Designing Dietary Monitoring System using Electromyography Sensors

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***Abstract*- Dietary monitoring can provide valuable information about disease diagnosis, body weight control and dietary habit management, and thus it is welcomed by patients, dieters and nutritionists. This system is consisted to build a prototype, equipped with an EMG sensor, micro-controller and implemented with Smartphone, the system provides BMI, TDEE measurements based on their parameters (weight, height, age). All the information is transmitted through the server and will be available in any Smartphone around the world. The product provides detailed information on intake schedule, the number of chewing cycles and calories of the food.**

1. INTRODUCTION

Dietary monitoring can provide personal and detailed information of various aspects (e.g., intake schedule, food amount and meal composition), which is of great help to prevent and intervene with unhealthy dietary habits. Long-term dietary monitoring can also provide valuable information for chronic disease diagnosis. Thus dietary monitoring technology is gaining popularity. Dietary logging is a built-in function in some commercial wearable devices (e.g. Fit bit ,Jawbone Up) and some Smartphone apps (e.g. Cholesterol Manager ,Visual Food Log).

There are many developed systems based on dietary monitoring and calorie measurement which are valued or calculated separately. We are proposing an advanced version of the system by relating both the calorie and dietary monitoring with electromyography. We are also proposing a detailed values to be sent to mobile phone through an android application with the help of a server. By our concept we could get the detailed information on intake schedule, chewing cycle and also the calorie of the food intake.

This system consist of three major parts

- The data collection and processing unit
- The data storage and control unit
- Transmission and android application

Firstly we are collecting data using EMG sensors and processing it and also collect the BMI-TDEE measurement. After analysing the result will be sent to the android application through a server and provide the history of analysis. This project aims for the design of prototype which recognising the dietary stages by providing valuable information about disease diagnosis, body weight control and dietary habit management in order to accomplish the proper dietary condition. It helps to control our diet and provide support to daily life.

The information obtained from this device can be accessed from anywhere in the world by connecting to that server though a Smartphone. So its more reliable in many aspects. And its user friendly any one can understand the basic working of the system. More over anyone can evaluate our daily diet all by our self, through this we can avoid diet based disease and abnormality.

2. MOTIVATION AND OVERVIEW

of the three key healthy lifestyle activities (exercise, sleep, eat), dietary monitoring is the most difficult to accomplish, but also very important. The motivation for dietary monitoring is to provide detailed and personal feedback on intake-related Behaviour, so as to prevent and intervene with unhealthy eating habits. When the dietary information is further combined with exercise and sleep log, it can provide the users with accurate and personalized dietary guidance. The functionality can also be integrated into remote healthcare systems, so as to help doctors monitor patients remotely. In this work, the focus is on the following dimension of dietary monitoring. The first one is intake schedule. People may skip meals when overwhelmed by work or eat excessively for comfort and stress relief. Intake schedule is about recording the time when intake events take place in daily routines.

It also reflects the duration of intake events. The second is the number of chewing cycles per bite. The fast-paced life makes it a common scenario that people are in a hurry, eating on the run and swallowing the food without chewing thoroughly. Eating too fast is a health hazard, setting the body up for the development of obesity. Monitoring the number of chewing cycles can detect whether the user chews the food properly and send an alert when he/she is eating too fast. As chewing is the most fundamental activity during food intake, monitoring chewing events over daily routines can generally reflect intake schedule. Last but not the least, there is an initial attempt to monitor food category. Food category describes the composition of diet and reveals the nutrition information, which is an important factor in a healthy diet. Although the system can only identify food category among a small set of predefined foods that used in daily life.

3. BLOCKDIAGRAM

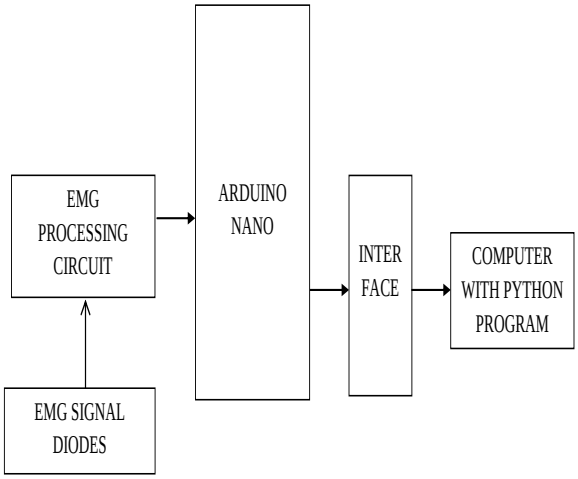

FIG 1

This system consist of three major units they are

- Data collection and processing unit
- Storage and control unit
- Data transmission unit

EMG electrodes collect the data from the muscles and processed by processing unit. After processing it controlled by a Microcontroller and transmitted to computer. In there we have two programs, one for EMG electrode and other for BMI-TDEE measurement. The computer must be installed with python algorithm, other way we can't process the program. After that the result is send to an android application through a server. We can access this information from anywhere through this server.

4. CIRCUIT DIAGRAM

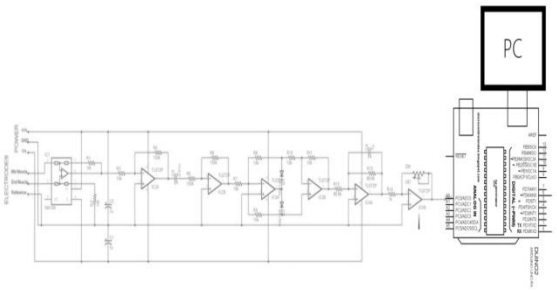

Fig 02

5. COMPONENTS

- EMG electrode
- Arduino nano (at mega 328)
- Python
- Serial communication
- Personal computer

a. EMG ELECTRODE

EMG electrode detects and records the electrical activity of the muscle. An electromyography detects the electrode potential generated by muscle cells. When these cells electrically or neurologically activated the signals can be analyzed to detect medical abnormalities ,activation level, recruitment order, or analyze the biomechanics of muscle movement.

b. PYTHON

Python is an interpreted high-level programming language for general-purpose programming, python has a design philosophy that emphasize code readability and syntax that allows programmer to express concept in fewer line code, notably using significant white space. It provides construct that enable clear programming on both small and large scale

c. ARDUINO NANO

The Arduino Nano is a compact board similar to Uno. Arduino nano is a small, complete and breadboard-friendly board based on the Atmega328P. It lacks only a DC power jack and works with mini-B USB cable instead of a standard one. It has 14 digital input/output pin(of which can be used as PWM output), 6 analog inputs, a 16MHZ crystal oscillator , a USB connection. it contain everything needed to support a micro controller , simply connected to a computer with a USB cable.

FIG 03

d. SERIAL COMMUNICATION

It is the process of sending data one bit at a time, sequentially, over a communication channel for computer bus.

e. PERSONAL COMPUTER

It is a multipurpose computer. PC act as the power supply for the working of the system. And it used to process the python program. The PC must be installed with python algorithm for reading the program. The message will send through the internet connection by using a server to the android application.

6. RESULT

This paper design of a prototype which recognises the dietary stages by providing valuable information about disease diagnosis, body weight control and dietary habit management in order to accomplish the proper dietary condition

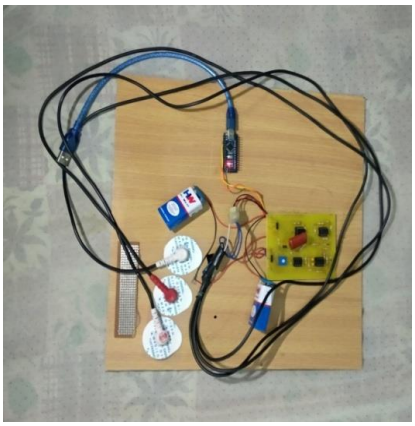

Fig 04

7. CONCLUSION

In this work, the idea of diet-aware system is proposed and implemented in a hardware prototype platform, which can provide long-term dietary monitoring in an unobtrusive and comfortable manner. The system measure the muscle activity and performs a real-time coarse-grained intake detection. When working together with a Smartphone, it can provide finegrained information on intake schedule, the number of chewing cycles, as well as broad food category. The performance of the prototype is evaluated from different aspects.It can also distinguish intake from other daily activities. It is expected that the system opens a new direction for dietary monitoring, which is promising for wide use in daily life.

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