Jurnal Teknik Elektro dan Komputer vol. 12 no. 02 May-August 2023, pp. 121-126
p-ISSN : 2301-8402, e-ISSN : 2685-368X , available at : https://ejournal.unsrat.ac.id/index.php/elekdankom

An Arduino-Driven Approach for Weight and Height Measurement Monitoring

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Received: 18 February 2023; revised: 25 August 2023; accepted: 29 August 2023

***Abstract* —The development of a weight and height measurement system based on Arduino has proven to be an effective tool for assessing body weight and providing valuable insights into individuals' health status. This system combines a proximity sensor and a digital scale to accurately measure weight and calculate the ideal body weight. The integration of buttons, an Arduino Uno, and an LCD 16x2 facilitates the operation and display of readings. Additionally, the system incorporates BMI calculation as a measurement guide, enhancing its functionality. The obtained results demonstrate the reliability and accuracy of the system in measuring weight and height. The device can be utilized not only in medical settings but also in fitness centers, households, and other environments where monitoring and maintaining optimal body weight is essential. By detecting overweight or underweight conditions, individuals can take necessary steps to prevent or manage weight-related health issues. In conclusion, the Arduino-based weight and height measurement system provides a practical and user-friendly solution for individuals to monitor their weight and obtain vital information regarding their ideal body weight. Further research and improvements can be made to enhance the system's capabilities, such as incorporating wireless connectivity for data transfer and analysis, enabling remote monitoring and tracking of weight trends.**

Keywords: Arduino, Berat Badan Ideal, BMI Calculation, Scales, Weight and Height Measurement, Wireless Connectivity, Body Weight Management

***Abstract* — Pengembangan sistem pengukuran berat badan dan tinggi badan berbasis Arduino terbukti menjadi alat yang efektif untuk menilai berat badan dan memberikan wawasan penting tentang status kesehatan individu. Sistem ini menggabungkan sensor proximity dan timbangan digital untuk mengukur berat badan secara akurat dan menghitung berat badan ideal. Integrasi tombol, Arduino Uno, dan LCD 16x2 memudahkan operasi dan tampilan pembacaan. Selain itu, sistem ini juga mencakup perhitungan BMI sebagai panduan pengukuran dan meningkatkan fungsionalitasnya. Hasil yang diperoleh menunjukkan keandalan dan akurasi sistem dalam mengukur berat badan dan tinggi badan. Perangkat ini dapat digunakan tidak hanya di lingkungan medis, tetapi juga di pusat kebugaran, rumah tangga, dan lingkungan lain di mana pemantauan dan pemeliharaan berat badan optimal sangatlah penting untuk dilakukan. Dengan mendeteksi kondisi kelebihan berat badan atau kekurangan berat badan, individu dapat mengambil langkah-langkah yang diperlukan untuk mencegah atau mengelola masalah kesehatan yang terkait dengan berat badan. Kesimpulannya, sistem pengukuran berat badan dan tinggi badan berbasis Arduino menyediakan solusi praktis dan user-friendly bagi individu untuk memantau berat badan mereka dan memperoleh informasi penting tentang berat badan ideal. Penelitian dan perbaikan lebih lanjut dapat dilakukan untuk meningkatkan kemampuan sistem, seperti menggabungkan konektivitas nirkabel untuk transfer dan analisis data, memungkinkan pemantauan jarak jauh dan pelacakan tren berat badan.**

Kata Kunci: Arduino, Berat Badan Ideal, Pemantauan Jarak Jauh, Timbangan, Pengukuran Berat Badan dan Tinggi Badan, Konektivitas Nirkabel, Manajemen Berat Badan

I. INTRODUCTION

Human health has a significant impact on body weight. Individuals who are overweight are at a higher risk of developing various diseases, including obesity, diabetes, and heart attacks. Moreover, body weight also holds significant social value in many communities as it can influence one's appearance and play a role in attaining desired beauty standards [1]. In the professional world, maintaining a healthy body weight can also be a determining factor in acquiring a job, as some employers tend to prefer physically healthy employees with good skills. To manage and maintain an optimal body weight, calculations such as Body Mass Index (BMI) and the Broca's formula are often utilized as guidelines. BMI is a commonly used measurement method to categorize an individual's body weight based on the ratio between weight and height. Meanwhile, the Broca's formula provides an estimate of the ideal body weight based on an individual's height [2]. In this context, having a weighing instrument that can measure ideal body weight is immensely helpful. This tool enables individuals to regularly monitor their weight and adjust their dietary and lifestyle habits as needed. With the presence of a weighing instrument, individuals can track changes in their weight over time and take necessary actions if there is excess or insufficient body weight [3].

In this study, we developed an Arduino-based weighing device capable of accurately measuring body weight. This device is designed by utilizing BMI calculations and the Broca's formula as guidance to determine an individual's ideal body weight. Furthermore, the device is equipped with additional features such as an LCD screen to display weight readings, as well as start and power buttons to operate the system. Consequently, this weighing device provides a practical solution for individuals to manage and monitor their body weight.

With the presence of this weighing device, it is anticipated that individuals can more easily and effectively manage their body weight. They can use this device as an aid to maintain their health, prevent weight-related issues, and enhance overall quality of life. Additionally, this weighing device also holds the potential for use in various settings, including medical environments, fitness centers, and households, as a tool to assist in regular weight monitoring.

II. METHOD

The flowchart in question in Figure 1's first panel has a section where it summarizes research findings that support the design of the object. The flowchart in question illustrates every step of the research process, including how the sensor being used can read the results of measurement weight and height of body.

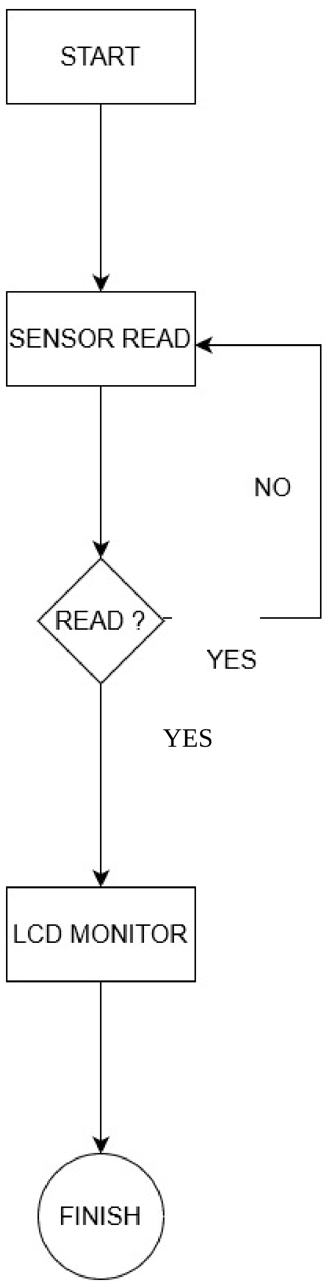

Figure 1. Flow Chart (Source : Processed Data, 2023)

To start with, Power Supply provides the necessary voltage for running Arduino Uno so that the device can function and be used. Following Arduino's initialization, the next step is to enable the use of the load cell and HC-SR04 sensor. Load cells are used to accurately measure weight of body, whereas HC-SR04 sensors are used to accurately measure badan ketinggian. The Arduino was then programmed using the appropriate programming language. The aforementioned program changes the operation of the load cell and sensor HC-SR04 to accurately perform the measurement weight and height of body. After receiving the data of measurement from the two sensors in question, Arduino is able to perform perforations in accordance with the body mass index data that has already been input into the program [4]. BMI is used to calculate a person's body mass index based on their weight and height. The results of the BMI measurement were then shown on a 16x2 LCD display. The purpose of the LCD display is to display the measurement weight and height of body and BMI measurements that were made by the Arduino. In this study, the flowchart's lengthy sections were designed to provide a tool that could accurately measurement weight and height of body, as well as easily calculate BMI. This design serves as a tool that individuals can use to maintain and improve their health through appropriate weighing gating.

There is an indication of the part that is used for the process of weighing device design in the block diagram on figure 2. A flowchart has an outline of the construction process, and the components and materials used are then identified in the block diagram. There is a power supply 12 volt that, when the tomograph is turned on, will begin to run and provide input to the Arduino Uno. Later, a sensor will continue to run and display the results of the penguin experiment on the LCD display. Diagram block demonstrates how components work together. To simulate or launch Arduino, use the start and reset buttons. Sensor for monitoring Has the ability to read and comprehend recently taped content. The current sensor for knowledge examines and monitors knowledge that is incorrect. As a result of the sensor's accurate and timely reading, the LCD is functional.

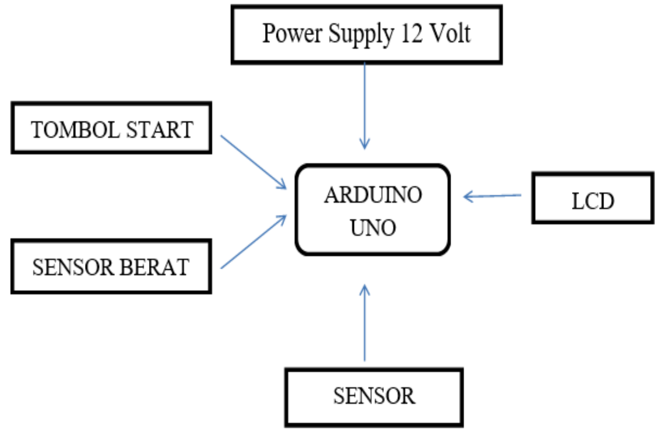

Figure 2. Block Diagram (Source : Processed Data, 2023)

p-ISSN : 2301-8402, e-ISSN : 2685-368X , available at : https://ejournal.unsrat.ac.id/index.php/elekdankom

The next step is to create a wiring diagram after creating a flowchart and schematic of block diagram for the project in question. Each component will be installed according to the connections shown in the wiring diagram throughout the assembly process. In this study, the primary components that are utilized are the load cell as a temperature sensor and the ultrasonic sensor as a pitch-fork sensor. Both of these sensors will work together to collect the information needed to calculate the user's Body Mass Index (BMI). To clear the path and detect objects behind it, an ultrasonic sensor will be used. Data from this report will be used as the sole parameter in BMI calculations. In addition, the load cell will function as an indicator to lower the user's badan usage rate. Data quality from a load cell will be another crucial factor in determining BMI. After the data has been collected, the primary controller, Arduino, will adjust the BMI value in accordance with the BMI estimate that has been computed using the information from the two aforementioned sensors. The BMI scale that is hit will then be used to classify the user's body mass index status into the categories "ideal," "thin," "fat," or "obesity." It's important to confirm that the connections between Arduino and the sensors being used are functioning properly. This will ensure that accurate data collection and BMI measurement results may be shown clearly on LCDs.The wiring diagram that has already been created will make the assembly of the components more organized and rapid. Every connection between components will be clearly marked, simplifying assembly and lowering the risk of a broken connection.

With a thorough and accurate wiring diagram, it is anticipated that the current project will succeed in producing a BMI system that functions properly and provides users with accurate results and informative data. By doing this, users can learn about their health status and find appropriate resources to look after their well-being.Detailed wiring diagram can be shown in figure 3, where the arrows will show how each component will connect to the next one to physically move an object.

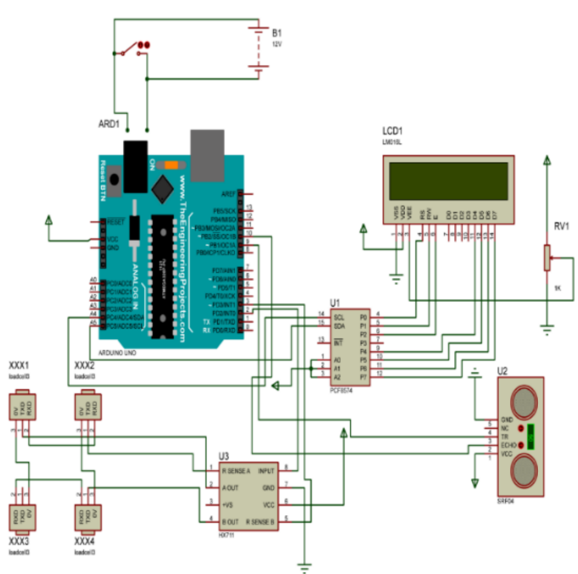

Figure 3. Wiring Block (Source : Source : Processed Data, 2023)

In the figure 4, you can see a sensor load cell, which is a sensor used to measure a beban's strength or tekanan. Sensor sel beban serves as the primary component of many digital timing systems. Load cells employ the tekanan principle to carry out pengukuran [5]. Wiring Blocks for a Load Cell are listed below..

Finally, the HC-SR04 is an ultrasonic sensor that reduces interference between the sensor and the penghalang. The HC-SR04 is an ultrasonic sensor that is used to measure the distance between a sensor and any objects or bends below it. This sensor employs the feedback of wave ultrasonic principle to reduce noise by accelerating the ultrasonic pulse and detecting its return. The two primary components of the HC-SR04 are the ultrasonic transceiver and the control module. Similar to the PING sensor, but with different pin counts and specifications. The HC-SR04 is an ultrasonic sensor that can be used to measure the distance between a sensor and an object or to measure the depth below it.

The sensor in question employs the principle of the wave feedback of ultrasonic, whereby it detects the pantulan gelombang that is returning to the sensor after pulsing the gelombang ultrasonic toward the object. The HC-SR04 can move the sensor's track to the object with a high level of efficiency by reducing the time that the ultrasonic waveform is in the field and is being recorded. Transceiver (pengirim-penerima) ultrasonic and modul control are the sensor's two primary components. The transceiver is fully focused on finding ultrasonic gelombang and retrieving it, while the modul control alters the processes of obtaining gelombang and retrieving it as well as performing jarak perhitungan.

Although the HC-SR04 and sensor PING have similar operating principles, there are differences in the number of pins and specifications of the two devices. HC-SR04 typically uses four pins: VCC (input of voltage), Trig (pin for measuring ultrasonic pulse), Echo (pin for detecting wave feedback), and GND (ground). In addition, depending on the type and model, a sensor PING may have several pin configurations.

The HC-SR04 sensor is very versatile and can be used in applications like robotics, otonomy, jarak detection, robotics, and many more. In a variety of electronic projects and applications that require a radar sensor, their reliability in doing so and their user-friendliness have made them a popular choice. The sensor HC-SR04 has a wiring diagram similar to that in figure 5. Where the sensor is connected to the Arduino.

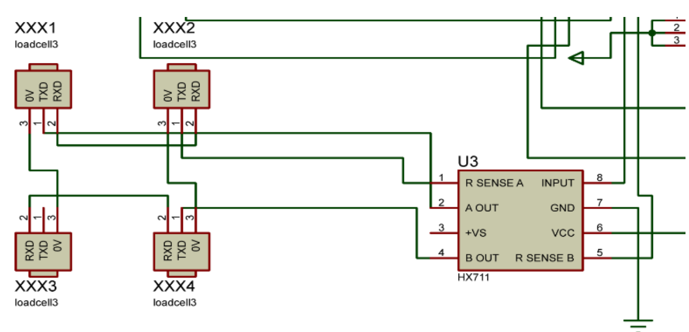

Figure 4. Wiring Block Load Cell (Source : Processed Data, 2023)

After the necessary component-by-component processing is complete, more research will be conducted in the area of alats, namely the creation of alats for building strong and brittle weight.

III. RESULT

Algorithm for determining the optimal body weight that uses an ultrasonic sensor to determine the ideal body weight and a load cell to determine the ideal body weight can help someone determine their ideal body weight. The user of this tool can explore the available tools for assessing the tool's performance by operating it. This function focuses on ideal weight scale fixed and weigh scale measurement based on the available LED output output chart.

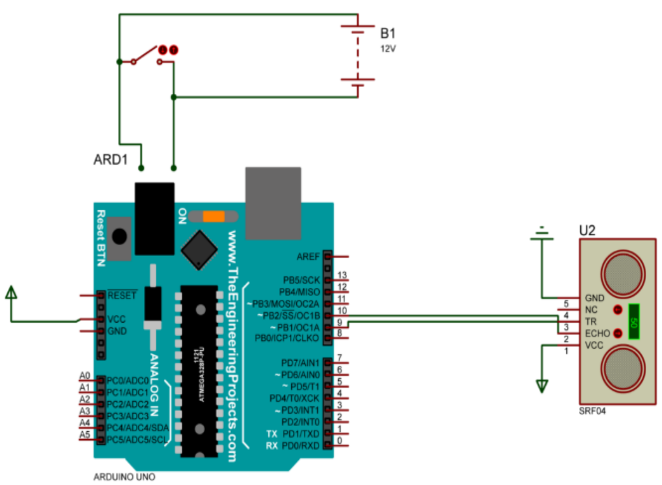

Figure 5. Sensor Ultrasonik (Source : Processed Data, 2023)

Figure 6. The Equipment (Source : Processed Data, 2023)

The process of measurement continues by sending high-level body data through an ultrasonic sensor. The function of an ultrasonic sensor is to transmit ultrasonic material to an object or user's body and then to detect the pantulan of that material in order to raise the level of a body. Finally, users can adjust body strength by entering body strength data through a load cell. The load cell will provide information about the preasure or weight that was detected by the sensor, and from there, the device can be used to lower the user's rate of negative behavior. The ideal weight scale tool will reduce body mass index (BMI) in accordance with the existing formula once high-level data and healthy weight have stabilized. The results of these measurements and calculations will then be compared to the monitoring chart that has already been made available on the website. The above table will provide details on the optimal body weight categories based on BMI, such as below normal, above lean, or above obese.

Individuals can assess if their body weight is within the healthy optimum range by using the information provided by this tool, or whether it is not. This encourages people to understand their health conditions better and, if necessary, to find the resources they need to reach or beyond their ideal body weight. This Ideal Weight Scales tool provides a practical solution to accurately and easily measure and evaluate a person's body health. It does this by combining the use of an ultrasonic sensor and a load cell.

The optimal body weight scale indicates whether a person has the ideal body weight or not [3]. This device includes an ultrasonic sensor for measuring the density of the body and a load cell for measuring its density. You can access the Hi function to understand the function of the device by operating it. The Functions of Ideal Weight and Height Measurement with Led Output monitoring table are as follows.

The following is a table II of measurement results and comparisons made with analog scales, where from the design results the tool can show BMI values and body condition information according to the measurement resultsran

TABLE 1 FUNCTION OF MONITORING

No.	Function Monitoring	Efective	
		Yes	No
1.	On the on press tool, type the on button.	√	
2.	When the tool is turned on, the display will show the identity of the tool	√	
3.	When the tool is loaded, the tool starts weighing.	√	
4.	When the tool starts calculating, BMI (measurement result) is displayed.	√	
5.	When finished weighing, the tool display will be set to "Scales ideal weight and height".	√	

(Source : Processed Data, 2023)

p-ISSN : 2301-8402, e-ISSN : 2685-368X , available at : https://ejournal.unsrat.ac.id/index.php/elekdankom

TABLE II RESULT OF MEASUREMENT

No.	Input	Measurement Result
1	Measurements of height and weight, BMI, and explanation of measurement results are ideal	  Figure 7. Result of Measurement
2	Comparation between digital and analog	  Fiugre 8. Comparation Result

(Source : Processed Data, 2023)

Following the results of the experiment, several people were measured and the results of the measurements were observed; The following are the results of measurements that have been carried out.

TABLE III ANALYSIS OF DATA

No.	Respond	Measure Height (m)	Measure Weight (kg)	BMI	Description
1.	001	168	58.7	20.80	Ideal
		168	58.5	20.72	Ideal
		168	59.0	20.89	Ideal
2.	002	154	58,9	24.82	Fat
	003	156	65.1	26.48	Fat
	004	159	65.3	25.56	Fat
3.	005	166	52.80	18.0	Thin
	006	166	52.32	17.0	Thin
	007	170	52.56	18.0	Thin

(Source : Processed Data, 2023)

Furthermore, an assessment of the accuracy of the measurement results is carried out; The following are the results of the measurements carried out,

Accuracy Analysis:

$$\% \text{ Error} = \frac{\%Error\ BMI1 + \%Error\ BMI2 + \%Error\ BMI3}{3} \quad (1)$$

$$\% \text{ Error BMI 1} = \frac{20.80+20.72+20.89}{3} = 20.80$$

$$= \frac{20.80}{20} X100\% = 1.04\%$$

$$\% \text{ Error BMI 2} = \frac{24.82+26.48+25.56}{3} = 25.62$$

$$= \frac{25.62}{25.1} X100\% = 1.02\%$$

$$\% \text{ Error BMI 3} = \frac{18.0+17.0+18.0}{3} = 17.77$$

$$\% \text{ Accuary Value} = \frac{1.04+1.02+1.07}{3} = 1.04\%$$

= 100% - 1.04%

% Accuary Value **= 98.96 %**

IV. CONCLUSION

The key finding from this study is that an Arduino-based scale body and height controller was successfully created. This device uses components such as an Arduino Uno as a microcontroller, an HC-SR04 sensor to measure the height and weight, a load cell sensor to measure the weight, and an LCD 2x16 to display the height and weight results. The prototype for the device in question was developed by using namesakes for a few people, and the measurements and weight have since run smoothly according to expectations. Based on the facts and calculations made using the BMI equation, there is an average inaccuracy of about 1.04%. This indicates that the tool has an approximate 98.96% accuracy level. As a result, the scales in question can be used safely and provide results that are accurate when it comes to reducing body weight and individual body levels. This development may involve adding features in the form of wireless connectivity for data transmission and analysis, enabling remote monitoring and tracking of body weight.

V. REFERENCES

[1] J. C. S. Tommy LS Visscher, "The Public Health Impact of Obesity," *Arjournals*, p. 22:355–75, 2001.

[2] M. A. B. P. N. L. Y. L. Q. C. Q. L. X. X. Irakoze Laurent, "The use of Broca index to assess cut- off points for overweight in adults: A short review," *Springer*, 2020.

[3] M. L. K. S. S. L. E. B. Yaguang Zheng, "Self-Weighing in Weight Management: A Systematic Literature Review," *Obesity*, vol. Volume 23, pp. 256-265, 2015.

[4] T. N. R. William H. Dietz, "Use of the body mass index (BMI) as a measure of overweight in children and adolescents," *The Journal of Pediatrics*, vol. 132, no. 2, pp. 191-193, 1998.

[5] D. P. B. D. Kunal D. Gaikwad, "Design And Development Of Novel Weighing Scale System," *IJERT*, vol. 2, no. 5, 2013.

[6] A. Adisry, Asuhan Gizi Nutritional Care Proscess, Yogyakarta: Graha Ilmu, 2012.

[7] A. K. Rhajiv Nur Ilham, "Pemetaan Faktor Determinan Perilaku Masturbasi Berlebihan pada Individu Dewasa Awal," *Buletin Riset Psikologi dan Kesehatan Mental*, 2021.

[8] C. T. Yuansheng Huang, "Research on Risk Assessment in Engineering Project based on Route Analysis and Hierarchical Variable Weight Fuzzy Evaluation," *The 2008 International Conference on Risk Management & Engineering Management*, 2008.

[9] e. a. Wing, "a Study on the Effect of Scaling Functions to Feature Weighting Performance," *Proceedings of the 2011 International Conference on Machine Learning and Cybernetics*,, 2011.

[10] B. R. M. N. Anju Latha, "Arduino based Weighting Scale using Load Cell," *IJSRST*, 2017.

[11] A. D. A. Yohanes Dhimas Sigit Budoyo, "The Digital Weight Scale of IoT System Using Load Cell Sensor in UD. Pangkuti Tani".

[12] A. D. Etsov, "Arduino - Based System for Measuring Weight and Quantity of Items (Digital Scale)," *28th Internasional Sciencetific Symposium Metrology and Metrology Assurance* , 2018.

[13] L. N. V. A. George Awad*, "Body weight, image and self-esteem evaluation questionnaire : development and validation of a new scale," *Elsevier*, 2004.

[14] A. H. Z. A. M. B. Ery Muthoriq, "The Effect of Object Position on Reading Error on Weighing Scale," *IEEE*, 2018.

[15] D. H. O. I. B. A. Tunji John Erinle, "Parametric Design of Height and Weight Measuring System," *IJIREEICE*, vol. 8, no. 7, 2022.

[16] Y. C. Chang Sheng, "Circuit Design of Electronic Weighing System," *201O 2nd International Conference on Industrial and Information Systems* , pp. 185 - 187, 2010.

[17] A. L. a. L.-F. C. Yeong-Kang Lai, "Fast and High-Accuracy Design and Implementation for Home Electronic Weighing Scale Applications," *IEEE*, pp. 269 - 270, 2005.

[18] R. P. B. N. J. Patil, "Tuning of Fuzzy Controller using Set Point Weighing PID Parameters," *International Conference on Pervasive Computing (ICPC)*, 2015.

[19] K. O. A. P. T. K. P. P. D. B. J. W. Adam Bujnowski, "Smart weighing scale with feet-sampled ECG," *IEEE*, pp. 3286 - 3291, 2008.

[20] C. F. I. H. Cristian Zet, "A magnetic amorphous wire based weighing scale," *IEEE*, 2017.

[21] "Research on Software Automatic Simulation Testing System of Electronic Scale," *2nd International Conference on Information Science and Control Engineering*, pp. 893 - 895, 2015.

[22] A. H. Z. A. M. B. Ery Muthoriq, "The Effect of Object Position on Reading Error on Weighing Scale," *IEEE*, 2018.

[23] T. A. Rahmalisa Suhartina, "Pulse Oximeter Monitoring Bracelet for COVID-19 Patient Using Seeeduino," *Jurnal Ilmiah Teknik Elektro Komputer dan Informatika (JITEKI)*, vol. 7, pp. 81-87, 2021.

[24] D. I. Z. R. S. A. P. M. Nanda Ferdana, "UVC Sterilization Robot with Remote Wireless Mode and Autonomous," *Sanitas*, vol. 13, pp. 68 - 80, 2022.

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