

Department of Electronic & Telecommunication Engineering University of Moratuwa



BM 1190 - Engineering Design Project

Project Report

Team Leptons

Anthropometric Measuring Device

Submitted by:

Risini Kumarasinghe	210321X
Nadun Rajapaksha	210504L
Chathura Weerasinghe	210687X
Isiri Withanawasam	210732H

Abstract

The ultrasonic height measuring device is a portable and independent device designed to measure patients' heights accurately in clinics. The device aims to address the labour expense and cumbersome nature of conventional height measurement techniques. Implementation of an ultrasonic sensor, programming of a microcontroller, implementation of a circuit with a designed PCB, and enclosure design comprised the four major phases of project development. The device measures the height of patients using ultrasonic waves and displays the results on an LCD screen. The enclosure was created with portability in mind and was optimised to safeguard the device's sensitive components during transport. Technically, the project is feasible, and performance goals have been met. The device is anticipated to be utilised in clinics and medical facilities, where it may reduce labour costs and enhance the patient experience.

Content

1 Introduction.....	4
1.1 Problem Description.....	4
1.2 Validation of the problem.....	4
1.3 The device.....	4
2 Technical Feasibility.....	6
3 Product Architecture.....	7
4 Design.....	8
4.1 User Interface (UI) and User Experience (UX).....	8
4.2 Enclosure Design.....	8
4.2.1 Initial Sketch.....	8
4.2.2 Final Sketch.....	8
4.3 PCB Design.....	10
4.3.1 Schematic Design.....	10
4.3.2 CAD Design.....	10
4.3.1 The PCB.....	10
5 Marketing.....	11
5.1 Marketing Opportunities and marketing segments.....	11
5.2 Future improvements.....	11
5.3 Marketing.....	11
5.4 Sales Strategy.....	11
5.5 Services that we aim to provide in the sale.....	11
5.6 After-sales services.....	12
6 Technical Specifications.....	13
6.1 Height Measuring Device.....	13
6.1 Wireless Display.....	13
7 Bill of Quantities.....	13
8 Acknowledgement.....	14

1 Introduction

Measuring human height accurately is important in many fields, including healthcare, sports, and research. Moreover, height measurement is an important metric for paediatric patients and their parents because height changes so rapidly during childhood and can indicate health concerns if it deviates from growth curves. The goal of this project was to create a digital version of the traditional physical height-measurement device (also known as stadiometers) currently in use in hospital clinics. This device would be more portable while maintaining the accuracy and speed of current devices.

1.1 Problem Description

Traditional methods of measuring height, such as using a measuring tape or stadiometer, require the assistance of a second person, which can be time-consuming and inconvenient. These methods have limitations that can lead to inaccurate measurements and inconvenience for both the person being measured and the person performing the measurement. Additionally, some individuals may experience discomfort or self-consciousness when being measured by another individual, which can lead to inaccurate measurements.

Furthermore, clinics require a dependable and precise method for measuring patient height. This is essential for a number of reasons, including monitoring the growth of children, tracking changes in adult height, and calculating the body mass index (BMI). Traditional height measurement methods, such as stadiometers, are typically immobile and require additional personnel to assist with the measurement process. Not only does this increase the labour costs associated with height measurement, but it also makes the process more cumbersome for both the clinic staff and the patients.

There is a need for a portable and independent height-measuring device that can provide accurate and reliable

height measurements in clinical settings in order to address these issues. This device would reduce the labour costs associated with height measurement, eliminate the need for additional personnel to assist with the measurement process, and allow patients to

independently measure their height, thereby reducing the burden on clinic staff.

1.2 Validation of the problem

As part of our investigation into the difficulties healthcare providers face when measuring the height of their patients, we contacted healthcare professionals to gain insight into the issues they faced. The difficulty in accurately and independently measuring height, especially for patients with mobility issues or disabilities, was a problem that was frequently cited by these professionals. In addition, traditional height measurement methods, such as stadiometers, frequently require additional personnel to assist in the measurement process, which increases labor costs and makes the process cumbersome for both staff and patients.

We believe that our device will be particularly useful for clinics and hospitals that serve patients with mobility issues or disabilities, based on the feedback of healthcare professionals. In addition to reducing labor costs associated with height measurement, the device will free up personnel to focus on other crucial tasks. Our ultrasonic height-measuring device has the potential to significantly enhance the precision, efficiency, and cost-effectiveness of height measurement in healthcare settings.

1.3 The device

Our electronic height-measuring device is a portable user-friendly device that allows patients to measure height accurately and independently. The device is simple to use and requires minimal training or assistance. The device precisely measures the distance between the patient's head and the floor, which is then converted into an accurate height measurement. Our electronic height measurement device

eliminates the need for additional personnel, enabling healthcare providers to allocate their resources more effectively. Its small size and portability make it suitable for use in a variety of healthcare settings, including clinics, hospitals, and nursing homes. The device is also adaptable and can be used for a variety of purposes, such as routine height measurements and monitoring children's growth.

2 Technical Feasibility

The device's primary purpose is to measure heights using a height sensor, send the data into the wireless display and display the measured height

- A distance sensor measures the distance between two objects, in this case, the patient's head's top and the ground.
- NRF modules to transmit and receive data
- Buttons to initiate measurements
- A LCD screen: presenting the data to the nurses, such as printing the findings of the height data on a screen for them to read

3 Product Architecture

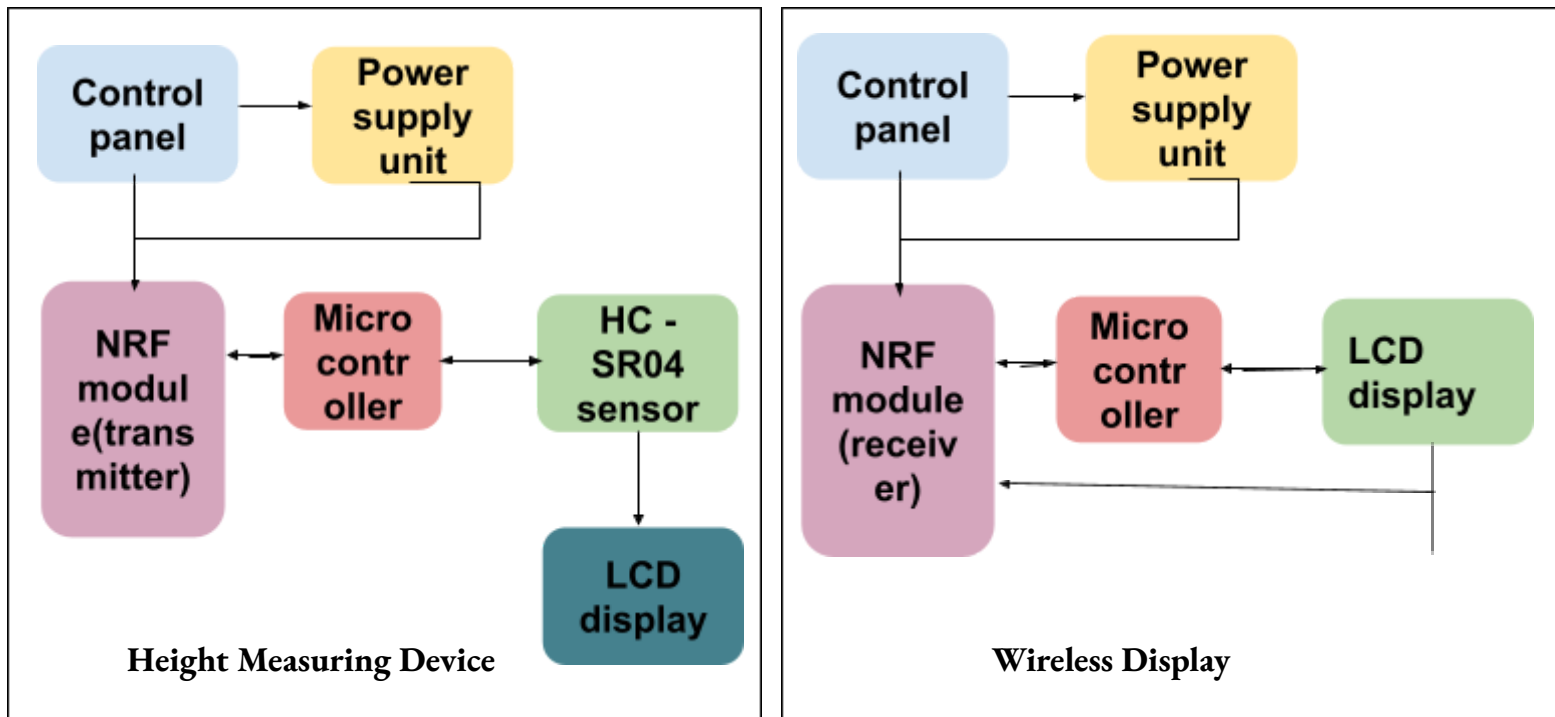


Figure 2:Product Architecture

3.1 Control Panel: The device's control panel includes two buttons: one for each part of the device; Height measuring device and wireless display.

3.2 Power Supply Unit: The device is powered by a 9V power supply that is required to operate the ultrasonic sensor, LED display, and microcontroller. The power supply is obtained by using two rechargeable 9V batteries one for height measuring device and the other one for wireless display

3.3 Display: The device's display is a 16x2 LCD display that displays the measured height in the selected unit.

3.4 HC - SR04 Sensor: The device uses an HC - SR04 sensor to measure the height between the device and the floor.

3.6 Microcontroller Unit: The microcontroller unit controls all device functions, including height measurement and unit selection.

4 Design

4.1 User Interface (UI) and User Experience (UX)

The height measuring tool itself and a wireless display make up the new height measuring equipment. The wireless display helps to display the measured height, whereas the height measuring device's main purpose is to measure height accurately. The two components are made to function together effortlessly, delivering a user-friendly experience without the need for outside support.

The user-centric design of the height measuring tool puts an emphasis on use and convenience. It has a built-in buzzer that gives the person being measured audio instructions. This enables users to take accurate measurements while positioning themselves correctly without constantly needing to look at the screen.

The device's user interface (UI), which just has a power button, is simple and intuitive. As a result, there is no complexity in terms of UI. Our system is set up to show both feet and centimetres of measured height.

By serving as a remote viewing screen, the wireless display enables users to read their measured height from a distance. Users no longer have to stoop or crane their neck to read the measurement from the height measuring gadget directly. A smooth experience is provided by the wireless communication between the two components, which guarantees real-time changes on the display as soon as the height is measured.

In conclusion, the new wireless height measurement equipment is intended to be user-friendly, precise, and practical. Height measurements are simple and effective without the need for outside assistance thanks

to the integrated buzzer and wireless connection, which also improve the entire user experience.

4.2 Enclosure Design

4.2.1 Initial Sketch

4.2.1.1 Hand-drawn sketch

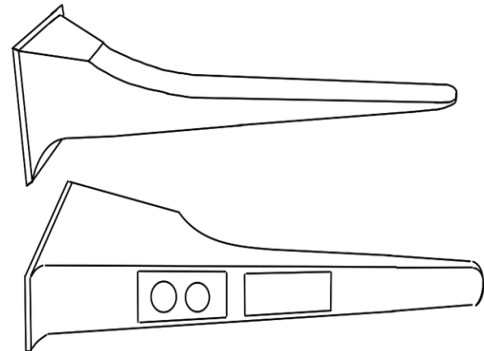


Figure 2: Initial Sketch

In our initial sketch, we decided to redesign the device as a single unit that can maintain perpendicularity to the wall on its own. We also took into consideration the

device's portability, and we were able to reduce its length by finding a more efficient way to use the device.

making it impractical to carry around and limiting its portability.

4.2.2 Final Sketch

Taking the above observations into consideration, we started a redesign process that led to the creation of a new and improved device that is made up of two components but performs as a single, portable unit. We cleverly designed the two components to fit within one another, creating a unified and user-friendly device, in order to address the challenges of portability and ease of use.

The height measuring device, which has the required sensors and display to precisely measure and display the height, is the initial component. The wireless display

height, is the initial component. The wireless display, which is the second component, acts as a viewing screen for the height measurement. The height measuring device can be combined with the wireless display to create a single, small device when not in use.

The capacity to maintain perpendicularity to the wall is maintained by the new design without the need for any additional parts or complicated configuration. Users only need to set the tool against the wall, and thanks to its ingenious internal processes, measurements are exact and precise without the need for user participation.

We put user experience and convenience first throughout the redesign process, creating a height measuring tool that is not only precise but also simple to use and carry. The device's operation has been made simpler by the combination of the two components into a single component, making it an easy-to-use instrument for quickly measuring height.

4.2.2.1 Hand-drawn sketch

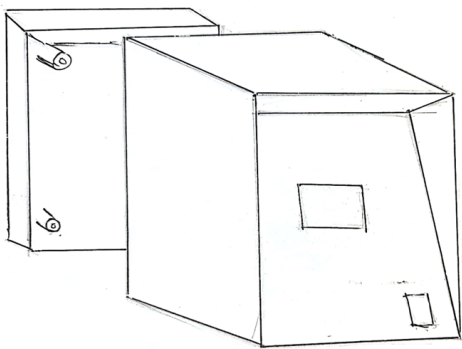


Figure 3:Wireless Display

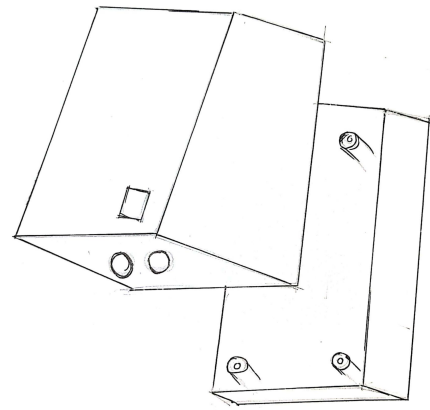


Figure 4:Height measuring device

4.2.2.1 CAD design

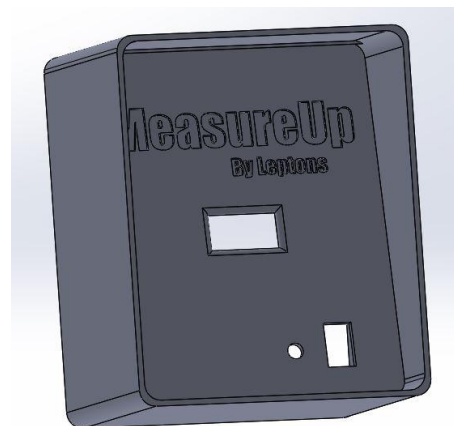


Figure 5:Wireless Display



Figure 6:Height measuring device

4.3 PCB Design

4.3.1 Schematic Design

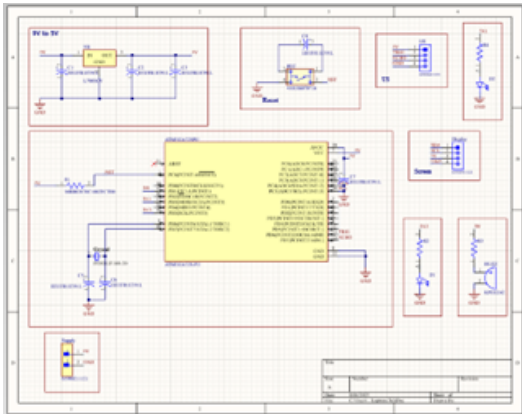


Figure 7:Schematic

4.3.2 CAD Design

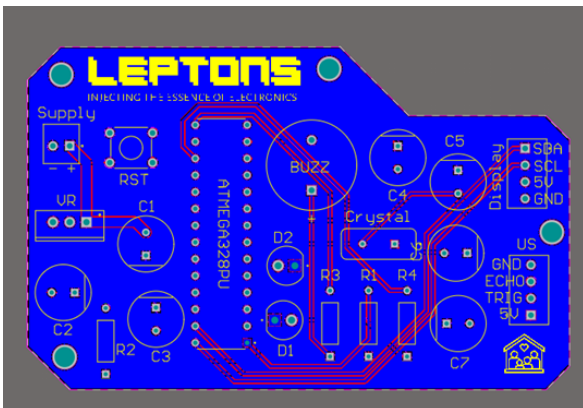


Figure 8:PCB

PCB design was done using Altium designer software using a reference design of an Arduino nano developn board.

We included the components that we needed in our de and excluded the extra ones when we designing the pcb.

Initially we designed our pcb where we could con bluetooth modules. Since we had the pairing issues we ha use NRF modules to fully automate our device.

The challenge we faced after deciding to use the NRF modules was there were not enough ports to connect the modules. Hence we used a dotboard to establish connections as we did not have enough time to print a new pcb.

4.3.1 The PCB



5 Marketing

5.1 Marketing Opportunities and marketing segments

- Our main marketing segment is medical clinics in both government and private hospitals, and medical centres. In medical clinics, the traditional way of measuring height is using a measuring tape or a stadiometer. Since it requires the assistance of a second person, it is time-consuming and inconvenient, and it is a waste of manpower. By using this product one can solve this since the product automatically displays the height of the patient.
- This product can be used domestically as well as in medical clinics. Height tracking is important in identifying certain disorders that affect growth and development, such as growth hormone deficiency or Turner syndrome. And BMI tracking is also important in identifying some diseases like diabetes B, coronary heart disease. Therefore, It is important to track anthropology measurements. By using this product someone can self-measure their height.

5.2 Future improvements

- With further improvements we are planning to develop a variant to measure any length, that can be used for various length-measuring purposes and an application where people can track their height as well as BMI.

5.3 Marketing

We are going to market our product by targeting the marketing opportunities that have been mentioned above. After the product is tested for functionality and durability, we aim

to get NMRA approval for our product. Thereafter,

we aim to market our product mainly targeting medical clinics both government and hospitals. And we have planned to introduce our product for domestic usage through pharmacies.

5.4 Sales Strategy

Our main marketing segment is the medical sector. Therefore, we are trying to partner up with potential medical sales representatives, and through them, we are going to introduce our product to medical clinics, pharmacies, etc. Also, we are going to market our product through social media. That way we are trying to market this device to domestic users.

5.5 Services that we aim to provide in the sale

- User manual – A user manual for the device will be given to the users to get a clear understanding of the product.
- Product packaging – The product will be packed into a cardboard box that will contain the device which will be packed in bubble wrap, a user manual, and a warranty card.

5.6 After-sales services

- Maintenance – The device must be kept in a dry place at room temperature.
- Repair - In any instance of malfunctioning, it will be repaired free of charge during the warranty period.
(Terms and conditions apply)

6 Technical Specifications

NRF modules	640
Total Cost	18990

6.1 Height Measuring Device

- Dimensions :110mmx55mmx90mm
- Weight : 200g
- Power consumption : <10W
- Tolerance : 5cm
- Accuracy : Estimated error <1%
- Lifetime : 5 years, 1 year warranty
- Water resistance : No

6.1 Wireless Display

- Dimensions : 115mmx95mmx72mm
- Weight : 200g
- Power consumption : <10W
- Tolerance: 5cm
- Accuracy : Estimated error <1%
- Lifetime : 5 years, 1 year warranty
- Water resistance : No

7 Bill of Quantities

Component	Price(Rs.)
ATmega	1400
OLED Display	900
3D Printed Enclosure	13000
PCB	2400
Ultrasonic sensor	300
Nuts and Bolts	100
Other Components	250

8 Acknowledgement

We are deeply grateful to our esteemed lecturers for their unwavering dedication, guidance, and expertise, which have provided us with the essential technical knowledge and design strategies necessary for the successful completion of this report. Additionally, we extend our heartfelt appreciation to the technical personnel for their invaluable support and assistance during the meticulous testing of our product in the laboratory. Their collective contributions have played a pivotal role in shaping our understanding and approach to the subject matter, and we acknowledge that our achievements are a testament to their selfless commitment to our academic growth. Their mentorship and encouragement have motivated us to strive for excellence, and we carry the lessons learned from them as we embark on future endeavors.

-END-