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Augmented Reality in Heat Stroke Emergency Medical Developing Design

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ABSTRACT

Global temperature extremes have increased both the incidence and fatality rate of heat stroke, and the majority of cases take place outside of hospitals, without the assistance of medical personnel. People who work in manual labour ignore vital physiological signals and are unaware that heat stroke is happening, losing the crucial 30 minutes for rescue and risking permanent physical harm or death.The general public is unaware of the proper treatment for heat stroke, even though medical specialists can frequently recognize labour-related heat stroke rapidly. With the development of technology, augmented reality (AR) technology has been incorporated into a variety of industries, providing the medical sector with cutting-edge applications in the area of emergency care. Medical practitioners can swiftly and repeatedly exercise their medical skills by using the advantages of visual medicine when augmented reality technology is used in conjunction with applications for clinical training and practice. Numerous studies have adapted augmented reality technology into applications to help first responders make crucial ambulance decisions in increasingly complicated situations with a visual aid interface, improving the effectiveness of emergency care. In conclusion, this study focuses on how augmented reality technology may be used to create an interface that enables members of the general public to obtain care for heat stroke victims most quickly and effectively as possible. This project adopts a Quality function Deployment to develop a user interface for heatstroke first aid that will satisfy users' demands and design criteria. The user interface is meant to give them a quick and easy way to understand how to manage heat stroke victims before they seek medical attention.

Keywords: Heat stroke, Augmented reality, Quality function deployment

INTRODUCTION

The worldwide population's health has been impacted by the severity of the extreme greenhouse effect (Chen et al., 2017). However, because athletes, employees, and others are continuously exposed in high temperatures, there is a rise in the morbidity and mortality of disorders connected to heat stroke (Howe & Boden, 2007). People who work in manual labour frequently disregard crucial physiological warnings and are unaware that heat stroke is happening (Lin et al., 2018), losing the critical 30 minutes (Liu et al., 2020) of rescue time. Heat stroke occurs most frequently when medical personnel are not around (Kenny et al., 2010; Lee et al., 2022). Death or severe physical harm may ensue from this.Pre-hospital heatstroke treatment and ambulance

treatment for heatstroke in labour are both feasible and potentially life-saving (Sonenthal et al., 2022). The general people are not aware of the proper therapy for heat stroke. In many circumstances, cold water immersion is not used for emergency treatment of labour heat stroke. Medical specialists can frequently immediately detect labour heat stroke (Altman, 2020). In conclusion, the primary cause of heat stroke is that workers often disregard physical warning signs; the majority are uninformed of appropriate and qualified heat stroke care; and some even use the diffe incorrect first aid. Many people must be informed of the right ways to treat heatstroke.The purpose of this project is to employ a smartphone as a teaching and practice tool for heatstroke ambulance, utilizing augmented reality technology to enable users to follow the AR interface prompts and instructions. The study is a tool for heat stroke first aid and focusing on the usability of the general public. It will increase public access to the expertise and abilities of heat stroke ambulances and contribute to a higher incidence of heat stroke patients surviving outside of hospitals. A wider audience can learn first aid care in a unique way thanks to the integration of first aid and augmented reality technologies.

USING QUALITY FUNCTION DEPLOYMENT TO DESIGN AUGMENTED REALITY HEAT STROKE EMERGENCY SYSTEM INTERFACE

Quality Function Deployment (QFD), a user-driven strategy that transforms consumer wants into appropriate technical requirements at each stage of product development and production, was developed in Japan in the late 1960s to assist the product design process (Lai-Kow Chan, 2002). To increase customer satisfaction at a price the company can afford, numerous businesses in Europe, the US, and Japan have built on QFD using various techniques (John J. Cristiano, 2001). QFD has also been used in schools to create digital learning systems for students on mobile devices and to meet the expectations of users of the learning devices (Xiaosong Zheng, 2007). This study served as a pre-development research study for the AR Heatstroke Ambulance using the Quality Functioning Development (QFD) methodology. The system's interface is created after identifying prospective user needs through literature research and expert interviews.

Utilizing Augmented Reality in Medical Visualization

Augmented Reality (AR) technology was created by Caudell and used in commercial settings. After more than ten years of rapid technological advancement, which successfully transitioned virtualization from the lab to industry (Arena et al., 2022), AR technology has changed from serving a single, narrow purpose to serving multiple purposes, with the proliferation of wearable technology, electronic devices, and high-speed internet elevating the interface and user experience. The medical industry has also been touched by technological advancements, with doctors employing devices like smart glasses and tablets to inform clinical training and practice (Klemenc-Ketis et al., 2021). In response to the development of AR technology, which will play a significant role in the future of nursing, clinical training for nurses is also

expanding quickly (Mendez et al., 2020). The widespread use of electronics is progressively coming to the attention of healthcare professionals, which has boosted interest in incorporating augmented reality technology into learning and new opportunities for doing so in nursing education and practice (Sural, 2017). The learning environment are no longer restricted to a fixed location, and AR technology allows rapid adaptation to existing environments with visualised assistive interfaces for learning (Beck, 2019). Globalising nursing education through the introduction of AR technology increases the opportunities for students to learn new skills and knowledge and promotes more effective and detailed learning (Martlı & Ünlüsoy Dinçer, 2021). Therefore, this study is based on the application of AR technology to nursing education, which allows the general public to learn how to be trained in the treatment of patients with heat stroke.

METHODOLOGY

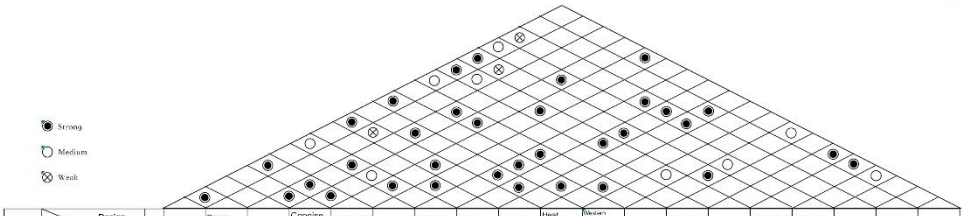
This study used AR technology and mobile devices as a vehicle to construct an AR heat stroke ambulance system. The measures for heatstroke emergency rescue were established from the user's perspective. A relationship matrix between the user requirements and the design requirements was established based on preliminary data collection and survey results. The interface model of the AR heat stroke emergency rescue system was designed by using a quality machine to develop a research method to rank the importance of the user requirements.

Expert Interview

For a semi-structured interview lasting 10 to 30 minutes with pertinent experts, the AR heat stroke emergency development medical system created for this study tried to better comprehend the information and procedures needed to established the application. To determine the usefulness of the system's heatstroke ambulance procedure and the interface setup of the AR-imported ambulance learning environment, nursing specialists spoke with two experts from the nursing field. In order to improve learner comfort and satisfaction and to make the application more user-friendly, three specialists with design-related backgrounds developed the AR-combined heatstroke ambulance visualization in the ambulance environment. A specialist with engineering experience could offer ideas on how to improve the system's logic.

Quality Function Deployment

The QFD team synthesized the information from the aforementioned literature and expert interviews, categorized it using the KJ technique and then rank the user requirements for the left wall of the Quality House according to their priority. The QFD team listed the design requirements for the user requirements based on the ranking of the user requirements and the discussion of the design requirements, and then selected the design requirements for the ceiling of the quality house. The design requirements and the related matrix (ceiling and roof) were first established. The degree of relationship between



User Requirement \ Design Elements	K	Sequential Visual Layout	Same Colour Matching	Regular Image	Concise and Specific	Emergency Instruction are clear	Vertical view	Symptoms of AR Recognition	Basic Diagnostic Functions	Instant Emergency Call Button	Heat Stroke Symptom Selection	Western medicine and Chinese medicine approach	Intuitive Illustration	Emergency Progress Bar	Notification window	Countdown Digital Clock	Hydration Options Suggestion	GPS	Back and Cancel Buttons	Set Action Reminder
User Interface Planning																				
1. Clear Interface Layout	5	9	9	6	9	9	3	9	6	9	3	6	9	9	9	9	3	0	9	9
2. Simple Colour Scheme	4	9	9	6	0	9	0	9	3	9	3	6	9	9	9	9	6	0	6	9
3. Clear Illustration	4	9	6	9	6	9	0	9	6	9	6	9	9	9	6	9	9	6	9	3
4. Easy-to-follow Instructions	3	3	0	3	9	9	6	9	6	9	3	9	9	9	9	9	9	3	3	9
5. Clear Steps	4	3	3	6	9	9	0	9	3	9	9	9	9	3	3	6	9	0	9	9
6. Non-horizontal view	1	6	0	0	0	3	9	3	0	0	0	3	0	3	0	0	3	0	0	0
Emergency Procedure																				
7. Vital signs Identification	5	0	0	9	9	6	3	9	9	0	6	6	3	0	0	0	3	0	0	6
8. Heat Stroke Identification	3	0	6	0	9	9	0	9	9	3	9	9	6	0	0	0	0	0	3	6
9. Emergency Call	3	3	3	9	6	9	0	6	9	9	9	9	9	6	6	0	0	9	6	9
10. Heat Stroke Severity Identification	4	6	6	6	9	9	0	9	9	6	9	9	6	3	0	0	0	0	0	6
11. Various first aid Methods	4	3	0	9	9	6	0	6	3	0	6	9	6	3	0	0	6	0	6	6
12. Non-video Tutourial	3	3	3	9	3	6	6	0	0	0	0	6	9	0	0	0	0	0	0	3
Accessibility																				
13. Emergency Progress	2	9	6	6	3	3	3	3	3	0	6	6	9	9	0	0	6	0	3	9
14. Heat Stroke prevention notice	3	6	6	3	6	0	9	0	0	0	0	3	3	0	9	0	9	0	3	9
15. Clear countdown to rescue	4	9	9	9	9	6	0	3	6	9	9	9	6	9	3	9	0	0	0	3
16. Patient hydration option	3	3	3	3	9	9	0	3	9	0	9	3	3	0	0	0	9	0	6	6
17. Locate the location of the patient	2	0	0	0	9	3	0	0	6	9	3	0	3	0	6	0	0	9	0	0
18. The mechanism of wrong click	1	9	3	9	6	3	0	3	0	3	0	6	6	3	3	0	3	3	9	6
19. Important Reminder	4	9	9	9	9	9	3	6	9	9	9	9	9	6	6	6	6	6	0	9
Design Elements K		324	291	393	450	447	120	387	348	333	357	438	423	282	240	228	273	105	243	405

Figure 1: Augmented reality heat stroke emergency system interface user requirements of the house of quality.

the design needs is then calculated by adding the relationships between the components in the design requirement.

RESULT AND DISCUSSION

The three most important design elements were clear Emergency Instructions (447), Western medicine and Chinese medicine approaches (438) and Concise and Specific content (450). The other design elements scoring above 400 were Intuitive Illustrations (423) and Set Action Reminders (405).In terms of functionality, the system offers the general public options for relief according to the severity of heat stroke by Western and Chinese medicine practitioners and aids the rescuer in administering first aid with illustrations and reminders. It was discovered that the layout of the interface and the steps of first aid measures were the main design focus of this study system.The results from the aforementioned studies are comparable to those from studies in the literature, such as Rometsch (2022), in which learning from simulated training of astronauts performing Extravehicular Activity (EVA) work was incorporated into Augmented Reality, and the user-centred design approach was adapted to the user's vision, usability, and operability, enabling (Rometsch et al., 2022); Herskovi (2014) used AR technology as a visual interface to assist firefighters in selecting the best (Herskovi, 2014); To ensure that the general people could appropriately administer CPR to treat patients, Hou (2022) used AR technology as a visual assistance for the CPR operation. The findings of this study demonstrated that using AR in conjunction with CPR allowed the user to appropriately do chest compressions and complete the CPR cycle more reliably than conventional CPR alone (Hou et al., 2022). As a result, the design components of this study's qualitative function are comparable to those in the literature in that they are focused on the user requirements and employ a visual aid interface to help them make quick and arduous judgments.

CONCLUSION

Through the use of a quality functional development approach, the study has created an interface for the development toward an AR heat stroke ambulance system, enabling the general public to increase the survival rate of patients suffering from heat stroke in the pre-hospital setting without the assistance of specialists. The system could be developed to support additional platforms in the future, increasing accessibility and minimizing platform constraints. The study could be used to learn more about emergency treatment and lower the price of medical services.

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