INTELLIGENT STUDENTS' PERFORMANCE ENHANCER (ISPE)

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Abstract- the authors present an intelligent agent model of Multi-Agent System that provides some of the important techniques to enhance the intellectual abilities of the students. Software named as ISPE (Intelligent Students' Performance Enhancer) was developed with the objectives to improve student's educational performance in an autonomous fashion. Poor intelligence performance may be due to environmental factors like an uneducated family background, poor family structure, less educated environment, remote areas of the country and possibly student's own mental limitations or even psychological shortcomings. The Sub-Agents of this tool are: Input Agent, Test Agent, Knowledge Base Agent, Exercise Generator Agent, Grading/Result Generator Agent, and Output Agent. Students' abilities are assessed through various types of (i.e. simple as well as complex) tests and proper guidance is provided according to the situation. The Multi-Agent System was developed using various tools, like; VB.Net for front-end design, SQL Server for Data Base Management and ASP.Net for online operations. Its application area is obviously Universities, Colleges and Schools as well.

Keywords—*Intelligent Agent, Multi-Agent System, Intelligent Performance, Data Base Management System, Intelligent Students' Performance Enhancer*

I. INTRODUCTION

The important attributes of an intelligent system would consist of words such as: learning, intuition, creativity, quickness of mind, clever, reasoning, understanding, autonomous behavior or self-governing, adaptive, ability to self-organize, coordinate and possess knowledge. Other than human beings, no other living things or man-made machines could currently fulfill all the above requirements. However, if a system could fulfill a subset of the attributed words, the system would have to possess some form of intelligence (or sub-intelligence). This will include a system that could perform quickly with a certain logical reasoning, and would be classified as 'clever' or 'smart' [1].

Not all students perform equally some are fine other are average and yet another with very low performance issues. These performance issues may be due to personal attributes as well environmental factors like an uneducated family background, poor family, less educated environment like village and possibly student's own mental limitations or even psychological shortcomings. Students can perform better if they are given proper attention but a single teacher can't give much attention to all students due to large numbers. So a method should be devised to help or assist students under strict supervision of the teacher as well.

This software agent does or at least try to achieve this objective. The technological tools used were VB.Net for front end due to its quick development environment, SQL Server for data base management as it is compatible with VB and also more secure and as this project will have online capabilities so we need ASP.Net to get it done.

Initially it will be tested in parent department but its scope can be enlarged to colleges and schools upon successful trials. It can be used for variety of subjects however for simplicity it's been developed to improve programming attitude of students for now to show the demonstration of this concept. The ISPE will be **useful for learners** to accelerate the process of learning to provide a clear picture of learning aims and objectives through selecting suitable courses during the stage of admission. He/she can find out and be able to overcome his/her deficiencies. This will be **beneficial to teachers** to guide students in a proper way through understanding the problem and hindrances in the students learning ability. ISPE will provide a low cost education and training **to institution** and will increase the quality of education. ISPE will increase the productivity of **the nation** in placement of suitable persons for suitable education, training and jobs.

II. BACKGROUND STUDY

Building computerized mechanisms that will accurately, immediately and continually recognize a learner's affective state and activate an appropriate response based on integrated pedagogical models is becoming one of the main aims of artificial intelligence in education [2].

Listed below are 5 easy techniques to extract a little more of creativity from your gray cells [3]:

(i)   Avoid Watching Television,
(ii)   Work Out,
(iii)   Read books that stimulate thought,
(iv)   Sleep Early, Rise Early,
(v)   Find Time to Introspect.

Recent findings suggest that students who used intelligent agents learned more and had more confidence about subject material [4].

The intelligent multimedia education system (IMMES) has been designed to enhance the quality of multimedia online learning such as improving performance, monitoring and feedback. IMMES consists of five components: learner interface, web server, intelligent engine, learner records and learning resources [5].

In the ILMDA (Intelligent Learning Materials Delivery Agents) project aims to design an intelligent agent to deliver learning materials. Each learning material consists of three components: a tutorial, a set of related examples, and a set of exercise problems to assess the student's understanding of the topic [6].

Intelligent Tutoring Systems (ITSs) may possess a combination of the following attributes: Generative in which an ITS dynamically generates instructional material including problems, hints, and help on student performance; Able to model students in which an ITS assesses the current state of a student's knowledge and does something instructionally useful based on the assessment; Able to model expert performance in which an ITS detects expert performance and derive an instructionally useful model; Able to change pedagogical strategies in which an ITS changes its instructional style based on the changing state of the student model, prescriptions of an expert model, or both; Mixed initiative in which an ITS changes its presentation schemes to improve human-computer interaction; Self-improving in which an ITS has the capacity to monitor, evaluate, and improve its own teaching performance as a function of experience [7].

The tutoring tactic states that tutor should [8]:

i.   provide negative feedback to the student
ii.   give the student a hint
iii.   ask a follow-up question
iv.   classify the student's response
v.   provide feedback to the student
vi.   tell the student the rule
vii.   tell the student that the topic is changing

The addition of testing tools can improve the learning power, especially if students are sent back to review material that they have not mastered yet.

Research has shown that if training material is presented to students according to their preferred learning style, learning improves [9].

A test was prepared to measure elementary school students' level of cognitive development according to Piaget's theory of developmental stages. Classic tasks were adapted to measure these levels for use a computer. The test requires approximately 10-15 minutes for students. This measure predicts student performance at a variety of grain sizes: effectiveness of hints received, rate of failure, amount of time to solve problems and the number of problems students need to attempt to master a topic [10].

III. HOW ISPE WORKS

The architecture of the ISPE shown in Fig 1.0 shows that student and/or teacher interacts with ISPE through keyboard and the results or feedback from ISPE is provided through display units.
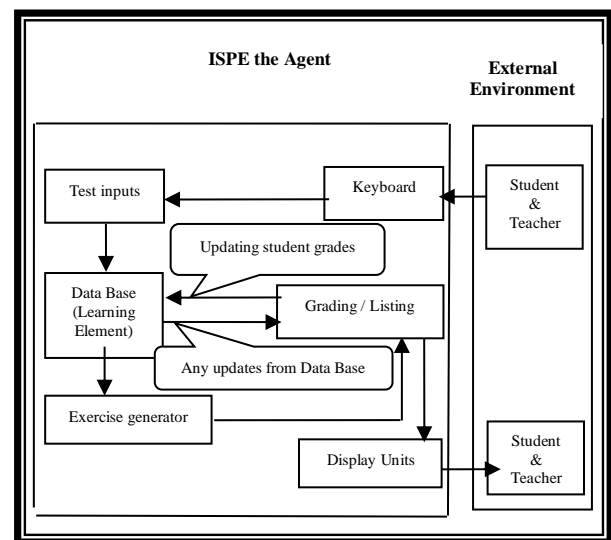

Fig.1.0: Architecture of the ISPE

Results of tests are sent to Data Base, which acts as a learning element and updates itself from multiple sources as depicted in the figure. The Exercise Generator composes various exercises based upon the inputs from database and feeds back to Grading/Listing element which decides the exercise submission according to its current state about the concerned student. Grading/Listing element also receives inputs from Database element and returns feedback to it as well to the Display Units.
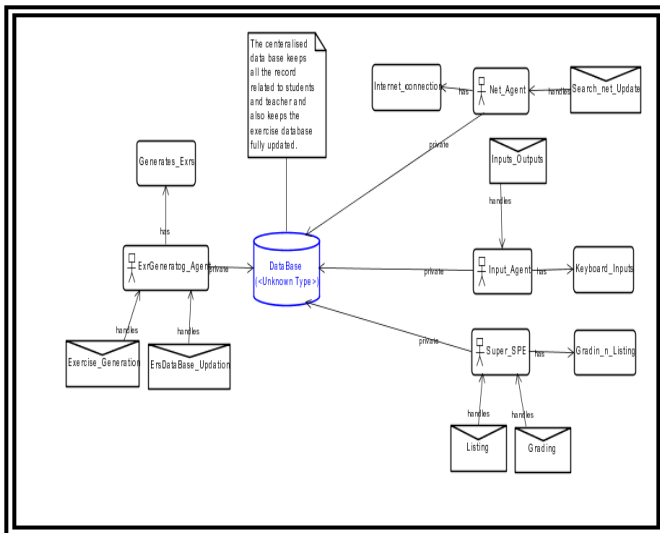
Fig 2.0: Working Components of ISPE

Fig 2.0 above shows the collaborative work relationship among various components of the ISPE being developed in JACK. The Net-Agent has internet connection with the ability to search the net and update itself if related knowledge is being found. As a result all the acquired knowledge is sent to the centralized database.

Logical working flow of the ISPE has been shown in Fig 3.0. Students are categorized according to their intelligence level and corresponding tests are provided agreeing to the student's ability ranging from challenging to less complicated.

The working procedure has been shown through the pseudo code as given below.

The Learning Element- This assisting agent should have some sort of learning or updating process in order to be a true intelligent agent. To cater this need ISPE regularly searches the internet to see if there are any exercises which are related to the current course outline if it finds some exercises it extracts and saves these. Say in a week it saves lot of exercises than it floats these exercises to the teacher, the teacher than checks all these selected pages and scrutinize these and whichever are useful it selects and creates a list and then send that list to the ISPE. By using that scrutinized list the ISPE can add new exercises to its data base.

ISPE can repeat this process continuously in a moderate way building a huge data base of related exercises and then making an efficient use of this collected information.

Apart from updating its database it can also gain knowledge by judging from long term exposure to students' activities. For example it can judge which student is better e.g. in programming portion than theory related area and can give some suggestions to student as well as to teacher.
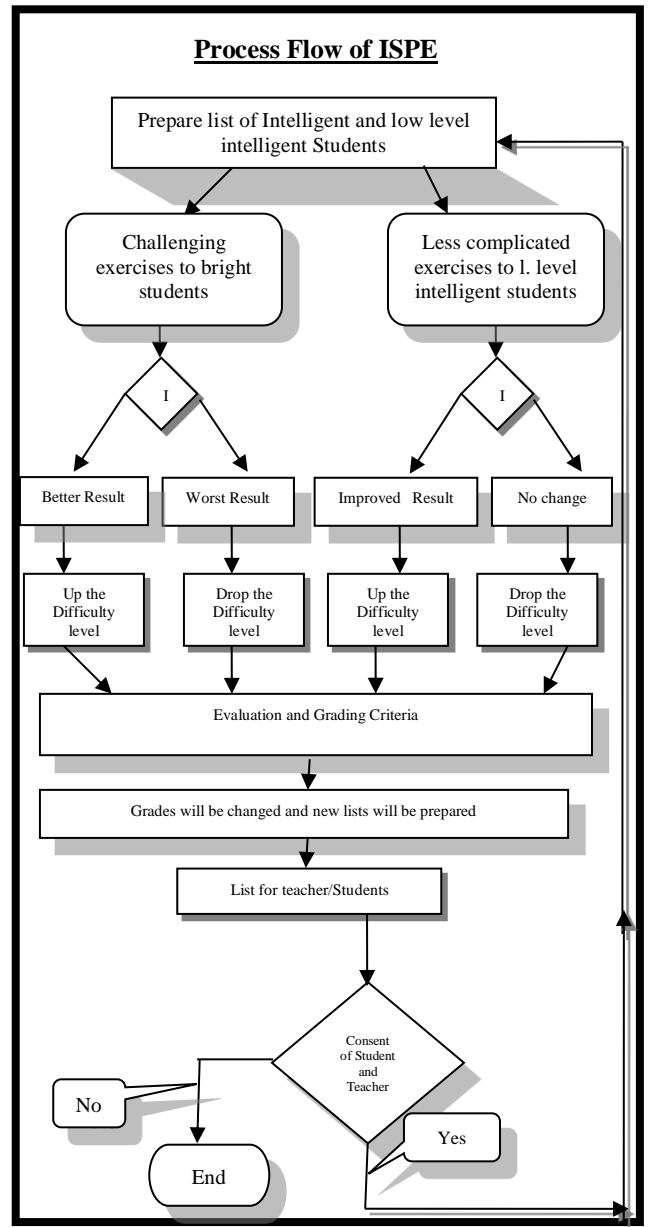

Fig. 3.0: Logical Working Flow of the ISPE

The following pseudo code clearly shows the steps of processing of the ISPE in a logical way.

Pseudo Code for the ISPE
Step 1   Filling of input form by student.
Step 2   Assign tests to students.
Step 3   Evaluate their intelligence.
Step 4   Print their intelligence in ascending or descending order.
Step 5   Assign specific tests to specific class of students.

        If   result is better Then
        Goto   Step 6
        Else
        Goto   Step 7
        End If
Step 6   Make exercises more challenging
Step 7   Drop the difficulty level
Step 8   Update the status of students

Step 9   Count the improvement in each cycle
Step 10 (a)   Goto Step1 [to prepare new list   based on result]
    (b) Submit these lists to Teacher and Students
    (c) If consent of teacher && student is True
        Then repeat from Step 2 to Step 10 (b)
            Else Step 8
        End If
Step 8   End   [Exit].

IV.   RESULTS AND DISCUSSION

Students' intelligent power will be judged to take computerized test for related subject through simple questions first. Then result of these tests will be floated to the ISPE (the main agent or super-agent being resident on Server) which will compile the final list of grades with student's name and detail about his weaknesses and strengths. This information along with score of the test is communicated to the supervisor or teacher and to students as well via email or LAN. Once the satisfactory response from both the teacher and students is received, the Server than starts the next phase which is the main objective of the whole process. The ISPE now selects the exercises (with lots of detail how to solve them) according to student's abilities and sends these to the selected student. These exercises are in more detailed form even the step by step procedures should be given to be easily understandable to the student. After completion it will be submitted back to the server. ISPE assesses these values, compiles another list and critically examine the Improvement Factor and no change is shown if the decline of student performance is observed. If ISPE finds improvement than it must submit more challenging exercises (approved by supervisor) to the bright student to give them a chance to further enhance their skills. And for no change or poor performance ISPE may repeat the same exercises or send easier ones. The whole process will be repeated a number of times depending upon teacher's decision and students' performance.

A Sample of C Language question may be:

Question 1:
main()
{
int a=7,b=3,c;
c=a+b;
printf("The value of c=%d",c);
}
What is the value of c?
(i) 12   (ii) 11 (iii) 10

This is a basic question and if the answer is wrong than it means that the student even failed to understand the basics of C language, so explanation is required for a particular student to know the basic concepts.

The detailed training session will repeat the same question but with different values to see if the student managed himself to grasp some information and if he correctly answers then process will be shifted to judgments of higher level abilities. Some of the snapshots and their details can be seen in the following paragraphs.

The ISPE initiate the tutorial work like given as under.

main()…. It's the main function which must be included in every c program.
{…….. Opening brace signifying the start of the program.
int….. specifying that variables are declared in integer format.
a=7,b=3….. Means a and b are integer variables and initiated with corresponding values.
c….. Is not initiated and will accept only integer value upon calculation of *c=a+b*; statement.
printf()…. Is a function used to display message or result on the screen which is enclosed in double quotes.
%d…. is format specifier for integer value and will receive value of c variable.
}….. Closing brace signifies the end of the program/function.

4.1 SNAPSHOTS OF THE ISPE

There are few snapshots of the working of the ISPE as in following forms and tables. In the Fig 4.0 as shown below, student's details are given so that the student may be identified by the system through his user name and password. A sample test data is being shown here.

StdId	StdName	Usr	Pwd
1	arshad	arshad	123
2	Qazi Khalil	Khalil	123
3			
4			
5			
NULL	NULL	NULL	NULL

Fig 4.0: Student's Identification Details

Fig 5.0 shows the form on which the students will attempt their test. Options are provided to be selected for correct answers and he/she will be ranked accordingly after evaluation.
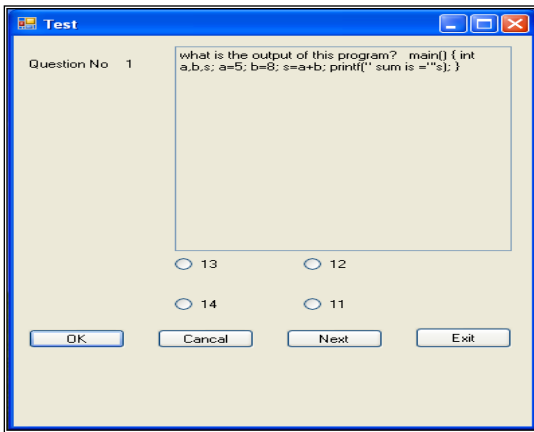
Fig 5.0: Sample Test for Students

Similarly, Fig 6.0 shows the student's test results, which will be used as to categorize the students according to intellectual levels to enter into next phase of abilities assessment.

Fig 6.0: Students Test Result

In the same way score of all the tests are shown in Fig 7.0, showing test numbers, question number etc. representing students' performance in various tests.

Fig 7.0: Overall Score in Tests

These are the few snapshots just to show the basic functionality of the ISPE, further work will be done and will be updated accordingly.

4.2 LIMITATIONS and FURTHER RESEARCH

Very small related material is available free on the web to learn how to create, compile and then upload exercises and their results. Major limitation to this project may be the scarcity of internet and even computer facilities in the remote areas of the country. This is a continuous process and requires both financial and manpower resources. A separate department must be responsible for that to maintain and keep update records.

V.   CONCLUSION

This work represents the real application of artificial intelligence in practical field of life which may make free the human and utilize the computer technology in useful way. If this project ends up as a success it may become an electronic 'Counselor', as it has the ability to learn from students' feed backs. This system can be adopted for students' admission and also in recruitment processes and may guide the organization to select a suitable person for a proper job. This will minimize the cost and labor of counseling and selecting. This is limited only to assessing the exercises; we will try our best to extend it to check the feasible areas of students' abilities and will give them advice to choose the proper area for their further studies.

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