DETECTING DEVELOPMENTAL DELAYS IN CHILDREN USING SMART TOYS

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Abstract— In this paper, we describe the design implementation of a series of smart toys systems.It is considered as a technology for observing and recording and also analyzing for detection the developmental delays in children using smart sensor toys so to accomplish the goal of automating the toys, we can use the sensor features to develop a series of sensor-based low-cost devices. Specifically, Our prototype system consists of 3 devices or series of smart toys or devices which are capable of sensing the capabilities or the movement that the user makes using that device. Basically, this paper gives an idea where all these toys will be behaving as a client and are connected to controllers where there will be sensors in the devices or clients which will generate certain data which will help in making decisions regarding the child's development

Index Terms— Children,Controller,Developmental scales,Devices,Health,Sensors,Smart Toys.

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1 INTRODUCTION

It is well known that kids use toys world wide.These toys can be considered as their main and first interface with the outside world.So according to this,we have used these toys in such a manner with using certain sensors so that when children handle these toys then the assessor can be able to detect developmental delays if any.

Therefore, the main aim of this project is to detect the various developmental delays in children who manipulate these toys.There are certain developmental scales such as **Merril-Palmer-R**, in this it helps identify developmental delays and learning problems.It basically uses pencil and paper.

The model used in the developmental scales used to be traditional objects, like cube towers,tokens representing placing the pegs,computerized games. The reviewer obtains various information from the tasks that are performed by the children and also help to check the developmental delays in the children.By using sensors inside the regular toys.Accordingly, the monitoring of the developmental delays could upgrade their skills and help them . The main objective of this research paper is to enhance the correctness of old evaluation methods by implanting sensors into regular toys that provide assessors with certain values which are not such processed information but a raw data .This paper presents the designs of a series of smart toys with implanted sensors that gives information to the assessors.The toys selected for this research paper is a set of cubes,Tokens for the replacement of placing the pegs and the computerized games and the defined activity is to build a tower of cubes, placing the sensored tokens in the correct blocks and determining the objects in the game. The information by the devices are:

For Cubes
• It checks the pattern of what is created by the children.

• It checks how much time is taken by the children to complete the task
• It checks that with what accuracy the child builds the cube tower.

For Placing The Pegs
• It checks with how much accuracy the pegs are being holded by the children
• It checks what is the smoothness of children's hands while handling the tokens.
• It also helps to check the color identification of the children using the RGB leds under the tokens.

For Autism Game
• How accurately objects which are shown in the screen are detected.
 • As the difficulty level increases also the suggestion are changed

2 DESCRIPTION OF SMART TOYS ARCHITECTURE

Here in this paper we will be using 3 different smart toys for detecting different developmental delays,which combines with a controller and a User Interface.

Stackable Cubes:

The main aim of this smart toy is to detect the motor skill of handling and alignment of things in real life by children. The task here is to build the tower of cubes.These professionals need to know the following parameters:Motion of the pattern,Tower Status.The cubes send the sensor data to the controller. When the activity is done the data is collected by the sensors then sent to the controller and stored to the database.
The proposed shape of the smart toy is cube which is not more than 2.5cm.It contains various sensors which are used to detect the developmental delays in the children.
All these cubes will give additional information such as

shaking quality of hand while picking up the cube. Also it will determine alignment of the tower.By this data it will very easy to understand various details and the comparison among them, an interesting possibility in the study of Developmental Coordination Disorder (DCD)

Autism Game:

Here an application(Find me) is developed using some steps that are strictly followed.A child with Autism plays this game.We can get some good results that are associated with the development of autistic children skills.

To conduct the research they have divided
methodology to four steps as below:

1)Interview and questionnaire: To find out the limitations and characteristics of children with Autism some interviews and questionnaires with parents and therapists was needed. The result of the interviews and questionnaires helped to classify the participants based on their problems and understand their talents and skills.

2) Select the game :
There are a lot of games that have been designed for children with Autism, each with special goals. Some of the games have been designed to help the child improve his/her communication skills, some to teach facial expressions, to name a few. The issue is that the game should be adept with the children`s problems and limitations. So the interview with parents helps in developing a more suitable game.

3)Participants play the game

4)Analyze the information from the
observation.
In this game,children will be asked to find the character ,so child has to touch his finger on the character.If the child will touch any other thing other than character which he was supposed to find/touch then it says the name of the thing child touched because the game should not be discouraging at all.If the child is able to touch the character in the game then a audio is played saying "you found me".

Placing the pegs Game:

It is basically for the age group of children between 5 to 7. This game proposed by the author has elements such as it consists of two small tokens and a board that depicts a kitchen, sleeping cats and a plate with cheese. The tokens are of the small shapes with cut out corners with an accelerator in it to determine the smoothness of the child's hand.

Each of the tokens carries a Light Blue Bean microcontroller with a built-in accelerometer and two RGB LEDs. LEDs are placed behind two semi-transparent facets with engraved images of mice and they provide visual feedback to players during the game. Given the size of the sensor, tokens were made as small as possible. Dimensions of each token small so that it can be easily held by children in hands that with cut out slots and a printed illustration of the kitchen and sleeping cats.This sensored device was basically made for detecting the delays in children's smoothness of hands and color capabilites.It was tested in a class where there were students of age 5 to 7. They all were first explained the game as the lights will glow at the back side of the tokens which the students have to pick up with one hand so that it will check the picking up things with one hand capability of the kids and also when they will detect the light it will test their color capabilities.The smoothness was detected by the accelerometer in the Token .Then it was suggested to the authors that the tokens are too large to hold.

3 DATA ANALYSIS

3.1 Controller System
Main components of the controller system are:-

A Web Server: The server here is mainly projected in Python and Django; it is basically a server which is software or hardware.

A system daemon: This daemon is used to receive data from the sensors. This data is stored temporarily so that when data is received by one by one device then when all the data is received at once then it is all received by the database and then stored in it.

A database: The database here is used to store the data that is received form the 3 devices in the database mainly used is sqlite which is compatible with Django.The data is stored
The File in which all the details will be stored in the JSON format. Once the experiment is finished,the data received in the collector will be stored in a plain text format by all the 3 smart devices one by one the data from the devices will be received by the devices and then stored in the Deamon system and when all data from the 3 devices are received by the controller then it is sent to the user Interface.

In the user interface the information are as follows:
Time of Start of the experiments
End of Start of the experiments
Name of the reviewer
Details of the Children taking the test
Details of the Results after taking the test.

3.2 End Users
There can be 3 kinds of End Users for this project
1.Teachers
2.Doctors(Pediatricians)
3.Parents

In this according to the SD the suggestions are set.
The calculation is done using The MABC-2 test, the
correlation coefficient between (0.5-0.9) ranging from good to

excellent lower than this the children have developmental delays.

So as all the Users differ from each other the data shown on the user interface will also differ according to the user.

4 METHODOLOGY

In this paper we will be using a MABC-2 comprehensive study to determine the Detecting developmental delays in children.
Basically ,MABC-2 test is the Movement Assessment Battery Test Edition-2 which is the standardized motor skills test that measures the motor development of children and adolescents aged 3 to 16 years.
There are basically 3 subsets involved in this study:-
1.Manual Dexterity
2.Balance Test
3.Aiming and Caching
There are various tests in these subsets such as in Manual Dexterity Posting Coins,Threading Beads,Drawing Trails; Balance Test Walking on Heels raised, Jumping on mat, Static Balance test Catching Beanbag,Placing the peg. In this our aim is to automate all these tests so that these test results can be handy to the Reviewer.
In this the children are asked to perform certain tasks and then manually the reviewer reviews the tasks performing by the children.
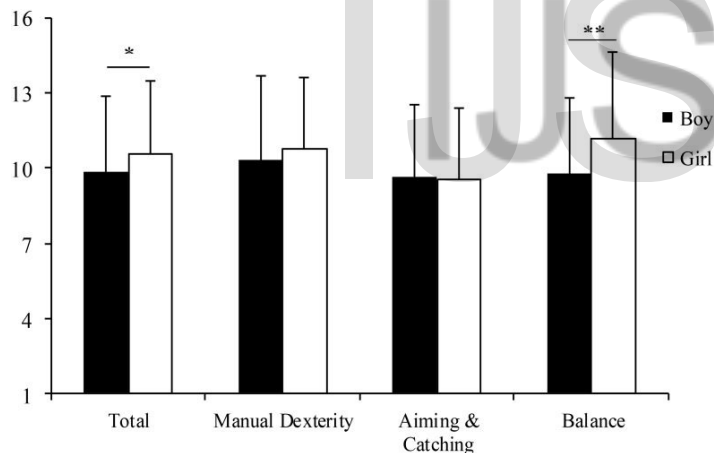

Figure:-Total and component scores for boys and girls.

In the above diagram , there are certain tasks that are performed by the children gender specific so accordion to the above diagram after evaluating the 3 subsets ie Manual Dexterity,Aiming and Catching and Balance so according to the Total graph girls perform better than boys,as the SD are greater in case of Girls.

So the basic aim is to use this comprehensive study to determine the developmental delays in the children. The difference is that rather than manually interpreting the aim is to automate it.

5 CONCLUSION AND FUTURE WORK

When we are working in the field of early detection of developmental delay in children, information is something precious. So all the information provided by the sensors are received by the controller . In the cubes the additional data obtained are shaking quality and the alignment of the tower.
In placing the pegs the accelerator in the tokens these are small tokens so that they can be held in hand by the children.
In Autism game the game is for autistic people to detect the objects which are on the screen.
The main aim is the data analysis; the data is stored and processed in the controller. The centralized controller architecture uses web server ,system daemon and database.
The architecture has also been designed to be easily extended with future new toys or experiments that can be performed using the interfaces provided, by just including the new activities as an option in the collector server. Moreover, in future more smart toys can be added to the controller which can be more compatible to the controller.

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