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Journal of Behavioral Informatics
Digital Humanities & Development Research
Vol 8, No 1, 2022 Series

Electronic Human Nutrition Analyzer for Managing Obesity (EHNAMO)

[1]Adepegba, O. A., [2]Adepegba S. A., [3]Longe O. B. & [1]Adesiyan A. P.
[1]Department of Computer Science, Adeleke University Ede, Osun, Nigeria
[2]Department of Computer Science, University of Ibadan, Ibadan, Nigeria
[3] Faculty of Computational Sciences & Informatics, Academic City University College Accra Ghana
Corresponding Email: *adepegbafunmilola@adelekeuniversity.edu.ng

ABSTRACT

The bad eating habits in the Nigeria society is increasing and the Obesity rate is constantly increasing but to monitor the Nutritional status simply means booking an appointment with a nutritionist with long hours of waiting time to get answers. Another important factor is cost of getting an appointment this could be high to an average Nigerian giving the fact that seeing a nutritionist is not one-time bargain as one would continuously need to book an appointment on the long run. The developed is capable of allowing users to enter personal details such as height, weight, age, gender and other factors to efficiently monitor the user nutritional status. By calculating the B.M.I (Body mass index) the system easily identifies the nutrition status of the user and proceeds to recommend appropriate profile for the user such as gaining weight, maintaining weight and losing weight and also likewise calculating B.M.R (Basal Metabolic rate) of the user the system automatically knows the amount of calories needed to be present in the individual nutritional status based on the users profile. The web application was developed using Php7 and Mysql which can be deployed on to any web server for the application to be accessible to users. This web based nutrition analyzer allows users to generate their own diet/Nutritional Food-time table which can be followed to achieve a healthy Nutritional Status. The study gives room for nutritionist to user interaction in order to help boost user satisfaction, the system has the capabilities of generating reminder, alerts, exercise routines and constantly motivates the user to use the application and improve their nutritional habits.

Keywords: Obesity, Body Mass Index (BMI), Basal metabolic rate (BMR), Diet, Nutrition

Journal Reference Format:
Adepegba, O. A., Adepegba S. A., Longe O. B. & Adesiyan A. P. (2022): Electronic Human Nutrition Analyzer for Managing Obesity (EHNAMO). Journal of Behavioural Informatics, Digital Humanities and Development Research. Vol. 8.No. 1, Pp 15-26.
Available online at https://www.isteams.net/behavioralinformaticsjournal
dx.doi.org/10.22624/AIMS/BHI/V8N2P2

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1. INTRODUCTION

Nutrition is getting food into the body for growth and energy, and for keeping the body healthy and living (Nordqvist, 2008). It also includes the environmental, psychological and behavioral aspects of food and eating. Nutrition focuses on how to protect the body from disease by healthy diet. There are seven major classes of nutrients: carbohydrates, fats, minerals, protein, vitamins, fiber and water (Al-Dhuhli, 2013). Most food contains a mixture of all or some of the seven nutrient classes. Not enough or too much of a nutrient, or some nutrients may result in poor health (Dharkar and Rajavat 2011)

The disease burden from overweight and obesity has continued to increase globally. The World Health Organization (WHO) reported that overweight and obese persons nearly tripled between 1975 and 2016. The bad eating habits of today's Nigeria society are alarming and obesity rates have increased making our country one of the most obese populations in the African Region. According to a research conducted in 2016 Sixty percent of one hundred people suffer a disproportionate increase in their weight because of their poor nutritional habits. This reality makes it necessary to raise public awareness about the need for a much needed dietary improvement and encourage preventive care. Hence, there is need for nutritional management.

The Dietary management system can be used for diagnosing, controlling, and monitoring human nutrition. The system assesses the physical characteristics of a user to determine their nutritional status and makes recommendations for reaching nutritional requirements and a balanced diet. The system generates, alerts, exercise routines and constantly motivates the user to use the application and improve their nutritional habits.

1.2 The aim and objectives

The aim of this work is to develop an electronic nutritional analysis system that will be used to carry out analysis on human nutrition based on the report of the user's BMI. This system would be used for diagnosing, controlling, and monitoring human nutrition so as to checkmate human nutritional habits.

The objectives of this research are to:
(a) Develop an electronic human nutrition analyzer system for obesity control
(b) Incorporate an interactive Diagnostic system, this study is based on human nutrition active diagnostic function that will assists medical officials in carrying out their diagnostic processes.
(c) Analyze and recommend nutritional diet needed by a patient/user.
(d) Evaluate the performance of the developed system in (a).

1.3 Significance of the study

The developed system will be useful as stated below.
i. It will help to retain the skill of an expert medical doctor in case of any eventuality or emergency.
ii. It can support academic development in the area of Information Technology and Health.

iii. It can be personalized and can be deployed and applicable in hospitals (federal, state and private hospitals).
iv. It can be used in the laboratory for research work.

2. LITERATURE REVIEW

YEAR	AUTOR	TITLE	DESCRIPTION	LIMITATION
2018	Balqees Ali Al-Dhuhli and Sultan Qaboos	Developing a Nutrition and Diet Expert System Prototype	The web-based system acts as a diet expert to help people evaluate there nutrition condition, It also recommends exercise routine for them in order to live a healthy life.	The system is only designed for healthy people didn't put into consideration diabetics, Pregnancy and other health issues
2014	*Lim-Cheng et al., 2014*	An Online Diet Counselling System	This work discusses Shed, our diet counselling system, that combines all the essential facilities of existing systems and provides live, on-the-fly healthy diet plan.	The system does not consider to take into consideration other bases like fats and carbohydrates, rather than just calories for weight management.

2.2 Related Works

KALORI HARIANMU (SISTEM PAKAR DIET) by **(**Firmansyah, *et al 2019),* this study aim to design an expert system which addresses individual diet based on calorie activities and body needs. This expert system uses a harmony search algorithm to determine the amount of food with Harris-Benedict formula to calculate the body's calorie needs. The limitation here is that there is a page used to change the data type of activity by the admin, where the Admin can only change activity data but cannot add activity data, no real time chat box, and also there is no room for food complaint by the users.

Dietos (diet organizer system) was developed to profile health status of users and to recommend typical foods in adaptive way in order to improve the quality of life of both healthy people and individuals affected by chronic diet-related diseases (Agapito. *et al,* 2017). The system was able to build a user's health profile, in particular it was able to profile users affected by hypertension, and diabetes besides healthy users. In particular, compliance to the diet in diabetes patients is an important issue due to the use of expensive aprotic food that needs time for separate cooking of meals, mending in poor palatability, monotony and lifestyle change for the patients.

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3. METHODOLOGY

Top down coding approach was employed in the application software implementation using PHP programming language, MySQL with AJAX. This involved dividing the implementation process into subunits or modules and each subunit being further divided into even smaller subs. This process of division is repeated until each unit is sufficiently small enough to be conveniently coded (implemented) from scratch as an independent entity that performs a clearly defined operation.

3.2 Architectural Design

The technological approach for implementing the Electronic Human Nutrition Analyzer is based on an architecture which provides the necessary framework for the services, components and interfaces using the client/server architecture. At the back-end, the vital services include the recording and analysis of an individual medical history for example the patient body mass, body size, BMR etc. The proposed Electronic Human Nutrition Analyzer is a web based tool that allows users to login to the system; the system allow the administrator (Nutritionist) to create and add food, it also helps client to determine their calorie recommendation (on the basis of whether to gain weight, loss weight or to maintain their present body size) in respect to the motive of the user and according to the analysis of the developed system. By so doing, the system is able to recommend to the user the food needed to meet up with the daily calorie target in other to achieve expected results. Figure 1 shows the architectural design of the developed system, Figure 2 shows the use case diagram, the interactive relationship between the actors and the system is indicated on the use case diagram. Figure 3 represents the flow charts of the developed system, it shows the sequence of flow of actions from start to stop. Figure 4 represents the Entity relational diagram of the database design of the developed system.

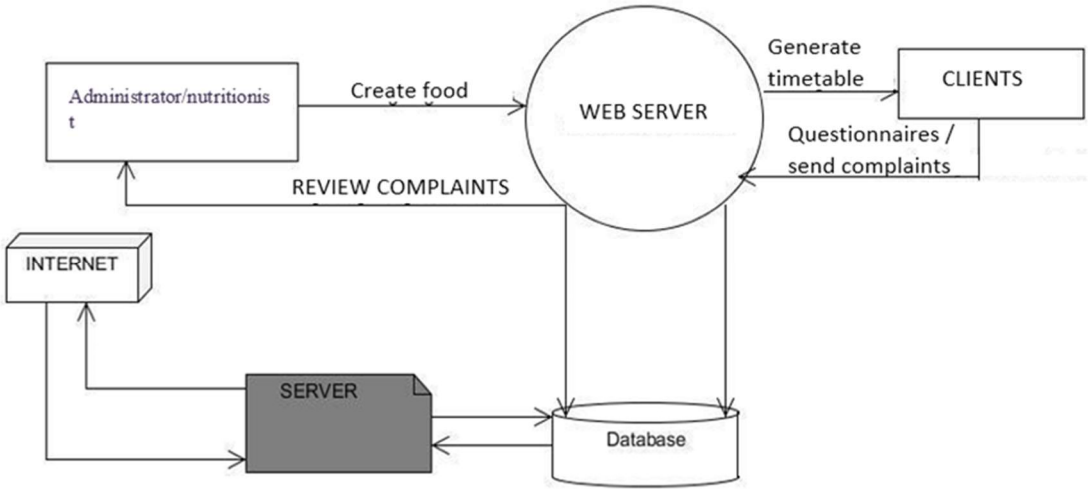

Figure 1: The Architectural Design of the developed system

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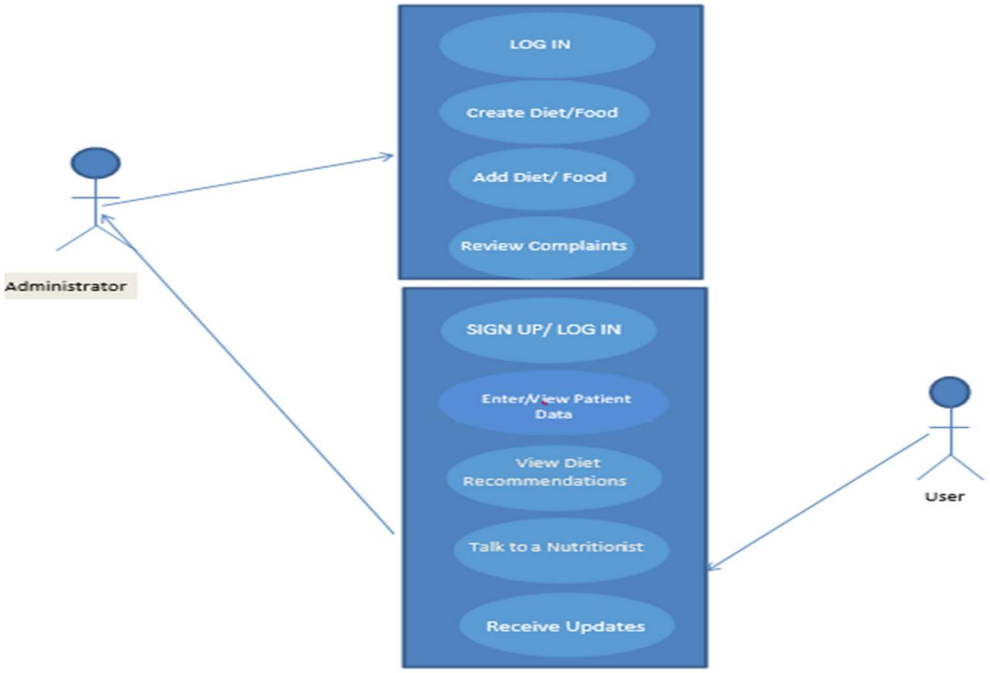

Figure 2: The Use case Diagram of the developed System

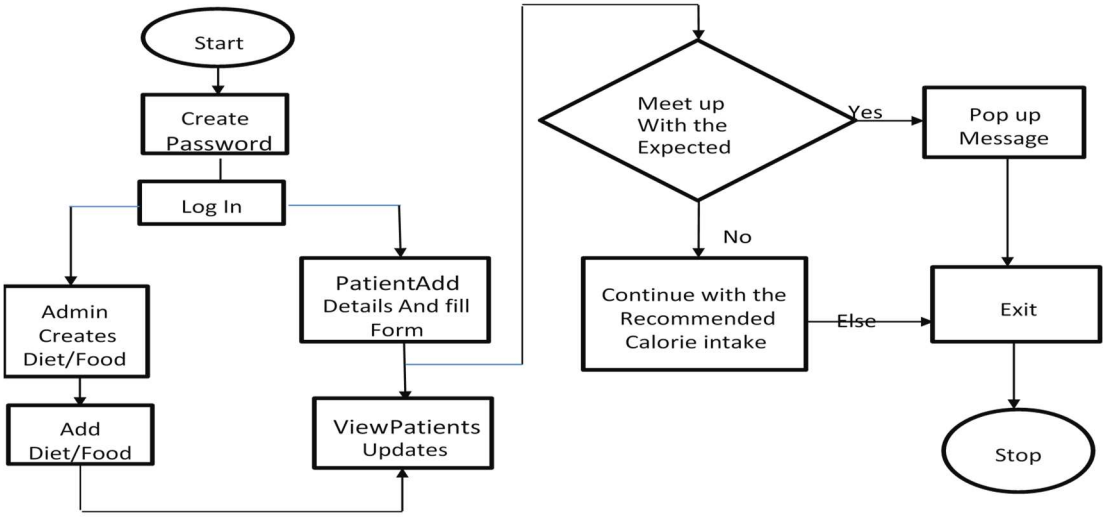

Figure 3: The Data flow diagram of the developed System

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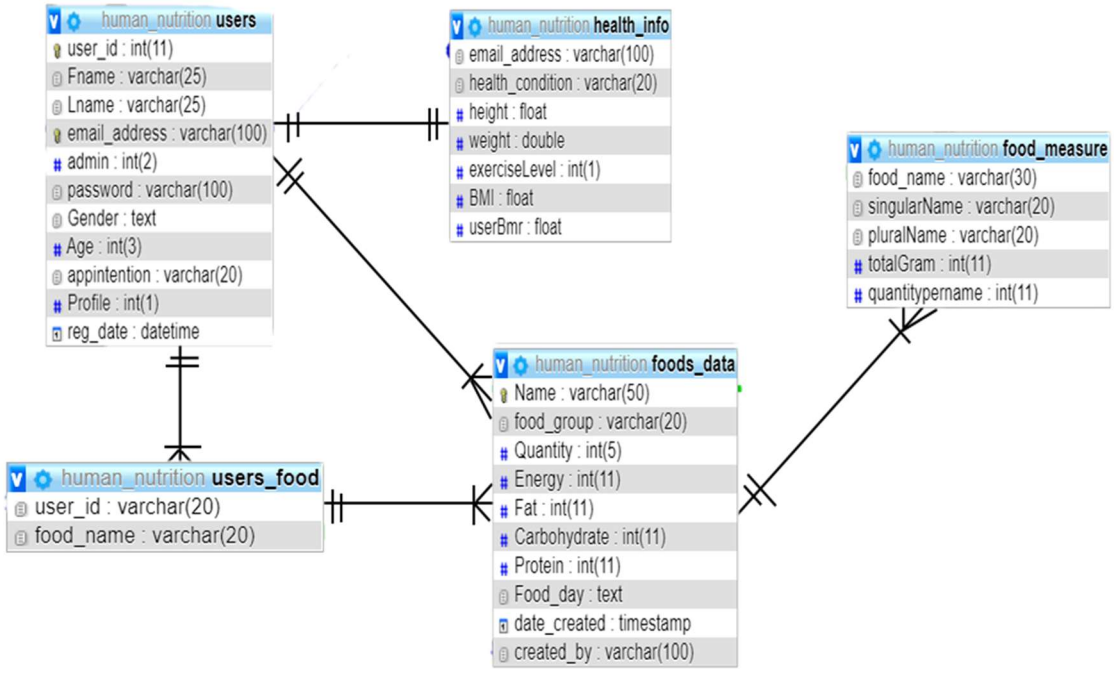

Figure 4: Entity relational diagram of the system

4. RESULT AND DISCUSSION

Description of the Developed Electronic Human Nutrition Analyser

The index page of the developed system is the users' homepage, where users can either signup or login into the system. New users are expected to create account by chosen a username and a formidable password in order to gain access into the services provided by the system, while returning users are expected to login with their chosen username and password. Users are to sign-up an account using their full name, email and password. The signup feature was done in such that users cannot set up a password by mistake, the user has to confirm the password and make sure the two do entries match. The sign-in feature includes an option to recover password, should the user forgets his chosen password.

The supply of matching username and password gives the user an access to the system dashboard, the first thing to be done is to complete personal profile set by supplying age and purpose of the use of the system. There are three options available for the user to choose from "Lose weight", Gain Weight", or "Maintain Weight", a user can only pick one. This selection of purpose of use would help the system determine the web appropriate calorie recommendation. According to W.H.O, the best way to lose or gain weight is to add or cut 10% off one's BMR every day.

Although, if according to the user's BMI, the user is overweight or underweight and the user's selection does not match the user web application intention then the system automatically gives the user a recommendation on the Dashboard. The user is also expected to give information on how often he engages in physical exercise in order to determine how active the user is. The options to pick from are "Sedentary", "Lightly Active", "Moderately Active", "Very Active" or "Extra Active". How often the user exercises is used to calculate the BMR of the user using Mifflin-St Jeor equation. The user is also expected to supply information of their physical appearance by giving their height and body weight. The last information to supply is the health condition of the user, whether diabetic or not. It should be noted that the user can always edit his/her profile details provided at any later time. For instance, if the Body Mass Index says the user is 'Underweight', but according to the user's goal (Web app use choice), he or she wants to Maintain Weight, the web application would further recommend to the user to gain weight rather than maintain it.

The daily calorie needs is the user's BMR, while daily calorie target is derived by calculating 10% of the user BMR. So this would either be added or removed from daily calorie needs i.e. DCT $\pm$ DCN would be used in food recommendation. The 'food data' showcases the daily food recommendation for the user, it gives suggestions (sort of diet prescriptions) that comprises of food categories namely; breakfast, lunch, dinner and fruits to be taken in order to achieve user's body/health goal. First of all this feature retrieves all the food that the user has selected in 'food data', then for each food a loop was created to retrieve each of the food's details. For example each food has a unique calorie value in terms of the amount of protein, carbohydrates, fat present. After retrieving all these and storing in them in an array, then the required BMI for the user is calculated, which is the user BMR +/- the daily target. But since the daily target already as '-' symbol indicating to lose weight, user BMR + daily target is only computed. According to standard health, 50% of human's daily BMR target should be eaten as breakfast because of the work calorie needs and 36% as lunch then the remaining 14% as supper. Therefore, the value of each percentage was calculated, then since an array is being used, any food in breakfast for example that has an energy value more than that the 50% specified would be unset.

The same is applicable to lunch too and dinner. If the user is not okay with this automated settings, he could request for the permission from the admin to go over it manually. To the choice of food, the user has to pick from food in each category pre added by the system admin. The system has aadministrator users with administrator privileges. An administrator is basically a nutritionist, has to follow the regular signup/login process but has a few privileges main users do not have. An Administrator can perform the following functions; He can 'create/add a food', basically he has the right to add a food to the database under a specific category, a regular user can only request for a food. Also a regular user has the right to pick a variety of food that has been added to the database this would be used in creating a healthy food timetable for him/her. It should be noted that all of the food that has been added were gotten from USDA database of food.

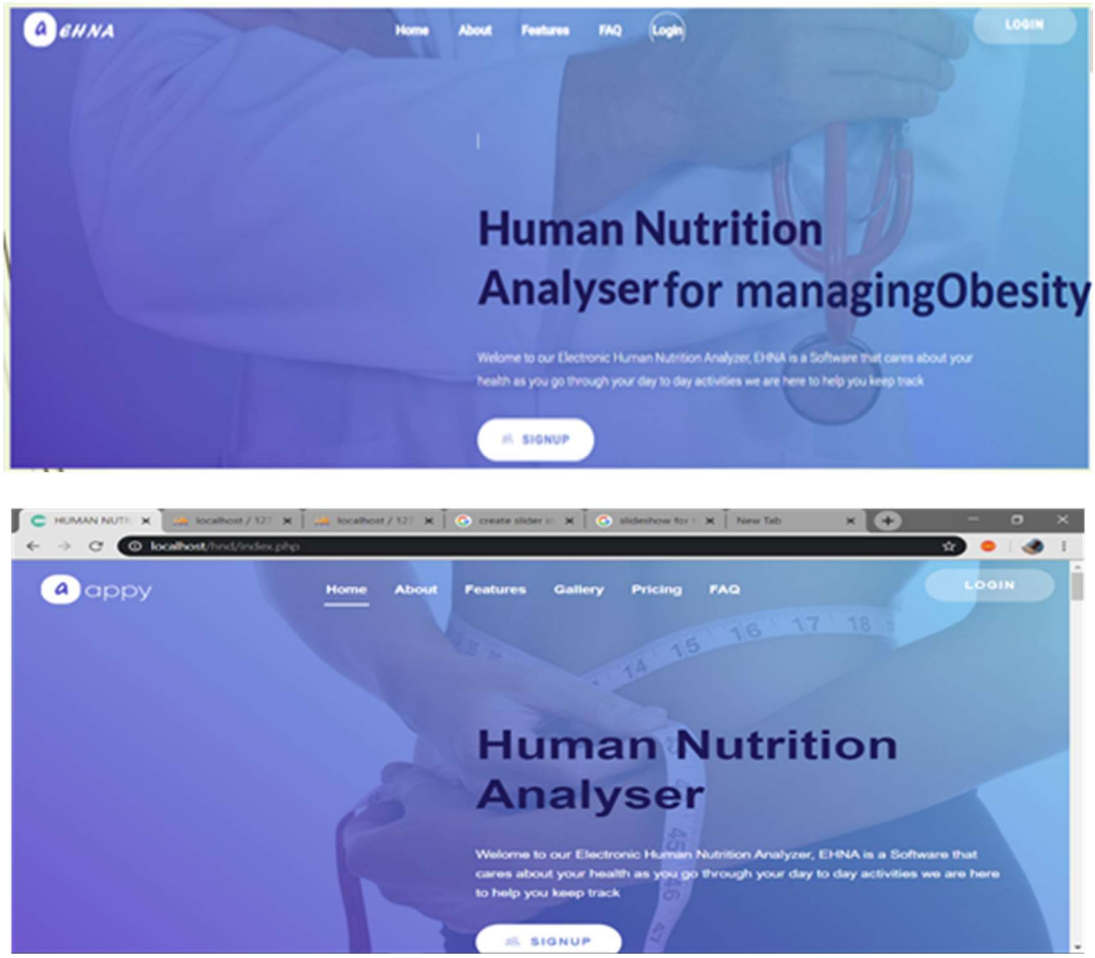

Figure 5: The Landing page for sign up or login

The system incorporates admin help (support) center, where users can chat to the admin on any health and nutrition issues they might be having. Aside from the live-chat, there is a system support ticket feature, where the users can raise a ticket (submit a complaint) to the system admin. The user has a support page where all complaints can be viewed and receive feedback from the admin, resolved issues are marked as "Resolved". The admin on his dashboard can have access to all complaints sent by all users, he can attend to them and give feedback to individual users. The last feature implemented is the daily exercise, the admin from his dashboard, post exercises that the users must engage. The users engage those exercises daily according to the instructions of the admin. Users and site visitors can add their emails by subscribing to newsletters and other vital information from the website. Figures 5-9 shows how the user navigates the system from account creation to enjoy a full use of all the web app's features.

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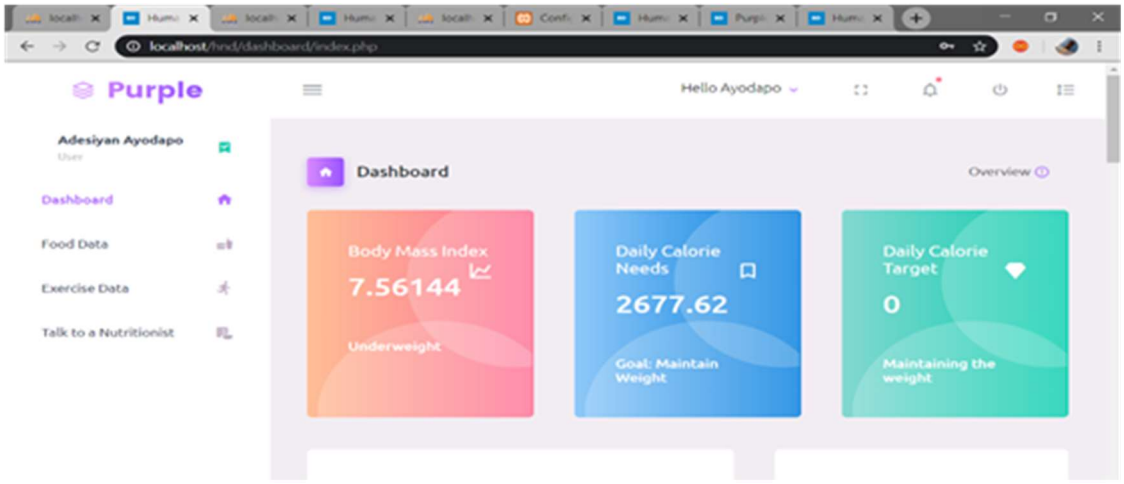

Figure 6: Dashboard showing a user that wants to maintain weight

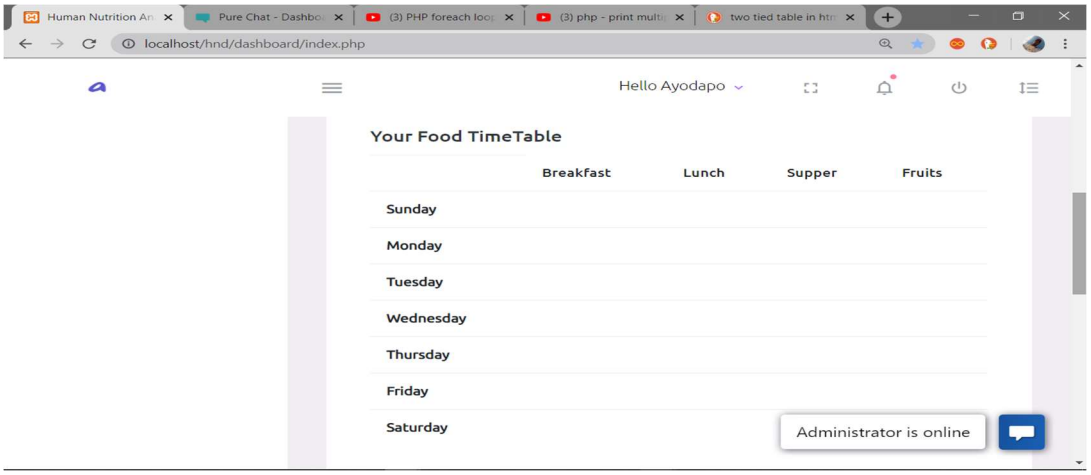

Figure 7: Users food time table

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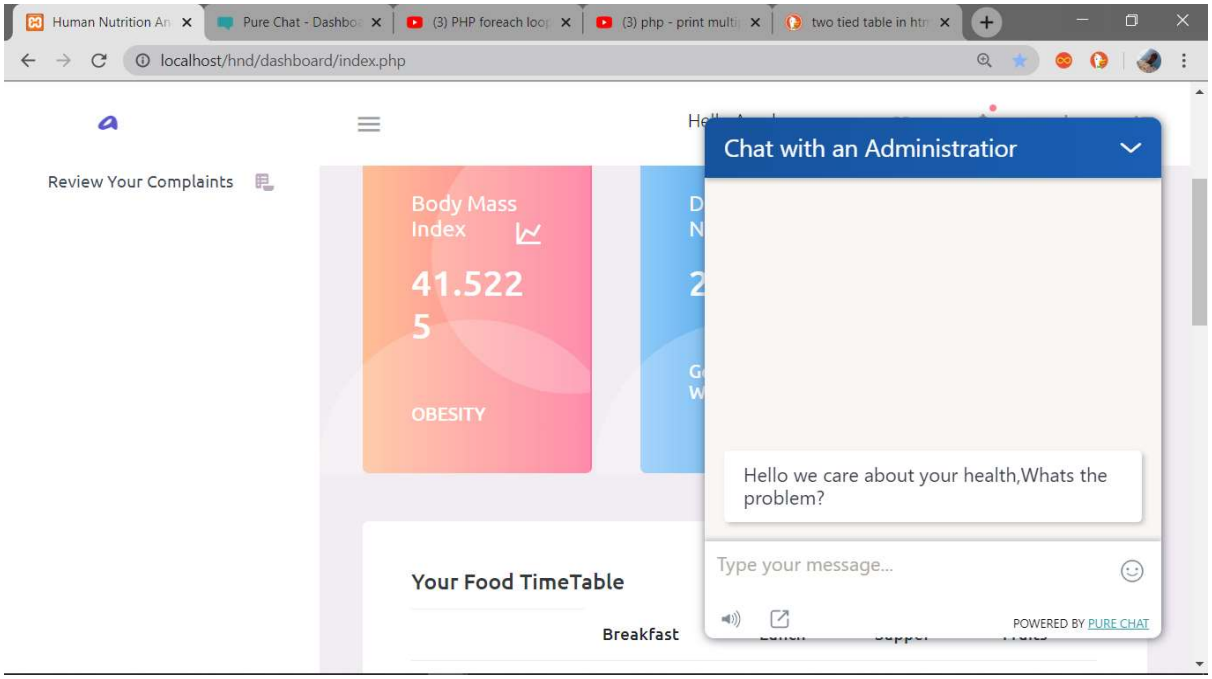

Figure 8: Live-chat with admin

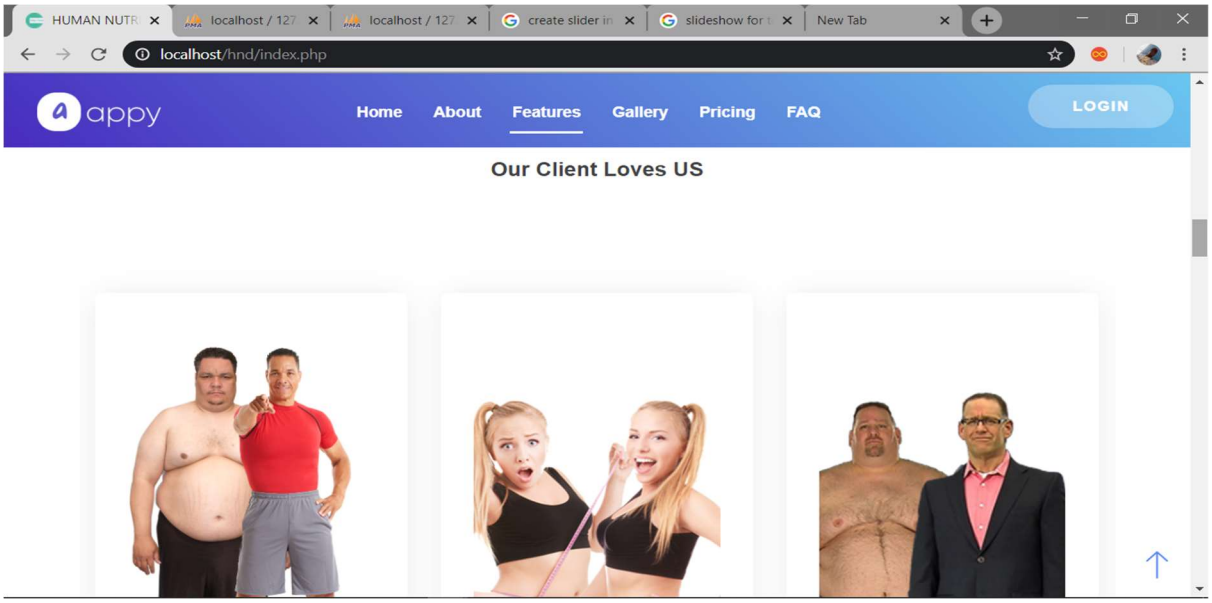

Figure 9: Featured clients

5.CONCLUSION

Every individual is unique and has varying nutritional and physical exercise needs which makes designing an expert system to provide support to individuals a challenging but worthy project. This research involved exploring existing nutrition analysis expert systems and related design issues, developing a better understanding of user requirements, translating those requirements into a prototype, and collecting feedback on the final design. The success of this project work meets the key longing of the ICT world to keep improving people's way of living. These mentioned advantages are given a louder voice by successful completion of this project work.

6. RECOMMENDATION AND FURTHER WORKS

More specifically, changes should be made to account for issues users faced when interacting with the developed web app prototype. The design could be further tested with a pilot study with potential users to determine whether using the app can impact real health outcomes such as improving food calorie management over time. In addition, the food calorie database portion of the app was not implemented. This would have provided a preliminary investigation into a food and calorie content related feature. Measuring and tracking food (especially carbohydrate) intake can be an onerous task for many users maintaining their weight, making this an area where creative research can be quite helpful.

REFERENCES

1. Agapito S. P (2017) Dietitian Food Quality and Safety Bachelor's degree Project on Nutrition Science Instituto Universitário Egas Moniz - Egas Moniz University Campus Portugal
2. Balquees A. A., Al-Gadidi, B. S., Al-Alawi, H. H., and Al-Busaidi, K. A. (2018). Developing a Nutrition and Diet Expert System Prototype. In 21 International Business Information Management Association Conference.
3. Brown L. , Rosner B. , Willett W. , and Sacks F. (2012) Cholesterol - lowering effects of dietary fi ber: a meta - analysis . Am. journal. Clinical. Nutr. 69: 30 – 42
4. Dharkar and Rajavat (2011). Web data mining for designing of Healthy Eating System. Available at http://interscience.in/IJIC_Vol1Iss1/paper4.pdf.
5. Firmansyah, E., Rosmawati, R., Fuadi, S., Fauzy, D., and Ramdhani, M (2019) "Design of expert system to determine the proper diet using harmony search method .December 2019 DOI: 10.1088/1742-6596/1402/7/077006
6. Lim-Cheng, N. R., Fabia, G. I. G., Quebral, M. E. G., and Yu, M. T. (2014). Shed: An Online Diet Counselling System Available Presented at the DLSU Research Congress 2014 De La Salle University, Manila, Philippines March 6-8, 2014

7. Nordqvist K. Karlsson, Magnus, Anders, Karlsson, Caroline (2008) "Physical Activity, Muscle function, falls and fractures" Food & Nutrition Research 2008/01 vol. 52; Iss.1 doi 10.3402/fnr.v52i0.1920
8. William R. Leonard (2012) "Human Nutritional Evolution" April 2012 DOI: 10.1002/9781118108062.ch7.pg.6,586
9. World Health Organization . *Overweight and obesity*. Geneva: World Health Organization; 2018. Available from: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight [Google Scholar]