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BMI CALCULATION AND HEALTH MONITORING SYSTEM WITH MULTILANGUAGE AUDIO FEEDBACK

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***Abstract*—** The issue of obesity has become a significant public health concern, and an automatic BMI machine for outdoor use with an inbuilt health monitoring system can be an effective solution. This project proposes a low-cost automatic BMI machine that can be installed at public places, designed using an Arduino Mega Microcontroller. The machine is activated by a coin sensor and provides an audio-based interactive service to the user. It calculates the BMI and measures health parameters such as temperature, Blood Pressure, Pulse Rate, and SPO2, displaying the results on a screen. A thermal printer is also interfaced to the system for printing the results after measurement. Such machines can be an easy-to-use, accessible tool for people to monitor their health and take necessary actions to prevent obesity-related complications.

I. INTRODUCTION

The body mass index (BMI) is a tool used to determine an individual's relative weight based on their height and mass. This calculation provides an estimate of the amount of body fat a person may have. It is widely used and considered an inexpensive and easy way to detect health risks related to obesity. The development of the Smart BMI machine is important since healthy living is essential for daily activities. The human health state is defined by physiological parameters, and BMI is an important one that can help people understand and take action to maintain a healthy weight. The ability to access BMI measurements in public places will eliminate the need for expensive medical equipment and materials, making healthcare more accessible to all health monitoring system is a system that monitors the health and well-being of an individual or a group of individuals. It typically involves the use of technology such as wearable devices, sensors to collect and analyze data about various health parameters such as pulse rate, blood pressure, temperature and SPO2.health monitoring systems can help individuals and healthcare professionals to proactively manage health and wellness, improve healthcare outcomes, and reduce healthcare costs.

II. METHODOLOGY

The working principle of the proposed low-cost automatic BMI machine is illustrated in Figure 1. This innovative smart BMI calculation machine is designed to measure weight and height accurately and efficiently. The weight measurement is accomplished using the half-bridge load-cell assembly via the load-cell amplifier module, while the height measurement is achieved using the HC-SR04 ultrasonic sensor module. These measurement modules are interfaced to the Arduino MEGA development board, where the BMI is computed automatically via a program embedded in the board. The half-bridge load-cells are arranged in a Wheatstone bridge circuit configuration format, which incorporates internally mounted SR-120 foil-type strain gauges for weight measurement. The load-cell HX711 amplifier module is used to amplify the millivolt (mV) from the half-bridge load-cell weighing system. The HC-SR04 ultrasonic sensor module serves as the primary sensor utilized in this study for measuring height. The coin acceptor module is interfaced to the Arduino and accepts coins to activate the machine. To make the machine interactive, an audio playback system is used, which includes an MP3 player module interfaced with the Arduino to play pre-recorded messages

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to guide the user of the machine to operate it. Additionally, a health monitoring system is implemented, which comprises a pulse rate sensor and pressure sensor to measure the pulse rate, SPO2, temperature, and pressure. These measurements are displayed on the LCD display interfaced to the system. Finally, a thermal printer module interfaced with the Arduino is used to print the report to the user once the measurement and predictions are complete.

In summary, this low-cost automatic BMI machine is a highly efficient and accurate system that incorporates advanced technology to provide users with a comprehensive health assessment. Its innovative design and user-friendly interface make it an ideal solution for healthcare providers, fitness centers, and individuals seeking to monitor their health and wellness.

In order to accurately determine a person's weight, a load cell or digital weighing machine is utilized. Additionally, the height of the individual is calculated through the use of an ultrasound sensor. This sensor emits ultrasounds which are then reflected back after striking an object or person in its proximity. By multiplying the speed of the ultrasounds and the time taken for them to return to the sensor, the height can be accurately calculated. The data collected from both the ultrasound sensor and load cell is then sent to a microcontroller where calculations are performed and the results are displayed.

To calculate the Body Mass Index (BMI), the standard formula is utilized: BMI = weight (in kg) / (height in meters)^2.

The health monitoring module incorporates a MAX30102 sensor which is interfaced with an Arduino board to measure pulse rate, SPO2, and body temperature. Additionally, a BP sensor is interfaced with the Arduino to read blood pressure. Audio feedback is achieved through the use of an Mp3 Player module which is interfaced with the serial port of the Arduino. Finally, the Thermal printer is utilized to print the final report.

By utilizing these advanced technologies, we are able to provide accurate and reliable health monitoring services to our clients.

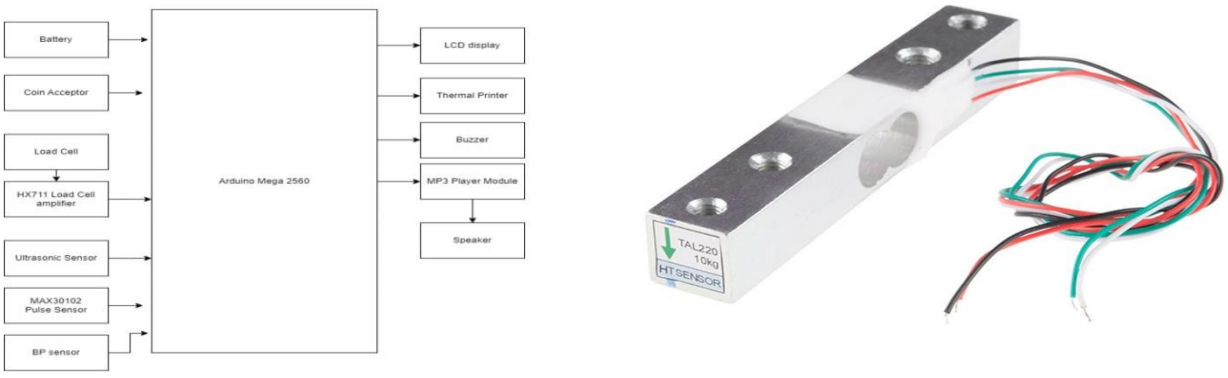

Fig.1 Block diagram of operation of SMART BMI MACHINE AND HEALTH MONITORING SYSTEM WITH MULTI LANGUAGES ADUIO FEEDBACK.

III. COMPONENTS

A. Arduino uno

- Microcontroller -ATmega2560
- Operating Voltage -5V
- Input Voltage (recommended)- 7 to 12V
- Input Voltage (limits) -6 to 20V
- Digital I/O Pins -54
- Analog Input Pins –16 pins

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- DC Current per I/O Pin- 20 mA
- DC Current for 3.3V Pin- 50 mA
- Flash Memory- 256 KB
- SRAM – 8 KB
- EEPROM - 4 KB
- Clock Speed - 16 MHz
- DC Current for 3.3V Pin- 50 mA
- Flash Memory- 256 KB
- SRAM – 8 KB
- EEPROM - 4 KB
- Clock Speed - 16 MHz

The Arduino Uno is a microcontroller board based on the ATmega2560 (datasheet). It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 16MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed tosupport the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Mega2560 boards is compatible with most shield designed for the UNO and the former board diecimila.

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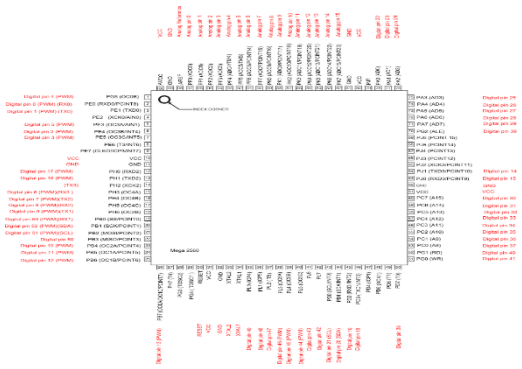

Fig. 2 Arduino uno

B. Load cell

This load cell serves the purpose of calculating an individual's weight through a microcontroller for monitoring. The straight bar load cell, also known as a strain gauge, has the capability of converting up to 80kg of pressure or force into an electrical signal. Each load cell can detect changes in electrical resistance that correspond to the strain, pressure, or force applied to the bar. This gauge provides the ability to accurately determine the weight of an object, track changes in weight over time, or detect the presence of an object by measuring the strain or load applied to a surface. It is worth noting that an 80kg load cell is utilized in this particular project.

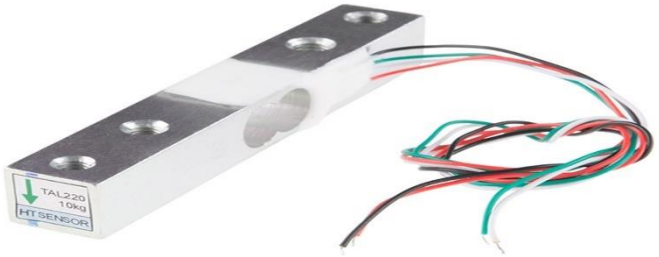

Fig.3 Load cell

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C. HX711 Load cell amplifier

Specifications
Input voltage:±40 mv
Data accuracy: 24bit
Frequency: 10/80HZ
Operating voltage:5VDC
Operating current: <10 mA
Size:24*16mm
HX711 module is load cell amplifier breakout board for the HX711 IC that allows you to easily read load cells to measure weight.

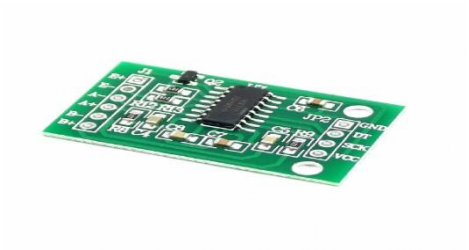

Fig.4 Load cell amplifier

D. Blood pressure sensor

The blood pressure sensor is a non-invasive detector designed to measure mortal blood pressure. It systolic, diastolic, and mean arterial pressure exercising the oscillometric fashion. Blood pressure observes work by inflating a cuts off until it temporarily cuts off blood inflow through the brachial roadway.

Fig. 5 blood pressure sensor

E. Ultrasonic sensor

An ultrasonic sensor is a sophisticated device that utilizes sound waves to measure the distance to an object. This cutting-edge technology operates by emitting a sound wave at a predetermined frequency and then detecting the echo that bounces back. Its primary application is to measure the level of garbage in both dry and wet bins. This innovative tool is highly effective in accurately gauging the amount of waste in a bin, making it an indispensable asset in waste management.

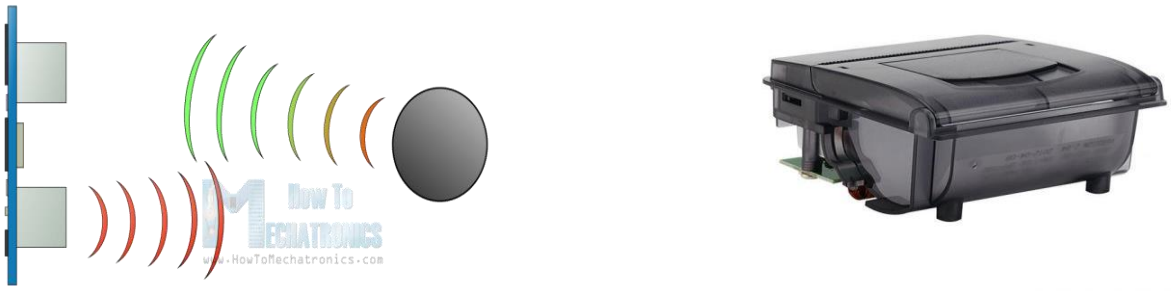

Fig.6 ultrasonic sensor

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F. MAX30102 pulse oxymeter sensor

Introducing the Pulse Oximeter and Heart Rate Sensor module, a cutting-edge device based on Maxim's MAX30102 integrated IC. This compact and cost-effective solution is designed to measure both heart rate and pulse oximetry with unparalleled accuracy.
The MAX30102 sensor boasts two LEDs and a photo-detector, which work in tandem to emit two different wavelengths of light. One LED is red, while the other is infrared. The photo-detector then senses the absorbance of the blood flowing through the fingertip. This signal is processed using a low-noise analog signal processing unit, and an internal micro-controller converts it into digital output, providing data in i2c protocol. What's more, the MAX30102 Sensor Module comes equipped with an inbuilt voltage regulator, allowing it to be powered via 5 volts and interfaced with any 5-volt micro-controllers, Arduino, or Raspberry Pi. This device is a game-changer in the field of medical technology, providing unparalleled accuracy and reliability in measuring heart rate and pulse oximetry.

FIG.7 pulse oxymeter sensor

G. Thermal printer

Thermal printing, also known as direct thermal printing, is a modern digital printing process that utilizes a thermal print head to selectively heat coated thermochromic paper, commonly referred to as thermal paper, to produce a printed image. As the paper passes over the thermal print head, the heat activates the coating, resulting in a high-quality printed image. This technology is widely used in various industries, including retail, healthcare, and transportation, due to its efficiency, cost-effectiveness, and ease of use.

Fig.8 thermal printer

H. LCD display

LCD is a flat optical display device which uses liquid crystals' light modulating properties combined with polarizes. Liquid crystals do not directly emit light, but use a backlight or reflector to create color or monochromatizates.

Fig.8 LCD display

I. Coin acceptor module

Introducing our state-of-the-art coin acceptance and detection module - a complete plug-and-play solution that streamlines the process of accepting and detecting coins from users. This cutting-edge

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module is designed to accept coins from users, detect their validity, and either accept or reject them by sending them back out.

Our module is equipped with intelligent sensors that are specifically designed to detect only valid coins, while rejecting fake ones. It operates on 12V and signals valid coins using digital pulses. Simply connect your microcontroller to the output of this module and start detecting every time a valid coin is inserted.

With the ability to program up to 6 different coin profiles, our module offers unparalleled flexibility and customization. Each coin is reported through a different pulse output, ensuring that you have complete control over the entire process.

Invest in our coin acceptance and detection module today and experience the ultimate in efficiency, accuracy, and reliability.

FIG. 9 Coin accepter module

V EXPERIMENTAL VIEW

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V RESULTS AND DICUSSION

The proposed model utilizes a coin insertion mechanism to collect data on the BMI, SPO2, and blood pressure of various individuals. This data is then analyzed and recorded for further analysis. Our innovative approach offers a convenient and efficient solution for monitoring vital health metrics. With our cutting-edge technology, individuals can easily track their health status and make informed decisions about their well-being.

SL NO	BMI	HIGH BP SYSTOLIC	LOW BP DIASTOLIC	SPO2	PULSE	HEALTH STATUS
1	26	120	65	96	72	NORMAL
2	24	178	95	98	110	NORMAL
3	18	70	78	97	70	NORMAL
4	37	112	72	96	60	ABNORMAL

VI FUTURE SCOPE AND CONCLUSION

The portable BMI calculator is a valuable tool for hospitals, clinics, pharmacies, and other health institutions. It allows health professionals to easily, quickly, and accurately calculate a patient's weight, height, and BMI, reducing their workload. This information can help identify various health concerns, such as malnutrition and overnutrition, and can be particularly useful in hospital admission departments for faster healthcare and services.

Moreover, the BMI calculator can also benefit schools and universities during feeding programs, enabling them to quickly identify unhealthy students. Fitness clubs and gym halls can also utilize this device to help bodybuilders, fitness enthusiasts, and weightlifters check their BMI for their target weight according to their height.

The system can also be used for commercial purposes by installing it in shopping centers, departmental stores, bus-stops, fun parks, resorts, and other social places. Additionally, the system finds its application in sports and athletics, military recruitment processes, swimming pools, and more. Therefore, the system is an essential tool for height, weight, and BMI measurement.

The system is coin-operated and can be installed in public places for health and BMI measurement. The project has scope for further modification, such as adding IoT-based systems for remote logging of the data collected from the system to improve the healthcare system. In the future, the system can also be implemented with scan and pay for cashless measurement of BMI and health parameters instead of coins

The use of a BMI calculation machine integrated with a health monitoring system that provides result announcement and printouts can be a useful tool for individuals who are looking to monitor their weight and overall health. However, it should be used in conjunction with other tools and advice from healthcare professionals to get a more complete picture of one's health.

VII REFERANCE

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