

BMI Based Diet Information System

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Abstract - The project aim is developing a BMI (Body Mass Index) calculator which plays a major role in alerting the risk of diseases due to overweight. The proposed system not only shows the calculated value. The proposed system is implemented through MATLAB and control through ATMAL (AT89S52). BMI is a ratio between weight and height. The project hardware consists a weighing mechanism and the height sensing mechanism in accordance of the BMI standard formula. All this data is interface through ATMAL (AT89S52). And the weight, height, & BMI are displayed on LCD display. All this data will compare with given standard BMI ranges, and then according to BMI range the result is displayed on computer through MATLAB software to the person about his BMI and his diet plan.

Key words: BMI, Weighing Machine, ATMAL (AT89S52), Diet.

I. INTRODUCTION

Body Mass Index (BMI) is based on the two variables such as height and weight of the person. Body Mass Index (BMI) is a person's weight in kilograms divided by the square of their height in meters. It is one of the most commonly used methods to estimate whether a person is overweight and hence more likely to experience health problems than someone with a healthy weight. It is also used to measure population prevalence of overweight and obesity. It is used because, for most people, it correlates reasonably well with their level of body fat. It is also a relatively easy, cheap and non-invasive method for establishing weight status. However, BMI is only a proxy for body fatness. Other factors such as fitness, ethnic origin and puberty can alter the relation between BMI and body fatness and must be taken into Consideration. Other measurements such as waist circumference and skin thickness can be collected to indicate a person's weight status or body fatness. None of these is as widely used as BMI. [4]

Several works are going on body mass index. Some of these are:

Now a day's weight and height measurement is one of the most important aspects in the recruitment process of defence and police departments. In both the departments, the height and weight is measured by conventional way which is very cumbersome and time consuming process. As an alternative to this problem. The paper provides an efficient solution in order to make the recruitment process fast and errorless. The webcam is used to capture the image of person. Whose height is to be measured to capture the image by using webcam image acquisition toolbox is used. After capturing the image of candidate, the processing is done on the image by using efficient digital image processing tool that comes with MATLAB. [1]

The microcontroller based automated Body Mass Index calculator is a very useful device when it comes to controlling weight of the person to maintaining a healthy life style. The calculated weight of the person by using load cell which converts the mechanical force into electrical signals. While the height of the person is calculated by the ultrasonic sensor with built-in transmit and receive circuitry. All this data is manipulated through microcontroller and then the result is displayed on the LCD display. [2]

The weight of the person is calculated through weighing machine. While the height of the person is calculated by the LDR, when dark light falls on it the resistance value decreases and we get high voltage at output. The result is displayed on the LCD display and a message is sent through GSM module to the person about his BMI and the suggestions related to it. [3]

II. BMI CONCEPT

A. Usage:

BMI is only an approximate to determining potential weight problems but it cannot be used as diagnostic tool. A person will be on a great risk if they have a high Body mass index. Through these measurements physician can advance different health risk related to weight. For example fitness of a person, nutritionist can decide the diet of a person, and other screening of person's health.

B. Calculation Of BMI:

The BMI can be calculated with the help of given standard formula. [5]

$$\text{BMI} = \frac{\text{Weight in Kilograms}}{\text{Height in Meters} \times \text{Height in Meters}}$$

C. Health Consequences Of Overweight And Obesity:

Overweight and obese category individuals are at increased risk for many diseases and health conditions, including the, high blood pressure, high Low-density lipoprotein cholesterol, low High-density lipoprotein cholesterol, diabetes, plaque in arteries of heart, heart Stroke and gallbladder infection, degenerative joint disease, respiratory problems, and breast cancer.

III. ALGORITHM

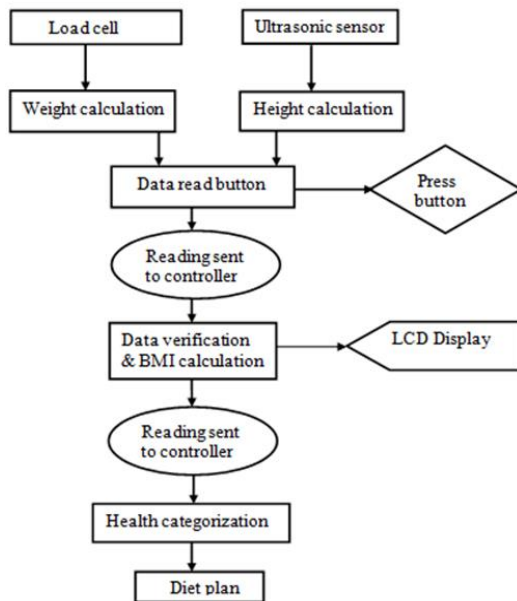


Fig. 1: Algorithm.

By using the load cell weight of person is calculated. The height of the person is calculated by the ultrasonic sensor. There is an ultrasonic sensor which both transmits and receives ultrasonic. First it emits ultrasonic, and when they strike any object or person in its presence, they are reflected back after striking it, which is sensed by that sensor again. The height is actually calculated by multiplying the 'speed of the ultrasonic' and the 'time taken by the ultrasonic sensor' to return back to the sensor. The data received from the Ultrasonic Sensor and the Load Cell is then sent to the microcontroller, where data take place and then the result is sent to the display device. That is the BMI of the person. Then this BMI is compared with standard range. Then according to BMI the diet plan will be display. [2]

IV. BLOCK DIAGRAM

The block diagram of the project is as shown in the figure.

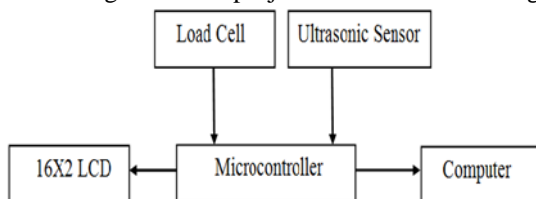


Fig. 2: Block Diagram of BMI Circuit.

The project consists following blocks, as shown in the block diagram.

- 1) Load cell
- 2) Ultrasonic sensor
- 3) Microcontroller
- 4) LCD display
- 5) Computer

A. Load Cell:

A load cell is a transducer that is used to create an electrical signal whose magnitude is directly proportional to the force being measured. The weight of the person calculated through load cell, converts the mechanical force into

electrical signals. Output of these given to microcontroller for further calculation. The system should be able to measure human weight in the range $0 < \text{weight} < 100$ (kg) [2].

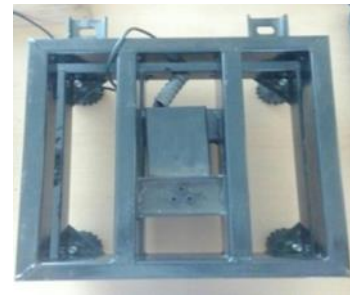


Fig. 3: Load cell.

B. Ultrasonic Sensor:

The modules includes ultrasonic transmitters, receiver and control circuit. In our project we using a ultrasonic sensor have ranging module is HC-SR04. The working voltage and current of this sensor DC 5V and 15 mA respectively. The working frequency is 40Hz and capable maximum range is 4m and minimum range is 2cm. [3]

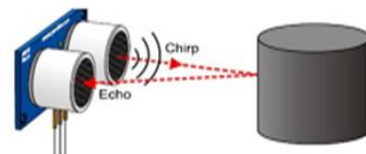


Fig. 4: Ultrasonic sensor.

V. CONSTRUCTION OF THE PROJECT.

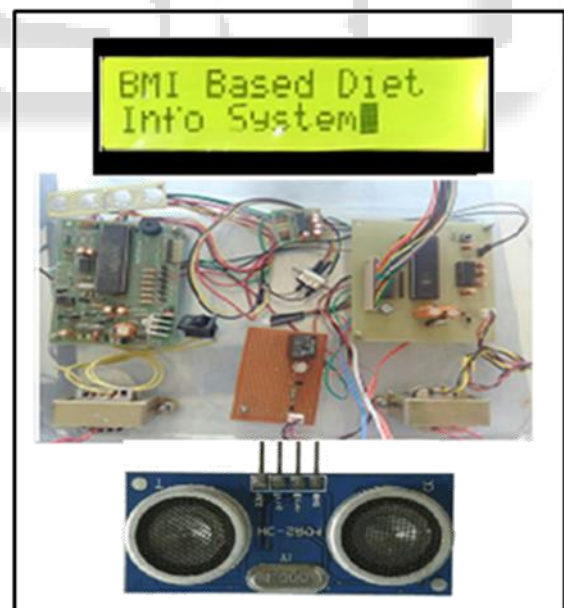


Fig. 6: BMI Calculator

VI. RESULT

The main objective of our project was to develop such a device that was capable of calculating a BMI & according to that BMI display the diet plan. There are making eight categories of the diet plan. Our Automatic BMI calculator was planned as a modern, elegant, electronic & importantly "accurate" medical device that also gives a useful & accurate diet plan. [6]

BMI RANGES

Sr. No	Category	BMI Range – Kg/M ²
1	Very Severely Underweight	Less Than 15
2	Severely Underweight	From 15 To 16
3	Underweight	From 16 To 18.5
4	Normal (Healthy Weight)	From 18.5 To 25
5	Overweight	From 25 To 30
6	Obese Class I	From 30 To 35
7	Obese Class II	From 35 To 40
8	Obese Class III	Above 40

Table 1: BMI Ranges

VII. DIET PLAN

A. Very Severely Under Weight:

BMI range (kg/m²): less than 15

VERY SEVERELY UNDER WEIGHT					
TIME	FOOD	CARBOHYDRATES (gm's)	PROTEINES (gm's)	FAT (gm's)	CALORIES
Early morning	1 apple	10	-	-	40
Break fast	1 plate pohe/upma/3idlies/2dosa's + 1cup tea	20+15	5+0	8+0	172+60=232
Mid morning	1 glass butter milk + 3 walnuts	10+0	0+7.5	0+3	40+19=59
Lunch	2chapati's +1 vati dal +1 vati bhaji +2 vati rice +1 tea spoon ghee	40+15+10+40+2	10+8+0+10+3	10+5+0+0+10	290+137+40+200+110=777
Evening tea	1 cup tea	15	-	-	60
Late Evening	1 besan ladu	50	5	5	265
Dinner	2chapati's +1 vati dal +1 vati bhaji +2 vati rice +1 tea spoon ghee	40+15+10+40+2	10+8+0+10+3	10+5+0+0+10	290+137+40+200+110=777
Bed time	1 glass milk + 2 tea spoon sugar	10+30	7+0	-	68+120=188
					TOTAL CALORIES = 2398

Fig. 7: Very severely under weight

B. Normal:

BMI range (kg/m²): From 18.5 to 25

NORMAL					
TIME	FOOD	CARBOHYDRATES (gm's)	PROTEINES (gm's)	FAT (gm's)	CALORIES
Early morning	1 fruit	Fructose category 10 Glucose category 20	-	-	Fructose category=40 Glucose category=80
Break fast	1 plate pohe/upma/3idlies/2dosa's + 1cup tea	20+15	5	8	172+60=232
Mid morning	1 glass butter milk	10	-	-	40
Lunch	2chapati's +1 vati dal +1 vati bhaji +1 vati rice +1 plate salad	40+15+10+20+20	10+8+0+5+3	10+5+0+0+0	290+137+40+100+0=567
Evening tea	1 cup tea	15	-	-	60
Late Evening	10 almonds	-	5	2	38
Dinner	2chapati's +1 vati dal +1 vati bhaji +1 vati rice +1 plate salad	40+15+10+20+20	10+8+0+5+3	10+5+0+0+0	290+137+40+100+0=567
Bed time	1 glass milk	10	7	-	68
					TOTAL CALORIES = 1612

Fig. 8: Normal

C. Overweight:

BMI range (kg/m²): From 25 to 30

OVERWEIGHT					
TIME	FOOD	CARBOHYDRATES (gm's)	PROTEINES (gm's)	FAT (gm's)	CALORIES
Early morning	1 fruit	Fructose category 10 Glucose category 20	-	-	Fructose category=40 Glucose category=80
Break fast	1 plate oats upma	10	5	-	40+20=60
Mid morning	1 glass butter milk	10	-	-	40
Lunch	2 fulka +1 vati dal +1 vati palebhaji +1 plate salad	40+15+10+0	10+8+0+0	0+5+0+0	100+137+40+5=282
Evening tea	1 cup green tea	-	-	-	10
Late Evening	1 rajgira ladu	10	-	-	40
Dinner	1 bowl boiled moong	50	10	5	285
Bed time	1 cup milk + ½ tea spoon sugar	3.5+7.5	2.5+0	-	24+30=54
					TOTAL CALORIES = 811

Fig. 9: Overweight

VIII. Features.

The advantages of the system are, it required less time to calculate the BMI. It can be used in rural areas for surveying. Also BMI is the most convenient and most efficient measure of obesity. Also it provides a further convenient way to measure BMI as it removes the hassle of calculations.

End users of the project are, the automatic BMI calculator has many applications in the vast field of the biomedical engineering. The electronic BMI such a device which is used in hospitals, clinic & even in rural areas. It can place at gyms, air ports, hotels, bus stand & other social places as well.

Future Plan of the project is The efficiency of the project can be increased by increasing number of height sensors. We can increase the number of height sensors for various heights. The weighing limitation can be increased in future. By using additional module the other parameters such as blood pressure can be measured.

IX. CONCLUSION

The project aims at developing a Body Mass Index calculator which plays a major role in alerting the risk of diseases due to overweight and obese. The proposed system not only shows the calculated value through monitor display but also, gives diet chart. The microcontroller based automated Body Mass Index calculator is a useful device when it comes to controlling your weight to maintain a healthy life style.

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