IRJIEST 6 (2020) 14-19
Available online at irjiest.batstate-u.edu.ph
International Research Journal on Innovations in Engineering, Science and Technology

CSS droid: An android-based computer system servicing training app with virtual computer hardware assembly

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ABSTRACT

Computer System Servicing (CSS) covers basic and common competencies such as installing, maintaining, configuring, and diagnosing computer systems and networks. The main objective of the study was to develop an android application for the students that would provide them a platform to practice with the aid of virtual computer hardware assembly, at any given time. This application presented a series of review questions designed to help students enhance their knowledge and abilities on the CSS NCII assessment. Different forms, manuals, and reports relative to CSS, assessment, and certifications were utilized. The study surveyed 119 respondents on their level of acceptance and satisfaction on the android application. The project was programmed and organized based on the actual procedures of the assembly of computer hardware and the software installation. Recognizing the issues and challenges that respondents had while completing the CSS NCII assessment, the android application received the highest ratings of highly acceptable and highly satisfied from respondents. The paper recommends the adoption and implementation of the developed android application in higher education institutions, as it highlights the concerns and challenges that students encounter while pursuing CSS NCII certifications.

Keywords: CSS, computer assembly, virtual, android application, application development

1. Introduction

Mobile phones are increasingly becoming part of the daily life of today's youth [1]. Young people, in particular, appeared to be highly susceptible to mobile use [2]. The Philippines had nearly 169 million smartphone subscribers as of 2019. For many Filipinos, mobile phones have been an important tool [3]. For education, smartphones help the students to learn information and have access to online learning. Students have benefitted in terms of searching for information, video lectures, and taking notes through the use of mobile phones [4]. According to [5], students in the twenty-first century are obsessed with technical advancements that it would be difficult for them to consider not using them in their daily lives.

Mobile applications are computer programs that are programmed to run on mobile devices. The use of technical devices in education has stimulated the interest of higher education institutions. In recent years, a growing number of cell phone applications have been used in teaching and learning [6].

The CSS course covers basic and common competencies such as installing, maintaining, configuring, and diagnosing computer systems and networks [7]. Information Technology students from higher education institutions shall be instilled with knowledge, skills, and attitude of the CSS. There are courses in the curriculum that highlight the assessment for national certification for CSS. To ensure that the students will pass the certification exam, they need extra time to review and practice the unit of competencies in CSS; install and configure computer systems, set up computer networks, set up computer servers, and maintain and repair computer systems and networks.

In terms of assessment and certification, the rate increased from 62.4% in 2006 to 87.36% in 2013. Regions IV-B, III, XI, II, NCR, VII, and VIII have high certification rates. Furniture and fixtures, processed food and beverages, maritime, HVAC/R, tourism, and construction all had high certification rates [8].

The challenge now is to make sure that there will be high passing rates for the college students who will take up the national certifications for CSS. This will be possible by identifying the problems encountered by the students before, during, and after taking the assessment and then developing solutions that will address them.

The main objective of the study was to develop an android application for the students that would provide them a platform to practice with the aid of virtual computer hardware assembly, at any given time. This application would provide a series of questions that serves as a review to improve the student's knowledge and skills in CSS NCII assessment.

As part of the evaluation, a survey was conducted to determine the level of acceptance on the proposed android

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application and the level of satisfaction of the respondents.

2. Materials and methods

The researcher used the descriptive-developmental method of research to collect data on current concerns and difficulties faced by respondents, which were then used to create a android application that addresses those issues. The researcher used various formats, manuals, and reports related to CSS and assessment in the data collection process. The researcher used purposive sampling procedure which involved a total of one hundred nineteen (119) respondents including seventy-eight (78) BS in Information Technology (BSIT) students, sixteen (16) BS in Computer Science (BSCS) students, and twenty-five (25) BS in Computer Engineering (BSCpE) students, all of which are from the College of Engineering and Computing Sciences of Batangas State University ARASOF Nasugbu Campus.

The researcher also used ranking to determine which issues and problems were always encountered by the respondents. It involved placing the value in numerical order and assigning new values to indicate where in the ordered set they fall [9]. For the most problems and difficulties faced, the researcher assigned the lowest number 1, followed by 2, 3, and so on.

Figure 1 shows the repressed structure that gave conceptual meaning through an articulated rationale and operations of the research.

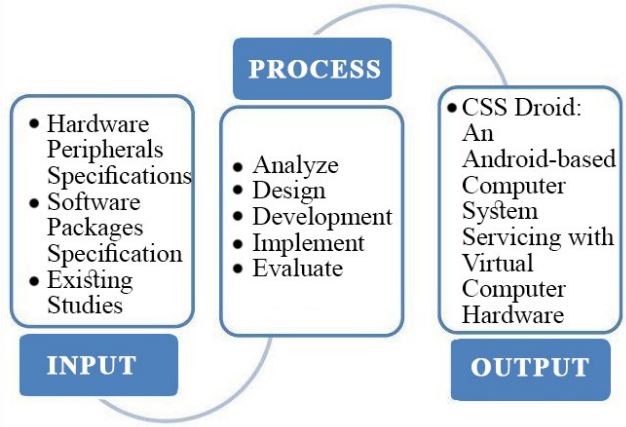

Figure 1. The input-process-output model used in the study.

Inputs in the project are the hardware peripherals specifications, software packages specifications, and the existing studies. The process includes an analysis of the input requirements to develop the research.

2.1. Software development

The researcher conducted methodical research to collect well-founded ideas that gave the assistance to comprehend the concepts of their subject matter. Different representations and cycles were scrutinized by the researcher to develop systematic procedures that will help in producing and designing the project. The researcher used Boehm's spiral model as a method to finish the project and have a valuable outcome. Figure 2 presents Boehm's spiral model which integrates risk management and incremental development [10]. It includes different steps and procedures that were used in the initiation and fulfillment of the research. It includes requirements gathering in the planning phase, prototyping in the risk analysis phase, coding and testing in the engineering phase, and customer evaluation in the evaluation phase. The functional and non-functional requirements were designed to develop and align to the needs and/ or overall significance to the end-users. The different risks were identified, classified, crafted, planned and monitored all throughout the software development phase. High-level test cases were written before coding started. The Test Plan and Test Cases were carefully utilized to ensure that each module of the android application is working according to its specified functionalities. The completeness and usability of the developed software were identified through the use of developed software evaluation tools.

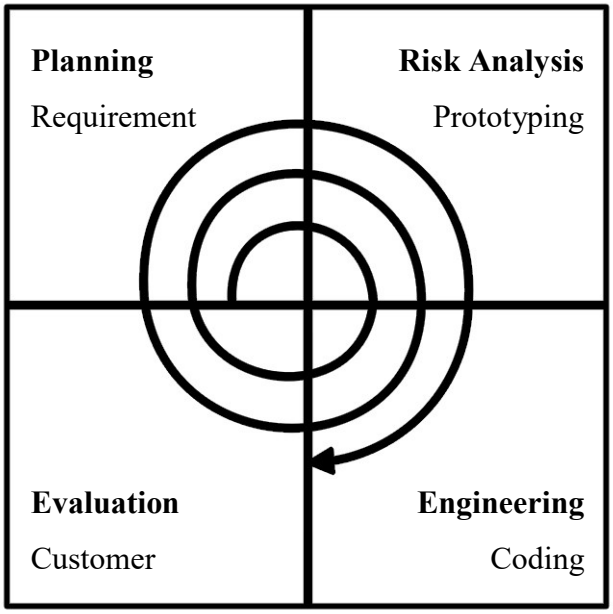

Figure 2. Boehm's spiral model illustrating the pattern of the research.

2.2. Programming procedure

It began with the review of the requirements of every part followed by analyzing the requirements and the preparation of the design. Using the unity platform, the hardware components were designed as well as the software application (Figure 3).

2.3. Hierarchical input process output (HIPO)

Figure 4 shows the hierarchy of higher-level modules: hardware configuration, software installation, instruction, and about their lower-level modules

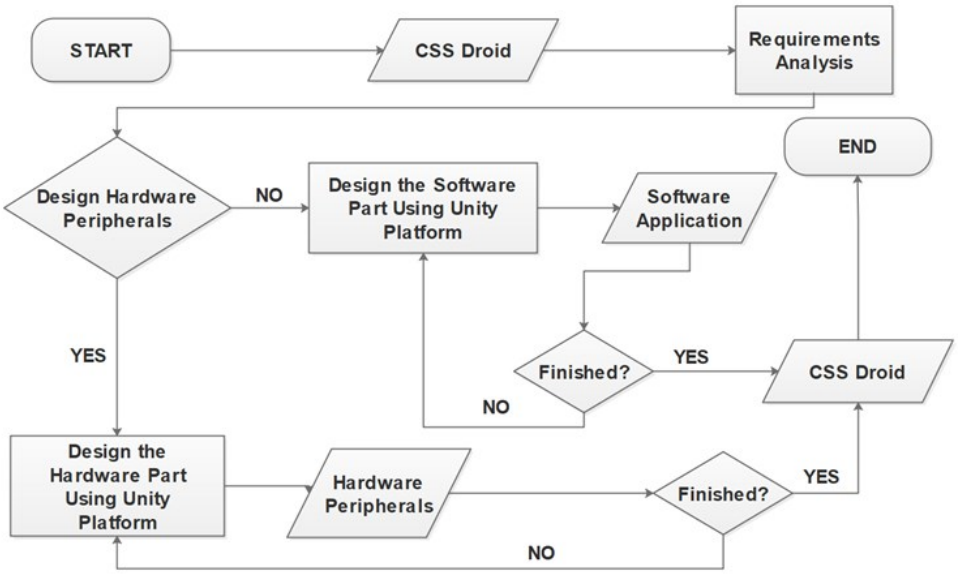

Figure 3. Schematic representation of the computer hardware and software installation.

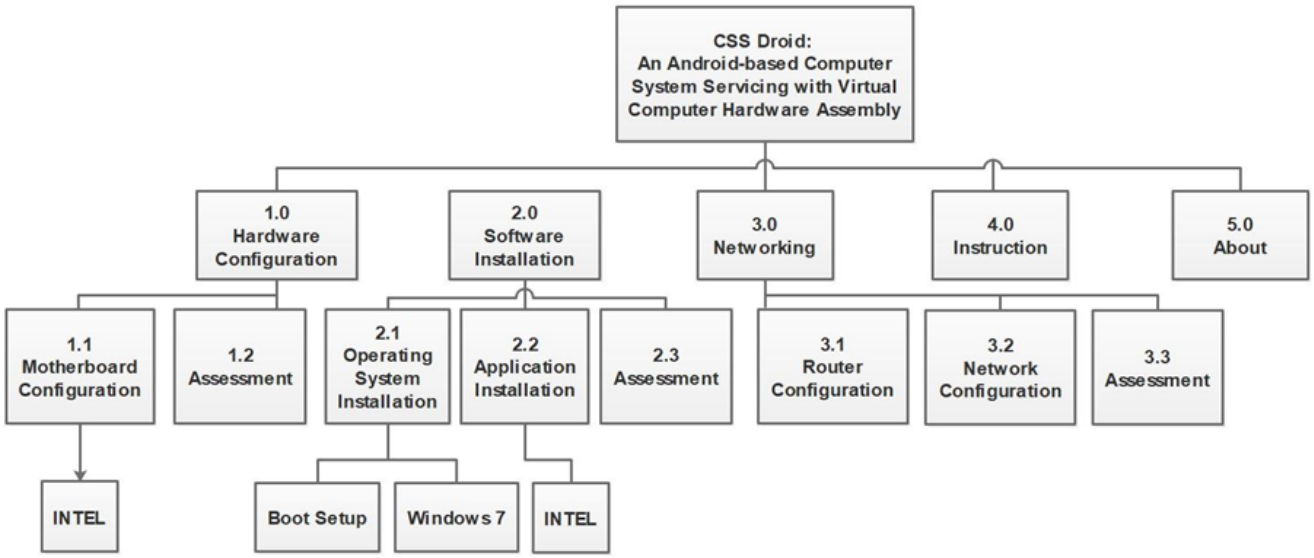

Figure 4. The Hierarchical input process output (HIPO) depicting the system modules and processes.

3. Results and discussion

3.1. Prototyping

The researcher utilized the extreme prototyping method. The development of the software was divided into sequential independent phases. In the first phase, the researcher developed static pages and mobile screens that show the order and hierarchy of the functionalities. Then, the functional screens were developed, and simulated data were included using a prototype services layer. Lastly, all the functional and non-functional requirements were implemented. With the use of the prototyping method, the researcher was given a partial product even in the early development phase. Errors were detected much earlier and saves a lot of effort leading to more quality applications.

3.2. Test plan

The purpose of this section was to evaluate the system's compliance with the specified requirements. Testing was done to review the overall performance of the developed system to enable the researchers to debug the errors that were found during testing. System testing was done to verify if all the features in the module were working. It was also done to provide a quality system for the users. The researchers demonstrated the developed system to the intended users to verify if the user met their needs (Table 1). This also helped the researchers to improve the quality of the developed system. The test was considered 100% complete if all test cases had been successfully executed. The testing tools involved were local host Apache web server, browser, text editing software.

3.3. Implementation

The implementation process started after uploading the developed android application on the Google Play Store (Table 2). During this phase, the android application has been evaluated by the users upon downloading it. Further improvements will be done with the help of the users through their comments and suggestions and other developers that would evaluate the developed application. It will be a tool for more effective educational material that copes with innovation.

Table 1. Test cases for the CSS Droid main functions.

Test Case ID	Test Case Description	Test Data	Steps	Expected Result	Passed/ Failed	Issue ID
CSS_ 00	Verify that the students are able to login when entering the expected values.	Enter your First name, Last name to sign up.	Click "OK" button Read introduction first. Click the "Let Get Started" Button.	The Page displays all the modules.	Passed	SM_0 1
CSS_ 01	The COC 1 module is opened only with the first part; unlocked and the rest; locked.	Display the first "Power Supply and other hardware parts" button.	Click the First "Power supply" Button.	The Button is unlocked when your answer is Correct.	Passed	SM_0 2
CSS_02	The information and the steps will be displayed when a page is clicked.	The Description, Video tutorial step by step pictures of the Hardware parts is Displayed.	Click the "Watch Video" Text to play the Video tutorial.	Click the "Continue" Button to the next page.	Passed	SM_0 3
CSS_03	The questions will be displayed after clicking the "Continue" at the page.	Read First the Question and Choose the Correct answer.	Click the Radio Button.	The Radio Button is turned on.	Passed	SM_0 4
CSS_04	When you Clicked the button without choose the correct answer.	Without Choose the Correct answer.	Click the Continue" Button.	A warning message will appear "please select an answer".	Passed	SM_0 5

1) The Students need an Android Phone 2) The Students should download the CSS Droid Application 3) The Android device must be Android 6.0 Marshmallow or above.

Table 2. Implementation Plan starts from pilot testing until deployment.

Strategy	Activity	Persons Involved	Duration
Pilot Testing	During the first trial before the actual usage, system faults and errors will be ascertained through continuous and periodic testing.	The researcher with the use of the testing tool, Selendroid.	1 Week
Evaluation	Evaluation of the CSS Droid: An Android Based Computer System Servicing with Virtual Computer Hardware Assembly	Students of CECS and NC II Assessors in the CECS Faculty	3 Days
Rework	Further improvements were done with the help and support of the researcher.	The researcher	3 Days
Deployment	Deployment of the Android	The researcher	1 Week

3.4. End-user's evaluation

To get the level of satisfaction and acceptance of the developed android application, the researcher utilized the weighted mean. The Likert scale, a psychometric scale, allows for qualitative information amenable to statistical analysis by transforming it to quantitative data [11]. Each possible option is given a numerical value, and at the end of the assessment, a mean number for all the responses is calculated.

Table 3 shows the issues and challenges encountered by respondents. The most common problem in taking the CSS NCII examination is the lack of educational materials (book, workbook), and students take too much time on other subjects and spend less time on CSS trainings with the frequency of 55 at the same time.

Table 3. Issues and challenges encountered in taking CSS NC II Examination.

Issues and Challenges	Frequency	Rank
Lack of resources (actual parts of the system unit such as the CPU, RAM, motherboard, etc.)	46	2
Lack of resources (actual parts of the system unit such as the CPU, RAM, motherboard, etc.)	55	1
Limited use of training facilities.	46	2
Lack of interest in taking the CSS NC II Certification.	33	3
Students take too much time on other subjects and spend less time on CSS Trainings.	55	1
Others. (students don't prioritize the CSS training, the students didn't have an effective reviewing strategy, many students didn't take the CSS NC II Assessment seriously)	16	4

Table 4 shows the result of the evaluation of the developed android application. The respondents rated the developed system with the level of acceptance of highly acceptable with a composite mean of 4.51 in terms of reliability.

Table 4. Level of acceptance in terms of reliability.

Components of reliability	Mean	Level of acceptance
The application displays pictures of the actual computer hardware parts.	4.61	highly acceptable
The system tells the correct definition of each computer.	4.48	highly acceptable
All the contents included in the module are validated by an accredited CSS NCII assessor.	4.45	highly acceptable
Composite mean	4.51	highly acceptable

Legend: 4.21- 5.00, highly acceptable; 3.41- 4.20, moderately acceptable; 2.61- 3.40, acceptable; 1.80- 2.60, slightly acceptable; and 1.00- 1.80, not acceptable

In Table 5, the respondents rated the developed android application with the level of acceptance of highly acceptable with a composite mean of 4.39 in terms of usability.

Table 5. Level of acceptance in terms of usability.

Components of usability	Mean	Level of acceptance
The application is always available.	4.06	moderately acceptable
The application is fit for android devices.	4.53	highly acceptable
The application involves processes that are easy to learn and understand.	4.58	highly acceptable
Composite mean	4.39	highly acceptable

Legend: 4.21- 5.00, highly acceptable; 3.41- 4.20, moderately acceptable; 2.61- 3.40, acceptable; 1.80- 2.60, slightly acceptable; and 1.00- 1.80, not acceptable.

Table 6. shows the result of the evaluation of the developed android application. The respondents rated the developed system with the level of acceptance of highly acceptable with a composite mean of 4.51 in terms of efficiency.

Table 6. Level of acceptance in terms of efficiency.

Components of efficiency	Mean	Level of acceptance
The topics included can be understood by any CSS trainees.	4.49	highly acceptable
The application is a tool that can be used by trainers to provide additional learning.	4.50	highly acceptable
Quizzes can help the trainee to assess their knowledge of CSS.	4.54	highly acceptable
Composite mean	4.51	highly acceptable

Legend: 4.21- 5.00, highly acceptable; 3.41- 4.20, moderately acceptable; 2.61- 3.40, acceptable; 1.80- 2.60, slightly acceptable; and 1.00- 1.80, not acceptable

Table 7 shows how the respondents rated the developed system with the level of satisfaction of highly satisfied with a composite mean of 4.52 in user-friendly.

Table 7. Level of satisfaction in terms of user-friendly.

Components of user-friendly	Mean	Level of satisfaction
The application displays a simple user interface.	4.63	highly satisfied
The application can be understood easily.	4.45	highly satisfied
The application is easy to use.	4.49	highly satisfied
Composite mean	4.52	highly satisfied

Legend: 4.21- 5.00, highly satisfied; 3.41- 4.20, moderately satisfied; 2.61 - 3.40, satisfied; 1.80- 2.60, slightly satisfied; and 1.00- 1.80, not satisfied

Table 8 shows the result of the evaluation of the developed system. The respondents rated the developed system with the level of satisfaction of highly satisfied with a composite mean of 4.50 in graphics.

Table 8. Level of satisfaction in terms of graphics.

Components of graphics	Mean	Level of satisfaction
The application provides a drag and drop function.	4.50	highly satisfied
The application displays understandable text on the reviewer.	4.60	highly satisfied
The application displays the artistic use of pictures and videos.	4.39	highly satisfied
Composite mean	4.50	highly satisfied

Legend: 4.21- 5.00, highly satisfied; 3.41- 4.20, moderately satisfied; 2.61 - 3.40, satisfied; 1.80- 2.60, slightly satisfied; and 1.00- 1.80, not satisfied

The respondents rated the developed system with the level of satisfaction of highly satisfied with a composite mean of 4.52 in learnability (Table 9). This means that the developed android application takes into account how simple it is for a user to complete a task the first time they experience the interface, as well as how many repetitions it takes for them to become proficient at that task.

Table 9. Level of satisfaction in terms of learnability.

Components of learnability	Mean	Level of satisfaction
The application is easy to learn.	4.57	highly satisfied
The application uses easy-to-understand instructions.	4.51	highly satisfied
The application is comprehensive, and the user can easily follow.	4.49	highly satisfied
Composite mean	4.52	highly satisfied

Legend: 4.21- 5.00, highly satisfied; 3.41- 4.20, moderately satisfied; 2.61 - 3.40, satisfied; 1.80- 2.60, slightly satisfied; and 1.00- 1.80, not satisfied

4. Conclusions

This research was able to identify problems and challenges that students faced when obtaining CSS NC II certification. The researcher concluded that doing a review and simulation of CSS is limited in time and there were limited interactive resources.

The android application highlights the following: it is a portable mobile reviewer that the users can easily access; it includes virtual parts which is the actual parts of a system unit that is used in actual training which covers the lack of resources, and it contains the basic precautions, activities, quizzes, and features just like the actual activities on CSS training.

The developed android application allows learners to have a broad scope for the CSS course's learning process, as it expedites a multidisciplinary learning platform and provides new opportunities for students.

The developed android application was rated highly acceptable and highly satisfied by respondents, who were very pleased with the app's features and agreed that it was efficient, secure, and accessible, according to the report. The paper strongly recommends that the developed android application be used and implemented in higher education institutions because it addresses the problems and challenges that students face.

The findings suggests that incorporating an android application into the teaching and learning process could have a significant impact on students' academic success. Adaptation and use of android applications in learning and teaching processes should also be considered by educational policymakers.

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