GAMING APPLICATION FOR ALZHEIMER DISEASE DETECTION

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Abstract—**Alzheimer's Disease is a leading cause of damage or loss of nerve cells and their connection in the brain. Depending on the area of the brain that is damaged, it can affect people differently and cause different symptoms. There is no cure for this disease, although treatments are available that may improve some symptoms. Symptoms of this disease depend on the stage of the disease, they usually develop slowly and get worse over time, becoming severe enough to interfere with daily tasks. An android application has been proposed that provides various tests in the form of levels of a game to detect whether a person suffers from Alzheimer's disease or not and also tells them the stage of the disease i.e. Mild, Moderate, Severe which helps to track the status of the patient. The main intention of this application is to make the player feel like the person is not being tested but rather is playing a game full of fun and excitement. At the same time, the application determines the ability to remember everyday things. People who have Alzheimer's are characterized as having problems with their cognitive functions, memory loss, and personality changes that affect large areas of brain certainty.**

Keywords— **Mobile Application, Alzheimer's Disease, Cognitive Functions.**

I. INTRODUCTION

Alzheimer's Disease is increasingly becoming an issue of public health concern, given that age is a known risk factor, and accordingly, prevalence rates re likely to rise with more people developing this condition in an aging population. A neurodegenerative disease that usually starts slowly and gets into the worse situations. Affected people increasingly rely on others for assistance, even placing a burden on the caregiver. The most common early symptoms are difficulty in remembering recent events. As the disease advances, symptoms can include problems with language, disorientation, mood swings, loss of motivation, self-neglect, and behavioural issues. As a person's condition declines, they often withdraw from family and society. Gradually, bodily functions are lost, ultimately leading to death. Although the speed of progression can vary, the typical life expectancy following diagnosis is three to nine years. The symptoms of Alzheimer's vary for each and every stage. In people with Alzheimer's Disease, the increasing impairment of learning and memory eventually leads to a definitive diagnosis. Alzheimer's Disease does not affect all memory capabilities equally. Older memories of the person's life, facts learned, and implicit memory are affected to a lesser degree than new facts or memories. Language problems occur in the early stage. Progressive deterioration eventually hinders independence, with subjects being unable to perform the most common activities of daily living. Frequent incorrect word substitutions become evident. Reading and writing skills will decrease than comparing to a normal person. The risk of falling increases. During this stage, memory problems get worse, and the person may fail to recognize close relatives. Common manifestations are wandering, irritability, and emotional liability, leading to crying, outbursts of unpremeditated aggression, or resistance to care giving. During the final stage, known as the late-stage or severe stage, there is complete dependence on caregivers or caretakers. Language is reduced to simple phrases or even single words, eventually leading to a complete loss of speech. Although aggressiveness can still be present, extreme apathy and exhaustion are more common symptoms. Language is reduced to simple phrases or even single words, eventually leading to a complete loss of speech. As of 2020, there were approximately 50 million people worldwide with Alzheimer's Disease. There are over 10 million new cases of dementia each year worldwide, implying one new case every 3.2 seconds. Alzheimer's Disease is among the most costly diseases for societies worldwide. Costs associated with Alzheimer's disease include direct and indirect medical costs. Direct costs include doctor visits, hospital care, medical treatments, nursing home care, specialized equipment, and household expenses. Indirect costs include the cost of informal care and the loss in productivity of informal caregivers. People whose family members suffer from Alzheimer's may have a higher chance of developing the disease. Also at risk are people who have experienced a head injury, people who have Down syndrome or diabetes, or those who have had a low-quality education. It is estimated that Alzheimer's accounts for 60 to 80 percent of all dementia cases. Unlike age-related memory loss, Alzheimer's is not a

normal part of aging and can affect a person's thinking, memory, and behavior. In the United States, more than 5 million have Alzheimer's disease, and it is estimated that in the year 2050, it may reach 14 million Americans who are older than 65 years may be living with the disease. Worldwide, it is estimated that there are 46.8 million people who are living with Alzheimer's disease. For people who are suffering from Alzheimer's disease, other people are needed, and many citizens provide their services that are not paid for their time. However, Alzheimer's disease is the sixth leading cause of death in people of all ages since it has increased by 89%. In Peru, the adult population suffers from Alzheimer's, which can be represented by 70% of dementia's, while 20% may be multi-infarct dementia's. According to the statistics that are provided by the neurologist of the National Institute of Sciences and Neurology, 1% of the population 60 years suffer from Alzheimer's in adults older than 60 to 65 years is 2%; while in those over 65 to 70 it is 4%; a percentage that rises to 8% if you are over 70 years old; while in those over 75 years of age, it reaches 16%, for this reason, it states that it is a disease that is perceived in the behavioural disorder and currently people who have Alzheimer's live excluded from their homes and without any treatment that is adequate for them. Cognitive impairment of multiple cognitive functions that people have and that affect memory is more likely to cause Alzheimer's disease. However, a percentage of the chronic forms are of discrete alteration that evolves. People with a low level of education, forgetful and distracted, have a greater probability of presenting the disease and presenting it more severely. Positioning system technology that is global allows great changes in societies to occur. Applications that use GPS can constantly grow and become more and more indispensable in our lives because it is very useful for everyone. That is why it takes advantage of the low costs and evolution to be used in favour. In addition, man has created innovations that are advanced in giant steps, allowing a clear disposition to improve the care of people. Alzheimer's disease can produce a progressive disorder of the central nervous system. People directly affected may experience depression, anxiety, psychosis, and sleep disturbances. The disappearance of memories and ceasing to make things necessary for one to live, such as personal hygiene, eating, remembering good times, and doing activities with family and friends, make people encrypt the disease both in its physical and physical aspects.

Therefore, the process is very destructive for the people suffering from the disease and those around them. The activities that can be carried out can be focused on or directed to the treatments of intellectual capacities that can be cognitively stimulated to the brain looking for healthy mental habits, and it is known that the human brain makes use of its neurons to access the information that is key for the development of the human being in his daily life, increasing brain exercise, at the same time the intellect and above all minimizing mental deterioration. To solve the problem and have a better follow-up of people who have Alzheimer's, a good way is to use technology, according to the times we are in, which would be smartphones, since now everyone has a mobile device. For this reason, the application can help those responsible for having a better follow-up because it will allow them to have an interactive game to develop their cognitive system that is suitable for people with Alzheimer's; they can also have control of medicines, a reminder Of the people or objects that you want to remember, for example, there will be a virtual assistant that will say some things that the person has forgotten, in addition to having a section included where it will be possible to observe where the people with Alzheimer's are, and the person in charge will be able to see where they are.

1.1 Objective

The goal is to identify the symptoms of Alzheimer's and to keep the mind mentally strong through games, which exercise different parts of the brain in the Games section. Combining brain games, and social interaction, the game can guide its users towards a multifaceted, holistic lifestyle change that may help curtail some of the effects of cognitive decline. This motivates the need to build relatively simple cross-platform mobile applications with interactive GUIs so as to enhance their cognitive abilities.

1. Early Detection of symptoms of the disease.
2. To include safety measures.
3. To reduce risk factor of dementia.
4. Reducing time required for diagnosis of the disease tests.
5. Improve quality of life through intervention and treatment methods.

II. LITERATURE SURVEY

In [1] authors says that Early detection is critical for effective management of Alzheimer's disease. Among several deep learning techniques that have been applied to assessing structural brain changes on MRI, CNN has gained popularity due to its superb efficiency in automated feature learning with the use of a variety of multi-layer perceptron. Alzheimer's Disease (AD) is a chromic, progressive and irreversible neurodegenerative disease clinically manifested by amnesia, cognitive dysfunction, and gradual loss of multiple other brain functions and daily living independency.

In [2] authors says that approximately 80% of patients with Alzheimer disease are older than age 75, with disease incidence increasing from 2 per 1000 at ages 65 to 74 to 37 per 1000 at age 85 and older. The number of patients with AD in the United States is projected to nearly triple by 2050, with the majority of growth attributed to the 85 and older age group. Prospective population-based studies provide strong evidence that the risk of late-life cognitive impairment and dementia is modified by medical comorbidities, lifestyle choices, and other environmental factors. The risk of dementia is increased in patients with vascular risk factors, and growing evidence suggests that aggressive treatment of these risk factors as early as midlife can reduce the risk of developing cognitive impairment in older age.

In [3] authors says that at present, there are around 50 million AD patients worldwide and this number is projected to

double every 5 years and will increase to reach 152 million by 2050. AD burden affects individuals, their families, and the economy, with estimated global costs of US$1 trillion annually. At present, there is no cure for Alzheimer's disease, although there are available treatments that just improve the performance of patient. A patient suspected to have AD should undergo several tests, including neurological examination, magnetic resonance imaging (MRI) for neurons, laboratory examinations such as vitamin B12, and other tests besides the medical and family history of the patients.

In [4] authors have done a report based on the number of people with dementia is rising. Predictions about future trends in dementia prevalence vary depending on the underlying assumptions and geographical region, but generally suggest substantial increases in overall prevalence related to an aging population. For example, according to the Global Burden of Diseases, Injuries, and Risk Factors Study, the global age-standardized prevalence of dementia between 1990 and 2016 was relatively stable, but with an aging and bigger population the number of people with dementia has more than doubled since 1990. In addition to this, one large study in China tried to separate cognitive activity in adulthood from activities for those with more education, by considering activities judged to appeal to people of different levels of education. It found people older than 65 years who read, played games, or bet more frequently had reduced risk of dementia.

In [5] authors have carried out work on the comprehensive study of mobile-health based assistive technology for the healthcare of dementia and Alzheimer's Disease. Assistive technology (AT) involvement in therapeutic treatment has provided simple and efficient healthcare solutions to people. Within a short span of time, mobile health (mHealth) has grown rapidly for assisting people living with a chronic disorder. This research paper presents the comprehensive study to identify and review existing mHealth dementia applications (apps), and also synthesize the evidence of using these applications in assisting people with dementia including Alzheimer's disease (AD) and their caregivers. Six electronic databases searched with the purpose of finding literature-based evidence. The search yielded 2818 research articles, with 29 meeting quantified inclusion and exclusion criteria. Six groups and their associated sub-groups emerged from the literature. The main groups are (1) activities of daily living (ADL) based cognitive training, (2) monitoring, (3) dementia screening, (4) reminiscence and socialization, (5) tracking, and (6) caregiver support. Moreover, two commercial mobile application stores i.e., Apple App Store (iOS) and Google Play Store (Android) explored with the intention of identifying the advantages and disadvantages of existing commercially available dementia and AD healthcare apps.

In [6] authors have carried out work on Dementia which involves in the deterioration of cognitive behaviour of a patient. It is observed that the patient's performance slowly deteriorates during the activities like memory loss, language, reasoning, decision making, attention etc., Normally patients with Dementia have sudden change in their behaviour inside and outside their house. This disease leads to Alzheimer's

disease and it last for decades with the patient. There is no cure for the disease or a very less and this disease last for decades. There are mainly two causes of dementia disease, they are: reversible and irreversible causes of dementia. Reversible dementia's are very rare and this type is curable, if the condition is treated. The condition included for the first type is depression, nutritional deficiencies metabolic and endocrine disorders, normal pressure. The other one is not completely curable and hence require proper treatment.

In [7] authors have done a case report which says about the Alzheimer's Disease (AD), the most common form of dementia, is a leading cause of death and a major cause of morbidity in older people. This disease is characterized by progressive memory loss, cognitive impairment, and the cerebral accumulation of amyloid-b peptide. Given the health and economic impacts of AD, treatments that target the underlying etiology of AD or modify the course of the disease are of significant interest. The gut microbiome has been increasingly implicated in the pathogenesis of several neurological diseases, including multiple sclerosis and Parkinson's disease. A growing body of experimental and clinical data implicates the gut microbiome in the pathogenesis of several neurological conditions, including autism spectrum disorder (ASD), Parkinson's disease (PD) and multiple sclerosis (MS). More recently, alterations in gut microbiome composition have been observed in patients with AD, suggesting a potential role for the microbiome in AD pathogenesis. This hypothesis has been supported by animal models.

III. ARCHITECTURE DESIGN

For developing applications (MVC) Model View Controller design pattern is created. The view of the application deals with UI logic. The controller deals with the Input logic. The model of an application deals with business logic. These MVC Architecture have 3 components:

MODEL: The Model encloses the clean operation-related data. But the model doesn't deal with any sense about how to present the data.

VIEW: The View is used for presenting the data of the model to the user. It deals with how to link up with the model's data but doesn't give any sense regarding what this data is all about or how users can use these data.

CONTROLLER: It is in between the model and the view element. It listens to all the incident and actions triggered in the view and perform an applicable response back to the events.
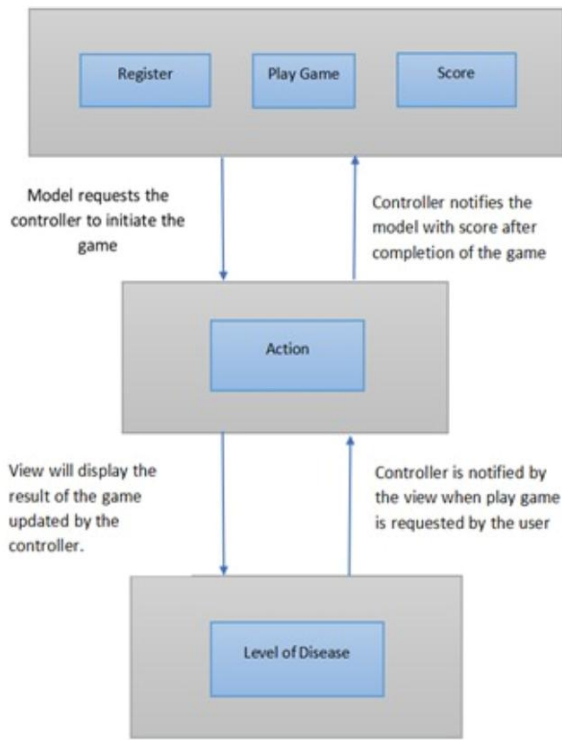
User clicks/taps on register button on the screen. The controller handles the clicks/taps and converts the event into an appropriate action. The Model requests the controller to initiate the game. Then the view will display the game updated by the controller. The view will then notify the controller when the user requested for game. Then the controller will notify the model to update and display the score after completion of game.
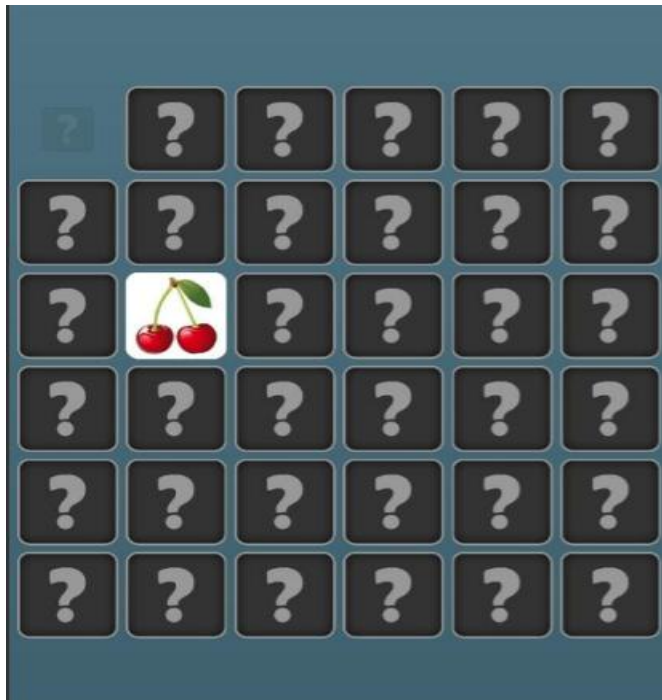
IV. WORKING

GAME 1: Number Sort
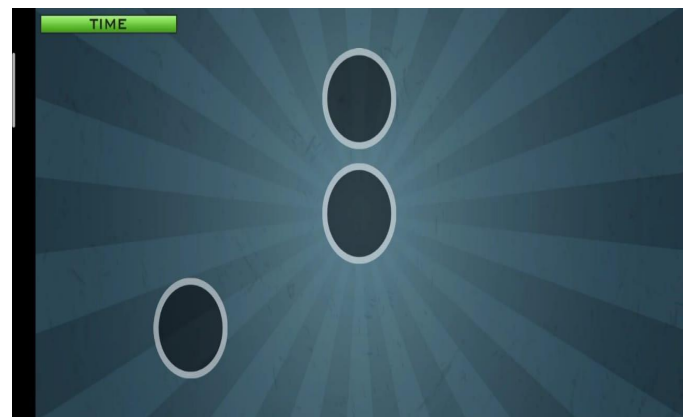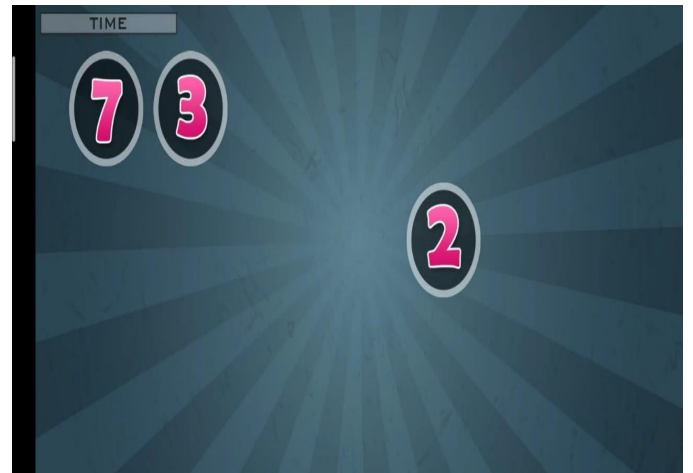
GAME 2: Matching Game
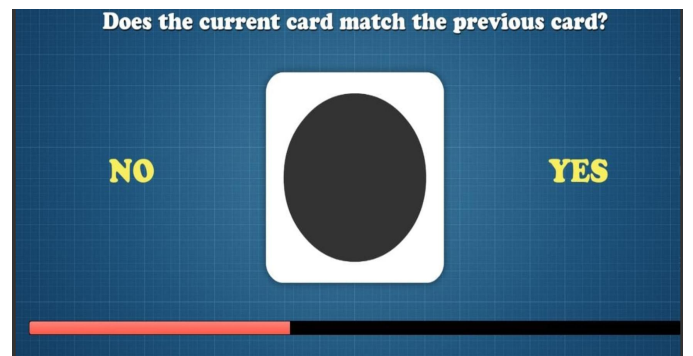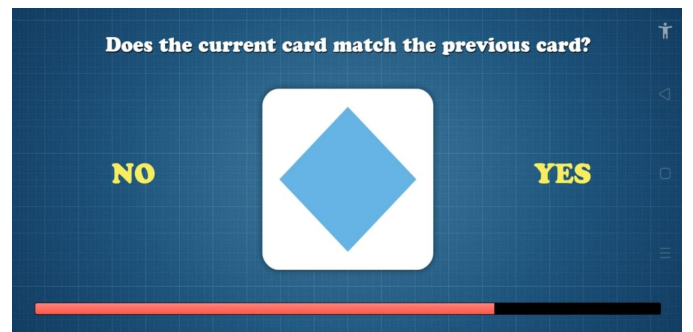
GAME 3 : Flip Game

Various parameters such as the count of participants, the accuracy of assessment, acceptance rate, user satisfaction, cognitive state improvement through intervention, feedback, the accuracy of indoor positioning, reliability, etc are used for evaluating the level of disease. Among all the evaluation parameters accuracy of assessment is performed mostly as it is founded reliable than other measures. The major difficulty in evaluating the level of disease is when the person is not willing to play the game.

In this application, the assessment takes place based on three games i.e., number sort, does the card match or not? and matching game. Evaluation takes place after playing all three games.

V. FUTURE SCOPE

Apart from the detection game we wish to add more options for remedies which will include more memory-simulating games, different workouts, and nutrition tips thus, these more aspects in-game will prove to be more obliging to the users. A virtual open workspace for people sharing the same affection which will give them a chance to open up and reveal themselves in front of others. Make their outside behaviour the same or congruent with your inside feeling and thoughts.

VI.CONCLUSION

People never prefer to visit doctor until the symptoms get intensified, which generally happens in later stages of disease. CT scans, MRI scans and PET scans are performed when prescribed by doctor only. Hence diagnosing the disease and providing the proper medication for the patient in early stages of disease, will help in preventing the serious effects caused by the disease in later stages. So we are developing the mobile application to diagnose the disease in early stages.

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