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AUTOMATIC DIET MANAGEMENT BASED ON IOT USING ANDROID APPLICATION

Kavyashree.J[1],Dinesh.R[1], Baviithran.K.R[1], V.Vidyagowri[2]

UG Students Dept. Of ECE[1], Asst.Professor Dept. Of ECE[2].

jkskavya@gmail.com[1], rg.dineshece@gmail.com[1] , baviithran.annur@gmail.com[1], vidyavellingiri@gamil.com[2]

ABSTRACT— Maintaining the nutritious food in our diet is necessary to maintain our health. At present, the diet maintaining systems applies self-noticing techniques of regular food habits to help the obese people. Thereby maintaining the regular database of the food intakes is a tough part for the users. Such large database reduces the efficiency of the technique. An essential step to overcome the disadvantage is to record the food intake of a person precisely and regularly. In our proposed work, an innovative concept is introduced called as Auto Diet Monitoring System. The Autonomous diet monitor is a wearable system to observe the food intakes regularly. A throat microphone could be worn on the neck to accurately record sound signals while eating. The sound signals are processed and then transmitted to a smart phone through the Wi-fi module, where food types are recognized through the developed android application using Arduino studio software that could provide suggestions on healthier eating, regular diet to be followed with time intervals.

Index Terms— precisely, autonomous, arduino, wifi module

I. INTRODUCTION

The number of people with excessive fat that is overweight and obesity are increasing rapidly in urban areas of developed countries and in developing countries among people with high earnings. The World Health Organization survey says that the obese high age people population have been increasing from 2000 million in 2009 to 3200 million in 2015 it may give rise from 500 to 700 million around the world during the same period.

The Real time reason for obesity is increase in the intake of over fried spicy food, oily food and fast foods and decrease in physical activity because of inactive working habits in the technically competitive world.

The precise and intensive measurement of indigestive food intake (excessive food consumption frequently and untimely, amount of calorie containing in the food that we take and amount of calories we spend in our work are some of the factors challenging in the obesity research, where these factors are important to be observed regularly with time intervals in order to maintain the energy balanced to avoid weight gaining. Monitoring eating behavior is the prerequisite for research on disease intervention and epidemiology as well as in deployed prevention, such as weight loss coaching programs. In order to systematically reduce disease risks, these programs target a modification of accustomed lifestyle. However, this is a tough challenge for the individual. It requires continuous, potentially life-long, everyday support and coaching. To support the coach and individual with actual information, eating behavior reporting must provide a similar temporal resolution, thus requires tracking of every individual meal intake.

Such actual information is particularly vital to adapt feedback in coaching programs and has been identified to improve success rates. In our proposed work, the constant trend of electronic miniaturization has enabled sensors and computers to be embedded in everyday objects. Process that undergoes this computing system will support their user with personal timely health position and training services. The core functions for such personal assistants are (1) sensing and recognizing the user's state and activity, (2) inferring health state as well as tracking tasks and actions relevant for the targeted service, and (3) providing adequate feedback.

II. LITERATURE SURVEY

Edward Sazonov used a technique named Monitoring of Ingestive behavior (MIB) in which Accuracy of epoch recognition for individual model is high but accuracy was not related to BMI and not common to every people.[1]. Ramani Durasiwami uses MVMF+ HMM Mises-Fisher PDF + Hidden Markov Model in which only chewing information can be estimated. [2]. Sundholm implemented a novel sensing technique statistics of the types of basic actions (cutting, etc.) plus the overall weight can at least help detect changes in the dietary patterns [3]. Pabler and wolf uses hidden markov models the detection and

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classification accuracy is high whereas the accuracy rate is for only 10% of record of data.[4]. Dong employed wrist motion of the person .He developed objective eating activity calendar ,resulted in high accuracy but it was a failure for those who do not exhibit vigorous wrist motion[5]. Christian Zieger developed a HMM based sound detection [6].

III. SYSTEM ARCHITECTURE

Auto diet monitoring application monitors the food consumed by the person may a patient or the overweight person whenever he intakes, it also, records the timing he intakes the food .The sound signals generated while he chews and swallows the food are kept recording through the throat microphone. These sound signals are filtered from the noise signal and processed further. The signals are processed to find out the type of food such as solid, liquid or semi solid are recognized using the algorithm hidden Markov model. After recognizing the food type and distinguishing it using MATLAB, the data on the regular intervals are transmitted through the Wi-fi module to the android application and updates the database. This android application alerts the patient monitor or the obese person whether he is following the proper nutritious diet.

The system architecture is as shown in fig 1. The food consumed is compared with the predefined nutritious diet chart such that if the obese person consumes excess of amount of food he would be given alert about the over consumption .In case of patients , they could be helped to take regular food intake in timely manner and maintain their body without getting dehydrated and lose energy.

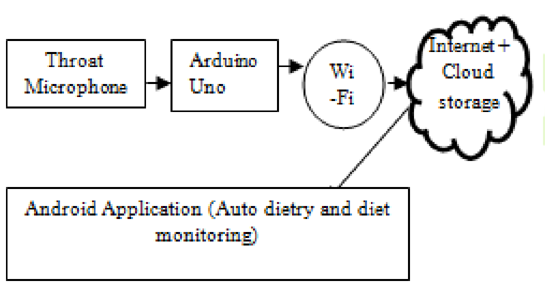

Fig1: system architecture

IV. SIGNAL ACQUISITION

The sound signals generated while the person chews and swallows the food are kept recording through the acoustic throat microphone. The throat microphones records the minute noise created in the throat region and the other noise. The analog signal is converted to digital signal. The signals will be very low and contains several noises. These signals are amplified and filtered through the accurate filters .The filter we use is band pass filter FIR. It consists of stop band frequency range of 0.35 to 0.45and pass band frequency range 0.45 to 0.55 A band-pass filter that selects the signals of frequencies within a certain range and discards signals out of that range. A band pass filter optimizes the SNR and sensitivity of a receiver .The signals are converted to high quality by filtering using the MATLAB.

V. HMM FOR EVENT DETECTION.

Initially the Hidden Markov Model which is based on the Mel frequency cepstrum coefficients is used in order to determine the chewing or swallowing events from the uninterrupted sound frames. Frames considered as an event are maintained collectively and the other events involved are removed. Hidden Markov model (HMM) can automatically detect the chewing and swallowing events from each continuous recording sample. HMM are used in several areas, such as speech recognition. Recently, various different acoustic event detection or classifiers based on HMM has been proposed. [6]. We can consider the detection of sound events similar to speech recognition by finding sequence that maximize the later probability of the frame sequence S = (S1;S2; _ _ _ ;SM), considering the observations

B = (B1;B2; _ _ _ ;BT):

S = arg maxW ;

P(S=O) = arg maxW ;

P(B=S)P(S) ;

The model P(S=B) represents the HMM for sound events and noiseless intervals, with 4 emitting states and left-to-right state transitions. Observations B consists 32 Mel Frequency Cepstrum Coefficients for event sequence or noiseless sequence. Figure 2 represents the example for hidden markov model classification.

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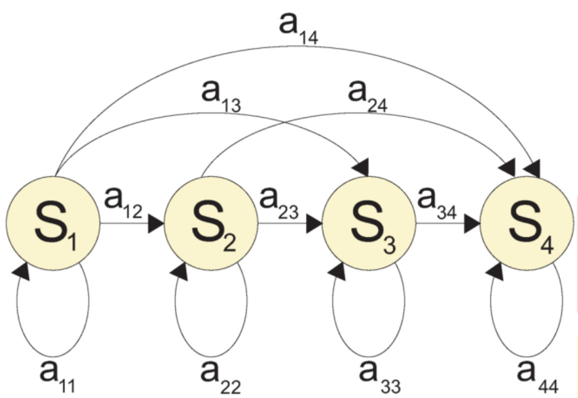


Fig 2: Four state HMM

A frame belongs to some acoustic event if its later probability of the event HMM is greater than the noiseless HMM. The frames belonging to the chewing or swallowing periods are grouped and allocated with bit 1 and the other silent periods or non-events are allocated with bit 0. Thus the chewing, swallowing and the silent periods are separated as frames for processing.

VI. EXTRACTION OF FEATURES

The type of the food can be precisely determined from the event features which differentiates between the food types accurately .In this method, we obtain the time-domain features, frequency-domain features and non-linear features for every events occurring. From the signal, high peak value, low peak value, mean value, variance and standard deviation are determined for the event based on time domain. With the frequency domain we determine the range of frequencies over which the signal lies. Non-linear features, such as slope or fluctuation analysis approximate entropy, fractal dimension, Hurst exponent and correlation dimension have been demonstrated useful to describe a signal.

VII. CLASSIFICATION OF FOOD TYPES

In order to classify we should predict the food type corresponding to a chewing or swallowing event that can be done by determining the feature values. We consider prior knowledge of many experimental feature values from several pre-recorded events for various types of known food. These data are used to classify the food type of the events we record. In the proposed method, we use the decision tree algorithm [9]. Thereby to distinguish between the food type of a given event, a decision tree process begins from the root node and evaluates the value of the leaf node . In this system the decision tree is developed using the MATLAB built in function *classregtree*. Multiple decisions are possible for a single type. An example for decision tree for water and cookie are as shown in fig 3.

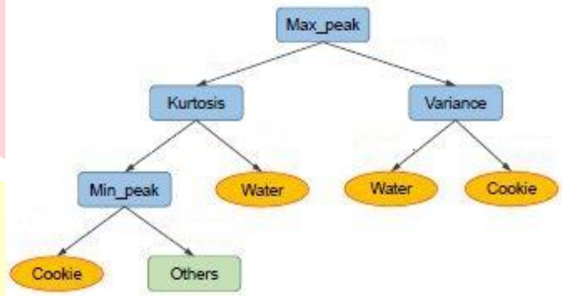
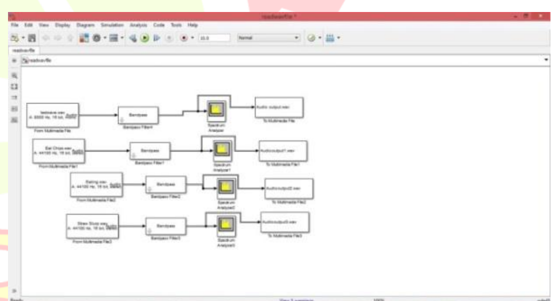


Fig 3: decision tree algorithm

VIII. RESULT

The figure 5 shows the signal that is processed in the MATLAB. The signal from the throat microphone is filtered from noise using the band pass filter and then the signal response is displayed through the spectrum analyzer.



The figure 5 shows the signal that is processed in the MATLAB

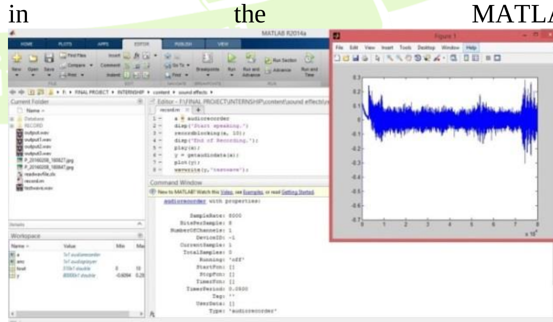


Figure 6 shows the input signal that is being recorded for processing .

The corresponding output waveforms for the different types of food are as shown in the below figures.

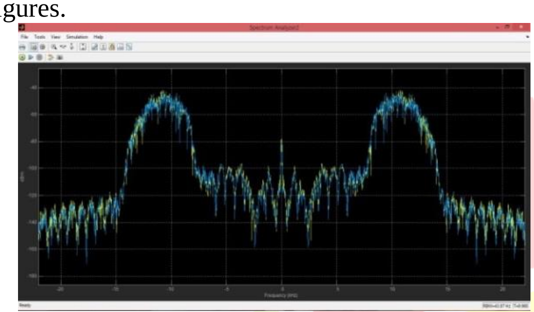


Fig 7a. Output of the eating apple

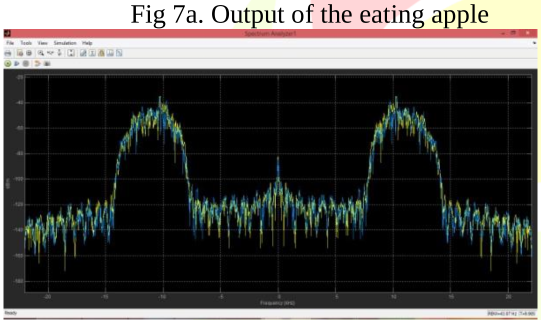


Fig 7b. Output waveform for chips

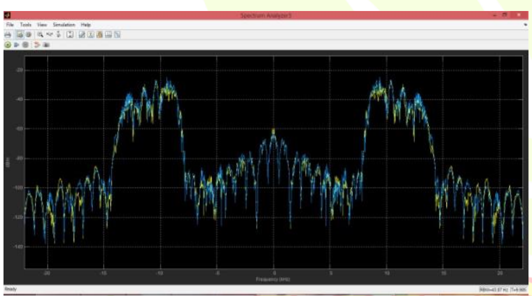


Fig 7c. Output waveform for straw slurp.

IX. CONCLUSION

Our proposed technique Auto Diet Monitoring System is developed in such a way that it helps obese people maintain their weight constant without getting increased. They are given alerts when they intake large amount of food and eat unhealthy diet. Patients are helped to maintain their hydration level and nutrition. This system helps reduce fat, to monitor the patient's food intake with regular intervals through the android application.

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Kavyashree.j pursuing the Bachelor of Engineering in Electronics and Communication at Jansons institute of technology, Coimbatore. The area of interest in Digital electronics, Embedded systems and networking. jkskavya@gmail.com.

Baviithran.K.R. pursuing the Bachelor of Engineering in Electronics and Communication at Jansons institute of technology, Coimbatore. The area of interest in Microprocessor and Microcontroller, Embedded systems and Networking. baviithran.annur@gmail.com

Dinesh.R pursuing the Bachelor of Engineering in Electronics and Communication at Jansons institute of technology, Coimbatore. The area of interest in embedded systems, Website development and Networking. rg.dineshece@gmail.com

Vidhyagowri.V is working as Assistant Professor in the department of ECE in Jansons institute of technology ,Coimbatore. He was graduated at Kongu engineering college in B.E. Electronics and Communication Engineering in 2003.He has done M.E in Biomedical Engineering in 2010 at College of Engineering Guindy,Chennai. Pursuing Ph.D in Medical Image Processing. Her area of interest in Biomedical instrumentation and Medical image processing and networking