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MOBILE-BASED PYTHON TUTOR FOR HIGH SCHOOL STUDENTS

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Abstract— The main focus of this study is on novice programming in Senior High Schools. The challenges and limitations experienced by novices in High Schools are identified, including issues related to basic program design, writing of program, and access to programming tools. By reviewing literature and existing software, some working methodologies were identified and adopted. A cross-hybrid mobile application was developed to mitigate the limitations and challenges that High School novice programmers do encounter. With just a mobile device, a high school student can learn how to program, plan or design code, write codes, run and debug codes.

Keywords— Programming, Python, mobile application, program design, mobile devices

I. INTRODUCTION

As technology keeps growing and expanding, mobile users need to benefit from these growth and development. The growth rate of mobile computing cannot be clearly stated as lots of developers are working every day to enhance and increase that power. On the other hand, there is a massive need of more programmers across the whole globe. Traditionally, learning of programming is only open for users of PC, Apple, etc. That means, if you cannot afford a PC or do not have access to one you cannot learn programming. But leveraging the advancement of mobile computing, learning of programming can be done on mobile devices, making the learning process affordable and accessible to every smartphone user.

Mobile technologies just like the web, can be used as a strong tool in reaching High School Students, The challenges of students not having access to PCs can be substituted with mobile technology (Smart Phones and Tablet). The researcher choose mobile platform reason been that, at minimum, a child have access to one or two mobile device(s) that the child could use in learning.

With the advancement of mobile computing technologies, it is now possible for one to write codes and run them in a mobile device just like on PCs. Though this kind of mobile application is limited to some functionality, users have the privilege to write code, run code, and save their code anywhere at any time without the need to carry a PC around.

Ubiquitous mobile learning has been made possible by the increasing availability and accessibility of mobile computing technologies and mobile software applications. The major affordances of mobile computing technologies for learning include mobility (the small sizes of the devices, making them highly portable); computing power (which enables users to complete tasks on small devices as effectively as on larger and less portable devices); and connectivity (always-on and stable Internet connectivity with high bandwidth, which allows for instant access to large amounts of information and real-time communication

regardless of location) [1]. These affordances lead to tremendous potential for innovative uses of mobile technologies in education. The innovation in mobile apps has raised interests among educators because it facilitates teaching and learning [2]. However, relevant and appropriate apps are not always available. These reasons lead to the needs and benefits for creating mobile apps for teaching and learning. In addition, empowering educators with mobile apps for teaching their students and also easing the learning stress for the students [2].

From the late 90's to this present time, the world has experienced a massive growth in technology. As Information Technology is making a great influence in the society, the demand for programmers world-wide is increasing. However, learning programming can be difficult and frustrating. This is either from deciding which language to learn first or getting the necessary resources needed or even understanding the language itself.

This work aims at developing a mobile application that will help educators in teaching programming and the learners also in learning the basics of programming. Despite the popularity of languages such as Java, C and C++, there has been much debate about the suitability of these languages for education, especially when introducing programming to a novice. This is because these languages have not been designed specifically for educational purposes [3]. Therefore this work uses the Python language which is more in this project which has been specifically designed for educational purpose [4].

II. LITERATURE REVIEW

Coding the syntax of today's popular programming languages can be frustrating for students who are new to programming. Aside from the art of coding, setting up the environment can somehow be challenging too. In the case of developing and undeveloped countries, a lot of High School Students do not have access to desktop/laptop computers. Because of this limitation, High School Students have limited access to this kind of knowledge.

The biggest problem of novice programmers does not seem to be the understanding of basic concepts but rather learning to apply them [5]. Students and teachers agreed that the practical learning situation were the most useful. The more practical and concrete the learning situation and materials are, the more learning take place. Learning by doing should be a part of the studies all the time.

It is also observed that programming syntax is considered "rigid" because it follows rigid rules that do not allow for maneuver and deviation. The rigidity is clearly highlighted when using characters like colon, semi-colon, curly brackets, and other characters when coding programs [6]. If these rules are not followed correctly, the compilers give syntax errors. To an inexperienced person these error messages may not appear helpful. Overall, this frustrates the coder, and for the students it may result in them dropping the program all together.

In a related study [5], languages like C++ and Java were used. However, those languages are not considered suitable for educational purposes [3]. Languages like C++ have a lot of complications even to an expert programmer. The use of pointers and other features of these languages if not taught well, can make those novices to drop the learning process. Also, the Object Oriented concept of programming used in Java and other syntax rules, may be hard to explain to those novice coders.

A common approach in programming education is to first teach the basics of a programming language, and then to the advance concept of the language. It is noted that novices spend little time in planning and testing code, and when necessary, try to correct their programs with small local fixes instead of more thoroughly reformulating programs [7]. Also the knowledge of novices tends to be context specific rather than general, and they also often fail to apply correctly the knowledge they have obtained.

Systems that aid teaching and learning of programming have been developed for users of all age ranges from 2-3 years and above. Each system has its own unique platform which could be either web-base, desktop application or new platforms like mobile application, which are all aimed at mitigating the difficulties involved in learning programming languages.

III. METHODOLOGY

This research tends to develop a cross-platform mobile application, which teaches high school students and any other novice programming using Python. The system/application incorporates a tutorial and coding platform, where students can take a class and afterward try the coding exercises. The lesson plan of the proposed solution adopt "Learning by Example" method of teaching, where students get to study already written programs and then try writing other similar programs from the concepts they have learned. The proposed system is to mimic the best approach used in the traditional way of teaching programming to novices. Therefore, the proposed system would be in-cooperating the following features:

Coding Environment: Students should be able to write their own code and run it, debug it, and also try running the codes from the tutorial they've learned.

Tutorial Platform: Students should be able to learn the basics of programming, and also, by going through the lesson plan, the students should be able to learn to write their code by themselves or with little help.

Familiar Activities: The system should use activities that the students are familiar with or can relate with in the learning process. It can be from their school activities, fun time activities etc.

A. *The Proposed System Workflow*

The proposed system process flow is represented in Fig. 1, while Fig. 2 represents the interpreter that users will be using for coding.

Upon lunching the application and reading the introductory and overview page, the user will be provided with options to choose the kind of program category he/she want to learn from. Whichever category the user chooses, the end result will always be the same i.e. learning to program by studying examples and checking sample solution to some given problem.
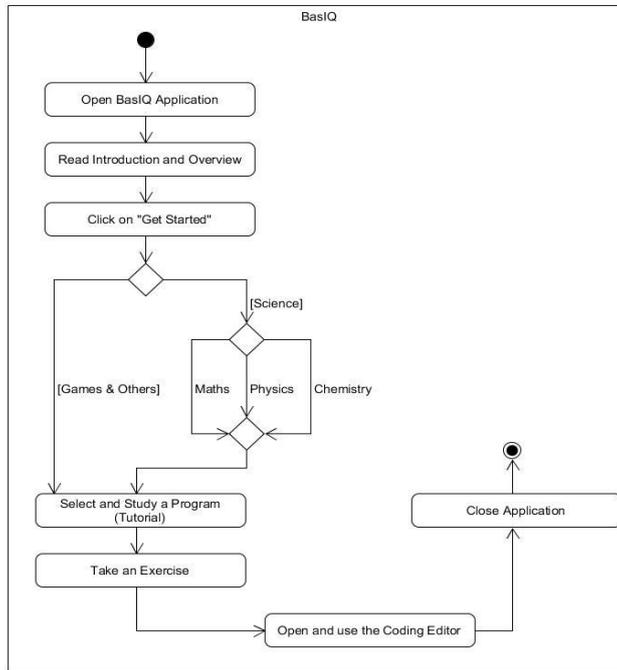
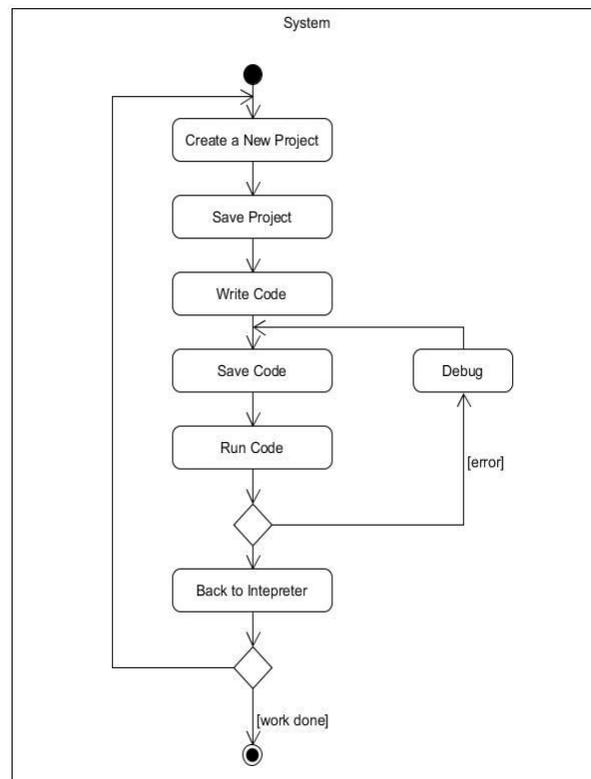Fig. 1   Activity Diagram Showing Workflow/Process Flow of Proposed System

Fig. 2   Activity Diagram Showing Workflow/ProcessFlow of Proposed System Interpreter

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B. Advantages of the Proposed System

The system designed in such a way that, users can easily navigate their way through the system. In High Schools, mobile device users outgrow PCs users. That means, Students are familiar with how to operate a mobile application and can also learn to use new system with no stress. Mobile applications have lots of advantages compared to other kinds of platform applications. These advantages include:

    a.   Mobile device are cheap and are in large use. Students have greater chance in accessing or affording a mobile device than PCs. Thus, having access to the proposed system is been made easy and cheap.

    b.   The proposed system will work offline. No internet connection is required. Students are not limited on the use of the application due to lack of internet connection.

    c.   Students can save their work for later use, debug their code and run it.

    d.   The mobility of the proposed system gives users freedom to use the system anywhere and anytime.

C. Development Framework

The application is developed using PhoneGap development tool. PhoneGap is a HTML5 application framework that is used to develop native applications through web technologies. This means that developers can develop mobile applications for Smartphone and Tablet applications with their existing knowledge of HTML, CSS, and JavaScript. With PhoneGap, developers do not have to learn languages like Java for Android. Applications that are developed using PhoneGap are hybrid applications. These applications are not purely HTML/JavaScript based, nor are they native. Parts of the application, mainly the UI, the application logic, and communication with a server, is based on HTML/JavaScript. The other part of the application that communicates and controls the device (phone or tablet) is based on the native language for that platform. PhoneGap provides a bridge from the JavaScript world to the native world of the platform, which allows the JavaScript API to access and control the device (phone or tablet) [8].

IV. DISCUSSION OF RESULTS

The system design was implemented as follows:

A. Home/Landing Page

The landing page or home page shown in Fig. 3 includes an overview of what programming is. It also contains some basic concepts that the student needs to know before kick starting programming. The menus are been arranged in a collapsible dropdown, showing only the heading, while the body content are hidden. User needs to tab each menu for the content to be revealed.
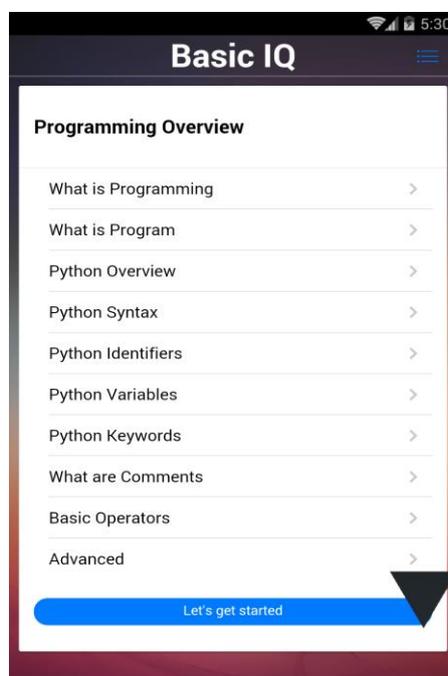

Fig. 3 Landing Page

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B. Category Page

Different programs that will be used in teaching the users are grouped into related class/category as shown in Fig. 4. Each category has some set of programs inside them. The grouping is based on activities/knowledge the users are familiar with in their everyday lives and can relate with fast.

Fig. 4 Category Page

C. Program List

Here, depending on the category selected, a list of different programs grouped under a specific subject is displayed. Topics, formulas, and laws that the users are familiar with in their academics or leisure time are included. Any item in the list has its written source code that will be used in teaching the users. Each program item in the list is treated as a class session, and at the end of each class session, a student is being giving a task to solve in order to test the level of learning.
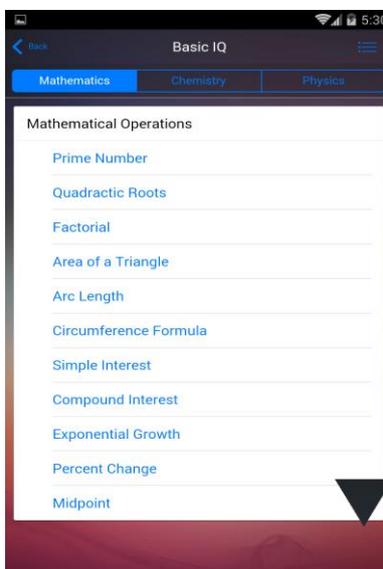

Fig. 5 Programs List

D. Advanced Programs

The advanced page (Fig. 6) covers other Python features/concepts i.e. Functions, String, List, and Class. Here, the researcher presented the tutorials in two ways, the user can either go ahead to solve a problem, or, check sample solution before trying the problem.
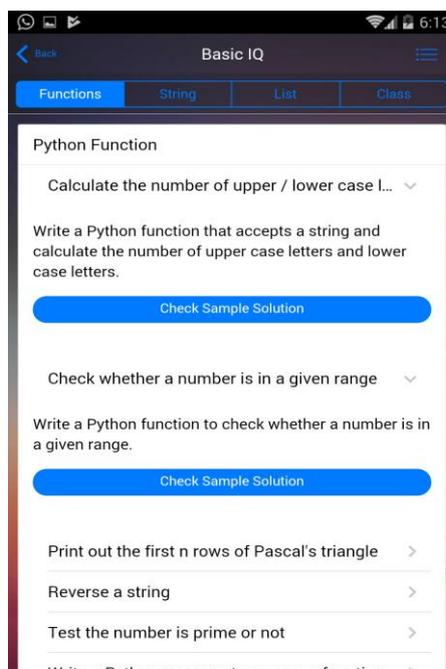
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Fig. 6 Advanced Programs

E. Coding Editor

The coding editor (Fig. 7) allows the user to write code and run their code, save project, open saved project and also open multiple projects in tabs. Users have the privilege downloading python libraries that by default are not installed.
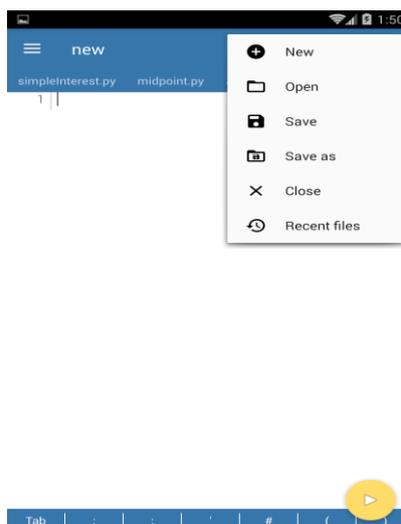

Fig. 7 Coding Editor

V. CONCLUSION

In this work, the difficulties that novice programmers (in general) faced were identified, and through these findings, the researchers narrowed the problems to that of learning programming by High School students using mobile devices. A solution (system) was presented that mitigates some limitation and difficulties High School programmers encounter, including the lack of regular computing devices such as PCs.

The system can be improved upon to integrate an internal python interpreter. Integration of a blog which will help in creating a community for the users to share their ideas and challenges would also be worth considering. More content needs to be added and updated continuously.

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REFERENCES

[1] Yu-Chang Hsu, Y.-H. C. (2012, October). Mobile Microblogging: Using Twitter and Mobile Devices in an Online Course to Promote Learning in Authentic Contexts. *The International Review of Research in Open and Distance Learning, 13*, 211-227

[2] Hsu, Ching. (2013). Mobile App Design for Teaching and Learning : Educators' Experiences in an Online Graduate Course. *The International Review of Research in Open and Distance Learning*, 117-139.

[3] Arnold Pears, Stephen Seidman, Lauri Malmi, Linda Mannila, Elizabeth Adams, Jens Bennedson, Marie Devlin, James Paterson. (2008). A Survey of Literature on the Teaching of Introductory. *Introductory Programming Literature*, 204-223.

[4] Nicholas H. Tollervey. (2015). *Python in Education.* Sebastopol: O'Reilly Media

[5] Essi Lahtinen, K. A.-M.-M. (2005). A study of the difficulties of novice programmers. 14-18.

[6] Smith, A. A. (2014). Teaching an introductory programming language in a general education course. *Journal of Information Technology Education: Innovation in Practice, 13*, 57-67.

[7] Ala-Mutka, K. (2004). A literature study for developing visualizations in the Codewitz-Minerva project. *problems in learning and teaching programming*, 1-13.

[8] Rohit Ghatol, Y. P. (2012). *Beginning PhoneGap mobile web framework for JavaScript and HTML5.* New York: Apress.