



BLACKBOARD SYSTEMS BASED GAMES FOR CHILDREN WITH LEARNING DISABILITIES

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Manuscript History

Number: **IRJCS/RS/Vol.07/Issue02/FBCS10082**

Received: 29, January 2020

Final Correction: 07, February 2020

Final Accepted: 11, February 2020

Published: **February 2020**

Citation: Majeed, Hatem & Naser (2020). Blackboard systems based Games for Children with learning Disabilities. International Research Journal of Computer Science (IRJCS), Volume VII, 21-27.

doi://10.26562/IRJCS.2020.FBACS10082

Editor: Dr.A.Arul L.S, Chief Editor, IRJCS, AM Publications, India

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Abstract: New researches in Artificial intelligence have given wide powers for many areas, which based on the fact that the performance of machine is better than humans. Widely, one of the most significant areas in Artificial Intelligence is education and learning. Occasionally the traditional teaching methods do not achieve the required goals from learning. Some teaching programs and game applications accomplished teaching more efficiently comparing to traditional class room. Among the most important categories of society that need to employ appropriate learning procedures are children with learning disabilities. Parents always worried about their child's capability to understand new subjects and to develop expertise. Early interference is very important to help children in their early stages for enhance their learning capacity. This paper presents a smart serious games based on black board system to assists the children sufferer from learning disabilities during the early levels of school. The proposed system targets the child with typical intellectual quotient (IQ). During the implementation of the system the child will go through two types of tests and experiments, which will determine the level of (IQ) and evaluate the diagnosis purposes (developmental disabilities). The rules of the inference engine are generated based on the knowledge engineering resulted from the test.

Keywords: Serious Games; Intelligent Systems; Learning Disabilities; Intellectual Quotient, Black Board System

I. INTRODUCTION

Education are one of most requirements needed for children, Very important feature in learning is motivation. Which mean keep the student interest and motivated for learn. Diagnosing various learning disabilities is costly process and can be highly delayed, educators normally not capable of determined the reasons of the kids learning disabilities meanwhile they need to accomplish teach mission using variety of education materials. Diagnosing various LD depend exclusively on our understanding of scientific research and actual findings came from the direct communication with the Infected People. Over the past few years, Artificial Intelligence solutions have been applied in various learning systems. Numerous researches demonstrate that kids are more concerned in computer games. Thus, serious games are one of the best hopeful ways for assisting children with learning disabilities.

Several games with curative goals are applied to support children conquer them learn disabilities. During the advanced games system, the child play through a number of serious games with a particular recurrence. The games determining the learning disabilities for the kid who is advised to reuse the system again for a later estimate. This continues iteratively using the system until disabilities detected are controlled. The system objectives the children between 3 to 6 years old age. Learning disabilities(LD) on other hand usually classified to (developmental and academic) disabilities. Developmental disabilities at most contain (memory, attention and concentration). academic disabilities include (mathematics, reading and writing). These are commonly mentioned to as (dyscalculia, dysgraphia and dyslexia) and will be explained later in this paper.

II. BACKGROUND

A diversity of AI mechanism engaged in education enhancements for kids with learning disabilities. many of expert systems presented applied for LD detection and identification, Most of the expert systems adopted the Expertise in the field of detection of disabilities.

Assistive Technologies Laboratory (ATL) team present an effective tool, they developed 25 tools used in different education centers for special need education. The model mix the knowledge from school employers with the education professionals experience [1].

The (fMRI) study proved that autistic like normal kids all head to be sinking to the independent agents. usually developed child had better relation with humanoid type of agents [2]. Some project that interaction with the artificial agent that resembles a human led to activation in child brain Which led to therapeutic results in this area, It was based on the representation of human facial expressions through the machine.

LIFE is GAME [3] introduce interactive game for teaching kids the recognition of the facial expression. other Hybrid systems produce a good results, but still some accuracy lose in diagnosing kids with LDs [4].

toward accomplish the main goal for applying the most efficient model for teaching the kids with learning disability a new researches are need and more attention for this category of the community.

A. Blackboard Systems

The blackboard model represents the method used to solve ambiguous problems, in such way where the problem divided into several parts, and the final solution come from the summation of its parts. Also blackboard system is an AI application based on the blackboard architectural model, where a common knowledge base, is iteratively updated by a diverse group of specialist knowledge sources, starting with a problem specification and ending with a solution. Not like most of the (AI) problem-solving technology that applied formal models [2]. Blackboard systems used in large scale application, such as:

- 1) Process control.
- 2) Planning and scheduling.
- 3) Computer vision.
- 4) Sensory interpretation.
- 5) Design and layout.
- 6) Case-based reasoning.
- 7) Knowledge-based simulation and instruction.
- 8) Command and control.

B. Knowledge Source (KSs)

Blackboard systems have practical modularization of expertise. Each knowledge module (KS) is a specialist at solving particular parts of the overall problem. Each KS is Independent and separate from other KSs. A KS not needs expertise knowledge or existence, KS should understand the case of the problem-solving process and the represent the related information on the blackboard [5].

Every KS understand the roles where in can contribute for the solution over the perfect timing. which mean its attempt to provide the data and information for solving the problem. such process is called the triggering condition. expert system are different from KSs in two main factors. the individual rules and facts in the expert system are much simpler than the KSs. blackboard system works by firing the total knowledge module, while in expert system by firing a rule in depending on the motivation, such as an expert system; a neural network or fuzzy logic. basically the blackboard system contains three major parts:

- 1) The Knowledge sources (KSs): are independent modules that contain the knowledge needed to solve the problem. KSs can be widely diverse in representation and inference techniques.
- 2) The blackboard: is a global database containing input data, partial solutions, and other data that are in various problem-solving states.
- 3) A control component: which makes runtime decisions about the course of problem solving and the expenditure of problem-solving resources. The control component is separate from the individual KSs.

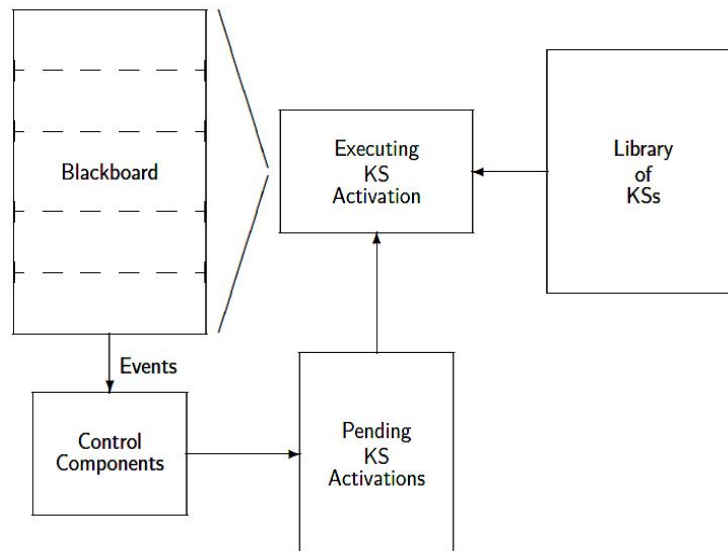


Fig. 1 Basic Blackboard System

C. The serious game

Serious games in general have gained a growing interest, not only as research areas but also as powerful tools for a large set of applications in various fields, such as politics, marketing and business, health, education and strategic intelligence intentions [5]. The use of games in educational contexts has become more popular, innovative tools have been widely recognized as having considerable potential to foster and support active learning. The learning by doing experience that student's get with this realistic game is very effective. In short terms serious games represent the researches techniques with social impacts [6].

D. Learning disability (LD)

It can be defined as the disorder in any one or all of psychological operation relating to language like the write, read, speak, think. also LD may include mathematical operations. in other case Learning disability involve brain injury, minimal brain dysfunction [8].

Learning disability can be cover a large areas where the effected person cannot learing in ordinary methods, where the normal education environment are not suitable and learing proress do not achive the final goals from teaching. usually the disability detection from the early age may help the speicailists to support teaching method in future. The National Joint Committee on Learning Disabilities (NJCLD) defines the term learning disability as [7]:

Generally, for children at the preschool age the main learning disabilities kinds are:

- 1) **The Memory:** Represent the ability of remember of something or fact that had been told before about some case.
- 2) **The Concentration:** child ability of concentrate on one mission at a time and forget about any other idea or thought.
- 3) **The Attention:** means the attention the child have for on one aspect from the surrounding environment.

For children at school stage the learning disabilities may include:

- 1) **Dyslexia:** represents the awkwardness of comprehension the written words.
- 2) **Dysgraphia:** referring to the difficulty writing in a specific space..
- 3) **Dyscalculus:** means the difficulty of performing mathematical calculation.

III. THE PROPOSED GAMES SYSTEM

The proposed system presents a web game based of black board system facts. Advance diagnosis of disability is very important, especially at the early stage well as the future facilities available by updating the requirements, facts and outcomes of each therapeutic stage. Most therapeutic methods go through levels and need unspecified time periods. Most of the proposed games are designed according to the guidance of specialists in the field of psychotherapy. It has been developed to suit the patient environment and postulates of the surrounding world.

All (Knowledge and rule) base for the interference engine have been designed and developed specially for this game system. Basically it's based on black board systems facts, For Example: a child trying to put together Jigsaw puzzle, to find an object. (Attention, memory, perception, language and thinking) are the main disabilities addresses in this project?

The prototype could be implemented in several languages like: Arabic, English and Chinese. We can extend our work to design an executable (Ipad game or android tablets game, etc.) With a direct connection to the internet, So the game keep updated according to the case of disabilities for the individual child. Means while all the result can be directly submitted to the parents through the email or directly to the responsible doctor how study the child disabilities case. We should refer to the system able to updated beside the GUI should be suitable to make children like to plays with the games.

IV. IWASGS ARCHITECTURAL MODEL

Intelligent Web-based Adaptive Serious Games System (IWASGS) was advanced and applied using programming mechanism Java Server Pages (Java/JSP) applied using internet. The IWASGS consists of three main level systems:

- 1) The Java Server Pages Controller: this level controls the web-based games system interfaces for children registration, IQ test, game playing, displaying the scores and displaying the final diagnosis together with recommendations and follow up of the child.
- 2) Knowledge base & inference engine: The result of the disability diagnosis test is used for determining the learning disabilities. The “therapeutic games recipe” is then assigned.
- 3) Data Access Layer: in this level the data and information related to the children are stored in the Intelligent Web-based Adaptive Serious Games System Database. The stored data represents the children game engagement and game scores.

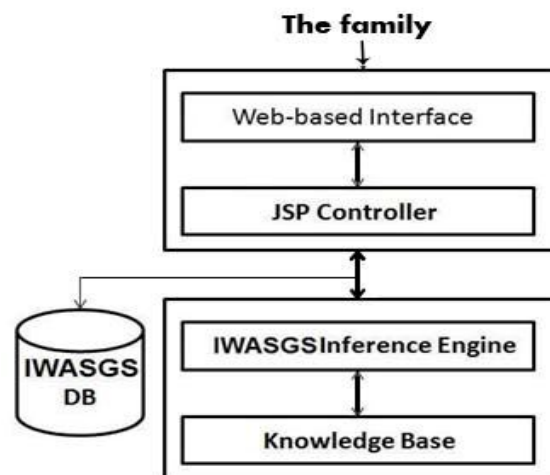


Fig. 2 IWASG architectural design

Working to implement the proposed system begins with answering a test of intellectual quotient (IQ). where, a reconnaissance separated into several categories are presented to the parents , Each one of these categories contains a number of questions that must be answered, every question have a weight. the higher weights assigned to the questions which straight denote a specific disability. questions and it weights are designed by specialists in the field of diagnosis of disabilities. Based on the questions weight and the information collected from the parents, the inference engine will assign the games types and the playing iteration weekly. according to the learning disabilities the system offered the suitable game with therapeutic effect to play. several of developmental disability like(language, Concentration, Attention, thinking and Memory) are targeted in the system, variety of techniques are employed such as the Analytical Hierarchy Process [9]. The learning disabilities are specified According to the following points:

- 1) Begging with response gathered from the parents answers.
- 2) According to the weights for each category the score is calculated.
- 3) The outcomes are push through to the Intelligent Web-based Adaptive Serious Games System deduction engine.
- 4) Intelligent Web-based Adaptive Serious Games System matches the identical principles of the XML file.
- 5) Intelligent Web-based Adaptive Serious Games System inference engine release the basics to define the Learning Disability and propose the games and playing iteration.

At the beginning the child registers his personal information; name, age and family email address. Parents may involve during the registration process to ensure the correct child information are listed in the system. After finish the registration child start with IQ test. This IQ tests divided into two types; phrasal part and pictures part. Here two scenarios may happen for the child progress during the test; child can (pass or fail) the test, in both cases and email sent to parent with a recommendation.

In case of child pass the email message asking him for replay the answer the developmental disabilities test. In case of fail the test will emphasize child's parents should consult a Specialist Physician. During use the system the child disability category will detected and that determine a specific games for the child to be played frequently during assigned period of time. The parent will keep updated about the child progress and scores by the sent emails. With a support from the parents the system can outcome a positive results. Child improvement can be reviewed by making a test again after short period of time; if we don't get any enhancement sign for child progress parents are responsible check that with a specialist.

V. SYSTEM IMPLEMENTATION AND EXPERIMENTATION

The Intelligent Web-based Adaptive Serious Games System are partially executed by using the below experimental platform. see Figure 3.

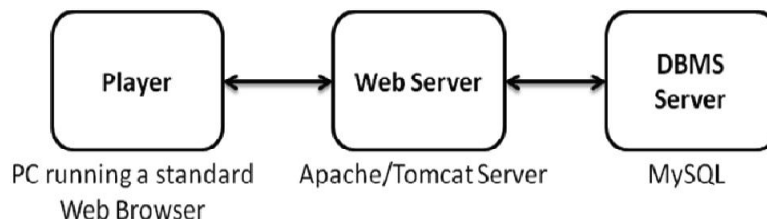


Fig. 3 STMAS Platform.

Intelligent Web-based Adaptive Serious Games System are designed uses a three level architecture and responsible for providing HTTP service when the system choose the game the children can play with easy graphical user interface using several set of Java Server Pages provided by tomcat web server. The Java Server Pages on the web server receive the inputs then stored it in the Intelligent Web-based Adaptive Serious Games database.

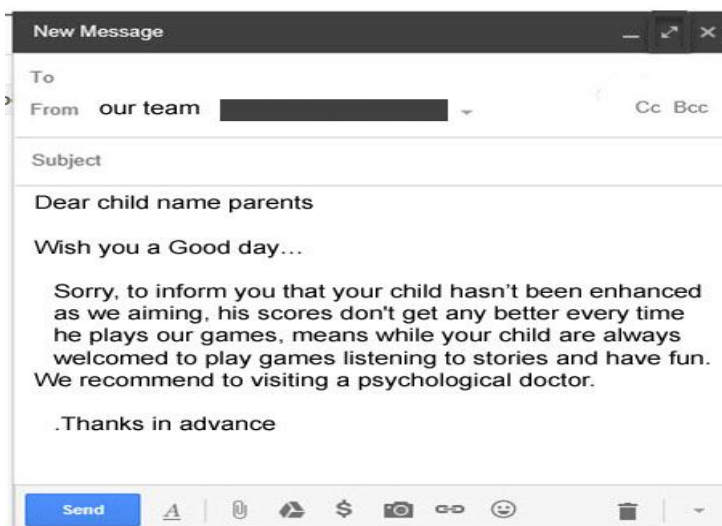


Fig.4 Sample of Parent email.



Fig. 5 Screen shot of IQ test.

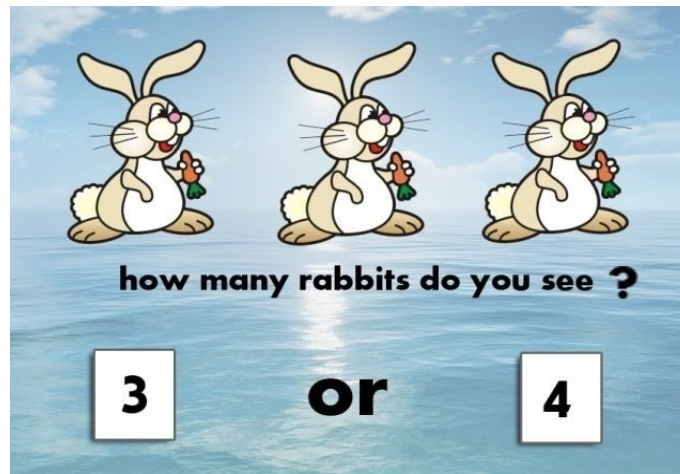


Fig.6 Screen shot of game.

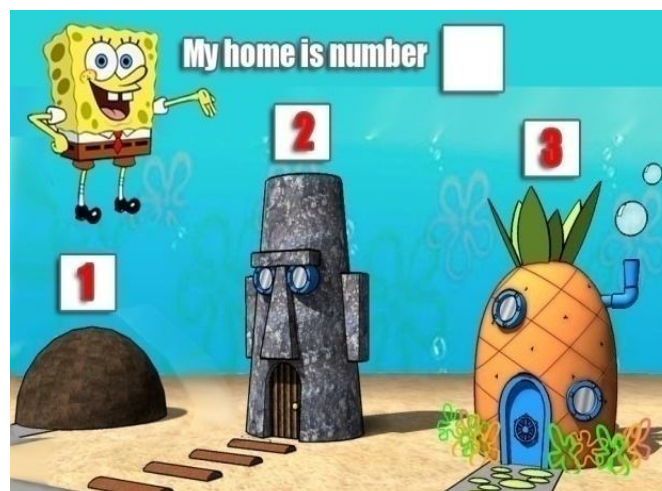


Fig. 7 Screen shot of game.

The above figure presents a sample email resived by parent. the system offering the ability of background customization by changing color rather than music. Applying the system needs an effort and support from the kid's parents. Mean while they need to be updated about them child progress. in future step the amount of information related to the children with learning disaplities can be filterd depending on environment requirement.

VI. CONCLUSION

New researches on autistic kids demonstrate that using artificial intelligence and computer base applications able to be predicted on those kids. Varsity of systems and applications designed to support and enhance autistic deficiencies caused by the disorder. Such systems can help connecting parents with educational material also keep updated with the children progress. Learn using fun and easy use interface is one of the key elements that serve the education.

This paper offers an intelligent games system which presents a private educational place for children with LD. Rather than the accurate information and advice offered to parents during the stages of the child's accession to the system. The system focus on children with development disabilities during the kindergarten age. Where, child plays a number of games in several recurrences depending on their diagnosis. They are estimated later to calculate the children development based on knowledge base. Future researches will introducing new games based on updating the knowledge base according to specialists' feedback.

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