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Smart Nutrition Monitoring System

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Abstract: ***A balance of nutrient intake is very important for every individual. When the body is deprived of essential nutrients, it can lead to serious disease which can cause serious health issues. Nutrient monitoring of the nutritional content of food, not only at home but also in day care facilities. To address this challenge, this paper presents two methods for calculating nutrient of meal. First one is IOT, comprises of Arduino and Loadcell to obtain weight of meal for infants. And second, which is Image Processing based, for achieving mobility for the system in outside world. In order to achieve better performance of detection and recognition of food we are using Convolution Neural Network. Information gain from above modules is maintain using Android Application.***

Keywords: Internet of Things, Convolution Neural Network, Detection, Recognition.

I. INTRODUCTION

Monitor daily food intake is a relevant and important problem in health care. Monitoring systems in smart healthcare is designed to maintain a healthy lifestyle, focusing on calorie input and calorie output monitoring. As important as it is to monitor the calorie output, it is equally important to monitor the calorie intake. Though the focus of such monitoring systems might range from tracking weight loss to having a healthy balanced diet, the underlying motivation is to address nutrition imbalances. This condition can be caused by both undernourishment, in which not sufficient nutrients are consumed, as well as overeating, which results in excessive consumption of non nutrient rich food, particularly in fats and salt. Overeating can lead to obesity which is a serious health concern in affluent societies today.

Imbalance nutrition in infants and children can manifest in numerous modalities in adulthood including weak immune systems, cognitive disorders, weakened skeletal structure, thinning hairlines and bleeding gums, to mention just a few. The system is designed to manage nutrient gained by the person from meal which is taken and helps the individual for maintain the good health. According to BMI of person if person trying to gain or lose or maintain the weight he/she should keep the record for nutrients gained from meal intake. This record will be efficiently handled using android application. Application maintains the log that can be accessible to user with information which shows the details up till . And hence it will be helpful to the user about how much meal user need to consume.

II. LITERATURE SURVEY

The Internet of Things (IoT) helps in connecting real world sensor data to cloud based solutions. It is an internetwork of sensors deployed in the physical world and helps in exchanging data between these sensors and the cloud [1]. From the computer vision side, several approaches have been proposed to tackle the problem, most of them using Convolutional Neural Networks (CNNs) Several of the published work consider the development of methods for food recognition [2].

Convolutional Neural Network (CNN) is one of the most prominent techniques in deep learning[3]. It was introduced by LeCun et al. [4] for the classification of handwritten digits.

CNNs is widely preferred in computer vision applications owing to its exceptional ability to learn operations on visual data and obtain high accuracies in challenging tasks with large-scale image data [5]. CNN, in contrast to other traditional methods, outperforms by a large margin.

In the field of food recognition and classification, several research works have implemented this approach. Bossard et al. [10] implemented a CNN model based on the network architecture proposed earlier [7].

III. EXISTING SYSTEM

Existing system uses the IOT sensor Loadcell for calculating weight of meal and sends calculated values on the cloud. System uses Bayesian Network structure for classifying food items and further determining the nutritional balance of the meals consumed with the help of the multilayer perceptron neural network.

A. Disadvantages of Existing System

The approach restricted to infants giving nutrient details of infants meal.

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IV. PROPOSED SYSTEM

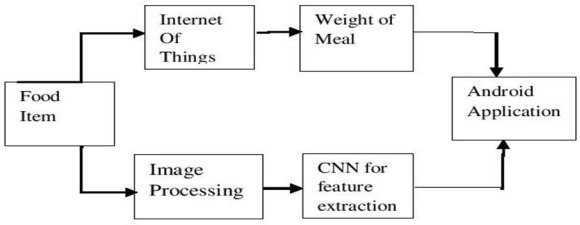

Fig. Proposed System

A. Advantage of Proposed System

Proposed system is useful for any individual.

V. METHODOLOGY

A. Internet of Things

The system can be considered as a product which includes a smart sensor board along with a smart phone application. The sensor board contains a food weighing sensor. The weight of the food product or ingredient is sent to the cloud through the Internet under the coordination of a microcontroller integrated with a wireless module. Thus, the propose system is converted to a "thing" in an IoT network. The main objective of using the food weighing sensor in Smart Nutrition Monitoring System is to quantify the nutrients consumed by the user. The ideal output of this sensor should be the weight of the food ingredients placed on it. The schematic of the food weighing sensor, which consists of load cells paired with a microcontroller. Data obtain from sensor is sent to mobile application via cloud.

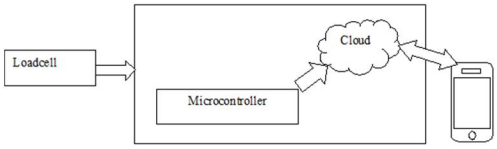

Fig. IoT based module

B. Materials Needed

1) Arduino - this design uses a standard Arduino Uno, other Arduino versions or clones should work also

2) HX711 on breakout board - This microchip is specially made for amplifying the signals from load cells and reporting them to another mircocontroller. The load cells plug into this board, and this board tells the Arduino what the load cells measure.

3) 20kg load cell - Load cells are specially shaped metal parts that have strain gauges glue to them. The strain gauges are resistors that change their resitance when they are bent. When the metal part bends, the resistance of the load cell changes (the HX711 measures this small change in resistance accurately).

C. Image Processing

1) Convolution Neural Network: A Convolutional Neural Network (CNN) is one of the most popular algorithm for deep learning. CNN are used to image and video recognition and classification problems. In our system we use this algorithm for detecting the food items. In each stage feature extraction is done and it produces the large feature set for original input. These feature sets help for describing the characteristics of data

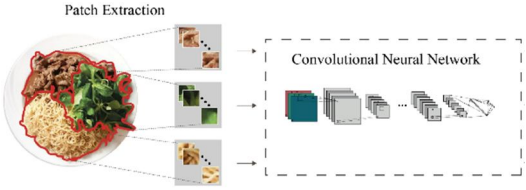

Fig. Extraction.

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D. Mechanism of CNN

1) *Feature Extraction:* In this part, the network will perform a series of convolutions and pooling operations during which the features are detected. If you had a picture of food, this is the part where the network would recognize its colour, shape, etc.

2) *Classification:* Here, the fully connected layer will serve as a classifier on top of these extracted features. They will assign a probability for the object on the image being what the algorithm predict it is.

VI. ALGORITHM

A. Convolution Neural Network

CNN is a Deep Learning algorithm which can take input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from other.

It is used in image recognition and processing that is specifically designed to process pixel data.

1) Convolution layers consist of a set of learnable filters (patch in the above image). Every filter has small width and height and the same depth as that of input volume (3 if the input layer is image input).

2) For example, if we have to run convolution on an image with dimension 34x34x3. Possible size of filters can be axax3, where 'a' can be 3, 5, 7, etc but small as compared to image dimension.

3) During forward pass, we slide each filter across the whole input volume step by step where each step is called stride (which can have value 2 or 3 or even 4 for high dimensional images) and compute the dot product between the weights of filters and patch from input volume.

4) As we slide our filters we'll get a 2-D output for each filter and we'll stack them together and as a result, we'll get output volume having a depth equal to the number of filters. The network will learn all the filters.

VII. PROBLEM STATEMENT

As daily food intake is relevant and important problem in health care. Smart Nutrition Monitoring System in smart health care is designed to maintain the healthy lifestyle, focusing on calories monitoring. As important as it is to monitor the calorie output, it is equally important to monitor calorie intake. Though, the focus of such monitoring systems might range from tracking weight loss to having a healthy balanced diet, the underlying motivation is to address nutrition imbalance.

VIII. CONCLUSION

To an analysis of the meal nutritional content, suggestions are made by the system to decrease the risk of imbalanced diet. It used to keep track of user activities for accurate automated prediction of diet. It gets food nutrition quantification, and a smart phone application that collects nutritional facts of the food ingredients.

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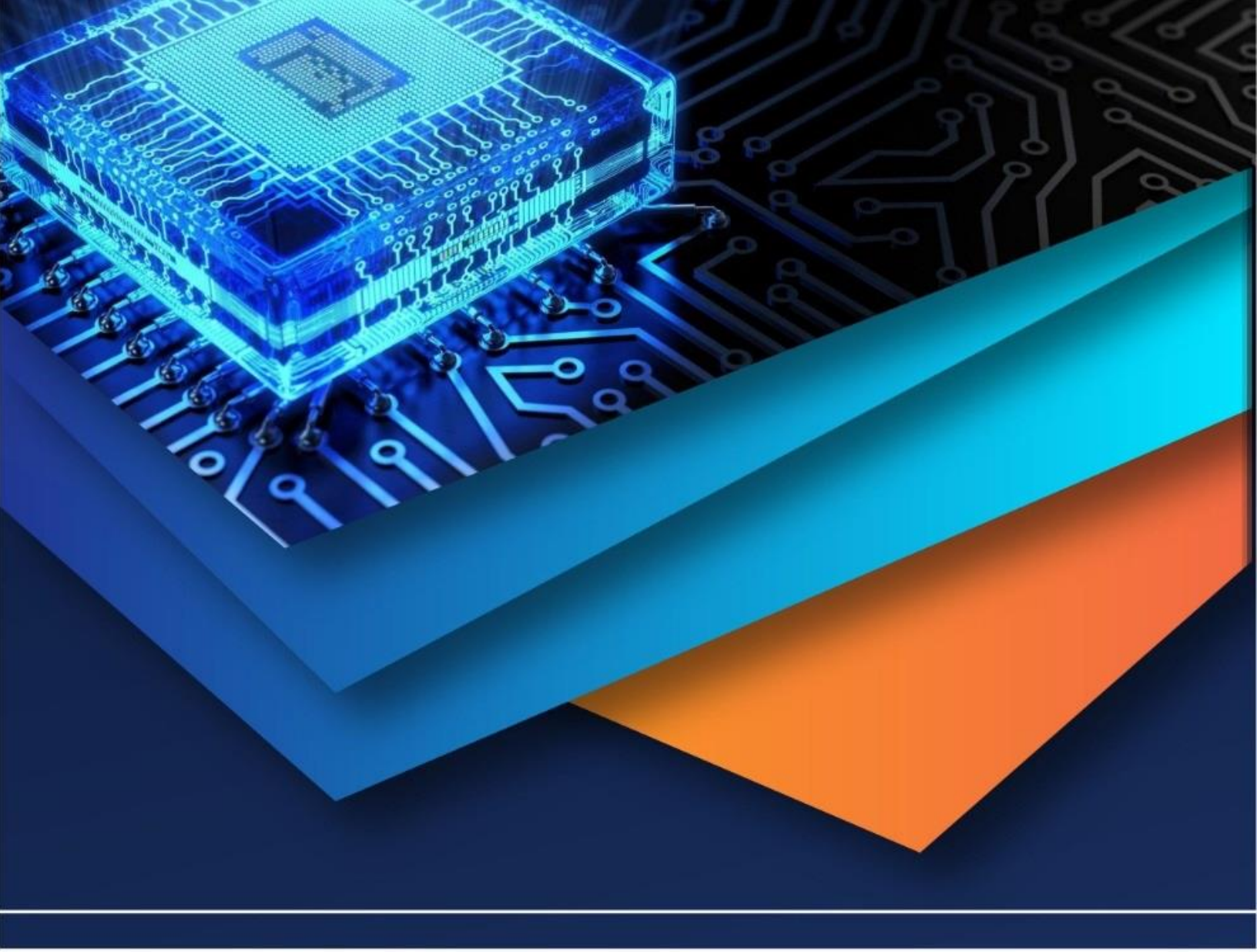

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