

# Eating Habit and Health Monitoring System Using Android Based Machine Learning

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**Abstract** – Now a days, there are many threats to human health. Nutrition-related diseases are now becoming a dangerous threat to human health. Balancing energy intake and expenditure is crucial step to maintain healthy lifestyle. To collect the acoustic signals during eating and chewing, a wearable device is to be worn around the person's neck. An embedded hardware prototype will collect the food intake data. Signals collected will be processed by the hardware. Blue tooth signal will send to Smartphone where food types are recognized. We use hidden Markov models to detect chewing or swallowing events. Developed an application on the Smartphone, which verifies the food intake results and gives relevant suggestions on healthier habits. It notifies the user by giving notification to the user.

**Key Words:** Health, Signal, Food, Smart phone, Acoustic, Bluetooth etc..

## 1. INTRODUCTION

It is Important to maintain a healthy lifestyle in our day to day life. Daily food intake must be worth neither it may lead to various diseases and other consequences. If proper care isn't taken then severe disorders may become threat. Present solutions to measure calorie expenditure are, such as Fit-bit, Philips Direct Life, etc. However, continuously and non-invasive monitoring on calorie intake remains a challenge. Currently present solutions rely on self-reports, which are not convenient because the food intakes differ from person to person or to different age groups. To develop easy-to-use solution to detect the daily food intake and its expenditure endorse Android Based Healthcare System Using Machine Learning. We propose this system as it is desirable to develop more accurate and more easy methods to monitor the food intake. It is user friendly, easy to use, interactive with any smart phone which can handle it and understand its working in detail properly.

## 2. RELATED WORK

Advances in wearable devices continues to play a major role in improving human healthcare as it provides several opportunities which help to balance food intake and energy

consumption. Advancement in wearable devices which help to monitor body organs, movement and action. Many sensors are being deployed in the system to collect the health related data of user. Interpretation of data plays the major role. Real-world degradation of signals are more prone to noise which lowers down the quality of system performance in speech recognition systems. Hidden Markov Model is used for construction of speech components which are spectral whose performance is degraded by unwanted noise. At each step there is discrete state among the number of possible states which are finite. In the frequency domain encoding of speech parameters is done by number of speech analysis.

## 3. PROPOSED SYSTEM

Main goal of this Technology is to make user aware of his/her daily food intake. Provide the suggestions according to it. Provide customized suggestions to individual regarding healthier eating habits. Develop an application food recognition results information in a most user-friendly way. Design of an Health Monitoring System which can be interfaced with an android Smartphone. The embedded system give updates the user by using Smartphone regarding its health.

### 3.1 Body Mass Index and Calorie Intake

To measure the daily calorie intake of a person we use one of the most easiest method. The method is to measure your body mass index (BMI). The BMI is a calculation of your weight in relationship to your height.

#### ➤ Calculating your BMI

1. Measure and record your height(in cm).
2. Measure your weight(in kg).
3. Calculate your BMI by using formula:  
$$\text{BMI} = \frac{\text{Weight (kg)}}{\text{Height (m)}^2} = \frac{\quad}{\quad} = \quad$$

Result will be either Underweight Normal Overweight Obese.

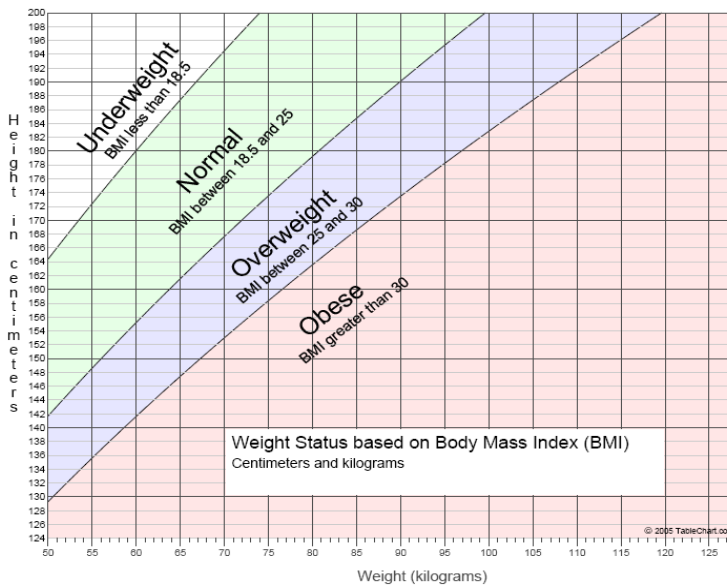


Fig1-BMI Chart

### 3.2 Calories In vs. Calories Out

Your energy balance is the relationship between “energy in” (food calories taken in into the blood through food and drink) and “energy out” (calories being used in our daily activities). The same amount of ENERGY INTAKE (calories consumed) and ENERGY OUT (calories burned) over the time = weight remains the proportionally same. More IN than OUT over time = gain in weight. More OUT than IN over time = loss of weight.

### 3.3 Calculating Your Energy Needs

#### Basal Energy Expenditure: Harris-Benedict Equation

Estimate basal energy expenditure using the Harris-Benedict equations.

Male     Female  
 Input Height:   cm     in  
 Input Weight:   kg     lb  
 Input Age:   yrs     mos  
 Stress Factor:    
 Activity Factor:  Bedrest     Ambulating  
   

B.E.E. =  kcal/d  
 Caloric Requirement =  kcal/d

For men,  
 $B.E.E. = 66.5 + (13.75 \times kg) + (5.003 \times cm) - (6.775 \times age)$

For women,  
 $B.E.E. = 655.1 + (9.563 \times kg) + (1.850 \times cm) - (4.676 \times age)$

Total Caloric Requirements equal the B.E.E. multiplied by the sum of the stress and activity factors. Stress plus activity factors range from 1.2 to over 2.

Fig2-Harris-Benedict equation

We use the Harris-Benedict equation to calculate the energy needs of a person.

## 4. SYSTEM ARCHITECTURE

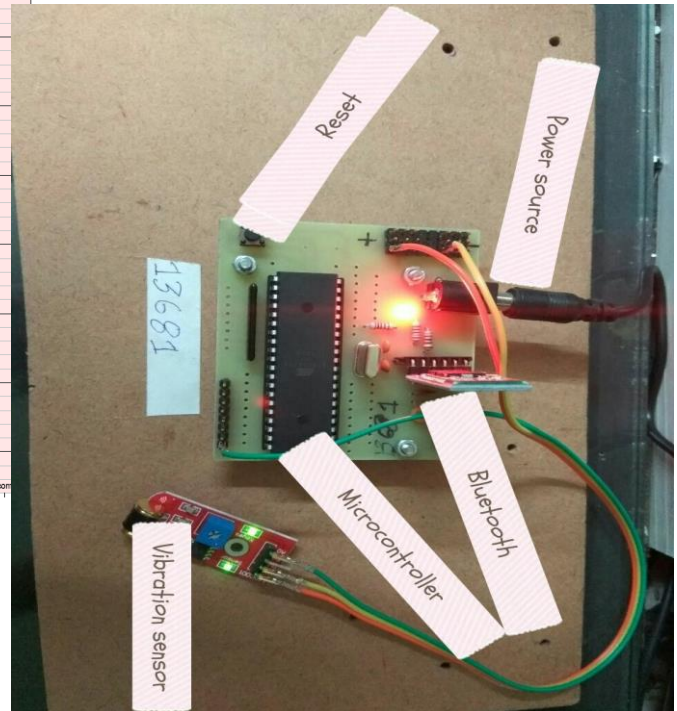


Fig3-Hardware Board

Android based health monitoring system is mainly comprises of two components: An embedded unit for acoustic data gathering and pre-processing, retrieval and smart-phone unit run the application to give suggestions to the user. These notifications are based on the calorie consumption by the user. Embedded unit interact with the smart-phone via Bluetooth connection. Architecture is divided into two system are given below:

### 1) Embedded System

1) Vibration Sensor - The wearable device worn around neck is used for sensing acoustic signals. 2) ADC, 3) AVR Micro controller : ATmega32 (40 pins), 4) Bluetooth : HC-05.

### 2) Smartphone Unit

The application developed on the Smartphone works as a data manager and provides an interface to the individual. To start the application when the user starts to eat, the system will store the detailed data into a database at smart phone side. The user can not only check the records, but also go through the notifications on healthier eating habits which are obtained by analyzing the data collected.

### ➤ WORKING PROCESS

The wearable device is worn around neck while eating food. Vibration sensor converts vibrations from the skin to acoustic signals. Embedded system is used for data processing and transmission. When the acoustic data collected from the throat vibration sensor. They are

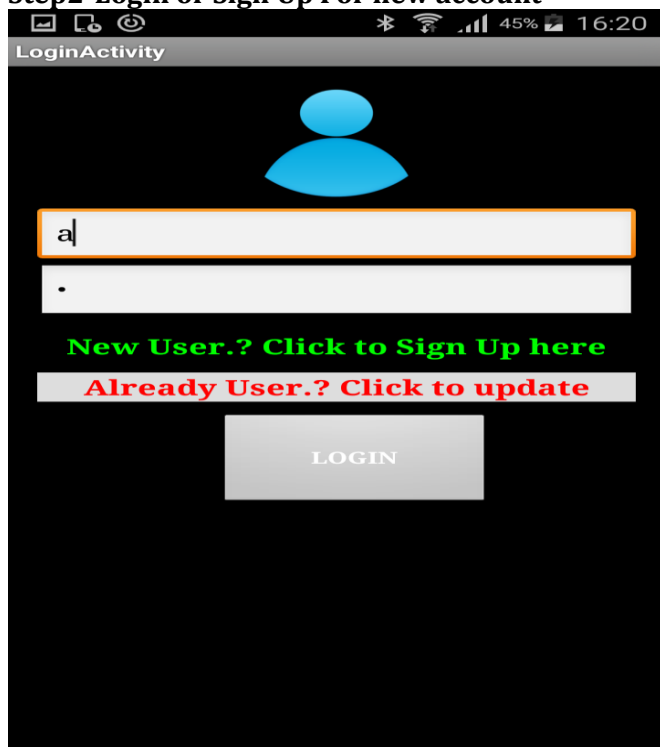
amplified and filtered to achieve better signal quality. Then the analog signals are converted into digital signal for later steps. The digital signals are passed to the microcontroller for segmentation and later for framing. The microcontroller is also responsible for frame admission control of raw signals from the vibration sensor. The data frames are being sent to the Bluetooth module through UART using SPI transport protocol and further sent to the smart phone by the Bluetooth module with a SPP profile.

➤ **WORKING ON SMARTPHONE:**

**Step1-Open the application**



**Step2-Login or Sign Up For new account**

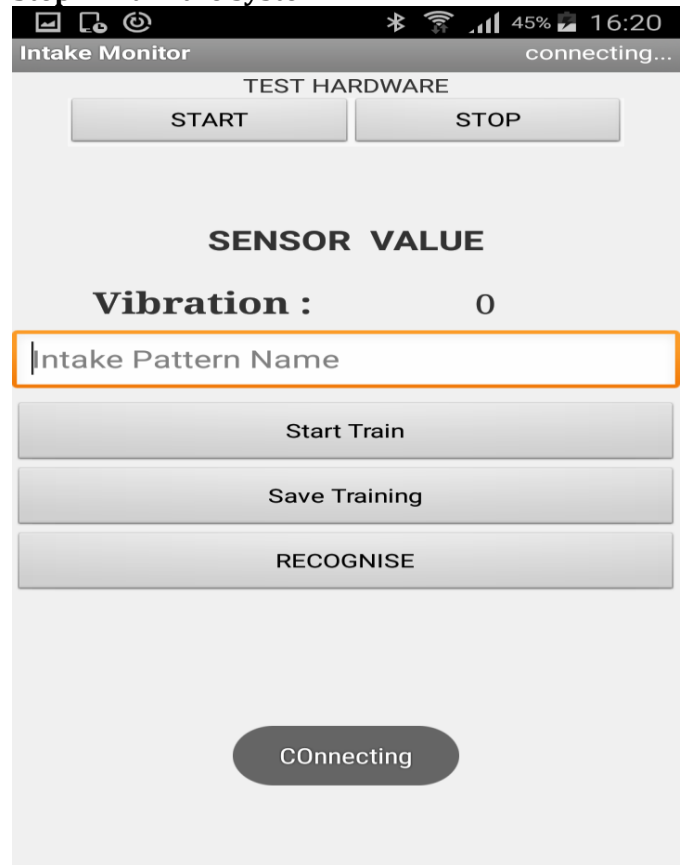


After user log in into application. His profile get created which contain his/her weight, height, gender, age.

**Step3-Calorie gain and burn calculation window**



**Step4-Train the system**



### Step5-Create and Save the patterns by training system



### 3. CONCLUSIONS

Android based health monitoring system is composed of two components: an embedded unit for acoustic data gathering, retrieval as well as per-processing, and Smartphone unit run the application to give suggestions to the user for healthier eating habits. These suggestions are based on the calorie consumption by the individual. Embedded unit interacts with the Smartphone unit via Bluetooth connectivity.

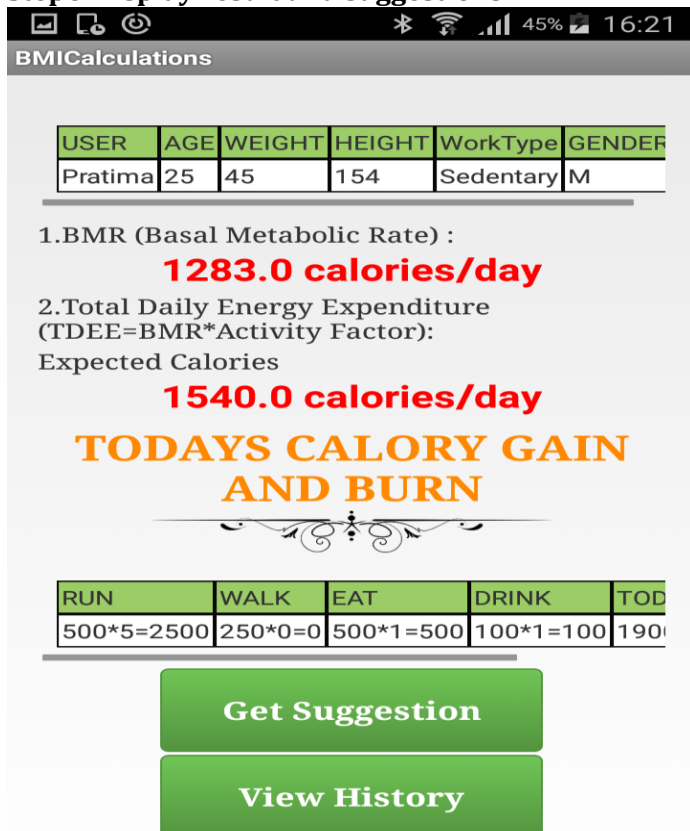
### 4.FUTURE SCOPE

Concept of image processing can be used to recognize the type of food intake. Solids can be differentiated from other solids and liquids can be differentiated from other liquids. The system can also be supported by use of audio processing. In audio processing, user needs to call out the name of the food item and it acts according to it.

### ACKNOWLEDGEMENT

The research is on the project topic "Android Based Health Monitoring System Using Machine". We are grateful to our esteemed guide, Prof. Avinash Palve, for providing the right guidance and advice at the crucial times. Last but not the least; we would like to thank our friends and family for the support and encouragement they have given us during this entire course of our work.

### Step6-Display result and suggestions



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