REPORT OF RESEARCH RESULTS for
Active Ageing Intervention and Monitoring System (AIMS) based on Intelligent Sensing and Nutritional Analysis .

(a) **Title**

Active Ageing Intervention and Monitoring System (AIMS) based on Intelligent Sensing and Nutritional Analysis

(b) **Primary Researcher: Name, Affiliation**

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Co-researcher(s): Name, Affiliation
The co-researcher, Dr PAN An, was an assistant professor at the Saw Swee Hock School of Public Health and now is a Professor in Huazhong University of Science And Technology

(c) **Summary: Include the outline and conclusions of the research**

The contemporary methods in monitoring lifestyle factors such as conducting dietary records and meal questionnaires normally require the subject to recall their meal for a past period of time. This method has limitations such as inaccuracy (as it is subject to memory bias), poor estimates of diet-disease relationships and pose significant challenges for dietary intervention and metabolic studies. Beside from questionnaires, there are several nutrition and lifestyle monitoring system available in the market which allow the user to type in their food intake immediately after the meal. However, most of these system have limitations such as not user friendly for the elderly, only function as diet recorder and no immediate intervention on nutrition intake and no personalized monitoring and intervention. Thus, an active monitoring and intervention system is proposed in this independent studies to monitor and intervene lifestyle factor in an automatic, accurate and user friendly way.
An app that can be used on mobile phone or tablet is developed to serve as the platform for intervention and monitoring system as continuous monitoring is needed. Several novel methods have been implemented into the app to make it user friendly for the elderly.

(d) **Aim of Research**

Suboptimal diet and poor lifestyle have been demonstrated to increase risks of many diseases (e.g., obesity, diabetes, cancers, etc.) in senior citizens. Therefore, we propose the AIMS system for dietary monitoring, nutritional epidemiology analysis, and health intervention in an automatic and unobtrusive way. It is of great importance to keep ageing healthy, economically and socially active.

(e)   Method of Research & Progression

Voice Recognition

In order to trace the food taken by the user, the app should allow user to input the food taken. The common way in doing so is using textfield component which allow user to type through keyboard. However, this method might be troublesome for some of the elderly as some of them have poor eyesight. A voice recognition system has been implemented into the app that allow the user to input the food taken through speaking to the app. The user can click on the voice search button to start the speech recognition system, pronouncing the keyword relevant to the food, wait for the system to analyse the input. The user can then choose and click the word from the list, the app will return a list of the food choices containing the chosen keyword from United State Department of Agriculture Nutrition Database.
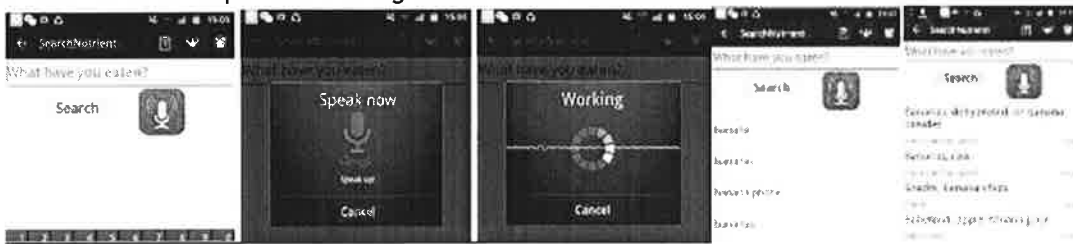

Personalized Diet Plan

As people in different gender, age and health condition need different nutritional intake, a personalized diet plan cater for these factors are provided for user to consider them for suitable daily nutritional intake.

According to the Recommended Dietary Allowances published on Singapore Health Promotion Board, the elderly generally need less calorie intake than adult and youngster in the same gender and lifestyle group.

Dinner Notification

A reminder system has been implemented into the app which allows the user to set his or her dinner time so that the user can receive a notification that remind them to check the remaining nutrition intake before having the last meal of the day.
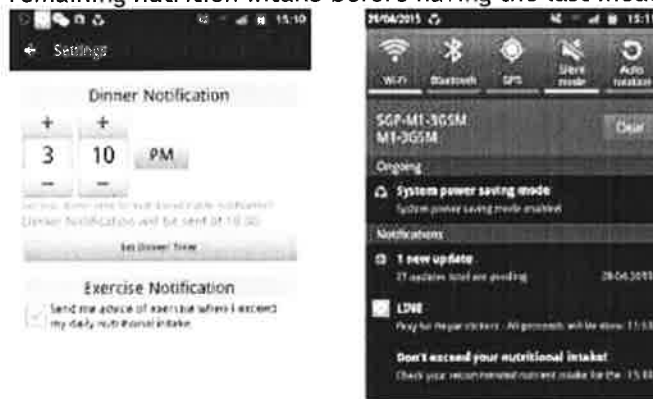
Immediate Feedback System on Excess Intake

When the user exceed the recommended calorie intake, the app will warn the user to exercise. A series of exercise is suggested for the elderly.

Picture: Exercise advice.
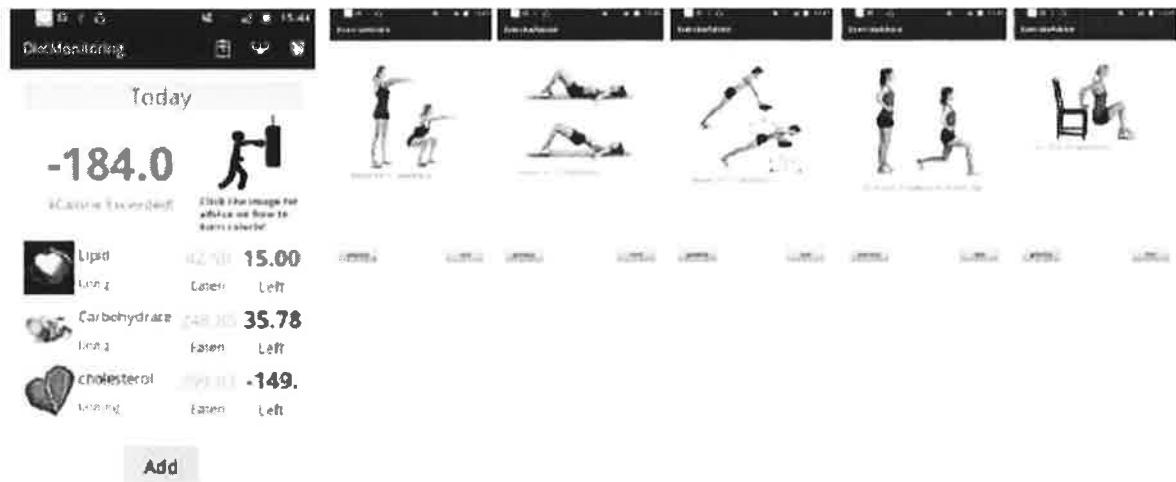
Database

The information of the nutritional content of the food is required to allow the user to trace how much he or she has consumed. A few online nutrition database is available such as National Nutrient Database, Calorie King and SelfNutritionData. The nutrition database that is incorporated into this app is National Nutrient Database published by United States Department of Agriculture. This online database has been chosen because its API allows free REST access to its database and it is more completed in terms of number of food (a total of 8618) and specific nutrient data recorded.

In order to access the database, the app should be programmed to communicate with the database API. An API (Application-programming interface) is a software-to software interface, not a user interface. It is a set of programming instructions and standards for accessing a Web-based software application or Web tool.

The National Nutrient Database allows the user to request for the data in JSON or XML format. Every JSON string contain a primary key, in this case, it is "list". In JSON, everything included in curvy bracket"{}" are an "object", everything included in square bracket "[]" is array. Everything included in comma """"" is string. In the case below, bread is a string named "q" in object named "list", the offset, name, group and ndbno of blue corn bread and cheese bread are two object in an array named "item" and group of cheese bread is a string in the sixth object in array "list".

The result gotten so far is actually a string of words contain all the information. In order to show only the parts user are interested in an easy to read way, read_ndbno_JSONFeedTask method will "parse" the JSON. For an example, to display group name of each food in the textview, the programmer has to first specified getting a JSONobject called "list", getting a JSONArray called "item" in this list, go into a loop of 25 iteration to get a JSON object of list[i] and finally get the string called "group". All the result are inserted into a list of array with 25 items and this list is displayed in a listView using setAdapter.

In order to get the nutrient report of a specific food from National Nutrient Database, the ndbno of that specific food is required to make a request link to the database. In this app, when an item in the listview is clicked, the ndbno of the food will be send be send to the new activity and start it (ShowNutrient.class). Similar to the method describe above, the url containing all the requested element is send to a method to get internet connection and if successful, the nutrient data in a String of JSON. The National Nutrient Database contain various nutrient data such as sugar, carbohydrate, protein, Vitamin ABCD, etc., in this demonstration, only 5 specific data are retrieved.

(f)   Results of Research

A mobile app for Asian dietary monitoring and intervention was developed, with specific functionalities including: voice recognition, Personalized Diet Plan, Dinner Notification and Immediate Feedback System on Excess Intake. Internal software testing and experiments have been performed to validate the app.

(g)   Future Areas to Take Note of, and Going Forward

The app can be improved by including more disease monitoring, not limited to only diabetes and hypertension. More intelligent and user friendly input method such as image recognition and barcode recognition can be implemented to ease the elderly in recording their diet. As the app is targeted for the senior citizen in Singapore, a database that provide local food nutrient information is recommended to be implemented into the app.

(h)   Means of Official Announcement of Research Results
Mobile app software & website http://bioeng.nus.edu.sg/mm/do/doku.php?id=fyp:nutritiona
pp