PCMJ

Progress in Computer and Mathematics Journal (PCMJ)
volume 2 [August, 2025]
e-ISSN: 3030-6728
Website: fskmjebat.uitm.edu.my/pcmj

HANDSAR RESQ: HANDS-ONLY CPR WITH AED THROUGH AUGMENTED REALITY

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Article Info

Received: August 2024
Accepted: March 2025
Available Online: August 2025

Abstract

Emergencies can happen anywhere and anytime, and CPR skills are needed in these moments. To ensure that individuals are prepared to respond effectively in emergency situations, learning about CPR can provide many benefits. However, some challenges have prevented people from practicing this skill in real-life emergencies because people forget how to perform CPR. This project, called HandsAR ResQ, tries to help individuals learn or retain their CPR skills that easily can be accessed using Android smartphones or tablets. According to the study, most of the problems are because most existing programs do not support acquiring or retaining high-quality CPR. Over time, individuals may forget or become less proficient in performing CPR, which can be a critical problem in real-life emergencies. This project is intended to enhance the training and retention rates of Hands-Only CPR with AED procedures. This project aimed to develop an effective AR platform that offers CPR training scenarios. The methodology used for the development in this project is the Iterative/Incremental Model. MAR Device and MAR Task from MAR Framework were also implemented in this project. An evaluation of the application's effectiveness was conducted using a pre- and post-analysis. This is to evaluate whether HandsAR ResQ really can help them in retain CPR steps through a Theoretical Capability to Perform CPR questionnaire. The results show that the project succeeded as all of the respondents's scores increase after using HandsAR ResQ. Future research should aim to develop this project to make it available on other operating systems, not only Android.

Keywords: CPR; AED; Effectiveness; Retain

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INTRODUCTION

Cardiopulmonary Resuscitation (CPR) is a critical lifesaving technique used in emergencies where an individual's heart has stopped beating or they have ceased to breathe. It involves chest compressions and, optionally, rescue breaths to maintain blood circulation and oxygenation. Mastering CPR is essential for healthcare professionals, first responders, and the public, enabling them to act swiftly in emergencies and potentially save lives. However, current CPR training methods face significant challenges in both skill retention and accessibility, which can impact the effectiveness of CPR in real-life emergencies.

One major challenge is the lack of sustainable skill retention post-CPR training. Traditional CPR programs, which typically require annual certification renewals, do not effectively support the retention of high-quality CPR skills (Anderson et al., 2019). Over time, individuals may forget or become less proficient in performing CPR, a critical issue in emergencies. Research has shown that skill retention deteriorates over time, emphasizing the need for frequent retraining (Nas et al., 2022). Studies have suggested methods to improve retention, such as brief intermittent refresher training and the use of feedback and prompts during sessions (Sutton et al., 2011; Greif et al., 2015). The variability in traditional instructor-led training also contributes to inconsistent skill retention and competency (Hsieh et al., 2016).

Another significant issue is the lack of accessibility to CPR training. Traditional methods often require individuals to travel significant distances and invest considerable time to attend courses, posing a barrier to many who need this training (Hubail et al., 2022). This issue is particularly pressing for Out of Hospital Cardiac Arrest (OHCA) patients, as cardiac arrest can occur suddenly and without warning, often at home where family members may need to respond immediately (Astuti & Jannah, 2021). To address these challenges, this project proposes the development of hands-only CPR training with Automated External Defibrillator (AED) support through augmented reality (AR). AR-based training can create lifelike simulations that immerse trainees in realistic emergency scenarios, providing real-time feedback and a more engaging learning experience (Boonbrahm et al., 2019). This

approach aims to improve both the retention of CPR skills and the accessibility of training, ensuring that more individuals are prepared to act effectively in emergencies.

OBJECTIVES

This project aims to model and develop an augmented reality application that enhances Hands-Only CPR training through realistic simulations and interactive learning. To achieve this primary goal, the following specific objectives must be met: 1) To model 3D objects for augmented reality CPR focusing on Hands-Only CPR training; 2) To develop an augmented reality application for Hands-Only CPR training; and 3) To evaluate the effectiveness of HandsAR ResQ in terms of sustainable skill retention.

SIGNIFICANCE

The objective of this project is to develop innovative methods for training Malaysians in CPR using augmented reality (AR) technology that simulates real-life incidents requiring CPR. This AR application is particularly valuable for family members of individuals at risk of cardiac arrest, as it equips them with practical CPR skills, enhancing their readiness to respond to critical cardiac emergencies and potentially saving lives.

In a formal context, the project emphasizes the importance of accessible and effective CPR education, ensuring that individuals are well-prepared to handle emergencies. This aligns with the broader goal of improving public health and safety in Malaysia and demonstrates the potential of technology to enhance lifesaving skills.

The project also offers the advantage of easy accessibility, as trainees only need a smartphone or tablet to use the AR application. It aims to provide a more realistic and immersive learning experience by simulating genuine emergency scenarios. Additionally, the project will benefit health workers, medical or nursing students, and the public by offering an opportunity to refresh or enhance their existing CPR knowledge with updated guidelines.

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METHODOLOGY

This project employs the Iterative/Incremental model, a method well-suited for demonstrating the feasibility of novel systems, especially when constraints or algorithm requirements are uncertain. The model comprises three key phases: Initial Planning, Iterative Process (including Planning, Requirements, Analysis and Design, Implementation, Testing, and Evaluation), and Deployment. By breaking down the development into smaller, manageable cycles, this approach simplifies testing and management, and facilitates early error detection, leading to a more efficient and error-resistant development process. Figure 1 illustrates the phases of the Iterative/Incremental model.

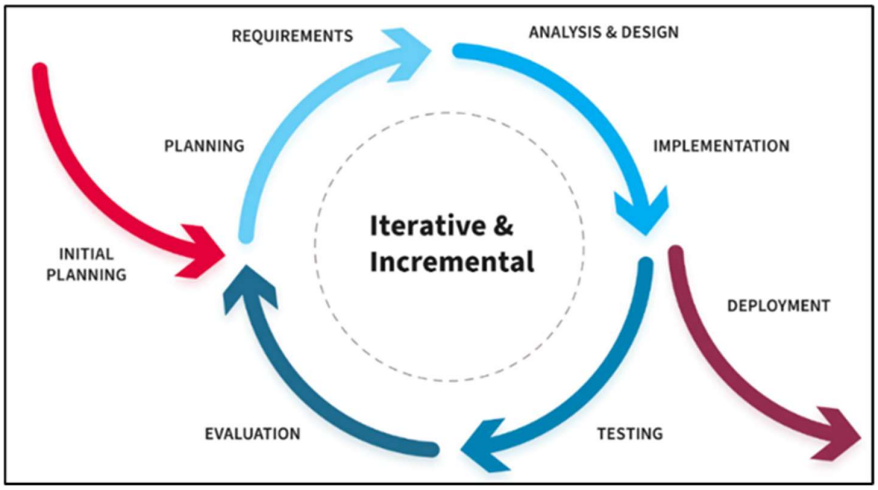

Figure 1: Phases of the Iterative/Incremental model

RESULT AND DISCUSSION

Theoretical Capability to Perform CPR Evaluations

The questionnaire used to evaluate this project is Theoretical Capability to Perform a CPR questionnaire. The evaluation focused on the HandsAR ResQ application's effectiveness in improving skill retention. Users completed the questionnaire before and after using the application. This approach allowed for a clear comparison of their skills and understanding, highlighting any improvements made after interacting with the application.

Demography respondents

For this application evaluation, a total of 32 participants were sampled. Among them, 27 (84.4%) were female, and 5 (15.6%) were male. Most participants were between 18 and 25 years old. A majority, 22 (68.8%), had never attended a CPR training course, while the remaining 10 (31.3%) had. Among those who had received CPR training, most had done so less than 6 months ago or more than 2 years ago and they typically reviewed or practiced their CPR skills only during training sessions. Table 1 shows the demography of the participants retrieved from the evaluation summary.

Table 1: Demography of HandsAR ResQ Evaluation Participants

Question	Range	Frequency (n)	Percentage (%)
Gender	Male	5	15.6
	Female	27	84.4
Age	18-25	30	93.8
	26-35	1	3.1
	36-50	1	3.1

Findings

To determine the effectiveness of the application, the scores before and after using the application were calculated. If the after score was higher than the before score, it indicated that the user could enhance their skill retention by using the HandsAR ResQ app. Figure 2 shows the summary of the respondent's scores before using the application, while Figure 3 shows the summary of their scores after using HandsAR ResQ.

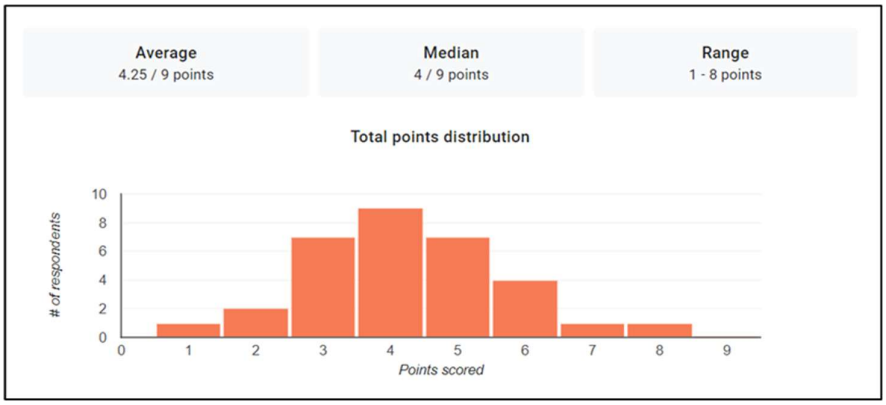

Figure 2: Summary of the Respondents' Scores Before Using HandsAR ResQ

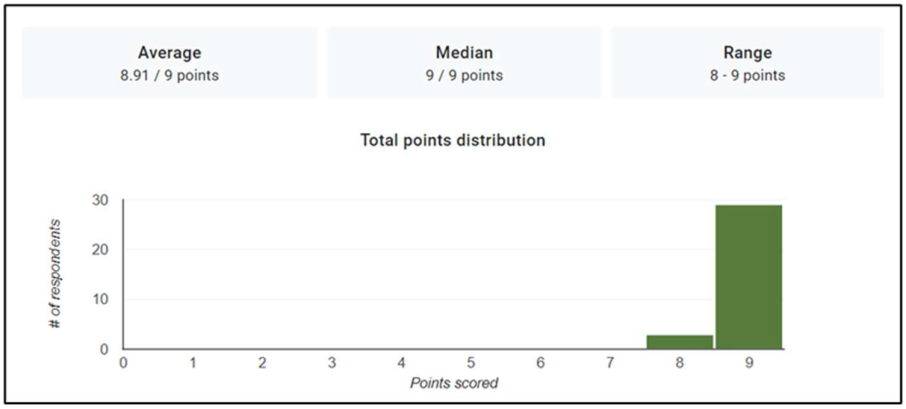

Figure 3: Summary of the Respondents' Scores After Using HandsAR ResQ

Findings Summary

For overall findings, the effectiveness of the application was evaluated through a pre- and post-analysis, showing a post-test mean score of 8.91, higher than the pre-test mean score of 4.25 after users were exposed to the application. This highlights significant improvements and overall trends in user skill retention performance, demonstrating the project's success in improving CPR retention. Table 2 shows the Mean Pre-Test Vs. Post-Test Score.

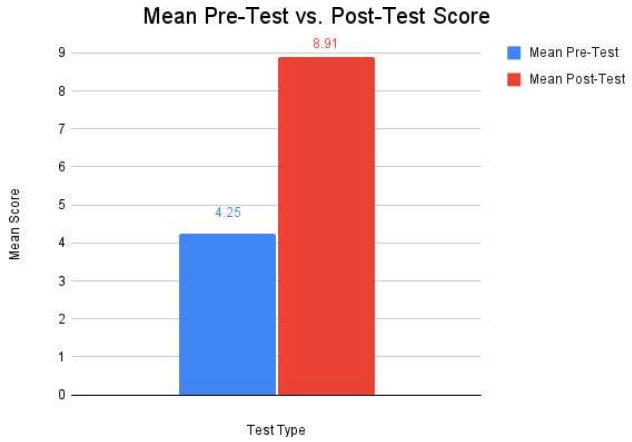

Table 2: Mean Pre-Test Score Vs. Post-Test Score

CONCLUSION

The HandsAR ResQ app effectively addresses the need for sustainable CPR skill retention and accessibility to training. Utilizing AR technology, it provides an interactive learning experience through 3D environments. Successfully designed to meet the project's objectives, it has proven effective in retaining CPR skills, as evidenced by the higher post-test mean score of 8.91 compared to the pre-test mean score of 4.25. This project demonstrates the potential of technology to improve lifesaving skills and underscores the importance of accessible CPR education for the broader community, ensuring that more individuals are prepared to respond effectively in emergencies.

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