TOY FOR ADHD CHILDREN

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ABSTRACT

Attention deficit hyperactive disorder (ADHD) is one of the most common childhood disorders and can continue through adolescence and adulthood. Symptoms include difficulty in paying attention, difficulty in controlling behaviour, and hyperactivity (over-activity). Children with ADHD have problems in focusing on doing certain tasks or activities. They easily lose focus while doing things which are not interesting to them. Children with ADHD tend to disturb their parents at home even when they are doing housework. Typically, when their parents give order, they do not obey because they are easily distracted with anything in sight. In addition, most of the toys nowadays for ADHD children to play with and help them concentrate are less interesting. ADHD children love to play something that are interesting. This project is made to produce new device for ADHD children for focusing. It also to create suitable size of toys for children to play with and portable. It is a device to practice focusing and also to monitor at the same time. Arduino is used as medium to transfer neurofeedback received from brainwave Neurosky via Bluetooth to trigger the motor motion as they focus. It can be concluded that this device will helps in focusing for not only for ADHD children but also for adults and normal children.

KEYWORD : Attention deficit hyperactivity disorder, brainwave, toy, Arduino, Neurosky
1. INTRODUCTION

Attention deficit hyperactivity disorder (ADHD) is one of the most common childhood disorders and can continue through adolescence and adulthood. Symptoms include difficult attention, difficulty controlling behaviour, and hyperactivity (over-activity).

ADHD is a chronic debilitating illness with onset in early childhood. The objective of this study was to look at the impact of children with ADHD on their parents. Based on research conduct by Psychiatry Adolescent and Child (PAC) Unit, Department of Psychological Medicine, Faculty of Medicine, University of Malaya.

A total of 95 parents participated in the study. The proportion of parents who reported significant stress in this study was much higher than in most studies (n= 69, 73%). Significant correlation was found between the severity of the child’s disorder (Children’s Global Assessment Scale [CGAS] score) and the parents’ stress level (OR 0.16, 95% CI 0.05–0.51). Mothers were significantly more stressed than fathers (OR 0.16, 95% CI 0.05–0.51) and non-Malay parents more stressed than the Malay parents (OR 3.92, 95% CI 1.29–11.94). Parents with children older than 12 years of age were six times more stressed than parents with children younger than 12 years old (OR 6.47, 95% CI 1.55–27.01). Stressed parents acknowledged that having a child with ADHD was their biggest worry. Stress has marked consequences on any person and has important bearings on their mental health. Stress among parent needs be looked into when treating children with ADHD.

2. LITERATURE REVIEW

2.1 Arduino

Arduino is an open-source prototyping platform based on easy-to-use hardware and software. Arduino boards (//www.arduino.cc/en/Main/Products) are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language, and the Arduino Software (IDE), based on Processing

2.2 Understanding brainwaves

Brain creates simple electricity through an electrochemical process measured in the form of brainwaves. Brainwaves occur at different frequencies depending on what the brain is doing. Brainwave activity occurs on a continuum from slow to fast wave frequencies. For measurement, these brainwave frequencies are separated into five categories based on their repetitions per second (Hz) or cycles per second (cps). The brainwave frequency bands used for clinical purposes are shown on Figure 1: Table of brainwaves
**Figure 1: Table of brainwaves**

<table>
<thead>
<tr>
<th>Brainwave</th>
<th>Frequency</th>
<th>When Does It occur?</th>
<th>When Does It occur? Mental State/Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Delta</strong></td>
<td>0.5 • 4 Hz</td>
<td>* The dominate brainwave of infants (from birth to 24 months) •awake, nursing or asleep. * In adults, found during periods of deep sleep</td>
<td>* Unconscious, deep sleep, very deep relaxation * No feelings/emotions in this state.</td>
</tr>
<tr>
<td><strong>Theta</strong></td>
<td>4•8 Hz</td>
<td>* Children's brainwaves begin to accelerate between the ages of two and six into the faster Theta state, which explains their rich imagination and creativity at this age. * In adults, we experience this state as we are drifting into sleep and just as we are waking up.</td>
<td>* Deep relaxation * Decreased sensitivity to pain. Under hypnosis, many people go into synaesthesia (so deeply relaxed that surgeries can occur with sensation but without pain).</td>
</tr>
<tr>
<td><strong>Alpha</strong></td>
<td>8 • 13 HZ</td>
<td>* Occurs when we meditate, daydream or enter the lighter states of hypnosis or highway hypnosis.</td>
<td>* Your mind is relaxed but alert. * A state of accelerated learning.</td>
</tr>
<tr>
<td><strong>Beta</strong></td>
<td>13 • 30 Hz</td>
<td>* The most common form of brainwaves. Beta brainwaves are present during mental thought and activity.</td>
<td>* A familiar state of eyes open, fully alert, focused on what is around us. This is the state in which we deal with the day-to-day solving of life's issues. * Emotional sensations in the Beta state include anger, worry, fear, anxiety, tension, surprise, hunger and excitement.</td>
</tr>
</tbody>
</table>
3. METHODOLOGY

This section discusses on experimental method that we used to complete this project. First stage of this project is to build a prototype based on the survey of current interesting toys, which is drone. Prior to this survey, a drone prototype using one motor and one blade called Braino is created. The first design lipo battery and the arduino circuit is attached to Braino but the drone cannot fly because the total weight is more then 800 gram. Therefore we disassemble the battery and the circuit and put them separately and only attach wire from the circuit to motor and the blade, after the alteration then the Braino can fly.

Second stage of this project is to test the effectiveness of Braino toward ADHD children with age less then 12 years old. The experimental is made to measure level of focusing of ADHD children. This experiment using five [5] respondent which are children less then 14 year old and diagnosed with ADHD. They focusing level while playing with other toys and Braino has been monitored. Data is collected using Neurosky device as shown in Figure 2. Braino is shown in figure 3 is still in prototype design will received signal from Neurosky powered by Lipo battery. This drone has Arduino, Bluetooth Module and electronic speed controller (ESC). ADHD children will apply Neurosky device on their head as shown in Figure 4.

![Figure 2: Neurosky Brainwave device that act as EEG to read brainwaves](image)

![Figure 3: Drone (toy) that receive signal from Neurosky powered by Lipo battery. This drone has Arduino, Bluetooth Module and electronic speed controller (ESC)](image)
Braino that can receive Bluetooth output signal form Neurosky, was created by using Arduino microcontroller board and Bluetooth Module HC-05. This two electronics board in figure 5, was programmed to receive Bluetooth signal from Neurosky device. As for the toy, we create a drone because of trending popularity of this toy nowadays and this device can attract the interest of people mostly children and youngsters. This drone is controlled by an Electronic Speed Controller (ESC) that trigger and control the speed and movement of the drone motor. The motor’s speed will control up and down of the drone. Braino is called from the combination of Neurosky with Arduino that control the drone.
4. RESULT AND ANALYSIS

Based on the result we collected from five [5] ADHD children, we analysed the results and transfer the data into table and graph. The result as shown in table 5.1.1 percentage shows that while playing with Braino ADHD children is more focus compare when they are playing with others toy. All the reading show percentage of while playing with Braino the percentage of focusing are higher compare playing with other toy.

Table 5.1.1: Readings between playing with other toys and braino while using Neurosky device

<table>
<thead>
<tr>
<th>User</th>
<th>Others (%)</th>
<th>Braino (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>User 1</td>
<td>59.62</td>
<td>73.95</td>
</tr>
<tr>
<td>User 2</td>
<td>47.22</td>
<td>51.93</td>
</tr>
<tr>
<td>User 3</td>
<td>44.1</td>
<td>64.71</td>
</tr>
<tr>
<td>User 4</td>
<td>51.67</td>
<td>67.86</td>
</tr>
<tr>
<td>User 5</td>
<td>16</td>
<td>43.6</td>
</tr>
</tbody>
</table>

5. DISCUSSION

By using Neurosky mindwave, we can capture brain wave signal by wearing it on our head. As we use beta wave during focus it will only transmit beta the signal to the Arduino. Arduino as medium to translate signal from the Neurosky which is in analogue signal into digital signal. As we are using drone as our receiver, the signal will transmit from Arduino to electronic speed controller (ESC).

This electronic speed controller (ESC) will trigger the motion of motor. Meanwhile, if Neurosky capture high beta wave it means that the person is in high focus thus the speed of the motor will increase. Generally, the higher the focus, the faster movement of the motor. If the person lost focus this mean, there are low beta wave captured by Neurosky, thus the motor will receive low signal from Arduino cause the motor to stop.

6. CONCLUSION

This device will help children learn focus while playing. As it is interesting toys, it will boost the children to play with it more and increase their focusing. It is also an alternative method for ADHD treatment. Lastly it also can be used for adult and normal children for focusing. This device will be a new generation of toys in the market in Malaysia as there are no kind of this toy for ADHD currently. We expect this toy will be placed in all ADHD centre and other educational institution for new generation of society to explore the greatness of brain
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