

# Development of SatuJantung 2.0 Revised Version Android Application, SatuJantung 2.5, for Cardiac Arrest Pre-Hospital Management



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## ABSTRACT

Cardiac arrest is one of the leading causes of death in Indonesia. Deaths can be prevented if symptoms are recognized early and immediate assistance can be provided. An Android application called SatuJantung 2.0 was developed in 2018 and has been in use. However, during evaluation in implementation, it was found that the application is not compatible with the latest version of Android. An application revision with newer features is needed. This study aims to develop a revised version of SatuJantung 2.0 with more advanced specifications. The method used is action research, which consists of 4 cycles: 1) Planning, 2) Action, 3) Observation, 4) Reflection. The final result of this study is a revised version of an Android application named SatuJantung 2.0. This application is developed in the Indonesian language. This application has a menu for login, registration, user profile, user status (based on analysis of user profile by risk calculator), user information, summary, emergency button, guidance for the first responders, sending WhatsApp messages for the family/contact registered with the geotag location, and an emergency call to the ambulance. SatuJantung 2.0 revised version, named SatuJantung 2.5, provides an easy way for patients to calculate the risk factors, get information about the disease and management, ask for help in emergencies, and guide first responders to do prehospital management in cardiac arrest cases.

**Keywords:** Android application; calculating risk factor; cardiac arrest; emergency call; first responders guidance.

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## INTRODUCTION

The Health and Demographic Surveillance System (HDSS) data in Sleman Regency from 2016 to 2021 indicates that heart attacks are one of the leading causes of death.<sup>1</sup> Sudden deaths from cardiovascular diseases can be prevented if the symptoms of this disease are recognized early and immediate assistance can be provided during a cardiac arrest.

The use of smartphones in Indonesia reached over 100 million people in 2018.<sup>1</sup> Internet penetration also reached the same figure in 2018, with Indonesians spending an average of 3.5 hours per day accessing the internet via smartphones.<sup>2</sup> This condition represents the potential for the community to address cardiac arrest at home with the guidance of smartphone applications and information technology, thereby preventing sudden deaths.

The author developed the SatuJantung 2.0 application as a self-alert system in

2018. The application already includes individual risk analysis, an emergency button feature linked to SMS, enabling family members or designated contacts to know the patient's location, and an alarm system to request assistance. The existence of technology and recommendations accelerates early assistance and access to hospitals, which are key in managing cardiovascular diseases.

Implementing the previous SatuJantung 2.0 development research on the drivers of online *Ojek* (motorcycle taxi) indicated that the application was incompatible with the latest Android version. Additionally, there is a need to develop the application further to provide additional features that can offer practical information for users.

Based on the background information provided, developing the revised version of the SatuJantung 2.0 application with higher technological specifications is necessary. Enhancing the application's technological capabilities can better serve

its purpose in addressing cardiac health issues and preventing sudden deaths. The study aims to develop the application with compatibility to the latest operating systems, provide additional practical features, and enhance user experience and accessibility.

## METHOD

The research used the action research method. Action research is a systematic approach to problem-solving and knowledge generation that involves a cyclic process of planning, action, observation, and reflection. It aims to address real-world problems and create practical solutions while contributing to theoretical understanding.<sup>3</sup>

### Planning

The first stage was planning. In this phase, the researchers and participants identified the research problem or goals, established the objectives, and devised a

data collection and intervention plan. We determined the key issues to be addressed and the actions to be taken. A user review of the SatuJantung 2.0 application by

the drivers of online Ojek (motorcycle taxi) found that the application cannot perform in Android version 11 and above. We also found that recently, most people

have internet data plans and prefer to make instant messaging apps and social media messaging than short message service (SMS) that need mobile credit. After the user review, an expert review of the SatuJantung 2.0 application was conducted. This activity involved inviting doctors and an information technology specialist to examine and provide input. A focus group discussion was conducted, and the results were qualitative data that will be used as input for the action stage.



Figure 1. User review by the drivers of online Ojek.



Figure 2. User-focused discussions.



Figure 3. The icon for the SatuJantung application. (a) SatuJantung 2.0. (b) SatuJantung 2.5.

**Action**

During this stage, the planned interventions or actions were implemented. This stage was held in June until August 2023. We actively engaged in activities and initiatives to address the identified problems or goals. These actions include developing new methodologies, collaborating with community organizations, and initiating projects to bridge the gap between researchers and society.<sup>3</sup> The action stage begins with revising the SatuJantung application, the SatuJantung 2.0 revised version. Initial trials by the planning team are conducted in this stage. The messaging mechanism was changed from SMS to



Figure 4. Participants and facilitators.

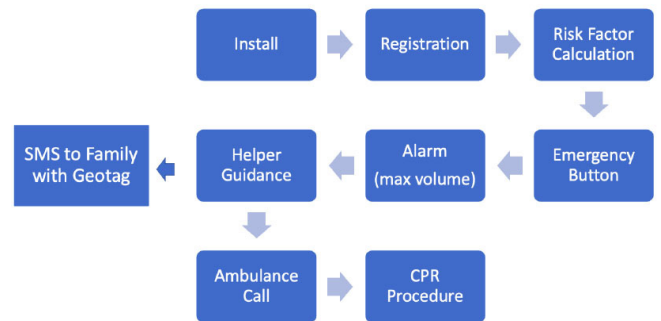


Figure 5. SatuJantung 2.0 overall operational process.

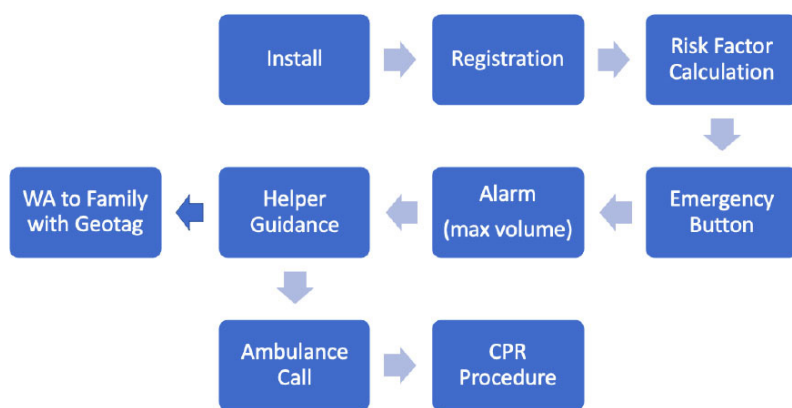
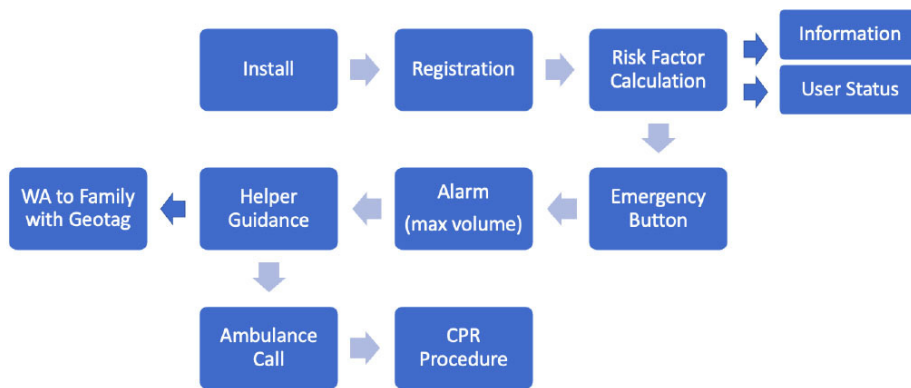


Figure 6. SatuJantung 2.0 revised version overall operational process.

Risk Factors	Score -> circle and sum	Risk Factors	Score -> circle and sum
BMI (body mass index) (Kg/m2)	13.79 - 25.99	Sex	Female
	26.00 - 29.99		Male
	30.00 - 35.58	Age	25 - 34
Smoking	Non-smoker	35 - 39	-4
	Ex-smoker	40 - 44	-3
	Active smoker	45 - 49	-2
Diabetes	Yes	50 - 54	1
	No	55 - 59	2
		60 - 64	3
Physical Activity	None	Blood Pressure (mmHg)	<130 / <85
	Light	130-139 / 85-89	1
	Moderate	140-159 / 90-99	2
	Heavy	160-179 / 100-109	3
		>180 / >110	4

Figure 7. The Jakarta Cardiovascular Score.<sup>4</sup>



**Figure 8.** SatuJantung 2.5 overall operational process.



**Figure 9.** The Survival Chain.<sup>8</sup>

WhatsApp. The application has also been upgraded to higher technology that is compatible with recent Android versions.

### Observation

The action research process emphasizes systematic data collection and observation to evaluate the effects of the implemented actions. The researchers and participants monitored the outcomes. This stage is conducted to test the application. Users are invited to participate in focused group discussions. Users try out the SatuJantung 2.0 revised version application and provide evaluations on three aspects: system aspects, user aspects, and interactions.

### Reflection

The reflection phase involved critically analyzing and interpreting the observed outcomes, SatuJantung 2.0 revised version application. The researchers and participants engaged in discussions, shared experiences, and considered the implications of the results. The Reflection stage is conducted by revalidating the application, which was finally released as SatuJantung 2.5 application.

This study was approved by the Institutional Review Board of Medical and Health Research Ethics Committee (MHREC) Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah

Mada-DR, Sardjito General Hospital, ID number KE/FK/0647/EC/2023.

## RESULT

The study's results are presented based on the implemented four-cycle procedures of action research.

### Planning

Thirty-six participants were involved in this study. They were grouped into three groups for focus group discussion (FGD). The FGD was conducted combined with skills training to get more comprehension.

Ten percent of participants installed the application successfully. The rest of them got notified, "This application is not available for your device because it was made for an older version of Android". We analyzed all participants' devices and concluded that the application is suitable for Android version 10 and below. FGD proceeded to the operational process issues. Figure 5 describes the operational process of the SatuJantung 2.0 application. Sending message feature in this version uses SMS that needs phone credit. Most users use data plans without paying attention to mobile credit (balance). People tend to have more access to the internet, for example, instant messaging apps or social media messaging and calls, than conventional communication modes.

An expert review of the SatuJantung 2.0 application is conducted following the user review. This activity is conducted by inviting doctors to review the medical standard used in this application. The Jakarta Cardiovascular Score has been decided to be used in calculating the risk of experiencing heart disease.

User status was grouped into three criteria: low, moderate, and high risk. Low risk is for users with a cardiovascular score of -7 to 1. Moderate risk is for users with a cardiovascular score ranging from 2 to 4. High risk is for users with a cardiovascular score of 5 or higher.

An information technology (IT) specialist was also invited to FGD with the doctors. The IT specialist team put all the input from the FGD into an application design draft. At the end of FGD, the IT specialist presented the design draft that had been made. We invited experts to give feedback to the IT specialist for validating the content.

### Action

The action stage was done by developing the SatuJantung 2.0 revised version of the Android application that is compatible with recent Android versions. Figure 6 shows the operational process of SatuJantung 2.0. A message was sent to the family by WhatsApp instant message. WhatsApp instant messages show the location based on geotagging better than SMS.

An initial peer review was done to ensure the application was running well in the newest Android version. All the features are running well at this stage.

### Observation

The observation stage of this study was done by putting the application into trial. Users were invited to a focus group discussion in which they tried the SatuJantung 2.0 revised version application. The users agreed that the revised version was easily operated in three main aspects (system, user, and interaction aspect). In the FGD, we found more user expectations regarding community health issues.

After user FGD, the application was improved with more detailed features, SatuJantung 2.5. In order to improve health literacy for the community, the

Jakarta cardiovascular score (figure 7) is displayed in the user status of the SatuJantung 2.5 application. User status also mentions recommendations for each category. Maintaining a user lifestyle is recommended for low-risk users. Improving user lifestyle is recommended for moderate-risk users. Consulting a doctor is recommended for high-risk users.

Information about the application is also added in this new version. Users can access the developer information, the references used, and the chance for collaboration.

### Reflection

In the last stage of this research, a revalidation process was done to the application. There is a slight readjustment in the application's display based on the responses from FGD and expert evaluation. Figure 8 shows the operational process of the final result named SatuJantung 2.5 application.

### DISCUSSION

Our study finds that SatuJantung 2.5 solves the technical issue found in SatuJantung 2.0. Technical issues in SatuJantung 2.0 application are incompatibility with the latest version of Android and notification sending via short message service that needs mobile credit. Adjustment to user needs is important to make faster first response to help people lead to the leading causes of death worldwide. In high-quality emergency medical systems, including trained emergency doctors, spontaneous circulation can be restored in up to 53% of patients until they reach the hospital.<sup>6</sup>

Brain damage is likely to occur if cardiac arrest lasts for more than 5 minutes without immediate cardiopulmonary resuscitation (CPR) intervention. Death may occur if cardiac arrest lasts for more than 8 minutes. Therefore, CPR for cardiac arrest should be initiated as soon as possible.<sup>7</sup>

The study by Neukamm J et al. also showed that starting CPR earlier and having faster access to emergency medical systems will increase the survival rate of patients.<sup>6</sup> Resuscitation that succeeds after cardiac arrest requires a series of coordinated and integrated actions

represented by links in the Chain of Survival. The chain includes immediate recognition of cardiac arrest and activation of the emergency response system; early CPR emphasizing chest compressions; rapid defibrillation; effective advanced life support; and integrated post-cardiac arrest care.<sup>8</sup>

Emergency systems implementing this chain can effectively achieve a witnessed cardiac arrest survival rate of nearly 50%. However, in many emergency systems, survival rates are lower, indicating opportunities for improvement by carefully examining the chain and strengthening weak links. The chain is interdependent, and each link's success depends on the preceding links' effectiveness. Rescue teams have various training, experiences, and skills. The status and response of cardiac arrest victims to CPR maneuvers, as well as the location of the heart attack, can also vary.<sup>8</sup> The study by Bakran *et al.* mentions that 10 out of 100 people who received assistance survived.<sup>9</sup> Recognizing the importance of patients receiving continued care after initial assistance is crucial.

The user FGD was conducted during the planning stage, combined with skills training for greater comprehension. The skills training given to the participant was cardiopulmonary resuscitation (CPR). CPR procedures are performed when breathing and heartbeats cease.<sup>10</sup>

Cardiopulmonary resuscitation (CPR) is a method to restore breathing and circulation in someone experiencing cardiac arrest and unexpected cessation of breathing, aiming to prevent immediate death. With the performance of CPR, it is hoped that blood flow and oxygen supply to the body can resume and death can be avoided.<sup>11</sup> In the brain, oxygen deprivation can disrupt the brain's ability to coordinate and control autonomic functions, such as heartbeat and respiration.<sup>12</sup> This rescue or intervention would be highly beneficial if performed quickly and accurately.<sup>11</sup>

Not only doctors or trained personnel can perform CPR techniques. As a layperson, performing Hands-Only CPR (compression-only) is possible.<sup>13</sup> This technique is recommended for laypeople because Hands-Only CPR is easier to perform and can be guided over the phone

by emergency service personnel.<sup>14</sup>

Hands-only CPR is a form of CPR without rescue breaths. This technique is recommended to be performed by someone who witnesses an adult or adolescent suddenly collapse at a hospital, at home, at work, or possibly in an open area.<sup>15</sup> This guide is a reference for developing the helper guidance in the SatuJantung 2.5 application.

The limitations of this study are related to time constraints and the lack of a network of hospitals available that can provide integrated information on the management of cardiac arrest cases and the readiness of catheter labs.

### CONCLUSION

The development of the SatuJantung 2.5 Android application has successfully improved upon the previous version, making it compatible with recent Android versions and adding more features. This application allows patients to calculate their risk factors easily, access information about diseases and management, seek help in emergencies and guide first responders in pre-hospital management for cardiac arrest cases. The development of SatuJantung 2.5 is a result of community empowerment efforts, with individuals contributing to its improvement to serve the community better. The application is now ready for further community empowerment, expanding its reach to include more Ojek drivers and other communities across Indonesia.

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### CONFLICT OF INTERESTS

The authors declare no conflicts of interest related to the study and this manuscript.

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