MINOR PROJECT

GAME-AID FOR DSYLEXIA AND DYSPREXIA

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ABSTRACT

Since Dyslexia is a very common learning disorder with more than 1 million cases per year in India. And Dyspraxia is also sometimes accompanied by Dyslexia, The current project aims to provide an innovative solution of the dyslexia therapy and research. These games are a method to train the brain in a way that helps Dyslexic and Dyspraxic children do their daily chores effectively. The games aim to improve eye-hand co-ordination, concentration, stability and empower motor skills as well as entertain the user. Games in this game platform provide different types brain teaser activities which are grouped according to different age groups.

PROBLEM STATEMENT AND ITS SIGNIFICANCE

Dyslexia is a learning disorder that involves difficulty reading due to problems identifying speech sounds and learning how they relate to letters and words (decoding. Dyslexia affects areas of the brain that process language.) A dyslexic person is predominantly using the right hemisphere of their brain instead of their left to read and spell.

In more detail: A brain-based problem in the decoding of written language

Broca's area   Wernicke's area
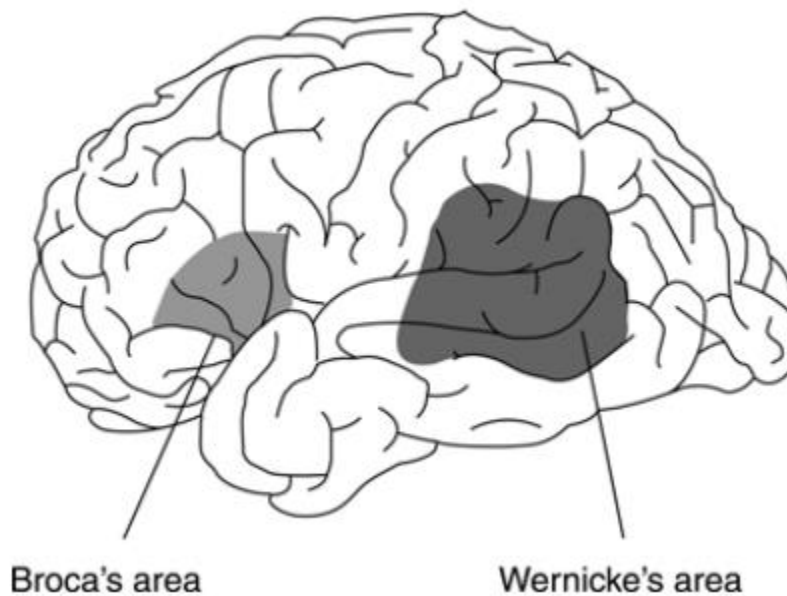
The latest research into the causes of dyslexia is saying that the dyslexic brain processes written words differently. There is a greater reliance on the Broca's area in the left frontal lobe. Strong readers rely more on areas to the back of the left brain close to the Wernicke's area.

Reading

Dyslexic reader   Efficient reader
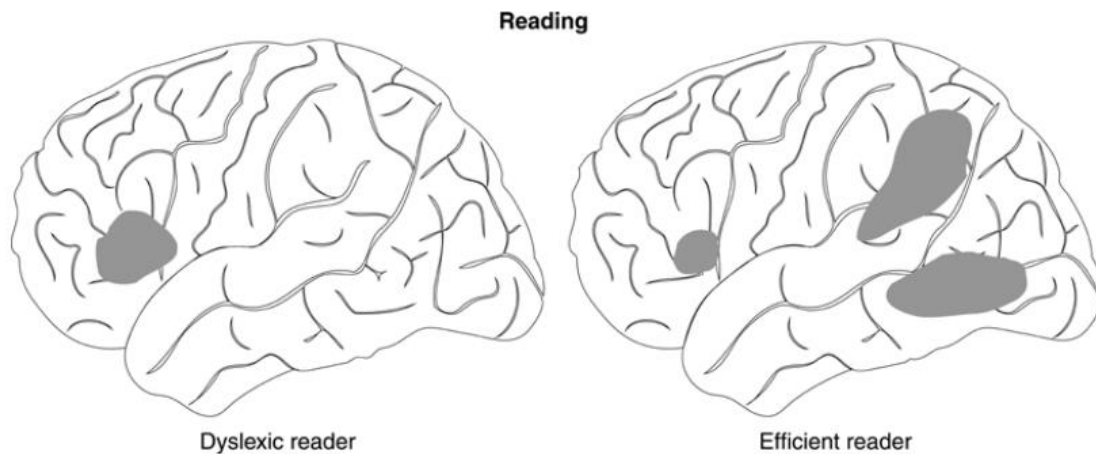
For non-dyslexic readers, this area at the back of the left brain is very active during fluent reading. Words are recognized here at lightning speed.

Dyspraxia is a neurological disorder that impacts an individual's ability to plan and process motor tasks.

Individuals with dyspraxia often have language problems, and sometimes a degree of difficulty with thought and perception. Dyspraxia, however, does not affect the person's intelligence, although it can cause learning problems in children.

Developmental dyspraxia is an immaturity of the organization of movement. The brain does not process information in a way that allows for a full transmission of neural messages. A person with dyspraxia finds it difficult to plan what to do, and how to do it.

The National Institute of Neurological Disorders and Stroke (NINDS) describes people with dyspraxia as being "out of sync" with their environment.

Experts say that about 10 percent of people have some degree of dyspraxia, while approximately 2 percent have it severely. Four out of every 5 children with evident dyspraxia are boys, although there is some debate as to whether dyspraxia might be under-diagnosed in girls.

Symptoms tend to vary depending on the age of the individual. Later, we will look at each age group in more detail. Some of the general symptoms of **dyspraxia** include:

- **Poor balance**
- **Poor posture**
- **Clumsiness**
- **Differences in speech**
- **Perception problems**
- **Poor hand-eye coordination**

When carrying out an assessment, details will be required regarding the child's developmental history, intellectual ability, and gross and fine motor skills:

- **Gross motor skills** - how well the child uses large muscles that coordinate body movement, including jumping, throwing, walking, running, and maintaining balance.
- **Fine motor skills** - how well the child can use smaller muscles, including tying shoelaces, doing up buttons, cutting out shapes with a pair of scissors, and writing.

WORK RELATED STUDY
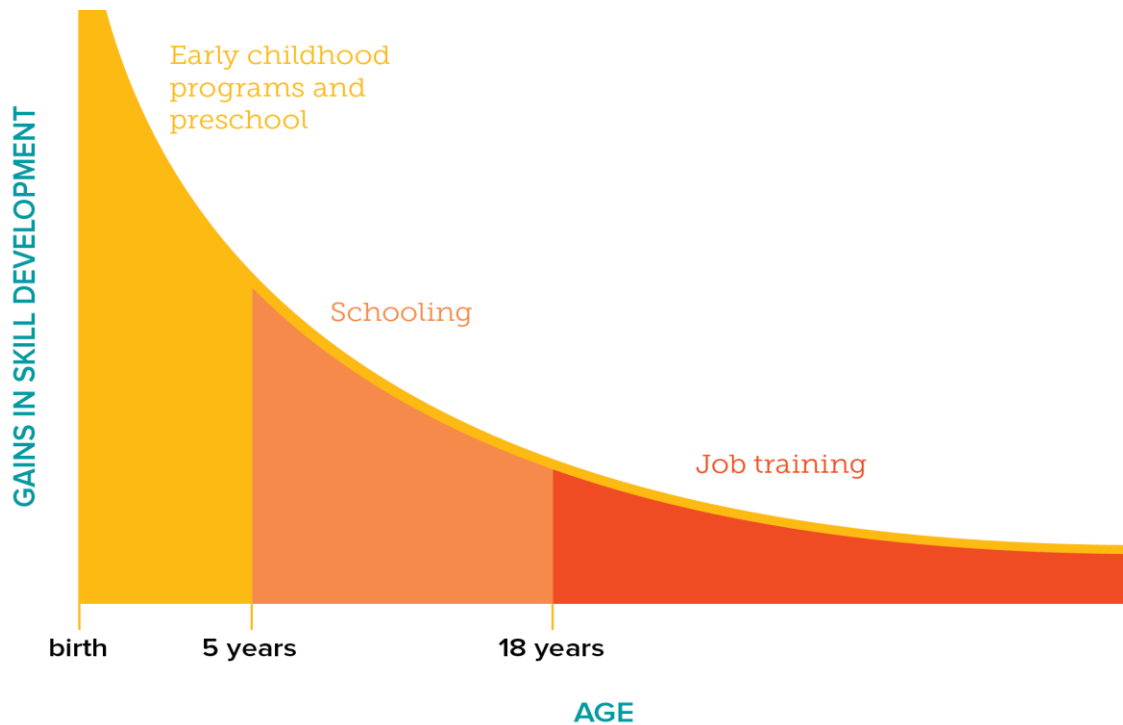
As per graph shown above, most of the gains in skill as well as motor development occur at young age that is approximately 50% before 5 years and 80% before 10 years.

It is a challenge to classify the prevalence of DCD, because like many others psychological disorders, it is prevalent far beyond the finite number of people who are able to be diagnosed with the condition. In the United Kingdom, the prevalence rate for DCD ranges between 1.4 and 19% with the variation dependent upon the particular diagnostic criteria used by practitioners.

Furthermore, DCD has high comorbidity – or presence of at least two health
concerns- with several disorders. In a review of cases of comorbidity to DCD, Visor (2003)
found that symptoms of ADD/ADHD, reading disability (RD) and specific language
impairments (SLI) most frequently coexist with DCD. The most significant case of co-
occurrence is observed for ADHD, which is estimated to have an overlap of approximately
50% with DCD. In other words, about half of those who have DCD also have ADHD. It has also been observed that many with Autism Spectrum Disorder exhibit symptoms often comorbid with dyslexia and DCD.
The precise comorbidity rates with other disorders remain rather unclear. This gap could be due to the lack of proper assessment for DCD in past screening methods for SpLDs as well as a general lack of knowledge of DCD among the medical professional populations. It is clear that increasing awareness of DCD among physicians, paediatricians, and generally across the medical community would assist in proper and timely diagnoses for those suffering from DCD.

A study of 10-year-olds who played 12 hours of an "action" video game found it improved their reading speed without any cost to accuracy. The effects were equivalent to more than a year's worth of reading development, the Italian team reported in Current Biology.

But more research was needed before games could be considered a treatment. Their work builds on earlier research in which they linked dyslexia with early problems in visual attention rather than language skills. They selected a fast-moving game requiring a high degree of perceptual, cognitive, and motor skills as well as being unpredictable and involving peripheral processing. Ten children spent nine 80-minute sessions playing the video game, which consisted of a series of mini-games. And their reading and attention skills were compared before and after with 10 children not exposed to the game.

SPEED AND ACCURACY

The researchers found those who had played the video games had better attention skills than before. And they were able to read faster without losing any accuracy, the team from the University of Padua reported. Study leader, Dr Andrea Facoetti, said: "Action video games enhance many aspects of visual attention, mainly improving the extraction of information from the environment.

"Dyslexic children learned to orient and focus their attention more efficiently to extract the relevant information of a written word more rapidly." He explained that attention should be thought of as a "spotlight" that can be moved, and adjusted in its size, in the visual field. When the spotlight is on a portion of the visual field, the details will be enhanced, the contrast improved and so on, while everything that is outside of this spotlight will be inhibited. The video games may be working to train the part of the brain responsible for attention and motion perception, he added. "These results are very important in order to understand the brain mechanisms underlying dyslexia, but they don't put us in a position to recommend playing video games

without any control or supervision," he said. The team are now planning to look at the effects of video games on the prevention of dyslexia in children before they learn to read. Dr Kate Saunders, chief executive of the British Dyslexia Association, said it was a complex condition but for some individual part of the problem may include difficulty with aspects of visual perceptual skills, and visual-motor coordination and attention. She added that more research was needed to establish whether repeated play on some targeted computer games could help build certain visual and attention related skills.

"There are questions, however, as to the extent that skills transfer from one situation to another and would be retained in the longer term."

PROPOSED WORK/TECHNICAL PLAN

SOFTWARE/TECHNOLOGY USED SPECIFICATIONS

<u>JAVASCRIPT:</u> JavaScript is one of the core technologies of the World Wide Web. JavaScript enables interactive web pages and is an essential part of web applications. As a multi-paradigm language, JavaScript supports event-driven, functional, and imperative (including object-oriented and prototype-based) programming styles. It relies upon the host environment in which it is embedded to provide these features. All the Game engineering id done using Javascript as prime language. Library in Javascript called p5 is imported and used to manage all in-built functions, graphics, storage and I/O.

<u>HTML and CSS:</u> HTML5(the Hypertext Markup Language) and CSS3(Cascading Style Sheets) are two of the core technologies for building Web pages. HTML provides the *structure* of the page, CSS the (visual and aural) *layout,* for a variety of devices. Along with graphics and scripting, HTML and CSS are the basis of building Web pages and Web Applications.

<u>PHP and MYSQL:</u> PHP7.2 (Hypertext Pre-processor) is the server-side scripting language used to send, retrieve, update, and receive data with MySQL database to website back and fro. MySQL Database is created by creating a local host on XAMPP software and interaction is done by scripting using PHP.
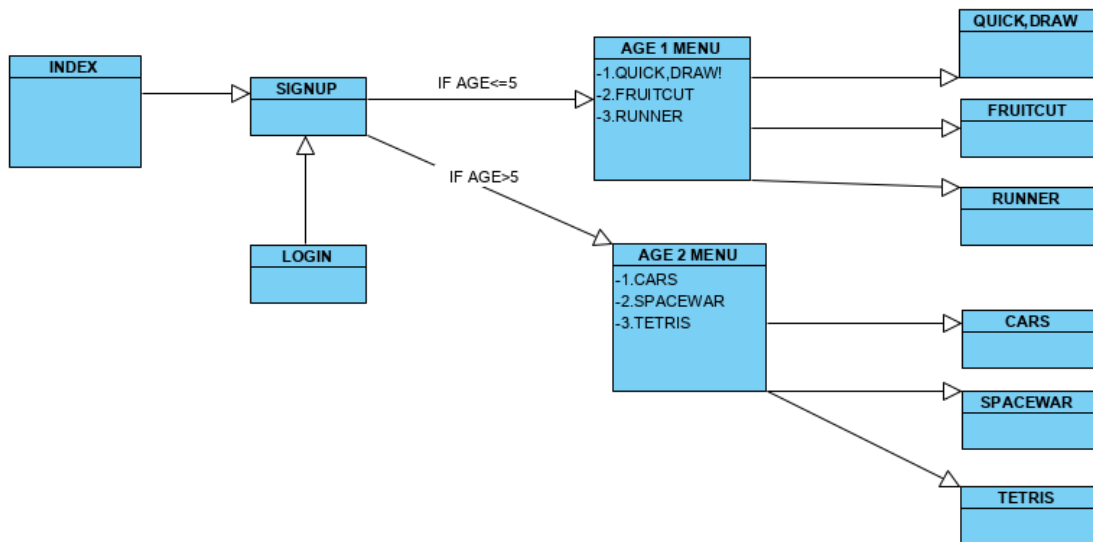

<u>HARDWARE REQUIREMENTS:</u>
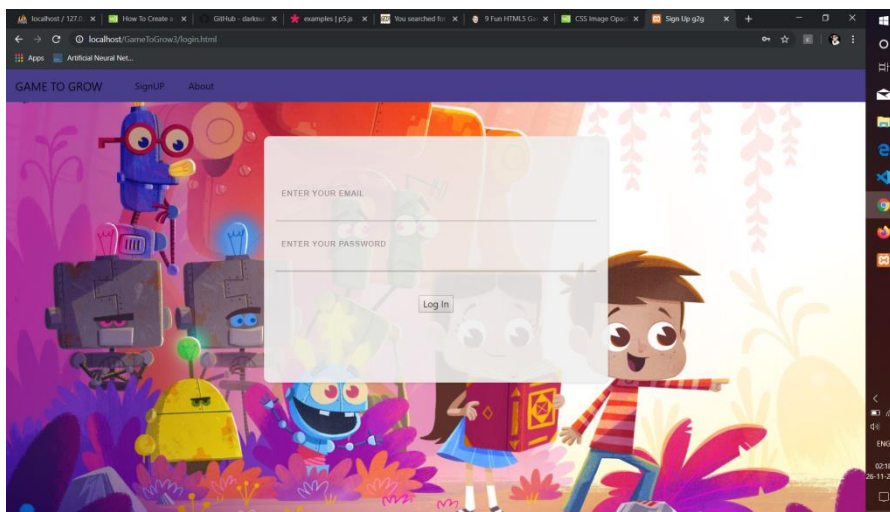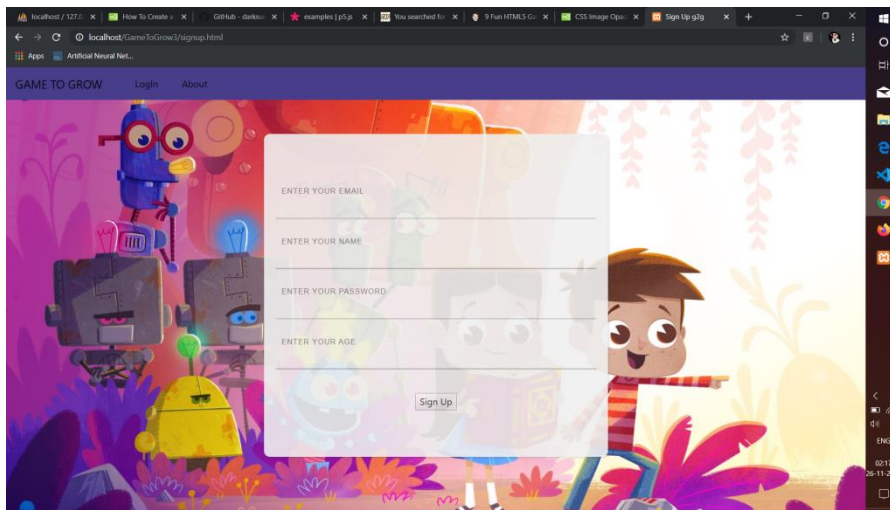
- Pentium IV or higher, (PIV-300GHz recommended)
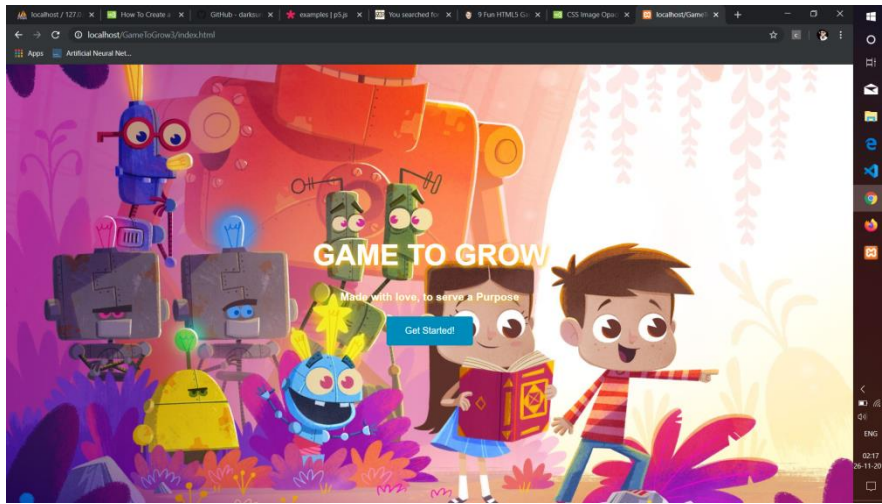- 256 MB RAM
- 500MB hard disk free space
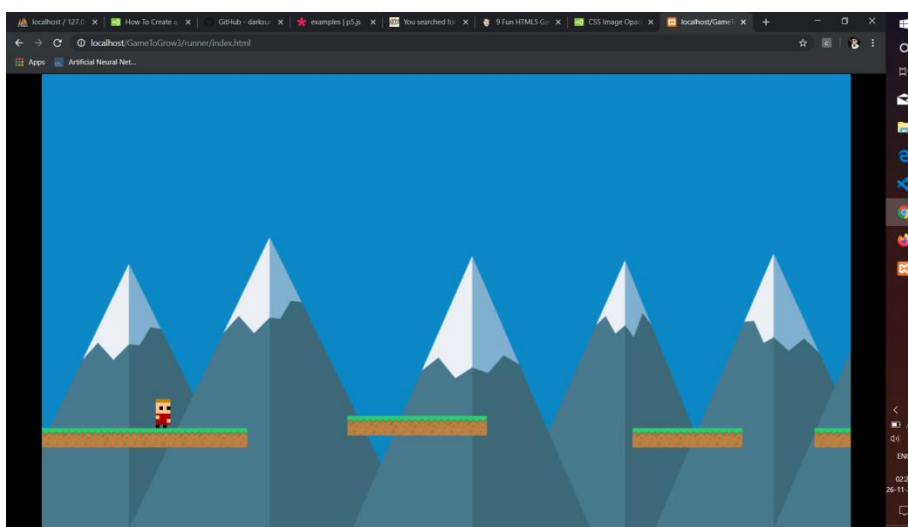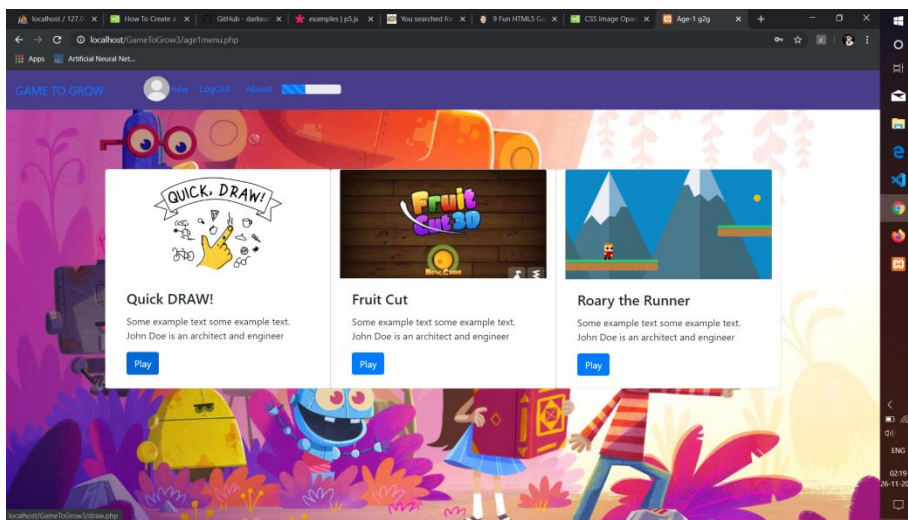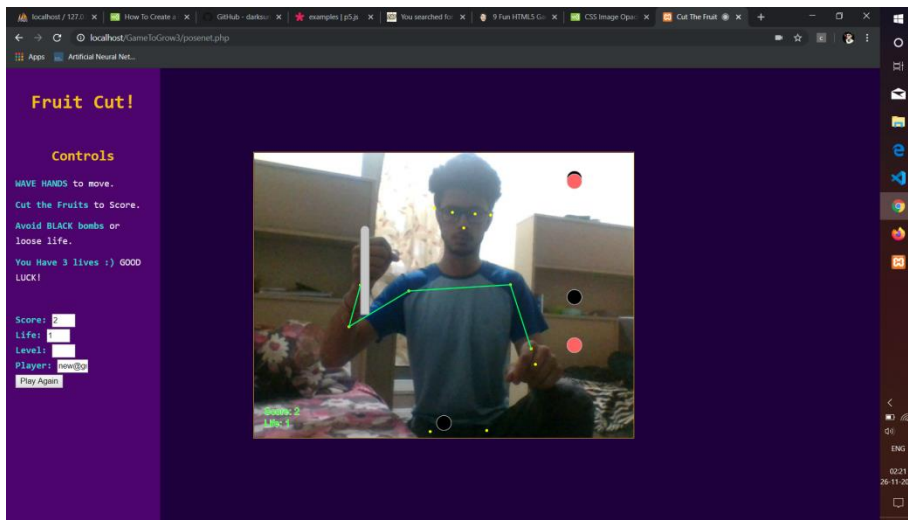
SOFTWARE REQUIREMENTS:

- PHP (front end)
- HTML
- JavaScript
- MS Word 97 or later
- Web Browser: Microsoft Internet Explorer, Mozilla, Google Chrome or later
- MySQL Server (back-end)
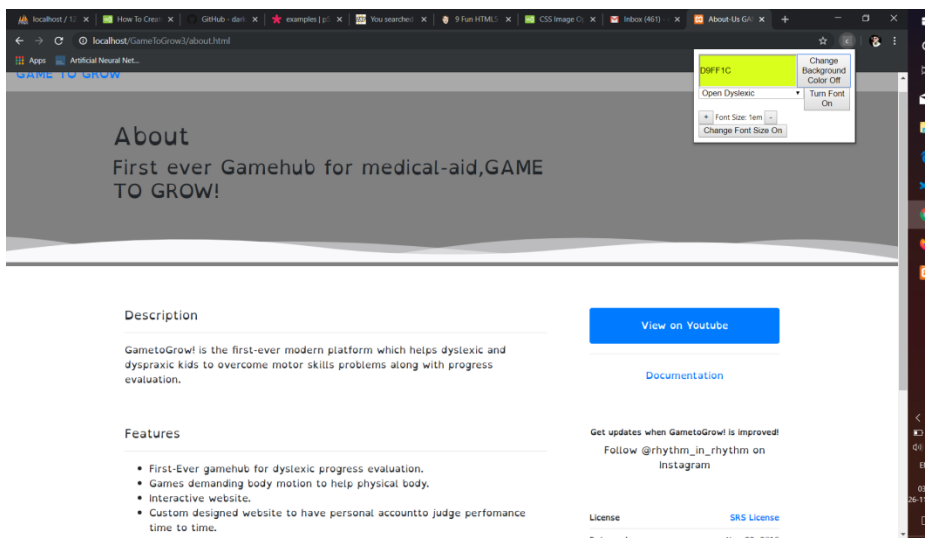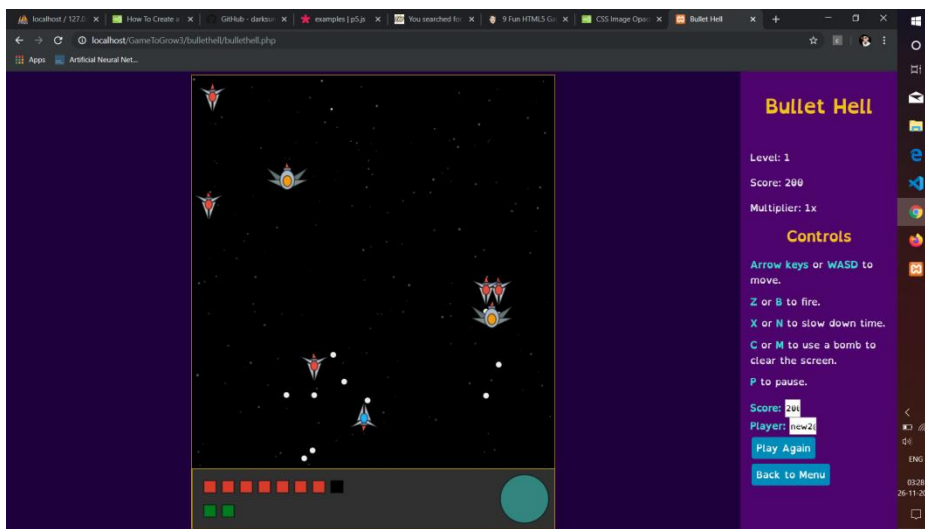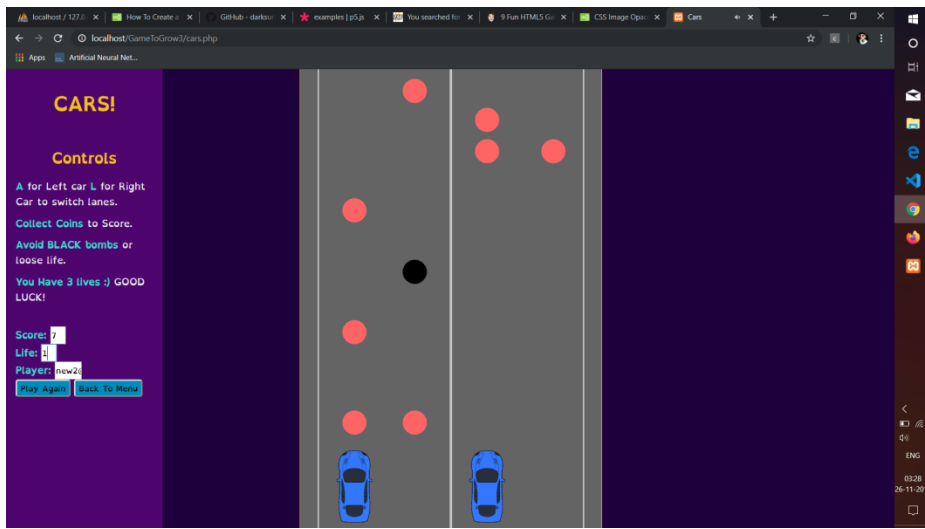- Operating System: Windows XP / Windows7/ Windows Vista

DESIGN OF PROJECT

PHOTO GALLERY

IMPLEMENTATION DETAILS

1. Chrome Extension for OpenDyslexic fonts to be applicable on any website: This chrome extension changes the fonts and colours of the webpage keeping in mind that the dyslexic children face trouble reading normal text. The changed text-font is "open-dyslexic-font-family" which has weighted characters from the bottom to give a sense of stability to the reader. Also they are well spaced to ease the reading.

   1.1. content.js file: It has an updateStyle() function to change the font-family attribute of all DOM elements in the Document. And this file has eventListeners() that perform tasks such as switch fonts and background colors with a click.

   1.2. Popup.html and popup.css files: they give the extension a layout and make the popup work with handy button which makes the extension easy to use irrespective of the audience.

   1.3. Several other JSON and CSS files: to store the state of the webpages and to keep the settings ready for the user.

2. AGE 1 MENU GAMES: Since not all children between 2-5 years age group can play games similarly simply because they are developed differently, we have made this menu that has at least one game suitable for each one.
   2.1 Quick draw! : Quick Draw is great game for children below 4 years of age. This is specially made for kids that can not understand complex coordination of keyboard and the game itself. In this painting game the kids can paint with the cursor. Kids are given tasks-to-complete which increases the level of concentration and engagement of the kids. It has very appealing interface to the children and they really love to play with colours.

   2.1.1. Draw.js: Draw.js file is a javascript file which has provided immense interactivity to the simple web-document. It has two main functions in it draw() and setup(). Draw loopsover and over and draws JS elements onto the web document. Setup() on the other hand runs once but is used to declare

variables and to add eventListeners(),etc. setup basically provides a start to the series of events to bring about anything on the document like to make a car move ,etc.

2.1.2. Draw.php: This file gives the game a structure as well as connectivity with the database to provide user-specific scores and tasks on the screen.

2.2 Fruit Cut : Fruit cut is a great project in itself. This game id enriched with state of the art technology which is Machine Learning. The ml5.js library is a great way to put machine learning to good use very easily. This strong library has numerous functionalities to make and train the models or to use previously made pre trained models. This game uses webcam to track live user movements and applies image classification algo to detect 17 keypoints on the body. This makes the games less keyboard intensive but more physical. Thus improving eye-hand coordination on the go.

2.2.1. posenet.js: posenet.js file is a javascript file which has provided immense interactivity to the simple web-document. Posenet pre trained model returns DOM object that contains all the information about the detected "pose" of the user. The returned "pose" object has further objects that has 17 key points of the body along with their confidence value, their (x,y) coordinates, body part types,etc. Posenet.js file exploits these objects to draw real life position of the user and the game works accordingly. If user gets a falling fruit score increases otherwise life decreases.

2.2.2 posenet.php: This file gives the game a structure as well as connectivity with the database to provide user-specific scores and tasks on the screen.

2.3 Runner : This game is more like zen mode of a game. This is an endless and aesthetically satisfying game. Kids can play endlessly

and this is a great game because it has no sense of losing so kids can play without any anxiety or burden.

2.3.1 main.js: file is a javascript file which has provided immense interactivity to the simple web-document. It has two main functions in it draw() and setup(). Draw loopsover and over and draws JS elements onto the web document. Setup() on the other hand runs once but is used to declare variables and to add eventListeners(),etc. setup basically provides a start to the series of events to bring about anything on the document like to make a car move ,etc.

2.3.2. index.html: this is the structure for the game.

1. AGE 2 MENU GAMES: This menu is very different from the first one. It has challenging but fun games for age > 5. This means the games here a bit challenging yet fun at the same time.

3.1 Cars : This is really a great brain trainer. This game is simply to collect coins but it gets challenging when you have to control two cars simultaneously.

3.1.1. cars.js :It has implementation of cars game with two cars one on each lane. The coming traffic i.e. the coins and the bombs, both are made javascript objects. Each one having its own x and y coordinates. Also this game has sounds for kids to make it more appealing.

3.1.2. cars.php: This file connects to database to provide user specific window to the user. and to enter the highest score in the database for the user. this file also provides basic structure to the web-document.

3.2 Spacewar : Very challenging for kids. But great graphics make it really fun to play. This game is very detailed and immersive requires full attention and it is high paced game that help kids to develop even faster.

3.2.1. main.js : It has implementation of space wars game with two cars one on each lane. The spaceships traffic i.e. the enemies

and the bullets, both are made javascript objects. Each one having its own x and y coordinates. Also this game has sounds for kids to make it more appealing.

3.2.2. bullethell .php: This file connects to database to provide user specific window to the user. and to enter the highest score in the database for the user. this file also provides basic structure to the web-document.

3.3 Tetris : Old but Gold. Tetris have been proven to help people with dyslexia. Engages vital parts of the brain. This game is very essential for mental growth of the kids as it engages specific parts of the user brain to help improve logic, memory and focus.

3.3.1. tetris.js: It has implementation of Tetris game. getShape() function makes the shapes that fall. CheckBottom() functions checks for if scored or not.

3.3.2. tetris.php: This file connects to database to provide user specific window to the user. and to enter the highest score in the database for the user. this file also provides basic structure to the web-document.

RESULT ANALYSIS AND TESTING
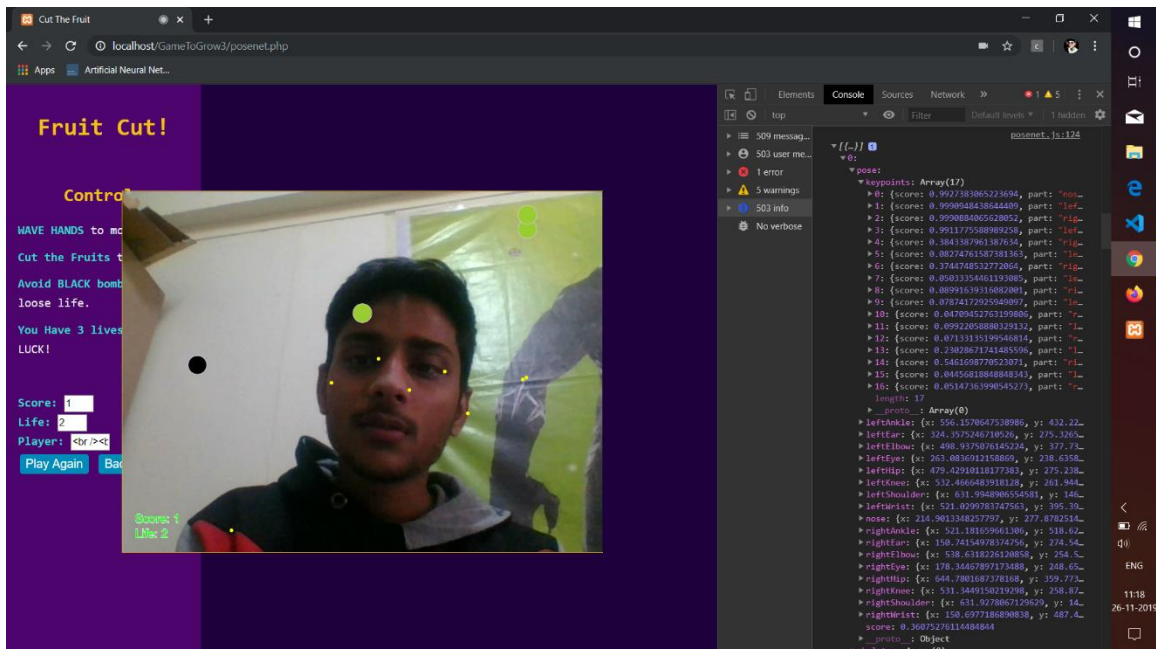
- UNIT TEST: Verification effort on the smallest unit of software design—the software component or module is done to:
  1. Local data structures are examined to ensure that data stored temporarily maintains its integrity during all steps in an algorithm's execution.

  2.All independent paths through the control structure are exercised to ensure that all statements in a module have been executed at least once.

  3.Boundary conditions are tested to ensure that the module operates properly at boundaries established to limit or restrict processing.

  4.And finally, all error-handling paths are tested.

- INTEGRATION TEST: Top-Bottom approach of integration test is used to check the complete software as a single module after making all sub systems.

- VALIDATION TEST: Determine if the software meets all of the requirements defined in the SRS.

- ACCEPTANCE TEST: Customer acceptance test is surveyed by co-students and our mentor.

CONCLUSION

GameToGrow proves to be a vital platform for kids in a long run. This engineered product has taken care of every aspect of problem of dyslexic kids as it provides familiar font extension and other ways to make website interactive and enjoyable. This gaming experience gives them enjoyment as well as therapy and shows the real progress after giving each game multiple attempts. The purpose behind this development serves the purpose well as well as society for a better cause.

FUTURE WORK

- Upgrade the present games with better time-oriented tasks and increase speed of reaction.
- Making User Interface of website more child friendly.
- We may contact NGO's like Child-line India or Samveda in India who servers the mentally challenged or backwards kids to help them recover to sell out our product in external market.
- Unfortunately, even though we are beginning to understand more about what causes these dyslexia and dyspraxia however, this study need an advanced and individualized training programs based on solid research and survey .

REFERENCES

- **The link below shows a research article by Li Li , Rongrong Chen, Jing Chen**

  https://journals.sagepub.com/doi/abs/10.1177/095679 7616650300

- **How do fast-paced video games affect the brain?**

  – **https://www.youtube.com/watch?v=FktsFcooIG8**

- **This shows Dyslexia & Dyspraxia and the alternative remedies.**

  – **https://www.youtube.com/watch?v=V1vhlwvXBPs**

- **An Article explaining some games that improve Eye-Hand Coordination.**

  – **https://empoweredparents.co/hand-eye-coordination/**