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Evaluation of the MMCT App Based on the Octalysis Gamification Framework

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Abstract

Gamification has tremendous popularity among the various domains such as e-learning, business, and healthcare. It is well documented that many applications are being developed to assist the patients to modify their behavior and most of them are designed to engage and motivate users to increase adherence, using gamified techniques. However, academic research and management pay little attention to the challenges of developing, implementing, managing, and maximizing gamification methods. In this research work we have presented a medication management application based on a gamification concept that provides reminder tools for patients who have difficulty in remembering their regimen. Currently, we have evaluated the efficiency of the platform in support of the motivating and engaging application of mHealth (MMCT) based on the Octalysis Gamification Framework. The latter contains several elements of the game design that can be used to enhance their experience as required in each stage of the player's journey. We conclude by discussing the following section on gamification in addition to the guidelines for further development of the Octalysis method.

Keywords: Gamification, mHealth, Octalysis framework, MMCT (My med care tool application), reminder.

INTRODUCTION

The introduction, in non-game contexts, of game elements is commonly called "gamification" (S. Deterding, ACM New York, NY, USA (2011)). The technology used to extract motivational and engaging elements found in gamification (J. Hamari, 2014) was gradually adopted and applied to real-world constructive or health-care activities. Games are all over the place. Generally, young people are considered as gamers. Nevertheless, the actual statistics could be impressive which shows that a significant number of gamers are 35-year-old average gamers among which-nearly 70% of whom are over 18 years of age and about half of whom are the women, which means that there are more female adults playing games than males under 18 (Gamers Demographic, 2017). Everyone can enjoy games- if there is a better reason to do so. Conversely, the perception of the word 'gamification' is that it is related to PBL (Points, Badges and Leaderboard), and this misconception leads people to think, of scoring points and putting them in a product or badges that make it fun and exciting (YK, Fremont: Octalysis Group; 2016.). But today gamification has become a buzzword, and a lot of people and organizations have started to take care of it, but very few people

truly understand. However, Gamification is beyond of just game designing. Essentially, it's about taking the aspects of games, like challenges, feedback, competition, and applying them to non-gaming environments to solve a problem or engage a user (Goodhue, 25 May 2017). It is a technique for motivating people to change their behavior through positive reinforcement. Medication non-adherence is a massive problem today. According to reports, practically everyone has a medication prescription and about 60% of the people do not take their medication as prescribed. (Noman Haq, June 2017). The term "medication non-adherence" is also known as the "silent killer" because it is estimated that non-adherence caused 100,000 avoidable deaths (Fred Kleinsinger, Perm J. 2018; 22). People are unaware that they are dying for not taking their medicine on time. In previous studies, the data have shown that the non-adherence is due to forgetfulness, high cost, and clinical difficulties which have significant percentage ratios like 69%, 16% and 15%, respectively- (Emilsson M1, 2017).

Surprisingly, due to busy or packed schedules, the rate of underage people is often not as good as that of the elderly who are non-adherent to medication (Crawshaw, 2016). Most of the mHealth applications have used the "gamification" principle to improve user participation and motivation in their applications. On the other hand, due to literature gap, it is unclear that how the developers have implemented gamification techniques in their products (Shaimaa Ewais, August 2015). In this paper, we designed a gamification-based application and evaluated the application based on Octalysis framework.

In our study, we have discussed the design of gamification-based application, the goal is to remind the patients of their timing of dosage (Section 1). We have presented a gamification framework that includes several game design elements that can be used to improve interactive player/patient experience (Section 2). We have evaluated the psychological motivation by using the Octalysis framework (Section 3). The paper concludes the further development of the application for mHealth addressing the Octalysis process and future aspects of gamification. The main objective of this research is to assess the MMCT app using the octalysis framework to determine how well we implemented the gamification principle. Finally, the MMCT application has been mapped on an octagon shape that reflects the Octalysis framework.

My Med Care Tool (MMCT) Application Design:

Presently, the world relies on gadgets, particularly smartphones, development, and technology-dependent lifestyles. It allows us to make better use of technology to make it valuable and help to survive in advance world in many ways. The significant concern of this research is that patients forget to take the prescribed drugs in the right proportion and at the right time. Medication non-adherence is a complicated and confusing healthcare issue. Adherence is defined as the ability of patients to follow guidelines for prescribed therapies (Jacqueline G Hugtenburg, 2013). Patients must take their drugs individually, and non-patients must be more vigilant concerning well-being and health management, regardless of their age (Noman Haq, June 2017). In this section, we describe the implementation of the MMCT app. We introduced an application called MyMedCareTool (MMCT). The ideas of designing the MMCT app is to change or improve health and well-being behavior. The application includes various activities, such as creating an account, managing multiple patients, setting up a schedule, setting up a medication kit, tracking history, receiving reminders, earning points, winning healthy tips.

Gaming components in the MMCT app is using the self-report of the intake of drugs. As the user accumulates points in this app, they're going to level up and earn a bonus point. The use of the MMCT app makes the possibility of positive rewards adding as a benefit of a healthy lifestyle and medical treatment.

Database design:

Analysis diagram of the MMCT app is shown in Figure 1, which illustrate how medication reminder entities (patient, medicine kit, schedule, and reminder) and gamification elements entities (points, leaderboard, badges, levels, and rewards) are connected to one another inside a system.

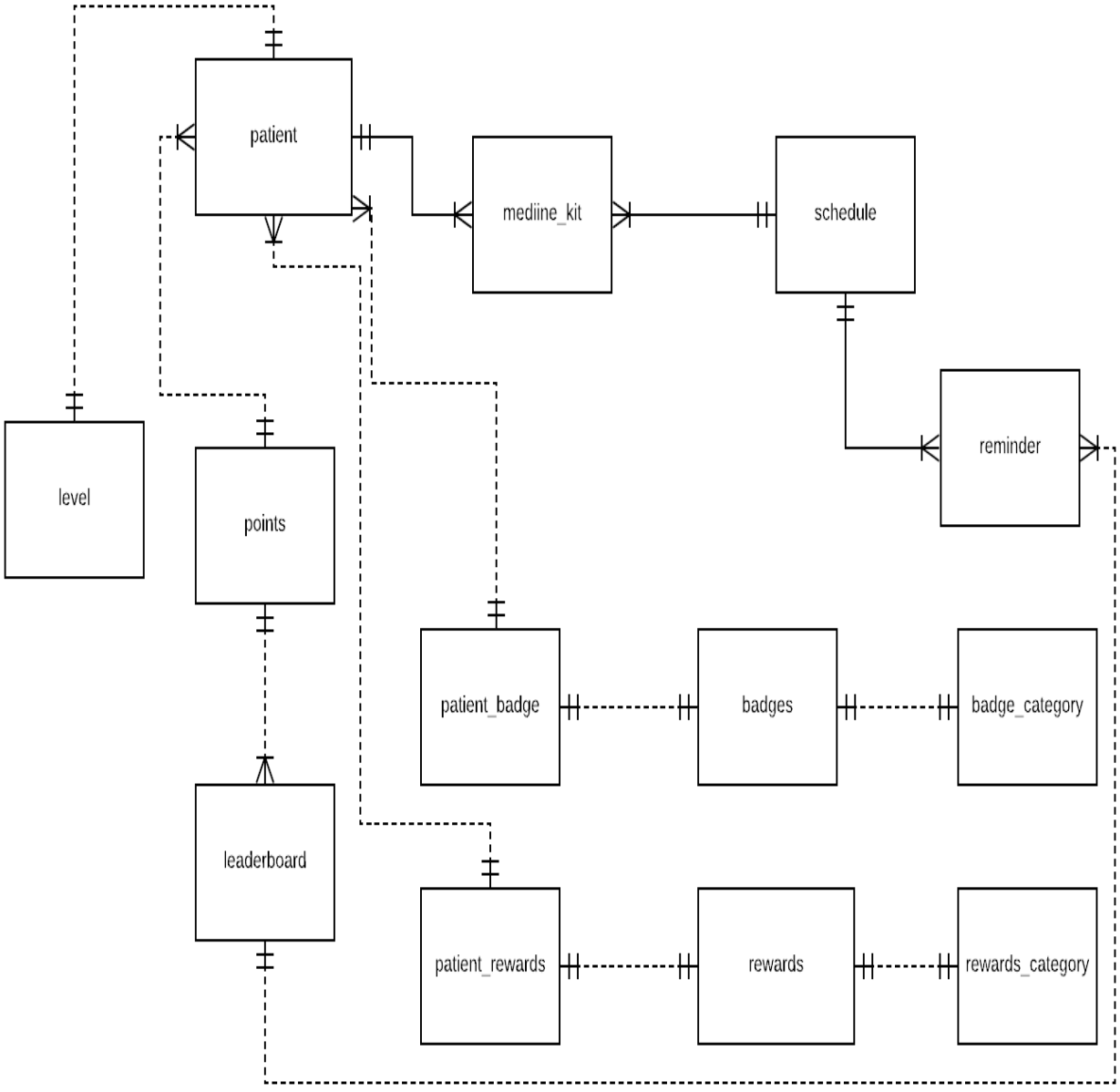

Figure 1.
Entity Diagram of the MMCT app

Class diagram:

To develop the MMCT app, we require information on patients, medicines, and prescription schedules. Class diagram of the MMCT app is shown in Figure2.

Figure 2.
Class Diagram of the MMCT app

User Interface of MMCT App:

The front end of the interface is shown in the following screenshots. We use Ionic-4 on front-end, Spring-boot for back-end development and the database tool, for MySQL.

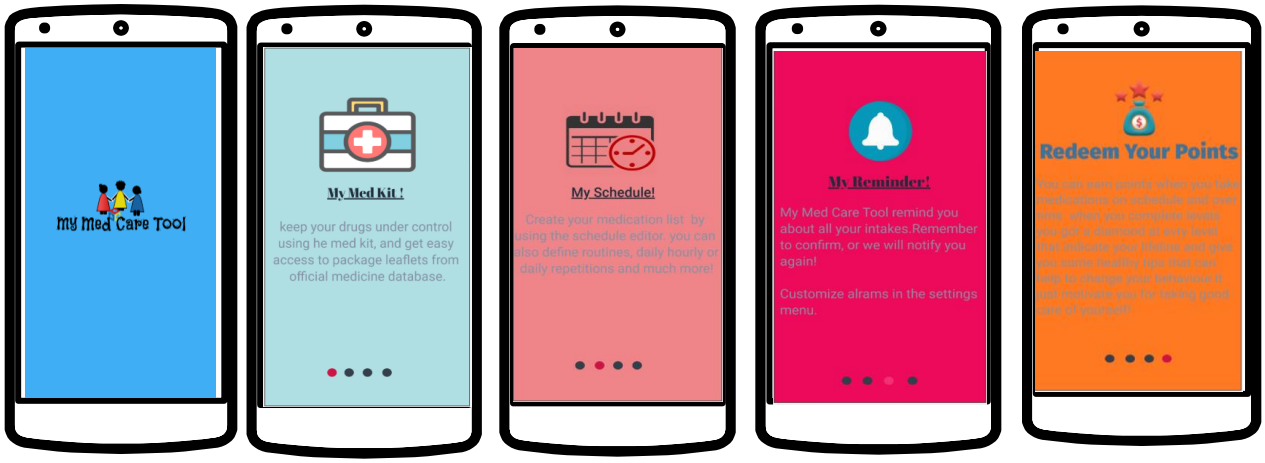

Figure 3.
Splashes images of the MMCT app

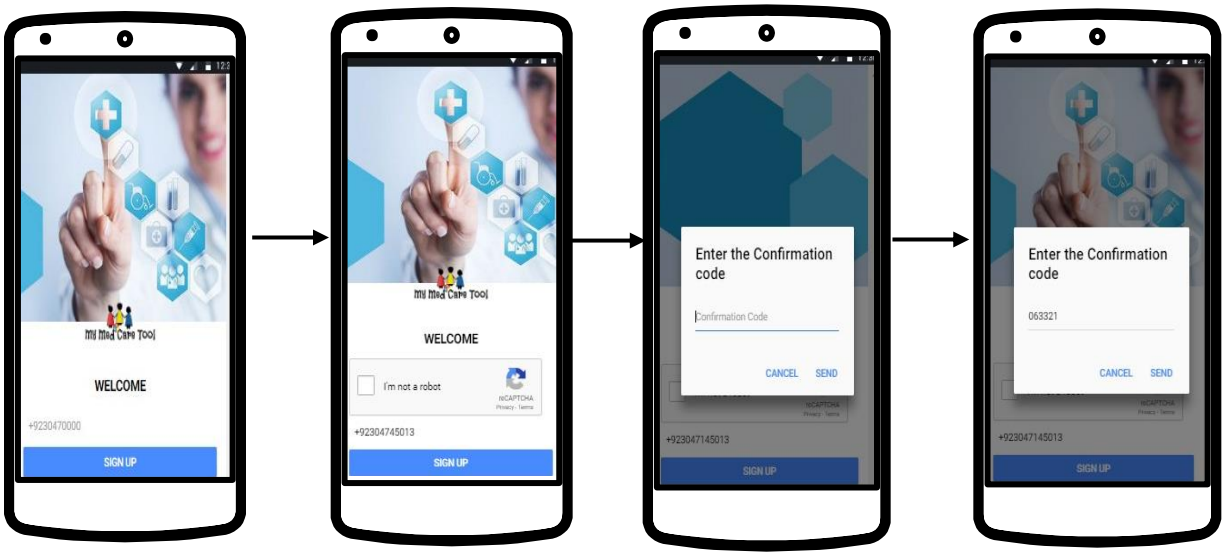

Figure 4.
Login Screen images of MMCT App

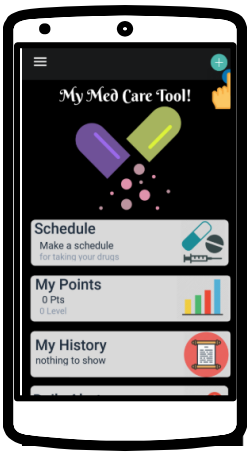

Figure 5. Home Screen image of MMCT App

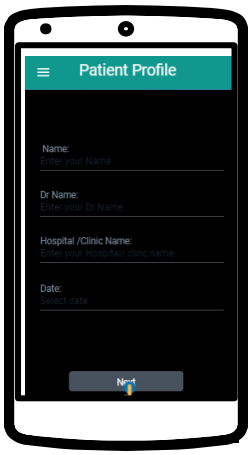

Figure 6. Patient Info Screen image of MMCT App

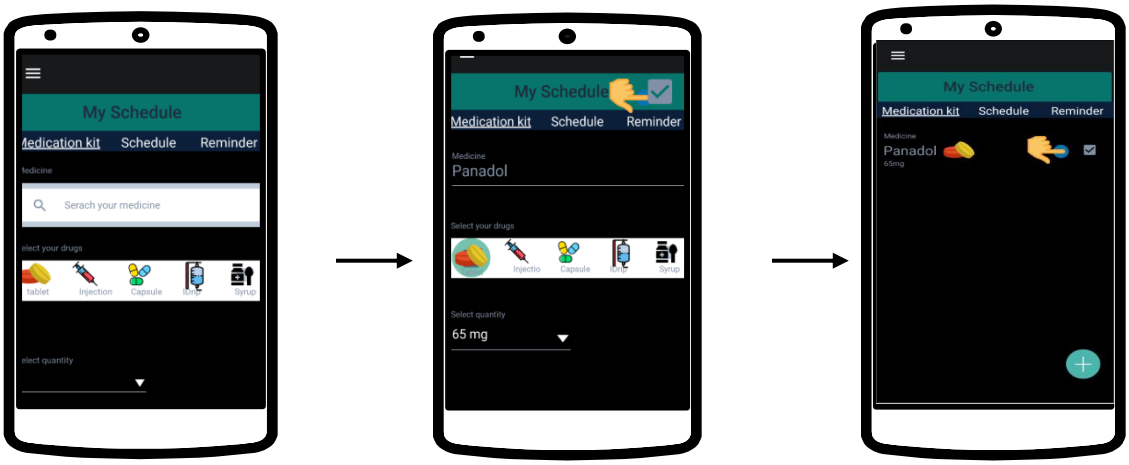

Figure 7.
Medication Kit images of MMCT App

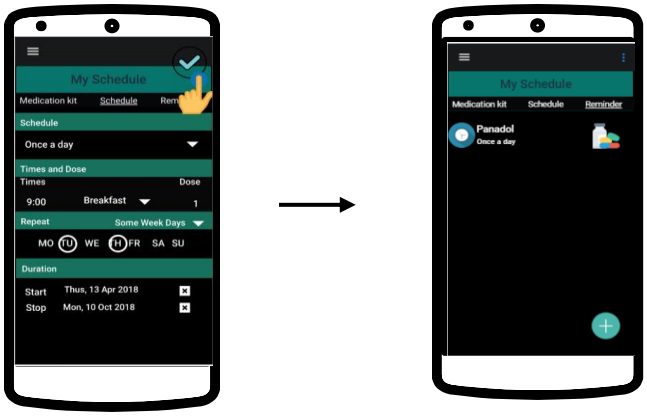

Figure 8. Screen images of My Schedule and My Reminder

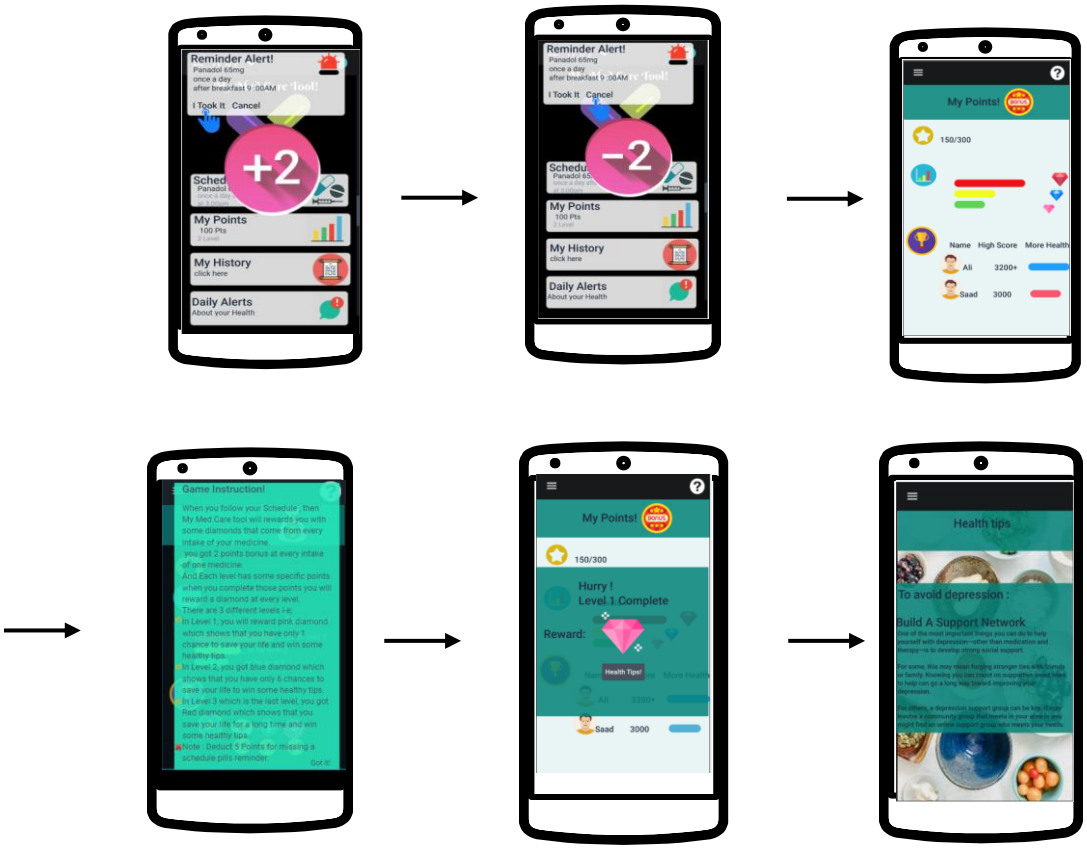

Figure 9.
Screen images of Reminder Notification, My Points, Game Instruction, Rewards System

Octalysis Framework

Octalysis is a process by which a series of gamified components or cognitive drives can be used in User-centered design (UCD) to make an application attractive and motivating (Daphne Economoua, 2015). The framework shows that almost all games are good because it appeals to some core drives within humans that attract players to certain behaviors. The Octalysis structure consists of 8 motivating factors, based on the form of an octagon.

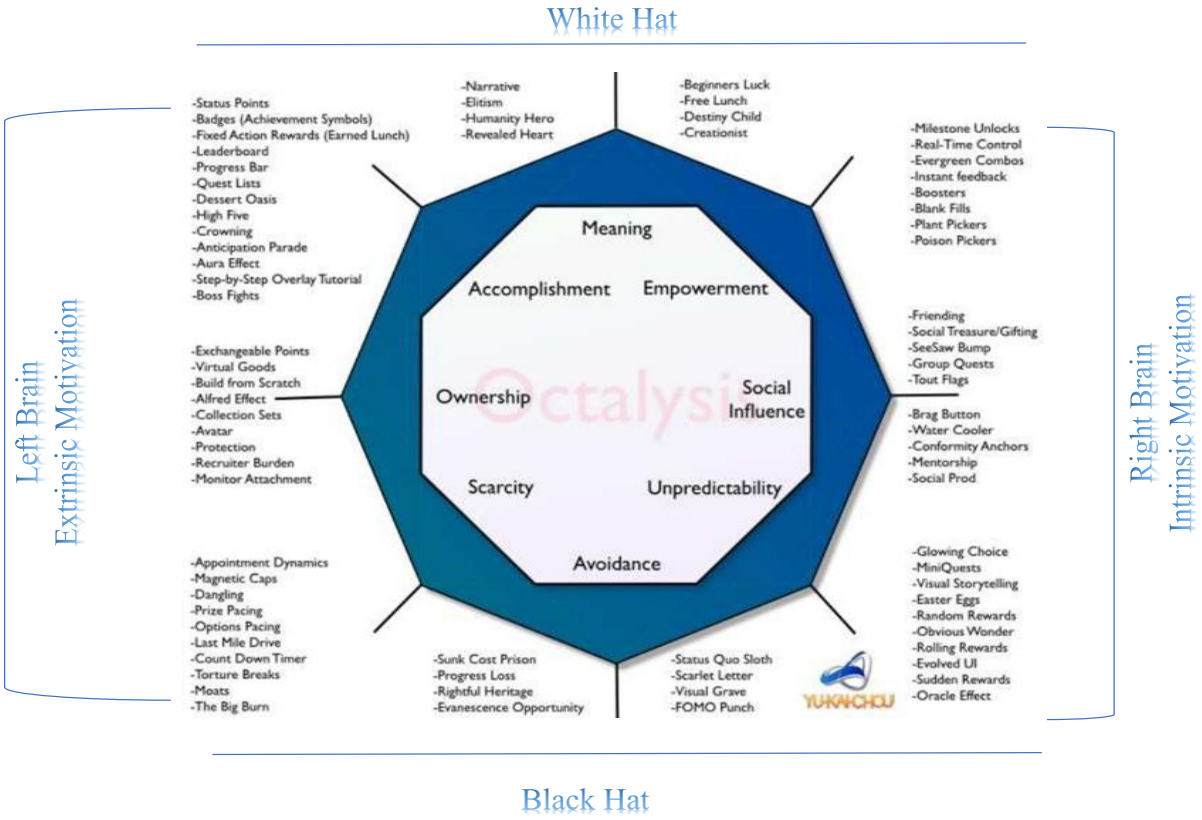

Figure 10.
Screenshot of the Octalysis framework (Chou, Accessed 25 May 2017)

The eight core drives of gamification are:

- Epic Meaning and Calling
- Development and Accomplishment
- Empowerment of creativity and Feedback
- Ownership and Possession
- Social influence and Relatedness
- Scarcity and Impatience
- Unpredictability and Curiosity
- Loss and Avoidance
- Epic Meaning and Calling is a drive where people are motivated because they are engaged in something bigger than themselves.

- Development and Accomplishment Development and achievement mean you are motivated because you feel like you're getting better, the level is getting up, and you're mastering it.
- Empowering creativity and feedback are a very engaging process, where users use their creativity to test different combinations of strategies and see their feedback.
- Ownership and possession are motivated by the fact that users believes that they own something, that they want to change it, preserve it, and that want more. This basic drive is based on virtual goods, virtual currency, and it motivates the user to accumulate wealth within the system.
- Social influences and relatedness are part of what other people believe they are saying and include every social element, including guidance, integration, friendship, competition, and jealousy.
- Scarcity and Impatience's are what motivates people because it is not immediately or easily obtainable in term of lacking something that they can't have.
- Unpredictability and curiosity might reveal unexpected consequences and necessitate taking a gamble.
- Loss and Avoidance Loss and evasion refer to reasons that lead people to avoid circumstances that they do not want to have (for example, losing a life in the game).

These are 8-core gamification drive systems that means everything that you do which is based on one or more of these core drives. The reason behind octagon shape is, the Left side drives are called Left brain core drives which symbolically means extrinsic motivation that means things to do for aims, purposes, and rewards. The Right-brain drives are about intrinsic motivation, which means things like you just enjoy doing it without a need of reward for your imagination and hanging out with your mates, and you do not have to earn anything by hanging out for suspense of unpredictability (Chou, Accessed 25 May 2017).

The top of the core drive is more optimistic and called white hat gamification techniques (YK, Fremont: Octalysis Group; 2016.). This top part of the drive indicates that the user is trying to make better use of the creativity and users can grow if they are doing something because they feel that they are a part of something bigger (Chou, Accessed 25 May 2017). The bottom part of the drive, Black Hat, means doing something to prevent a loss. The positive and productive account should be taken of all 8 drives so that everyone will be more happy and healthier. In the next section, we used the Octalysis framework to evaluate the MMCT app to identify the concept of gamification. This study gives an example of how effective the program can promote initiatives that build the engaging and inspiring opportunities in the healthcare sector.

Evaluation of the MMCT application based on the Octalysis framework.

To build a game mechanics and game design strategies to engage people and inspire them to achieve their health goals involves detailed analysis, reasoning, testing, and adjustment. This section presents the preliminary evaluation outcomes of the MMCT App against the core drives of the Octalysis Framework (Section 3). Octalysis is an online tool that allows diagnostics to be tested on a scale of one to ten against Octalysis core drives, while 10 being the "best" and rating that how well these drives were implemented based on the overall scoring in the system/process. The purpose of this evaluation was to

analyze the features of the MMCT application for customized game applications to meet specific healthcare requirements (Section 2).

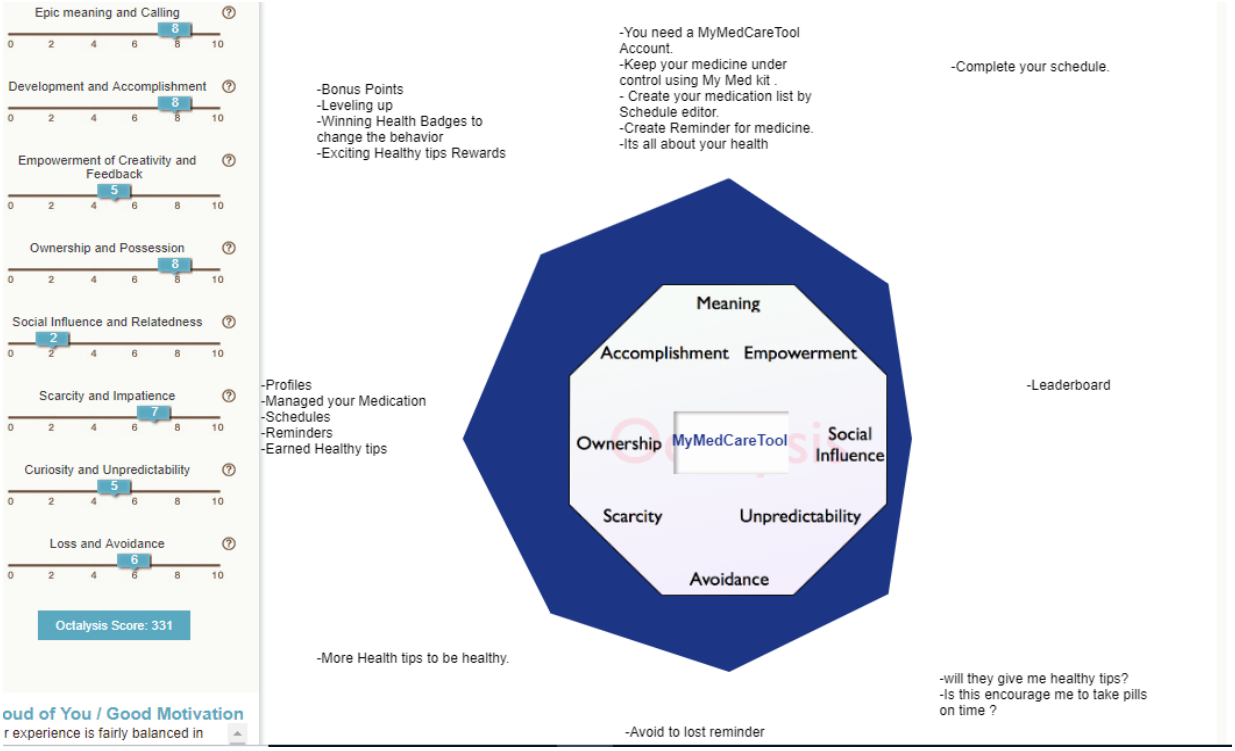

Figure 11.
Screenshot of the average score evaluation of MMCT app based of Octalysis.

The evaluators use the MMCT application to familiarize themselves with it. Below are the reasoning reviewers ' summaries and the average grade for each core drive, followed by a graph showing the correlation between these evaluators, Figure 4.

My MedCareTool (MMCT) is a gamified application that allows users to track medicines every day. For instance, the MyMedKit Tool will track the medicines, MySchedule will generate a daily medicine editorial chart, etc., the application provides patients with high-level information and alerts about interaction with medications they would like to use the program. Thus, the application is therefore considered to be a device that promotes meaningful significance that's the epic meaning and calling. Development and Accomplishment: The gamified application is designed for patients seeking compensation for adherence to their medication. After the data collected over a while, MMCT app allows users to level out and earn bonus points and reclaim motivation (e.g., healthy tips) to demonstrate their results. Empowerment of creativity and feedback: The empowerment of creativity and feedback is encouraged, for example, receiving instantaneous feedback that completes the plan.

Ownership and Possession: The platform's entire concept revolves around virtual commodities and currencies, which allow us to create riches within the system. The drive helped the MMCT app handle profile care, medication, and medication alarm and improve health. Social influence and relatedness: Social influence and relatedness are fascinating concepts with potential health benefits as MMCT provide a leadership

feature in which "you can compete with your friends to improve health". The platform supports social influence and interaction slightly. Scarcity and impatience-- Lack of resources or entities can motivate people to use it wisely or take steps to achieve it. Players on this platform are looking forward to their bonuses (e.g., health tips). Unpredictability and Curiosity: The visual narration comes with unpredictability and curiosity because they don't know what is going to happen next in the MMCT app. Players in this platform always think about their healthy rewards like they're going to give me a health tip and think about their health benefits like Is this something that motivates me to take my medications on time? Loss and Avoidance: Negative marking and bonus point reductions might be a fascinating approach for increasing or maintaining engagement in the MMCT app. The average score for the MMCT app's Octalysis tool was 331, indicating that the platform can generate a balanced application using both fundamental White Hat and Black Hat drivers. According to the results of the MMCT app evaluation revealed that the gamification aspects extrinsic motivation such as development and accomplishment, ownership and possession, scarcity and impatient had significant influence on patient behavior, while some of the factors of intrinsic motivation such as empowerment of creativity and feedback, social influence and relatedness, unpredictability and curiosity had shown a slightly lower influence on patient behavior. Hence it demonstrates a good balance between left-brain and right-brain drives, indicating that intrinsic and extrinsic motivation is being balanced.

CONCLUSION AND FUTURE WORK

In this research work, our team have presented a gamification-based application for the department of healthcare. Most of the other apps have already incorporated game elements into their designs. However, the main aim of developing the MMCT app was to see how successfully we could incorporate gamification techniques into the app. To do this, we used the octalysis framework to review the app that can contribute to inspiring and engaging experiences. And result revealed that the MMCT app was good balanced with both white hat and black hat. In addition, the MMCT app has a strong balance of left brain and right brain core drives, indicating that it has a solid balance of intrinsic and extrinsic motivation. The game designer's main goal is to get players to be more active to finish the task by using octalysis drivers on their system and just be careful before the development of the gamified app because poorly conceived extrinsic motivation might destroy intrinsic motivation. To begin, they should recognize that different types of consumers will be motivated by different motivations, and their products should be able to accommodate all of them. The evaluation process revealed that future efforts should focus on enhancing health by incorporating additional game features. For example, the platform should be extended to encourage social influence. In addition, it is, therefore, necessary to test the main drivers of the octalysis method to evaluate the effectiveness of medication adherence.

DECLARATIONS

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Conflicts of Interests: The authors declare no conflict of interest.

Consent to Participate: Yes

Consent for publication and Ethical approval: Because this study does not include human or animal data, ethical approval is not required for publication. All authors have given their

consent.

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