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Baby Weight And Length Based On Arduino Uno With Combination Of Ultrasonic Sensor Hc-Sr04 And Weight Sensor (Load Cell)

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Abstract- Infant development and growth at the age of 0 to 1 year. Babies are easily affected by malnutrition or, if parents ignore the development and growth of the baby. Generally, parents will take their babies to Posyandu or Midwives to have their weight weighed and the length of the baby's body measured. At the time of measuring the baby's body weight and length still using separate and manual measurements. Therefore we need a weighing device that is able to measure the baby's weight and baby's length simultaneously. Then an "Arduino Uno-Based Baby Weight and Length Weighing Device was made by Combining the HC-SR04 Ultrasonic Sensor and the Weight Sensor (Load Cell)" to simplify the process of measuring the baby's weight and length simultaneously and recording the results of these measurements. The benefit of making this tool is that it helps parents to know the growth and development of their babies aged 0 to 1 year. And the purpose of making this tool is to measure the baby's weight and length simultaneously, which in general the process of measuring the baby's weight and length is still not automatic, and still uses analog or digital scales but there is no tool that can measure automatically and simultaneously in the process of measuring the baby's weight and length. From here we submit a research proposal in which the results of this research proposal are expected to contribute well as a first step in our research so that in the process of designing the tool it can work well and be useful for parents and medical personnel.

Keywords—Baby Weight Scales, Baby Body Length Measurement, Arduino Uno, Ultrasonic Sensor HC-SR04, Load Cell.

I. INTRODUCTION (*HEADING 1*)

Babies' nutrition and their parents' caregiving styles have a big impact on their growth and development. Adequate nourishment, customized to the infant's requirements, guarantees sound growth and maturation. On the other hand, food that is either too little or too much might harm a baby's development. In order to check their development, parents are vital in keeping an eye on their child's growth and frequently take them to medical facilities like Posyandu, Puskesmas, or midwife clinics.

At the moment, weighing and measuring a baby's length separately using various instruments is the only way to track their progress. This can be time-consuming and complicated. Even if it works, the conventional approach takes longer and is less effective since it cannot measure length and weight at the same time. Given this difficulty, a more simplified strategy is required to enable frequent and precise tracking of growth.

In order to remedy this, the author suggests creating an integrated baby weighing gadget that can measure an infant's length and weight at the same time if they are between the ages of 0 and 1. With the help of this cutting-edge tool, parents and healthcare professionals should find the measurement process easier and more simple. It improves the effectiveness of growth tracking by integrating both features into a single gadget, guaranteeing that infants obtain precise and timely evaluations of their development.

II. METHODS

This research method describes in the form of Block Diagrams, Flowcharts, Wiring Schematic Circuits, Arduino IDE Coding, Tool Designs.

A. Block Diagram

The block diagram of the design of the baby weighing device is by combining the Ultrasonic Sensor and Load Cell as input or input to the weighing device, then processed using Arduino UNO and LCD as output.

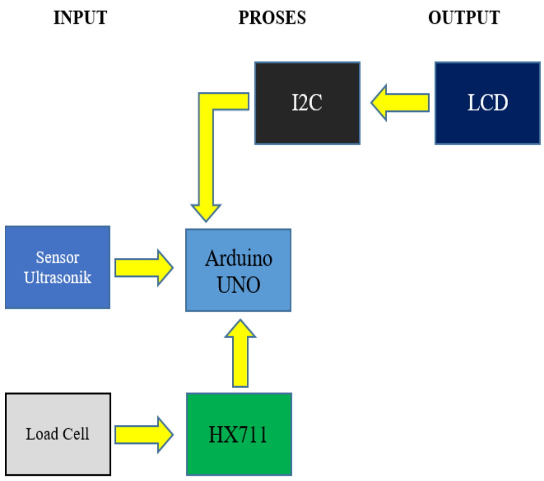

Figure 3.1.1 Block Diagram

The proposed baby weighing device incorporates several key components to accurately measure both the length and weight of a baby. The system utilizes an ultrasonic sensor to measure the baby's length. This sensor works by emitting ultrasonic waves and calculating the time it takes for the waves to bounce back after hitting the baby's body, thus

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determining the length. Additionally, a load cell is employed to measure the baby's weight. The load cell is a type of transducer that converts the baby's weight into an electrical signal, which can then be measured and processed.

The core of the system is the Arduino Uno, a microcontroller that processes the data collected from both the ultrasonic sensor and the load cell. The Arduino Uno takes the raw measurement data from the sensors and computes the final values. The load cell requires an amplifier to enhance its output signal for accurate measurement, which is accomplished by the HX711 module. This module amplifies the signal from the load cell, making it readable by the Arduino. To streamline the connection of components and facilitate communication with the display, an I2C interface is used. This interface simplifies the wiring by reducing the number of pins needed to connect the LCD to the Arduino, thereby consolidating the connections.

The final processed measurements are displayed on an LCD (Liquid Crystal Display). The LCD presents the baby's length in centimeters (cm) and weight in grams (g) or kilograms (kg). This clear, numerical display allows parents and healthcare providers to easily read and record the baby's growth metrics, ensuring precise and convenient monitoring of the baby's development.

B. Flowchart

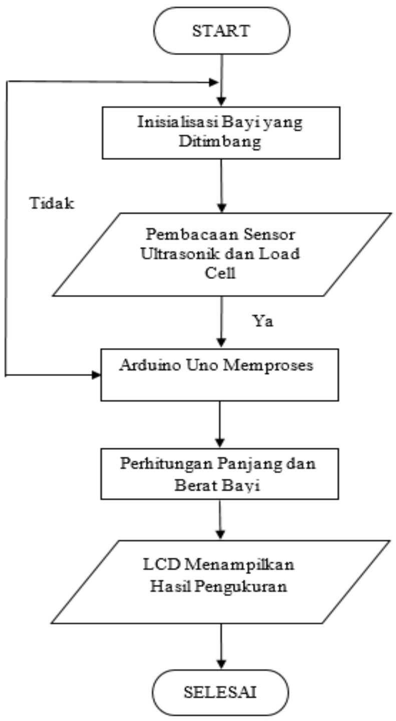

Figure 3.1.2 Flowchart

Upon powering on the baby weighing device, it automatically enters a state of readiness to commence operations. Subsequently, when a baby is positioned on the weighing mat, both the Ultrasonic Sensor and Load Cell activate to precisely measure the baby's length and weight, respectively. These sensors provide input to the Arduino Uno, which processes the data obtained from both the Ultrasonic Sensor and Load Cell. Following this, the Arduino Uno performs calculations based on the sensor inputs and transmits the computed measurement results to the LCD display. Through the LCD, the output measurements of the baby's length and weight are conveniently presented for observation.

Once the baby is lifted from the scales, indicating the end of the measurement process, the weighing device returns to its initial position, ready for subsequent use. This cyclical operation ensures seamless functionality and ease of use, facilitating efficient monitoring of a baby's growth metrics.

C. Circuit Wiring Schematic

Wiring Weighing Equipment Body length and weight of this baby is a picture of the whole series of components on the tool.

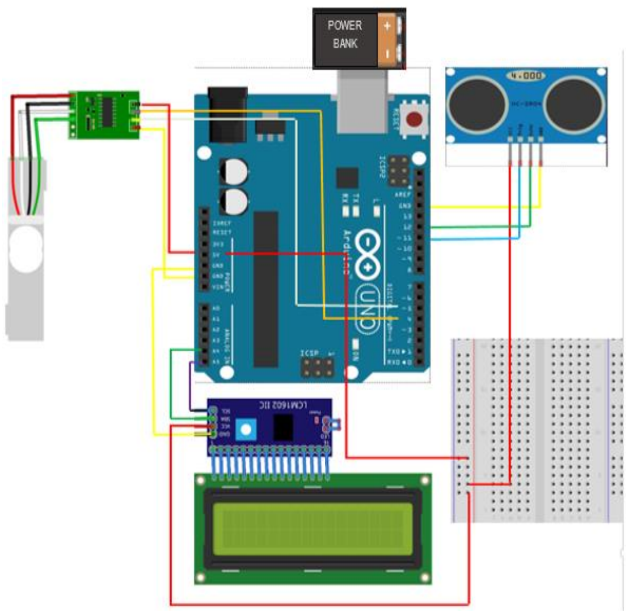

Figure 3.1.3 Circuit Wiring Schematic

The power bank serves as the primary voltage supply for the Arduino Uno, ensuring uninterrupted operation of the baby weighing device. The power is distributed through the breadboard, functioning as a 5V voltage terminal connector, which then provides power to components requiring a 5V supply. The Ultrasonic sensor serves as an input device, directly connected to the Arduino Uno, facilitating the measurement of the baby's length. Similarly, the Load cell, coupled with the HX711 amplifier, measures the baby's weight and transmits the amplified signal to the Arduino Uno for processing.

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Subsequently, the Arduino Uno undertakes calculations based on inputs from both the Ultrasonic sensor and the Load cell. The processed data is then routed through the I2C interface, enabling seamless communication with the LCD display. Through this interface, the calculated results are displayed on the LCD screen, providing users with clear and accurate measurements of the baby's length and weight in a user-friendly format.

Table 3.1 Description of Wiring Relationships on Components

COMPONENTS	CABLE
LOAD CELL + HX711	RED : E + BLACK : E - WHITE : A- GREEN : A+
HX711 + ARDUINO UNO	GND : GND DT : PIN 4 SCK : PIN 5 VCC : 5V
SENSOR ULTRSONIK + ARDUINO UNO	GND : GND VCC : 5V ECHO : PIN 12 TRIG : PIN 11
I2C/LCD + ARDUINO UNO	GND : GND VCC : 5V SDA : PIN A4 SCL : PIN A5

D. Coding Arduino IDE

Arduino IDE coding functions to facilitate or simplify programming that you want to do as needed and to connect components that have been designed or programmed so that the components can work as desired.

```
if(berat>=1000)
{
lcd.clear();
lcd.setCursor(0,0);
lcd.print("Panjang =");
lcd.setCursor(10,0);
lcd.print(tinggi);
lcd.print(" ");
lcd.print("Cm");
lcd.print("   ");
float hasil=berat/1000;
lcd.setCursor(0, 1);
lcd.print("Berat = ");
lcd.print(hasil);
lcd.print(" Kg");
}
scale.power_down();
delay(10000);
scale.power_up();

long duration, gape;
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);
  duration = pulseIn(echoPin, HIGH);
  gape = (duration/2) / 29.1;
  tinggi = jarak - gape;
```

```
#include <LiquidCrystal_I2C.h>
#include "HX711.h"
#include <Wire.h>

#define trigPin 11
#define echoPin 12

const int LOADCELL_DOUT_PIN = 4;
const int LOADCELL_SCK_PIN = 5;

LiquidCrystal_I2C lcd(0x27 ,16,2);
HX711 scale;

int jarak = 54;
int tinggi;

void setup() {
  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);
  Serial.begin(9600);
  lcd.init();                    // initialize the lcd
  // Print a message to the LCD.
  lcd.backlight();
  lcd.setCursor(1,0);
    lcd.print("TIMBANGAN BAYI");
    delay (2000);
    lcd.setCursor(0,1);
    lcd.print("PANJANG & BERAT");
    delay(2000);
```

Figure 3.1.4 A Coding Arduino IDE

Figure 3.1.4 B Coding Arduino IDE

p-ISSN 2715-2871
e-ISSN 2714-5247

```
    scale.begin(LOADCELL_DOUT_PIN, LOADCELL_SCK_PIN);
  scale.set_scale(440.0);                    // this
  scale.tare(50);                  // reset the scale to

}
void loop() {

    Serial.print("Berat");
  float berat= scale.get_units(25);
  if(berat<=0.1)
  {
    berat=0.0;
  }
  Serial.println(berat,1);
  if(berat<1000)
  {
  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("Panjang =");
  lcd.setCursor(10,0);
  lcd.print(tinggi);
  lcd.print(" ");
  lcd.print("Cm");
  lcd.print("    ");
  lcd.setCursor(0, 1);
  lcd.print("Berat = ");
  lcd.print(berat,1);
  lcd.print(" Gr");
  }
```

Figure 3.1.4 C Coding Arduino IDE

Arduino IDE Coding Description:

1. Include: include components to identify supporting components such as HX711 and I2C.
2. Define : make a fixed variable on the Ultrasonic Sensor component between the Echo and Trig connected to Arduino pins 11 and 12.
3. Const int : so that the variable does not change or is consistent in the load cell connected to the HX711 with DT and SCK inputs to Arduino Uno pins 4 and 5.
4. LiquitCrystal: LCD introduction with type 16 x 2 with I2C.
5. Int: the number of measurement distances measured by the Ultrasonic Sensor with a maximum capacity of 54 Cm if it is close to the Ultrasonic Sensor. And shows 0 cm If there is no mass blocking the Ultrasonic Sensor.
6. Void setup: declares variables that are input or output that is started using libraries.
7. Void Loop: repeat the program that has been made.
8. Lcd print: to display the writing of characters or output results that are displayed on the LCD.
9. Setcursor: the layout of the letters or numbers printed between the rows and columns on the LCD.
10. Delay : show time or delay in milliseconds.
11. If : suppose that if the measurement is less than 1000 grams, it will be converted into grams, if more than 1000 grams, it will be used as kilograms.

E. Tool Design

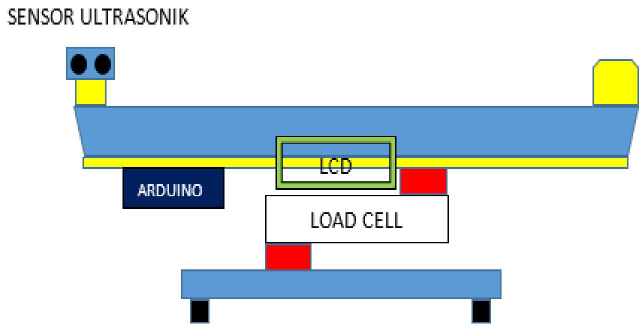

Figure 3.1.5 Tool Design

Tool Design Description:

1. Using acrylic base material that is cut using a saw or cutting blade.
2. Drill 4 holes in the acrylic with a drill for the M6 bolt locking place to the load cell and 4 more for the rubber base so it doesn't slip.
3. Assemble the cut acrylic components and glue them using aquarium glue or Sealine glue.
4. After drying, install important components such as Ultrasonic Sensors, Load Cells, Arduino Uno, and other components that have been programmed.
5. Assemble the wiring components and the baby scale is ready to use.

Product Test

The stages of tool testing are as follows:

3.2.1 Ultrasonic Sensor Test

Ultrasonic sensors work based on the ability of the barrier to reflect back the ultrasonic waves sent. The sensor does not output a value because it does not get a wave value. And there will be a value displayed on the LCD when the sensor gets the wave value.

3.2.2 Load Cell Sensor Test

The Load Cell sensor works when the sensor gets pressure and is processed by the HX711 which functions as receiving input data from the load cell which is then sent to Arduino for

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reprocessing and displayed to the LCD when the Load Cell

sensor is working.

3.2.3 Overall Tool Test

a. When the weighing device is turned on and ready to work, the indicator on the LCD screen shows the condition of the number 0 kg in the baby's weight measurement and 0 cm in the baby's body length.
b. And when the baby is placed on the weighing board, the ultrasonic sensor and load cell automatically work.
c. The load cell sensor gets pressure and is processed from the HX711 amplifier then processed with Arduino and the results of the baby's weight measurement are displayed by the LCD with units < 1 kg.
d. Likewise, the ultrasonic sensor will work when it gets a wave value from the tip of the baby's head that blocks the ultrasonic sensor. then processed with Arduino and then displayed the measurement results by the LCD with units < 1 cm.
e. And when the weighing time, the LCD will show the size of the baby's weight and body length, and when the baby is lifted, the LCD will show the original numbers as in the initial state.

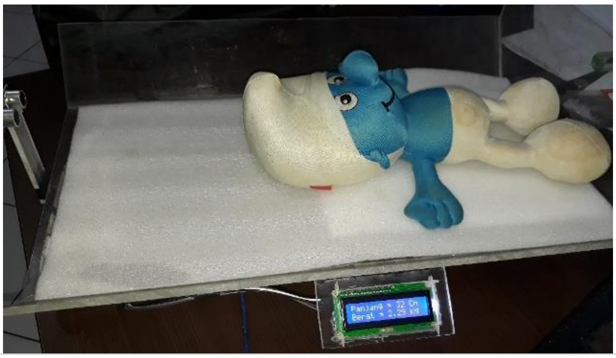
III. Results and Discussion

Product Results and Evaluation

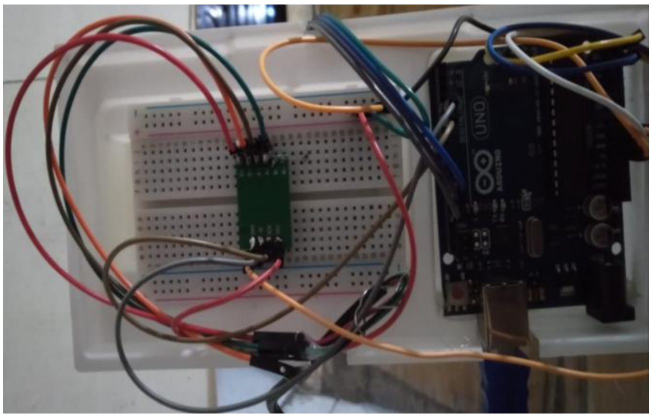
Results and Product Evaluation aim to assess the functionality and effectiveness of the tested tool, determining its capability to perform as intended and identifying any potential shortcomings or errors. Through rigorous testing and analysis, the tool's performance is evaluated to ascertain whether it meets the specified requirements and functions optimally. Any identified issues or deficiencies are addressed and corrected to ensure that the tool operates efficiently and reliably, ultimately fulfilling its intended purpose effectively.

4.1.1 Product Results

Arduino Uno-Based Baby Weight and Length Weighing Device is a useful tool for medical personnel or the general



public. With a combination of two sensors, namely



Ultrasonic Sensors and Load Cells that function to measure the baby's length and weight simultaneously.

There are component parts in the Baby's Weight and Body Length Weighing Device whose parts are visible from the outside and inside there is a box where several components are assembled.

Figure 4.1.1 A Overall Toolkit

Components visible from the outside:
1. 16×2 . LCD
2. Ultrasonic Sensor HC-SR04
3. Load Cell
4. Arduino USB Cable

Figure 4.1.1 B Contents in the Component Box

Components in the component box:
1. Arduino Uno
2. HX711
3. Jumper Cable

Figure 4.1.1 C I2C Rear LCD

LCD rear components:
1. I2C
2. Jumper Cable Connection

4.1.2 Product Evaluation

In this tool there is an evaluation or development of the product contained in the Load Cell, which must be calibrated first so that the baby being weighed can be measured with good accuracy. The problem with the Load Cell is that when it's finished weighing the Weight indicator on the LCD it will slowly turn down.

4.2 Data Presentation

From the results of the presentation of research data on the Baby Weight and Body Length Weighing Device before applying it to infants, the author conducted several testers first using the doll media as follows:

4.2.1 Testing on Load Cell

The first test with Baby Doll media with an original weight of 2.30 Kg and the LCD shows a weight of 2.29 Kg, a difference of 0.01 Kg, it can be said that the load cell sensor works with an accuracy of 99.96% or very well.

Figure 4.2.1 Load Cell Testing on Baby Dolls

Table 4.2.1 Load Cell Test Results with Inanimate Media

No	Name Media	Weight Original	Weight Test	Error	Type
1.	Baby Doll	2.30 kg	2.29 kg	0,4%	Very Good
2.	Teddy Bear	1.00 kg	982.7 gram	1,8%	Very Good
3.	Panda Doll	500.0 gram	498.9 gram	0,22 %	Very Good
4.	Dora Doll	1.60 kg	1.60 kg	0%	Very Good
5.	Minions Doll	250.0 gram	249.2 gram	0,3%	Very Good

4.2.2 Testing on Ultrasonic Sensor HC–SR04

The second test is with the Baby Doll media with a length of 27 cm and when testing the Ultrasonic Sensor, the LCD shows the length of the size of the baby doll according to the actual length, which is 27 cm, there is no difference. So, it can be said that the Ultrasonic Sensor works very well.

Figure 4.2.2 Ultrasonic Sensor Testing on Baby Dolls

Table 4.2.2 Ultrasonic Sensor Test Results with Inanimate Objects

No	Name Media	Original Length	Testing Length	Error	Type
1.	Baby Doll	27 cm	27 cm	0%	Very Good
2.	Teddy Bear	35 cm	35 cm	0%	Very Good
3.	Panda Doll	32 cm	32 cm	0%	Very Good
4.	Dora Doll	28 cm	28 cm	0%	Very Good
5.	Minions Doll	10 cm	9.9 cm	1%	Very Good

IV. CONCLUSION

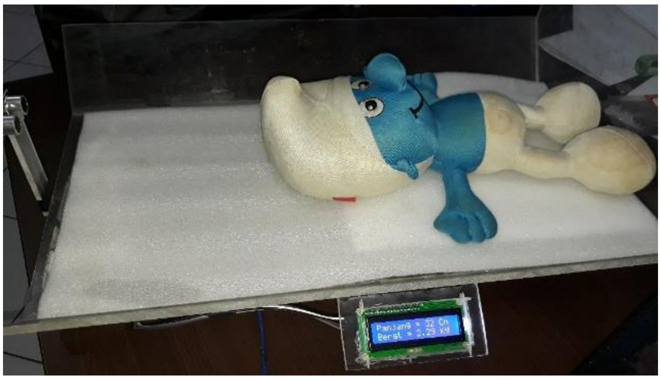
Based on the measurement results, the authors conclude that

1. The Arduino Uno-Based Baby Weight and Length Weighing Device by Combining the HC-SR04 Ultrasonic Sensor and the Weight Sensor (Load Cell) which is made according to a calibrated measuring instrument.
2. With the display output on the LCD, it will provide convenience for users, especially medical workers.
3. Measurement errors for the baby's weight and length caused by the baby being actively moving so that it is less accurate in reading the measurement results.
4. The percentage of average accuracy in measuring the length of the baby's body is 99.95% and the percentage of average accuracy in measuring the baby's weight is 98.02% with a very good level of accuracy.

Acknowledgment

In making the Arduino Uno-Based Baby Weight and Body Length Weighing Device by Combining the HC-SR04 Ultrasonic Sensor and the Weight Sensor (Load Cell) there are still many shortcomings, the authors provide suggestions to readers, namely:

1. It is recommended that this tool add a sound sensor output so that it can make it easier for users of the tool for people with special needs.
2. So that the baby does not move when it is measured and weighed, it is best if the base of the scales is added to a special belt or baby belt so that the accuracy of the measurement can be more accurate.
3. And add a baby nutrition calculation system based on Body Mass Index (BMI) so that users can find out if their baby is undernourished, thin, ideal, or obese.



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