



Use of Technology in Health and Fitness: “BE FIT SMART BAND”

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Abstract: Fitness is one of the most important part in every individual’s life. But in today’s pandemic situation, where everybody is at home and leaving house is quite risky. For this, there should be some exercise done to keep us fit & fine. Just by walking/running and burning calories is not enough. One should be considerate about various other aspects while exercising. Some basic exercises need to be practiced to keep us in-shape. Certain motion exercises such as Push-ups and Pull-ups need to be done properly or else it might lead to serious injuries. This isn’t achieved normally without any aid. For the same, this smart band will aid in overall exercise development. “BE FIT SMART BAND”. This is a new, innovative, accurate and user-friendly smart band which allows user to do his/her exercise properly and also to keep its track record daily. This band makes the user to do Push-up and Pull-up neatly and also measures his/her BPM (Pulse rate). The “BE FIT SMART BAND” maintains precision and quality output. This band is a perfect exercise partner for every individual. Basic innovation giving advanced fitness aid for future. Fitness trackers are the leading consumer products because most consumers use wearable devices to record their exercise and health statistics and progress.

Keywords: Fitness, innovate idea, Smart band, exercise, electronics, BPM.

1. INTRODUCTION

Fitness trackers are the leading consumer products because most consumers use wearable devices to record their exercise and health statistics and progress.[9] While the other fitness bands focus on cardio-based exercises such as walking, running, cycling, swimming, etc. This Be Fit Smart Band focuses on certain motion warm-up exercises which are beneficial for muscle building as well as having proper exercise with neat accuracy.[10] [15]

The “Be Fit Smart Band” is used for certain motion exercises. It measures the count of the pushups/pullups using an ultrasonic sensor. The ultrasonic sensor senses the distance between the ground/bar and the body and gives the count of the exercise. [7] There is also a pulse sensor which monitors the BPM of the user. After the completion of the exercise there is a buzzer which blows, indicating the user that the exercise is completed. This band also helps to keep a track record of every day’s exercise and this data is stored in the user’s smartphone or PC. The user can check the input data time to time and make a daily comparison on his/her fitness activity. Calorie measurement done as per exercise count.

2. PROBLEM STATEMENT

Fitness is one of the most important part in every individual’s life. But in today’s pandemic situation, where everybody is at home and leaving the house is quite risky. For this, there should be some exercise done to keep us fit & fine.[16] Just walking/running and burning calories is not enough. Some basic exercises need to be practiced to keep us in-shape.[11] Certain motion exercises such as push-ups and Pull-ups need to be done properly or else it might lead to serious injuries. This isn’t achieved normally without any aid. For the same, this smart band will aid in overall exercise development.[12]

3. SYSTEM FRAMEWORK



Fig. 1. Technical implementation of “Be Fit Smart Band”



3.1 Input Stage:

At the input stage, we have a HC-SR 04 Ultrasonic sensor which is used to sense the distance between the body and ground/bar while doing exercise. It is placed at the chest level for use. Ultrasonic ranging module HC-SR04 provides 2cm- 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The module includes an ultrasonic transmitters, receiver and control circuit. The basic principle of work:- 1) Using IO trigger for at least 10us high level signal, 2) The Module automatically sends eight 40 kHz and detects whether there is a pulse signal back, 3) IF the signal is back, through high level, time of high output IO duration is the time from sending ultrasonic to returning. Test distance = (high level time × velocity of sound (340M/S) / 2. Operating Voltage= DC 5 V, Operating Current= 15mA, It's Operating frequency= 40Hz.

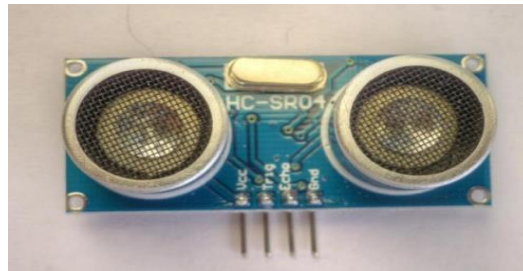


Fig. 2. HC-SR04 Ultrasonic sensor

For monitoring the BPM i.e., Pulse rate, we use a Pulse sensor. It measures the heart rate of the user and sends the data to the display device.[4] Biometric Pulse Rate or Heart Rate detecting sensor, Operating Voltage= +5V or +3.3V, Current Consumption= 4mA, Inbuilt Amplification and Noise cancellation circuit, Diameter: 0.625”.

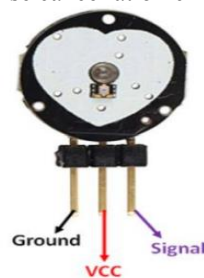


Fig. 3. Pulse sensor

3.2 Processing Stage:

At the processing stage, we have an AT Mega 328P Arduino Uno board as the main microcontroller board. It is a high-performance processor board, 8-Bit Microcontroller and Advanced RISC Architecture. Features:- Power-on Reset and Programmable Brown-out Detection, Internal Calibrated Oscillator, External and Internal Interrupt Sources, Six Sleep Modes:- Idle, ADC Noise Reduction, Power-save, Power-down, Standby, and Extended Standby, Operating voltage is 1.8 - 5.5V, Temperature Ranges between 40°C to 85°C.

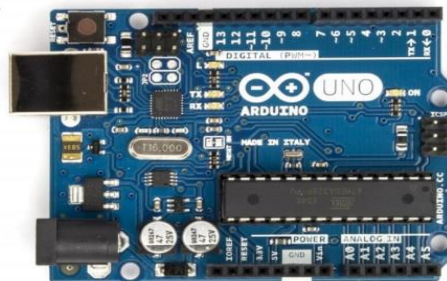


Fig. 4. Arduino UNO

DS3231 is a RTC module which manages all time functions. Real-Time Clock Counts seconds, minutes, hours, date of the Month and Year. Programmable Square-Wave Output Signal, Simple Serial Interface that connects to most of the Microcontrollers. Fast (approx.. 400kHz) I2C Interface.

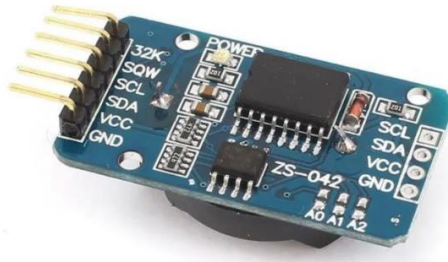


Fig. 5. Timer Module

Used for connecting this “Be Fit Smart Band” with the user’s smartphone/PC we use an ESP 8266 Wi-Fi module [1]. It is a low cost, compact and powerful Wi-Fi Module. Power Supply:- +3.3V, Current consumption:- 100mA, I/o voltage:- 3.6V, I/o source current:- 12mA. It supports serial communication, hence compatible with many development platforms like Arduino. It can be programmed using Arduino IDE for Arduino based projects. Pin configuration:

- 1 Ground:- Connected to the ground of the circuit,
- 2 TX GPIO:- Connected to Rx pin of programmer to upload program Can act as a General purpose pin,
- 3 GPIO-2:- General purpose Input/output pin,
- 4 CH_EN:- Chip Enable – Active high,
- 5 GPIO:- Flash General purpose Input/output pin,
- 6 Reset:- Resets the module,
- 7 RX GPIO:- 3 General purpose Input/output pin,
- 8 VCC:- providing power to the module,



Fig. 6. ESP8266 Wi-Fi module

SPDT (Single Pole- Double Throw) switch used for changing the mode of operation of the band. Connected with Arduino Uno and LCD screen. 0.4volt-amps, Contact rating:-20v AC or DC, Mechanical Life:- 30,000 make-and-break cycles, Contact resistance:- 20mΩ



Fig. 7. Single Pole Double Throw switch

3.3 Output Stage:

A 16x2 LCD display with I2c is used for displaying the type of exercise, its count and the BPM of the user. It is compatible with Arduino Board or other controller board with I2C bus, Display Type:- Negative white on Blue/Green backlight., I2C Address:- 0x38-0x3F, Supply voltage:- 5V, It can interface I2C to 4bits LCD data and control lines, Contrast



Adjustment:- built-in Potentiometer, Operating Voltage:- 4.7V to 5.3V, Current consumption is 1mA without backlight, Alphanumeric LCD display module which can display alphabets and numbers, It consists of two rows and each row can print 16 characters, It can work on both 4-bit and 8-bit mode.



Fig. 8. 16x2 LCD with i2c

An active buzzer is used for indicating the set exercise is completed. It also indicates when a person halts for more time while exercising to indicate him/her to complete the exercise quickly. After completion of exercise the buzzer blows continuously for min 10 sec. If the buzzer beeps, it indicates the user to complete his/her set exercise. Has two pins:- Positive (providing power of 6V DC) and Negative (for providing ground to the buzzer). It's rated Voltage:- 6V DC, Operating Voltage of this buzzer:- 4-8V DC, Rated current:- <30mA.

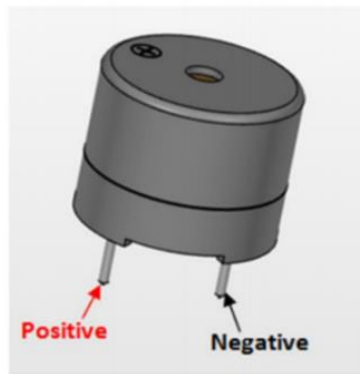


Fig. 9. Active buzzer

4. METHODOLOGY

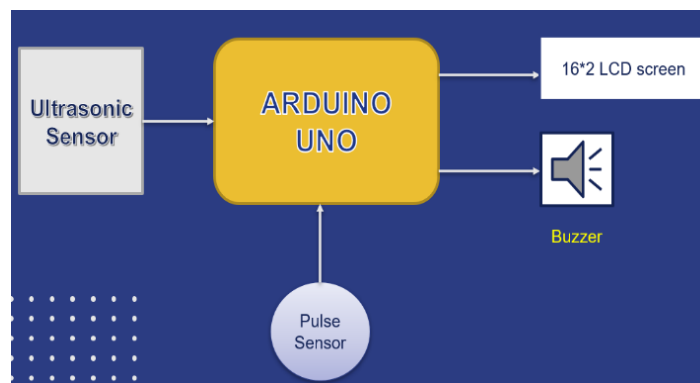


Fig. 10. Block diagram of Be Fit Smart Band

In this device, an Ultrasonic sensor is placed at the chest with the help of a normal belt and is connected with our Smart band. The user must first set the type of exercise he/she wants to perform and then set the no. of counts of that exercise. Then the user can start exercise. The ultrasonic sensor which is used initializes the exercise being done properly or not.[7] The ultrasonic sensor senses and gives the count when exercise is carried out.[3] There is also a pulse sensor connected to this band which will display the person's BPM (Beats Per Minute).[6] The type of exercise, its count and the BPM is



displayed on the LCD screen.[14] Once the set exercise is completed, a buzzer blows indicating that the exercise is completed. After every count, there will be minimum 20 sec of time for next count being carried out. If a person halts for more than 20 sec, there will be buzzer ringing for reminding the person to complete his/her exercise quickly. A timer module is used for this operation. If the buzzer beeps continuously, it indicates that the set exercise is completed. If the buzzer beeps at interval of 2-3 sec, it indicates the user to complete the set exercise quickly.[5] There is also a Wi-Fi module connected to this band for keeping a track record of every day's work out. This record will be saved and displayed on smartphone or PC.[13]

The "BE FIT SMART BAND" maintains precision and quality output and it is user friendly.[8] This makes any individual to use it easily. This band is a perfect fitness partner for every individual.

Table 1 Push ups calorie burn

Push ups count	Calories burnt (approx.)
1	0.4
2	0.8
3	1.2

Table 2 Pull ups calorie burn

Pull ups count	Calories burnt (approx.)
1	1
2	2
3	3

4.1 Advantages of "Be Fit Smart Band":

- 1) Innovative smart band which helps the user to do his/her basic workout without going out.
- 2) Measure's the bpm and makes the user aware of his/her health.
- 3) Keeps a well track record of daily exercise.

4.2 Disadvantages of "Be Fit Smart Band":

- 1) Appropriate hardware needed to be compatible with this smart band to keep track record.
- 2) Extended smart band design than other bands.
- 3)



Fig. 11. Using Be Fit Smart Band



CONCLUSION

After successfully testing the “Be Fit Smart Band”, the type of exercise, its count and the BPM of the user can be seen on the LCD screen.[14] The Wi-Fi module used helps to store the data of the users every day’s exercise to keep a well tracked record of his/her fitness. The ultrasonic sensor measures the distance of the body and ground/bar and the sensor and gives the count. Every count and BPM are properly stored in the user’s smartphone or PC. For testing purpose, minimum 3 counts of exercise were performed. For practical application, this band works well.



Fig. 12. Be Fit Smart Band output

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