Digital Scales Based on Arduino Uno for Parents and Children via android and PC applications

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Abstract. Stunting is a problem that we all face towards the golden generation of 2045. Stunting is a serious condition in children which is characterized by the child's height being below average or the child being very short and his body not growing and developing properly. The problem of stunting is an important issue in the world of child health which is still a great concern, especially for children in underdeveloped and developing countries. Stunting is characterized by a child's height below average or the child is very short and his body does not grow and develop properly. According to the Indonesian Ministry of Health, one way to prevent stunting is to continue to monitor the growth and development of children, especially in terms of height and weight. The obstacle that occurs in measuring children's weight using digital scales is that children, especially babies, often cry and keep moving so the scale becomes inaccurate. Based on these problems, the solution taken is to design a weighing device that can be used to weigh mothers and children simultaneously. Scales for mother and child together are needed to provide safety and comfort for children. Safety and comfort are basic priorities for designing weighing systems. The system is equipped with a mobile phone and PC interface. This tool makes it easier for mothers and nurses and can display the results of weight measurements properly so that they can be used to monitor children's weight development. The results of the study of this system indicate that the product system is an appropriate scale, safe, comfortable and easy to use.

Keywords: Digital Scales; Arduino Uno; Android applications; PC Aplications

1   Introduction

Children at the age of five years have a process of growth and development that is very fast. At this time, toddlers generally have a high variety of physical activities so they need nutrition. Currently, one of the most common nutritional problems is stunting. Stunting is when a child fails to grow to the minimum height appropriate for his age [1]. Stunting is something that needs attention from all parties considering the various

impacts it has [2]. Stunting carries a risk of hindering physical growth, children are also vulnerable to various kinds of diseases and allows for cognitive development barriers to occur which will affect the level of intelligence and productivity of children in the future. The Ministry of Health's Basic Health Research (Riskesdas) in 2018 found that 30.8% of Indonesian children were still stunted. [3]. Fig. 1 shows that there are 2 provinces with stunting rates above 40%.
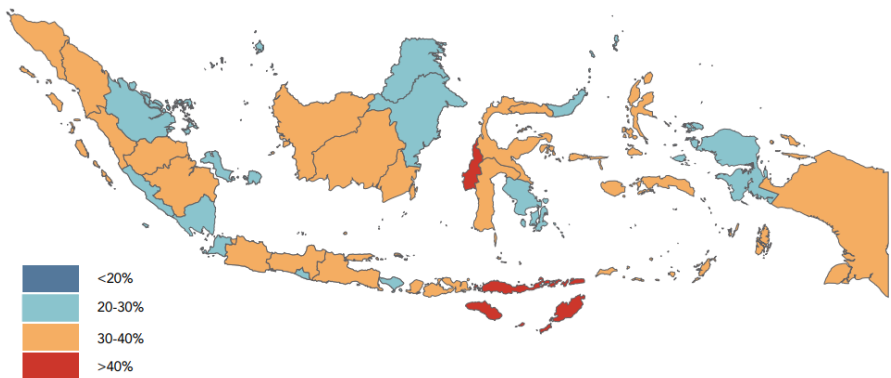
Fig. 1. Geographic distribution of stunting prevalence by province

For this reason, in the context of preventing and treating stunting, the government is committed to achieving a 14% reduction in stunting by 2024 [4]. Various efforts must be made to prevent stunting, including meeting nutritional needs from the time of pregnancy, exclusive breastfeeding until the baby is 6 months old, giving healthy complementary foods, always monitoring the growth and development of children and always maintaining cleanliness [5]. The Ministry of Health utilizes Posyandu in all corners of Indonesia to monitor children's height as an effort to detect stunting [6]. The process of monitoring the growth and development of children is usually carried out every month by measuring the child's height and weight. Measuring a child's current weight usually uses a child's digital scale. The obstacle that often occurs is that children, especially toddlers, will feel uncomfortable, cry and keep moving, causing the scales to be inaccurate. With these problems, the researchers developed a digital scale system and prioritized safety and comfort as basic priorities. The system created is controlled by the Arduino Uno microcontroller and is equipped with mobile and PC interfaces.

2 Method

The research method used is research and development (R&D). According to [7] states that R&D is a series of processes carried out in order to develop new products or improve existing products so that these products can be accounted for. In this study the R&D model was chosen because it fits the pattern of the research being carried out,

namely by developing an existing weighing algorithm into a digital maternal and child scales. The research flow used in building this system as a whole is to use the waterfall model and is shown in Fig. 2.
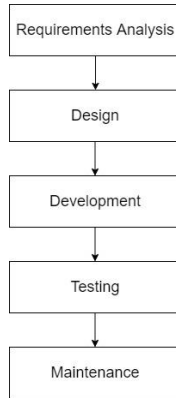

Fig. 2. Watterfall Method

In the watterfall method the approach is carried out in a systematic way, starting from the system requirements stage then moving on to the analysis, design, coding,testing/verification, and repair/maintenance [8].

2.1   Requirements Analysis

At this stage, data was collected from several health centers in Surakarta and the data collection process carried out is shown in Fig. 3. Some of the information obtained from this process is that early detection needs to be reported immediately to take action to prevent stunting. The data reporting process is currently still done manually, so it takes a relatively long time to reach the center. For the process of weighing children, scales are required according to the standards of the Ministry of Health.

Fig. 3. Data collection process

2.2   Design

Information regarding requirements specifications from the requirements analysis stage is then analyzed and implemented in the development design. At this stage the design process is carried out to help provide a complete description of the hardware and software that will be made. The 2D drawing design sketch in Fig. 4 is used as a basis for the process of making a product.
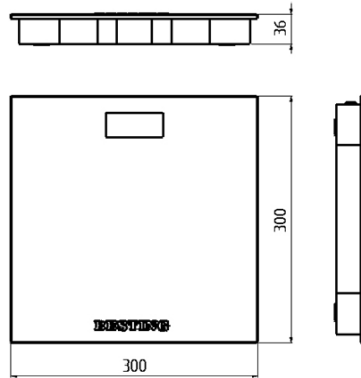

Fig. 4. Design 2D

Product design specifications are length x w x h (300 x 300 x 36 mm). Next, Fig. 5 shows the wiring drawings and interface design on the digital scales that are made.
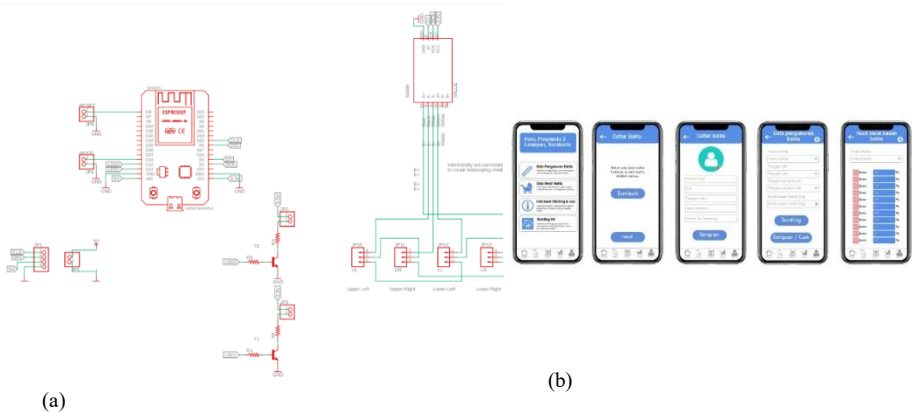

(a)

(b)

Fig. 5. (a) Electrical circuit; (b) Interface design

2.3   Development

This stage is the manufacture of software and hardware. In this phase, testing and initial inspection of the functionality of the modules that have been made are also carried out and the overall integration process is also carried out.

2.4   Testing

During the test phase, the overall system is inspected and tested to identify possible system failures and errors. To find out how much the deviation value occurs, the results of the system testing process are compared with the measurement results from digital scales on the market.

2.5   Maintenance

In the final stage, the finished software and hardware are operated by the user and carried out maintenance. The maintenance carried out allows for a process of repair of errors that were not detected in the previous stages. Maintenance includes error correction, system unit repair, and system adjustment to suit needs.

3   Result and Discussion

In this study, trials were carried out on several loads. The measurement results are compared with the measurement results from digital scales on the market with the 180 KG Electronic Scale Taffware Dipounds type - SH-Y01-U1. From several trials conducted, the maximum deviation that occurred in the mother's weight was 0,01 % and the largest deviation in measuring the child's weight was 0,44 %. The value of the measurement results is in accordance with Table 1.

Table 1.   Comparison of test results

No	Besting		Digital Scale SH-Y01-U1	
	Mother	Child	Mother	Child
1	91,16	4,11	91,15	4,1
2	91,16	4,76	91,15	4,75
3	91,15	7,66	91,15	7,65
4	91,16	5,26	91,15	5,25
5	91,16	2,51	91,15	2,50
6	98,96	4,21	98,95	4,20
7	98,96	4,81	98,95	4,80
8	98,96	7,66	98,95	7,65
9	98,96	5,31	98,95	5,30
10	98,96	2,51	98,95	2,50
11	77,81	4,21	77,80	4,20
12	77,81	4,86	77,80	4,85
13	77,81	7,66	77,80	7,65
14	77,81	5,32	77,80	5,30

No	Besting		Digital Scale SH-Y01-U1	
	Mother	Child	Mother	Child
15	77,80	2,51	77,80	2,50
16	67,96	4,11	67,95	4,1
17	67,95	4,76	67,95	4,75
18	67,95	7,67	67,95	7,65
19	67,96	5,26	67,95	5,25
20	67,95	2,51	67,95	2,50
21	72,81	4,11	72,80	4,10
22	72,80	4,81	72,80	4,80
23	72,80	7,56	72,80	7,55
24	72,81	5,26	72,80	5,25
25	72,81	2,51	72,80	2,50
26	93,20	4,11	93,20	4,10
27	93,21	4,76	93,20	4,75
28	93,20	7,66	93,20	7,65
29	93,20	5,26	93,20	5,25
30	93,21	2,51	93,20	2,50

From Table 1 it can be mapped the data on the mother's weight and child's weight from the test results compared to the test results on other digital scales. The mapping results are shown in the Fig. 6.
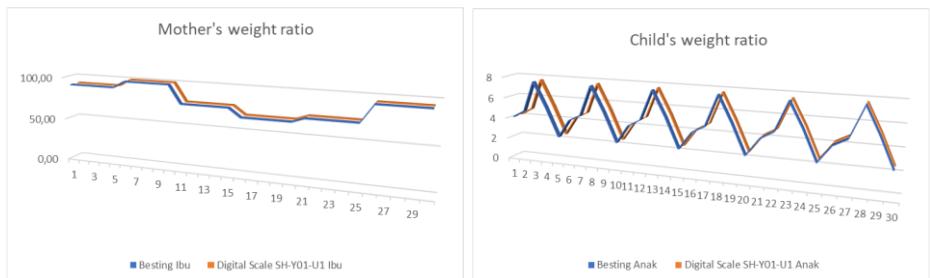
Fig. 6. (a) Mother's weight Ratio; (b) Child's weight Ratio

The results of weighing adults using the besting digital scales have a difference of 0.01 kg with other digital scales. The results of weighing children using besting digital scales have a difference of 0.015 kg with other digital scales.

4   Conclusion

The results of the study show that the product system is a precision scale, safe, comfortable and easy to use.

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