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INNOVATION IN ACTION: TURNING IDEAS INTO REALITY

Chapter 62
Kabel Realiti AR: A Network Cabling Learning Application

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ABSTRACT

Network cabling is a vital component of data transmission systems and forms the backbone of modern infrastructure such as data centers and home networks. However, in many educational institutions, particularly vocational colleges limited access to physical cabling materials makes it difficult for students to gain practical experience. Traditional learning methods like textbooks and static presentations often fail to effectively convey the structure and functions of different cable types.To address this issue, Kabel Realiti AR was developed, an Augmented Reality (AR) learning application designed to support the KSK2033 Network Cabling Preparation module at Malaysian Vocational Colleges. The app enhances learning through interactive 3D AR cable models, brief explanatory notes, and a user-friendly interface with gamified elements to cater to visual and kinaesthetic learners. Developed using Unity and the ADDIE instructional design model, the project also utilized Blender for 3D modeling and Figma for UI/UX design. The AR feature allows students to view and manipulate cable models in real time using smartphones equipped with ARCore-compatible hardware, offering an immersive and engaging educational experience. Beyond classroom use, the app serves as an alternative digital resource for both students and instructors in Computer Systems, Networking, and general IT fields. By offering a scalable, affordable, and interactive solution, Kabel Realiti AR promotes deeper understanding, greater student engagement, and improved knowledge retention. This project highlights the valuable integration of AR technology in technical education and supports the advancement of vocational learning environments.

Key Words: Learning Application, Augmented Reality, Network Cabling, Interactive Learning Tool, ADDIE methodology, Information Technology

1. INTRODUCTION

The Kabel Realiti AR application is developed by the Department of Information and Communication Technology at Kolej Vokasional Kudat. This application includes concise

learning notes and integrates Augmented Reality (AR) technology for educational purposes in line with the KSK2033 Network Cabling Preparation module. This module is a core requirement in the Malaysian Vocational Certificate (SVM) program for the Computer Systems and Networking Technology course offered at Malaysian Vocational Colleges. What makes this application special is its Augmented Reality feature, which allows users to view various types of network cables in semi-virtual 3D form. The application is not only suitable for students enrolled in the Computer Systems and Networking Technology program but is also accessible to anyone interested in learning the basics of industrial network cable types.

2. LITERATURE REVIEW

2.1 Concept and Explanation of AR Technology

Augmented Reality (AR) presents 3D virtual information while remaining connected to the real world, enabling users to interact with virtual objects naturally. Initially used in fighter pilot helmet displays, AR is now widely accessible through smartphones and headsets. It works by merging virtual images with reality via infrared sensors or smartphone cameras. Designed to enhance learning and interaction, AR is valuable for location tracking, markers, and data visualization (Chen et al., 2019).

2.2 AR Technology in The Entertainment and Gamification Industry

Augmented Reality (AR) and Virtual Reality (VR) have revolutionized 2D and 3D gaming by enhancing user interaction with digital environments. AR overlays digital elements onto the real world, while VR creates fully immersive virtual spaces. Companies like Microsoft and Meta have invested in AR development, supporting user-generated applications and services. Major manufacturers like Apple and Google integrate AR into platforms such as Apple Maps and Google Earth (Mealy, 2018). Development tools like ARCore and ARToolkit ensure compatibility with Android and iOS. The gaming industry has embraced AR and VR through devices like Samsung Gear VR, Microsoft HoloLens, PlayStation VR, and Google Cardboard, featuring eye tracking and motion controllers for enhanced interaction. These advancements make AR and VR essential in gaming, creating dynamic visuals that adapt to user movements and perspectives (Mealy, 2018).

2.3 Types of Internet Network Cabling Mediums

Internet network cabling plays a crucial role in data transmission, evolving from traditional copper-based telephone lines to more advanced broadband cables. UTP (Unshielded Twisted Pair) and STP (Shielded Twisted Pair) cables, commonly used in network setups, enhance data quality by reducing interference, though STP is more flexible but less resistant to signal disruption (A. Kateeb et al., 2013). Coaxial cables, known for durability, are widely used in television and older internet systems, but UTP remains the preferred choice for DSL services, utilizing telephone lines for internet access. Fiber optic cables, transmitting data as light signals through glass fibers, offer unmatched speeds ranging from 100 Gbps to 402

Tbps, but their fragility makes them vulnerable to breakage and external damage (A. Kateeb et al., 2013). Each cable type serves distinct purposes in network infrastructure, balancing speed, durability, and accessibility.

3. METHODOLOGY

The ADDIE model Analysis, Design, Development, Implementation and Evaluation is a widely used framework in instructional design. It follows an iterative approach, where feedback from the evaluation phase informs revisions to earlier stages, ensuring continuous improvement. Each phase provides opportunities to refine and enhance the learning process, making it an effective methodology for designing educational tools and programs.

3.1 Analysis Phase

The Analysis phase involved collecting data to identify challenges faced by the target group and determine suitable solutions, using a survey to assess students' and lecturers' existing knowledge of system hardware. Section A gathered demographic details, including age range and institution name, to understand how respondent backgrounds influenced their responses. Section B evaluated application functions regarding readability of the notes, 3d models interactiveness to input and 2D game experience. Section C focused on application design, assessing theme consistency, colour schemes, font readability, notes design and 3D model clarity to ensure a user-friendly experience. The insights from this phase played a crucial role in refining the application for optimal usability and effectiveness.

3.2 Design Phase

This phase involves processes that illustrate relevant information in the development of the application. This includes sketches of the application's functions and working process of developing the app in a flow diagram form. The purpose of this is to facilitate a clearer understanding of the initial structure of the application being developed.

3.3 Development Phase

This phase involves the process of developing the application, starting with the collection of application content such as notes, making 3d models and structuring and implementing coding functions. In addition, the development process uses software such as Unity, Blender and Visual Studio Code along with the programmed code that has been created.

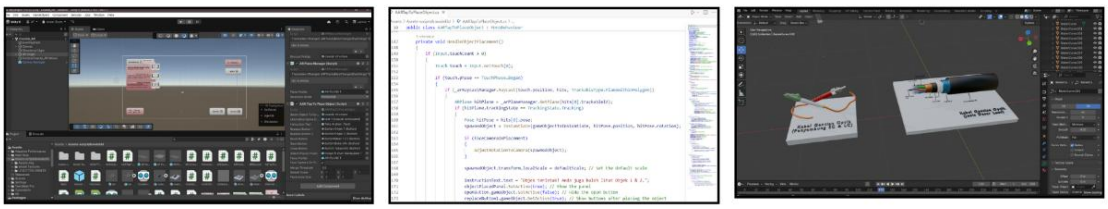

Figure 8: Designing in Unity, Coding structure and 3d modelling

3.4 Implementation Phase & Evaluation Phase

The Implementation Phase follows application development, ensuring proper functionality for end users. Real-world usage and training are conducted based on instructional modules, with staged evaluations to identify minor issues like interface bugs or performance errors. Documentation supports continuous improvement, while feedback from Google Forms and evaluation sheets refines the application. This phase transitions the app from beta to official release on platforms like the Google Play Store and Apple App Store, alongside promotion efforts.

The Evaluation Phase is the final stage, where the completed application undergoes user testing to assess usability and effectiveness. Users interact with the app, providing feedback through surveys to measure functional performance and user experience. Responses are analysed to ensure alignment with project goals, informing future enhancements for improved usability and engagement.

4. RESULTS & DISCUSSION

The project was successfully completed, delivering all planned features and content. A major strength is the 2D cable color-coding game, which users found engaging and easy to understand. The app received positive feedback for its consistent interface, appealing color theme, and responsive 3D model, making it effective for visual learners. However, some weaknesses were noted. The AR feature using Google ARCore is not supported on all Android devices, limiting access. The 2D game's interface design differs from the rest of the app, causing inconsistency in aesthetics. Additionally, the app is not yet available on the Play Store, restricting accessibility. Addressing these issues will enhance usability and expand its reach.

5. CONCLUSION & RECOMMENDATION

The project was completed on time with effective planning and development, receiving positive feedback. The AR-based application is now ready for Malaysian Vocational College students, offering interactive model manipulation to enhance learning. It has potential for expansion to lecturers and the public, especially for teaching network cabling. To improve usability, recommendations include listing ARCore compatibility on the Play Store, refining the 2D game interface, and setting a public release date. Future updates could add quizzes, more mini-games, and clearer AR object manipulation instructions. An iOS release is also planned to broaden accessibility.

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