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The Detection of Stunting Anomalies in Toddler by Computer Vision

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Abstract

The golden age is the most important period that all children go through. At this time, parents need to optimize their child's growth and development. The nutritional adequacy of toddlers must be monitored to detect abnormalities such as stunting, wasting, obesity and malnutrition. Stunting is a condition in young children where height or body length as measured by Z-score does not correspond to age. In today's digital era, healthcare generates large amounts of data every day. This data is in various forms, including text, numbers, and digital images or videos. Computer vision in health care is a field of artificial intelligence that allows computers to interpret and act on visual data, including monitoring the growth and development of toddlers. Computer vision can be used to analyze data on stunting status of toddlers. The aim of this research was to develop mobile media to be able to screen and monitor stunting in toddlers using computer vision. The type of the research was research and development methods where the function of using this method was for product validation and development, with the dependent indicator being stunting toddlers. The results of this research showed an accuracy of 90.5%. These results showed that the application of computer vision and artificial neural networks to predict stunting anomalies in toddlers could be used and showed good results. It is hoped that in the future this application can be used by the government, midwives and cadres to continuously monitor toddler stunting.

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INTRODUCTION

Babies are children aged between 1 and 5 years who experience rapid growth. The baby's growth and development in this period determines the success of his growth and development in the following period. During this period, the baby's nutritional compliance must be monitored to detect abnormalities such as stunting, wasting, obesity and malnutrition (Khulafa'ur Rosidah & Harsiwi, 2019).

Stunting is one of the failures of growth and development in toddlers. Stunting is a condition where a toddler's height or body length does not match his age, as indicated by a Z-score that is >-2SD from the median growth standard of the World Health Organization (WHO) (Kementerian Desa Pembangunan Daerah Tertinggal dan Transmigrasi, 2017). The stunting toddler epidemic is one of the problems facing the world today. According to UNICEF and WHO data, the incidence of stunting in Indonesia is the 27th highest out of 154 countries that have surveyed stunting data, Indonesia is the 5th country among all countries in Asia (PMK, 2023). The prevalence standard set by the World Health Organization (WHO) is less than 20% ((SSGI), 2023). The prevalence of stunting in Indonesia based on the 2023 Basic Health Survey (Riskesdas) was 24.4% in 2021 then fell to 21.6% in 2022 and the target that the Indonesian government wants to achieve is that the incidence of stunting can decrease to 14% in in 2024 (SSGI, 2023).

The world is currently entering the era of Society 4.0 and 5.0. The major changes occurring in the 21st century present opportunities and challenges for various stakeholders (Teknowijoyo, 2022). The health sector has become one of the most important areas of focus, because with the changes in this era, it is hoped that health workers can develop various IT media to improve the health status of the community (Mahayanti & Ismoyo, 2021). WHO and UNICEF have created a program for monitoring and handling deviations in the growth and development of toddlers in the form of growth monitoring and promotion (GMP). This program can be carried out through posyandu. Monitoring and growth promotion programs as screening programs to prevent malnutrition (Selamawit M. Bilal, 2014).

Currently, the media for early detection are very developed. According to several studies showing the development of growth and development monitoring media, such as research by Fajri Hardhita, et al (2016) regarding the development of web-based applications for monitoring children's nutrition and growth and development based on anthropometry and Agus Suryanto, et al (2017) regarding a service system for monitoring children's nutritional status based on Android is integrated with the web. In this study, researchers attempted to develop an application that is integrated with the web to monitor children's nutrition and growth and development (Murti et al., 2005) (Suryanto et al., 2017) .

Researchers still find several limitations in the development of media for monitoring children's nutrition and growth and development. So researchers designed media that would help detect and monitor stunting. This media will be in the form of a cam scanner application which has been systemized between cellphone cameras with a Z score as the World Health Organization (WHO) growth standard for detecting stunted toddlers. This media will record and save the detection results on a graph as a monitoring tool.

METHODS

Development research (research and development/R&D) was used as a research method. Research and development methods are research methods that aim to test, develop and produce certain products. Research carries out several systematic steps, namely identification, correlation, accumulation and analysis and making conclusions which are combined into knowledge.

The following is the research procedure:

Preliminary study stage

This stage begins with reading existing literature and looking for additional literature needed to deepen the material on monitoring toddler growth and development, including how to measure toddler height and weight, standards for determining toddler nutritional status, and journals that have been developed regarding how to monitor toddler growth and development. Then check and interpret reference sources. as a theory related to research problems. Then a field study was carried out to collect data. The data collected is data related to standard benchmarks for monitoring stunting status in toddlers, namely height and age. The data taken and used as the brain of the system is a total sampling of cohort data from all toddlers in Baron village, Nganjuk

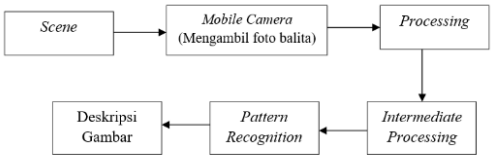
Planning and development stage

Based on the description and analysis of factual findings, the next stage is to develop the following development steps: 1) Formulate a development plan which includes identifying all application/system requirements to be developed; a) computer vision

flow; b) artificial neural network processing flow, determining the goals to be achieved at each development stage, and testing the accuracy of the prediction results applied to the application; 2) Develop application features including; a) form that displays toddler data; b) Android cellphone camera that will be used to take pictures and measure the toddler's height and weight; and c) system prediction results on stunting status in toddlers; 3) Calculate the accuracy of the application prediction results. The aim of this step is to find out whether the application developed can be implemented correctly by midwives to monitor stunting in toddlers with a high level of accuracy.

A. Computer Vision Flow

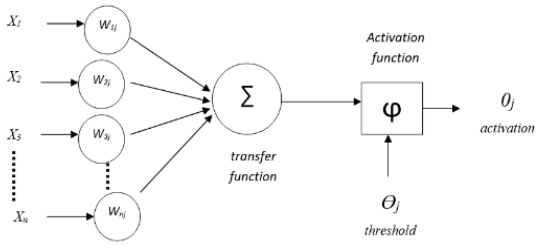
Picture 1 Computer Vision Flow



In the image processing process in computer vision, three processes will occur; 1) obtaining and acquiring digital images; 2) image processing operations; 3) analyze and interpret images to determine the deviant physical characteristics of toddlers who are stunted.

B. Image Processing Flow (Artificial Neural Network)

Picture 2 Image Processing Flow (Artificial Neural Network)



In the image processing process, several processes will occur starting from the image taking process, then continuing with the filter process where the image will be cleaned so that it does not interfere with the analysis process, finally the photo will carry out image processing and show the analysis results according to the researcher's desired goals.

RESULTS

The results of testing the data into the system to determine the level of application accuracy showed an accuracy picture of 90.5% of the 42 data entered into the system. Accuracy is calculated with SPSS using the Binnary Regression test.

Table 1 Accuracy test results

Classification Table[a,b]					
Observed			Predicted		
			Diagnosa		Percentage Correct
			Normal	1	
Step 0	Diagnosa	Normal	0	4	.0
		1	0	38	100.0
Overall Percentage					90.5
a. Constant is included in the model.					
b. The cut value is .500					

DISCUSSION

This research produces an Android-based system that is built based on the system requirements that have been obtained, namely data-based in the form of nutritional monitoring data for stunting toddlers. System testing uses the One UI 5.0 platform based on Android 13 with 128GB/256GB internal storage, 6GB/8GB RAM capacity, 6.4-inch screen size, and 48MP OIS camera. The working system of this application is to predict stunting in toddlers using computer vision which has been developed and implemented in a mobile application.

This application is a continuation of research I conducted previously regarding the development of a forward chaining-based Android application for early detection of the risk of stunting in pregnant women. Referring to the same database and website, I developed this application. By applying the same prediction system with different methods, researchers obtained test results for new input data entered into

this application of 90.5%, so it can be said that this application has a good level of accuracy in determining stunting status in toddlers.

This application is the result of applying Artificial Neural Networks to provide real-time information and updates. The use of artificial intelligence technology methods becomes relevant, because with the help of artificial intelligence the predictions made will be more comprehensive (Trenggono.,et al, 2023). By collecting data on toddlers' height via camera using computer vision, midwives and toddlers can predict the risk of stunting in toddlers.

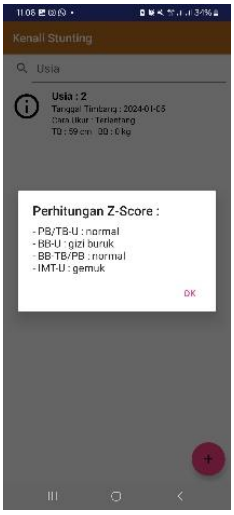
Determining the nutritional status of toddlers in this application refers to the Child Anthropometric Standard table with standard Z_Score calculations as well as child growth and development charts that have been installed and can be monitored via a website connection. Apart from the stunting status of toddlers, this application can also determine the overall nutritional status of toddlers according to the data that has been input and the master data will carry out automatic calculations according to the formula that has been set in the application.

In the application menu display, 4 menu options will appear, namely: toddler data menu, toddler height measuring camera, toddler weight detection camera, and toddler stunting prediction results. The application start menu can be seen in the image below:

Picture 3 shows the appearance of the toddler data form which must be completed as supporting data so that midwives can carry out further analysis of the risk of stunting in toddlers

Picture 4 shows the camera view used to measure a toddler's height by clicking on 2 points as the upper limit, namely the tip of the head and the lower limit, namely the tip of the feet

Picture 5 shows the camera view used to measure a toddler's weight by taking numbers on a scale



Picture 6, shows the results that the system has processed as a form of prediction that has gone through a data accumulation process by the system

Stunting has a big impact on children's growth and development. All aspects of a child's growth and development, including growth in weight and height, cognitive development, gross motor skills, fine motor skills, language skills, and social emotional development, will be slower if the child is stunted and their nutritional status cannot be said to be optimal. situation. If this situation occurs during the golden years, the child's growth and development will be less than optimal and may be irreversible or impossible to change in adulthood (Linuria et al.,2023).

Monitoring the development of toddlers really needs to be monitored so that if abnormalities occur, they can be detected early, because development during the toddler years really determines development next time (Linuria et al.,2023).

In this problem, digital image processing can be alternative because it is easier to use. This research carried out to design a system that can measure height using image processing digital and predict possible stunting conditions operated on an application. The computer vision used in this application is an automatic process that combines or integrates several visual recognition processes, such as image acquisition, image processing, recognition and decision making. Computer vision is a system designed to imitate the functions of the human visual system, but is actually quite complex (Marpaung et al., 2022). In line with research conducted by Anom (2023) which shows the effectiveness of taking images to measure body height to detect stunting in toddlers. Also supported by research conducted by Rudy Adipranata (2006) shows that the use of 3D images is considered quite good visually (Adipranata et al., 2006).

However, this application has several limitations such as; Can only be installed on Android with certain specifications, does not have the ability to take 4-dimensional pictures so photos/pictures of toddlers cannot be taken while standing upright, and requires a place to take pictures with appropriate lighting.

CONCLUSION

In this paper, researchers develop an Android-based application for early detection of the risk of stunting in toddlers. We use Artificial Neural Network techniques to predict stunting by utilizing computer vision as a medium or tool for measuring toddler height. The results show that stunting detection accuracy is 90.5%. With accuracy results of more than 90%, this application can be used to predict and monitor stunting anomalies in toddlers.

SUGGESTION

We hope that the application we have developed can help the government, midwives and cadres to monitor stunting in toddlers so that they can reduce the incidence of stunting in toddlers.

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CONFLICTS OF INTEREST

The authors have no conflict of interest in publishing the article.

AUTHOR CONTRIBUTIONS

All authors contributed fully to research activities starting from preparation activities, collecting basic data, creating applications, writing manuscript drafts and analysis. Each author made a positive contribution to this activity from start to finish, including publishing articles in this journal. Give a brief explanation on contribution of each author.

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