PERSONALIED APPLICATION FOR DEMENTIA PATIENTS IN CONGNITIVE REHABILITATION WITH CONTINUOUS MONITORING

Project Id: 2020-017

Project Proposal Report

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Department of Software Engineering

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DECLARATION

We declare that this is my own work and this proposal does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other university or Institute of higher learning and to the best of our knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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ABSTRACT

Sri Lanka has one of the world's fastest ageing populations [1]. According to the recent predictions, 20% of Sri Lankans will become over 60 years in 2020 [1]. Therefore, illnesses like Dementia will become more prevalent in the community. The current medicine can’t cure this Disease [2]. However, during the early stages like mild or moderate in Dementia, there are several ways to assist those patients to keep their brain active by slowing the symptoms of one stage to the next stage for a little longer.

Due to the frequent usage of smart devices at present and according to the requirements of the doctors the implementation of new application including games and activities for increasing the memory power of Dementia patients will be beneficial. There are number of brain training mobile applications in the world that could be useful to develop human concentration, attention and all sorts of brain activities but there isn't suitable mobile application for Sri Lankan culture because most of the dementia patients in Sri Lanka are senior citizens and they are not proficiency with the English language and also the available current applications are not free and the users must pay a fee for using those applications. The people who are experiencing early signs of dementia or the patients in mild or moderate stages in dementia can use this application step by step and boost their condition with continuous monitoring. Also, the Doctor of those patients could be used to check the patient's records which include the score that they have gained and the performance of the levels that they have passed.

The implementation of the application will be including mind games based on reinforcement learning and activities by using voice to text communication, along with the supervision and recommendation from a Consultant Psychiatrist in Sri Lanka.

Keywords: Dementia, Reinforcement Learning, Psychiatrist

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ABBREVIATIONS

CNN	Convolutional Neural Network
ASR	Automatic Speech Recognition
RNNs	Recurrent Neural Networks
HMMs	Hidden Markov models
GMMs	Gaussian Mixture Models
CTC	Connectionist Temporal Classification
SER	Speech Emotion Recognition
MMSE	Mini-Mental State Examination
RL	Reinforcement Learning
AD	Alzheimer's Disease
SARSA	State Action Reward State Action
DQN	Deep Q Network
DDPG	Deep Deterministic Policy Gradient
MMSE	Mini-Mental State Examination
SDLC	Software Development Life Cycle

1. INTRODUCTION

With the growth of the machine learning techniques, most of the people are used to use this technology in their relevant requirements of the application. There are wide range of mind exercises in the world. This system will be brought out the mobile application including different types games or activities under the cognitive functionalities like Attention and Concentration, Executive Functions, Language, and Memory. A syndrome like Dementia is a symptom of several underlying mental or brain disorders. There are number of Dementia categories. But there is no exact medication for those categories. Only the way is to assist the patients who is under the mild and moderate stages to keep their brain active using different activities by slowing down the stages one by one. Due to the frequent usage of smart devices in this present society, implementation of a mobile application including games or activities to increase the Memory power of Dementia patients will be beneficial.

Using the technologies of machine learning like Reinforcement Learning, NLP and CNN, the implementation of the games and activities will be done. Next level of this games or activities will be predicted with the usage of Reinforcement Learning by learning from the user. And some of the games which is included in this game will be implemented on voice to text communication by using NLP, CNN. The most important of the application is to follow the advancement during the time that they are spending at home. While the patient is away from the doctor, the patient can restore their subjective functionalities from their own by using this application. This will be an incredible assistant for the patients since there is not suitable cure to the Dementia.

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2. Background and Literature Survey

2.1. Background

Dementia is a disorder wherein there is decay in memory, thinking, conduct and the capacity to perform regular exercises. Even though dementia, for the most part, influences more seasoned individuals, it's anything but an ordinary piece of maturing. Around the world, around 50 million individuals have dementia, and there are about 10 million new cases each year. Dementia is one of the significant reasons for incapacity and reliance among more established individuals around the world. Dementia has a physical, mental, social, and monetary effect, on individuals with dementia, yet additionally on their cares, families, and society on the loose. Dementia influences every individual in an alternate manner, contingent on the effect of the disease and the individual's character before getting sick. The signs and side effects connected to dementia can be comprehended in three phases.

1. Early stage
2. Middle stage
3. Late stage

There is no treatment as of now accessible to fix dementia or to adjust its dynamic course. Various new medications are being researched in different phases of clinical preliminaries. In any case, much can be offered to help and improve the lives of individuals with dementia and their cares and families.

While the accompanying applications won't fix the condition, they can help control their loss of memory and autonomy. This rundown of applications is a long way from thorough, and there are a lot of progressively other extraordinary applications out there. Timeless, as per their site, "is a first-of-its-sort, straightforward, simple to utilize the application for Alzheimer's patients to recall occasions, remain associated and drew in with loved ones, and to perceive individuals through man-made consciousness-based facial acknowledgment innovation." The application is anything but difficult to utilize and encourages them to recollect occasions, remain associated with loved ones and cause them to recognize faces and names. It additionally helps manufacture, or if

nothing else keeps up, Dementia understanding self-assurance and regard [21]. Decoder is another game created by Cambridge University for fixation and consideration preparing. Decoder is story based and simple to play. Iridis is somewhat not the same as the previously mentioned versatile applications. It is a portable application planned by The University of Stirling for dementia guardians. It gives a great deal of realistic guidance for dementia patients' families and guardians, encouraging them approaches to manage patients' eating regimens and everyday schedules [22]. The Lumosity application includes a blend of more than 25 subjective games that are planned for "working out" the mind. The games challenge memory and consideration by drawing in the client in like manner psychological and neuropsychological assignments. While not cheap, this application is at present utilized by more than 70 million individuals around the world. The Mind Mate application is maybe conclusive in dementia applications. It is in excess of a device however is increasingly like a companion. It is consistently there for the patient. It can help your adored one remain centered with exercises like memory, critical thinking and consideration just as working with their speed. It likewise gives diversion through eight intuitive games that are fun while giving learning materials to recent developments in medication [23].

The wide collection of accessible applications for a general crowd joined with the restricted accessibility of applications explicitly produced for individuals with dementia indicates that careful thought is required to choose usable applications for individuals with dementia. The usage of the application will incorporate brain games for attention, concentration, language, executive functions and memory dependent on reinforcement learning by utilizing voice to text communication.

2.2 Literature Survey

2.2.1. Dementia

Dementia is one of the most well-known sicknesses in the old, with unrefined commonness rates between 5.9%–9.4% for subjects matured more than 65 in the

European Union [5]. The least and sexual orientation explicit administration of all-causes dementia detailed in the writing is 61.1% among ladies aged100 or more prominent so the inquiry "on the off chance that we live long enough, will we as a whole be unbalanced?" is turning into a gravely intermittent one. Dementia influences day by day life and regular individual exercises are frequently connected with social side effects, character change, and various clinical confusions, it builds the risk for urinary incontinence, hip crack, and most uniquely reliance on nursing care. Therefore, it isn't amazing that the expenses of care for patients with dementia are huge [13].

In Sri Lanka, the normal future from birth has expanded for men from 62 years in 1963 to 70 years in 1991, and females from 61 years to 74 years (Annual Health Bulletin, 2000). Along these lines, the level of the populace matured more than 60 years right now expected to increment quickly from 8% as of now, to arrive at 13% in 2010, and 21% in 2025. Fundamentally considering lesser accentuation on the wellbeing of more seasoned grown-ups and lesser assets for wellbeing research contrasted and the industrialized nations, Sri Lanka has not had the option to report solid epidemiological information on maturing related scatters, for example, dementia. Along these lines, the degree of the general wellbeing trouble right now presented by Alzheimer's illness (AD) and different dementias in Sri Lanka is obscure [14].

2.2.2. Mobile Applications for Dementia patients

Innovation can help cross over any barrier among patients and staff to improve the personal satisfaction for the subjectively impeded. Innovation instruments, for example, iPods, help invigorate those with dementia. This examination centers around inventive gadgets, for example, iPads and tablets, which are standard and simple to utilize, can't just assistance decide phase of dementia, yet additionally give incitement to improve subjective working. In a time where Alzheimer's and dementia in more seasoned grown-ups are expanding, parental figures are looking into new answers for interceding the emergency. One of these new arrangements is the utilization of cell

phones to animate the perception of more established grown-ups and patients experiencing AD. New research has demonstrated that the utilization of cerebrum, memory, and taking care of issue games help invigorate the mind and diminish the side effects of AD. The utilization of the cerebrum games and other PC based incitement treatment has given new light to medicinal services experts, guardians, and the patients themselves [15].

In 21st Century, everybody is running on exchange plant of life. Right now, rivalry, Dementia/Alzheimer can be tousled result of such upsetting life. Alzheimer is most basic sort of dementia. For the most part it occurs at an age of 65 or more noteworthy.[24] In our nation, dealing with patients who have been experiencing this infection is troublesome. Larger part of them have been admitted to the psychological clinic by their relative or they must be detained at home. With the assistance of this application, we have attempted to fill the hole among patient and guardians. The thought behind the execution of it on "Android" is, these days android is generally acknowledged and open source working framework. Lion's share of helpful devices is being bolstered by it like Tablet, Wristwatch, Cell Phone and so forth. This application has a few essential usefulness like "GPS Navigator", "Fall Detection System", "Brain Games", "Specialist Finder" and "Crisis". With the help of clinical experts like researcher and scientist’s future improvement can be conceivable.

2.2.3. Reinforcement Learning

Reinforcement learning will be learning through communication with a situation by taking various activities and encountering numerous disappointments and victories while attempting to augment the gotten rewards. The agent isn't advised which move to make. Reinforcement learning is like regular learning forms where an instructor or a boss isn't accessible and learning process advances with experimentation, unique concerning administered learning, in which an agent should be determined what the right activity is for each position it experiences.

Reinforcement learning is not the same as different parts of machine learning both supervised learning and unsupervised learning. And it is considered as a third model of machine learning, at the edge of unsupervised learning and supervised learning [16].

Reinforcement learning is a field of machine learning strategies and issues dependent on the idea of learning from numerical rewards received by an agent through communicating with a domain. In some random advance, the agent watches a condition of the earth and gets a prize sign. Because of the present state and the agent's conduct work — the approach — the agent picks a move to make. The activity is then sent to the environment which is refreshed and the circle repeats. See Figure 2.1 for an outline of the agent-condition interface [17].

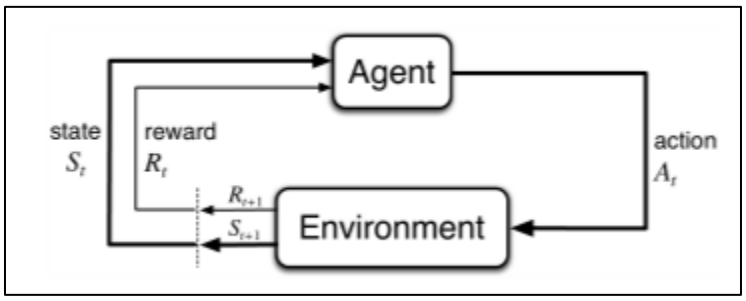

Figure 2.1: Reinforcement Learning Illustration [2]

Action (A): moves that the agent can possibly take

State (S): current situation that is returned by the environment

Reward (R): immediate feedback returned by the environment in order to evaluate the last state

In RL issues, a specialist picks an activity at each time step dependent on its present state and gets an evaluative criticism and the new state from the earth. The objective of the specialist is to get familiar with an ideal approach that boosts the collected prize it gets after some time. In this manner, operators in RL don't get immediate directions regarding which move they should make, rather they should realize which activities are the best through experimentation cooperation with the earth. This versatile shut circle highlight renders RL unmistakable from customary administered learning strategies for relapse or arrangement, in which a rundown of right marks must be given, or from solo learning ways to deal with dimensionality decrease or thickness estimation, which target finding concealed structures in an assortment of model information. Besides, in correlation with other conventional control-based techniques, RL doesn't require an all-around spoke to a numerical model of the earth yet builds up a control strategy

legitimately for a fact to foresee states and prizes during a learning system. Since the plan of RL is letting a specialist controller collaborate with the framework, obscure and time-shifting elements just as changing execution necessities can be normally represented by the controller. Ultimately, RL is particularly fit to frameworks with natural time delays, in which choices are performed without prompt information on adequacy however assessed by a long-haul potential compensation [18].

Szepesvári, C has stated that Reinforcement learning is a learning paradigm concerned with learning to control a system so as to maximize a numerical performance measure that expresses a long-term objective [28], further Ahmad Hammoudeh has discussed that reinforcement learning is different from other branches of machine learning both supervised and unsupervised learning and consider it as third model of machine learning, at the edge of unsupervised learning and supervised learning [4]. Further open-handed to consideration to explanation of RL, will be learning through the communication with a situation by taking various activities and encountering numerous disappointments and victories while attempting to augment the gotten rewards.

2.2.4. Reinforcement Learning for Dementia

Right now, informatics, it has gotten foremost to give customized proposals to moderate the impacts of data over-burden. This area of biomedical and medicinal services informatics is yet undiscovered most definitely. The vast majority of the current recommender frameworks have, somewhat, not had the option to address sparsity of information and non-linearity of client thing connections among different issues. Profound fortification learning frameworks can upset the proposal structures as a result of its capacity to utilize non-straight changes, portrayal learning, grouping displaying and adaptability for the usage of Wellbeing industry, for the most part, manages long haul issues. Customary recommender frameworks neglect to consider the long-haul impacts, henceforth neglecting to catch dynamic opinions of individuals. This methodology regards the procedure of proposal as a successive choice procedure, which addresses the previously mentioned issues. It is evaluated that more than 700

million individuals will have wearable gadgets that will screen each progression they take.[25] Information gathered with these savvy gadgets joined with different sources like Electronic Health Records, Nutrition Data and information gathered from studies can be prepared to utilize Big Data Analysis apparatuses and took care of two suggestion frameworks to create alluring proposals. The activity, state pair is taken care of to the pundit arrange, which produces a prize related to the activity, state pair. This prize is utilized to refresh the arrangement of the Actor organizes. The pundit arrange picks up utilizing a pre-characterized Expected Reward.

2.2.5. Different techniques of Reinforcement Learning

In games, machine learning can be utilized for different purposes. It very well may be utilized to acquire the greatest scores, win the game at the base time conceivable, get most collectibles, or improve survivability. As we don't think a lot about the games, it is ideal to actualize the reinforcement learning technique as it can take in without anyone else from its surroundings. Reinforcement learning has its choice of systems, for example, Q learning, SARSA, DQN, and DDPG [19].

There are two kinds of algorithm model which are model-based and model-free. In the model-based algorithm, the model will learn the transition probability T. The agent will realize how to enter a particular and activity space develops; the model-based algorithm will turn out to be more impractical. The model-free algorithm refreshes its information by depending on the experimentation technique. In this way, the blend of states and actions shouldn't be put away in another space. Instances of the model-free algorithm are Q-learning and SARSA.

2.2.6. Q-learning

Q-learning is a type of model-free reinforcement learning. It works by steadily refreshing the normal estimations of activities in states. For each conceivable state,

every conceivable activity is assigned out a worth which is a component of both the immediate reward for making that move and the normal award later dependent on the new express that is the consequence of making that move. This is communicated by the one-advance Q-update condition [20].

$Q(s, a) = Q(s, a) + \alpha [r + \gamma \max_{a'} Q(s', a') - Q(s, a)]$ (1)

Q – expected value of performing action

s – state vector

a – action vector

r – reward

α – learning rating which controls convergence

γ – discount factor

The discount factor makes rewards earned before more important than those got later. This technique learns the estimations of all things considered, as exposed to simply finding the ideal procedure. This information is costly in terms of the measure of data that must be put away, yet it brings benefits. Q-learning is investigation insensitive; any activity can be completed whenever, and data is picked up from this experience [20].

2.2.7. Q-learning algorithm

Q-learning is a reinforcement learning technique where the learner assembles steadily a Q-function which attempts to measure the limited potential rewards for taking activity from given states. The output yield of Q-function for the states furthermore, activity is appeared in equation (1). Q-values are as a rule hidden away investigate the table. Officially a Q-learning can be described as follows:

Algorithm:

Initialize Q(s, a) arbitrarily

Repeat (for each episode)

Initialize s

Repeat (for each step of episode):

Choose a from s using policy derived from Q

Take action a, observe r, s'

$Q(s, a) = Q(s, a) + \alpha [r + \gamma \max_{a'} Q(s', a') - Q(s, a)]$

s← s' ;

Until s is terminal

2.2.8. Q-learning algorithms for games

Correlated-Q learning, a multiagent learning calculation that learns harmony strategies in Markov games, similarly as Q-learning figures out how to ideal approaches in Markov choice procedures. Correlated learning is named for associated equilibria (Amann 1974) [26], which sum up Nash equilibria by taking into consideration potential conditions in vital decisions. A Nash harmony is a vector of autonomous likelihood dispersions over activities, in which all specialists streamline concerning each other's probabilities. An associated balance is a likelihood appropriation over the joint space of activities, in which all operators enhance regarding each other's probabilities adapted all alone. As of late, there have been a few endeavors to structure a multiagent learning calculation that combines to balance arrangements all in all total Markov games. Hu and Wellman (1998) propose a calculation called Nash-Q that joins to Nash harmony strategies in limited classes of Markov games.

2.2.9. Speech recognition using Deep Neural Network

Over the previous decades, a huge amount of research has been done on the use of machine learning for speech processing applications, especially speech recognition. However, in the past few years, research has focused on utilizing deep learning for speech-related applications. This new area of machine learning has yielded far better results when compared to others in a variety of applications including speech, and thus became a very attractive area of researches. Deep learning models can also operate as a greedy layer wise unsupervised pre-training. This means that it will learn hierarchy from extracted features from each layer at a time. Feature learning is achieved by

training each layer with an unsupervised learning algorithm, which takes the features extracted from the previous layer and uses it as an input for the next layer. Deep learning algorithms have been mostly used to further enhance the capabilities of computers so that it understands what humans can do, which includes speech recognition. Speech being the main method of communication among human beings, received much interest for the past five decades right from the introduction of artificial intelligence. The conventional speech recognition systems are based on representing speech signals using GMMs that are based on HHMs. This is since a speech signal can be considered as a piecewise stationary signal or in other terms a short time stationary signal. In this short time scale, the speech signal can be approximated as a stationary process, thus it can be thought of as a Markov model for many stochastic processes [4].

However, the CNNs have shown effectiveness when used in computer vision or image recognition tasks. Also, with some appropriate changes in the CNN for image analysis purposes such that it incorporates speech properties, the CNN can be utilized in speech recognition as well. RNNs are considered as a class of deep networks for the use in unsupervised learning in the cases where the depth of the input data sequence can be as large as the length since RNNs allow parameter sharing through the different layers of the network. The RNN is very prevailing when it comes to modeling sequence data such as speech or text [4].

State-of-the-art ASR systems map the speech signal into its corresponding text. Traditional ASR systems are based on Gaussian mixture model. End-to-end ASR systems are gaining much popularity due to simplified model-building process and abilities to directly map speech into the text without any predefined alignments. Three major types of end-to-end architectures for ASR are attention-based methods, connectionist temporal classification, and CNN-based direct raw speech model. End-to-end model may take raw speech signal as input and generates phoneme class conditional probabilities as output. The three major types of end-to-end architectures for ASR are attention-based method, CTC and CNN-based direct raw speech model [5].

Figure: 1.1. General framework of automatic speech recognition system.

Speech has not been used much in the field of electronics and computers due to the complexity and variety of speech signals and sounds. However, with modern processes, algorithms, and methods we can process speech signals easily and recognize the text. android platform using eclipse workbench. Our speech-to-text system directly acquires and converts speech to text. Speech recognition is done via the Internet, connecting to Google's server. The application is adapted to input messages in English. Speech recognition for Voice uses a technique based on HMM. It is currently the most successful and most flexible approach to speech recognition. Process involves the conversion of acoustic speech into a set of words and is performed by software component. Accuracy of speech recognition systems differ in vocabulary size and confusability, speaker dependence vs. independence, modality of speech (isolated, discontinuous, or continuous speech, read or spontaneous speech), task and language constraints. Dictionary is used to connect acoustic models with vocabulary words. Language model reduces the number of acceptable word combinations based on the rules of language and statistical information from different texts. Speech recognition systems based on hidden Markov models are today most widely applied in modern technologies [6].

Deep learning methods are being applied in various recognition tasks such as image, speech, and music recognition. CNN especially show remarkable recognition performance for computer vision tasks. In addition, RNNs show considerable success in many sequential data processing tasks. Investigating the result of the SER algorithm is based on CNNs and RNNs trained using an emotional speech database. Deep learning involves hierarchical representations with increasing levels of abstraction. By traversing sequentially constructed networks, the results corresponding to each selected audio frame are classified using a sum of probabilities [7].

Figure: 1.2. Block diagram of our time distributed network-based SER method

3. RESEARCH GAP

In fact, moving on with mobile application which helps Dementia patients, take through about research gap is most vital for forthcoming researches. While in a conversation about mobile applications that were introduced for Dementia patients mainly supported for English Language, novelty of proposed system is supported both Sinhala and English language which can be mainly suited for elderly population of Dementia. And, to make interaction between patient and proposed system is used voice text component, nevertheless **Kiho kang et al.** has stated that Serious Game to Help Prevent Dementia is mainly played through finger tapping and touch [27].

Features	Lumosity	Brain Games	Elevate	Eidetic	Proposed System
Learning from the user and personalize it	✗	✗	✗	✗	✓
View the daily report	✓	✗	✓	✓	✓
Doctor can view the progress of the patients	✗	✗	✗	✗	✓
Games in Sinhala language	✗	✗	✗	✗	✓
View the history	✗	✓	✓	✓	✓
Suitable for elderly people	✓	✗	✓	✗	✓
Take voice inputs	✗	✗	✗	✗	✓
Based on many functionalities	✓	✗	✓	✓	✗

Figure 1: Compare Existing Mobile Game Application

4. Research Problem

Dementia is one of the most significant problems facing with the increase in the ageing population. The estimated current prevalence of dementia is 47.5 million worldwide [1]. This number will nearly double in every 20 years globally [1]. As well as the same problem has occurred in Sri Lanka. Dementia is basically a syndrome which can't be cured by medicines. In any case there are medications that help to slow down the movement of the sickness. There are medications just as mental and behavioral treatments that help. But a patient could be performed that treatments during their treatment sessions only. And, doctors can't get the history of treatments of each patient regularly. According to the requirements of the doctors, the use of a brain training application could be better than medicine. There are number of brain training mobile applications in the world that could be useful to develop human concentration, attention and all sorts of brain activities but there isn't suitable mobile application for Sri Lankan culture because most of the dementia patients in Sri Lanka belong to the old generation and they are not proficiency with the English language and also the available current applications are not free and the users must pay a fee for using those applications. According to the resources, developing this application is an actual global requirement for dementia patients.

5. OBJECTIVES

5.1. Main Objectives

Our proposed application has an ability to overcome those issues. It has games and activities to improve the cognitive functionalities for the Temporal lobe and Frontal lobe from the Cerebral cortex. There are four main subcategories under them as Attention and Concentration, Language, Executive functions and finally Memory. Each game consists of different levels. Reinforcement Learning is used in these games in order to predict the best level for the users. All these games are designed with user friendly interfaces specially for the elder people and in a way suitable for our culture. And the patients can view their progress with the score level as well as the doctor of the relevant patient via a report. Implementation of the application will take over throughout the year.

5.2. Specific Objectives

- Implement a game to help to increase the Attention and Concentration level of patients.
- Implementation of an activity to improve Language skills.
- Implement a game to develop Executive Functionalities.
- Implementation of games to improve the Memory of the patients
- Only the patient, caregiver and the doctor can view the patient details and scores.
- Make both patients and caregivers life easier.
- Slow down the moving from one stage to another stage of Dementia.
- Giving rehabilitation with continuous monitoring.

6. METHODOLOGY

6.1. System Overview

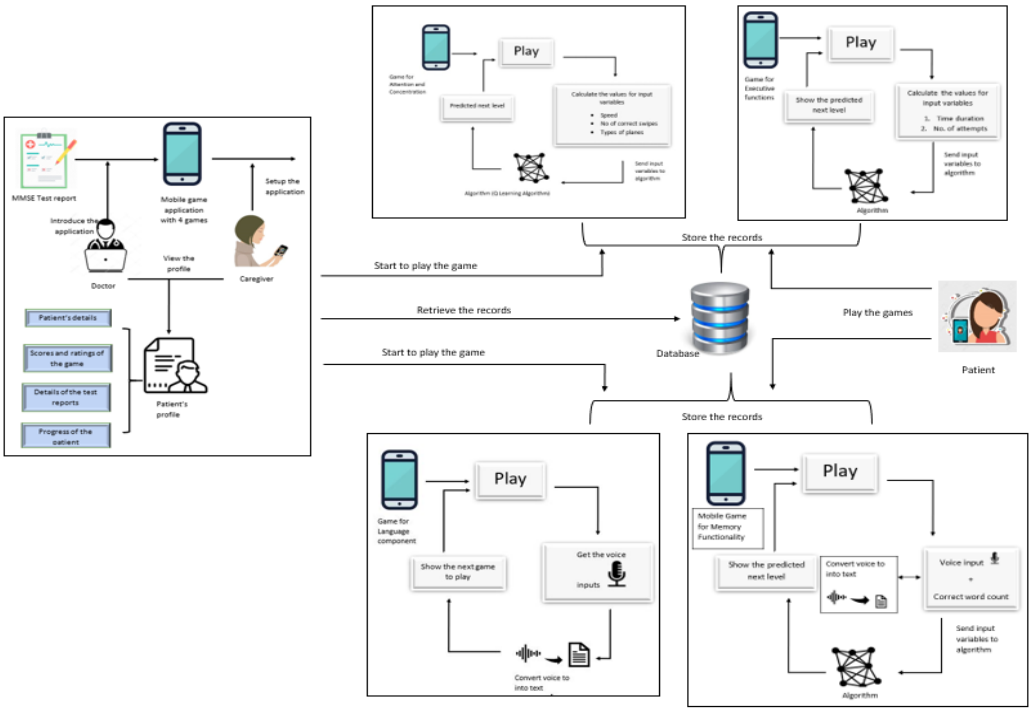

Figure 6.1: System Overview Diagram

The main outcome of the research paper is to build a mobile application for Dementia patients which includes different types of mobile games or activities using Reinforcement Learning and Speech to text communication to rehabilitate those patients in cognitive way.

The doctor will do the MMSE testing for the patients who meet the doctor (relevant Psychiatrist). According to the MMSE test result, patients will be categorized into some stages. Only the patients under the mild and moderate stages will be selected to use this application. Through the other diagnose tests of patient for Dementia, the doctor will be selected the game functionality name for the patient to and recommended to practice the game which is most suitable for that patient and once they are finished a level they can see the progress of their own for that level.

1. First, patient should register with the system and create a profile (This can be done by the caregivers also).
2. When the patient logging into the system, they should select the relevant functionality to play.

Maintain Attention and Concentration of Dementia Patients

- Develop the related activities or games
- Apply RL algorithm
- Predict the next level

Improve the effectiveness and speed process of Executive Functions

- Develop the related activities or games
- Apply RL algorithm
- Predict the next level

Improve the impairments of Language Skills

- Convert speech into text using CNN
- Develop the related activities or games using speech to text communication

Maintain the registration, recall, recognition of memory

- Develop the related activities or games using speech to text communication
- Apply RL algorithm
- Predict the next level

3. Store all the records of each game level inside the database.

4. After playing the games or activities, patient can see the score that they have gained and see the progress report which is stored in the database. As well as the Doctor can see the progress report of related patients.

6.2. Software Development Life Cycle

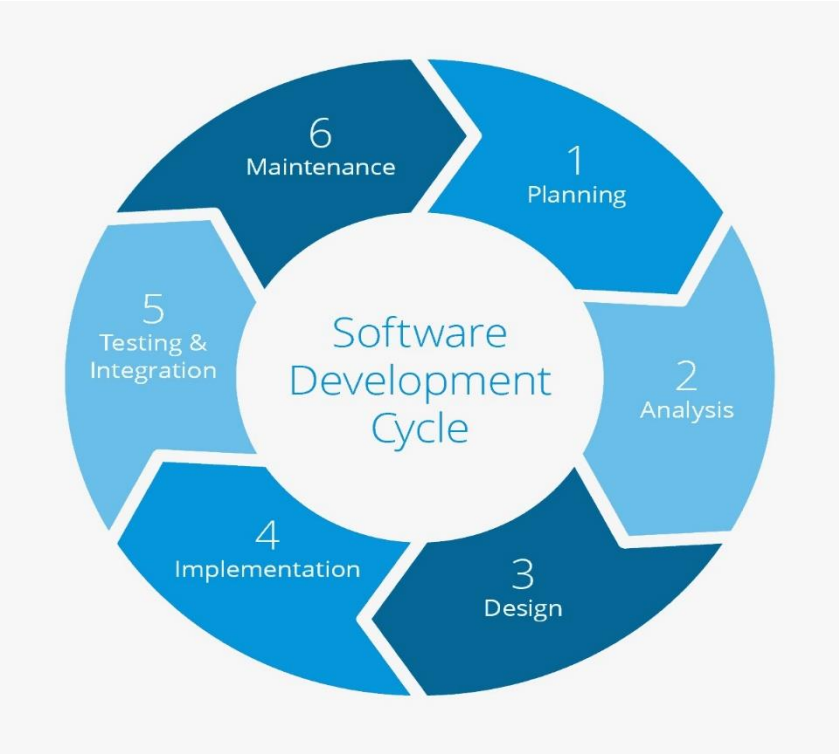

Figure 6.2: Software Development Life Cycle

SDLC is a procedure followed for a product venture, inside a product association. It comprises of a point by point plan describing how to create, keep up, remove and change or upgrade explicit programming. The existence cycle characterizes a procedure for improving the nature of programming and the general improvement process.

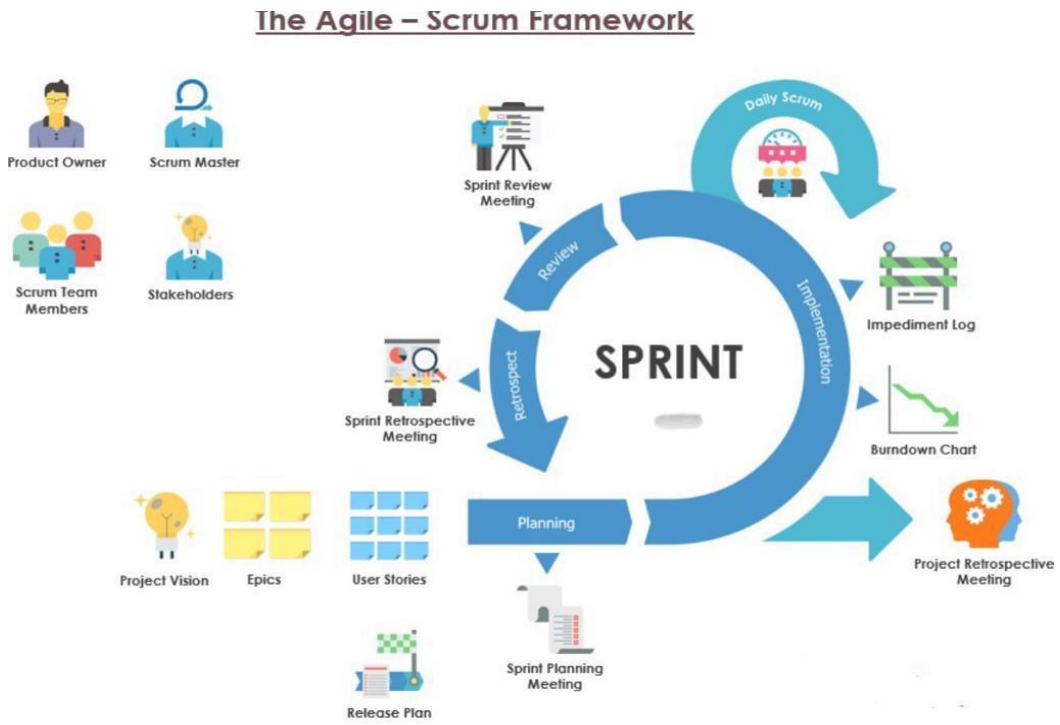

Figure 6.3: Scrum model

The software development methodology which will be utilized the Agile Scrum Process. The developers will be provided lots of features to build up a system in an adaptive manner. As well as it is easy for system developers to fulfill the new requirements of the customer. When considering about this research project, there are lots of changes to be done in the future while implementing the system. It is suitable when comparing to processes like Waterfall model etc. Scrum process is mostly focused on task management within a time-based environment. This process is supported for team performance and solved the problems individually since this project is going to be done among four members. Having daily scrum meetings will help to understand the updates of all members of their research area.

6.3. Work Breakdown Structure

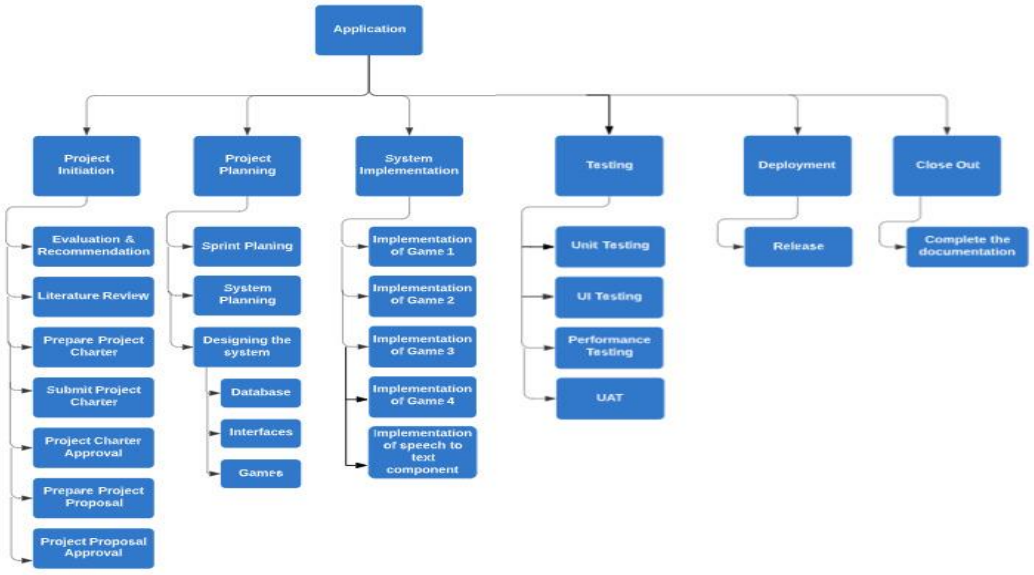

Figure 6.4: Work Breakdown Structure

6.4. Gantt Chart

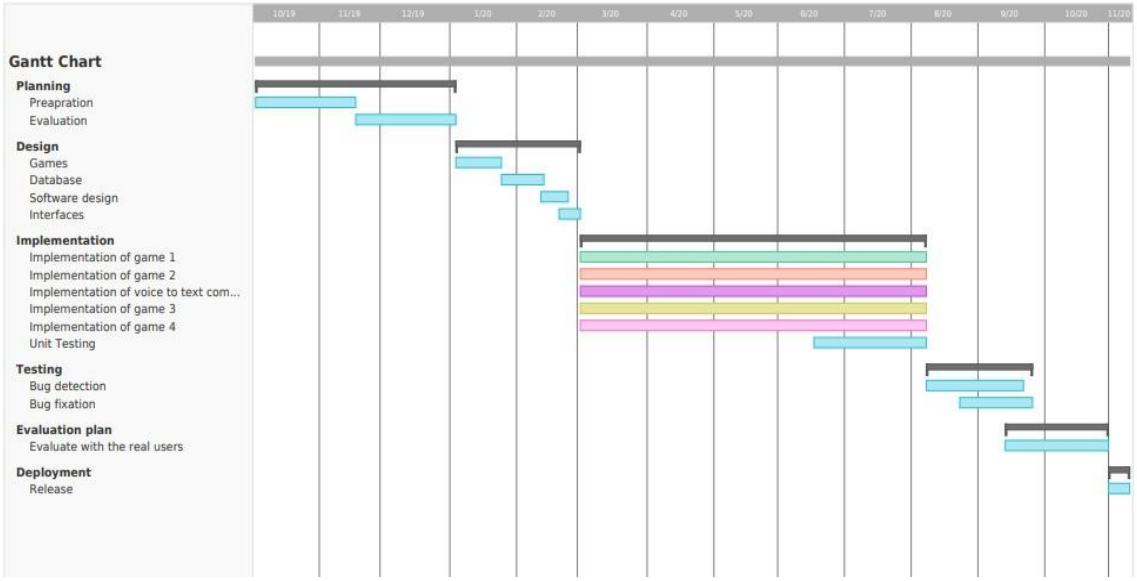

Figure 6.5: Gantt Chart

7. PROJECT REQUIREMENTS

Real world requirement is given by consultant psychiatrists Dr. Chathurie Suraweera at National Hospital of Colombo.

7.1. Functional Requirements

The proposed system should be containing 4 different games under different categories such as, Attention and Concentration, Executive Functions, Language Skills, Memory.

- The proposed system should contain login functionally and should be able to maintain logged history.
- The proposed system should be supported both English and Sinhala languages with the Dementia patient.
- The proposed system should be communicated with patient by using voice to test component.
- The proposed system should be learning from user and predict the functionality of the next level of the game.
- The proposed system should be able maintain history related to the level of the game.
- The proposed system should be allowed doctor to view progress report of the Dementia patient.

7.2. Non-functional Requirements

- The proposed system should be able to give the progress report accurately to the doctor.
    - It should be recognizing the behavior of the patient and predict the next level of the game very correctly.
- Usability of the proposed system.
    - The patient should be fingered the proposed system with effortlessness
- Availability
    - History of the level of the game such as scores history data should be available to the Dementia patient and for the doctor at any given time.

8. BUDGET & BUDGET JUSTIFICATION

Table 8.1. Budget

Item	Cost (Rs)
Travelling	10 000.00
Internet	7 500.00
Hospital Charges	15 000.00
Web Hosting	40 000.00
Total	**72 500.00**

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