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Design of a Height and Weight Measurement Tool for Toddlers at Spreadsheet-Based Posyandu

Rancang Bangun Alat Ukur Tinggi Badan dan Berat Badan Balita di Posyandu Berbasis Spreadsheet

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Abstract_ *When it comes to disease prevention and quality human development, the main focus is on promoting optimal under-five health and growth. Integrated service posts, also known as posyandu, often take center stage when it comes to tracking the development of under-fives in the community. However, there is still no effective system to measure the height and weight of toddlers in posyandu. Therefore, a spreadsheet-based tool was created that can help the process of measuring the height and weight of toddlers in posyandu to be easier, faster, and more accurate. The data can also help posyandu officers, medical personnel, and parents in making decisions related to the health and nutrition of toddlers. Height and weight monitoring is done through a spreadsheet. The components used in this tool are ESP 8266 as a microcontroller, ultrasonic sensor as a height meter, load cell sensor as a weight meter, LCD to display measurement notifications, rfid-rc522 to communicate data from rfid tags so that when scanning/tagging to rfid, the data from height and weight measurements will be uploaded to the spreadsheet. From the tests carried out, it is obtained that the device functions properly and helps posyandu officers to monitor and measure the growth of height and weight in toddlers efficiently.*

Keywords: *NodeMCU; Load Cell; Ultrasonic; RFID-RC522; Lcd i2c.*

Abstrak_ Dalam hal pencegahan penyakit dan pembangunan manusia yang berkualitas, fokus utamanya adalah mempromosikan kesehatan dan pertumbuhan balita yang optimal. Pos pelayanan terpadu, yang juga dikenal sebagai posyandu, sering kali menjadi pusat perhatian dalam hal melacak perkembangan balita di masyarakat. Namun, masih belum ada sistem yang efektif untuk mengukur tinggi dan berat badan balita di posyandu. Oleh karena itu, dibuatlah sebuah alat bantu berbasis spreadsheet yang dapat membantu proses pengukuran tinggi dan berat badan balita di posyandu menjadi lebih mudah, cepat, dan akurat. Data tersebut juga dapat membantu petugas posyandu, tenaga medis, dan orang tua dalam mengambil keputusan terkait kesehatan dan gizi balita. Pemantauan tinggi dan berat badan dilakukan melalui spreadsheet. Komponen yang digunakan pada alat ini adalah ESP 8266 sebagai mikrokontroler, sensor ultrasonik sebagai pengukur tinggi badan, sensor load cell sebagai pengukur berat badan, LCD untuk menampilkan notifikasi pengukuran, rfid-rc522 untuk mengkomunikasikan data dari tag rfid sehingga ketika melakukan scanning/tagging terhadap rfid, data hasil pengukuran tinggi dan berat badan akan terupload ke spreadsheet. Dari pengujian yang dilakukan, didapatkan hasil bahwa alat berfungsi dengan baik dan membantu petugas posyandu untuk memantau dan mengukur pertumbuhan tinggi dan berat badan pada balita secara efisien.

Kata Kunci: NodeMCU; Load Cell; Ultrasonic; RFID-RC522; Lcd i2c.

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I. INTRODUCTION

One of the posyandu services that support public health, especially the health of children under five, is weighing. However, the use of standardized measuring instruments to determine height and weight still requires more time and energy and is less accurate[1].

Parents want their toddlers to reach their full genetic potential as they grow and develop[2]. At the posyandu park, the weight and height of children under five are measured as part of the immunization procedure[3]. Conventional or manual scales are typically used to calculate an object's weight,The measurement findings are neither exact or reliable because conventional scales lack the necessary level of accuracy[4]. Under-five growth, however, is a continuous process that demands equal care. The cadres of the Posyandu have few abilities[5].

There is a lot of discussion about weight these days, as ideal weight is essential for health and appearance[6]. Every child under five is required to visit the posyandu once a month during their growth period, as monitoring is needed to determine their growth and development[7]. The human brain grows and develops most quickly during the toddler period, known as the "golden period", and the baby phase, known as the "critical period"[8]. Babies who have reached their first birthday are considered toddlers. During this period, known as the "golden age," when a child's brain grows quickly, health, nutrition, parenting, and education must all be given a strong boost[9]. At the Posyandu, a measuring instrument called an infantometer, a manual scale called a dacin that is useful for determining the weight of children under five, and a measuring tape are still used to determine the circumference of the upper arm and head and the length of the toddler's body[10]. Height-for-age lists one of the causes as long-term underconsumption of energy, protein, and micronutrients[11]. Every month, weighing is done at the posyandu in order to measure growth, including checking toddlers' nutritional state, giving them vitamins, checking their health, and immunizing them[12]. Few parents realize that a toddler's weight is also an indication of nutrition, so it's important to constantly monitor their growth[13].

Errors in determining age will lead to incorrect nutritional status interpretation. Body weight parameters can be used to determine both nutritional status and the rate of physical growth. The height parameter, however, is a condition that contrasts the past with the present[14]. Measuring the height and weight of children under five are some of the activities carried out at the posyandu[15]. There are disadvantages to doing this at the posyandu by manually measuring their body mass and height[16]. Data processing systems must be implemented in a variety of industries, including government organizations, the corporate sector, education, health care, and other businesses a public health service is Posyandu[17]. It is very important to monitor the growth and development of toddlers regularly and gradually. This is done to identify growth deviations and correct them as quickly as possible[18]. A very strategic effort to find growth disorders in toddlers at the posyandu is to monitor their growth[19]. In addition, many mothers do not take timely action because they do not know the weight gain chart of their toddlers[20]. Therefore, accurate and precise data collection is essential to provide valid health information. In addition, since there are many registers, many data must be recorded repeatedly, processing and data re-access is necessary[21].

Along with the progress of the times, people now realize how important service information systems are in helping to complete complex tasks in a short time[22]. errors in height measurement occur when a cm tape measure (metelin) is used instead of a long board, and the position of the toddler's feet is not taken into account[23].

Therefore, for this study, we used the NodeMcu ESP8266 microcontroller, which is integrated with an IOT-based Wi-Fi module, and designed a device to determine height and weight and have better accuracy than previous studies[24][25]. Therefore, we make the design of a spreadsheet-based height and weight measuring tool for children under five. Where here a height and weight tool will be made using the NodeMCU ESP8266 microcontroller which is integrated with an IOT-based Wi-Fi module. Where the measuring device that will be made is used because it can make it easier for posyandu cadres to check height and weight automatically, then the data will automatically enter the spreadsheet in a short time. With this tool, it is hoped that posyandu cadres can make it easier when weighing weight and measuring height. This spreadsheet-based height and weight measuring device integrated with a Wi-Fi module is expected to be a technological innovation in the world of measuring the height and weight of children under five at posyandu. Although there are some obstacles such as delay to difficult internet connections.

II. METHODS

This system design utilizes IoT for posyandu and clinic cadres. IoT is used to facilitate users in weighing the weight and height of children under five at posyandu and clinics. There are two stages in the design, namely hardware design and software design. Hardware design requires a block diagram and wiring design. Software is a flowchart of the methods used.

2.1. System Design

The wiring design, which describes the system's components and their connections, is the first step in the system design process. Making a flow chart that details the system's workflow and how its various components interact with one another is the second step. The third step is creating the block diagram, which displays the system's input, processing, and output components as well as their interrelationships. Together, these three sections offer a thorough knowledge of the system's conception and functionality.

2.1.1. Wiring Design

The wiring design as shown in Figure 1 appears to be for a system that uses NodeMCU master (microcontroller board based on ESP8266), NodeMCU slave (microcontroller board based on ESP8266), load cell sensor (possibly load sensor),

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ultrasonic sensor (possibly HC-SR04 sensor), RFID-rc522, LCD i2c.

Table 1 shows the specific pin connections between the nodemcu master and nodemcu slave and the various components in the system, including the load cell sensor, ultrasonic sensor, rfid-rc522, and LCD i2c. the table shows the pins of the nodemcu master and nodemcu slave, which are connected to the input/output pins of each component, as well as the type of connection (e.g. digital, serial, analog, etc.). the correct pin connections must be made for the system to function properly.

[Figure 1 about here]

[Table 1 about here]

[Table 2 about here]

2.1.2. System Flowchart

The flow chart of the system in this study is shown in Figure 2. In this flow chart, it starts by connecting the load cell sensor and the hc-sr04 sensor, if it is connected, then sending data to the nodemcu slave. In this case the Load Cell sensor and HC-SR04 sensor provide input to the nodemcu master, and a notification appears on the LCD. After that nodemcu master sends data to nodemcu slave.

[Figure 2 about here]

This program starts from reading the data that has been sent by the NodeMcu master, then tags or scans the rfid-rc522 card. Furthermore, the data will be sent to NodeMcu 2 or slave and then executed by Spreadsheet. In this case the RFID-rc522 and Lcd 16x2 provide output to the nodemcu slave, after which the nodemcu slave sends data to the spreadsheet.

[Figure 3 about here]

2.1.3. Block Diagram System

To facilitate the design and manufacture of tools, a system block diagram is made as a whole. The following is a block diagram of the Design of Height and Weight of Toddlers at Spreadsheet-Based Posyandu as shown in Figure 4.

[Figure 4 about here]

The design of the tool starts from 6 parts, namely the load cell sensor, hcsr-04, nodemcu 1 (master), nodemcu 2 (slave), rfid, and lcd i2c 16x2. In the master block diagram there are load cell sensor components, hcsr-04, and nodemcu 1 acts as a master or sender. While in the slave block diagram there are 16x2 lcd i2c components, RFID-rc522 acts as a slave or receiver or nodemcu 2, and spreadsheets, The output of the load cell sensor and ultrasonic sensor is in the form of an analog signal, then this signal is processed by nodemcu into a digital signal through the ADC process and the results of the digital signal are converted into serial form. The output of nodemcu 1 or master received by lcd i2c is in the form of a serial, then processed by nodemcu 2 or slave and the data will enter and then forwarded to the spreadsheet.

III. RESULTS AND DISCUSSION

The following is a display of the realization of the tool in the research design of a spreadsheet-based height and weight measuring device for toddlers that has been carried out. where in Figure 5 shows the components used, namely: 1. NodeMcu Master, 2. NodeMcu Slave, 3. Ultrasonic Sensor, 4. Load Cell Sensor, 5. LCD i2c 16x2, 6. RFID-RC522.

[Figure 5 about here]

How to use this tool is as follows:
1. Connect to the nodemcu microcontroller usb cable then connect to the laptop and make sure the hotspot is on.
2. Then the nodemcu microcontroller will connect to the hotspot then the i2c LCD will provide notification. Then the tool can be used directly.
3. If it is connected, the next step is to put the toddler into the position of the tool, if it is appropriate then the load cell sensor as weight and ultrasonic sensor as height will work, then the weight and height will appear on the LCD i2c.
4. Then if the weight and height have appeared on the LCD then the next step is to scan the Rfid-rc522 card/tag, if you have scanned it then a notification will appear on the LCD i2c, then the next step is the height and weight measurement data will be sent to the spreadsheet.

3.1. Testing Wi-Fi Connection to NodeMCU ESP8266

Wi-Fi connectio testing of the NodeMCU ESP8266 connection was tested with 5 and 6 seconds, then the test results are shown in table 3. The test results show that the NodeMCU ESP8266 can establish a fast Wi-Fi connection.

[Table 3 about here]

3.2. RFID-RC522 Testing

The RFID-RC522 has been tested five times as shown in table 4. from these results, it is clear that the rfid runs correctly and follows the instructions correctly.

[Table 4 about here]

3.3. Load Cell Sensor Testing Results on Toddlers

This test is done by comparing the measurement results between measuring instruments made using load cell sensors with digital body scales. This test was carried out on 6 toddlers, where the results were as shown in table 5.

[Table 5 about here]

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Based on table 5 shows the results of testing of toddler weight measurements using measurement tools and digital scales. In the table, the average error value and accuracy level of the sensor are obtained. For the average error (%) result is 2,04% so for the accuracy rate on the height sensor obtained is 97,96%.

3.4. Ultrasonic Sensor Testing Results on Toddlers

This test is done by comparing the measurement results between the measuring instrument made using an ultrasonic sensor with a meter. This test was carried out on 6 toddlers, where the results were as shown in table 6.

[Table 6 about here]

Table 6 shows the test results of measuring the height of toddlers using measuring instruments and meters. In the table, the average error value and accuracy level of the sensor are obtained. For the average error (%) result is 1.70% so that the accuracy rate on the height sensor obtained is 98.3%.

3.5. Spreadsheet Testing

In testing this spreadsheet, you can match the value of the sensor readings that appear on the LCD with those stored in the spreadsheet. where this tool will automatically send data from the load cell sensor readings and ultrasonic sensors through the rfid-rc522 scan/tag which will be directly received by the spreadsheet according to each column and section.

[Figure 6 about here]

from figure 6, it can be seen that the system works as intended, namely the data information from the sensor received matches the data information sent by the device then to the spreadsheet. it's just that a stable internet connection is needed to be able to send the data.

IV. CONCLUSION

Based on the results of the research on the design of a height and weight measuring device for toddlers in a spreadsheet-based posyandu and the discussion described earlier, it can be concluded that: First, the height and weight measuring device for toddlers that has been made can be used in the measurement process at posyandu or pukesmas. Second, measurements will become easier and more efficient because when measuring height and weight and the data will appear on the LCD and then scan the rfid card/tag, then the rfid will upload it to the spreadsheet so that it becomes easier and more efficient. Third, it makes work easier because the system used is Spreadsheet-based, whose data will be collected into the spreadsheet. Fourth, the system of this tool will turn on when connecting the usb cable to the laptop on Nodemcu and then connect to wifi or the internet if the height and weight measuring device can be used. Fifth, to connect the Nodemcu microcontroller to the data base, a strong and stable internet signal is required. If the internet network signal is weak or unstable, the system on the measurement tool will not run properly.

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Table 1. NodeMcu Master Port Usage

No.	Nodemcu Port	Usage
1.	3,3V	VCC
2.	D8	Trig Ultrasonic
3.	D7	Echo Ultrasonic
4.	GND	GND
5.	D6	DT Load cell
6.	D5	SCK Load cell
7.	3,3V	VCC
8.	GND	GND

Table 2. NodeMcu Slave Port Usage

No.	Nodemcu Port	Usage
1.	D2	Pin SDA LCD
2.	D3	Pin SCL LCD
3.	Vin	VCC
4.	GND	GND
5.	D7	Pin RFID MOSI
6.	D6	Pin RFID MISO
7.	D5	Pin RFID SCK
8.	D8	Pin RFID SDA
9.	A0	Pin RFID RST
10.	3,3V	3V
11.	GND	GND

Table 3. Testing Wi-Fi connection to NodeMCU ESP8266

Testing To	WiFi ESP8266		Accuracy (%)
	Condition	Waiting Time (s)	
1st Test	Connected	5	Medium
2nd Test	Connected	5	Medium
3rd Test	Connected	5	Medium

4th Test	Connected	5	Medium
5th Test	Connected	6	Medium
6th Test	Connected	6	Medium

Table 4. RFID-RC522 Testing

Testing To	RFID-RC522		Percentage of Success (%)
	RFID Tags	Distance (cm)	
1st Test	Aisyah Putri	1	100
2nd Test	M Rifqi	1	100
3rd Test	Iqbal R	1	100
4th Test	A Syaiful	1	100
5th Test	Chandra W.	1	100
6th Test	M Abbas	1	100

Table 5. Load Cell Sensor Testing Results on Toddlers

Testing To	Name	Age	Load Cell	Sensor Load Cell (kg)	Deviation	Error (%)
			Digital Scales (kg)			
1st Test	Aisyah Putri	6 Months	8,9	9,02	0,12	1,34
2nd Test	M Rifqi	4 Months	6,5	6,7	0,2	3,07
3rd Test	Iqbal R	5 Months	7,6	7,83	0,23	3,02
4th Test	A Syaiful	6 Months	8,7	8,81	0,11	1,26
5th Test	Chandra W	8 Months	9,7	9,88	0,18	1,85
6th Test	M Abbas	7 Months	9,2	9,36	0,16	1,73
Average Error						2,04
				Accuracy		97,96

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Table 6. Ultrasonic Sensor Testing Results on Toddlers

Pengujian Ke			Ultrasonic			
	Name	Age	Alat Meteran (Cm)	Sensor Ultrasonic (Cm)	Deviation	Error (%)
1st Test	Aisyah Putri	6 Months	58	58	0	0
2nd Test	M Rifqi	4 Months	54	55	1	1,85
3rd Test	Iqbal R	5 Months	56	58	2	3,57
4th Test	A Syaiful	6 Months	59	60	1	1,69
5th Test	Chandra W	8 Months	66	67	1	1,51
6th Test	M Abbas	7 Months	61	62	1	1,63
				Rata – Rata Eror		1,7
				Akurasi		98,3

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10.21070/jeeeu.v7i2.1677

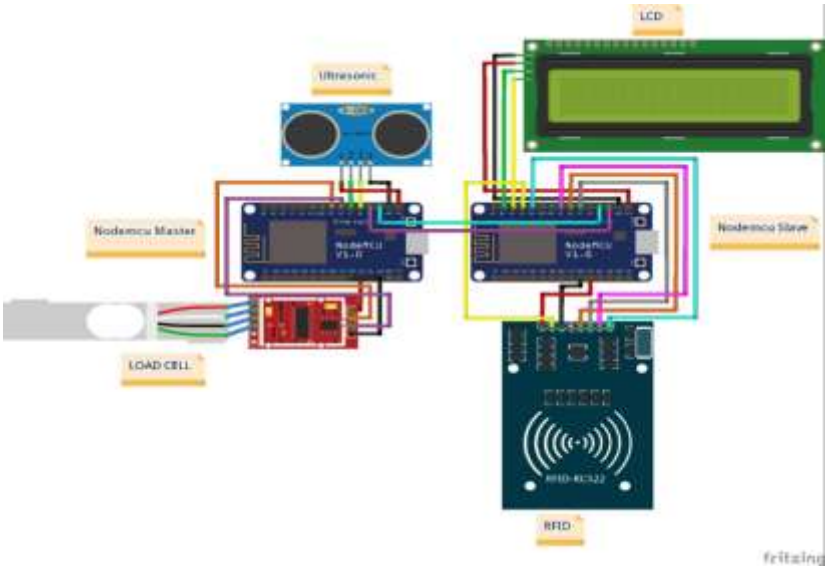

Figure 1. Wiring Design

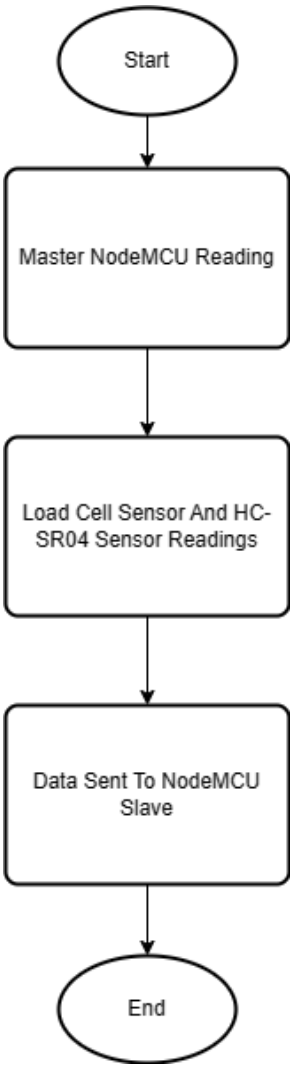

Figure 2. Master Flowchart Program

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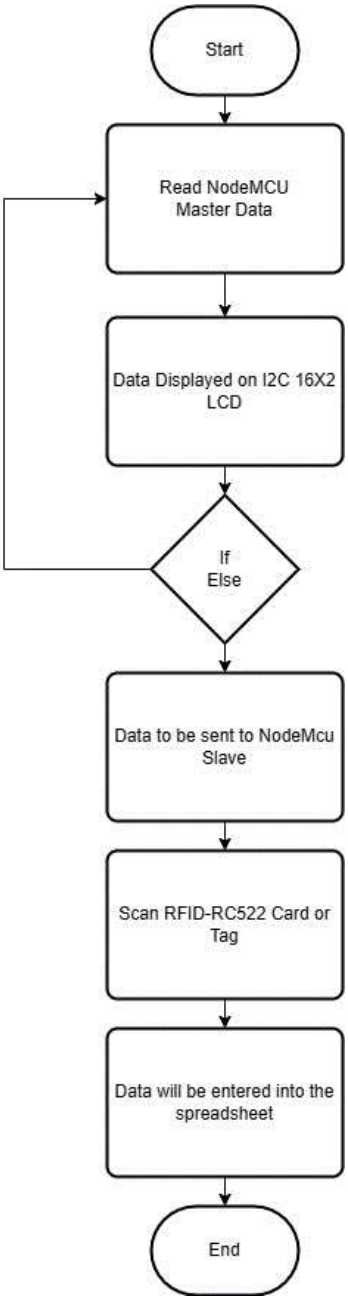

Figure 3. Slave Flowchart Program

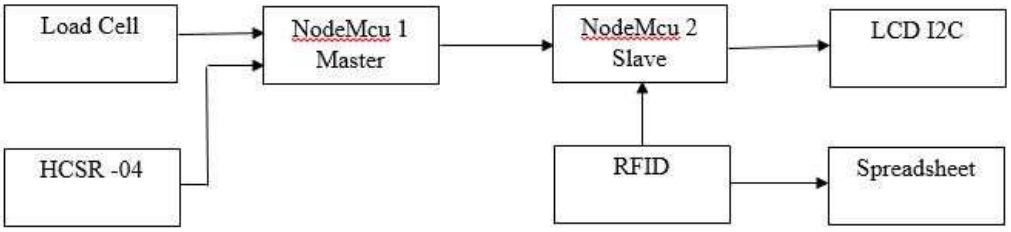

Figure 4. Block Diagram System

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Figure 5. Tool Realization

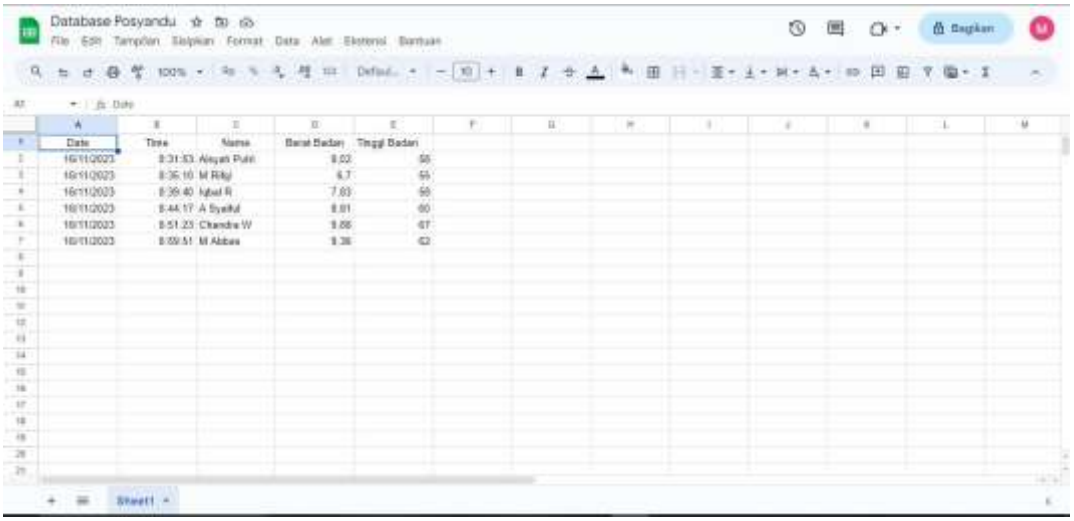

Figure 6. Menu In Spreadsheet