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BMI Machine for Visually and Audibly Impaired People Featuring IoT Technology

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Abstract: This paper depicts a new method of measuring Body Mass Index (BMI) data. Obesity nowadays is one of the most important health issues worldwide. Nowadays people are getting more attracted towards a comforting lifestyle which is leading them in reducing the physical activities that a human body is supposed to do to keep it fit and fine. A study was conducted to determine the prevalence of obesity among a group of people. A total of 550 people were selected for the study out of which 42% of people were obese and at a higher risk of getting very harmful diseases. Overweight and obesity were found higher in upper class and upper middle class people or with a sedentary working lifestyle. A BMI machine will help the people to constantly check the status of their health and work upon it to maintain a healthy life.

Keywords: Body Mass Index (BMI), Height, Weight, Load Cell, Ultrasonic Sensor, Internet of Things (IoT), Text To Speech (TTS)

I. INTRODUCTION

Height and Weight measurements are one of the most common and important aspects in medical fields or in the recruitment process of defence and police departments. In both the fields the measurement is done by the conventional way using tapes and analogue scales which are not precise and are time consuming process. As an alternative, this project provides an efficient, fast and errorless solution. Excess bodyweight contributes to the overall burden of disease in human body. At least 55% of adults and 10% of children are now overweight or obese, leading to decreased life expectancy due to many diseases [1].

The body mass index (BMI) can be derived from the weight and height of an individual i.e. body weight (in kilograms) divided by the square of the body height (in meters), expressed in units of kg/m^2 [2].

The BMI is determined by a table consisting of different BMI category ranges- underweight, normal, overweight, obese, extremely obese.

Table I: BMI Ranges

BMI Range	Category
<18.5	Underweight
18.5 – 24.9	Normal
25 – 29.9	Overweight
30 – 34.9	Obese
35<	Extremely Obese

II. BLOCK DIAGRAM and WORKING

This BMI machine has a very user friendly approach for a normal person as well as a physically challenged person. This BMI machine consists of human body load cell to measure weight and an ultrasonic sensor to measure height of the subject. Using these two physical parameters, BMI as well as the physical fitness of the subject can be easily determined. The machine will be equipped with some special features to help the challenged people, e.g. For audibly impaired subject, the machine will display its output on the liquid crystal display(LCD) and for the visually disabled subject the machine will give an audio output using a speaker. This machine consists of a PIR sensor which will detect human presence.

The BMI machine is constructed using the following blocks:

A. Input Blocks

- 1) **Ultrasonic Sensor:** Ultrasonic sensor works on a basic principle of emitting short & high-frequency sound pulses at regular time intervals which propagates in the air at the velocity of sound. The pulses are reflected back as echo signals to the sensor

when they strike an object. The sensor itself measures the distance to the target based on the time-span of transmitting the signal and receiving the echo [4]. Thus this principle of the sensor is used detect the subject's height.

- 2) **Load Cell:** A load cell is a sensor which simply converts force acting on it into an electronic signal. This electronic signal can be a voltage change or resistive change depending on the type of the load cell and circuitry used. We are using a resistive load cell in this case. When a load/force is applied to the sensor, it changes its resistance i.e. it works on the principle of piezo-resistivity. This change in resistance leads to a change in output voltage when an input voltage is applied [5].

B. Processing Block

In the processing block this machine will use the microcontroller which is the vital part of the machine. All the decisions are made by the microcontroller itself. Microcontroller receives and processes the input signal and based upon these signals the microcontroller produces output, thus decides the status of the output.

C. Output Blocks

- 1) **Liquid Crystal Display (LCD):** The purpose of LCD is to display the output status.
- 2) **Text To Speech (TTS) & Speaker:** The Text To Speech (TTS) module converts the text data into a series of frequencies which is used to drive the speaker. These frequencies are in the range of the audible frequency range of the human body which is from 20Hz to 20KHz. As a result, the measuring parameters i.e. height, weight and the BMI will also be converted into speech (for visually disabled person).

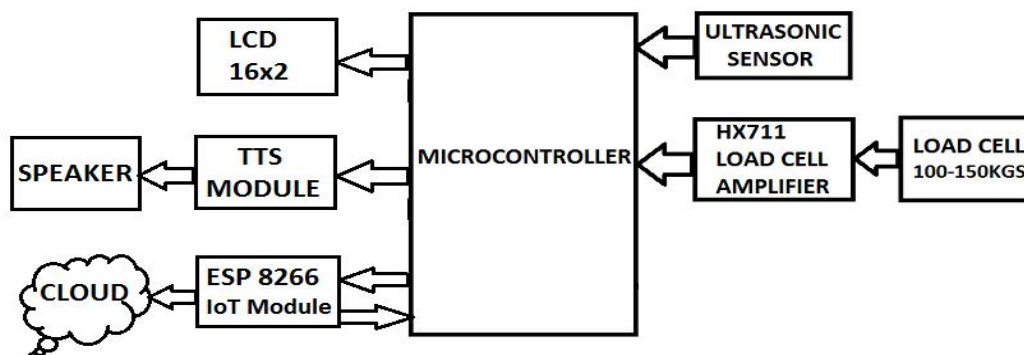


Fig. 1 Block Diagram for BMI Machine

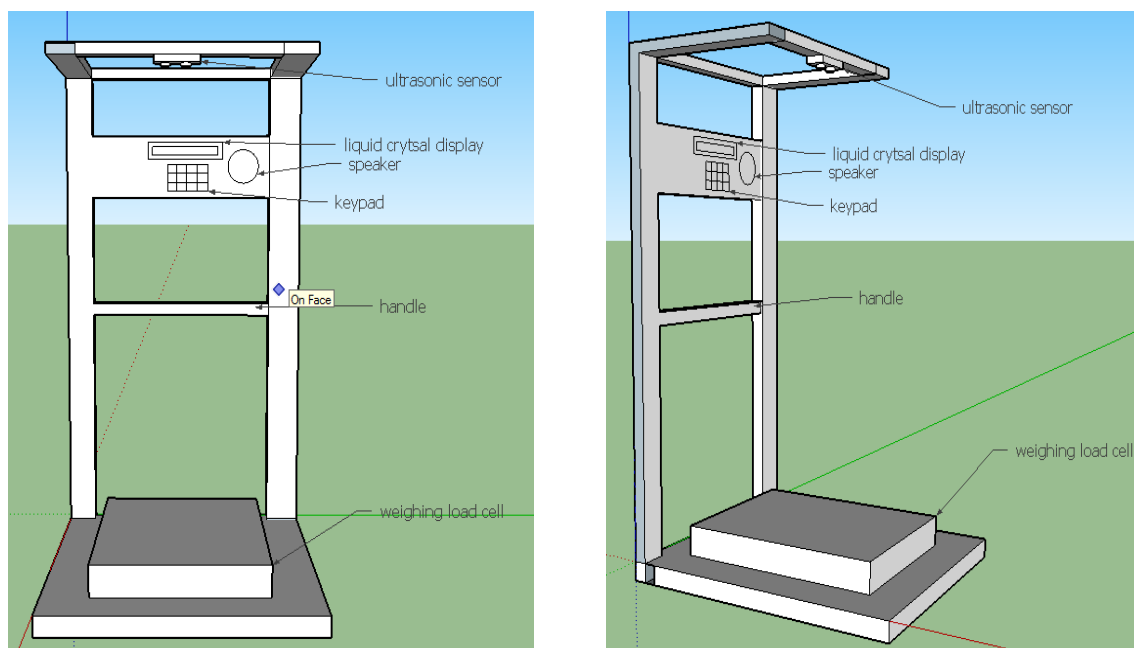
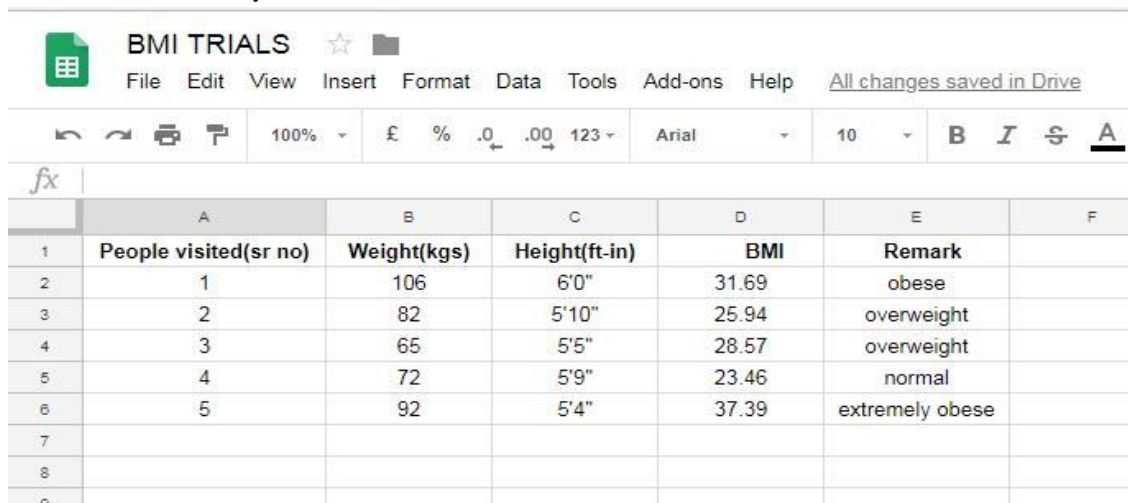


Fig. 2 Prototype Model of BMI Machine

III. RESULTS

The BMI of the subjects was precisely calculated and displayed by the machine, including the category of the BMI range. With the help of IoT (Internet of Things) the output data base is logged in the Google spreadsheet. This Google spreadsheet is directly linked with an app. This would help the app users to access and monitor their data respectively. Thus a data base is being maintained for the users, this may be used for further analysis.



	A	B	C	D	E	F
1	People visited(sr no)	Weight(kgs)	Height(ft-in)	BMI	Remark	
2	1	106	6'0"	31.69	obese	
3	2	82	5'10"	25.94	overweight	
4	3	65	5'5"	28.57	overweight	
5	4	72	5'9"	23.46	normal	
6	5	92	5'4"	37.39	extremely obese	
7						
8						
9						

Fig. 3 BMI datalog on Google spreadsheet

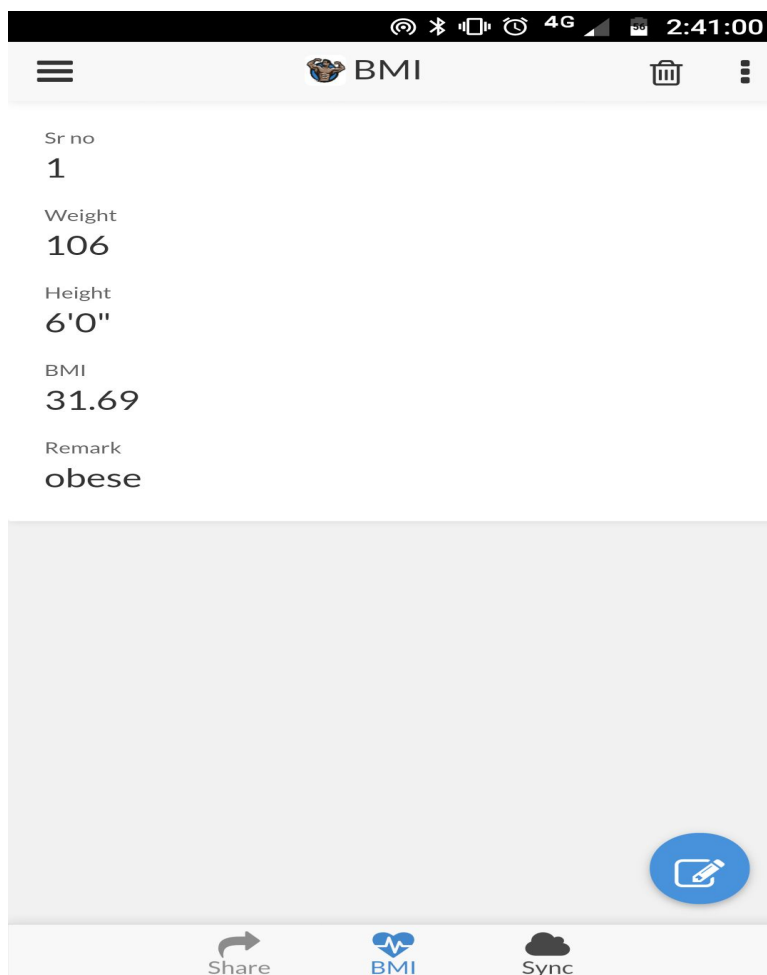


Fig. 4 App database of the subject



IV. CONCLUSIONS

The BMI machine trials were undertaken for the people falling under different BMI category ranges, successful results were found accordingly. The prevalence of overweight and obesity has increased substantially, developing countries like India face burden of malnutrition, underweight and obesity. Hence, effective preventive strategies such as high intake of dietary fibre, increased physical activity and school based nutrition education program should be encouraged and adopted to halt this epidemic [6].

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