Article

"DIA SMART" Android-Based Intelligent Application Expert System for Diagnosis and Mapping of 10 Diseases at Teaching Factory Nutrition Care Center

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Abstract: The Basic Health Research in 2018 showed that the prevalence of non-communicable diseases including cancer, stroke, chronic kidney disease, diabetes mellitus, and hypertension increased in Indonesia. The main risk factors are metabolic factors, behavioral factors, and environmental factors. Based on the existing problems, an Android-based intelligent application for the diagnosis and mapping of 10 diseases was proposed at the Teaching Factory Nutrition Care Center. This application development used the Expert System Development Life Cycle model and Dart Language. The framework used is Flutter. This article only discusses the implementation and testing of applications made based on Android. This application was developed to perform a diagnosis based on some patients' data. This application is used as a reference for early detection of a disease, allowing patients to take preventive measures. It can map the number of patients who had health consultations in each department. The users of the application were a doctor, nutritionist or health consultant at the Teaching Factory Nutrition Care Center. System functionality tested using blackbox-testing showed that the application ran well.

Keywords: Intelligent Application; Mapping Systems; Non-Communicable Disease; Health Information System

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1. Introduction

In recent decades, non-communicable diseases have globally increased. Nearly 71% of deaths worldwide are caused by non-communicable diseases [1]. This increase also occurs in Indonesia and causes health problems such as morbidity and mortality. Non-communicable diseases are diseases that cannot be passed from person to person through any contact.

The Basic Health Research in 2018 showed that the prevalence of non-communicable diseases including cancer, stroke, chronic kidney disease, diabetes mellitus, and hypertension increased in Indonesia [2]. The main risk factors are metabolic factors (high blood pressure, high blood sugar, obesity, dyslipidemia, impaired kidney function, maternal and child malnutrition), behavioral factors (dietary behavior, smoking, occupational health risks, lack of physical activity, alcohol consumption), and environmental factors (air pollution, violence, poverty) [3].

In 2021, the Jember Health Service collected data from children under five years old in 17 special stunting locations. They found 4,268 malnourished toddlers [4]. Based on the results of interviews, as many as 21.5% of adolescents in East Java Province experienced hypertension, and 26.2% had blood pressure measurement results [5]. Hypertension in adolescence will affect the body organs. Adolescents with hypertension will continue to keep this disease until they are adults; hence, they have a high risk of morbidity and mortality [6]. More cases of non-communicable diseases will devastate health costs if they cannot be handled [7]. Non-communicable diseases increase significantly every year because there are risk factors from interrelated diseases [8].

Politeknik Negeri Jember has a Teaching Factory Nutrition Care Center (NCC). The Director of the Politeknik Negeri Jember, Syaiful Anwar said, NCC is not only intended for the internal Politeknik Negeri Jember but is also open to the wider community [9]. The public can consult with a doctor or nutritionist about their health, obstetrics and nutritional care. From the consultation, data on non-communicable diseases such as hypertension, hyper cholesterol, obesity and so on were recorded at the NCC. However, patient medical records are not kept using digital applications. The doctors or nutritionists only used a consultation sheet to record their patients' data. It was difficult to provide further health information even though the patients' data are still useful for making decisions and monitoring the patient's health. In supporting NCC to become an effective teaching factory, a digital application is proposed to give better management in decision-making. The application was made fundamentally to connect society, information technology and organized procedures [10].

Departing from the existing problems, the proposed application was envisioned to conduct an initial diagnosis of the top 10 diseases which were observed at the Teaching Factory Nutrition Care Center. This application could perform real-time mapping on the number of college employees who had health consultation at the NCC. Another goal of this study is to implement an android application to perform an initial diagnosis of the top 10 diseases [11]. The android application makes it easy for consultants to manage patient data [12]. In addition, this Android-based application can be downloaded on the Android Play Store [13]. This is in line with the non-communicable disease control activity targets explained in the National Mid-Term Development Plan and the Strategic Plan of the Indonesian Ministry of Health by 2024. The targets are to decrease morbidity and mortality from non-communicable diseases and increase prevention and control of non-communicable diseases [2].

2. Materials and Methods

This application development was performed using the Expert System Development Life Cycle model following some stages: assessment, knowledge acquisition, design, test, documentation and maintenance. Android-based application was created using Dart language. Dart is a cross-platform programming language that can run on different operating systems such as Windows, Linux, Unix and MacOS [14]. Dart was originally developed by Google and later approved as a standard by Ecma, which is currently used to build web, server, desktop, and mobile applications. The framework used was Flutter, a framework used to help developers create multiplatform mobile applications [15].

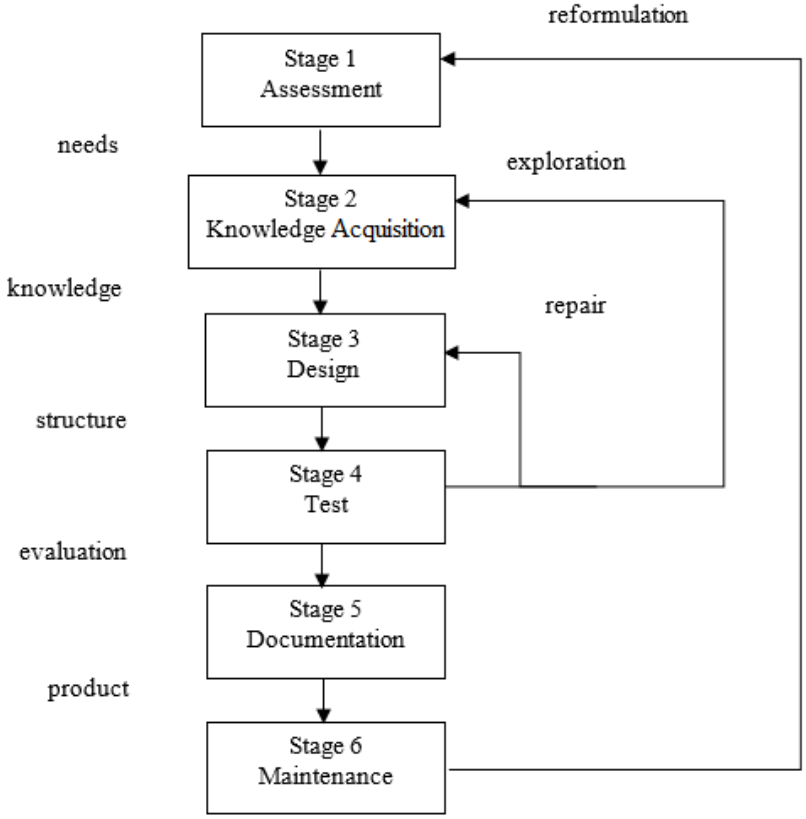

Figure 1. Expert System Development Life Cycle Model

The android version used was a minimum version 6. However, this article only discusses the implementation and testing of Android-based applications. Implementation was the stage where the application was designed and developed. Testing was the stage where the functionality of the application was observed.

3. Results and Discussion

A digital application was developed to make a diagnosis based on some patients' health information. It was expected to be a reference for early detection of a disease and to offer time for patients to take preventive measures. It could also map the number of the college employees who had health consultations. Application development was based on the required design which included analysis, system flowchart and user interface. The users of the application were doctors or health consultants at the Teaching Factory Nutrition Care Center. This study showed the implementation of the android-based application in the next sections.

3.1. Application Start View

To use the application, users were shown a splash screen display of Politeknik Negeri Jember. After that, they had to log in with the ID and password provided by the admin. Users entered the login page as shown in Figure 2.

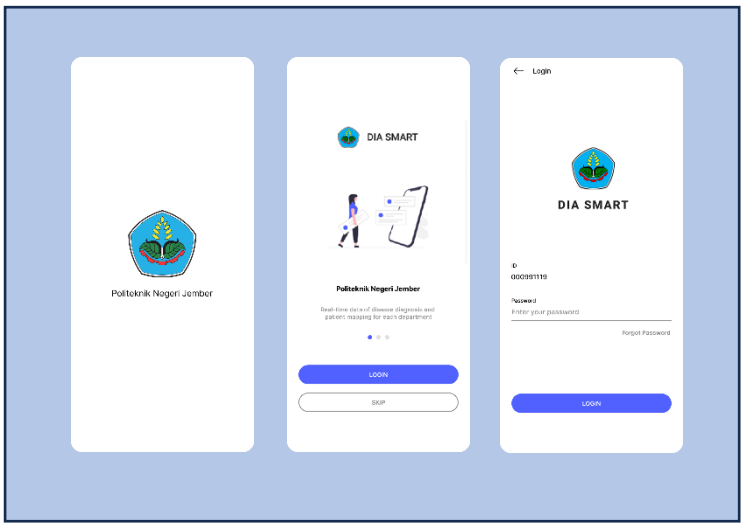

Figure 2. Application Start View

3.2. Home Menu

Users who logged in entered the Home menu. They could view the data of the top 10 diseases and of the last patients who were done with the examination. At the bottom right, they used a button to add patient diagnosis data.

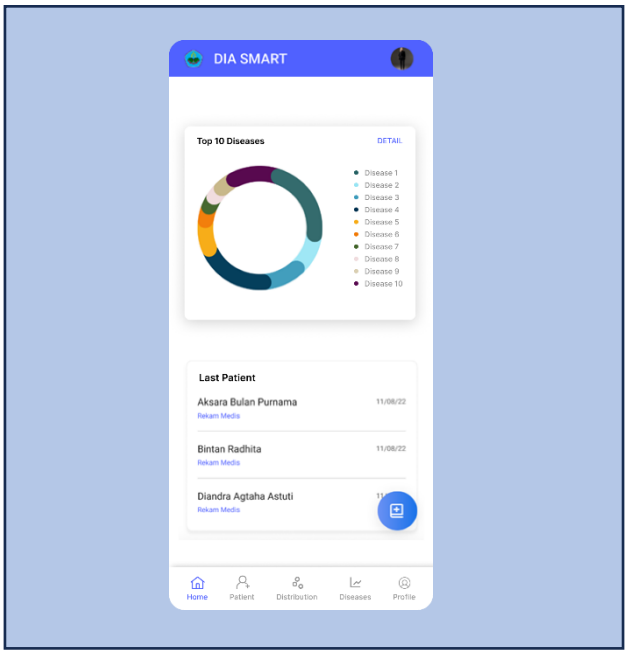

Figure 3. Home Menu.

3.3. Patient Diagnosis Menu

By pressing the blue button at the bottom right on the Home menu, the users could add patient diagnostic data. Users were directed to the Patient Diagnosis menu. Users then searched for patient data using the patient's Population Identification Number and clicked the search button.

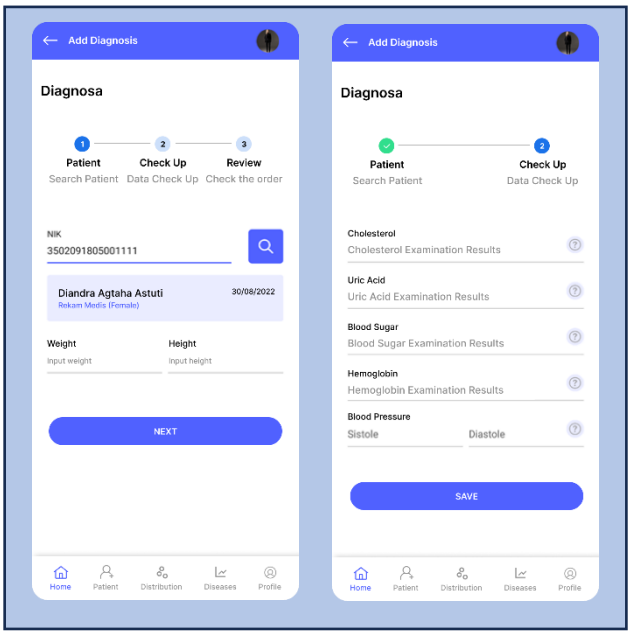

Figure 4. Filling Diagnosis.

When patient data were found, they would appear at the bottom of the Population Identification Number column. The users could then add data and then pressed the next button to continue.

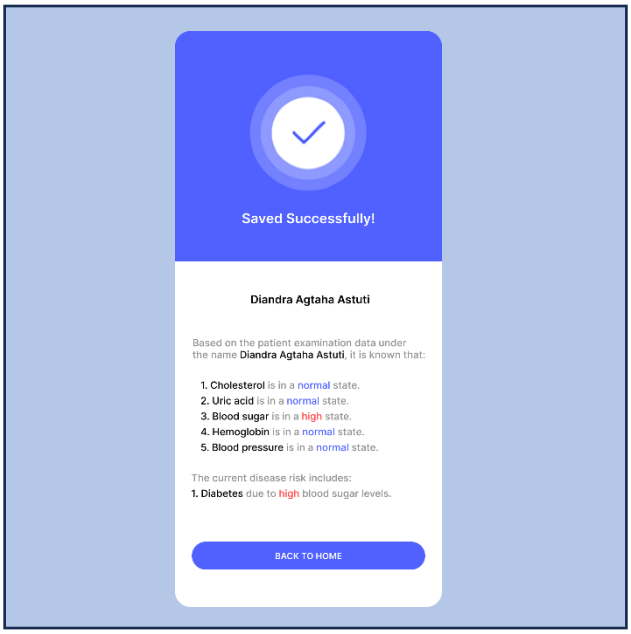

Figure 5. Diagnostic Results.

Once the users moved to the next section, they could enter the results of examinations such as cholesterol, uric acid, blood sugar, hemoglobin, and blood pressure checks. After they then pressed the Save button, the expert system performed an analysis to estimate the risk of disease based on the existing data.

3.4. Patient Data Menu

This menu displayed all the patient data stored. Users used the Search bar to find patient data.

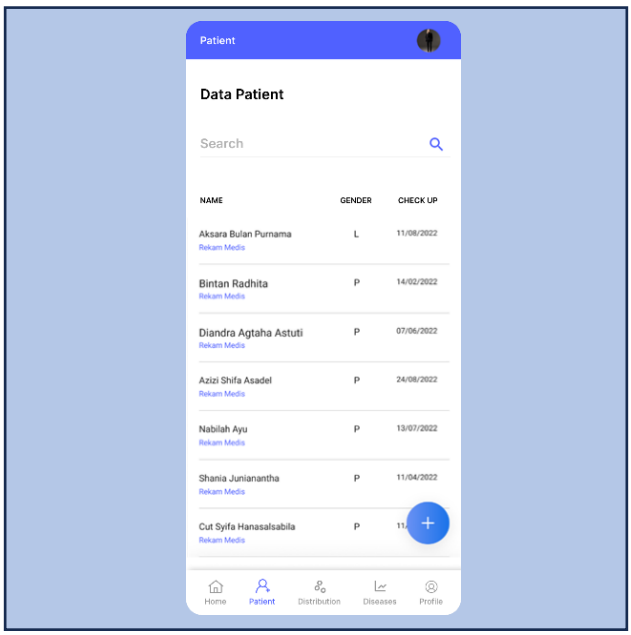

Figure 6. Patient Data Menu.

Users added patient data by pressing the blue button on the bottom right. They then entered the patient's personal data such as national identity number, name, place, date of birth, address, weight, height, major, employment status and gender.

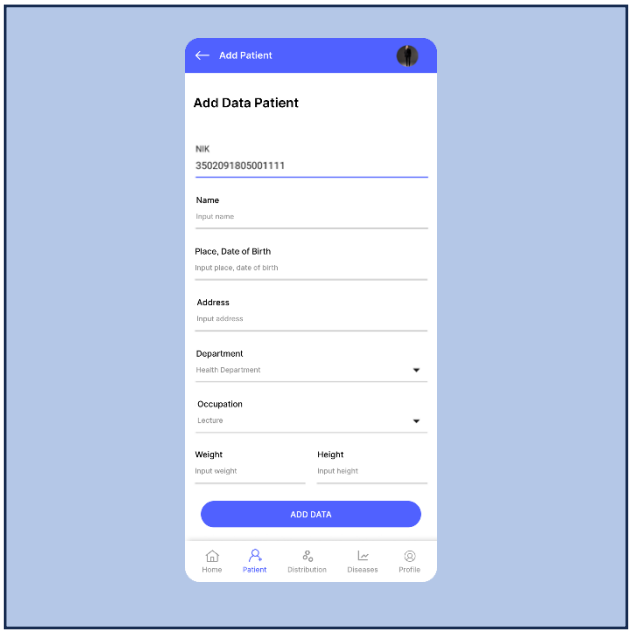

Figure 7. Add Patient Data.

3.5. Distribution Map Menu

In Distribution Map menu, the users could see a map of number of employee patients at Politeknik Negeri Jember.

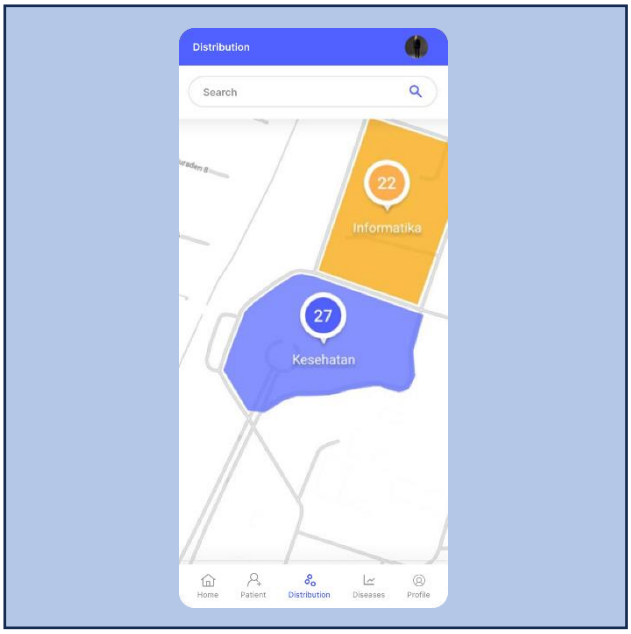

Figure 8. Distribution Map Menu.

3.6. Disease Graph Data Menu

In Disease Graph menu, the users found 10 most common diseases in patients who ever took health examination at the NCC. The users also performed Filter button to choose data they wanted to display.

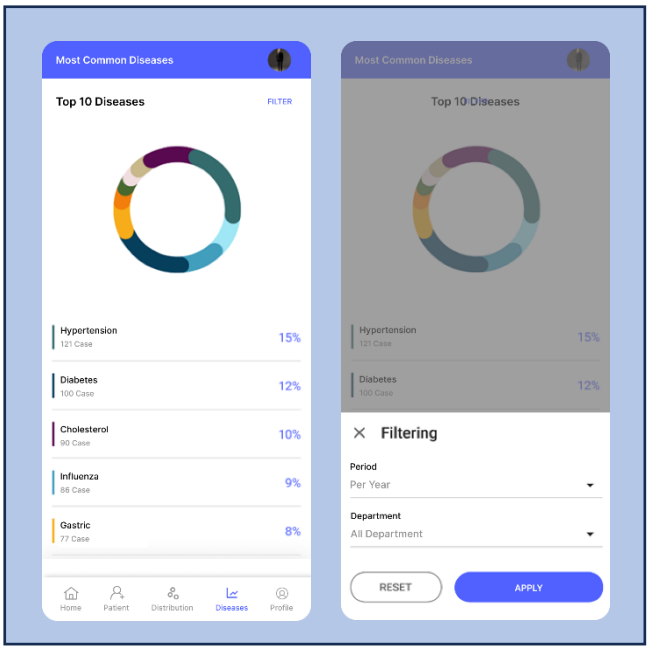

Figure 9. Disease Graph Data Menu.

3.7. Profile Menu

In Profile menu, the users had their profile. After trying the application, they logged out from their account.

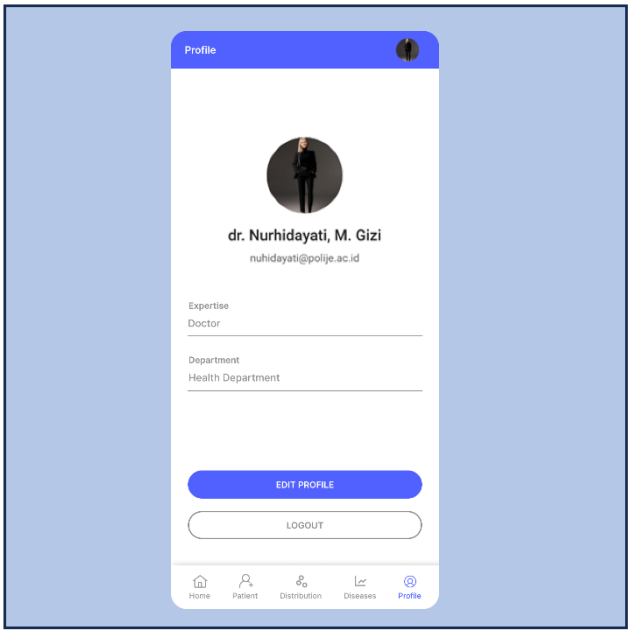

Figure 10. Profile Menu.

3.8. Testing Stage

The next stage was the testing stage where the system functionality was tested using blackbox. The results of the test can be seen in Table 1.

Table 1. Testing Stage.

Application Menu	Result
Application Start View	Successful
Home Menu	Successful
Filling Diagnosis	Successful
Diagnostic Results	Successful
Patient Data Menu	Successful
Add Patient Data	Successful
Distribution Map Menu	Successful
Disease Graph Data Menu	Successful
Profile Menu	Successful

The next stage was that doctors and health consultants installed the application on their smartphone. When they found a problem with the application, repair and maintenance of the application were carried out.

4. Conclusions

This article discusses the implementation and testing of an Android-based application aimed at performing an early diagnosis of diseases. This study found some strengths of this application such as the ability to map the number of employee patients who conducted health consultations, provide helpful features for doctors, nutritionists or health consultants at the Teaching Factory Nutrition Care Center. Based on the blackbox testing, the application ran well.

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