everything with all the things that have to be remembered to do and all the classes that one should study and prepare for.

There are more options for taking notes than just using a word-processing app or paper notebooks.

2.2 Related Studies About Apps

Chergui et al. developed a generic classification of educational mobile uses using learning strategies, considering learners' and teachers' activities. They validated their findings by analyzing popular mobile apps. The study aims to provide educators and learning designers with a tool for designing functional mobile learning environments and social mobile environments for university scientific learning modules [9]. A series of well-known mobile procedures for secondary students have been presented in order to promote their learning and skills. In addition, its role has been examined as regards secondary education students who suffer from learning and other difficulties.

Faizi et al [10] investigated the benefits of using social media in education, social media could improve communication not only between students and teachers but also

among students. The case study of the research was social media as communication channels, engagement tools [11] as well as collaborative platforms [12]. The results revealed that social media effectively increases the students' engagement, by sharing their knowledge/ideas on either Facebook, Twitter, or YouTube. However, using online social tools could enhance the learning experience, hence it was recommended in the study that educators should use online social communities whether working in fully online, merged, or face-to-face learning contexts [13].

Multiple Apps were designed, to promote engagement, interaction, and participation in the core academic areas as well as participation in common school areas [14], Apps could be categorized as free, fee-based, or subscription-based using smartphone, iPod Touch, and iPad to serve as a categorical system.

Khaddage et al [20] investigated the significant elements that mobile phone Apps may contribute to the learning environment, as well as how these aspects are critical to education. Teachers' roles in today's learning environment were also explored. A few questions were asked to see if the instructors were willing to use these Apps in their everyday professional job. Are they ready to accept them? The re-blending of educational Apps was described, as well as how this may support the learning community's rising mobile learning process and delivery demands. This might create a well-balanced learning environment that meets the demands of today's digital learners and promotes collaborative, portable, flexible, and accessible learning experiences that could be integrated with the globe internationally [21], beyond the traditional classroom. The investigation on student attitudes was done towards various new forms of technology (Apps), the advantages of using Google Apps [22] in learning as well as their behaviors while collaborating on Google Apps, the aim was to expose the students to a new way of learning in a new form of technology [23].

Goh [24] concentrated on creating m-learning modules with the use of a basic case study. According to him, traditional e-learning systems are designed for PC-based online access and have not been adapted to work with mobile devices such as Personal Digital Assistants (PDAs). Furthermore, he emphasized in his presentation that the material created in many of these systems is not standardized. In this work, an architecture and prototype of a mobile learning system were discussed. The system was run using device and user profile adaptation. The system was compatible with both PC and mobile platforms. In addition, the study detailed the underlying multidimensional adaptation architecture that was utilized to create the prototype mobile learning system discussed in this article. As a result, mobile learning may be described as an interaction between internet-based learning and mobile computing technology. The usage of it could boost students' motivation and interest in the topic. Despite the many apps that have been created, Apps assisting with the concepts such as percentages, fractions, and algebra needed to be developed hence, this study aimed to develop the use of the Elec Eng App which could assist in assignment writing, report writing as well as submitting them to Lecturer anytime anywhere.

2.3 Challenges of Using Apps

Some of the challenges of developing a mobile app depend on compatibility, to ensure that the app can work well on all devices. In some instances, some devices might have compatibility issues with respect to screen sizes. However, the Elec Eng app seems to work flawlessly, and it is compatible with various devices namely smartphones, tablets, and other devices. This gives it a great look and feel on as many screens as possible.

Secondly, for the app to be discoverable is one of the challenges, most people are familiar with Play Store App as it is easy for them to download the apps, hence the Elec Eng app can only be downloaded from Play Store, which gives it the chance to be discoverable.

Another challenge might be network connectivity, as some of the students may be staying in rural areas where there is a shortage of electricity, and affordability of data or airtime to log in during the submission, therefore, in future the studies need to be conducted to address these challenges.

2.4 Motivation for Using Apps

The benefits of taking notes using apps range from the elimination of paper pens, rubbers, and rulers. So, there is a cost-saving because an app aggregates all the different tools into one tool on one device. The principle of reuse is invoked since the device can be used repeatedly to do assignments. Another advantage is that of file transfer. This means that the files can be moved back and forth between users, viz. students, and lecturers as well as among students themselves.

In a world that is becoming more digital, embracing technology is not an option but the only option. The fourth industrial revolution dictates a drastic change in the mindsets and those that do not want to be left behind need to quickly adjust and adapt to the emerging technologies of artificial intelligence and machine learning. These technologies bring many other conveniences.

3 Methodology and Design

3.1 Software Development Life Cycle (SDLC) and Methodologies

When designing software, there are crucial steps that are followed. This process is called a Software Development Life Cycle (SDLC). It consists of six development stages. These stages are Planning, Requirement Analysis, Designing, Implementation, Testing, Deployment and Maintenance. This cycle can go through several iterations. Large software systems require teams to work on various aspects of the software system [29]. Team members are assigned their responsibilities under the leadership of team leaders and project managers. Various tools are used during software development and a use case diagram is one of them.

3.2 A Use Case Diagram

A Use Case Diagram is a graphical representation of what a system must do. It models the functions of a system using actors and cases. Actors are people or entities that operate under defined rules and use cases are actions, services, and functions performed by actors. Fig 2 below shows a Use Case Diagram for the Elec Eng App.

The actors in this system are the student and the lecturer. The student is a primary actor in the sense that he uses the system to type and submit assignments as required by the lecturer. The lecturer may type and submit assignments that he may require the student to do and submit via the system. The actor can also be a student who wishes to take notes in a lecture room, or it can be an ordinary person who wishes to take notes in any meeting or gathering.

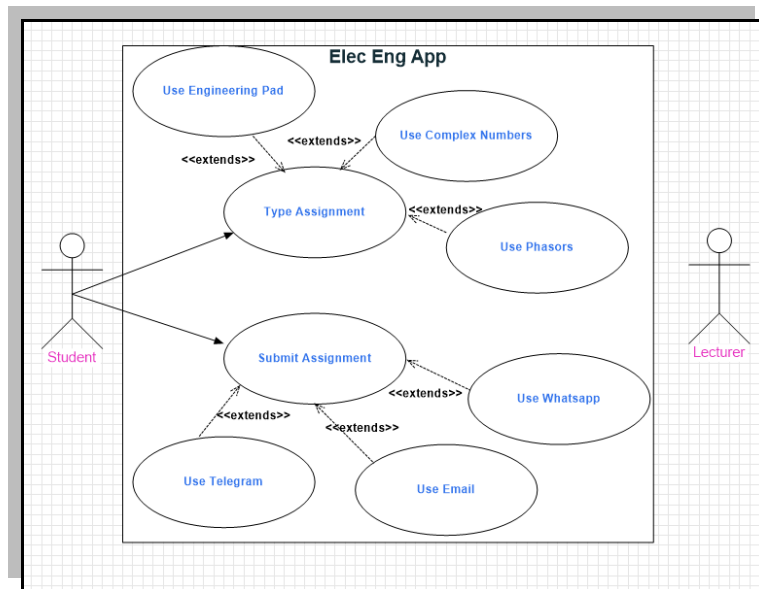


Fig. 2. Use Case Diagram – Elec Eng App.

There are basically two use cases namely, Type Assignment and Submit Assignment which themselves have included use cases. The basic app use cases include use cases that assist the student to type the assignment such as using an engineering pad, using complex numbers, and using phasors. The other basic use case is to submit assignments which may use various transfer protocols such as using WhatsApp, email, and telegram.

3.3 User Participation in the SDLC

It is clear from the use case diagram that during the SDLC, users can also participate in making their contributions. Users can include the owners of the software project

and their employees that may be directly involved in using the software. Their participation can be at the feasibility study stage where the information about the system required is carried out. Their participation can also be apparent during the deployment and maintenance stages where they can verify whether the software application does what it was designed to do. Their feedback can be invaluable in this regard.

4 Results and Discussion

4.1 Installation of the App

The App can be downloaded from Google Play Store and installed on any Android device. It can be either a smartphone or a tablet. Once it is installed the icon shown in Fig. 4 (a) will appear on the device screen.

Clicking on the icon opens an empty screen as shown in Fig 4 (b). The app name “Elec Eng” is shown in the left-hand corner of the screen and the menu bar is shown on the top right corner of the screen. The “File” menu shows some information about the app and the “About” menu shows something about the designers’ information.

The three dots on the far right are the extension of the menu bar. The only difference is that the menu is not visible but if one clicks on the three dots, more options are shown. These options are tools for computations used especially for engineering and scientific calculations.

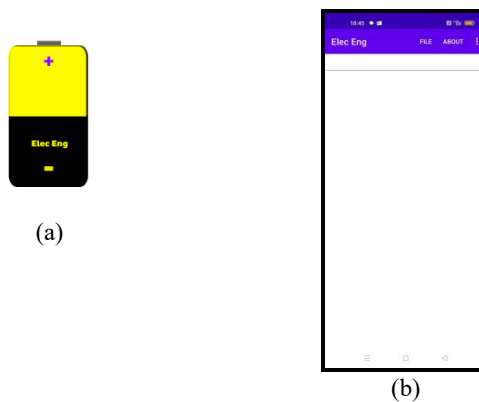


Fig. 3. App Icon (a) and Empty Screen for Typing an Assignment (b)

The app has other engineering and scientific functionalities which are encapsulated inside three dots on the top right corner.

4.2 App Functionality

If the three dots are clicked a dropdown list will show up with three menu items: ‘Engineering Keypad’, ‘Complex Numbers’, ‘And phasors. The engineering keypad provides functionality for performing scientific and engineering calculations. The complex number menu option provides a capability for performing complex number calculations and the phasor option provides is useful when dealing with phasors.

4.3 Example Assignments

As indicated in the previous discussion, the assignments are text-based. So, the assignments can be in any field, like engineering, computer science, social sciences, human sciences and many other fields.

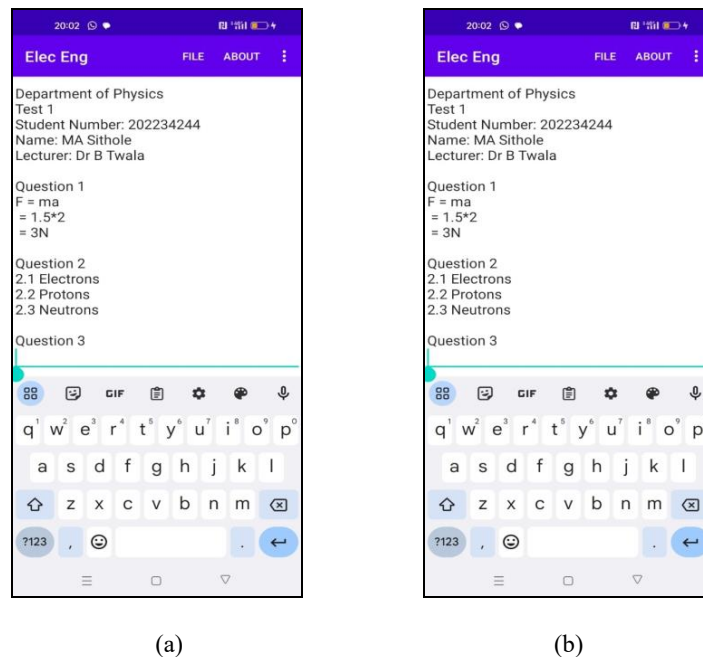


Fig. 4. Examples of Assignments Composed Using the App

Fig. 4 demonstrates that the assignments can be in any field if it is text-based. The student can type his or her assignment on his mobile device at any time and in any location even when he is in transit in taxis and buses for instance. This is possible due to the portability of mobile devices.

4.4 Assignment Submission Procedure

Once typing the assignment has been completed it can be submitted to the lecturer via the platform of choice. This is the only time the student requires to be connected to the internet. So, the assignment can be written while the device is offline and only make a connection as soon as the assignment is ready for submission.

Fig. 5 (a) below shows the screen configuration during the submission process. To get to this screen, the user presses and holds the finger on the text. The app will generate several options like 'Define', 'Cut', 'Copy', 'Share' and other options that are hidden within the three vertical dots on the right. The user should select 'Select All' in the option menu to select all the text.

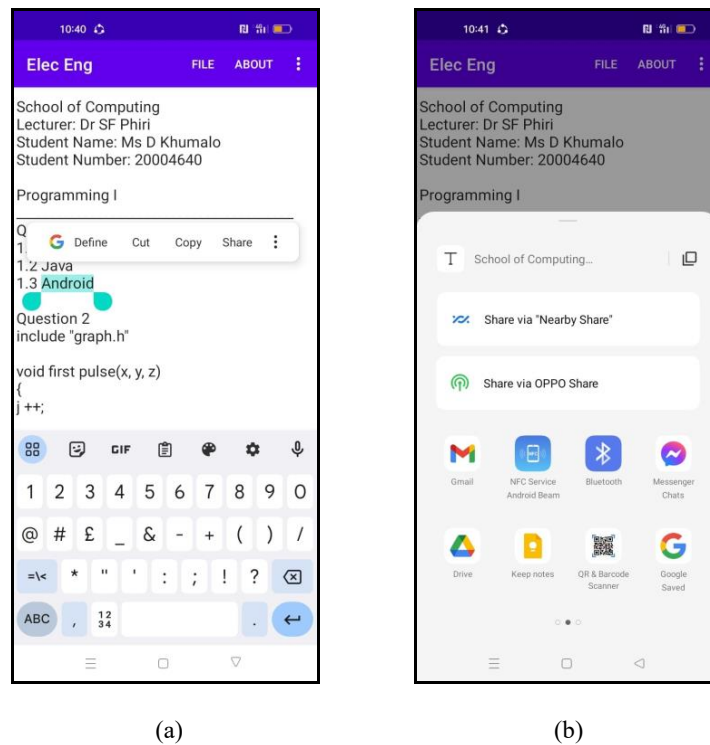


Fig. 5. Assignment Submission Screens

After the user has selected all the text then he can choose an option from the option menu to submit the assignment. Any platform of choice can be used as shown in Fig. 5(b). Platforms like email, SMSs, messenger, WhatsApp, Bluetooth, drive, etc. are made available to the user or student. Obviously, the desired platform should be in-

stalled in the device in order to make use of it to send the assignment. If email is used, for example, then the lecturer receives the email with the assignment in the email that he provided to the students.

5 Recommendations and Conclusion

5.1 Recommendations

The app is a functional creation with the capability of helping students to create their assignments and submit them via file transfer protocols. This eliminates the need for pens, paper and other accessories. However, there are some shortcomings such as drawing capability. For instance, in physics, a student may be required to draw vectors. Something like a canvas to draw images is required. In future designs, it will be necessary to add these features. Students will need to ensure that their assignments are directed accordingly using the appreciative file transfer protocol to ascertain secure communication between the student and the lecturer. Further investigation is required in order to enable the student to compile his assignment over a period of time for instance typing the assignment in chunks in a period of say two days. The need to create passwords, to assure the safety of student work, is recommended in future design. It also recommended making a counter app so that the student assignment is protected and not copied from one's work as well as designing a student signature or watermark that will detect that the learner is responsible for that assignment. The actors in this system are the student and the lecturer. The student is the primary actor as typing the assignment and submitting it to the secondary actor (lecturer).

5.2 Conclusion

In conclusion, this paper has presented an app that is a notepad and calculator in one. The design of the app was accomplished by following the software engineering design principle of the Software Design Life Cycle (SDLC). The installation and features of the app were discussed. The functionality was also discussed, and examples were shown to demonstrate its use. The app will benefit the students and lecturers with assignments and practical reports as well as with writing exams and tests. Recommendations on how it could be improved were presented with a summary of the rest of the paper.

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