Hong Kong Student Science Project Competition 2022
Template of Extended Abstract (Invention)
(Word Limit: 1,000 words, Pages: 2 pages only)

Team Number: SAPE258

Project Title: AI4ALZHEIMER: An All-in-one Solution To Keep The Memory Sharp At Any Age

Project Type: Invention

To our best knowledge and after thorough literature research, as at _2022_ / _6_ / _30_ , there are / are no* similar works. If there are, the reference links are as below:

The enhancement our project has made for the existing related products or research is summarized as below:

*Please delete if not applicable. HKSSPC values the originality of works. Students must conduct literature research thoroughly to ensure that their works are unique, and to list relevant reference materials to complement the research or invention.

I.   Background

Alzheimer's disease (認知障礙症 in Chinese), is a syndrome affecting the brain functions, including but not limited to memory, thinking, comprehension, learning and judgement. Sadly to say, despite the over-spilling growth of population in Hong Kong, improving quality of life and the longer life expectancy of Hong Kong citizens, there has been an inclined trend of patients suffering from Alzheimer's disease and Dementia, especially the aging residents.

We want the patients or the seniors to lead a normal life despite the deteriorating memory. We lay particular emphasis on "personal experience" and "own memory", instead of a general idea to improve the overall memory and thinking capabilities. Therefore, for the patients suffering from Alzheimer's disease, it is not that they want their brain functions to deteriorate, but that the brain cells are de-generating, and most importantly, this is irreversible. Therefore, our team would like to design an invention, "AI4ALZHEIMER", which incorporates the elements of Big Data, Artificial Intelligence with Computer Vision and Internet of Things to assist the patients with Alzheimer's, and to perform early intervention.

There are three core components in the "AI4ALZHEIMER" system
[To be used by the seniors/ Alzheimer's patients]
●   AI Object Recognizer with Remote for recognizing objects based on AI Model
[To be used by the family members]
●   A Mobile Application for adding personalized data into the AI Model for use by the Object Recognizer
[To be enjoyed by the seniors/ Alzheimer's patients]
■   A Kahoot-like Recognition Game for memorizing people/object interactively

II.   Objectives

Below is a list of daily life problems that we would like to address on:

●   The ageing population in Hong Kong is increasing, meaning that the potential number of patients suffering from the Alzheimer's disease will increase exponentially.
●   Current practice (e.g. regular activities, chess playing and maintaining a healthy mental state) can help slow down the overall pace of Alzheimer's population, but it is not personalized.
●   The all-in-one solution to make the patients, or the seniors lead a normal life as if they are young remains unanswered.

III.   Methodology

For the patients suffering from Alzheimer's disease, it is not that they want their brain functions to deteriorate, but that the brain cells are de-generating, and most importantly, this is irreversible. Therefore, it is crucial for us to make the patients lead a normal life as far as possible, given the limitations.

Based on the reasons above, our team would like to design an invention, "AI4ALZHEIMER", which incorporates the

elements of Big Data, Artificial Intelligence with Computer Vision and Internet of Things to assist the patients with Alzheimer's, and to perform early intervention. We have three missions and visions for our invention:

✓ ***Alzheimer's Patients Does Not Mean You Are Useless***
It is very important that we need to let the patients to embrace their current situation and be confident to themselves.

✓ ***Making A Personalized Memory Experience for the Alzherimers'***
We lay particular emphasis on "personal experience" and "own memory", instead of a general idea to improve the overall memory and thinking capabilities.

✓ ***Learning and Memorizing Can Be Fun!***
The elderly is just like kids who would like to enjoy the process of learning, instead of being forced to learn. Therefore, we must keep in mind to create a fun and enjoyable environment for the elderly to play.

IV.   Design of Invention

It is a solid fact that the Hong Kong Government, scientists and health organizations have been making concerted efforts to slow down the degree of seriousness of the Alzheimer's disease. Scientists have started testing the effects of mental stimulation in slowing down the Alzheimer's. Nutritionists have also advocated the so-called "Mediterranean diet", by attempting to limit the saturation fats and have simple carbohydrates to maintain the cardiovascular system in healthy state. Biogen, a US biotechnology company, has also started producing first drug with the ability to slow down the development of Alzheimer's. Certainly, they are of good news to us, as they can slow down the increasing pace of the number of patients suffering from Alzheimer's disease and Dementia. Having said that, are those who ended up suffered from Alzheimer's disease "unfortunate"? They have to bear the brunt of losing memory and learning capabilities? Would there be some activities that can help rejuvenate their normal lives?

There have been many forms of learning activities for the Alzheimer's patients to try on. Their superiorities and downsides are listed in tabular format as follows:

	Regular exercise	**Regular diet with adequate vitamins**	**Play Mahjongg and/or chess**
Advantage(s):	• Regular aerobic exercise can constantly activate the brain cells, which reduces the pace of losing memory.	• Low carbohydrates intake and more Omega-3 absorption can increase the health of the patients.	• Mahjongg and chess playing involve a high stimulation of neural activation pattern, which can reduce the chance of Alzheimer's.
Disadvantage(s):	• The ability for the elderly to perform aerobic exercise decreases with age. • No personalized method to retain the patient's own memory.	• No personalized method to retain the patient's own memory. This serves as a general-for-all approach.	• Mahjongg might lead to a chance of obsession, might cause potential financial issue. • Activating brain activity does not mean he/she can retain the memory of his/her own events.

As you may also find out in the table, we lay particular emphasis on "personal experience" and "own memory", instead of a general idea to improve the overall memory and thinking capabilities. Therefore, for the patients suffering from Alzheimer's disease, it is not that they want their brain functions to deteriorate, but that the brain cells are de-generating, and most importantly, this is irreversible. Therefore, it is crucial for us to make the patients lead a normal life as far as possible, given the limitations.

Apart form giving personalizing memory, we can also provide a Kahoot-like gaming experience for the elderly to increase their intrinsic motivation to learn.

V.   Application / Market Need

Because of the pandemic situation we are not able to visit grandpa and grandma, but we invited our family members to join and try. The functions works and they also agreed that it should be relatively easy for the elderly to get in touch with the function to enjoy a brand new learning experience. As they think that it is an interesting function for object recognizer and Kahoot-like Python game, we assume our product is well assured by them but there are still a lot of rooms for further improvement.

Having said that, there are rooms for improvements:

Short-term Improvements
- ✓ The accuracy of the recognition of objects can be improved by training more models into the program.
- ✓ Faster and more accurate model training can be incorporated to reduce the time for training, as it currently takes some time.

Intermediate-term Improvements
- ✓ More translated languages can be supported by the program to meet the needs of people from various countries.

Long-term Aspirations
- ✓ The "Big Data" of objects being trained can be used to analyze how the government can increase the effectiveness of promoting social inclusion.
- ✓ The big data can be contributed to the Government with connection to DATA.GOV.HK.

VI. Conclusion

➢ Make a **data-driven** conclusion of the project and the way forward of the invention process
➢ Justify if the proposed project meets the objective(s)

☐ **Our project is developed based on our school's previous project and the enhancement is as below:**