

## Hong Kong Student Science Project Competition 2023

Template of Extended Abstract (Invention)

(Word Limit: 1,600 words, Pages: 3 pages only)

**Team Number: SAPE248**

**Project Title: Rejuvenating Our Neurodiversity with AI: DyspraxiaNoMore!**

**Project Type: Invention**

*To our best knowledge, there ~~are~~/are no \* similar works in the market; (if there are, ) related product links are as below:*

--

**The enhancement our project made / the difference with related products are:**

--

*\*Please delete if not applicable. The competition values the originality of works. Students must do enough literature research to ensure that their works are unique and list relevant reference materials before starting research or invention.*

### I. Background

- Provide background information as to learn about the audience for whom the project is addressing
- Provide highlights of **literature review** and/or related technologies or devices, with the support of pertinent and reliable references
- Provide an overview of work, create a point of view as to define the needs and insights of the audience and mention the **research or technology gap the project is trying to fill**

Hand-eye coordination is a skill that develops naturally, and it has always been an important part of one's development. Such complex cognitive ability requires us to unite our visual and motor skills to give spontaneous feedback to an incident or an action. The reaction time of different individuals is different, and of course, the faster the eye-hand visual reaction time, the more flexible the person is to react to a target. Believe it or not, a person who has a poorer hand-eye coordination might be suffering from Dyspraxia (運動障礙症), a neurological disorder that impacts an individual's ability to plan and process motor tasks.

When investigating further about the reason for the poor hand-eye coordination (or the symptoms of Dyspraxia), it is found that The Beta rhythm (15-30 Hz – used for decision making and thinking) and Alpha rhythm (8-14 Hz – used for relaxation and rest) of the human brain's motor cortex have many connections with human movement. Such poor hand-eye coordination is related to the combination of the low Beta and Alpha rhythm brain waves.

It is a fact that there have been many ways, both digital and non-digital methods that can improve one's reaction speed, yet it has its own superiorities and downsides. Digital tools like BlazePod are good for people who simply would like to enhance their hand-eye coordination. With repeated practice and trial-and-error, one's hand-eye coordination would be better. Yet the improvement is primarily caused by "memorizing" the rules and there is no data analysis system behind each action. Non-digital methods like playing different kinds of sports can help make practice makes perfect. The more time that we spent on training, the better the performance. Therefore, patients with Dyspraxia can simply improve their hand-eye coordination and sports performance by playing more sports. However, when taking their initiatives and motivation into account, it comes as no astonishment that dancing or playing intense sports are a big hurdle to them. It same applies to students learning that when something is too difficult that is out of their capabilities, they will lose the initiative to improve themselves, let alone challenging themselves.

Indeed, technology can come into play in a more intelligent way to offer a better hand-eye coordination training experience. AI could be used to monitor one's attention and alpha and beta bands by analyzing its patterns. It reduces one's boredom by choosing the most suitable game to train hand-eye coordination based on the attention level and rhythms of the user. Therefore, our team invented "DyspraxiaNoMore!", an all-in-one solution to rejuvenate our neurodiversity with AI.

## II. Objectives

➤ State the aim(s) of project

We understand that patients with Dyspraxia usually have relatively shorter attention span in sports/motor skills, difficult to acquire new skills and poor hand-eye coordination. In fact, the issue of poor hand-eye coordination is also happening to our members as well. During physical activities including but not limited to playing badminton and dancing, the long reaction time renders our ability to react to the goal/action as expected. At some point, we are also saddened by the poor performance and become more and more reluctant to playing this kind of activity. Therefore we want to use AI to solve the problem.

the purpose of incorporating Artificial Intelligence is to ensure that there will be a virtual coach to offer a personalized training for different patients with Dyspraxia. It handles patient's data, including but not limited to analyzing EEG attention and brain waves data, arranging the most suitable hand-eye coordination game with reference to the users' condition and provide personalized recommendations.

AI performs in twofold ways:

- (1) Closely Analyzing Patients' EEG Patterns  
AI will continuously monitor the levels of attention and rhythm ways and provide immediate feedback in the system. For instance, when the attention level is detected as lower values, some more relaxing games are given to training.
- (2) Using Object Recognition Game  
Inspired by Kinect games which let users to follow characters' movements and dance in various arenas to earn points, similar practice can be done by Artificial Intelligence.

## III. Methodology

- Briefly describe the approaches used e.g. use of equipment, materials, tests and experiments
- Explain the selected implementation strategies with the scientific theory

It is a fact that there have been many ways, both digital and non-digital methods that can improve one's reaction speed, yet it has its own superiorities and downsides. Some of the common items are listed as follows,

### Digital Method: BlazePod

BlazePod is a system used for fitness purpose. The system will turn each of the lights in the system in a random pace, and the user will have to press the touch-sensitive area of the BlazePod to turn off the lights. It serves to increase people's hand-eye coordination.

It is good for people who simply would like to enhance their hand-eye coordination. With repeated practice and trial-and-error, one's hand-eye coordination would be better. **Yet the improvement is primarily caused by "memorizing" the rules and there is no data analysis system behind each action.**

### Non-digital Method: Playing Different Kinds of Sports

We always know that practice makes perfect. The more time that we spent on training, the better the performance. Therefore, patients with Dyspraxia can simply improve their hand-eye coordination and sports performance by playing more sports.

However, when taking their initiatives and motivation into account, it comes as no astonishment that dancing or playing intense sports are a big hurdle to them. It same applies to students learning that when something is too difficult that is out of their capabilities, they will lose the initiative to improve themselves, let alone challenging themselves.

To address the dilemmas, we need to answer the following three questions

Dilemma	Response(s)
Being reluctant to get in touch with an area you are not interested in	<ul style="list-style-type: none"> <li>● Why not start from something easy? Earn confidence from simplicity!</li> </ul>
No spoon feeding or “memorizing”	<ul style="list-style-type: none"> <li>● Indulge yourself in different forms of coordination skills, not just one of them.</li> <li>● Personalize your learning with AI with feedback/recommendation system</li> </ul>
Not knowing about my brain status, and having no idea to stimulate the Beta and Alpha rhythm brain waves	<ul style="list-style-type: none"> <li>● Use Electroencephalography (EEG) sensor with AI to train your attention span and mindset.</li> </ul>

Indeed, technology can come into play in a more intelligent way to offer a better hand-eye coordination training experience. AI could be used to monitor one’s attention and alpha and beta bands by analyzing its patterns. It reduces one’s boredom by choosing the most suitable game to train hand-eye coordination based on the attention level and rhythms of the user. Therefore, our team invented “DyspraxiaNoMore!”, an all-in-one solution to rejuvenate our neurodiversity with AI.

#### IV. Design of Invention

- Describe the **design** and the **principle** of invention (e.g. The ideation of the projects, the prototypes or creative solution as far as applicable)
- Provide sketches / drawings / photos of the invention

In summary, there are two core components in the “DyspraxiaNoMore!” system

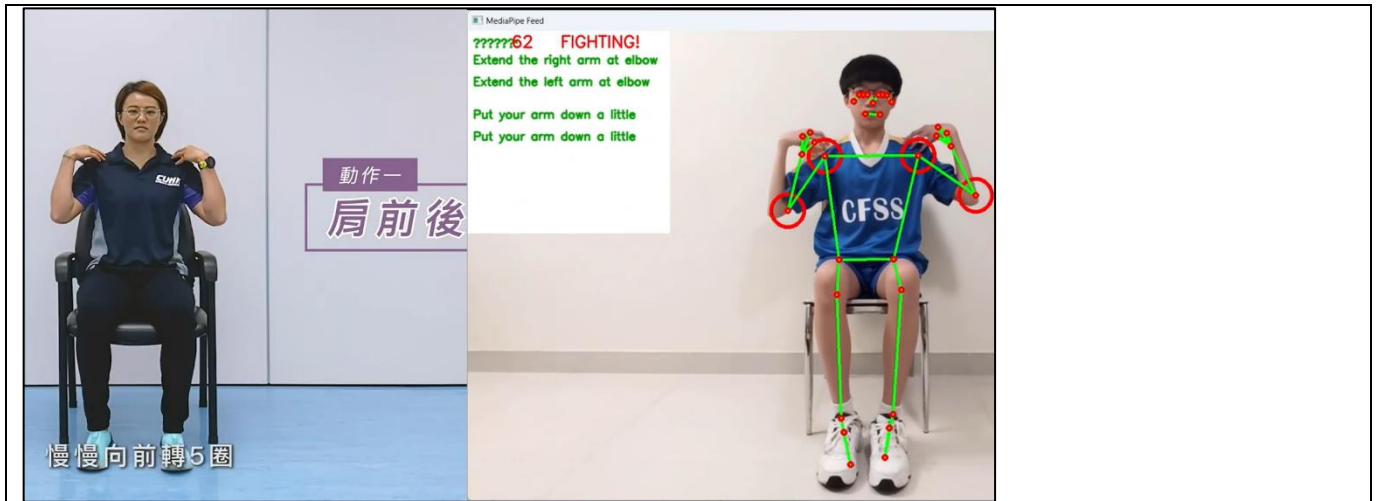
##### AI with EEG Sensors

- Use AI closely analyze patients’ EEG patterns to see if he/she is focusing or not, and to give recommendations based on his status.

##### AI with Object Recognition Game

- A series of games at different ranges of difficulties to boost the response time, and train hand-eye coordination. Scoring system is included to compete with others. The games will be randomly assigned based on the patterns from AI with EEG Sensors.





## V. Application / Market Need

- Explain the area of **application** and function of invention
- Indicate the market need and impact of invention
- Discuss **limitation** and compare with existing related works (if any)

The invention is highly applicable. When designing our invention, we are making it with the prime goals as below:

1. To improve the overall hand-eye coordination of all people;
2. To increase their confidence when going out for sports activities or playing some games involving reaction time;
3. To personalize the training with the help of AI, so that individual learning needs can be catered.

We have tried our best to make our invention to be suitable in all stages. Although we have not tested it thoroughly, we believe that it could be welcomed by all users, especially that it would be available at low cost. Yet, we want to include more hand-eye coordination effective exercises to improve our item.

### Short-term Improvements

- The accuracy of the recognition of hands and EEG graphs 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. If your team will compete the Sustainable Development Award, please indicate the specific sustainable development goal the project is related to, and provide justification for competing for this award. (Word limit: 300 words)**

We understand that patients with Dyspraxia usually have relatively shorter attention span in sports/motor skills, difficult to acquire new skills and poor hand-eye coordination. In fact, the issue of poor hand-eye coordination is also happening to our members as well. During physical activities including but not limited to playing badminton and dancing, the long reaction time renders our ability to react to the goal/action as expected. At some point, we are also saddened by the poor performance and become more and more reluctant to playing this kind of activity. We want to use AI to solve the problem.

Therefore, our team invented “DyspraxiaNoMore!”, an all-in-one solution to rejuvenate our neurodiversity with AI. It handles patient’s data, including but not limited to analyzing EEG attention and brain waves data, arranging the most suitable hand-eye coordination game with reference to the users’ condition and provide personalized recommendations.

**VII. If your team will compete the Social Innovation Award, please list the target group or social issue the project focuses on, and provide justification for competing for this award. (Word limit: 300 words)**

We understand that patients with Dyspraxia usually have relatively shorter attention span in sports/motor skills, difficult to acquire new skills and poor hand-eye coordination. In fact, the issue of poor hand-eye coordination is also happening to our members as well. During physical activities including but not limited to playing badminton and dancing, the long reaction time renders our ability to react to the goal/action as expected. At some point, we are also saddened by the poor performance and become more and more reluctant to playing this kind of activity. We want to use AI to solve the problem.

Therefore, our team invented “DyspraxiaNoMore!”, an all-in-one solution to rejuvenate our neurodiversity with AI. It handles patient’s data, including but not limited to analyzing EEG attention and brain waves data, arranging the most suitable hand-eye coordination game with reference to the users’ condition and provide personalized recommendations.

**VIII. 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)

It is hoped that with the development of “DyspraxiaNoMore!”, the neurodiversity of all people can be increased. We understand that there are still a lot to do to increase people’s hand-eye coordination and improve the reaction time, so that people won’t be afraid of playing sports or dancing. Having said that, we hope that at least with the aid of Artificial Intelligence, there is a personalized coach to urge people to concentrate on the sports training and improve the reaction time.

The project could be further extended to not only for the people who suffer from poor reflex actions or Dyspraxia, but that the same hardware and software could be used to aid other social issues. For instance, the EEG sensors can be used for diagnosing other issues, such as the Alzheimer’s or to help some students who suffer from Special Learning Needs, like ADHD or Developmental Dyslexia. We can use the brain data (attention and the rhythm indexes) to analyze the effectiveness of brain training exercise in rejuvenating the memory and leaning ability of every individual. In addition, the Python games (especially the Response Training and Hand-eye Accuracy Game) can be used as personalized coach for sports, dancing and take-home exercises as well.

We will continue to improve the limitations of our project, as mentioned in the previous chapter, so that people can benefit from using our system.

---

**Our project is developed based on previous project and the enhancement is below:**