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DESIGN AND DEVELOPMENT OF THE MEASURING OF THE BODY MASS INDEX TO THE INDONESIA NAVY BASED ON VISUAL STUDIO

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ABSTRACT

Height and weight measurement tools are one of the important measurement tools used to monitor the health status of the Navy personnel periodically every six months through the URIKES program, with a comparison between height and weight later this will be known to the health status of soldiers in the underweight category , Normal, Overweight and Obesity. With this monitored health status, it is hoped that Indonesian Navy soldiers will not be constrained by health problems in carrying out their duties or training and can assist leaders in determining policies. In this final project, a system will be designed to make it easier and faster to measure height and weight automatically using the Sharp sensor as a height gauge and the Load Cell sensor as a weight gauge. The output of this measuring device is in the form of display on a PC monitor and can be uploaded then the data can be stored on the server, so it can be accessed via Android. This tool is expected to later be used as a substitute for measuring height and weight that is still manual.

Keywords*: URIKES, underweight, Normal, Overweight, Obesity, Sharp Sensor, Load Cell Sensor and Android.*

1. Introduction

Not only are Navy Soldiers required to be proficient in war or have a strong physique, but they must also have an ideal posture. Given the importance of the body posture, it is necessary to check the posture of the soldiers of the Navy on a regular basis. One way to find out how much a soldier's health risk is through measurement of body mass index. This method is used to determine healthy posture based on the ratio between body weight and height. Body mass index figures are used to indicate whether a person's weight category is proportional or not. Through measurement of body mass index, each soldier will find out whether he is in the ideal category or not. Height and weight measurement tools are one of the important measurement tools used to monitor the health status of soldiers periodically every 6 months through the urikes program, with a comparison between height and weight later this will be known to the health status of soldiers in the Underwight category (very thin), Ideal (Normal), Overweight (fat) or Obesity (Very fat). With this monitored health status, it is hoped that in carrying out their heavy duties the TNI AL soldiers will not be constrained by health problems. In the Navy environment, especially in the soldier health service work units, for measuring height and weight in the implementation of urikes, they still use manual equipment. The same thing happened when the selection of recruitment of personnel both in the officers, Bintara, Tamtama and the State Civil Apparatus (ASN) strata, measuring devices to determine whether the ideal posture or not still use manual and separate measuring instruments, for example in height measuring instruments the body still uses the meter that is attached to the wall, while for the weight measurement tool uses analog or digital scales, then to find out whether the posture of the soldier / prospective soldier is ideal or not, the committee / officer must calculate manually with a certain formula so that the risk of measurement error or calculations can occur.From the above, we designed to build a height measurement tool which is combined with a portable weight measurement tool, hereinafter referred to as a body mass index measurement tool. The tool uses a Sharp Sensor for height and measurement tools *Load Cell* for weight measurement tools which are

then processed by a microcontroller (Arduino Mega) which will then be displayed on the monitor screen or Personal Computer (PC) and can be accessed via android. Measurement data will be stored in a database so that the Unit Commander or Navy can see and print the results of these measurements so that the Unit Commander can determine further policies. Body mass index measuring instrument is expected to be used as a substitute for measuring instruments that are still used at this time whose operations are still manually and separately, so that officers / committees will be easier to carry out their duties, while also faster with accurate results.

2. Research Methods

This research can be classified as engineering research because of the application of science in a design to achieve performance in accordance with specified requirements. The design is the synthesis of design elements combined with scientific methods in systems that meet certain specifications. This study aims to prove that the design meets the specified specifications. The research begins by determining the design specifications that meet the specified specifications, choosing the best alternative, and proving that the design chosen meets the specified requirements efficiently, effectively and at a low cost.

2.1 Conceptual Framework

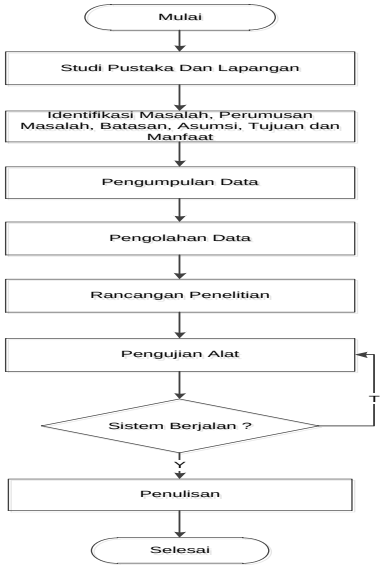

Figure 1: Overall Research Flowchart

2.2 Research Design

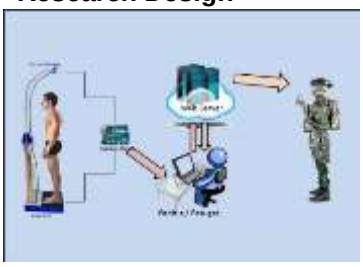

Figure 2: Overview

2.3 System Flow

The system design is carried out after an analysis of the system, which in the design of this system can provide an overview of the system that will be made. System flow is the flow (picture) of the system to be built. System flow is not much different from document flow, it's just that the process is more computerized.

System flow design and build a body mass index measuring tool for TNI AL soldiers based on Visual Studio consists of a system flow process for processing personnel data, measuring the body mass index and reporting the measurement process.

a. System Flow Process of Personnel Data Processing.

The process of personnel data processing can be illustrated in Figure 3. In the process of personnel data processing, each member who carries out measurements will enter personal data into the database.

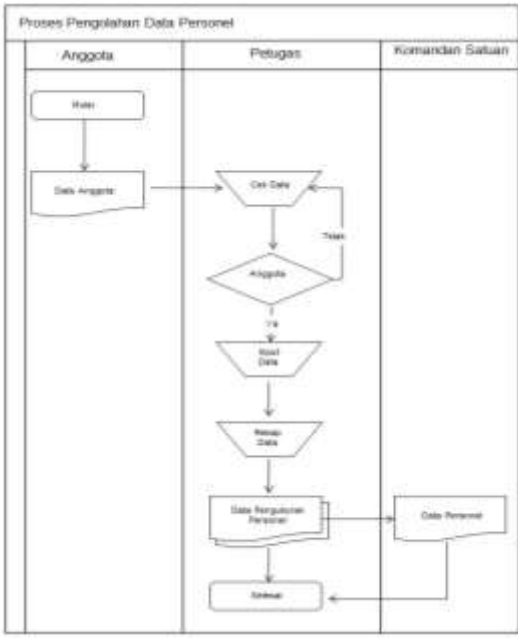

Figure 3: System Flow Process for Personnel Data Processing

b. System Flow Measurement Process of Body Mass Index

The body mass index measurement process can be illustrated in Figure 4. In the body mass index measurement process begins with the input of personnel data that will carry out the measurement. Furthermore, body mass index measurements are carried out by weighing the body and height measurements together, later it will be known the health status of personnel in the category of Underwight (very thin), Ideal (Normal), Overweight (fat) or Obesity (Very fat) then stored in a database which will facilitate the Unit Commander in making policies / decisions.

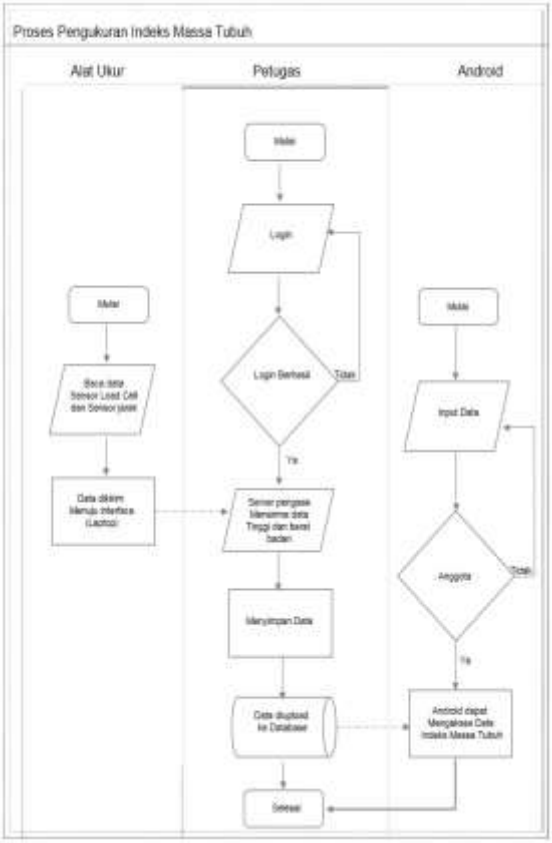

Figure 4: System Flow Measurement Process of Body Mass Index

c. System Flow Reporting Process Measurement Results

The process of reporting the results of operations can be illustrated in Figure 5. In the process of reporting the results of measurements, officers recap the results of measurements that are stored in a file and printed in the form of documents which are then reported to the Unit Commander.

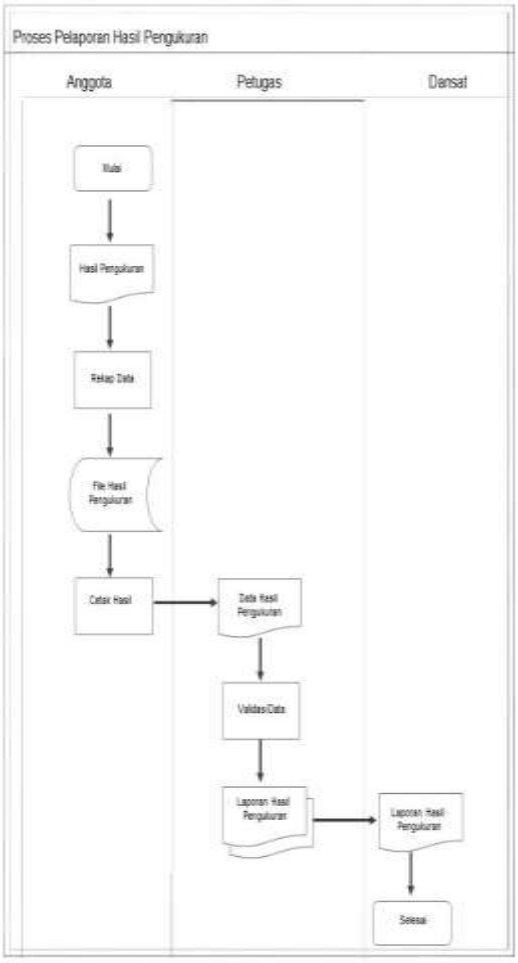

Figure 5: System Flow Reporting Process Measurement results

2.4 Context Diagrams

In making this system, a design is made using Context diagrams. The context diagram in the picture illustrates the system in outline of all the relationships that exist in the design of body mass index measurement tools for the Navy based on Visual Studio. Context diagrams can be illustrated in Figure 6.

Figure 6: Context Diagram

2.5 Data Flow Diagrams (DFD).

Data Flow Diagrams or often abbreviated as DFD are structured analysis and design tools that enable system analysts to understand systems and subsystems visually as a series of interrelated data flows. Data flow is the movement of data from one point to another (its depiction by means of the arrow heads pointing to the destination of the data.

The process usually always shows a change of data and the process of transformation of the data. Data storage (data store) is named with nouns, according to the data stored therein. Figure Data Flow Diagrams (DFD) can be seen in Figure 7.

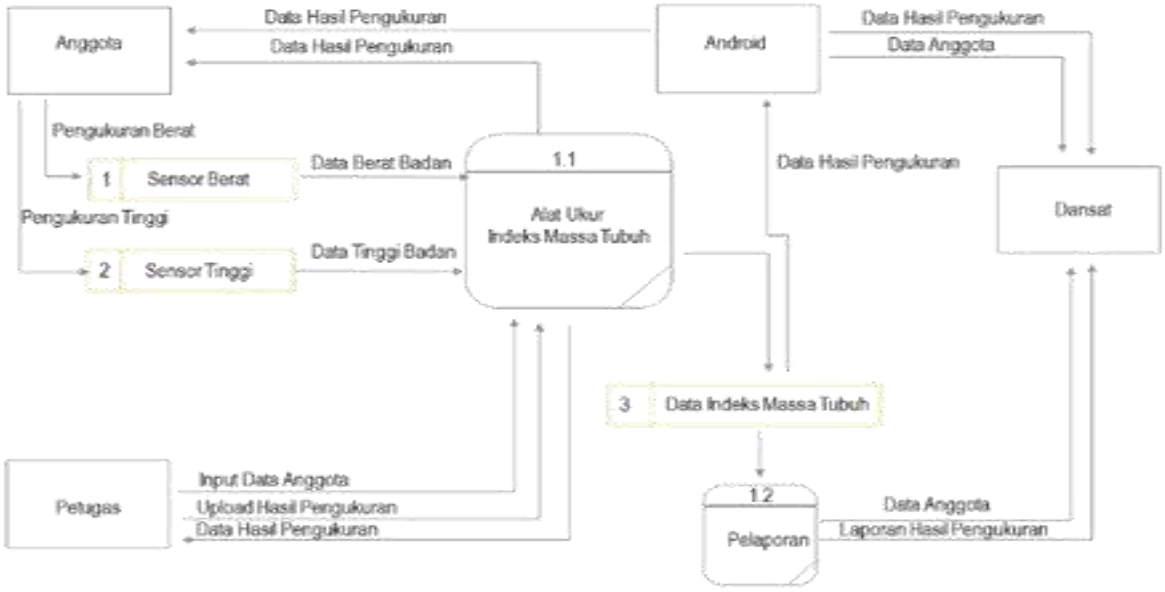

Figure 7: Data Flow Diagrams (DFD)

3. Results and Discussion

Software testing is carried out to determine the extent of work ability of the application system software for determining body mass index. Software testing conducted on this system is the process of reading and sending height sensors, the process of reading and sending weight sensors, the calculation process of determining the body mass index, the

login process, the logout process, the input process. Testing software system consisting of the process of reading and sending height sensors, the process of reading and sending weight sensors, the calculation process of determining the body mass index, the login process, the logout process, the input process.

The results of software testing can be said to be successful, because height and weight data can be entered in real time and the calculation of the determination of the Body Mass Index Status (IMT) can be read on the application display on the computer. Data of test results can be seen in table Table 1.

NO	PROGRAM	TARGET	INPUT	OUTPUT (IDEAL)	OUTPUT (REAL)	STATUS
1.	*LOGIN*	Entry program	Username Password	Entry program	Entry program	Success
2.	READ SENSOR	Read Height and Weight	Height and Weight	Height and Weight dibaca sistem	Height and weight terbaca sensor	Success
3.	SEND DATA SENSOR	Send sensor to database	Height and weight soldier	Data sent dalam database	Data sent dalam database	Success
4.	CALCULATE IMT	Calculate status IMT	Height and weight soldier	Jumlah and Status IMT	Jumlah and Status IMT	Success
5.	INPUT DATA PERSONEL	Entry data personel	Data personel	Data entry database	Data entru database	Success
6.	MONITORING PERSONEL	Monitor personel that measures	Data Personel	Data personel	Data personel	Success
7.	LOGOUT	Exit program	Sign out	Out	out	Success
8.	DISPLAY TABEL	Display table		Display data personel	Able display data all personel	Success
9.	DISPLAY DATA INDIVIDUAL	Display Individual	NRP personel	Display data individual personel	Able display data individual personel	Success
10.	DISPLAY DATA CHART	Display data grafik	NRP personel	Display data grafik	Able display data grafik	Success
11.	DISPLAY DATA SOLUTION	Display data solution	NRP personel	Display solution	Display solution	Success
12.	MENU PRINT	Print measurement		Print measurement	Able print measurement	Success
13.	MENU DELETE	Delete data personel		Delete data personel	Able delete data personel	Success

Hardware testing is carried out to determine the extent of the ability of the working hardware installed in the application system for determining body mass index. Hardware testing conducted on this system is testing the process of detecting height from sharp sensors, testing the process of detecting weight from load cell sensors and testing the ability of an android smartphone to display data.

Testing the process of detecting height from sharp sensors, testing the process of detecting body weight from a load cell sensor is carried out to determine the extent of the sensor's ability to read height and weight of personnel with the best level of accuracy. The test is done by standing on the load cell sensor and under the sharp sensor. Robust mechanics and exact standing position greatly affect the accuracy of the data on the Sharp Sensor and Load Cell sensor. Praurit who carry out measurements must also use a head covering because the thickness of the hair of each soldier is different. From testing the height sensor (Sharp sensor), the test results can be seen in table 2. While the weight sensor testing (Load Cell sensor) obtained test results that can be seen in table 3.

Table 2: Height sensor test table

NO	MEASUREMENT	CONDITIION		HEIGHT BAAND (CM)				AVERAGE	DIFF
		WITH HAT	WITH OUT HAT	Manual	IMT				
					1	2	3		
1.	Serma Candra	Yes		165	165	163	164	164	1
			Yes		-	-	-		
2.	Serma Iwan	Yes		165	164	163	164	163,6	1,4
			Yes		-	-	-		
3.	Serka Agus	Yes		168	167	168	166	167	1
			Yes		-	-	-		
4.	Serka Bayu	Yes		165	163	164	165	164	1
			Yes		-	-	-		
5.	Serka Yudha	Yes		165	165	162	164	163,6	1,4
			Yes		-	-	-		
6.	Serka Rizki	Yes		175	175	173	174	174	1
			Yes		-	-	-		
7.	Serka Khairul	Yes		168	165	166	168	166,3	1,7
			Yes		-	-	-		
8.	Serka Fathur	Yes		172	172	171	170	171	1
			Yes		-	-	-		
9.	Sertu Krisnal	Yes		172	168	170	172	170	2
			Yes		-	-	-		
10.	Sertu Nirwan	Yes		166	165	166	163	164,6	1,4
			Yes		-	-	-		

Table 3: Weight sensor test table

NO	MEASUREMENT	WEIGHT (KG)				AVERAGE	DIFF
		Manual	IMT				
			1	2	3		
1.	Serma Candra	76	76,2	76,1	76	76,1	+ 0,1
2.	Serma Iwan	61	61,3	61,	61	61,1	+ 0,1
3.	Serka Agus	74,5	74,1	74,6	74,5	74,4	- 0,1
4.	Serka Bayu	75	75,4	75,2	75	75,2	+ 0,2
5.	Serka Yudha	72	72	72,2	72,1	72,1	+ 0,1
6.	Serka Rizki	75	75,3	75	75	75,1	+ 0,1
7.	Serka Khairul	74	74,2	74,1	74	74,1	+ 0,1
8.	Serka Fathur	65	65	65	65	65	0
9.	Sertu Krisnal	72	72,2	72,1	72,2	72,1	+ 0,1
10.	Sertu Nirwan	65	65	65,1	65,1	65,05	+ 0,05

Testing the ability of an android smartphone in displaying data needs to be done, but before entering the android application, the icon of this application must be known. Application icons on Android can be seen in Figure 8.

Figure 8: Android Application Icon / Logo

An Android application written in the Java programming language. Android SDK Tools compiles the code with data and resource files into an APK. An Android package, which is an archive file with a .apk suffix. One APK file contains all of the material for an Android application and is a file that an Android device uses to install applications. After the Body Mass Index (IMT) application has been installed on an android smartphone, the data will be immediately accessible to soldiers. Data that can be accessed on android smartphones are table data, individual data and chart data. The ability of an android smartphone to display body mass index data can be seen in Figure 9 and Figure 10.

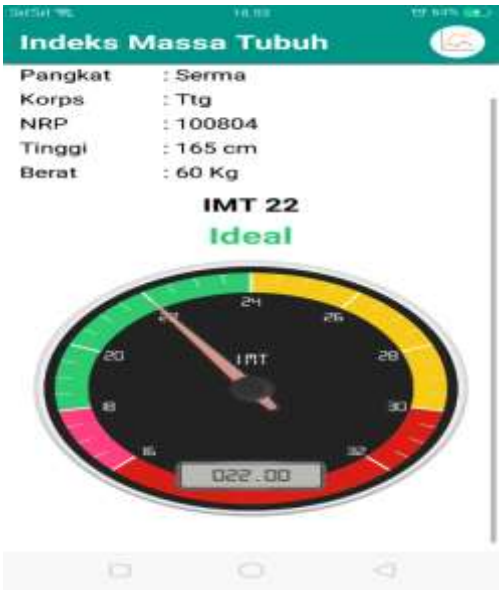

Figure 9: Android smartphone testing in displaying individual data.

Figure 10: Android smartphone testing in displaying the graph menu

4. Conclusions and Recomendation

Conclusion

Based on the results of tests that have been carried out on the design and construction of an application system for determining body mass index, the following conclusions are obtained:

a. For height measurements, headgear must be used. The accuracy of standing position can also affect the results of height measurements.
b. The results of body weight measurements are almost accurate, between -0.1 to +0.2 kg.
c. Can display Soldier's Body Mass Index (BMI) status.
d. Can display weight information that must be changed if its Body Mass Index (BMI) status is other than Normal.
e. Information can be accessed through an Android Smartphone.

Recomendation

Recomendation for system development are as follows:

a. For the sake of data accuracy, the Sharp sensor can be replaced with a Distance Meter (Laser).

b. Can be developed by adding a heart rate sensor to measure soldier tension.

c. Can be developed by adding a temperature sensor to detect soldier's body temperature.

d. Can be used in the recruitment of Navy personnel.

e. The screen (LCD) that integrates with the device to make it simpler.

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