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An Effective Online Gross Motor Movements Screening Tool For Dyslexia Based on Kinesthetic Perception

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Abstract

Dyslexia is a specific learning disability and it is most common disorder of childhood. Kinesthetic can be described as the form of learning that involves hands on experience. Multimedia enables learning to become fun and friendly, without fear of inadequacies or failure. The paper proposes online tests for Gross Motor movements that are usually done face to face. These tests are developed to identify children with dyslexia at an early stage and to overcome their disabilities early in a child's school career. These tests are implemented presently in hyper terminal which will be later integrated with the already developed web based tool R U LEXIC which has been developed to screen visual and auditory perceptions of dyslexia. Hence, this tool can be used for early identification of difficulty in Gross Motor movements in children.

Keywords: Dyslexia, Kinesthetic, gross motor

Introduction

The aim of the research is to develop a computer-based on-line screening tool by implementing multimedia elements that is suitable for dyslexic students. The tool is named as **R-U-LEXIC** and will be as an alternative to the manual screening. This tool has a great potential to be used to identify the probability of students having dyslexia. It can be used in mass screening of students in schools. The tool is developed based on the different classifications of dyslexia namely

1. Visual dyslexia
2. Auditory dyslexia
3. Kinesthetic

Initially a Web based Assessment tool named R-U-LEXIC has been developed for the screening of Visual and Auditory perception, and the results are encouraging [1-3]. Kinesthetic can be described as the form of learning that involves hands on experience. It is a learning style in which learning takes place by the student carrying out a physical activity, rather than listening to a lecture or watching a demonstration. In simple, Kinesthetic mean motor skills or movements. Motor skills are categorized into Fine and Gross motor movements.

- Fine motor skills are the small movements that occur in the hands, wrists, fingers, feet, toes, lips and tongue. They are the smaller actions that occur such as picking up objects and other small muscle tasks that occur on a daily basis.
- Gross motor skills involve the large muscles of the body that enable such functions as walking, kicking, sitting upright, lifting, and throwing a ball.

Common indication of kinesthetic dyslexia include:

- Lack in Upper-Limb Coordination
- Lack in Bilateral Coordination
- Difficulty in major muscle movements such as walking, jumping, running etc.

This paper is about development of online tool for screening dyslexia based on Kinesthetic perception which included tests for Gross motor movements. All the tools developed were integrated and tested.

Methods and Materials

Gross Motor Movements

The system which we put forth is an online testing tool to examine the Gross motor skills which involve the large muscles of the body that enable such functions as walking, kicking, sitting upright, lifting, and throwing a ball. This screening tool was developed as a hardware kit (microcontroller and sensor based) that would be connected to the system. These tests are categorized based on the grade levels, based on the class they study and age. The student has to select their grades and should take their test. This online tool is user friendly and can be used in schools and institutions to examine their children and give them special care and assistance if they are dyslexic.

Proposed Tests For Gross Motor Movements

The Four tests that are proposed for Gross motor movements are:

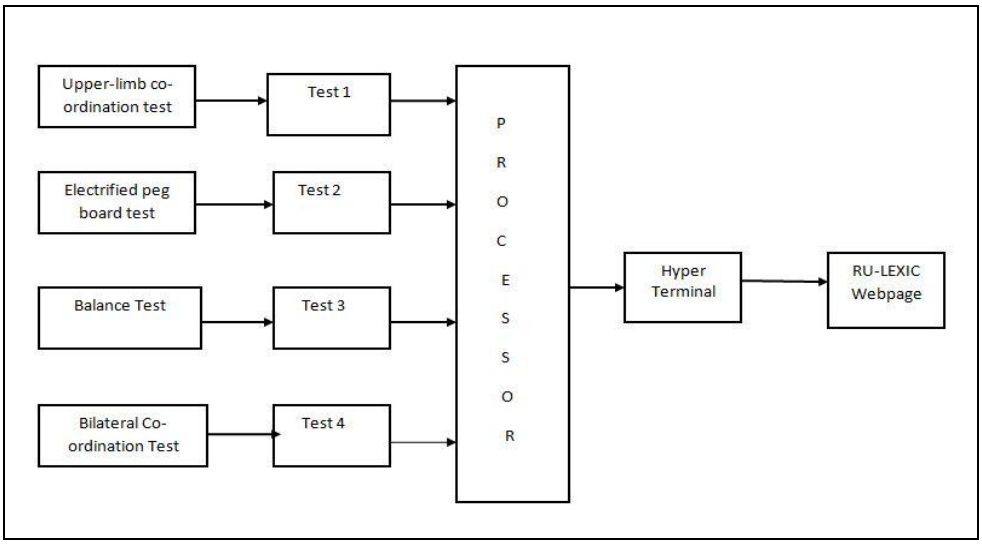

Figure 1: Overview of the online Kinesthetic screening for Gross motor movement

Upper Limb Co-Ordination Test:

This test is based on throwing a ball to target which checks the upper-limb co-ordination. A Child is made to throw the ball on the target. The level of difficulty varies based on the grades of children like reducing the target size or increasing the distance from the target.

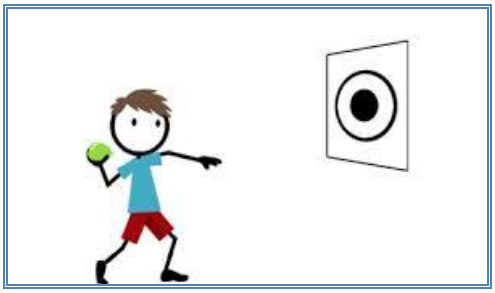

Figure 2: Upper limb coordination test

Electrified Peg Boards:

A peg board is a pattern of shapes in which the respective shapes called as pegs can be fitted. This test is to check the child's co-ordination between mind and hands. The level of difficulty varies by increasing complexity in shapes.

Figure 3: Test For Co-Ordination Between Mind And Hands

Balance Test

In this test the child will be made to walk on a path to check their balancing ability. Levels of the test will vary according to the grades of the children. Deviation from the path will be recorded in the system

Figure 3: Test For Balancing and Bilateral Co-Ordination

Bilateral Co-Ordination Test:

A platform with sensors will be placed and will be divided into boxes based on directions. The child has to jump on to the box on the platform based on the instruction given. This test is to check their bilateral co-ordination.

Implementation and Results Achieved

Of all the four tests, the first two tests have been implemented and tested.

Upper Limb Co Ordination Test (Throwing The Ball To The Target):

Throwing the ball to target is a test to check their upper-limb co-ordination. A flat surface will be

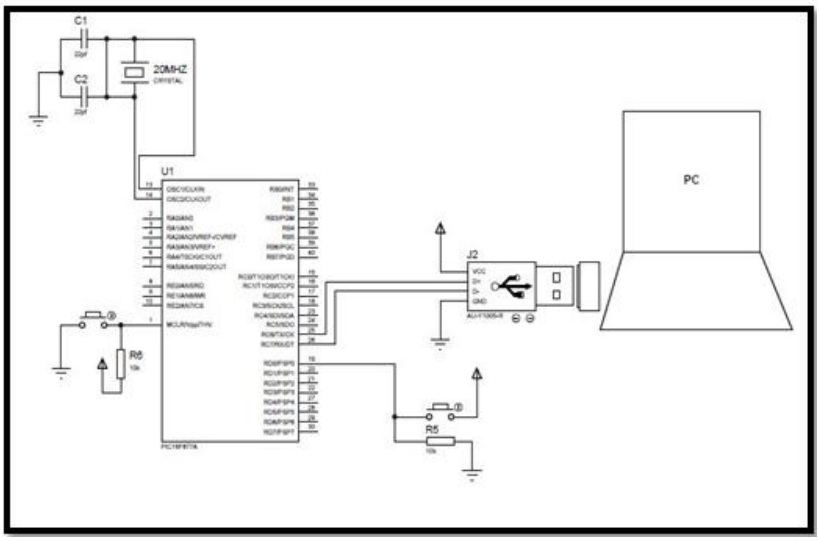

Figure 4: Circuit diagram for upper limb co-ordination test

fixed vertical to the wall and this will act as the target and the child has to throw the ball to the target. If the ball hits the target or if there is any deviation it will be recorded and will be indicated in the output screen. The level of difficulty varies based on the grades of children like reducing the target size or increasing the distance from the target.Figure 4 and 5 show the circuit involved and overall system that has been developed for upper limb co-ordination test.

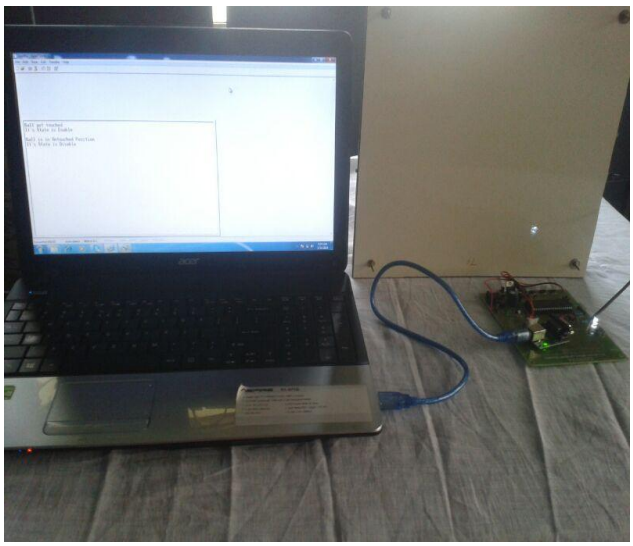

Figure 5: Overall system of upper limb co-ordination test

Figure 6: Target board developed for upper limb co-ordination test

In the above circuit a leaf switch is used. A child is made to throw the ball and hit the target placed before. When the child succeeds in hitting the ball on to the target a switch is pressed which is placed in between the plates that act as the target to be hit. When the switch is pressed a trigger is sent to the microcontroller which stores output. The corresponding output is displayed on the hyper terminal. For Grade 1& 2, a target of dimension 40X40 cm was used and for Grade 3&4, a target of 30X30 cm of a still smaller size was used

Electrified Peg Boards:

A peg board is something which has a pattern of shapes into which small pegs can be fitted. The pegs and the holes are electrified, in such a case when the child places the pegs in the respective patterns the system will be informed of it. This information can be used for keeping a score.

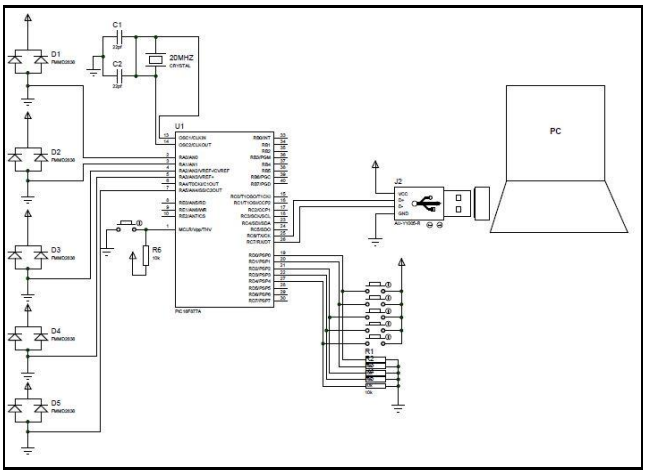

Figure 7: Circuit Diagram of Peg board for upper limb Co-ordination test.

In the above Figure 7, the circuit shows a LDR sensor and wires are placed on the boards where the respective shapes have to be placed. Small conducting plates are placed on the shapes. A child is asked to take up the test. When the child places a shape on the board light falling on the LDR sensor will get destructed. Thus the LDR sensor will sense and wait for the next 4-5 seconds. If the the shape placed is the correct shape then the plate fixed on the shape and wire on the board will act as a switch as they conduct. Thereby the switch will get closed. Both the signals from sensor as well as the switch will be given to the micro-controller and the output will be displayed on hyper terminal. If the shape placed is not appropriate one then only destruction in light to the sensor will be there but not conduction. Thus only the output of sensor will be given to the microcontroller. Hence the output will be displayed as mismatched in the hyper terminal. Because matching the shapes will require both the outputs of the sensor as well as switch.

Figure 8 shows the overall system and Figure 9 to 12 shows the peg boards developed for all 4 grades

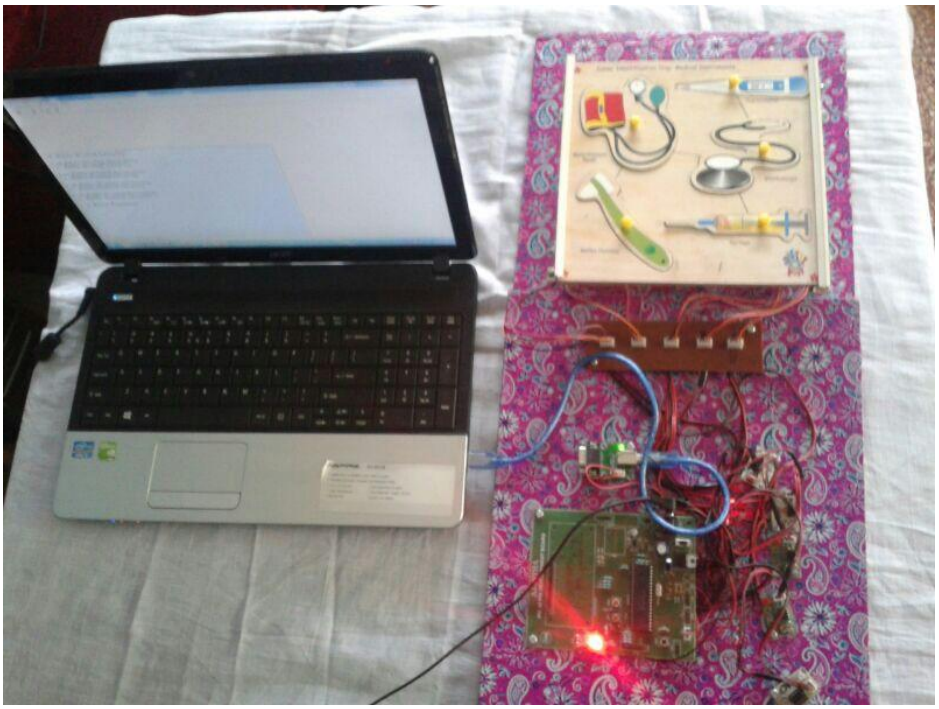

Figure 8: Overall system for electrified Peg board

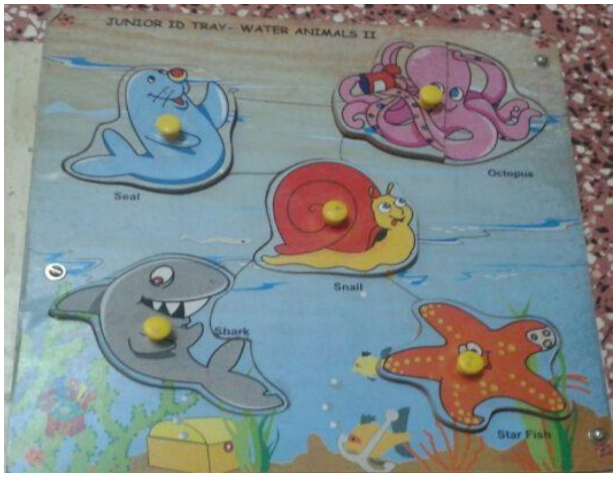

Figure 9: Electrified peg board for grade1

Figure 10: Electrified peg board for grade 2

Figure 11 : Electrified peg board for grade 3

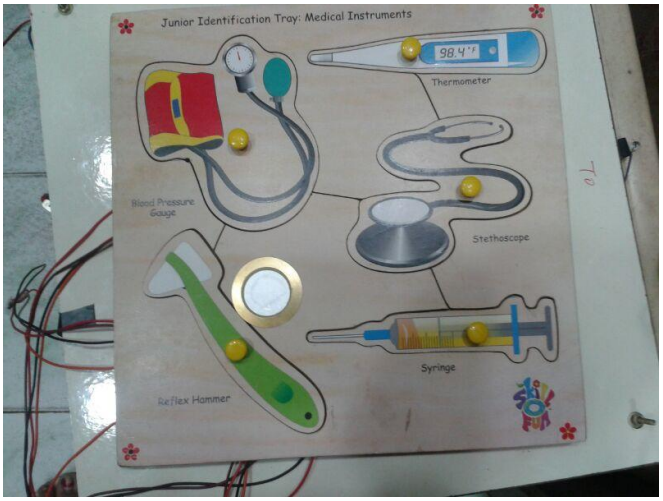

Figure 12: Electrified peg board for grade 4

Results

The output of upper limb co ordination test is displayed in the hyper terminal. If the ball hits the target , it will be notified in the PC. The figure 13 below shows the output when the target board was tested by connecting it to a computer. When the ball hits the target, the switch is pressed and a message will be displayed as “Ball got touched, it’s state is enable”. When the ball does not hit the target, the switch is released the message will be diaplayed as “Ball is untouched, it’s state is Disable”.

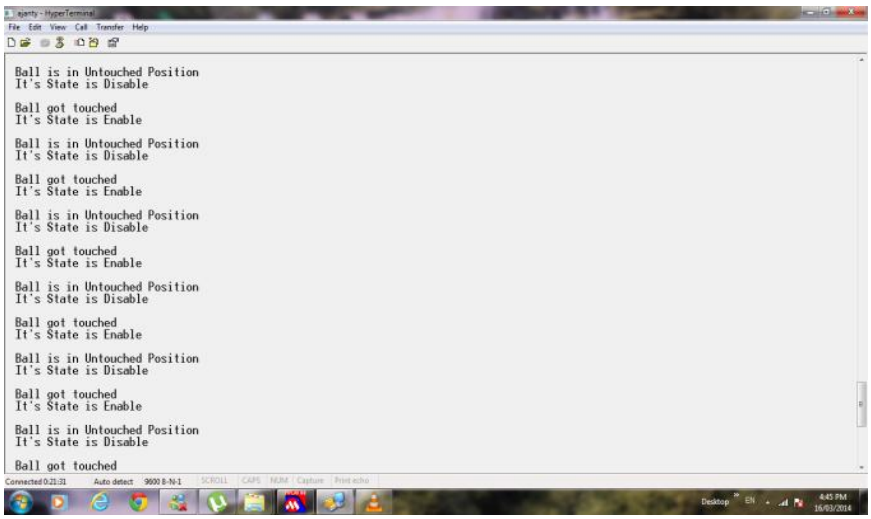

Figure 13: Output for target for upper limb co ordination test on hyper terminal

The figure 14 shows the result of Peg board connection for upper limb Co-ordination test, when the shapes are placed correctly in their respective patterns. It also gives the information about how much modules (i.e the no of shapes) are

correctly attached . The first line gives the current module attached and the second line gives the total no of modules attached. If the modules are not attached properly, a message is displayed as 2nd module mismatched and 4 modules are attached successfully. These tests are implemented presently in hyper terminal which will be later integrated with the already developed web based tool R U LEXIC which has been developed to screen visual and auditory perceptions of dyslexia.

Conclusion

This research has reviewed the important elements in identifying dyslexic children and suitable criteria in designing the multimedia screening tool for dyslexic children. This would in turn mean that these children would receive specialized support or treatment to help them to improve. This application can be one of the methods in screening dyslexic children at early stage whereby children enjoys test. This causes the children to produce more reliable results. This research could be extended by integrating the Kits with an already developed web based tool to make it user-friendly.

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