Microcontroller Based Automated Body Mass Index (BMI) Calculator with LCD Display

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Abstract—The aim of the project was to design a microcontroller based automated Body Mass Index (BMI) calculator with LCD display, which calculates the body mass index using the two basic parameters that are weight and height. The hardware of the project consists of a load cell or a weighing mechanism, which is used to calculate the body weight of a person, and a built in height calculating mechanism, which is used to calculate the height of a person. The weight of the person is calculated in Kilograms and the height in meters in accordance of the BMI standard formula [3]. The microcontroller based automated Body Mass Index calculator is a useful device when it comes to controlling your weight and maintaining a healthy lifestyle. The calculated weight of the person through load cell, converts the mechanical force into electrical signals that can be easily obtain after processing through microcontroller. While the height of the person is calculated by the ultrasound sensor with built-in transmit and receive circuitry as when it transits the ultrasound signal by transmitter, it reflect back to the receiver after striking the object or person and height is then calculated by multiplying the speed of the ultrasound signal and the time taken by the it to return back to the sensor. All this data is manipulated through microcontroller and then the result is displayed on the LCD display.

Keywords—Component; Body Mass Index Calculator; Maintaining Healthy Life Style; Load Cell; Ultrasound Sensor.

I. INTRODUCTION

BODY Mass Index, can approximately calculates the total fat of the person present in the body. BMI is based on the two variables such as height and weight of the person. Even tough, the BMI does not give an exact measurement of total body fatness but according to many researches on BMI, one thing is clearly obtain that it is correlated with total body fat like other methods of body fat calculation, such as dual energy x-ray absorptiometry and underwater weighing techniques [1], [2]. BMI is a widely used method compared to obesity.

II. CONCEPT OF BMI

It is not a new concept to calculate BMI by using a formula, in 19th century; Quetelet Index of Obesity was introduced by a Belgian statistician named Adolph Quetelet. According to his index, BMI is calculated by dividing weight of a person in kilogram by square of their height in inches. Before 1980, physicians were generally using tables for weight and height estimations and they were different for men and women with incorporated ranges of body weights for height in inches. But these tables were imperfect as it relied on weight only, not on the body composition [5]. Currently there is so much advancement in the BMI calculation like the height and weight is calculated automatically with the help of formula and the data is then automatically fed in the computer which shows the BMI of the person on the monitor screen or on LCD display.

A. Aim of the Project

The aim of the project was to design a BMI unit which gives numeric value and this numeric value gives a percentage which correlates to the body fat composition. If the numeric value is less than 20, the person will consider as
underweight and person will be considered healthy if the value lies between 20 and 25. Above 25 is considered as overweight and above 35 is considered as Obese. In such case we require a precise instrument to calculate percent body fat like immersion tank. Two people having same weight might not float on the same level due to the difference in Body fat composition. BMI is useful tool for health related professional and investigators in some cases where risks of death are high for the overweight person, one extra pound can put a person on critical situation. People with coronary heart problems are one of them. Fat in our body increases which blocks the veins and arises different problems. The automatic or the electronic body mass calculator could be a useful tool to overcome the margin of errors.

III. DESIGN METHODOLOGY

The weight of the person is calculated through the load cell or a digital weighing machine. The height of the person is calculated by the ultrasound sensor. There is an ultrasounds sensor which both transmits and receives ultrasounds. First it emits ultrasounds, and when they strike any object or person in its proximity, they are reflected back after striking it, which is sensed by the sensor again. The height is actually calculated by multiplying the ‘speed of the ultrasounds’ and the ‘time taken by the ultrasounds’ to return back to the sensor. The data received from the Ultrasound Sensor and the Load Cell is then sent to the microcontroller, where calculations take place and then the result is sent to the display device.

A. Project Design

The design of our project is shown in figure 1 in the form of flow chart.

B. Main Features

Our BMI machine is a modern, elegant, and importantly an accurate electro medical device that will measure one’s height and weight in just a matter of a minute. Its main features are as, measuring of height and weight, Calculates body mass index, displays the output on the LCD screen, easy to operate with minimum user interactions, accurate results.

C. Applications in Biomedical Engineering

The automatic Body mass index calculator has many applications in the vast field of biomedical engineering. As we all know that the biomedical engineering is about the application of engineering in...
the field of medicine. The electronic BMI is such a device which is used in Hospitals, Clinics, and even Pharmacies. It can be placed at Gyms, Airports, Hotels, Bus Stands and other social places as well. Obesity as we all know is the leading cause of death nowadays, either directly or indirectly. And BMI is the most convenient and most efficient measure of obesity. Our particular project aims to provide a further convenient way to measure BMI as it removes the hassle of calculations. It can also be used for commercial purposes by installing a fool proof coin acceptor system.

D. Construction of the Project

The figure 2 and figure 3 shows the construction of our project in the form of block diagram and the circuit board of the BMI calculator unit respectively.

![Circuit View of BMI Calculator Controlling Unit](image)

IV. RESULTS

Body Mass Index is a name given to the ratio of one’s height and weight which represents the body fat percentage against the weight of organs, muscles or bone. Increasing BMI will indicate higher fat percentage in one’s body. The main objective of our project was to develop a machine that was capable of calculating a person’s height and weight automatically and computing the person’s BMI. Our Automatic BMI Calculator was planned as a modern, elegant, electronic and importantly “accurate” medical device that will measure one’s height and weight in just a matter of a minute.

V. DISCUSSION

The weight of the person is calculated through the load cell or a digital weighing machine. The height of the person is calculated by the ultrasound sensor; there is an ultrasounds sensor which both transmits and receives ultrasounds. It emits ultrasounds, and when they strike any object or person in its proximity, they are reflected back after striking it. The height is actually calculated by multiplying the speed of the ultrasounds and the time taken by the ultrasounds to return back to the sensor. The data received from the Ultrasound Sensor and the Load Cell is then sent to the microcontroller, where calculations take place and the result is sent to the display device. The Automatic Body Mass Index Calculator has many applications in the vast field of Bio-Medical engineering. As it is a well-known fact that the Bio-medical engineering is about the application of electronics into the field of medicine; the Automatic BMI Calculator is such a device which is used in Hospitals, Clinics and even Pharmacies. By adding a coin acceptor system, we can use BMI even for commercial purposes.

VI. CONCLUSION

We can conclude from our project study, how important BMI as a statistical tool is, to calculate the Health Risk of different diseases. The theoretical study, which we did in the start of our project, tells us the significance of BMI as a heath indicator. By designing the different aspects of our Automatic Body Mass Index Calculator, we discovered the application of the electronic principles that we learned in our course work. We also learned a great deal about application of Mechanical principles that are so vital to any type of engineering application. We readily improved our skills in Micro-controller, and ascertain the wide array of applications of Micro-Controller. By compiling this report, we learned the importance of preserving the information in black & white. It helped us throughout, in our different stages of project implementation, by being a constant guide in difficult times. Last but not the least, we discovered the importance of team work, and how straightforward the journeys becomes when people collaborate with each other, and help each other in difficult times.

REFERENCES