

SMART VISION OF IOT TECHNOLOGY AND DIGITIZATION IN VARIOUS AREAS OF ACADEMICS IN CURRENT ERA

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ABSTRACT

In the current era there is a need for digitization of the Education it is a part of developing and innovation of organization through various applications of academics. It has been seen as still encountering difficulties in the utilization and benefits of technology in the education area. Technology has made the automatic embedded system covered through the Internet of Things such as sensors, network facility, actuators, IOT things and digitization Medias. It is helpful to academics in various areas of learning and teaching aspects. Educational members need to adjust with the most recent innovation for their instructing and other training related process. With the utilization of digitization and Internet of Things Technology it becomes more helpful for developing 'Smart Academic System' in the educational field.

Keywords: Embedded System, Smart Education, Smart Academic, iLearning

Introduction

In today's Digital Era, new technological functionality - Artificial Intelligence (AI) which has become a knowledge-based system in our lives. It allows us to adapt to the changing surrounding environment of the world. The Internet Based Digital era having web functionality useful for getting significance, replacing the inquiry capacity of accidentally coordinating words, which regularly have different implications. In time, inside this form of the Internet, programming operators will trade information without human intercession.

The IOT is fundamentally a system of a few gadgets which are joined with incidental programming, hardware, and system network of unmistakable directions, planned for trading and assembling of any sort of data. IOT is applied in numerous enterprises including money, travel, educating, media transmission, etc. With regards to actualizing IOT in the training division, the significant explanation is simply the IOT upgrades, the instruction and gives propelled an incentive to the structures and condition. The vast majority consider being associated as far as PCs, tablets and cell phones. IOT depicts an existence where pretty much anything can be associated and impart in a wise manner. At the end of the day, with the web of things, the physical world is turning out to be one major data framework.

In the era of Internet, all over educational organizations need of IOT and digital infrastructure for educational growth & become a 'SMART EDUCATION'.

At present educational organizations use of digitalization as well as IOT functionality helpful for educational process. This technology supported educational environment

Higher degree of collaboration among institutions with staff members and students.

IOT - Digitization in Education

In the current digital era IOT technology is in need of education with innovative technology. IOT technology in education uses smart objects on campus for change of education with modern technology and improves the quality of education as well as teaching and learning. Smart campus systems with digitalized and IOT technology increases students online learning environments.

Literature Review

An icampus model with smart objects to improve campus management and learning perspective smarter. The term 'Living Lab' introduced a proposed framework in "The Cloud of Things" (COT) with smart box strategy for with desktop facility to rooms, building etc. Paper describes pillars of iLearning concepts and pervasive interactive programming (PiP) a teaching tool that contains the rules of programming distributed computers process for IOT with examples of mappings of rules. (Chin, 2013).

This Technology based smart classroom presents multiple IOT devices for learning and teaching. Different challenges faced in the time of installation of IOT technology in the campus. The IOT technology improves

educational quality and reduces time and efforts. The various types of the signal are to be used in IOT technology based applications to store information in database. (Gul, 2017)

Benefits as well as functionality of smart campus system which established on digital era of IOT products like physical examination used in education & management. It contains topology structure and components of digital era is hardware devices like smart scanner, smart camera, actuator, sensors of (fans, windows and doors) etc. The development of IOT technology was proposed, which can create a new platform for economic growth and greatly improve users better. The objective of paper refers to the structure of system involved detailed study of IOT modules as scan, light, Thermostat, Alarm and also Smart Classroom, Smart library etc. (Han, 2011).

IOT technology maintains security of library system. In the library of institute there are multiple books are inward and outwards so there are many possibilities to misplace books so paper concepts to build a smart Library system in education. Paper describes the first section of an existing system with RFID based library management, which is applicable currently in education. The Second section introduced a proposed system of library that implemented an LCD, the Motorola MC 9090 for identifying the books, NFC sensor for read data is positioned in entry point, LPS updates library server about the rack location & its flowchart with its architecture. (Brian, 2014).

The arising change in computer word need of IOT in educational sectors & necessary to educate current generation of IOT, started open elective IOT introduction course for different stream students. The content of this course involved the all layers of IOT architecture design. The paper describes the problems in course content and students in the learning process. It includes an IOT prototype system developed in a layered approach of course for analysis of the impact of this course on active learning by PO (Program outcome). This paper evaluated activity or value added learning of the curriculum. (Raikar, 2016)

An IOT plays a great role in today's a smart education system using different techniques in the teaching & learning process, this does not depend upon time, distances & real or virtual study. This paper expand through deep IOT concerned applications likes, smart Electric learning and smart classrooms, smart libraries, Smart Attendance record System. Using detail information of network protocols used in IOT, New techniques & applications used in IOT compared by its requirements & cost. Comparison among different applications with its advantages & disadvantages which is useful to all educational sectors using IOT objects. This paper explains in depth of the some IOT technology based applications like, smart E-learning, smart classrooms, smart library, Smart Attendance System. (Das, 2015)

The IOT technology useful in the area of Laboratory Management its practical model of indoor localization algorithms. Such work has an impact on learning theoretical methods. The major components of the framework are Arduino microcontrollers and XBee radios. It is a help to students IOT implementation which is available online educational tutorials. I also use it to implement indoor localization lab assignments (Atabekov, 2016). This Paper describes billions of machines or objects connected with each other using IOT technology which is done by persons & processes by anything, anywhere & anytime. In this paper observed that IOT technology uses in higher level of educations. This discovering these components use, problems faced in these types of education. (Hanan,2017)

Digitalization and IOT in Smart Academics System:

The Smart digitalized IOT system of academics makes education to work on multiple areas in the institutes. These areas have made the process easier in terms of services of education, learning and teaching, security and safety. In this way the learning, teaching and administration services of the institutes, which helps to improve development activities of the education.

The Smart IOT system of academics are classified into five different main categories:

- 1) Smart Classroom
- 2) Smart Learning and Teaching
- 3) Smart Library
- 4) Smart Laboratory
- 5) Smart Project Management

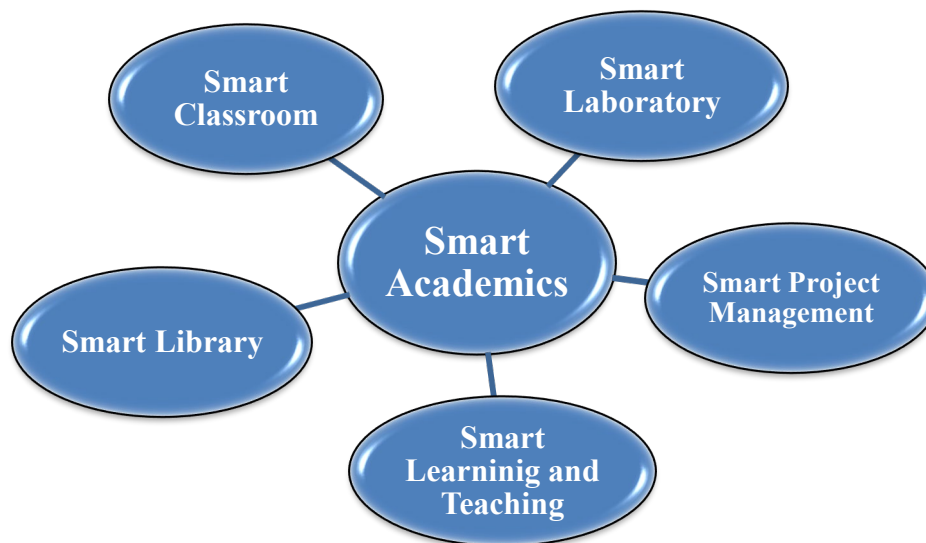


Fig No. 1 Model of Smart Academic system

Academic components:

Institutional components, the technology implementation in the academic point of view based on IOT. Technologies that applied for enhancing the overall performances of institute and goodness of teaching institutes. The different applications, that comes under the same of categories.

Smart Academic Management: - Smart education includes institutes that use smart devices for teaching, control and manage classrooms. Which helped students to improve interest in learning, it made a new approach to education for the academic section.

The Researcher had made a Smart IOT framework for a Smart education system involving different Smart IOT devices for different purposes. This framework included detailed work of all areas of academic like Smart classroom, Smart Learning and Teaching, Smart Laboratory, Smart Library and Smart project guidance. This framework is used in Smart Learning and teaching for enhancing features of educational institutes by making digital education.

a) Smart classroom and Smart Learning and Teaching:

IOT based Smart classroom and Smart Learning and Teaching both are correlated with each other. Smart classrooms use smart IOT components in the classroom for learning and teaching purposes. The smart classroom makes learning and teaching smart with the help of IOT technology. The smart classroom with smart devices helps to provide a learning and teaching environment better and easy. Smart classroom is a combination of IOT objects, multiple smart things together for advanced teaching and learning purposes.

An example of Smart E-learning Application, Smart IOT enabled Classroom, Smart Lab sessions, online notes sharing, mobiles phones etc. These all smart IOT services make digitization based education and maintain connection between various devices with electronic learning in education.

IOT enabled classrooms helpful for e-learning applications in the institute used for real time activity of e learning concepts. Students have been accessed these shared information of E-content and online content which can be controlled by administrator person. These IOT e-learning applications are very cost effective and helpful to students. It is very effective for designing smart learning activities through IOT service. The rapid change of use of IOT technology in education for sharing subject notes, easy way of learning in education to enhancing effectively classroom by teaching techniques.

Smart Classroom and Smart E-Learning Applications

- **Smart Whiteboard:** The main Smart device of the classroom is an electronic digitized whiteboard which connected with IOT sources for teaching purpose, stored data of learning and teaching. The display board is used for interactive learning and access to subject data notes using information sharing, controlled by the administrator for adding updates.

- **E-Notes Management:** An ICT technology used in education for teaching and learning. The information collected from smart devices shared using E-Learning applications. Smart devices helped for gathering information and perform action on it. The features of this application is automatic sharing Notes using Smart virtual classroom. The use of E-Learning applications of IOT makes it easy to share notes, information to students by mobile, Laptop, and other smart digital devices, which creates a great impact on learning circles. The Google classroom feature is used for communicating with each other by digital way.

Smart Virtual Classroom Monitoring: The use of IOT enabled classroom system students can attend lectures through IOT enabled virtual mode. The Flipped classroom can monitor all activities of classroom updates & synchronize with the E-learning system. Setup platform of learning environments of virtual classroom Management. It makes it easy to give a blended classroom through a digital platform for students. It is one of the suitable platforms for sharing notes in groups. The virtual classroom used for doing different types of work like content sharing, creating chapter wise titles, Assigning assignments, quiz to students etc. The setup of a model for collaborating classroom learning environments for /teaching and Learning.

Smart E-ID System: The Smart electronic card is an efficient approach of authentication, identification and monitoring to students easily. The chip on a smart card can store multiple identification factors of a specific person of institutes. The Smart electronic ID cards have different coded systems of information for different users of institutes like faculty members, other staff, students etc. So that every user has a different valid authentication provider ID in order to access. It is also used to trace a particular student in an organization for security aspects.

E-ID devices are also used to monitor or record all activities of students' work, so that it makes it easy to track individual students or groups of students. Also it is used to give students activities details to the students parents like student attendance, health care, extracurricular activities, campus facilities and accessing labs etc. So that the educational institutes provided E- ID cards to transfer information through the IOT platform.

Smart Attendance Management: IOT Technology used for Smart attendance tracking systems using sensors. It makes work easy and time saving, also it helps to avoid the teacher manual process of attendance. The sensors have traced student's presences using these automatic systems. It is helpful for automatic store and printing of student's attendance records, so it is easy to monitor students in the classroom as well as for examinations.

Different Attendance Management System Applications:

Finger print based System: Automated attendance Management system with IOT based system for attendance use finger print based system which stores records in the central database. It uses Nodes, RFID sensors and Finger print sensor machine (Biometric System) in the institutes. It depends on confirmation of data. RFID sensor systems are helps to detect RFID tags for collect data to store in the server and directly generate an attendance report.

Smart Roll Caller System (SCRCS): Smart Classroom Roll Caller System (SCRCS) is installed in the classroom and reads students ID cards details to calculate total students of class as student's attendance in the class helps for students to have good study performance. Another solution of roll caller is a face recognition system used to read attendance of class. The use of RFID roll call systems reduces the time which one spends taking attendance as well as the accuracy of data to be maintained.

Face detection and Recognition System: The IOT based automatic attendance system is save time and human effort. The face detection and recognition system works as it takes the images of members of institutes and analyzes and recognizes faces, this detected faces through image processing algorithms. After it collects data of recognized faces using image processing data and attendance has been marked and stored in the server or cloud and finally report is generated.

E-ID Card accessing System: The RFID technology with IOT is installed in the classroom to collect attendance records. This system has an HF and UHF reader which is situated in the doorways as well as entrance of the school and at same time passive RFID card tag is attached to students ID card. It is a one type of to access information automatically. The sensors in the E- ID cards are accessed automatically by cameras and stored information of students in the attendance sheet.

Smart Learning Hardware and software

There are multiple smart IOT based devices used in the classroom for smart Teaching and Learning process like Mobiles, laptops, ipads, C-pen, 3-D printer, interactive classroom board, interactive flat panel, interactive touch

table, digital displays, Indoor LCD display, LED Video wall, Motorized projector screen, Large format display, Digital podium, Touch screen display, Touch screen panel etc.

Smart Learning gadgets and software used for new Model Setup of classroom needs some smart gadgets which perform different types of automatic works. It is useful for avoiding human effort and makes work easy. The education system has used mobile apps and software for Teaching and Learning process.

Smart Evaluation and Feedback: Feedback and evolution is a natural part of the learning to interact with e-learning systems for the found learner's performance as well as improvements. The feedback system in e-learning is a technique which has comments, advice, recommendations, evaluation and also interpretation format. It is also used to make collaboration and communication with other students and improve the e-learning system. Smart feedback systems (SPS) have features of tag based and graphical based systems. There are found different objectives of designing systematic smart feedback systems such as planning and designing, blended virtual learning environment, assessment of faculties, authoring system, program perspective. The SPS system is structured in different components and step by step presentation of feedback represents a way to learners needs done.

Smart Audio System in class room: The Smart audio facility in educational institutes has several advantages for delivering lectures in online mode and stored in databases. It is an amplifier system which distributes sound which reaches every desk of students. There was a focus on multimedia clarity teachers sound talk comfortably with natural volume and are heard everywhere. The use of amplified learning focused on hearing lessons. The smart audio system designed for smart classrooms contains wireless technology which uses better ways to adjust the volume of microphone and speaker.

Smart Notice board: The smart digital GSM based Notice board needs for comfort living life. It is the easiest way to give the latest news and updates to students. It is a digital SMS based automatic display board used in education. It is an integration of various systems together to make a user friendly application which used to give instructions, recent news to students.

Smart AR/ VR enabled technology in Smart Classroom: Augmented reality and Virtual reality technology is the hottest concept in education technology which makes creative and interactive learning to students. This is a digital technology which enhances creative thinking of students. It is mostly used in practical learning subjects.

Virtual Reality (VR): This provides students gives real time visualizing experience of any activity. It fills the activity physically and expressively to interrelate with the thing which are present in the actual case. VR is experienced in a workplace setting.

Augmented Reality (AR) : This allows for the merging of computer-generated graphics or videos to make the real world which one we seen. The AR technology uses visual presentation of video and audio presentation views which enhanced digital information.

Smart Learning with 3 D IOT objects: This 3 dimensional visuals concept is used in classrooms for teaching with more effectiveness. The virtual animated videos, virtual posters and 2D, 3D images makes learning effective. It is captured in real time from physically located materials or images and recorded in 3 - D from.



Source: <https://www.indiatimes.com>

Figure No. 2 Smart Learning with 3D Virtual objects

The Smart Virtual objects of smart learning from www.indiatimes.com.

Smart IOT Things: These objects are linked with one another to make effective IOT classrooms. The classroom activities are collected and stored in the centralized cloud system. The information is controlled and updated on a daily basis. It makes centered design environment used to build a smart learning environment for analysis as per users' requirements, for improving personal learning strategy.

Smart Security System of classroom: Smart classroom contains automatic wireless with sensor based locks to doors which maintain security of classrooms.

Smart Temperature / Energy Consumption IOT devices: IOT devices useful for monitoring energy and temperature of classroom, conferences halls labs, other rooms etc. It conserves more energy consumption of devices for monitoring energy efficiently. Temperature of the classroom is maintained automatically using an IOT device. The students are more concentrated in lectures because it maintains the temperature of the classroom from climate change.

Smart IT infrastructure in the classroom: The smart learning concept is to use Smart IT devices, connected through network and makes digital assistants. It involves particular hardware and software devices connected through smart IOT interfaces for intellectual conversation of data. These physical and digitized devices and tools are smartly connected to perform in the smart environment of education.

Smart Library System

Smart Library System in the Education

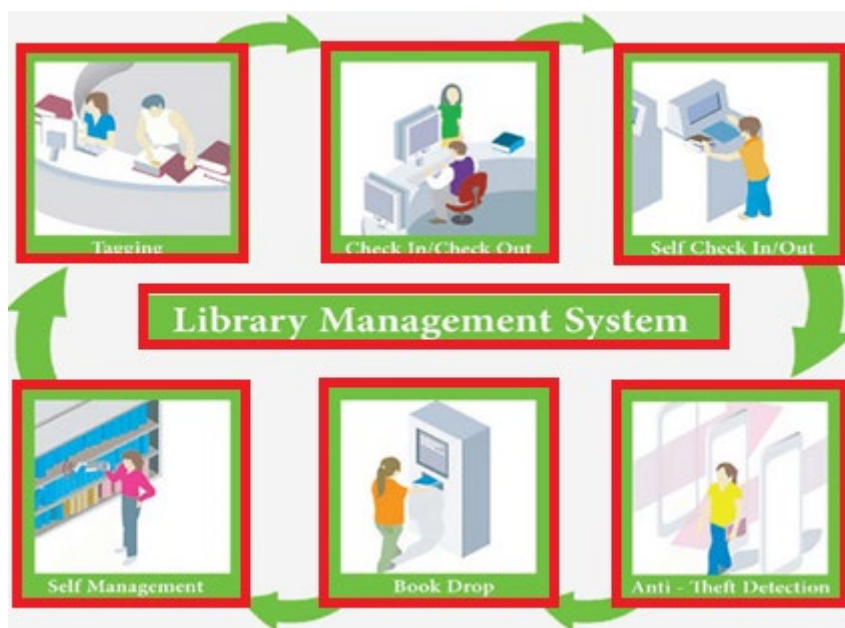
The Traditional Library system needs to be exchanged by new IOT applications on the Smart library system. The new technology of developing new IOT based applications in education. IOT technology and mobile technology makes easy and effective smart library management. The Smart system is used for reducing work, saving time, maintaining security, safe transaction of library and users can trace the availability of the book easily.

The Smart Library system is combined with mobile applications for need to install in the user phone, using mobile the users can easily access all details of the library also issue and return books through the mobile phone itself. This mobile application contains information about whether a book is available in the library or not and other information like availability of magazines, papers, research articles, journals, projects etc. The mobile phone which connects with this system it detect the location of books by LPS technique and given facilities of book issue as well as book return. It also shows details of books present in the library in the authorized mobile.

The Smart library consists of all the detailed information of the books present in the library as well as all members detailed information belonging to the issue of books like students of all programs, staffs, admins etc. This system has stored all information of student's entry to exit details. The entry of students is stored and detected in cameras, the students ID card allows students to access the library system for book issues. The smart library system consist of different IOT tools and applications are used in the in Educational institutes like RFID microcontroller system for extensive card reader, NFC book tracing system, LCD screen for details of book issues, OPAC System, Mobile access to tags, Wi-Fi based local positioning system(LPS) etc.

Use of IOT Technology in Smart Library System

1. **Smart Book Racks:** This smart book racks contains an LED alarm system when any book is misplaced in the racks. This helps to search and fast work of the library system for increasing the efficiency by a great extent.
2. **Smart Cameras:** The entire library is under surveillance camera systems. This makes safe, control the conditions, easy to identify unauthorized situations and any problem in the system. This is a very good way to track the users of the library system.
3. **Automatic work:** The RFID reader helps work automatically. If the student issues or returns any book the information of the book is maintained automatically in the database.
4. **Sensors:** There are different types of sensors present in the smart library system which help to do automatic work. All devices are connected to each other with a central database or cloud system. The different sensors used for different purposes like light sensor, tags, scanners, cameras, computer, LPS, RFID, bar code reader, biometric machine temperature sensor etc.



Source: <https://www.indiamart.com>.
Figure No. 3 Smart Library System

The NFC (Near Field communication) book tracing system contains each book in the library containing NFC Tags, it reads the information and gives the details from the database. It automatically detects the number of books in the database and using NFC card readers read the data and book issued details added in the students account, at same time same book availability removed from list of central database. The students account is indirectly linked with the database, when students issue books and remove book names from the list, it is informed to authorities of an authorized book alert retrieval system. In the same time the notification sent on student mobile number, it contain allow number of days to keep book with students and warning of returned book date as well as if book is not returned after notified date, amount of fine need to be pay by students.

The LPS system helpful in tracing place of books. Students use their phones for link with this system for connected with Wi-Fi based local positioning system having embedded tags process. By using this system the students can known about book is available or not. The availability of book is located in the right position shown through the system.

RFID based library management systems consist of RFID microcontroller broad card reader, RFID writer and RFID tags system. This technology used radio waves for identifying students, members of institutes automatically. The Goal of RFID is the tag detect data in the analog logic format and convert it into digital logic format of machine readable. This system helps to reduce the working time of Librarian staff of scanning barcodes of books while issuing and returning books.

These systems were used by the librarians for managing the books in a library. It helped the process of give and take books. Users have own RFID card for books tagging system, here when the book issue, re- issue and return of book process is done, in this process when the user wants to issue any book, the user put this issued book for checking information by RFID card reader for reads data. This collected data updates in stored database of user book issue details.

Smart Laboratory System

An institutional laboratory has to perform different types of experiments. It is to provide existent experience to perform practical experiments which makes easy to understand concepts. The automation of laboratories in education makes smart labs which includes the different sensors, IOT devices, new digital tools and techniques, virtual lab, embedded devices etc. There is a need for education to develop smart laboratory systems on the campus to learn practical experiments. The emerging tools and techniques were used to explain the practical concepts.

The smart laboratory system reduces the manual effort of work by automating laboratory resources, for achieving an important model of laboratory using IOT and digital system. This can be developed by replacing

some traditional laboratory devices with smart IOT hardware kit and gadgets. In this system devices are connected with each other for better access of data. The embedded board with sensors is used to perform actual work of the system. This system gives real time environment experiences to students in the practical subjects. The smart laboratory system includes different real time tools like camera, projector, PIR sensor which detect light, PT voltage, LDR sensor detect intensity of light, DHT 11 sensor to detect temperature and Humidity of laboratory, web applications which perform control of smart laboratory system, smart phone which accessible the smart laboratory as well as computer systems and IOT devices which connected with each other in the network facility.

The resistors are connected with a transformer to apply an attenuator circuit system for controlling the voltage. The sensors, temperature and voltages are controlled and monitored using smart devices in the electrical and electronics engineering educational institutes. The objective of developed smart laboratories which consider some environmental parameters to process of work to analysis of data to perform effective utilization of the process. The global network framework based on interoperable communication of protocols for identification of physical and virtual interfaces. Connecting multiple smart elements gives a smart environment experience. This system consists of several models and hardware and software applications which are used for different experimental work.

There are use of IOT devices and digitalization in the laboratory to better work and give real time experience. In the library there is use of an automatic attendance system, there is no need to spend attendance time during the session. There are higher levels of configured desktop systems to be used in the practical of Information technology programs for use of better practical concepts and higher versions of software, and it is connected with a network for storing information. In the laboratories use of digital projectors in the session for explanation of practical concepts of information technology programs, like mechanical and electronics as the projectors by animated 3D way explanation, it gives a better idea of practical sessions. The electrical circuits and microprocessors helped for connecting laboratory devices for work as sensors which gather information and stored it into the server through internet facility examples like arduino electrical circuits etc. The most AR/ VR tool used in the laboratory for effective and real time experience of the concepts. The Virtual reality gives facility to students real time activity experience features from practical. It is used in mechanical and electrical departments to explain real working examples of industries and factories.

The Augmented reality tool is used for graphical and 3D presentation of concepts in the format of video and audio representation. It is mostly used in civil as well as mechanical departments to present the conceptually. In the mechanical department explanation of developing devices through 3D effect and animated videos. The devices like vehicles, machines parts, devices, pumps etc. In the civil department it is used in the way of 3D designs of buildings, it helps students easily understand terms.

The smart learning and teaching includes virtual classroom systems for distance learning courses as well as online research phenomenon, it is seen as in the practical experiments the IIT tools and techniques, and software's are used in learning and teaching of various stream programs.

Smart Project Management

The Smart project management system is useful for students project work through effective devices. IOT tools and digitalized technology give different ideas to develop projects. The smart learning devices are used to grow student thinking power. It describes the impact of smart and connected products gives many dimensions and recommendations to develop the stage of projects. It changes the project environment, the power of structured capabilities of products, way of standard practice of project, essential other skills required for projects etc. The Smart project Management system helps to explain the influence effect of projects in the work area.

The Smart Project Management system has features of developing projects. The feature of IOT tools makes it easy to monitor students by experimental practical sections. The feature of project management of advanced collaboration with apps, software's and smart hardware devices gives connections of software's having algorithms and hardware's of IOT devices and digitalization through the internet gives better practical experienced output. And last most important feature is the use of a smart research Lab for project practice. It is a need of the institute to develop smart research labs in the institutes for student's project experiments.

Conclusion

IOT technology helps educational devolving real time smart environment of academics for students. The academic model works on two fundamentals of education like key activity and key resources. The key activities means research, teaching, assessment, development programs for collection of data and key resources means main assets of education such as faculty members, students, staff members, buildings accreditation and

environment of campus. The IOT technology in academics developed both those activities to improve future prospects. The Smart classroom with implementing IOT devices performs on the E- Learning platform. This E-learning concept is implied as social learning applications which combination of various features of education. It is seen that the Smart classroom applications and smart E- Learning applications are correlated to each other helps to improve quality learning and teaching, improve students' performance and develop the educational structure functionally.

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