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RESEARCH **Open Access**

Android Application Based Cardiac Health Monitoring System: Patients with Heart Disease

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Abstract
A variety of disorders affecting the heart and blood arteries are together referred to as heart disease. These disorders may impair the heart's capacity to pump blood efficiently and may result in major health issues. This smartphone software assists people with heart problems in following their exercise regimens, receiving medication alerts, and maintaining their medical data. Due of its open source nature and ease of use, an Android-based platform was selected. Physicians utilize cellphones as their main source of medical knowledge and education, as well as for information management tools. Mobile phones, however, can also serve as a platform for initiatives aimed at raising the standard of healthcare. This research aims to utilize technology as health monitoring for heart disease in the community, such as reminders to take medication or access to information (with supporting health examination records and medical diagnoses), and it contains reading articles that provide public knowledge about the importance of maintaining heart health and can improve healthy lifestyles. Methods observational study of 20 heart disease patients at the media farma clinic samarinda with the length of research conducted from application development to application trials takes about April-August 2024. This android mobile-based application uses React Native technology, PHP and Mysql. The result show in the an application with features that have been tested by heart patients with a survey that has been tested for validity. The reliability test was indicated by Cronbach's alpa 0.938> 0.532 which indicates that the instrument is realiable then the ability to use the application is obtained with the results (80%) and the benefits that make it easier for respondents to monitor heart health are obtained (90%). Conclusion this research has successfully created an android-based heart disease health application that can be used by patients or patient companions as a management and accessibility of their health data. With proper integration, this application can be a very useful tool in improving the quality of life and health of users.

Keywords: Alarm Exercise, Heart Health Monitoring, Medication Reminder Alarm, Mobile Application.

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1. INTRODUCTION

Heart disease with or without complications can be said to be 'the silent killer'(Susanti et al., 2019). Heart disease is the number 1 cause of death in the world (Utami et al., 2023). Heart disorders are often not felt or known to the patient. Cardiovascular disease, a disease that affects the heart/blood channels (arteries and veins) (Kusuma et al., 2018). It is sometimes recognised after the disease has become severe or life-threatening. In 2020, one of the heart diseases, Coronary Heart Disease, is expected to be the most common cause of death, with a percentage of 36% of all deaths occurring globally (Leutualy et al., 2022). Heart disease can be caused by an unhealthy lifestyle (Hasbani et al., 2022). The symptoms of heart disease and disorders are often not felt or known to the sufferer, people often neglect or pay less attention to their heart health and have no time due to busy work (Bahana et al, 2018). They will forget about the schedule, which results in irregular taking of medication. Compliance with the treatment programme must arise from the patient himself. According to Sugiyanti et al., (2020), it shows that most patients who are discharged from the hospital and then re-admitted have a low level of compliance with taking medication (73.3%). This explains that compliance in taking medication is a determining factor for rehospitalisation and not.

The gap in this study arises from the lack of access to quality health services in remote areas is still limited in Kalimantan, so an application is needed that can help monitor patient conditions in real-time. Family support that always monitors heart disease patients is needed, but there are times when patients are busy working and are not monitored by their families so the heart disease monitoring application is needed (Kitko et al., 2020). One of the latest operating systems is Android, which is an operating system for mobile devices (Kevin et al, 2022). Digital transformation, which includes the use of various technologies, is an important step in helping the development of health improvement (Ramatillah et al,, 2023). In mobile app development, React Native is often used as the primary choice, supported by previous research on its effectiveness. According to Asoka et al., (2024), the React Native framework is widely chosen by developers because it is easy to learn, has a simple code structure, and is equipped with a live reload feature that allows faster development without having to repeat the building process (Kurniawan & Yulhendri, 2023). Another reason why developers choose React Native is its ability to develop applications that can run on two operating systems, namely Android and iOS, in one development. Meanwhile, according to Fentaw (2020), React Native is supported by a strong developer community, provides various alternative solutions for various use cases, reduces development costs, and has an attractive user interface (UI) (Asoka et al., 2024).

Types of coronary heart disease, also called coronary artery disease (CAD) (Quertermous & Ingelsson, 2016). Ischaemic heart disease (IHD), or atherosclerotic heart disease, and heart muscle disorders due to the end result of the accumulation of atheromatous plaques in the walls of arteries that supply blood to the myocardium (heart muscle) as well as congenital heart disease acquired at birth (Lakhsmi & Herianto, 2018). Congenital Heart Disease can be classified into two groups based on its effect on oxygen levels in the blood, cyanotic and cyanotic. Serious congenital heart disease requires treatment as soon as it is diagnosed Serious congenital heart diseases require treatment as soon as they are diagnosed.

Treatment may involve medications, procedures or heart surgery. Medications may be given to treat symptoms or complications of congenital heart disease (Varela-Chinchilla et al., 2022). If the child has a severe congenital heart disease, a heart procedure or surgery will be recommended, to control the action requires taking regular medication to avoid the risks that occur such as heart failure (Lestari, 2023). In other heart diseases such as coronary heart disease. In addition to self-care, by doing disease control with a doctor or nurse, taking aspirin or other blood-thinning drugs, controlling blood pressure, exercising, taking prescribed medications, a low-fat diet, using a medication reminder system, eating fruits and vegetables,

avoiding cigarettes and smokers, and controlling weight are highly recommended activities (Ramatillah et al, 2023). Therefore, an application is needed to help people do self-care so as not to aggravate heart disease (Rippe, 2019). The selection of Android-based mobile phone platforms for one of the application developments in addition to being open source and easier to operate (Kadek et al., 2018). Smartphones are especially popular among clinicians, who use them as a primary source of medical education and knowledge as well as information management tools (Fauziah et al., 2024). On the other hand, smartphones also offer a promising platform for extensive healthcare quality improvement initiatives (Qu et al., 2021).

The data may be for personal use, such as observations of daily living, or using fitness apps to monitor and guide health-related behavior (Mars et al., 2022). This user interface design application with large icons and intuitive navigation buttons for users of all ages. User Profile Personalisation feature to record age, weight, medical history.

Application development solutions that are able to cover these shortcomings, in the development of mobile-based applications is currently using react native for application development, which is supported by previous research data related to React native. According to Malahella et al., (2020) react native framework is more widely used by developers because it is easy to learn, easy code structure, has a live reload feature without having to repeat the building process so that development becomes faster and another reason why developers choose react native because in one time developing/making the application can run on two Android operating systems (Kuniawan & Yulhendri, 2022). This Problem solving approach the creation of this application will open new possibilities in terms of optimising the use of technology for the community to improve a healthy lifestyle and always monitor their heart health. Monitoring heart health is the basis for the development of health technology which is of particular interest and importance to the health sector. Real-Time Health Monitoring on health Application for heart disease allow patients to monitor their condition in real-time, including heart rate, blood pressure, and physical activity. The application can remind patients to take medication, follow treatment schedules, or have regular check-ups, which improves adherence to treatment for optimised health outcomes. Through the application, patients can access information on healthy diet, active lifestyle, and stress management, all of which contribute to the prevention and management of heart disease. Data collected from the application can be used by doctors to provide more personalised and data-driven treatment recommendations, resulting in more effective treatment outcomes.

The state of the art of this research, it does not yet exist in the Kalimantan province environment and will later be used by the wider community, the design of applications that can help people to monitor their heart health starting from reminders to take medicine and storage of medical information access (with health examination record such as reminders to take medication or access to information (with supporting health examination records and medical diagnoses), and it contains reading articles that provide public knowledge about the importance of maintaining heart health and can improve healthy lifestyles.

2. RESEARCH METHOD

The first procedure is analyzing with interviews with medical personnel (heart specialist doctors); then, design prepares an application with the name “Jantung Sehat” Application, then compiles a design and collaborates with Informatics Engineering Experts. The Planning Stage (Plan) is carried out to discuss the expertise of having heart disease against several user needs regarding health information that will be displayed to find out the features needed. Collecting the necessary data based on the features used in the design. Coding is done to build a system in accordance with the design that has been compiled at the planning and design stage. The development of this Android mobile-based application uses technology with application coding using the React Native framework, PHP, and MySQL, and the implementation of application trials on the initial user group of patients testing its features on heart patient respondents. The

research data obtained from each variable will be statistically tested using validity (Pearson bivariate correlation method) and reliability (Cronbach's Alpha) tests using 20 respondent data. Data analysis was carried out using the SPSS statistical analysis program for Windows version 26.

3. RESULTS AND DISCUSSION

This research begins with the creation of a prototype, then a mock up is carried out and consulted by a heart specialist expert and tested on heart patients. Expert discussion is carried out to test the feasibility of a heart disease expert system that has been designed in the previous stage. This expert test was conducted using a direct interview method with a cardiologist expert, as a doctor pulmonary heart specialist. The following are the results of the expert test on the distribution of the types of heart disease that are included in the application is a Heart Arrhythmias, Heart Valve Disease, Coronary Artery Disease, Heart Failure, Peripheral Artery Disease, Congenital Heart Disease, and Pericardial Disease**.**

The following is the interaction between the system and the user in the healthy heart application, with steps including. There are several examples of heart defects such as when the coronary arteries narrow or get blocked, the heart muscle experiences ischemia and oxygen deprivation, which is known as coronary heart disease (CHD) (Wang et al., 2020).

Actor identification explains who uses the healthy heart application. The following actor identification is in Table 1.

Table 1. Actor Identification

No	Actor	Description
1	Application Developer	Accept new users, give users access to log in, manage and access changes to patient data, health data and access all application data that the system has stored for the needs of the clinic.
2	Designer	Designer Provide user friendly design for the application
3	User	Patients who can create an account, enter their health history and create a medication schedule and exercise alarm schedule.

Activity Diagram

Describing the sequential activity steps in the form of a flow of objects can be seen in Figure 1.

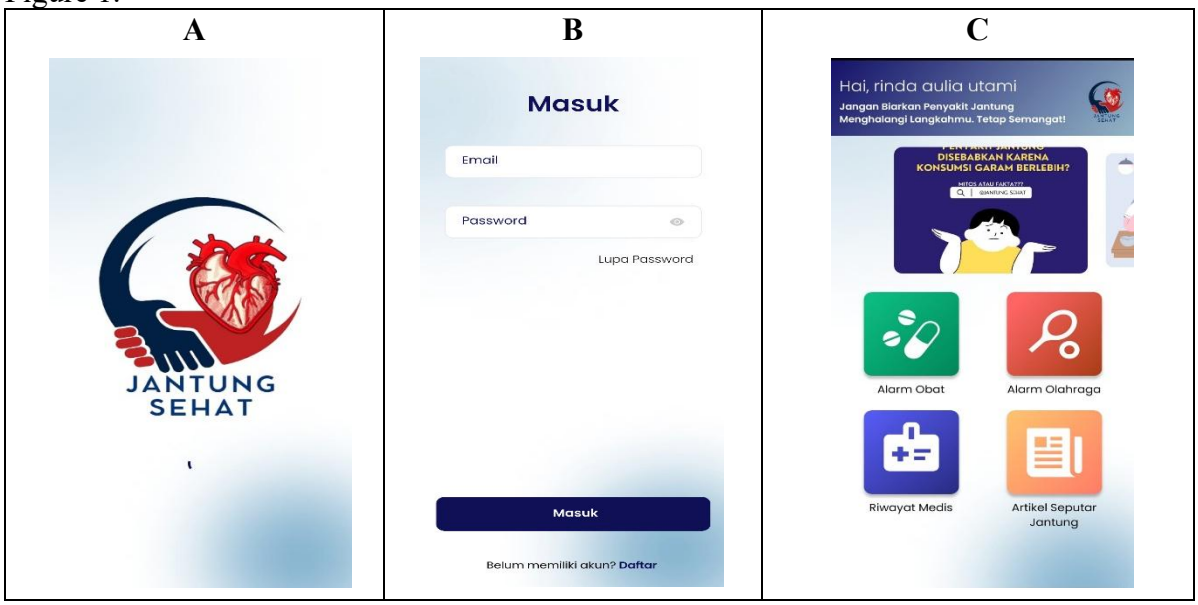

Figure 1. A. Application home page, B. Activity Sign up and Sign in page, C. Application Features page.

Figure 1 shows that the features page section of the app specifically on medical history is designed to assist users in managing, and accessing their health information efficiently. This feature allows users to record various medical information such as diagnosis, treatment, and laboratory test results. Users can enter data manually. Users can easily access their medical history anytime and anywhere through the app, making it easier for them in their daily health management and in emergency situations.

Users can enter information about medications to be taken, including medication name, dosage, frequency, and time. The app will save this schedule and set reminders according to the preset settings. This feature will send a notification or alarm to the user at a predetermined time. This notification can be in the form of an alarm sound, text message, or pop-up display on the mobile phone screen, to ensure that the user does not miss the medication schedule. This exercise alarm feature as a regular reminder helps users or heart patients to stay on track with their exercise routine according to the desired duration, this feature is very important for their heart to always stay healthy with this alarm reminding users of exercise times, the risk of missing exercise sessions is reduced, especially for heart patients who have busy schedules and are still doing normal activities. This feature encourages patient adherence and supports users to follow their exercise plan and provides additional motivation to stay active and complete workouts, especially on days when motivation is low.

Scenarios

It is a focus on the performance of the work on the application and knowing how to do the work starting from the first step in achieving the full objectives of the research.

Table 2. User Scenarios

No	Scenario	Activity
1.	Opening the application	User opens the application with the onboarding start page and then chooses to log in to the application.
2	Register account User	Creates a new account
3	Click Profile	User views personal data
4	Changing profile	User changes personal data
5	Creating a medication alarm schedule	Users create a medication schedule as a reminder
6	Creating exercise alarms	Users create exercise alarms and are adjusted to the level and type of patient's disease
7	Click Article Users	Get information from news articles published in the application

Validity Test of Questionnaire

Validity test The validity test is carried out to determine the valid level of the research used. A study is said to be valid if it is able to measure what is desired and can reveal data from the variables studied precisely. This validity test using the pearson bivariate correlation method (Pearson moment product). This analysis by correlating the item score with the total score. The test criterion is to compare the rh (correlation) value with rt (product moment table). The value of n (number of samples) = 20, then look at the r table using the real level of 5% (0.05) obtained the value of r table = 0.444

Table 3. Validity Test

Variable	r	r table	Description
P1	0.773	0.444	Valid
P2	0.805		Valid
P3	0.805		Valid

Variable	r	r table	Description
P4	0.838		Valid
P5	0.805		Valid
P6	0.805		Valid
P7	0.805		Valid
P8	0.773		Valid
P9	0.905		Valid
P10	0.773		Valid
P11	0.805		Valid
P12	0.725		Valid
P13	0.773		Valid
P14	0.805		Valid
P15	0.773		Valid
P16	0.805		Valid

From table 3, it can be explained that the value of r count> r table based on a significant test of 0.05, meaning that the variables above are declared all valid. The validity test results with 20 respondents showed good results, all questions were declared valid (r> 0.444).

Reliability Test of Questionnaire

The reliability test was carried out with the calculation of *Cronbach's Alpha*, which shows that the variables used to measure the concepts in this study are quite reliable. Information about the number of samples or Respondents (N) analysed in the SPSS Program, namely N is 12 people because there is no empty data (in the sense that all respondents' answers are filled in), so the number of Valid is filled in 100%. After that, look for the *Cronbach's Alpha* value to find out whether these 16 variables/items are reliable or not. The condition is that the Cronbach's Alpa value> from the r table value, so first look for the r table. The r table is obtained from n (number of variables) - 2, so 16-2 = 14. Then look at the r table, using the real level of 5% (0.05) the value of r table = 0.532 is obtained.

Table 4. Reliability Test.

Variable	*Cronbach's Alpha*	R Table	Description
P1	0.933	0.532	Reliable
P2	0.934		Reliable
P3	0.934		Reliable
P4	0.933		Reliable
P5	0.934		Reliable
P6	0.934		Reliable
P7	0.934		Reliable
P8	0.933		Reliable
P9	0.931		Reliable
P10	0.933		Reliable
P11	0.934		Reliable
P12	0.933		Reliable
P13	0.933		Reliable
P14	0.934		Reliable
P15	0.933		Reliable
P16	0.934		Reliable

Table 4 shows that the reliability test analysis can be seen from the SPSS out put by looking at *Cronbach's Alpha* if the *Cronbach's Alpha* value> r Table is said to be reliable (Xie et al., 2023). The *Cronbach's Alpha* value of 0.938 is compared with the r table of 0.532

obtained 0.938> 0.532, the instrument can be declared reliable or consistent as a tool in data collection in a study. The characteristics of the respondents show that the percentage of male respondents is (55%) and female 45%.

Table 5. Research Variable Indicators Application Display and Benefits.

Description	Answers (n) (%)			
	(1) Strongly Disagree	(2) Disagree	(3) Agree	(4) Strongly Agree
Application View				
The application is easy to understand and learn	0 (0.0)	0 (0.0)	3 (15.0)	17 (85.0)
The application takes a long time to learn to use	0 (0.0)	1 (5.0)	4 (20.0)	15 (75.0)
The application is easy to use	0 (0.0)	0 (0.0)	5 (25.0)	15 (75.0)
The appearance of the application is attractive	0 (0.0)	1 (5.0)	2 (10.0)	17 (85.0)
The appearance of the application is complicated and confusing	0 (0.0)	2 (10.0)	2 (10.0)	16 (80.0)
The instructions given by the application are clear	0 (0.0)	3 (15.0)	5 (25.0)	12 (60.0)
Application Benefits				
The information conveyed by the application can be understood well	0 (0.0)	0 (0.0)	3 (15.0)	17 (85.0)
The application makes it easy for me to monitor my heart health	0 (0.0)	2 (10.0)	0 (0.0)	18 (90.0)
The app helps me to remember my exercise schedule	0 (0.0)	0 (0.0)	5 (25.0)	15 (75.0)
The app is reliable	0 (0.0)	2 (10.0)	9 (45.0)	9 (45.0)
The app increases my interest in using it to monitor my heart health	0 (0.0)	1 (5.0)	4 (20.0)	15 (75.0)
The application increases my enthusiasm to maintain heart health	0 (0.0)	2 (10.0)	6 (30.0)	12 (60.0)
The features of the app make me want to recommend to others to use it	0 (0.0)	1 (5.0)	11 (55.0)	8 (45.0)
The application can be an option to help monitor my heart health	0 (0.0)	0 (0.0)	6 (30.0)	14 (70.0)
The app makes me want to know more about maintaining heart health	0 (0.0)	0 (0.0)	2 (10.0)	18 (90.0)

Description	**Answers (n) (%)**			
	(1) Strongly Disagree	**(2) Disagree**	**(3) Agree**	**(4) Strongly Agree**
The app makes me want to know more about maintaining heart health	0 (0.0)	0 (0.0)	4 (20.0)	16 (80.0)

Based on Table 5. Respondents who answered strongly disagree did not exist and those who answered disagree were on the question 'The instructions given by the application are clear as many as 3 (15%), respondents who answered agree the most were on the question "The application features make me want to recommend to others to use it" as many as 11 people (55%) and respondents who answered strongly agree the most were on the question "The application makes it easy for me to monitor my heart health" and the application makes me want to know more about maintaining heart health' as many as 18 people (90%).

Analysis of the application usability showed that the majority of users (80%) were able to use the app effectively, while the other 20% experienced difficulties. The main focus should be on addressing the issues faced by the less able group, by providing technical guidance on learning to use the heart-healthy app. By addressing these challenges, the app can become more inclusive and beneficial to all users, why is it important that the app features medication alarms for heart patients, such as blood thinners, beta-blockers, ACE inhibitors, and diuretics, designed to control symptoms of heart disease, reduce blood pressure, and prevent blood clots.

Irregular consumption of medications may lead to recurrence of symptoms or increased risk of complications. heart disorders are increasing and people still have very low awareness about heart health (Kusuma et al., 2018). Strictly following the medication regimen helps prevent serious complications, such as heart failure, heart attack or stroke. Proper treatment with regular medication can improve the patient's quality of life and prognosis. Consistent Adherence as Many heart patients require several types of medications on different schedules. Remembering the right time and dosage can be difficult, especially if the patient has a hectic daily routine or other medical conditions.

The application feature on exercise alarms can be used because if the patient exercises regularly Improves Cardiovascular Health, Regular exercise helps improve cardiovascular health by strengthening the heart muscle, improving blood circulation, and reducing blood pressure. Physical activity helps in weight management, which is important for reducing the heart's workload and reducing the risk of heart disease. Exercise can reduce stress and anxiety, which contribute to better heart health.

Some heart patients may feel tired or experience pain that discourages them from exercising regularly. Exercise programmes should be tailored to the patient's physical capabilities and with the approval of the doctor. Maintaining a consistent exercise routine can be challenging, especially if patients have busy schedules or experience motivation issues. Several inputs were provided to improve the prototype and improvements have been made based on the feedback received from the cardiologist. Designed to assist users in managing their heart health more effectively. The limitation of this research is that the feature development is still limited to android users only and must pay attention to user needs such as being developed to iOS users as well as strict security and privacy standard.

This application contains several articles related to educational reading that can be viewed by heart patients who have downloaded the application. Such as articles on the myths or facts that excessive salt consumption can contribute to increased blood pressure, which is a potential risk factor for cardiovascular disease (Wang et al., 2020). The second article discusses obesity because obesity also leads to the development of cardiovascular disease and cardiovascular disease mortality independently of other cardiovascular risk factors (Powell-

Wiley et al., 2021). The third article is that consuming oil can be replaced by using olive oil because it can reduce the risk of cardiovascular disease. Consuming up to 20 g/day of olive oil may be an option. These results support current dietary recommendations to increase olive oil intake over other fats to promote health and longevity (Xia et al., 2022).

Cardiac health monitoring application developed in this study offers innovative features that aim to improve heart health management for its users. The thing that supports this research is because according to research Abdurrahman et al., (2024); Dhany et al., (2024); Herdiana & Herawati, (2023); Wirotomo et al., (2024) they only conducted research on the relationship between symptoms and diseases between the heart and stomach, and prediction of heart attack risk by looking at various patient risk factors.

One of the significant new findings is the implementation of a heart monitoring system equipped with reminder alarms for drug consumption. Previous studies from (Ricky et al., 2024; Kaharuddin et al, 2022) only discuss early detection of coronary heart risk on smartwatches, lifestyle change applications for heart failure patients, cardiac resuscitation assistance only while this study has features designed to assist patients in adhering to their medication schedule, which is a crucial aspect in the management of heart disease. With this reminder, it is hoped that patients can be more disciplined in taking their prescribed medications, thus preventing more serious complications.

Research Datau, (2025) discusses detecting heart health checks such as blood pressure, basic life support what if cardiac arrest and heart rate while the difference to the advantages of the application we developed also provides an organized medical record file storage facility. Users can store their health records, including examination results and medical diagnoses, in one easily accessible platform. This not only makes it easier for patients to manage their health information, but also allows doctors to quickly access the necessary data when conducting consultations. With features designed to support patients in the management of heart disease, this app has the potential to be an effective tool in improving people's quality of life. The limitation of this application is shortcomings of our application are that we are only android users, we have not developed it for IOS users. hopefully this application IOS users can also use it. Cardiac health monitoring application serves not only as a monitoring tool, but also as a source of information that educates users on the importance of maintaining heart health. These findings are expected to make a positive contribution to the development of health technology in the future.

4. CONCLUSION

Based on the description of the research results, conclusions can be drawn from the healthy heart application using the React Native framework, PHP and Mysql. This research has successfully created an android-based heart disease health application that can be used by patients or patient companions as a management and accessibility of their health data. With proper integration, this application can be a very useful tool in improving the quality of life and health of users. The underlying knowledge of the types of heart disease is obtained through direct interviews with a doctor specialising in heart disease. The existence of this expert system is expected to provide initial information and assistance for adherence to taking medication and regular exercise.

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