DEVELOPMENT OF E-LEARNING IN EXPERIENTIAL PEDAGOGY

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Abstract

The proposed work is to design an interactive learning management system. The work includes design of Content Management System, app development, database management, e-commerce integration and IoT modules. Main feature of the project is to design an interactive app which can control external hardware, through the Learning Management System. Interaction happens through web based interface and mobile based interfaces. The initial part of the project involves configuration of the Content Management System as a Learning Management System. This includes configuration of courses, chapters, question pages, quiz pages, lessons and development of a web based interface using WordPress touch. The app developed for android based handheld devices includes design of individual pages, integration of pages, development of the dynamic pages for collecting databases and storing it on localhost. The database management system included configuration of the dynamic data for the web based interfaces. This includes design and development of the frontend of the Learning management System. Development of the interactive part of the hardware includes controlling of the external hardware. These have been developed using Internet of Things modules.

Keywords: e-learning, STEM experiential learning, Learning Management System.

1 INTRODUCTION

The term 'e-learning' is a pedagogical process methodology to learn, to teach, to collaborate, to exchange contents using electronic media and communication systems. This includes mobile communication, internet, recorded audio and video. It makes it easier for the learner to learn the formalised teaching using the latest technology. The teacher exchanges the knowledge and skills to the learner via electronic media. The current system provides the flexibility for the learners to learn on their own (self-learning). E-learning content includes audio, video, data, simulation, graphics, text, database etc. large number of people can learn from anywhere anytime and in the world using e-learning systems. It has been proved as a boon for the people in all sectors. Although in the beginning it was not accepted by the masses, in the last two decades with the advent of internet and mobile communication it has found wider acceptance [1].

E-learning systems can be categorized in two different ways. They are real time E-learning systems and recorded E-learning system. Real time, e-learning systems is the interactive e-learning system. The learners and the teachers can be online at the same time from different locations or same locations. E-learning can be done through resources like video chat, or conference call as well any interactive tools like zoom, WebEx etc. The most beneficial part of real time learning is that there is one to one communication between the learner and the teacher. The learners are free to ask questions and get it resolved by their teachers immediately. Real time e-learning system is highly recommended by its users due to the advancement in the technologies**.** Recorded E-learning system relies on recording the data and then makes it available for the learners. The learners can refer to the videos anytime anywhere. The learner and the teacher cannot be part of the learning at the same time. blogs, email, discussion forums, e-book's CDs, DVDs, etc. These are the medium for the recorded e-learning systems. Learners may record the data and learn at their convenience [2].

Although the current e-learning systems are found to be very beneficial still they have few disadvantages. The learner has to watch the simulation in a video or through immersion. Practical approach is lacking in the current e-learning systems. Experiential learning and activity learning is totally missing. Graphics and simulations allow visualizing things but do not provide any practical experience. This can be described by the statement believed to have been quoted by Confucius.

"I hear and I forget,"

"I see and I remember,"

"I do and I understand".

2 E-LEARNING METHODOLOGY

The project is for developing a new kind of e-learning system which combines software and hardware. It provides a mobile based interface application. The basic idea behind the project is not only to provide the traditional Learning Management System (LMS) but also to allow the learner to develop their own experimental hardware and then interact with the hardware through the LMS. The LMS has customized featured which are hosted in the cloud. In brief, the project is a solution for education at home. It is a complete education system online, including teachers, learners, administrators, laboratory and experiments. Instead of recorded videos the learners can actually create models. Interact with the working models through IoT and then retrieve data through an android application for mobile devices as well as web based application for Laptop/Personal computer. The uniqueness of the project includes executing real time experiments as per the curriculum and beyond for experiential learning. The platform includes live video lectures, recorded video lectures, simulations and interactive hardware. This is represented in the block diagram as shown in figure 1.

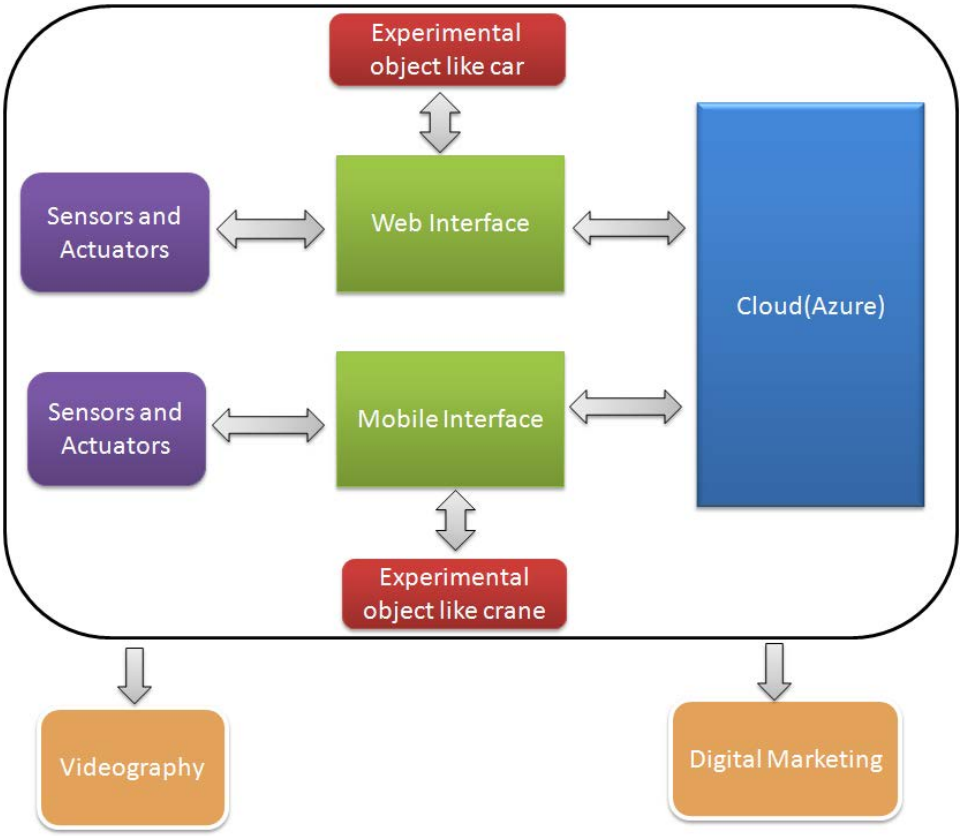

Figure1. Concept of the project

The user can access the content through web interface as well as mobile interface. The LMS is stored in the cloud. Every subject and their corresponding unit courses are listed through the interface. For each subject there are specific set of experiments to be performed by the user.

3 E-LEARNING CONTENTS AND PROCESS FLOW

The user purchases the course content through the website or app. The registered users are given access to the standard wise content. Currently the contents are being developed for Standard 1 to Standard 7. The LMS includes videos, quizzes, notes, e-mail and chat interfaces for uses and the trainers to interact. The major innovation has been the registered users receive a portable mini-laboratory. This is a physical box that contains a book, work sheets, toys, resource materials for making working models, laboratory glassware for performing experiments, electronic components and certain tools [3].

3.1 Content development

The contents have been developed broadly based on different curriculums that are being followed in India. Since the project is in the initial stages focus has been on science and mathematics. In India, school education is a state or provincial subject. Therefore, each state in India has its own curriculum. These are called state boards. The central government in India runs its own curriculum for public which are specifically designed to support migrating work force children. This is called Central for Secondary Education (CBSE). The content for this project has been designed by mapping different curriculum to centralized common format. The contents have been developed in such a way that it can address the needs of students pursuing different curriculum across India. The developed content has been standardized to the International Baccalaureate. The main focus of the content includes two important aspects 1) Theoretical foundation and 2) Application of theory through experiential learning. The overall learning content can be categorized into four verticals. They are course contents (LMS), model making), experiments and IoT modules.

3.1.1 LMS components

Currently Science and Mathematics are only subjects that are available for the user. For users of Standard 1 to Standard 4, content in the LMS includes Chapter wise video modules which include animations and short video lectures. These are ably aided by toy building modules for each chapter. . The videos to build these toys are also available in the chapter wise modules of the subjects [4].

The contents for Standard 3 and 4 additionally include experiments in specific chapters. These are to be performed by the students. The guidelines videos are included for each chapter in the online modules. The mathematical part of the content is gamified using toys and interactive videos for lower classes. Starting from standard 5 the mathematical contents which are online in the LMS complement the models to be constructed by the students. This means the students have to implement the concepts learned online using models which are supplied in the portable Minilaboratory. Each chapter in the science and mathematics have installation units content which allows to interact with toys that are built by the user. These units are IoT modules which allows the user to play with the toys they have built to understand a specific concept.

3.1.2 Portable Minilaboratory

It is a physical box that includes textbooks ton science and mathematics, worksheets, model making resources and experimental resources for science related subjects. For lower classes that are from standard 1 to 3, all the models are based on paper. For standard 4 and standard 5, other materials are provided to perform experiments related science. For higher classes portable laboratory also contains IoT modules which are to be assembled by the students to learn scientific concepts.

3.1.3 IoT modules

The IoT modules allow the user interface their model with the online LMS content. That is any user learning about graph for velocity can read the book, learn the content through online video lectures in the LMS and also make a model of vehicles to understand the concept of motion. The IoT module can be easily fixed to the model, thereby making it interactive. This allows the learner to plot the velocity graph in the webpage of the chapter or in the mobile app in real time. Therefore, instead watching and listening to an online simulation, the learner will also be able to build his/her model, understand the concept and at the same time deduce necessary observations real time [5]. This is illustrated in Figure 2.

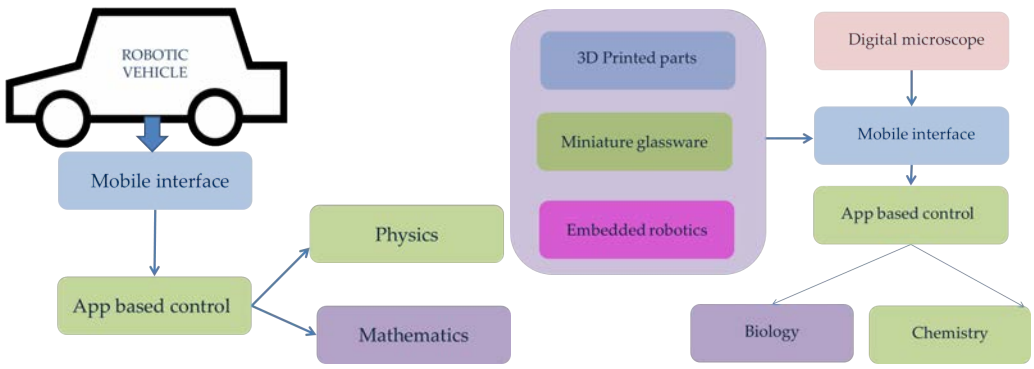

Figure2. IoT modules for interactive learning

3.1.4 Blended experiential learning:

The future of education is being propelled towards on online mode. But human interaction and implementing theory learned practically are missing in most of the online modalities. This has to be addressed in an innovative manner. So the current form pure online delivery or recorded delivery may not totally replace real face to face delivery mode. The current school education pedagogy will undergo subsequent changes in the current pandemic situation. Especially, in Indian context current education system has been lacking experiential learning. This can be addressed only if face to face, online mode and experiential learning are blended together for the future.

3.1.5 Implementation and analysis:

The product has been implemented on a trail run basis for 1000 students till date. Based on the feedback certain changes have been made with regard to the hardware of the IoT, the web interfaces and the online LMS systems. This analysis of the feedback data has shown that the student's involvement has increased with combination of model making, experiments, and short duration LMS videos. It has also enhanced their creativity and attention span. The fun element of model making has more positive response with respect to lower classes. The higher standard students (5, 6 and 7) were able to distract themselves from the online mode to perform experiments and making real time data analysis using the IoT modules. Most of the students were able to perform the assembly of the IoT modules and interact online with LMS content. Overall, the feedback with regard to divergent thinking, activity based learning and explorative learning outcomes were very high. The initial shortcomings are mostly related to integration IoT modules with the LMS. This has been sorted out recently. The overall final product has been displayed for reference in the figure 3.

Figure 3: Trail stage product

4 CONCLUSIONS

Initial trail runs of the project have given a positive outlook. And the product has been gradually released in the market. The analysis has shown marked improvement in learning, abilities of the students. And the future plans include developing complete blended modules for higher classes and may be for the bachelor level degree programs also in the near future. The subsequent technical details and hardware design have been communicated for publication in journals.

ACKNOWLEDGEMENTS

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