ICT - A Tool to Enhance Teaching Learning Activity in Technical Education

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Abstract—In today's era the demand of ICT tools has played a vital role in improving the education system. As there is a tremendous growth in technology in last few decades, it becomes mandatory to make use of ICT tools for better and improved quality education. Industry revolution is towards the 4.0, so to sustain in global market, to compete with real world problem, to grow with technology education foundation need to be very strong. ICT is the tool which will help in reaching to maximum students in online as well as offline teaching learning mode. It is said that to build the strong nation, education system of the nation must be strong. Teaching learning process can be made more effective by using advance technologies. In this paper the way how ICT tool can be used in more effective way for teaching various courses has been analyzed. Various courses like digital signal processing, digital image processing, digital electronics have been analyzed on various scales. Student's better understanding and learning, their feedback, student's involvement in research with proper impact analysis has been carried out. Effectiveness of using the ICT, advantages, disadvantages and challenges in assessment and learning is elaborated in details. Received results have proved that use of ICT is the only way to enhance student's skill and get better outcome for a better nation.

Keywords—ICT, Teaching Learning process, pedagogical initiatives, fundamental courses, e-learning environment

I. INTRODUCTION

Education is an integral part of human life now days. For building the best nation, build the best society, to build the best society build the best human being and to build the best human being build the best education system. Development in technology may become the pillar to build the best education system. Here is a little bit efforts are done to teach the students in innovative way. Always the focus point is students and student centric learning process. In this paper the focus is more on teaching the technical core courses in innovative way. For an engineering student having basics and fundamental concept clear is first step towards the good education quality. In engineering / technical education system students are working on various scales. Students are learning the theoretical concepts and correlating this theory concept with the practical in lab sessions. It has been observed now a day's student's tendency is changing drastically. If comparison of resources available is carried out, huge information and variety of technologies are easily available on a single click. In this paper the focus is on use of recent technology to teach the theoretical concepts and correlate the execution of practical experiments using various software and virtual labs. The motive behind the same is to make the advance platform readily available for the students. In the current pandemic situation suddenly the teaching methodology is changed from

offline mode to online mode. As a result of which a number of observations can be enlisted during online teaching. Following are some of the prominent observations which should get addressed properly to maintain the quality education system,

- Student's concentration span
- Internet facility available with students
- Students involvement in theory and practical sessions
- Activity based learning in conduction of theory and practical session and the assessment of students
- Response of students for various activities planned
- A closed loop feedback system to improve the quality of education
- Response and outcome of the assessment and activity conducted.

In this paper three different courses are considered for the analysis purpose. These courses are closely associated with each other or rather than that they are prerequisite of each other. First course considered is Digital systems & application which is offered as one of the basic and fundamental course for engineering students. Second course considered is Digital signal processing which is offered at somewhat higher level students class wise. Third course offered in this link is Digital Image processing for final year students. It is assumed that whatever the basic and fundamental concepts students are going to learn in digital systems and application course, they must be able to apply it in digital signal processing course. The concepts students are learning in digital signal processing must be able to implement the various real life applications in Digital image processing course. Now the challenge lies in explaining the students

- Basic and fundamentals in this stream using proper ICT tool. Explain the correlation of theory and practical concepts.
- Implementation of real life applications by making use of particular course knowledge.

For achieving the better height in teaching and learning process here the use of ICT is done to is best possible extent and result received are excellent and helped in analysis on two

different scale. Students involvement, participation was good as well as knowledge gain in related filed like project implementation, presentation on any topic related to course, active participation in question answering session has improved. Remaining section of the paper is arranged in following manner, section II elaborates the related work carried out by the various researchers in associated field. Section III course positioning, correlation and pedagogical approaches, section IV elaborates the augmented learning related to core courses, section V and VI gives the details about the implementation and results with conclusion.

II. RELATED WORK

[1] Authors tried to elaborate the concept of millennial learners. Focus has been kept on learning and concentration span of the students. As per the author and learning theory capacity of each student is different. It is always better to teach the fundaments and basic concepts in chunks rather going in one glance. For better understanding the learning in small chunks is the best solution. Students in a class sitting together have different understanding level; way of grasping the knowledge is also going to change per student. Approach and human nature is also going to vary for the students towards the learning process. [2] As ICT is one of the tools to reach maximum students while teaching. There are number of agencies coming into the market and launching the tremendous products related to ICT. It is the lookout of the teacher and find out which one is the most suitable for the students and for the particular course. Use of ICT, implementation, acceptance and adoption, it's usability is the major concern of the author. In this paper author had taken the review of maximum ICT tools available and it's usage for teaching purpose. [3] As ICT tools are playing important role in education system as well as industry sector it is necessary to educate the people for ICT tools. Author has put the light on important factor, of educating the people for using ICT tools and spreading awareness about the usage and usability of ICT tools in the market. How proper education and training will improve the quality of using the ICT tools and effectively the working style is explained very well in the cited paper. [4] Paper is the best example of how education can be strengthens through proper teaching learning process. Here the sample of Stevens Institute of Technology is taken for the analysis purpose and complete formation or transformation is analyzed related to software engineering education. [5] In this paper the major aspect of creativity, capability and challenges are addressed. How students can be more creative is analyzed. In 21st century to feed the students and fulfill their thrust of knowledge is in itself a challenging task and how we can overcome / minimize it is topic of discussion. [6] Outcome based education is the need of today's time. As per the demand of generation traditional way of teaching is now out dated. It is more important to measure the output based on the outcome not only in the form of numbers or marks but in form of students contribution in various activities like project implementation, paper presentation / publications and participation in various technical activities. [7] Revolution in industry demands the ready products from the educational institutes. It is the demand of time that students must be ready to serve the industry and fulfill the requirements of industry in better way. To get better learning experience it is always desirable to have project based learning. Actual implementation and design experience groom the students in best manner to face and sustain in industry.

III. COURSE POSITION, SYLLABUS AND PEDAGOGICAL APPROACH

Project based learning is the demand of new industry revolution. In industry 4.0 approach candidate must have knowledge of project design, implementation and execution. By keeping n mind the same concept courses are offered to students in different class and at different difficulty level. Course selection in this paper is done by focusing on digital image processing and digital signal processing. Digital signal processing (DSP) is the integral part if different applications in medical field, communication sector and devices related to processing of signal. Digital image processing (DIP) is one of the immerging sectors where vast numbers of applications are associated. In almost in every automation system and for quick decision signal and image processing is basic need. Syllabus framing is done by considering the industry demand, need of the era, students demand and fundamental and core concepts of engineering education. Three different courses and it's teaching learning methodology has been discussed in this paper. First course offered is at second year level, Digital Systems & Applications (DSA), contents of the course are at primary level, like combinational and sequential circuits, state machines, Ram ROM implementation etc. These are the very basic and fundamental requirement of digital electronics. These concepts are also working as a prerequisite for the DSP and DIP courses. Students are asked to implement small and simple projects in this course, which helps the students to make their doubt clear about the digital electronics. Fig. 01 shows the simple project implemented by the students using simulation software. By using the simulation software it becomes easier for the students to implement the circuit, check the results, check weather getting expected results are not and workout accordingly for the desired output.
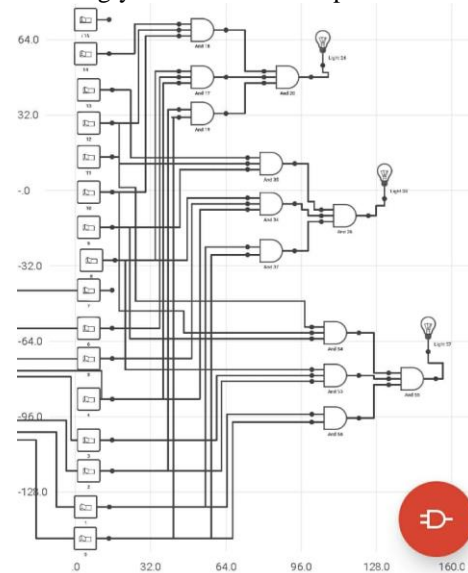

Fig. 01 – Digital electronics circuit implementation using simulation software

As students move to next class it is expected that the thinking level also should also move towards the higher level. By keeping in mind the course offered at third year is Digital

Signal Processing (DSP) which is the advance version of DSA. Here students are covering the fundamental concepts of signal conversion and signal processing. Discrete Fourier Transform (DFT) is the starting of signal processing, further it goes with various filter implementation like, FIR, Multi rate signal processing, DSP processor etc. Practical sessions are full of implementation part, application implementation using Discrete Fourier Transform, Spectral Analysis and Leakage Effect, IIR Filter Design are get designed and simulated using simulation software. The course makes the students very well aware about the signal processing and it's applications in different fields. Fig. 02 gives the proof of practical implementation and result received related to digital signal processing. Students had used SIMULINK as one of the simulation tool and implemented the circuit successfully.
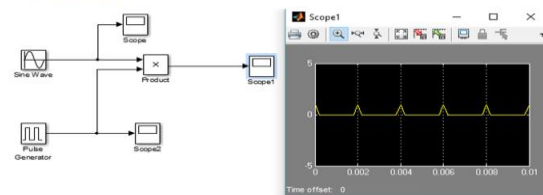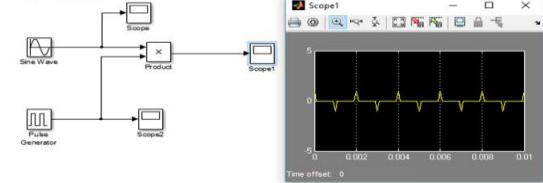
Fig. 02 – Filter design using Simulink simulation software

As the students move ahead in higher class the course offered to the students in the coordination of DSA, DSP is Digital image processing (DIP). In DIP the students are learning all about the image processing and application implementation related to the field of image processing. Contents covered in DIP course are, fundamental concepts of image processing, image analysis in spatial and frequency domain, image compression, morphological image processing, segmentation etc. In practical session students are implementing the various applications using the concepts of image processing. MATLAB is software used to perform practical. It has been observed due to proper coordination of the courses and linking between the contents students much eager to work on projects related to image processing, artificial neural network and machine learning as their final project. Here is the example of project implemented by the students in the field of image processing as final year project. Topic of the project was visual feature extraction. Students had received very good results which can be observed in following Fig. 03.
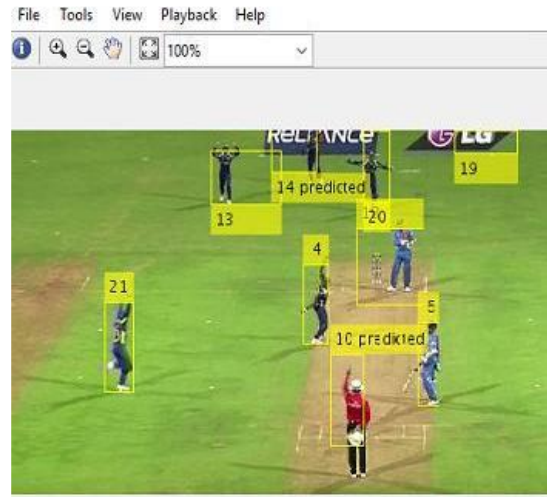

Fig. 03 Use of Image processing to detect, track objects from an image

MATLAB is one of the most popular and user friendly software for education system. It helps in designing, implementation and analysis of various circuits related to digital signal processing and digital image processing. For Digital Systems and Application (DSA) course the practical implementation is done using the hardware kit available in laboratories. Students get very well practice of connection and testing on board. The major concern here is to make the students aware about the actual result testing and connection handling capability. Onward third year practical are more associated with software / simulation software. As the complexity of the code and circuit go on increasing it becomes better for students to implement it using simulation software and program it in software.

IV. COURSE IMPLEMENTATION IN E-LEARNING ENVIRONMENT

For reaching up to maximum students and helping them in performing in better manner use of ICT tool has been done at various platform. The ICT tools identified in campus are Moodle, CollPoll, Canvas, AMCAT, Google class room etc. DSA, DSP and DIP course are implemented in virtual learning environment (VLE). Platform used for different course may be different depending upon the requirement and availability of resources in campus and with students also. Moodle being a bit more flexible while Canvas LMS is the world's fastest growing learning management system, more preference is given to use it. When the pandemic occurred and everyone switched to online teaching from offline campus interaction, CollPoll is considered as one of the LMS. CollPoll is a web and mobile based AI-powered Campus automation for a better learning workflows. Mobile based application was the demand of the time, so CollPoll LMS was the best solution identified. Courses were configured using Moodle as shown in Fig. 04.
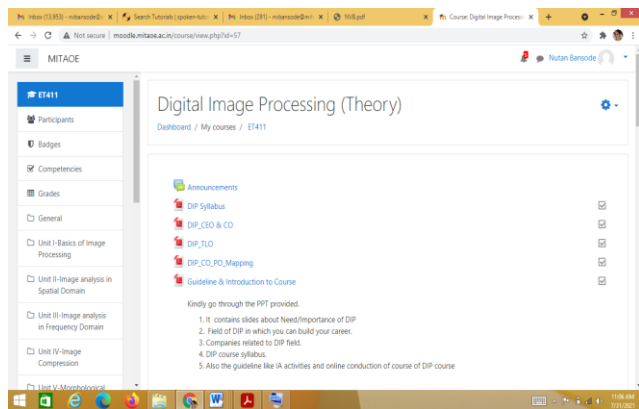
Fig. 04 - Course configuration on Moodle as one of the ICT

On Moodle students are enrolled for different courses year wise. Channel creation is done by considering the courses and their respective academic year. Fig. 05 shows the students enrollment on Moodle.
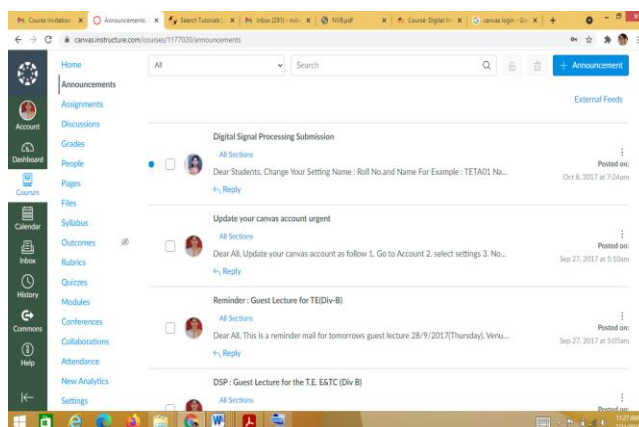

Fig. 05 - Students enrollment on Moodle

Moodle, Google class room and Canvas are also good to share study material also. The use of this platform is done to share the study materials as shown in following Fig. 06. Due to this students become very much comfortable and have access to study material as per their convenience.
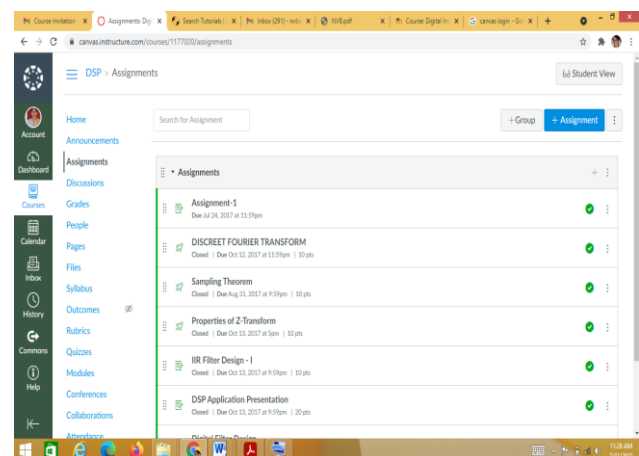
Fig. 6 - Study material sharing using ICT platform
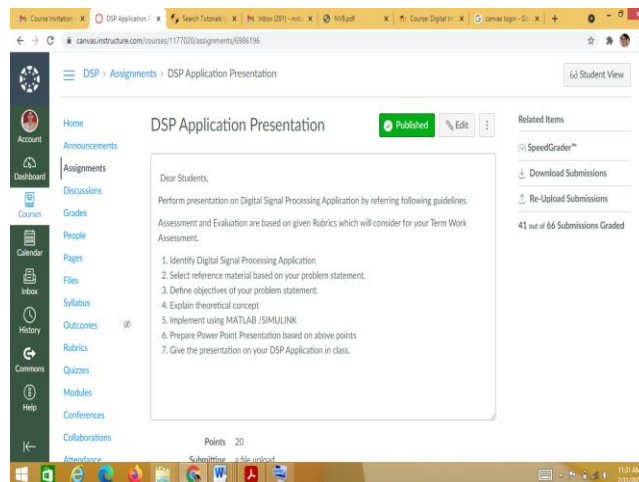
Fig. 07- Activity based learning using ICT platform

As discussed earlier the main focus remains on application based project implementation. Various activities planned for active and problem based learning. The goal of the activities planned was to improve the skills of students like, presentation, communication, team work and active participation by solving the problem. Fig. 07 shows the activity based learning using Moodle.

A. Problem based learning activity

To enhance the skill of project implementation and other skills like presentation skill, communication skill, team work, and social awareness among the students, project discussion, and design and implementation activity had planned. Students got all the notifications on Moodle platform. In this activity it is expected that faculty coordinator will share a tentative list of related topics with students. Students will form the team as per their choice and comfort. Once the team members are finalized and topics are selected by each team sufficient span time is given to the teams to work. After the scheduled timeline students are expected that they will present their work on common platform which is open to all for peer review. Once presentation is over question answer session is carried out and the assessment is done on the basis of pre shared / discussed rubrics.

To keep enthusiasm of students, it is very important to show constant attention in their work and to provide timely support when problems arise. Thus for each activity like Quiz, Problem Solving, Assignments, Case study with real time application, separate discussion forum was assigned. Students should be interactive & encouraged to provide answers. At the beginning of the semester it was announced that the all the activities will be floated on LMS Platform which will be assessed positively.

B. ICT as a Platform for Continuous performance monitoring & Rubrics based assessment

Students are provided with study material which is available on Moodle, Canvas, and Google class room or on Collpoll. All the activities are planned and shared well in advance with students so that they will be able to plan the studies and work for it to achieve better results. For every activity rubrics is

shared on Moodle well in advance, which motivates the students to progress in right direction and get ready with expected solution. Fig. 8 shows the rubrics shared with the students for project presentation activity.

Fig. 08 - Rubrics based activity assessment

Assessment of the students activity is also done on the Moodle due to which it becomes an ease to have a close eye on students overall performance. As shown in Fig. 09. Overall performance monitoring is also done using ICT.

Fig. 09 - Overall performance monitoring using ICT platform

V. CONCLUSIONS AND FUTURE WORK

Student development and education quality improvement is the major concern of this work. With ICT tool it is possible to reach up to maximum students, monitor the performance of each and every student. During the offline teaching it has been observed that students attention span is less than 100% due to lack of attention students might miss many of the points during the offline session also. Later on there is no reference available once the class is over. By using ICT tools

it is possible to prepare all instruction lists and share it with students, and students can refer it as per their requirement. In system it is desired that students will have study material available easily. Proper activity calendar sharing and advance information about the assessment parameters is one of the way to make journey smooth from student side. ICT is working as the best option to make all this things available for students. For faculties, ICT helps in sharing study material, assessment based on rubrics, attendance monitoring and overall performance monitoring. In this pandemic situation when switching of offline to online happened ICT worked as sustaining solution for all education system. In future as well education system will relay on ICT only for betterment of education system.

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