Development of a Smart e-Coach Recommendation System for Obesity

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1. Introduction

By 2030, 8 out of the 10 leading causes of death will be linked to risk conditions of 'Lifestyle diseases', irrespective of gender [WHO]. Obesity is one of the major lifestyle diseases that lead to other health conditions, such as cardiovascular disease, chronic obstructive pulmonary disease, cancer, diabetes type II, hypertension, and depression. e-Health monitoring has become increasingly popular providing ICT-based remote and timely care support to patients and healthcare providers. In our research, we are working on a smart e-Coach solution to perform regular monitoring of health and wellness parameters related to obesity. We are going to develop a smart e-Coach system utilizing ICT, IoT and AI technologies to provide individual behavioral recommendations aiming at a healthier lifestyle to prevent obesity.

2. Method

We have divided our project work into the following task groups based on the well-established design-science-research methodology: (1.) Systematic literature review; (2.) Design and development (feasibility study, data collection, development of a recommendation engine, e-Coaching through interaction); (3.) Trial run; and (4.) Model evaluation with performance parameters (goal achievement). The feasibility study includes (a.) What to measure? [independent variables (e.g., demographics) and dependent variables (e.g., weight)]; (b.) How to measure? [spending time to explore and find the right instruments and methods]; (c.) Type of data to be collected [personal, physiological, contextual and behavioral] and determination of data collection process; (d.) Policy for the recruitment of the participants; (e.) Preparation of consent form; (f.) Ensuring data security and privacy; (g.) Use of a standard framework for eHealth intervention and determination of its efficacy. This research is deeply focusing on **"What to coach" and "How to coach", including** the design, development, testing and evaluation of observational evidence-based, context specific and individual obesity recommendations. We have targeted group size of participants to 50-99 in Norway within an age group of 18-40 (both male and female). Healthy participants will be recruited on voluntary basis following a physical condition check and a consent form

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[approved by *the Regional Komiteer for Medisinsk og Helsefaglig Forskingsetikk* (REK, https://helseforskning.etikkom.no/)] handover process during recruitment.

3. Results

The project is in an early design phase with the focus on the data collection part. We have designed a solution architecture to collect data from participants and store them securely. We are working on the 'eHealth ontology design' that is another important part in our study to support the structuring and to establish interoperability between different heterogeneous system components and networks. In this poster presentation, we will demonstrate charts and diagrams related to 'Health and Wellness Data Collection Process', 'Type of Data to be Collected', 'Solution Approach', and 'eCoach Recommendation plan for Achieving Goal'.

4. Discussion

The analysis of the problem space has shown three research directions that we will follow in this research: (1.) Data acquisition and its security; (2.) Health risk prediction; (3.) Personalized e-Coaching. We have targeted three main problems to solve in this research project: (a.) Creation of a compact, intelligible abstraction from massive, unintuitive raw, unstructured observations for health and wellness data (e.g. sensors, user preferences, questionnaires.) using an eHealth ontology; (b.) Protection against illegitimate access to the system and EHR; (c.) Development of a digital e-Coach system to model meaningful, observational and empirical evidence-based, context specific, automatic, personalized recommendations to achieve health wellness goals, and to advise about physical activity, nutrition, medication, and other relevant factors for healthier lifestyle. The digital e-Coach system will capture physiological (blood pressure, heart rate, blood cholesterol, blood glucose, height, weight), contextual (time, location, environment, social), and behavioral (activity, nutrition, sleep) data over time from secure wearable sensors, customized questionnaires, interviewing, apps, feedback forms and minimal-invasive way. Time series analysis of collected data will help to determine day-by-day random variation in lifestyle, weekly variation, seasonal variation, variation in diet, meal pattern, true changes in diet over time, and behavior change. In the recommendation process, participants will be given personalized, evidence-based, contextual recommendations and motivation (related to activity, nutrition) for long-term goal evaluation to keep BMI in the range of 18.5 - <25.

5. Conclusion

We are working on the assumed hypothesis that an effective e-Coach mechanism can reduce the obesity risk with automatic generation of personalized recommendations. Integrating offline (human) coaching psychology to an e-Coach, selection of an effective recommendation plan and improving it further to reach the convergence criteria (overweight to normal weight) is a computationally hard problem that we have planned to solve in our research with eCoach behavioral (diet, activity) interventions.