

Design Stunting Detection Applications Using Artificial Intelligence on Android Devices

Ummi Rizki Alfi Stania¹, Moehammad Sarosa², Rieke Adriati Wijayanti³

^{1,2,3}Digital Telecommunication Network Study Program,

Department of Electrical Engineering, Malang State Polytechnic, 65141 Indonesia

¹alfistania93@gmail.com, ²msarosa@polinema.ac.id, ³rieke.adriati@gmail.com

Abstract— In this era, careful attention is needed to the development and growth of children, so that if there is an abnormality it can be detected as early as possible. One of the main factors that affect the growth and development of children is the nutritional factor. Lack of knowledge about growing children causes parents not to realize if their child has a disorder such as stunting. Stunting must be detected as early as possible so that solutions can be given to prevent it from happening. These problems must be corrected immediately and the development of the child is not disturbed. Therefore we need an application that can detect stunting disorders in children from an early age so that they can be handled quickly and precisely. In making this application, it will detect the child's height and weight through the camera to perform a nutritional check that detects the child is stunted or not. This application uses artificial intelligence or Artificial Intelligence based on android. Weight measurement results will be sent from the weighing system to the application using the Bluetooth address for the connection so that the weight results can be displayed on the application. Height measurement is carried out using the camera in the application which will detect the child's height through an image. The test results show that the stunting detection application is very helpful for parents to observe the growth and development of children without having to use and calculate children's nutritional problems manually. The accuracy of the measurement accuracy of the stunting detection application is quite good, but it must require the correct placement of measurement points so that the measurements can match reality.

Keywords— Stunting, Nutrition, Anthropometry, Artificial Intelligence, OpenCV, Firebase, Android.

I. INTRODUCTION

Every parent wants to see their child grow and develop optimally, have intelligence, and good health. Children have rapid growth and development at an early age, from 0 to 5 years. This period is often referred to as the "Golden Age" phase or a very important period to pay attention to the growth and development of children so that they can be detected as early as possible if abnormalities occur [1]. One of the main factors that affect the growth and development of children is nutrition. Unfulfillment of good nutrition from the womb until birth can lead to various health problems, one of which is stunting. Handling abnormalities quickly and appropriately can reduce the risk of children experiencing permanent abnormalities.

Stunting is a chronic nutritional problem in children which is characterized by a shorter height compared to children his age [2]. Height for age is below minus 2 Standard Deviation (<-2SD) from the WHO median standard [3]. Stunting has a short-term impact and a long-term impact, the short-term impact caused by stunting is disruption of brain development, intelligence, impaired physical growth, and metabolic disorders in the body[4]-[10]. The long-term impact is decreased cognitive ability and learning achievement, decreased body immunity, and the risk of developing diabetes, obesity, heart and blood vessel disease, cancer, stroke, and disability in old age [4].

To overcome this problem, an application that can detect stunting is needed as early as possible. The design of this application has been carried out using the certainty factor method in the web-based diagnosis of stunting in children [5].

Based on the problems that have been described, a study entitled Design of Stunting Detection Applications Using Artificial Intelligence on Android Devices will be made. In this application that will be made using artificial intelligence or Artificial Intelligence on android[11]-[17], so it can be used by parents to detect stunting in their children without having to register. Another advantage of this application also does not require an internet connection so it can be used anytime and anywhere.

II. METHOD

A. System Diagram

The design that will be made to facilitate the manufacture of the system requires a system block diagram. Fig. 1 is a block diagram of the stunting detection.

When opening the application, the first display that appears is the Login view, if the user has not created an account, the user will be directed to the Registration screen to register an account first. When the account registration is complete, the user can directly login and enter the Home view. On the Home view there is a Measurement menu, The Child, and FAQ. To take measurements the user must select the measurement menu and select the measurements to be carried out, the example above is measuring using a camera after selecting through the camera the user will be directed to the usage information display, and the user will start taking photos of the child to be measured, before starting to measure the user must input the value references and reference images to be used. After getting

a high value, the user will fill in further information to be calculated by the system. The diagnostic results will come out after the system performs calculations and to view the child's data, the user can select the Child menu which contains a detailed display of the child's measurements.

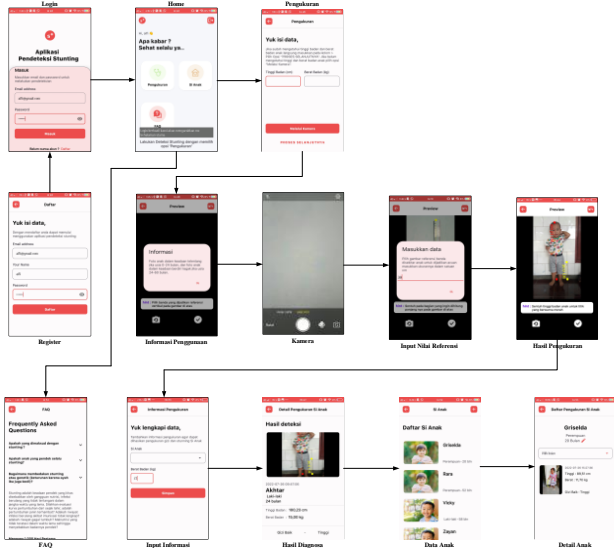


Figure 1. System Diagram

B. Flowchart How the System Works

Flowchart how the stunting application system works is shown in Figure 2. as follows.

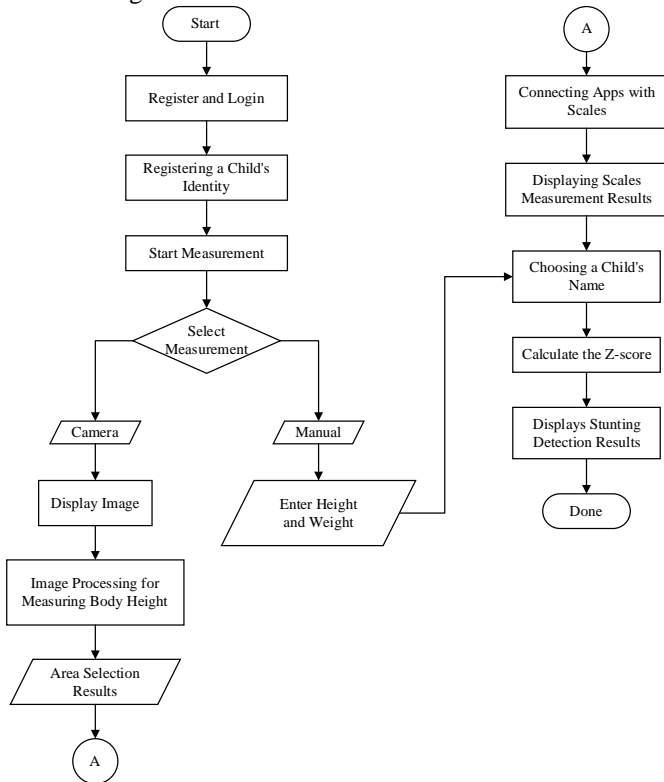


Figure 2. Flowchart How the System Works

Description of the System Design Flowchart in Figure 2:

1. The first stage is that the user opens the android application, registers an account and logs in as a user or admin.
2. The second stage is to enter the android application, for the admin can only see the data of children who have taken measurements while users can take measurements and also the history of measurements that have been taken previously.
3. The third stage is measurement, here there are two measurement options, manual measurement and measurement using a camera, if you don't know your height, you can use the measurement option with a camera.
4. The fourth stage is the system will display an image of the measurement results if using a camera and the image will be measured in height using the line that has been made.
5. The fifth stage is the value that has been obtained is processed by the Z-Score formula by the system.
6. The sixth stage is that the user gets the results of the diagnosis that the child is stunted or not and the child is malnourished or not.

C. Block Diagram System

Data Flow Diagram is a data process model that is designed to describe the flow of data, from and also to where it is going, DFD is also a diagram that describes the flow of data from a process or information system. In DFD, there is information related to the input and output of each process. DFD also has various functions, such as conveying the system design, describing the system, and designing the model. The following is a DFD system that will be used in the system.

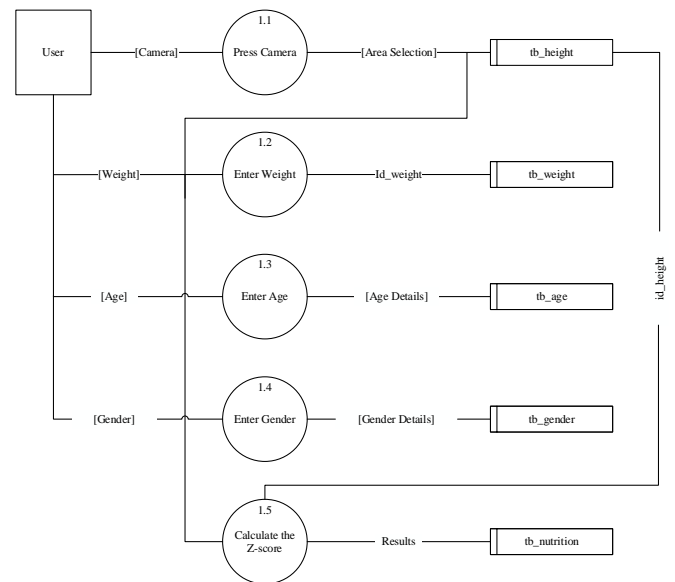


Figure 3. Block Diagram System

Data Flow Diagram above describes the flow of data between the user and the system. In this system there is a flow of data that comes from the user in the form of commands and data from the selection that will be processed or calculated.

D. Connection of Scales to Applications

The following is a diagram regarding the connection between the scale and the application.

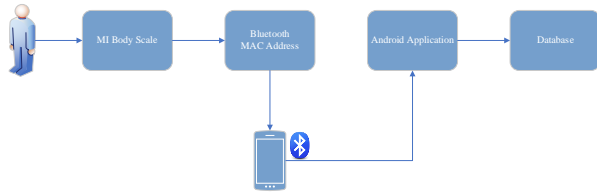


Figure 4. Connection of Scales to Applications

Explanation of the connection of the scales to the application as follows:

1. The user measures weight with the MI Body Scale.
2. The android application tries to establish a connection to the MI Body Scale using the Bluetooth MAC Address that has been recorded in the system so that the application no longer needs to search for Bluetooth devices.
3. The results of the weight measurement are then sent to the Android application and stored in the database.

E. Image Processing Processing Procedures

The following is an image processing procedure for the stunting detection application.

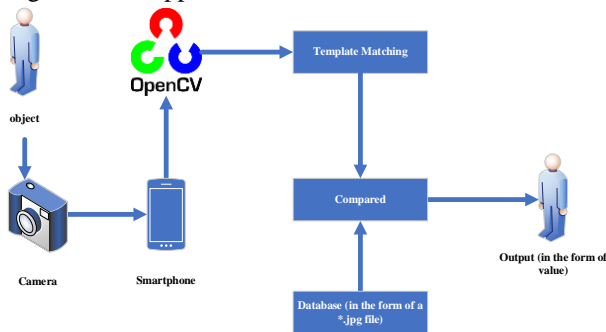


Figure 5. Preparation Image Processing

The image processing procedure for the stunting detection application is as follows:

1. Determination of the object to be processed.
2. The camera on the smartphone works to capture predetermined objects.
3. OpenCV works to process images and convert from analog to digital to be identified. The digital image is obtained from the results of digitizing the analog image. Digitization involves two processes, namely sampling and quantization. Sampling shows the number of pixels/blocks to define an image. Quantization shows the number of degrees of value in each pixel (indicates the number of bits in a digital image). Image processing is carried out to improve image quality so that it is easy to be interpreted by humans/computers. The input is an image and the output is also an image, but with better quality than the input image.

4. Template matching as digital image processing works to match each part of an image generated by OpenCV with the initial image as a reference. If a template is found to match the pattern that has been processed, then the subject can recognize the shape. After the match between the object and the template occurs, further processing and interpretation of the object can occur.
5. The database in this application is for storing images of objects produced by cameras that have gone through image processing.
6. The output displays an image of an object that has been compared with another image in the form of a measurement value.

III. RESULTS AND DISCUSSION

In this chapter, we will discuss checking the application through testing on children by measuring their height and the results of the child's diagnosis. Testing is carried out to find out the system made runs according to the design that has been set. Application checking is in the form of functional table testing by checking application features and system accuracy with reality.

A. Place and Time of Data Testing

The test was carried out in an area located in Bringin, Mojorejo Village, Pungging District, on July 26, 2022. The test was carried out on toddlers aged 0 to 60 months in the area, by measuring height and weight with a measuring instrument. Tests are also carried out using applications that have been made to compare the accuracy of the system with measuring instruments.

B. Testing

Testing will be carried out on the application to test the feasibility of using it by the user. This test is carried out to find bugs or errors while the application is being used, if an error is found, the application must be repaired immediately so that the application can be used properly. Application testing will be carried out using the blackbox method.

Blackbox testing is a software testing method that tests functionality without regard to the internal structure of the application. Testing the black box method will be used to find errors such as: functional errors, interface errors, data structure errors or application access errors to the database. Blackbox testing will be carried out using a validity table to test the functionality of the application.

C. Functionality Installation

TABLE I
INSTALLATION FUNCTIONALITY

No.	Condition Output	Target	Results	Information
1	Applications can be installed	Installed successfully	Installed successfully	In accordance

D. Login Page Functionality

TABLE II
LOGIN PAGE FUNCTIONALITY

No.	Condition Output	Target	Results	Information
1	Text "Enter email and password to detect"	Show text	Show text	In accordance
2	Form edit text email and password	Show form and can be filled	Show form and can be filled	In accordance
3	Login button directs to home page	Go to home page	Go to home page	In accordance
4	Register button directs to the register or registration page	Go to the register or registration page	Go to the register or registration page	In accordance
5	FAQ button redirects to FAQ page	Go to FAQ page	Go to FAQ page	In accordance

E. Registration Page Functionality

TABLE 3
REGISTRATION PAGE FUNCTIONALITY

No.	Condition Output	Target	Results	Information
1	Text "By registering you can start using the stunting detection app"	Show text	Show text	In accordance
2	Form edit text email, name, and password	Show form and can be filled	Show form and can be filled	In accordance
3	Register button directs to home page	Go to home page	Go to home page	In accordance
4	Sign up successful warning	Show warning	Show warning	In accordance

F. Home Page Functionality

TABLE IV
HOME PAGE FUNCTIONALITY

No.	Condition Output	Target	Results	Information
1	The text "How are you? Always healthy huh.."	Show text	Show text	In accordance
2	The Measurement, Child, and FAQ menu appears	Show menu	Show menu	In accordance
3	Measurement menu leads to measurement page	Go to measurement page	Go to measurement page	In accordance
4	The Child menu directs to the child list page	Go to child list page	Go to child list page	In accordance
5	FAQ menu directs to the question list page	Go to the question list page	Go to the question list page	In accordance
6	Text "Perform stunting detection by selecting Measurement option"	Show text	Show text	In accordance
7	Login successful warning	Show warning	Show warning	In accordance
8	The exit button appears warning "Log out of your account now?"	Show warning	Show warning	In accordance
9	Exit button directs to login page	Go to login page	Go to login page	In accordance

IV. CONCLUSION

Based on the results and testing of the Stunting Detection Application above, several conclusions can be drawn including: The test results show that all the features are running well. The accuracy of manual measurement and application has not too much difference. The difference in measurement is due to the

starting point of the measurement, this point greatly affects the value of the image. After testing, it can be seen that stunting children do not have to be thin, but stunted children have poor nutritional characteristics so that growth is disrupted. In this application the Z-Score calculation to find out the nutritional status of children is quite accurate so that it can help parents monitor their child's development at any time.

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