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CAMPUS INTERACTIVE INFORMATION KIOSK WITH 3D MAPPING

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Abstract: This study's fundamental reason is to develop a Campus interactive Information Kiosk with 3D Mapping that can provide information and detailed instructions to campus visitors and clients. A 3D map module was also designed and integrated into the system for campus navigation purposes. The researchers used the Feature Driven Development methodology agile approach model under the Software Development Life Cycle (SDLC) to develop the system. This method serves as the basis for planning, designing, developing, testing/debugging, and deploying the software. It serves as a core foundation to implement or deploy a successful Campus Interactive Information Kiosk with 3D Mapping that will answer the end users' problems and a big help to the campus university. A survey questionnaire was used to determine the quality and usability of the software based on ISO/IEC 25010. As a result, the system got a very high rating showing that the system caters to the respondents' needs and successfully passed the software quality testing.

Keywords **-** Kiosk, 3D, SDLC, Mapping, Interactive.

Introduction

The use of interactive kiosks by an educational institution is rapidly increasing to address the needs of students, visitors, and the school's personnel. The Central Philippine State University – Victorias Campus is a higher educational institution located at Hda. Estrella, Brgy. XIV Victorias City. The institution currently has problems with information dissemination throughout the campus, especially when they have events and activities. They also do not have an existing campus directory of faculty, staff, and even offices and buildings present on the campus. During the pandemic times, everyone should strictly observe physical distancing (UNICEF, 2020). Moreover, higher education institution should strengthen its health services, communication system and resources to address educational needs in the new normal (Sabando 2023; Sabando & Alo, 2021; Sabando et al., 2023). Students, visitors, and even personnel must have a single point of information where information can be accessed even when no person onsite is present.

Numerous numbers of kiosk systems have been developed nowadays and can be seen in places like malls or train stations. This indicates that kiosk systems are essential in a growing industry (Vakulenko et al., 2018). Hence, it is necessary for the Higher educational institution to provide information communication technology through research integration in order to strengthen client support services (Sabando, 2022). The system developed by the researchers was tailored and customized based on the needs of the clients. It can be considered an educational all-in-one kiosk because it provides information based on the needs of the major stakeholders of the school.

As stated by OEMKiosks – A Portuguese company that developing a bespoke kiosk product, Interactive kiosks are increasingly a strong investment of the Education sector. It provides incomparable access to information. To address these problems, the researchers developed a Campus Interactive Information Kiosk with 3D mapping that can provide information and detailed instructions to campus visitors and clients and to integrate a 3D Map module for campus map navigation.

I. OBJECTIVES

This study aims to develop a Campus Interactive Information Kiosk with 3D mapping. Specifically, it aims to:

1.Design a system that can provide information and detailed instructions to campus visitors and clients.
2.Design and integrate a Campus 3D map module;
3.Determine the extent of usability of the system in terms of usefulness, user-satisfaction and ease of use;
4.Determine the quality of the developed system based on ISO/IEC 25010:2011 Systems and Software Quality Requirements and Evaluation (SQuaRE) Quality Model.

II. CONCEPTUAL FRAMEWORK OF THE STUDY

The framework illustrates the overall steps that are taken to finish the research. It served as a guide to the researchers
in achieving the goals and objectives of this study.

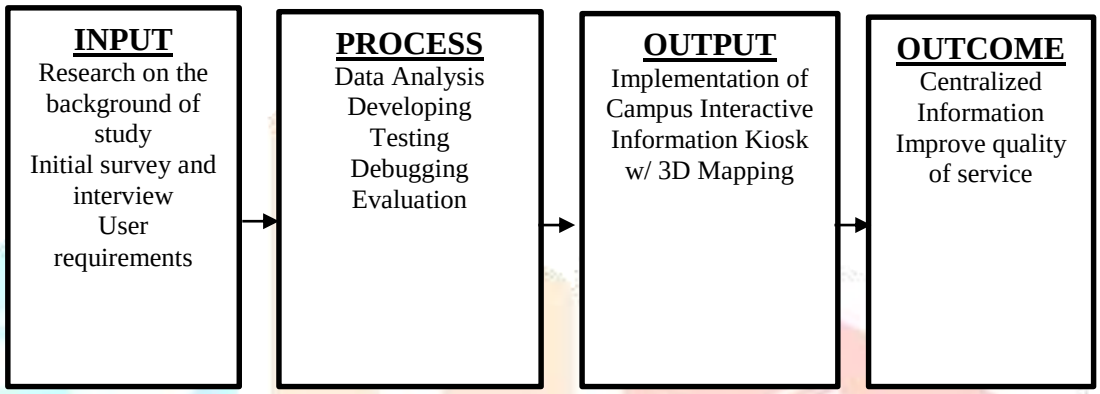

Figure 1: *Conceptual Framework of the Study*

III. METHODS

Research Design

In this study, the developmental research approach was used. The responders were chosen using a technique known as the convenient purposive sampling strategy. The unique characteristics of the population that most interested them and would best address the study issues were what the researchers concentrated on. The composition of the evaluators are as follows: thirteen (13) students, eleven (11) personnel, and six (6) visitors of Central Philippines State University.

Instrument

The developed system was tested in this stage. The primary respondents of this test are the students, personnel, and visitors of the campus. The system was installed at the school's lobby for evaluation purposes, and all the gathered data are used in improving the system. The researchers takes note of all the comments and suggestions of the testers. The evaluation tool used was based on the standard ISO/IEC 9126-1:25010 Software Quality in Use Model. Table 1 shows that the proponents used a five-point Likert scale, with five (5) highest and one (1) lowest. This software evaluation tool is a criteria-based questionnaire that assesses the Usability, Security, Reliability, Performance, Availability and Scalability of software.

Table 1. *Five-point Likert Scale with the mean range interpretation.*

Mean Score	Verbal Interpretation
4.21 – 5.00	Very High
3.41 – 4.20	Very Good
2.61 – 3.40	Good
1.81 – 2.60	Fair
1.00 – 1.80	Poor

Data Gathering

The researchers gathered important information about the guidelines that need to be included in the software. The school personnel, students, and visitors' responses are considered about the format, contents, and sections of the software. The gathered information served as the basis in the formulation of the Campus Interactive Information Kiosk with 3D Mapping for CPSU Victorias Campus. During the second round of data collection, the researchers distributed and administered surveys to the respondents directly using hard copy Evaluation Forms.

PART I. Quality of Software

Please check (√) the appropriate spaces of every statement that corresponds to your answer using the following answer code to measure the level of quality of the developed system:

Score	Description 5	Verbal Interpretation
	Very High	The quality of system is excellent and greatly exceeds expectations.
4	High	The quality of system is very satisfactory and fairly exceeds expectations.
3	Moderate	The quality of system is satisfactory and is within expectations.
2	Low	The quality of system is poor and is below expectations.
1	Very Low	The quality of system is very poor and is too far below expectations.

Please rate the level of quality of the system. **Software**

Product Quality	Description	Answer Code				
1. Functional Suitability		**5**	**4**	**3**	**2**	**1**
a. Functional completeness	Set of functions covers all the specified tasks and user objectives.					
b. Functional correctness	System provides the correct results.					
c. Functional appropriateness	Functions facilitate the accomplishment of specified tasks and objectives.					
2. Performance efficiency		**5**	**4**	**3**	**2**	**1**
a. Time behaviour	Response and processing times and throughput rates of a system, when performing its functions, meet requirements.					
b. Resource utilization	Amounts and types of resources used by a product or system, when performing its functions, meet requirements.					
c. Capacity	Maximum limits of a system parameter meet requirements.					

3. Compatibility		5	4	3	2	1
a. Co-existence	System can perform its required functions efficiently while sharing a common environment and resources with other products, without detrimental impact on any other system.					
b. Interoperability	Two or more systems or omponents can exchange information and use the information that has been exchanged.					
4. Usability		**5**	**4**	**3**	**2**	**1**
a. Appropriateness recognizability	Users can recognize whether the system is appropriate for their needs					
b. Learnability	System can be used by specified users to achieve specified goals of learning to use.					
c. Operability	System has attributes that make it easy to operate and control.					
d. User error protection	System protects users against making errors.					
e. User interface aesthetics	User interface enables pleasing and satisfying interaction for the user.					
f. Accessibility	System can be used by people with the widest range of characteristics and capabilities to achieve a specified goal in a specified context of use.					
5. Reliability		**5**	**4**	**3**	**2**	**1**
a. Maturity	System or component meets needs for reliability under normal operation.					
b. Availability	System or component is operational and accessible when required for use.					
c. Fault tolerance	System or component operates as intended despite the presence of hardware or software faults.					
d. Recoverability	In the event of an interruption or a failure, a product or system can recover the data directly affected and re-establish the desired state of the system.					

6. Security		5	4	3	2	1
a. Confidentiality	System ensures that data are accessible only to those authorized to have access.					
b. Integrity	System or component prevents unauthorized access to, or modification of, computer programs or data.					
c. Non-repudiation	Actions or events can be proven to have taken place so that the events or actions cannot be repudiated later.					
d. Accountability	Actions of an entity can be traced uniquely to the entity.					
e. Authenticity	The identity of a subject or resource can be proved to be the one claimed.					

7. Maintainability		5	4	3	2	1
a. Modularity	System or computer program is composed of discrete components such that a change to one component has minimal impact on other components.					
b. Reusability	An asset can be used in more than one system, or in building other assets.					
c. Analysability	Degree of effectiveness and efficiency with which it is possible to assess the impact on a product or system of an ntended change to one or more of its parts, or to diagnose a product for deficiencies or causes of failures, or to identify parts to be modified.					
d. Modifiability	System can be effectively and efficiently modified without introducing defects or degrading existing product quality.					
e. Testability	Degree of effectiveness and efficiency with which test criteria can be established for a system, product or component and tests can be performed to determine whether those criteria have been met.					
		5	4	3	2	1
8. Portability	System can effectively and efficiently					
a. Adaptability	be adapted for different or evolving hardware, software or other operational or usage environments.					
b. Installability	System can be successfully installed and/or uninstalled in a specified environment.					
c. Replaceability	System can replace another specified software product for the same purpose in the same environment.					

Comments and Suggestions:

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_____

Thank You and God Bless!

Figure 2: *Evaluation form based on ISO/IEC 25010*

Data Analysis

Using the mean, the researchers assessed the Campus Interactive Information Kiosk With 3D Mapping for functional sufficiency, performance efficiency, usability, maintainability, and portability. The researchers employed statistical analytic methods. The researchers used the scaling algorithm it contains to encode the assessment's rating and get the mean. The researchers reviewed all of the data, information, and user requirements. At this point, the researchers also have a clearer idea of how to design the application, can see how the proposed application will help users, and can determine whether it would satisfy the needs of the responders.

Software Development Life Cycle (SDLC)

Agile SDLC model is a combination of iterative and incremental process models with focus on process adaptability and customer satisfaction by rapid delivery of working software product. Agile Methods break the product into small incremental builds. These builds are provided in iterations. The researchers used the Feature Driven Development (FDD) methodology of the Agile model approach under the Software Development Life Cycle (SDLC) to develop the system. This method served as the basis for planning, designing, testing, debugging, and deploying the software. The researchers used the descriptive research design to determine the respondents' evaluation of the Campus Interactive Information Kiosk with 3D Mapping for CPSU Victorias Campus.

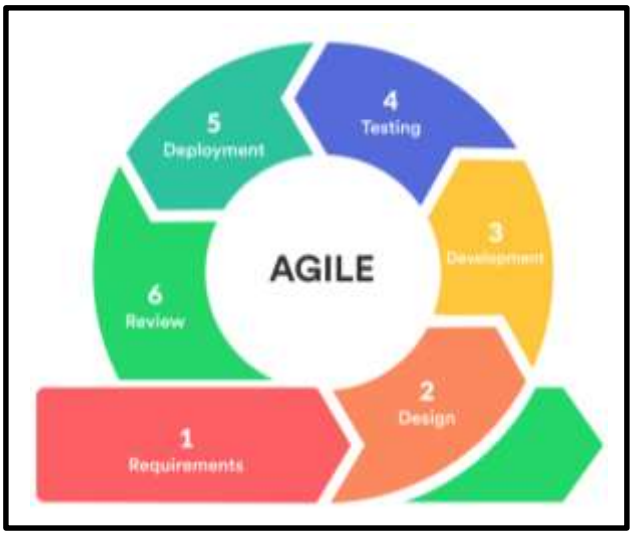

Figure 3: *Agile Software Development and Life Cycle Model*

Data Gathering

The researchers gathered important information about the guidelines that need to be inluded in the software. The school personnel, students, and visitors' responses are considered about the format, contents, and sections of the software. The gathered information served as the basis in the formulation of the Campus Interactive Information Kiosk with 3D Mapping for CPSU Victorias Campus.

System Design

The gathered data from the target users were taken into consideration following the software's design and features. The user interface and the system's flow served as guides for the researchers in formulating the software.

Development

All the designed software components are implemented, and the researchers created the source code of the program. The researcher ensured that the system meets and provides all the user needs and requirements mentioned in the research objectives. The researchers used HTML (Hypertext Markup Language), CSS (Cascading Style Sheet), JavaScript, SketchUp, and PHP (Hypertext Preprocessor) programming languages and technologies to develop the system.

Unit Testing

At this point, the developed system was tested. Students, staff, and visitors to the school are the main respondents to this survey. The thirteen (13) students, eleven (11) staff members, and six (6) guests make up the evaluators. For assessment purposes, the system was set up in the school lobby, and all of the information collected is utilized to make improvements to the system. All of the testers' remarks and recommendations are noted by the researchers.

Five professionals in the IT field assessed the system during the expert testing. Three of them have degrees from MSIT, one from MIT, and one from computer science, which she uses to teach senior high school.

Deployment / Implementation

The system was installed at this point. The researchers provided a brief explanation of how to use the device. A user guide was also made to make the system easier to use for the admin user.

Maintenance

The system was being monitored to ensure that everything ran smoothly. An evaluation after using the kiosk was implemented to gather further suggestions and comments that could help improve the system.

IV. RESULTS AND DISCUSSION

A. Users Panel

***Figure 4**: Screensaver*

The screensaver is displayed when the system is in idle state. The user may tap or click anywhere to open the menu screen.

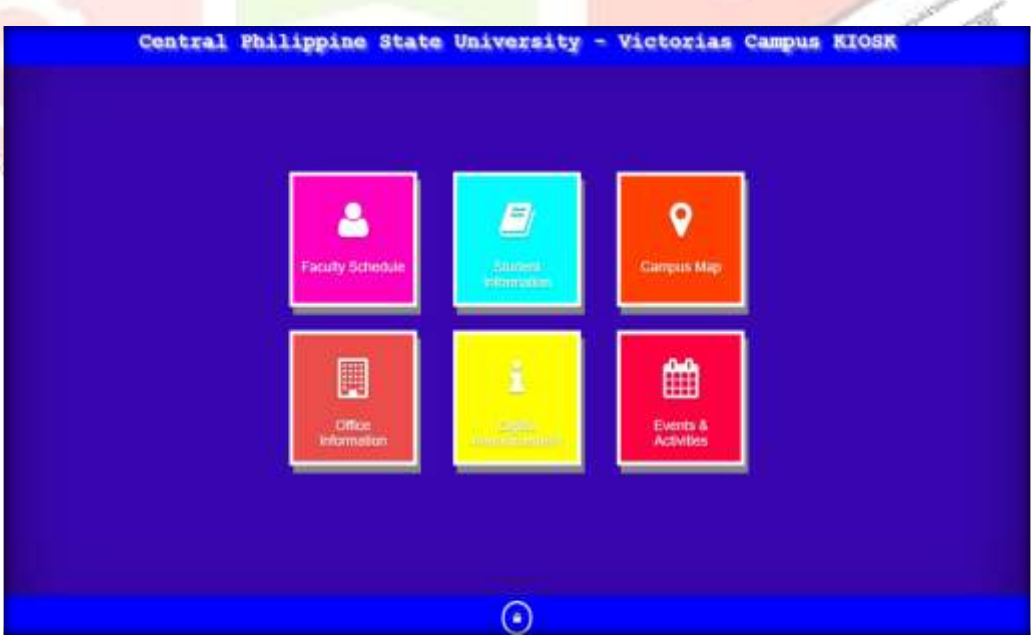

***Figure 5:** Main Menu*

The user may click the intended menu for every transaction or process.

1. Faculty Schedule
2. Student Information
3. Campus Map
4. Office Information
5. Digital Announcement
6. Events & Activities

Figure 6: *Campus Interactive Map*

On the interactive Map category, click on any menu at the lower part of the map that corresponds to the office you are looking for.

Figure 7: *Campus 3D Map*

On the 3D Map Category, you may navigate the whole campus through its 3D map. Camera can be rotated 360 degrees. Use the tools provided at the upper right part of the map for easy viewing.

B. Application Evaluation Result

The overall result shows a 4.35 mean with a corresponding "Very High" interpretation. It indicates that the system was effective, efficient, and meet all the requirements needed by the users. Table 2 will provide more details on this.

Table 2. *Summary of Evaluation Result on the Usability of the System Based on Quality in Use - ISO/IEC 25010.*

Criteria	Mean	Verbal Interpretation
Effectiveness	4.63	Very High
Efficiency	4.56	Very High
Satisfaction	4.40	Very High
Freedom from Risk	4.04	High
Context Coverage	4.11	High
Total	**4.35**	**Very High**

The table above shows the result of the evaluation for the respondents of the system. This was accomplished by some students, visitors, and school personnel who will be the system's primary users. The system got a grand mean of 4.35, which was interpreted as very high.

Expert Testing

A panel of experts from IT industry rated the system with a grand mean of 4.36 which was interpreted as very high. The system was tested using the ISO 25010 Software Quality Model.

Table 3. *Summary of Evaluation Result on the Quality of the System Based on Product Quality - ISO/IEC 25010.*

Criteria	Mean	Verbal Interpretation
Functional Suitability	4.39	Very High
Performance Efficiency	4.13	High
Compatibility	4.60	Very High
Usability	4.72	Very High
Reliability	4.13	High
Security	4.24	Very High
Maintainability	4.32	Very High
Portability	4.33	Very High
Total	**4.36**	**Very High**

The Table 3 shows the result of the evaluation conducted by the experts from the IT Industry using the ISO/IEC 25010 Software Quality Model Characteristics. The system's Functional Suitability was rated 4.39, which was interpreted as very high. It indicates that the system provides accurate results and covers all the objectives and tasks of the users. On Performance Efficiency, the system got a rate of 4.13, which is also interpreted as high. It shows that the system was efficient enough when it comes to responses and processing when performing its functions. The system got a mean of 4.60 on the Compatibility, which was interpreted as very high. It demonstrates that the system can co-exist with other applications in the same environment. On the Usability, the system has an average mean of 4.72, which was interpreted as very high. It shows that system was easy to learn, use and have a satisfying user interface.

Reliability got a rating of 4.13, which was interpreted as high. It shows that the system was available and operational most times. The system can also recover its previous sessions when a power failure occurs. For the Security the system was rated 4.24, which was interpreted as very high. This implies that the system

provides access only to information depending on the user's privilege and permission. In terms of Maintainability, the system got a mean of 4.32, which was interpreted as very high. It shows that the system can be modified its modules without affecting the other. Portability of the system earned an average mean 4.33, which was interpreted as very high. It clearly shows that the system can adapt to evolving hardware changes. It can be easily installed and uninstalled in different environments.

VI. CONCLUSIONS AND RECOMMENDATIONS

With all the findings and data gathered, the researcher concludes that Campus Interactive Information Kiosk with 3D Mapping is highly efficient, usable, and secured. It can cater to the respondents' needs in terms of Campus Navigation, Accessibility of Student and Faculty Information, including their schedules and room assignment, Calendar of events and activities, Services offered of every office, and a Centralized Electronic Announcement system. It will help the school in improving the quality of service provided in academic and non-academic terms.

Based on the findings and conclusion formulated, the researcher highly recommends, firstly, that the management of Central Philippines State University – Victorias Campus may consider implementing the system to address information dissemination and campus navigation problems. Secondly, install the system in a kiosk in a container in order to improve the mobility of the system. Lastly, further study will be conducted to enhance and add functionality to the system, like deploying it to an online platform for further coverage of the system.

VII. LIMITATIONS

This system software has its limitations. Since it is a web-based application, it will need a browser to run. It was developed using the localhost server; thus, this release version is not intended for online viewing. It will require a third-party application that will make the software full-screen and prevent unwanted keystrokes from the user's input in the client's window. The 3D map module will need to update manually if new buildings are present on the campus.

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