Educational Robotics: Comparative Study and Amendments

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Summary

This paper focus on the comparative study on the current educational robotics and biases which effects this fields not be completely suitable for education. Through the study conducted we have identified the various biases and tried to solve the individual biases with the some amendments which can done in this field to enhance Educational Robotics.

This paper not only aims on biases and amendments, but also included the educational requirements and keeping them in mind to suggest the proper robotic structure to ensure the robotic layout with add-on capabilities and provide a proper learning environment.

Once after the proper implementation and through certain run and fixed, we would be having the better Educational Robotics model to enable senior wings utilize educational robotics in studies.

Key words:
Education Robotics, Structure Design and working, Biases Solving.

1. Introduction

Educational Robotics is the growing field now days. The various amendments made in the robots structure and its integration with technologies were done to make Robot suitable to multiple places. The major advantage of using the robotics is that always you get the unified and fixed quality output. Utilization of robotics in the educational stream will also beneficial.

Based on the "Robotics Camps, Clubs, and Competitions: Results from a U.S. Robotics Project" teaching through robotics is applied for the youth aged between 9-14 years in the form of camps and clubs to provide them educational experience through robotics. The teaching conducted in the informal way and provide experience to over 5000 youth and 400 educators. Getting into the same and on the similar background working and enhancing the technology for the younger youth we can implement some technology which is capable of more enhancement and through which we can expend boundaries (one of them is Machine Learning which is currently in trend and be easily integrated with robotics).

Robots can be an entertaining platform to learn about computers, electronics, mechanical engineering and languages. It has been shown [2] that young children performed better on post-learning examinations and generated more interest when language learning took place with the help of a robot as compared to audiotapes and books. Educational robots are a subset of educational technology, where they are used to facilitate learning and improve educational performance of students.

Machine learning is the one of the major upcoming technologies and considered as subset of Artificial Intelligence through which we can build us the software model and trained them based on the specified dataset (activities and their corresponding action taken). Machine learning utilize these sample (instance/activity) dataset specified dataset and evaluate the pattern (action) as output. As more and more we trained our software will result in better output and accuracy depending upon the subject content.

Based on the paper published "A Review on the Use of Robots in Education and Young Children" by [2] which focus on the deep analysis of the articles published and their selection strategy (based on design, technology and subject dedicated) and out of them most are maximum were non-experimental. Though this paper we have focused on approach, robotic structure, process required and technology.

The biases/issue for educational robotics, going through individually and evaluating the solution to overcome such biases will be mention in the following methodology section [4].
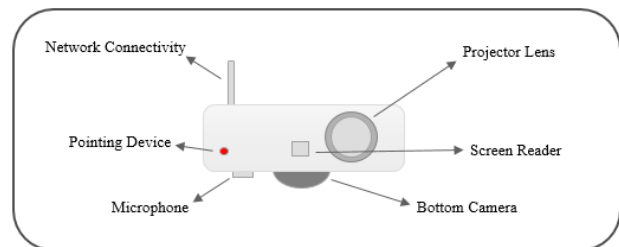
2. Figures.

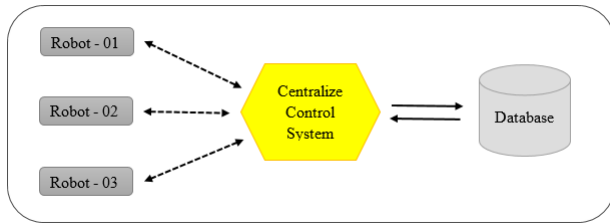Fig. 1 Proposed Robotic Structure Design

Fig..2 Proposed High Level Diagram of Robotic Setup.

3. Methodology and Implementation

Initially talking about the education robotics and making it feasible we have to go through all aspects of current educational role model and teaching techniques involved with detailed brainstorming considering the prospective of student, educator, parents and regulations.

Based on such analysis and we have proposed a structure model to make robot suitable in class with automatic abilities.

Structure of Robot

We have viewed multiple robotic model and based on the education teaching requirement would like to propose the model in the designed in projector shape, since it not mandatory that the robot is locomotive, but should have the capability of pointing the screen by in-built positioning pointer or external laser light beam attached to robot. The robot will have capability to capture the coordinates of position of individual sitting in class and mark attendance by face coordinates and other detailing which help to gain more accuracy. The robot will have the in-built voice receiver which can listen the questions/query in term of and will return answers based on the search result from database. Although the database will be have maximum number of question stored will help us robot to search the required result and evaluate through algorithms, In case the robot will not able to search required query will raise the incidence globally. Which will be solved my subject expert. The robot will have machine learning capabilities utilizing which we can train the robot, logic update and many other things.

The robot attached to the individual class room will be centrally lead by main server available in central room in school/center which directly connected to limited site on web[5]. For any update in the software/ database will restore during night, reason for doing backup in night will help/save us any unexpected error during the class.

Below are the detail description of the components used in proposed structure design (Figure 1):

Wi-Fi Connectivity

As moving to the cloud computing, robotics can be also managed through could which saves the individual organization cost. As one center unit can control multiple robot at time. All the instruction and the database connectivity can be managed though same. An actual computation/processing can be performed in the centralized center and the output and input receiving and transmitting can be done through connected robot.

Projector Lens

Projector lens is the primary output element which display the output on the screen. The project screen works on the coordinate system and will know the pointing area as defined in database.

Screen Reader

Screen Reader is the component which will help us in reading the content from screen through image processing, so in case of any question/equation solved by the student can easily be read through robot and based on the business rules/logic/subject expertise can identify the error rectify them and teach the issues involved.

Pointing Device

Pointing device included here can be utilized to point any object student, indicating for his/her turn, or to point the screen identifying/highlighting in between.

Bottom Camera

This is utilized for maintaining the discipline in classroom through this robot can auto monitor the activities and mark attendance. In case some major issue captured by robot will send clip along with details to the assigned person.

Sound Speaker

Sound is also the mandatory component which allow the robot to speck through, the robot will be capable the pitch variation technique with proper and clear voice.

Sound Receiver

Sound receiver is the used to received input for any query asked in class-room. Once the query/question is asked robot listen the question match it with the database and revert back.

The structure is not everything to take care, there are multiple algorithms which need to implement over the machine learning, to manage the proper uses/utilization of the robot.

Software Implementation

There should be centralized software to the used with such implementation, which enables the easy software updates and accessibility. The software should be have following capabilities:

Identity the individual class based on the IP/Robot ID.

Manage/Conduct study course as per the Timetable.

Robot would have complete course details that what to be teach and how to be teach along with the pitch variation technique to be utilized.

It should utilize image processing capabilities to identify the students and mark their attendance.

Robot would be capable to identify disturbing activity based on coordinate/sound receiver to maintain proper decorum.

The software should be enable to listen the cross-question and search the same over the database and for the match should return the answer, if the asked question does not exist in database should refer to the assistant facilitator and mark this under the queue and once the facilitator confirm should be added to database.

In-case any guest lecture come/ any sort of lecture/ awareness program is conducted will be directly delivered through this setup. Also if the facilitator exist in the other part of the world can be easily be connected and communication can be done.

The software have capability to evaluate the student understanding based on the quiz.

In figure (Figure 2) we have proposed the high level diagram to be implemented.

Artificial Intelligence implementation

Along the utilization of Machine Learning some additional requirements needs to be added in the robots to self-assist while teaching this may include following:

- **Matching Query with the Database**:

It is bit difficult for the software to match the string dictated by individual to match with the database, in order to solve this we should require some pre-transformation before matching to the database includes the removal of stop-words (words which do not have meaning covers punctuations) and then matching the query with the based on weightage search (matching based on the word by word and position where each match consist of some weightage) the maximum weightage match would be given priority and the result is evaluated. In case the result not meets with the lower threshold value (decided based on the test conduct and should be always greater than 85/100 weight) can be discarded.

- **Image Processing**

This include once the individual enters in the class camera will capture the individual face coordinate and based on the initial database, match the result and for the perfect match it will mark the attendance. In case any un-known person enters in the class will report to authority once the authority confirm will save the result for future.

Other part which should be take care of is the screen reader. Although everyone have the different free style writing the screen reader functionality is to read whatever is written on screen, for this the complete screen image is captured and fragmented based on the alphabet/numbers and each alphabet/numbers are recognized and sentence is completed.

- **Management of Course Content**

The robot should utilize artificial intelligence to manage the length of the topic and the time utilized in cross questioning along with course completion without skipping anything, this would be done based on the algorithm to evaluate the remaining time and topic duration managing both. In case some of the course falls lack behind the schedule will be covered in free periods.

4. Discussion

Based on the study conducted on the biases, below are the some overcome amendments.

Teachers are slightly reluctant to use Educational Robot in the classroom

Every automated machinery at its initials stage may doubt the individuals about its authenticity and applicability. More over once the individual test it by run some sample and getting proper result will only then believe them, similarly in order to overcome this we need to create one functional prototype and code it accordingly, in the initial run might be the expectation rate were low but through machine learning and the bit more update will definitely reach to the high accuracy, although this is one time activity but result we get after this will be definitely good [5].

Behavior and Emotions are lacking in machine

This is true said as machine have no emotion and feeling, but in order to train the robot suitable for the education we can implements a bit like vocal pitch and tuned them based

on the reaction and situation with some artificial intelligence and the face reading logic this can be controlled, some vocal pitch change algorithm and training will solve this some extend [6]. Also if we notice the emotion factor for major students will get fixed once they get mature over the class and class, so this might be not more required for higher classes.

Student evaluation based on Teaching

In order to evaluate students and their learning for the teaching done by robot we can add the question answer series, when the robot can ask frequently question and the student has to response back or solve. Through this exercise we can evaluate the student efficiency and force the individual to contribute more toward the studies. Also if required then the specific report can be generated based on the evaluation.

5. Key Highlights of Approach

The approach mention above have significant value in various term discussed below in details:

Centralize Control System

Advantage to utilizing the centralized system is first is save cost, for this we do not need to add-on the logical unit to each robot. All the robots available in the School/Center can be lead by single central processing unit. Also when we require to update the software/ database can be reflected over the all the robotic action.

Structure of Robot

The structure of robot proposed is in the projector shape, which make it suitable for conducting studies along with some extra amendments which make it suitable to transform as robot. The structure is build simpler and out of reach to student to enhance the live span of robot [7].

Robotic Learning ability

As mentioned that robot utilize machine learning through which we can train our robot, so by this way if any new amendments come we can update them and fix.

Management through Robot

As above mentioned that robot can manage the student attendance which means no extra time require to mark individual attendance with in class.

- **Individual Class Work**

All the class work done by the student on the board can be saved in the image format and can be mailed automatically to the student mail id this will save student's time and proper notes distribution. Also it help in environment as no extra paper/ photocopy is utilized [8].

Notification to Authority

In case of any miss-behave conducted in the class can be live checked by the authority and can send message robot in class.

6. Conclusion

The suggested approach can be implemented and can be extended in the big picture by amending the different variety of the techniques which, whose combination can make it unbeatable, although to make it suitable required more training as more it gets trained along with the additional supercell business logic will work more than expected quality.

The approach/ design/ functionality are designed considering all the biases and the unique technique to overcome all.

Once after the approach is implemented and trained the cost spent for the multiple teachers for same subject can be saved with the uniformity in the study. The teaching through the robot and evaluation can be also used further helpful to the student for counselling which can be the further add-on to this approach once made.

7. References

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