

A Survey on Iot Issues, Methods and Its Implication in Higher Education

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Abstract

Recently, Due to the availability of High Speed internet connectivity all over the world and cutting edge technology, a wide range of interconnected objects comes into existence and gain its popularity termed as Internet of Things. Besides its much application in recent years, it can also be utilize in the field of education to improve the teaching and learning outcome. This paper focuses on the ongoing research works for key issues and challenges of IoT in higher education. This proposed survey is also focuses on the methodology adopted to improve the learning methodology in education sector.

Keywords: *IoT; Teaching and Learning; Internet; Connected devices; Higher Education*

I. Introduction

The Information Technology has assumed a noteworthy job in interfacing and instructing the students in the present days. Therefore, IoT innovation has assumed a significant job to improve the educational objective particularly in higher education. Due to the utilization of IoT, the traditional teaching methodologies and framework of educational organizations has changed [1]. The present research show that the IoT in education system has two facet i.e. an innovative tool for improving the teaching methodology and another one is as a subject to deliver key ideas of related hypothesis [2]. The innovation in IoT is assumed to be a feasible job for the improvement of education including school, college and university teaching. This innovative technology not only gives the benefits to the students but also it is profited the educators at both in campus and off the campus. All the stakeholders in an educational system can communicate with each other through different sensors which is another approach to comprehend the effect of IoT. Now days, even the persons

having no knowledge coding may utilize the content and control the sensors through small codes effectively which is available in the internet. As per the authors of [3] "coordinating IoT as another on-screen character in educational situations, can encourage the cooperation of individuals (students and instructors) and (physical and virtual) items in the academic condition". As a new innovative subject, IoT is a energizing and invigorating point which draws the student's attention and it also gives a perfect scenario for teaching software engineering [4]. Due to its importance, it is introduced in some open university of UK for the UG students named as "My Digital Life" which helps students to utilize IoT as a device to comprehend and scrutinize their general surroundings and realize their job in comprehension of IoT. IoT is likewise used to show major ideas of Programming language to students [4]. The researchers have purposed an intelligent model utilizing visual sensors and voice recognition tools are used to address the correct pronunciation and the state of mouth of the English learning student based on IoT [5]. Some researcher presents another framework that uses gadgets with labels and

Learning Management System (LMS). These gadgets collect the data and break down students' learning method by utilizing learning examination methods [6]. IoT can be a effective tool to improve educational objective and make educational life simpler.

For effective connectivity of IoT gadgets in the education system, an education supplier need to tackle with various troubles like good Wifi Connectivity, security, protection of personal data, accessibility of gadgets for students, system data transfer capacity, instructors preparedness and cost of hardware, and so on.

Since IoT works with the internet to facilitate the effective communication between its gadgets and systems, the data collected by gadgets are hosted in internet which makes student's personal data at a risk. Any hacker could break through the security and could reveal student's personal data, therapeutic record, family money related information or some other private data. There is a persistent requirement for new advances for education, similar to high speed data connection which gives the transfer speed to sound and video content. A couple of gadgets and applications aren't up to the mark and can disappoint the establishment's ability to build an IoT course of action that is both reliable and open to all users. For productive execution of IoT, an educational foundation must guarantee that the two of its IT rigging and teaching philosophies reinforce the use of IoT in the classroom. Regardless of the way that dangers and potential blocks are connected with advancement, educational affiliations may get focal points from examining and investigating various roads with IoT. Rest of the paper is organized as follows. Section 2 covers the research work conducted by various authors relating to the implementation of IoT technology in the field of education. Various aspects pertaining to implementation of IoT in the field of higher education are detailed in Section 3. A comprehensive discussion on different methods utilized in innovative learning systems in higherv education is included in Section 4. Gamification as one of the methods of innovative teacing methodology is described in Section 5. Problem-based learning style based IoT system for education has been detailed in Section 6. Various challenges to

implementation of IoT systems in education are included in Section 7. Section 8 concludes the paper.

II. Related Works

Different smart learning methodology has been proposed by many researchers in recent years to improve education system. An education approach has been proposed in [7] by working together scholarly with different foundations including industry for upper graduation level courses. The structure of the courses inside in the zone of keen home and healthcare system has been executed in flipped classroom environment. In the wake of utilizing the technique for the understudies, a good response was collected. Different sorts of learning techniques are examined in [8, 9] which bolster distinguished keenness levels and highlights some key point of smart classrooms. After top to bottom examination, the authors have discovered a few rundown of teaching techniques and learning methods and a few results from the feedbacks of students. A web based programming course is proposed by the authors in [10] called as Hstar specifically in the smart class room where the two, educators and students can make ongoing and offbeat correspondence with each other. They have demonstrated that with just single direction addressing technique students can't be assessed appropriately. By mixed teaching technique understudies are assessed by their learning progress. As per an overview paper [11], smart items are utilized to upgrade client interface which fills the space between the real and virtual world, to encourage narrative learning and to accumulate information in learning domain. To catch student activities, smart objects can be utilized inside learning environment. ALECSO which is a smart learning environment has been proposed for Arab nations in [12] which depend on three standards: portable innovation, cloud computing, and open learning system. Dependence on advanced mobile phone in youthful age is truly expanding. According to the researcher, IoT innovation is actualized at each study environment which has upgraded online-Learning by lessening expenses and upgrading learning results [13, 14, 15]. As per their findings, a traditional study environment can be transformed by joining IoT along with the social and behavioral examination outcomes. Smart cameras can be used in the class room to analyze the degree of

satisfaction level of the students by observing their emotion and movement in the classroom. At the point when talk is out of their interest, the students produce more clamors which can be estimated by sound sensing devices. It is critical that past examinations have exhibited midway fulfillment of capable splendid learning necessities. Some system has been proposed unmistakably for the courses for PG level students [7]. As industry people are locked in with establishment so it will require all the more spending intend to fulfill their goal. The blended learning methodology is extraordinarily fitting only for the people who have a high learning want [10]. Regardless, there have different sorts of weak learning students. They haven't offered any response for these students. There has no reenactment result subject to the proposed framework in [9], anyway the model has been formed plainly. Another hindrance is that the learning model part is very monotonous as they have to order the students subject to different characteristics.

Some researchers has proposed a project focused methodology custom fitted for school to build up student's aptitudes in IoT, to be specific, coding and prototyping improvement in association with their regular school exercises [16]. A contextual analysis was presented in [17] where small groups of lower optional pre college students took an interest in a training program and attempted the job of a designer for IoT based applications. Besides that, they utilized a committed designer toolbox that encouraged participants' imaginative answers for issues that can show up with regards to a smart city. The paper displays an all encompassing student appraisal system for this decent domain. Specifically, to investigate the effect of the workshop for the students, the authors have utilized four distinct methodologies i.e. examination of students' structure arrangements, classroom perceptions, a post-test and an overview. The outcomes show that the intercession has advanced a successful teaching technique for the fundamental and structural parts of IoT, however it hasn't tended to similarly adequately the frame of mind related viewpoints.

The improvement of an IoT-based nature observing framework for indoor working environments of classroom is introduced by the authors in their paper [18]. The remotely accessibility mechanism enables

the students to include/evacuate sensors to the system, design the hubs and the network system, manage distinctive sort of sensors and controllers, examine and post process the gathered data. It likewise permits looking at the vitality utilizations for ecological control with the genuine natural wellbeing. The actualized network framework and the accessible educational situations are also examined in their paper.

A proposed structure was displayed by the creators of [19] to the learning training associations that information assembled by IoT devices and dismembered can be feasible as well as profitable, encouraging to upgrade the web learning methodology and educating for both the instructors and understudies.

The interconnection of the things, people, collected data and processed object has become the foundation of Internet of learning things [20, 21]. The advancement of the new technology has driven the world of IoE (Internet of Everything). A few experimental approaches is conveyed in online-Learning on the most proficient method to improve the student's academic performance. Several schools in UK took an interest to improve learning in science, innovation, and Geography using IoT [22]. There are different open source as well as subscribed e-learning platforms are available like Moodle, Sakai, Ilias, Olat, Clix, Desire2learn and so on [23]. With current advancement of innovation many institutions are adopting the IoT inside their internet based learning stages to collect and upload the data to the cloud. The information gathered is progressively mind boggling and testing because of increment in the volume of information gathered [24, 25]. The business based on IoT change through looking for circumstance with regards to item is utilized in the item as well as in accomplishing transformative results through armada influence not straightforwardly through cutting edge IoT usefulness [26]. IoT enables ventures to make an incentive in the biological system through making the most of the accessible chances [27].

III. Internet of Things on Higher Education

All aspects of society sooner or later will be influenced by the concept and framework of the IoT. The higher education institute as well as the

universities specifically, can work crosswise over different disciplines and lead the IoT technological advancement, plans of action, morals of the IoT empowered economy of things. For example, college educators of software engineering are coordinating IoT based labs for the advancement of innovations in the corresponding field. Likewise, some of the Colleges related to informatics can instruct how to use the measures of IoT data. Additionally, the educator can collaboratively work with business schools to set and structure internet based courses to make new plans of action. Likewise in medical course, the experts can engage their things to the internet and the Law universities can instruct IoT morals, protection as well as strategy. As per Zebra innovations, as advanced education establishments initiate to create and use arrangements for the solution of different problems, for example, the organization have the option to investigate and oversee large volume of data by RFID and hybrid cloud computing utilizing IoT advances. It isn't only an innovation update and improvement inside the business, yet can have ability to transform the society including advanced educational organizations. As indicated by the authors of [28], IoT will prompt transformation in innovation in education, transformation in teaching methods, transformation in learning methods, the progress board, transformation in grounds teaching assets and others.

According to the authors, students' dynamic assessment, combination of current teaching methods and advancement of educational middleware are the three angles that lie in advanced education [29]. This transformation gives expanded comfort to students, and makes the teaching procedure increasingly successful for educators. The stream in associated gadgets and innovation implies that educators can concentrate upon the genuine study that is more valuable to the understudies as opposed to play out the normal assignment.

Likewise, IoT can expand the learning background by accommodating ongoing and noteworthy experiences into student execution. These days, students especially in college are step by step moving endlessly from reading material to new advances, for example, smart phones and smart processing units. By utilizing this approach the students can learn at their own ability i.e. at their

own pace and they have their expertise in that field [30], which rises a good progression and satisfaction level as well as the educators can convey balanced guidance to each of the student and diligent student evaluations [31]. In addition, through IoT innovation, educators can gather data about students' progression and after that figure out who need more attention and consideration. Through this the teacher can precisely change the learning strategies for the future sessions. Furthermore, associated gadgets can enable educators to have dynamic study environment. Intercessions just as sign in participation will be improved if they have a gadget to monitor ECG designs. Besides, these IoT gadgets can divert a understudies's concentration through active task to do in his gadgets only. Likewise, the understudies' subjective exercises can be monitored by utilizing EEG sensor.

This information gives the academic partners a perspective on students, association and money related resources. This benefit insight empowers association to settle on educated choices so as to upgrade student information and learning encounters, operational capability, and the security of campus. As indicated by Zebra innovations (2015), by upgrading resource knowledge, educational organizations can upgrade results by including esteems in certain territories include: Upgraded Learning Outcomes, Efficiency and Safer Campus Designs.

In addition, off the campus, colleges can utilize associated gadgets to screen their understudies, employee, assets and hardware at a diminished working expense [32]. Moreover, the development of versatile innovation and the IoT empower colleges to isolates the campus from the possible threats, upgrade access to data and web based applications at whenever from anyplace, and monitor primary assets [27].

IV. Methods Utilized in Innovative Learning system in Higher Education

IV.1. IoT-based CBL-Flip Learning Platform (IoT-C-FLiP)

A real world case study based innovative learning approach has been proposed by utilizing IoT as a tool in Flip Education Model for the medical

students that is depicted in Fig.1 [33]. A lot of different approaches has been used and demonstrated to improve the learning approach in medical education [34, 35]. Above all suggested methodology, the Case Based Learning System (CBL) is found to be a good alternative for the medical students [36, 37, 38]. In this Learning approach, a group of students are sharing their knowledge to diagnose and solve the case of a patient [39]. The cases which are generated by the experts for the case study is used here [40] and the expert plays an active guidance all the time for the entire process [41]. Moreover, this methodology enables the students to face the real world scenario by comparing the theory and the practical in details [42]. Currently, the flip methodology has not been utilized in the Case based learning system [43, 44, 45]. The flip learning is an approach in which the students are interacting with the instructors outside of the classroom where as inside the class room, effective knowledge is delivered about the case through discussion by the instructor [46, 47].

The architecture of the proposed platform [48] along with the description of each layer is discussed in this section. The proposed platform integrates and exploited many individual platform that can be used for different domain of study.

The proposed platform contains 8 layers and one of four layers out of the eight layers is grouped together [49]. The first four layers are named as local processing blocks that contains of data perception layer, data aggregation layer, local security layer and access technology layer. These layers deal with the communication and resources utilization in between the layers locally and based on the communication and resources utilization at cloud level, The cloud processing block composed of security of data in cloud, presentation of data, application and services along with business layers.[50].

The main feature of these layer are heterogeneous data handing through data interoperability, network traffic handing through smart gateway, resource management to avoid delay information through fog computing, multilevel security for data, error handling, policies for application delivery and business policies. The brief description of each layer is discussed below.

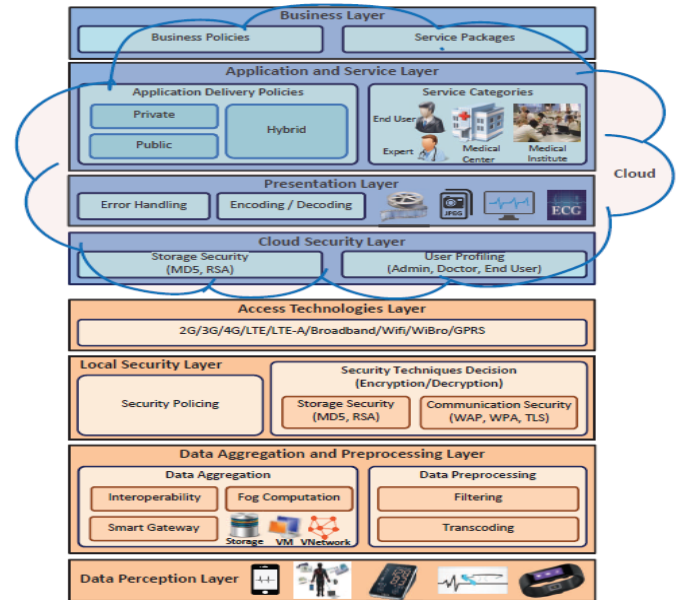


Fig.1: IoTFLiP architecture

4.1.1. Data Perception & Data Aggregation Layer

This is the basic layer of this proposed framework. This layer consists of data perception along with aggregation and processing. As the data generated from the data perception layer is heterogeneous in nature, here both the data interoperability and load balancing is very vital issues that are dealt by this layer. The data that are generated from the less rich sensors need data preprocessing and aggregation. Therefore these data are incorporated by the fog computing cloud service which is an extended cloud in the edge of network [51]. A smart gateway is used to do rich tasks and filters the communications. The data processing block deals with the irrelevant data through filters to establish faster communication [52]. Here encoding, decoding and transformation of data are carried out.

4.1.2. Local Security Layer

In medical education, patient's information is the very vital ethical issue and has to be protected against unauthorized user and attackers [53]. The patients are always very concern about their medical information to be publicly exposed. So the local security layer is introduced here for securing the temporary storage in the fog cloud service. This layer is used depending upon the requirement of the data security. For a

critical patient the data urgency is more important so here the security can be compromised at some extent. Therefore the policies for the data security is defined and regulated in this layer. The decision of data security is depend upon the application requirements. Different storage security algorithms and communication security algorithm are used here as shown in fig. 1.

4.1.3. Access Technologies Layer

After securing the data collected from the perception layer, this layer chooses the access technology to communicate with the cloud. Different communication resources are utilized to establish a connection like Wifi, Wibro, GPRS, LTE, Blue tooth, Zigbee etc. depending upon the requirement, availability and capability of the services.

4.1.4. Cloud Security Layer

In cloud security layer, the information security is very important as it exists in the cloud and can be tracked or hacked by many security attacks. The storage security and the profiling of the users i.e. admin, experts and the end user is formulated in this layer.

4.1.5. Presentation Layer

This layer presents the data in a user friendly or user understandable format in the form of graph, text, picture or video etc. Different process is executed here such as encoding, decoding and error handing while data is transformed.

4.1.6. Application &Service Layer

The application access policies are defined here. The access policies are categorizes into three parts i.e. private, public and hybrid access. The service scope is categorized based on the user’s priority i.e. User, Expert and Admin up on which the access policy is chosen. Here the admin gas all the access permission while the user has only restricted access to some modules but the experts has hybrid access permission [54, 55].

4.1.7. Business Layer

This layer deals with the services policies whether the services are free or can be given

at a subscribed rate. The offering of the package are as per the usages.

IV.2. Interactive Case-Based Flip Learning Tool (ICBFLT)

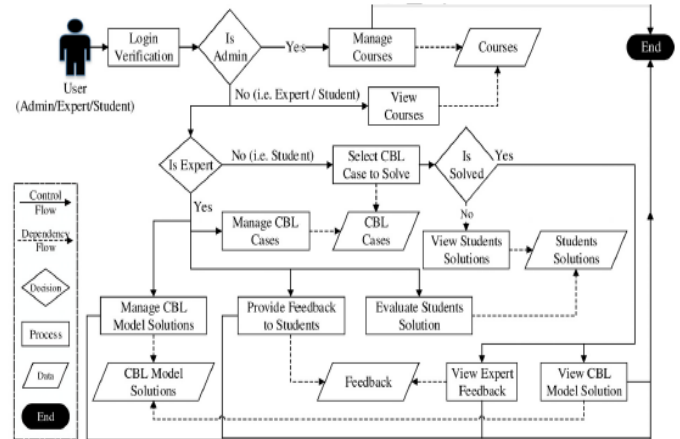


Fig.2: Flow chart of Interactive Case-Based Flip Learning Tool

The Fig. 2 shows the flow diagram of ICBFLT. It is designed to address the features of CBL through the effective participation of students with their experts in the relevant domains. It also provides an advance tool for case base learning services using virtual cases. In this toll, three types of users are interacting with the system namely admin, domain expert and the students or end user. The fig. 2 shows the functionalities of the ICBFLT. The details of the course, its modules and their allotments to the students are governed by the admin. The expert formulates the case scenario and their modular solutions. He also evaluates the solutions provided by the students and give feedback to the students. The course details, modules, real cases, case summary, assignments, model solutions, student solutions and the feedback of experts are stored in a database and will be used by the other user as and when required from the cloud [55].

IV.3. Working Scenario

The workflow of the proposed framework is discussed here. The workflow covers case formulation, evaluation by expert, feedback by expert to students and storing outcomes as shown in fig. 3.

A real world CBL case is formulated by generating a dataset as shown in table 1 with the help of

concerned domain expert. The dataset is generated by the different IoT sensors or gadgets.

the expert’s requirement to diagnosis the disease [59, 60, 61]. Some of the IoT devices and sensors used in medical are illustrated in Table 2.

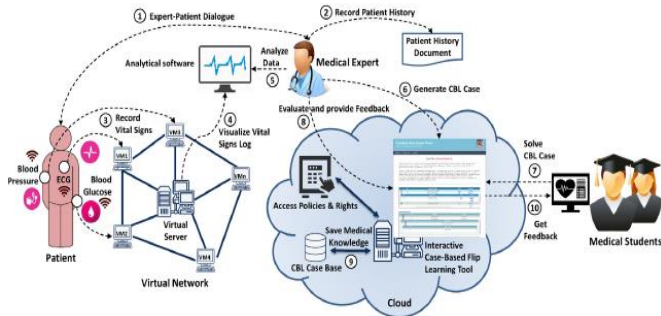


Fig.3: Working scenario for IoT-FLiP

In medical Education domain, a patient dataset is prepared by expert-patient dialogue. Then different IoT gadgets are used to collect patient’s vital signs over a specified time as required by the expert [57]. The collected data is validated by comparing the valid ranges which is available from the well known online resources. The experts generates multiple cases as per his requirement out of which one is shown in Table 1 as an example for a case study. The case study is for the general medicine and a lower difficulty level.

Table 1. Patients’ vital signs data

ID	Age	Gender	Systolic BP ^a	Diastolic BP	GL ^b at Fasting	GL at Random	Heart Rate
1.	65	M	135	89	145	247	90
2.	57	F	130	87	110	160	95
3.	54	M	139	92	90	130	89
4.	16	M	136	85	85	120	79
5.	9	M	123	75	80	125	130
6.	35	F	125	84	90	125	80
7.	3	F	110	78	70	125	130
8.	35	M	110	78	85	115	63
9.	45	M	123	85	80	130	85
10.	43	M	127	85	130	180	84

^a Blood Pressure, ^bGlucose Level

The process flow of the case [58] is described as follows in steps.

Step-1: Basic information regarding the patients such as name, gender, age and address etc are collected by the expert. The gender and the age are collected to clustering the data into a specified group.

Step-2: The experts also record the patients past medication history, family history and his present symptoms to understand hereditary issue.

Step-3: The IoT sensors and devices are connected to the patient’s body to collect the vital signs as per

Table 2. IoT gadgets to collect vital signs

Vital Sign	Available Devices
1. Blood Glucose	iHealth’s Blood Glucose Monitor, iHealth Align, iBG Star, etc
2. Blood Pressure	iHealth Wireless Blood Pressure Monitors, Omron BP786, Microlife WatchBP home A, QardioArm Blood Pressure Monitor, etc
3. Heart Rate	LG gear watch, Wellograph, Polar V800, Mio LINK, Epson Pulse Watch, Spree Headband, etc

Step-4: The medical experts examines the vital signs collected from the IoT devices through the presentation layer either in graphical, text, audio or video format as shown in fig 4.

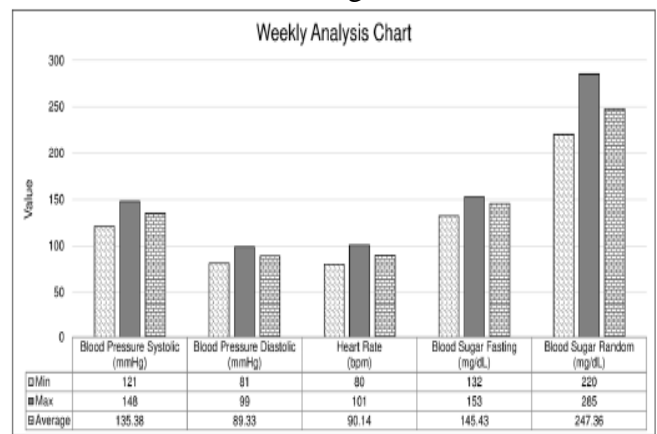


Fig.4: Weekly pattern of patient

Step-5: The experts deduce the signs of the patients such as systolic blood pressure i.e. one week average value by analyzing the data.

Step-6: A new CBL case is created by the experts by analyzing the vital signs and the patient’s history, symptoms.

Step-7: The new CBL case is uploaded by the expert in the course module. Students will be given the CBL case bas on their privileges as governed by the administrator. Based on the data available, the students trying to interpret the case and submit their interpretation to the expert.

Step-8: The expert collects all the interpretation, analyzes it and gives his/her feedback to the students.

Step-9: The student’s interpretation, expert’s feedback is stored for the future case study in the database [62, 63]. Based on the expert’s feedback the students can update their knowledge and skill to be expert in that relevant domain.

Using the low cost and reduced sized IoT devices, the learning environment can be transformed into

the real world case based learning system. Due to which the students from various domains can enhance their knowledge and have practical exposure. The proposed platform takes the advantages of all the three platforms i.e. inter of Things, CBL and Flip learning. It also integrates them to evolve an evolutionary learning methodology that can be used for different domains of study.

The proposed platform is scalable and can accommodate futuristic requirement of the different technology.

V. Gamification as a method of innovative teaching methodology

The present students are advanced locals. They grew up with advanced advances. Educators need to understand significant issues identified with the adjustment of the learning procedure towards students who have distinctive learning styles and new necessities for teaching and learning. Gamification is one of the educational methodologies and strategies that expansion inspiration and commitment of students the architecture of which is depicted in Fig.5 [64]. The point of the present work is to study and present the nature and advantages of gamification and to give a few thoughts how to execute it in education.

Gamification is academic ways to deal with, connect with and inspire the understudies in the higher education. This advance teaching methodology is to utilize the game components in academic scenario [65]. In this methodology, the gaming elements are defined as an activity according to the context and nature of games. According to the gaming context like running, surfing, online shopping and learning, the gaming elements are set. As per the literature survey of different researchers, the gaming elements are categorized as surface element, underlying dynamics and gaming experience.

Four game components i.e. description, challenge, progression and criticism are esteemed notable in advanced education to connect and inspire students specifically. The description is the utilization of the background stories to motivate the students to learn, for example contextual investigation or real world problem. The utilization of an errand that can be

used for both testing their capability and enjoyment is known as challenge. The progression of exercises leads the student's attention and keeps up their inspiration through a learning action. Criticism is the utilization of continuous and focused on input that urges students to learn.

In light of these experiences a structure was created to delineate how gamification may assume a job in the improvement of intellectual limit, systematic capacities and regulating desire of learning.

V.1. Gamification and game elements

V.1.1. Surface elements

Point systems, leader board and badges are some of the gaming components which are generally used in game to measure and exhibit the performance of the participants [66]. These components are regularly utilized in games to measure and imagine the exhibition as well as accomplishments of individual players. Point system and badges are likewise applied in different settings. The badges are typically a representative symbol to identify the skill which is acquired by the participant.

The progress bar and leader board are used to represent the point system and badges as they are substantial gaming components. These progress representative tools are valuable which gives information to each participant of their advancement towards achieving a particular level in the game. Leader board, then again, can be utilized to look at singular clients and rank these against one another. These points and badges might be valuable to convey progress (achievement) and recognize exertion. Hence to make the gaming activity more captivating, fun, aggressive as well as challenging, these components can be utilized as a reward instrument.

The authors in [67] discovered that generally utilized gaming components are points, leader boards and badges. While focuses and identifications speak to a typical game component in non-game settings, they may not consequently enhance educational settings [67]. In many learning procedures, focuses and identifications are as of now set up. For instance, student execution in tests

is regularly converted into focuses and the general accomplishment in a course reviewed as needs be.

The utilization of point frameworks and related components (for example pioneer sheets) have likewise been censured for restricting the capability of gamification. Robertson [68] conceptualizes the utilization of focuses and identifications as grade or point system and contends that those components are the very low level fundamental component of game.

Some of the researcher named as Stott and Neustaedter [69] has proposed some unmistakable gaming elements which makes games more attractive and engaging. All these gaming elements can be utilize in the educational system to improve the learning methods. They recognize the accompanying hidden elements which is applied to different learning situations, they are: opportunity to come up short, quick input, movement, account and narrating.

V.1.2. Underlying dynamics

Opportunity to come up short, criticism, advancement, narrative and decision are the dynamic components of the game. Every one of these game components are additionally talked about beneath opportunity to fall flat: in many games, the participants have multiple lives to cross that gaming level which enable them to try unafraid of failure in the game. This gaming component can be conveyed to make an 'experimentation' dynamic in learning to upgrade student commitment [70, 67]. For instance, such components might be utilized to urge students to investigate themes, settle on choices on what angles to investigate, and urgently to uncover the outcomes of settling on poor choices [70]. A dynamic experimentation in learning method can likewise enable the understudies to concentrate towards skilling himself instead of the final product. Utilized in an unexpected way, in any case, opportunity to fall flat presumes no punishments for poor assignment execution, for example enabling students to resubmit assignments.

Criticism: It is a typical component in education which gives consolation, counsel, difficulties and general affirmation in the learning procedure. The players exhibition and progress in a game can be

reflected through its feedback. Feedback or criticism in games, notwithstanding, will in general be continuous and focused on contrasted with that of criticism in education [70]. In this way, criticism as gaming component can be utilized in learning to advance progression and focused on criticism to students.

Advancement: It is a dynamic component that enables a player about their progression and execution skill in the game through advancement bar chart. Utilized in an unexpected way, notwithstanding, movement can likewise be utilized in a game to educate players about their advancement and ability to read a compass by the game, for example levels in game. In numerous games, players need to finish an undertaking to get to the following step. The advancement starts with one level then onto the upper level is frequently rung leveling. This methodology a test is given to the students in virtual learning environment as a major aspect of the study [71]. Effective finishing of a test or level in game is commonly required to precede the following degree of skill. Movement can likewise be utilized to arrange occasions that increase and hold participants' consideration in a game [70].

For sure, learning goals can be composed to help dynamic aptitudes improvement:

- 1) Distinguishing, comprehension and recollecting
- 2) Dissecting, assessing, scrutinizing and condensing
- 3) Forming, making and arranging.

Narrative: It is the thing that most games utilize, for example, a larger background of the game. It is also broadly utilized to draw in the players attention through dream and tension. An narration can likewise be based on the standard of dynamic revelation. Instead of attempt to give a client a perplexing circumstance, stories should be utilized to control the client through these. A course related background can be presented to the students which moves from easy to complex problem.

Narrations can connect with and persuade clients. For instance, to inspire a player an attentive story

should be presented to reveal what has occurred or envision what will occur next in a game. In narration a participant choose a character and play with the others. By this, his social interaction with other will improve.

A contextual investigations after frequently used to give stories in teaching. These reflect certifiable circumstances and also used to spur understudies to investigate a topic thoroughly and to interface hypotheses along with complex substances.

Decision: It is a dynamic component in which the participants can choose a character according to his choice and play along. Here he/she can also choose their path to complete the game level. For instance, in a seminar, the participants were given diverse task alternatives, marked journeys, to which the students could look over [69]. In the educational model, the understudies have the right to choose the level basically lower level of the course out of different levels. But they can't choose the upper level until they qualified through the lower level of the course to accomplish recognized learning goals.

V.1.3. Gaming experience

It is the third type of gaming element.. In education, different learning challenges can be given to the students both in reading form and writing form. As in game the challenges are different from each other and its level of difficulty is also different, this can be applied in educational model to engage them in different activity [72].

Table 3: Gaming elements, its use

Elements of the Game	Context in Game	Utilization in Teaching and Learning system
Point/Badge/Leader board	Estimating the players performance and achievements	All these gaming components are accustomed to evaluating the understudies' execution.
Trial- Error	The game player can accept preliminaries as much they need to finish point.	It tends to be utilized to support learning by enabling the understudy to investigate a theme, settle on diagnostic choice and be presented to the results of choices made.
Feedback	Game players will in general	While feedback is regular in instructing, the

	get visit and focused on criticism identified with their exhibition and/or then again accomplishments through the game.	utilization of incessant and focused on feedback during learning (for example developmental evaluation) may improve understudies inspiration in a learning action.
Advancement	The utilization of game levels or grouping of missions advises the player about their movement in a game.	Can be utilized in educating to advise the understudies about their movement. For example giving understudies dynamic learning targets with expanded trouble.
Narrative	The larger story that seizes the player through the game.	Stories (for example contextual analyses or situations) can be in educating to make interfaces among hypotheses and genuine circumstances.
Multiple choice	Game players can choose between different ways, including level of trouble, when playing game.	In a showing circumstance, different decision can be displayed to understudies to choose a way suitable for them in accomplishing their learning goals.
Role play	Game players can pick both character (who they need to be) just as choosing a way to finish a game.	In a showing circumstance, understudies can be approached to take on various jobs to empower discourse and discussion.
Challenge	Game players are tested with troublesome errands.	In education, understudies are tested with assignments that connect with them to learn.
Competition	Many game enable game players to compete with one another.	The students can be motivated through competition.
Enjoyment	Games are enjoyable.	Learning can be entertaining.

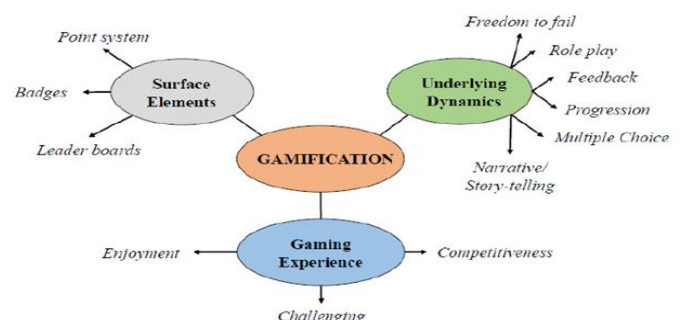


Fig.5: Architecture of Gamification

The gamification pedagogical approach can be useful for the students as well as for the educator. Due to its attractive gaming elements, the engagement of the students towards their study will be taken as a game by them and hence their interest will gradually increase. Here the students can utilize their knowledge and skill acquired by the game more skillfully in their real life problem. This also reduces the stress on the educator and it also reduces the workload for the educator.

VI. Problem-based Learning Style Based IoT System Education Method

Now days, the IoT framework is utilized in different zones i.e. traffic control, health care system, industrial automation, agricultural business and in education. Now it is the need of the society to make innovative thought which will explore as well as exploit the qualities of each field. This approach can extend the utilization of each field using IoT. As depicted in this, the proposed educational strategy is for the students to execute IoT model framework without anyone else development, and to exhibit and talk about thoughts of IoT framework administration in PBL style classes [73]. Educator help is significant for delivering items, for example, the wiring of electronic parts in development practice. Thusly, the creators arranged three operators to help reasonable preparing rather than an instructor [74]. The IoT framework education technique comprises of a stepwise framework development in four stages [75] and thoughts for administrations utilizing IoT frameworks are made after down to earth learning.

For students to make IoT framework thoughts, they ought to really encounter the framework through IoT framework development. On the off chance that every structure component of the IoT framework is improved and in the event that the model framework is amassed, at that point the other students have the option to develop it. All the participants will build it utilizing pragmatic information identified with assembling. Utilizing this development strategy, the interface between outside details of individual structure components and different components is distinguished to permit simple development of the IoT framework. Accordingly, subtleties of the components are dark boxed. At the end of the day, even students without master specialized learning of

the synthesis component can build an IoT framework by thinking about blends of the components which ables them to experience model framework development [76].

Students learn IoT model framework development in sequential manner by adding components to meet this organization. The sequential development of IoT model framework comprises of self progression of student and PBL style education class. The result of the progression practice is presented and discussed in the class by the student. A learning framework has been setup to give students materials, for example, training set manuals which is useful for preparing the goal that students can build model frameworks through self-study. Moreover, for training, many industry experts are called to help students rather than instructors, in spite of the fact that educator backing is important. We give the accompanying three significant specialists for IoT model development: a "wiring bolster operator" underpins the wiring work of electronic parts; a "programming bolster operator" bolsters production of a codes to gain and transceive sensor data; and a "remote setting bolster specialist" underpins setting for the remote correspondence. All the understudies will have the access to the framework to collect the learning notes, videos etc. that are essential for making the training manual. On the off chance that students don't continue with development work, at that point they call the help operator from this framework, get clues, and proceed with the training. Next, in an exercise where an educator and students accumulate, students present and talk about functional preparing results as well as can identify their missteps. Toward the culmination of development in each stage, students are mentioned to display thoughts for IoT frameworks. At that point they present thoughts and talk about thoughts in the class. The following passage introduces a blueprint of down to earth preparing in each progression [73].

VI.1. Sequential Constructional Approach for IoT Prototype System

Step-1

At the beginning, the students get familize with the gadgets and sensors. With the help of these sensors and actuators, they will create a circuit on copper board utilizing the electronics components. They will

test the circuit. If the circuit doesn't work well they may take the help of the wiring bolster operator. Utilizing the data from the specialist as a clue, they can address the trouble once more. Moreover, students make a program to get sensor esteems. On the off chance that some point about this programming emerges that they don't see, at that point they call the programming bolster specialist and handle programming with data from the operator as an insight. At that point the students can interface the code with the arduino i.e. a IoT development prototype board to build a IoT based gadget [77, 78]. All the data is verified that is obtained from the sensors. In the class, every individual delivers the consequences of these errands. By Utilizing this education technique, the understudies can identify the trouble and solve it by their acquired knowledge. At last, a better comprehension of framework can be foreseen by the students.

Step-2

In the subsequent step, the students will get connect their devices to the personal computer to test for the acquired data. The acquired data is presented in the form of graphs. The communication is established by the ZigBee between the gadgets and portal. If the students find some difficulty to setup the communication between the devices, they can call the remote setting bolster specialist to settle it down. After reasonable preparing, students are mentioned to make thoughts for administrations utilizing the IoT framework. After each session, every individual presents aftereffects about the errand and talks about its substance.

Step-3

In the third step, the students will be getting acquainted with the cloud services. Here they will create a framework to work with the cloud. At first they will get registered them self to use the cloud platform. Accordingly the setting in the code as well in the gadgets will be changed. The sensor data will be collected and transmitted to the cloud. The user can access the data or control the device using his PC or mobile phone by an app or program. In the class, every participants discuss the consequences and talks about different aspects of the framework.

Step-4

In this step, a frame work is constructed to give directions to the actuator. The students have to make sure that the actuator is working properly by observing the threshold value of the sensed data which is present in the cloud. All the participants have to discuss the aftereffects of this framework.

Step-5

After down to earth preparing, students are mentioned to make thoughts for administrations utilizing the IoT framework. Among themselves, they have dialogs to evoke recently seen focuses.

VII. IoT issues & challenges in higher education

VII.1. Security Issues In Iot

There are numerous dangers that advanced designs face today. The security vulnerability has not confined to network servers, now days it also affects our personal home network, smart TV, gadgets etc which is generally comes across in our daily life. The IoT is also facing these security issues as well. As the utilization of IoT devices is increasing day by day and due to its open engineering, it is very hard to detect the vulnerability in each. Some of IoT properties that have security and protection issues are described by the researchers in their paper [79], for example, portability, remote, implanted use, decent variety, and scale. Thus new difficulties in data security arise due to these attributes of IoT.

A. Architecture and Layers

The gadgets which are generally used in IoT have extraordinary engineering which is characterized as three distinctive operational layers as suggested by different researchers [79, 80, 81]. These layers are discernment layer, arrange layer and application layer. All of these layers offer diverse usefulness; in this way, every layer has its very own one of a kind danger. Furthermore, each layer is associated with and depends on different layers to work. In this way, security related to these layers should likewise be verified.

Discernment Layer: The accumulation of data is performed in this layer. Each of the IoT hubs plays out a capacity which requires the accumulation of sensor data. Along these lines, RFID, Zigbee, and different kinds of sensors are also utilized in this layer [81]. A lot of data which is accumulated in the observation layer can't be verified and these data could be malignant in nature. As IoT gadgets are commonly independent, the assailants can penetrate into it. Thus at the discernment layer, some cryptographic security components can be employed which can monitor strange sensor readings [82].

Application Layer: It is a very versatile and entangled IoT engineering. Due to huge numbers of various items, gadgets, and makers, the development of the application layer is quite difficult as the standard is not properly regulated. There are a few unique difficulties in this layer. For instance, an authorization of data and personality verification is a reason of concern. In this layer, it is hard to oversee get to consents and validation due to different types of users and utilization of resources. At last, likewise with a wide range of programming, a consistent worry of security bitches lies in the product at this layer [81]. Additionally, as different coder uses many non standard codes, security and privacy can be at risk in their applications [83].

System Layer: The transmission of sensor data is associated in this layer. The working of this layer is just like as TCP/IP. Thus indistinguishable conventional security issues from the TCP/IP model are also applicable for this layer. Some of the security issues related to the system layer are unlawful access systems, spying data, secrecy harm, honesty harm, DoS assault, Man-in-the-center assault, infection intrusion, abuse assaults, and so forth [81].

B. Risk Vector : this is a type of threat in which the hacker uses a malicious program to hack the IoT devices or to hack the data [84]. Here the hacker wants to get into the system by some malicious program as there are several vulnerability present in the framework of the IoT system.

Several researchers have identified different treat vector i.e identity threat, physical treat, database management threat, attacks on the communication channel etc [85]. All these threats can be divided in to different attacks. The authors in [86] describes

different categories of threat i.e. privacy attack, physical attack, DoS and intruder model etc. Due to the communication attack like packet sniffing, spoofing and man in middle attack, the data privacy becomes the challenging issue in IoT. Some researchers also categories the threat vector according to the security i.e. communication based, service based and device based [87]. But they failed to address too many threats. As a concluding statement, the threat vector can be divided into three attacks i.e. attacks on communication channel, attacks on physical devices and attack on the programs or code.

Communication Attacks: in this type of attack, the communication channel comes into picture. Here a hacker can use different atks such as DoS, DDoS, SQL injects, jamming, spoofing and man in middle attack etc. when large no. of IoT devices are connected in a single channel, the hacker can penetrate into the system and can cause power down which will create great loss to the entire IoT framework. We will examine some of these assaults quickly.

DoS and DDoS: as the administrator or the server has to respond to all the incoming request from the client, the hacker exploits these feature to attack the server which leads to the unnecessary busy of the services of the server and make it down. But when a bot is utilized by the hacker for the request of service and the bot is generated in the victim's computer without his knowledge, then this attack is called DDoS. This attack creates a hanging of services in the server.

System Injecting: In general, when any gadget or space uses a SQL database, a assailant can infuse malignant programs to cut the SQL database down, change or record data is known as system injecting. In IoT, numerous gadgets actively records and stores the data in different databases [87]. System infusing assaults can access databases through IoT gadgets.

Physical Attacks: When an attack is made physically through wired or wireless medium, then it is known as physical attack. Some of these attacks are identified but it is not limited to Tampering, Radio disturbances, jamming and reverse engineering. In these type of attacks, network devices are

intentionally physically tampered to block or record the data unethically. These attacks are generally performed at the MAC layer of TCP/IP as well as at the perception layer and top most layer i.e. at the application layer.

Reverse Engineering: In this type of attack, series of programs are used to investigate the possible vulnerability on a target device which empowers the hacker to endeavor known and obscure vulnerabilities. Subsequent to doing this figure out, one could imitate an assault on every gadget that is associated with a network system.

Jamming and Radio Interference: When a hacker utilizes a gadget or sophisticated program to downgrade the network connectivity of an IoT gadget is known as Jamming. In this type of attack, the aggressor is in the region of the defenseless gadget. Sometimes intentionally or unintentionally, some interference arises due to the circuitry noise, environmental noise or the thermal noise which is called as Radio Interference.

Tempering: Generally the tempering is done when a gadget is at its assembling or testing or at the packaging stage. At this very moment, the hacker intentionally temper with the device. A carefully designed lodging system can be employed in order to avoid this type of attack is performed at the time of delivery and sale.

Application/Software Attacks: when a user is writing a code for the IoT device, there always exist treat due to the misconfiguration which leads to security breaches. When managing IoT programming, we are managing APIs and internet applications explicitly [88]. It is imperative to verify this product vector as there are more potential outcomes and open doors for attacks. What's more, the data being put away or moved in this vector isn't crude data and could give progressively valuable data.

SQL Injection: Now days, the most recognized sorts of code infusion is SQL infusion. These infusions happen in the SQL database. In this type of injection, an inquiry in an unbound field is entered. This kind of danger is far reaching over every extraordinary kind of frameworks. A SQL infusion is more dangerous as that it can allow the aggressor more access to the framework. This can be avoided

by approving every one of the data that is given by the customer before it is utilized in explicit APIs [88].

Cross Site Scripting: This is kind of code infusion that executes a noxious content by the web portal of the person in question. Basically, these contents divert the target person to a different site and can make the person in question to take part in DDoS or even completely take the client's session [89]. The information approval is obligatory to counteract XSS assaults just like as SQL injection.

Abuse of a Misconfiguration: In IoT, different applications need to setup of numerous frameworks and segments to work appropriately. Consequently, every one of these parts requires a legitimate security setup. On the off chance that they are not appropriately designed, they can be effectively misused by a vindictive on-screen character. Working frameworks, servers, structures, database the board frameworks, and some other applications should be appropriately arranged in a protected IoT condition.

C. Trust in IoT

When we are taking about the trust in the IoT environment, we generally consider four unique levels of trust i.e. Trust in User level, Trust in Application level, Trust in Network level and Trust in Physical layers level [80]. Relatively few people do care about the security on their associated gadgets that has utilized in IoT environment. In the event that the gadget works for the ideal reason and is moderate, clients may see no compelling reason to stress over security. Progressively costly IoT gadgets are commonly increasingly secure, yet customers can pick, as a rule, progressively moderate gadgets. This penance of security for worth is an issue in the IoT condition. Basically we can consider the IoT trust in three diverse classes i.e. Protection, Accessibility and Reliability.

Protection: The gadgets generally used in IoT gather all of data which is required for execution of the application. Generally these data are physical, therapeutic, correspondences, internet perusing history, and so on. All these data can be used suit the people needs [90] and can be advantageous, speedy, simple, and reasonable but it isn't the most

secure. Organizations may offer your personal data to different organizations. In many cases, the organization probably won't have adequate security to ensure your own data.

Accessibility: IoT end-clients necessitate that these gadgets are accessible and controlled to finish errands. Off, Always On, and Low Power are three distinct alternatives described by some researchers: [91]. However, all the gadgets should be refreshed regularly at a time interval. A standard accessible refreshing stage accessible to all of the gadgets in a specific space can be employed to address the issue. As described by the authors, the Makrov Model is an approach that will keep the frameworks up with continuous power control for IoT systems [92]. As in these models, IoT gadgets are speaking with other IoT gadgets is distinguishable. It is something to be thankful for as a few hackers could abuse the data to assault different gadgets.

Reliability: The surety of the effective data exchange might be something worth being thankful for including the huge measures of gadgets in the IoT based infrastructure [91]. Solid plans to speak with gadgets with included security including honesty, secrecy, and accessibility is the most extreme significant viewpoint we can have as an order. Consequently, effective and solid correspondence is essential for everyday tasks in the IoT condition.

D. Compliance in IoT

Policy Control, Administrative Oversight and Non Governmental Oversight are some of the security class that falls under compliance. In an organization, the security can't be optimized without a proper compliance, policy and control procedure. Some reliable systems, best practices and models are always there for an organization to depend on. This authoritative administration can emerge out of past organization approach control, legislative oversight, and non-administrative oversight.

Policy Control: The authors in [93] describes that an organization ought to consistently prepare their representatives to not give away any sort of information related to their personal identity. They likewise demonstrated that each organization ought to have a sketched out strategy and rule for data

security. That can incorporate a reason, arrangement, specialized perspectives, and announcing prerequisites [93]. This ought to pursue each security approach recorded in the organization's handbook, so representatives can pursue and be progressively secure in the working environment with IoT data and gadgets. Organizations ought to consistently have a lot of arrangements and systems to verify the IoT gadgets inside the organization's system. Others, similar to Cisco, include different sorts of approaches including proposals to fortify the DNS in their IoT security [94]. There may be some additional security system including network enforced policy, authorization and authentication. The primary layer includes approaches of implementation, and can be split into the executives of security arrangements along with testaments. The Authorization can be split into trust connections among gadgets, and the gadget's entrance to various systems. The Authentication includes human qualifications. According to AT&T, the IoT has three layers: gadget, application and association layers, alongside a associative layer of threat management [95]. It includes these three layers along with discovery and aversion of risk to verify their IoT arrangement.

Legislative Oversight: End User, Regulator, and Infrastructure Provider are the three distinct way that the government can be an oversight. The Department of Homeland Security [97] has described four unique phases of security approach for IoT that are coordination over divisions to anticipate dangers, manufacture familiarity with IoT dangers, distinguish motivations for consolidating IoT security and to add to global principles. A three-layered strategy approach including, a human-driven IoT, a solitary market idea is concocted by The EU Alliance for IoT Innovation to make a flourishing environment [95, 98]. The EU additionally covers licensed innovation, versatility, the design of IoT system, the correspondence of IoT, institutionalization of IoT, and areas [98, 99].

Non-Governmental Oversight: A thirteen advance procedure to verify IoT gadgets has been proposed by The Cloud Security Alliance (CSA) [96]. These means incorporate a safe procedure, ensuring data and systems, by giving a protected advanced framework, and logging instruments [100]. The CSA additionally expounds cryptographic measures,

arrangement rules, and the board of IoT risks in the 2015 report [101]. IEEE additionally has principles in IoT which include characterizing engineering, security and environment of IoT [102]. All of These non-administrative associations are developed by the scholastics, rehearsing security experts, and arrangement makers who construct the sum of the IoT strategy and oversight condition.

VII.2. IoT Challenges in Higher Education

VII.2.1. Cloud Computing

Due to the ubiquitous services of the cloud computing, many colleges are exploiting cross breed cloud for facilitating IoT applications [103]. Ten to twenty year before, some technically knowledgeable students in the colleges uses tablet and versatile innovative gadgets that has opened a new strategies to build the viability of big business design, instructional advances, research and learning situations. Big business design in numerous advanced education establishments rely upon crossover cloud foundations with different computing levels. As the open clouds are free for all, it is being utilized for the educational applications. As the no. of educational content is increasing day by day, the latency time in the cloud need to be reduced.

VII.2.2. Instructional Technologies

Now days, the students prefer the web based learning management system for their learning platform. Thus this increase in demand increases the video, audio and texts on the web. These data are available in both structured and unstructured format. Therefore a smart class room with the online streaming and lectures recoding system an enhance the learning attitude among the students and the internet spilling give a chance to students to get to instructional substance on request whenever they require it [104].

VII.2.3. Mobility Applications

Recently, the mobile apps facilitate the students as well as the instructor to view the video lectures, view or manage the course progression report. This also facilitates to provide the assignment to the

students. Some specialized lectures can be delivered to the students [105]. the standard of these videos and the audios needs to be regulated so that the students will be guided in proper direction.

VII.2.4. Security and Privacy

As the IoT is quite new in the field of IT, it has a unique security issue. Now days the use of IoT devices is growing exponentially as a result lots of data is generated and due to lack of proper security mechanism [107], these IoT devices are the most vulnerable. Different IoT devices uses different coding platforms and different protocols to communicate with the system as a result the data breaches can occur and hard to detect. In higher education, the personal data of the student and educator is very ethical issue related to its privacy. So these data needs extra care and a secured standard has to be built. Thus a synergetic technique is required to face the security related challenges in IoT. Moreover, the maximum capacity of the IoT relies upon procedures that think about individuals' protection. Hence, to satisfy these chances, there is have to grow new techniques that think about a person's security decisions and desires, while still advance development in new advances and administrations [106].

VII.2.5. Research Computing

Due to the reduced cost of hardware, the popularity of the IoT devices among the students and the customers are increasing day by day. This leads to give a momentum to the interdisciplinary research. Due to the availability of bigdata, cloud computing and analytics, small universities and colleges are also coming forward to do research in interdisciplinary field [108].

VII.2.6. Quality and Ethics

Now days, the cost of education is increasing day by day. Thus the IoT is a useful tool to give the digital contents to the students whenever they want to access it. But the quality of the video contents and the lecture notes need to be optimized. So the IoT based application need specialized tools to improve the quality of the digital content that is delivered to the students addressing ethical issues [109].

VIII. Conclusion and Futurework

The emerging cutting edge technology along with IoT enhances the educational field which leads to improve the learning strategy of the educational stakeholder. So many researches has been going to enhance the IoT based teaching and learning approaches which includes smart study environment, interconnected labs, smart campus etc. Recent researchers are additionally want to explore the convenience of IoT based brilliant learning applications, tools and still significantly there is more to exploit and explore the IoT in the field of education. IoT has shown its tremendous advantages in the every field including education but it has to tackle with the present days threats and has to regulate a general policy for using the devices. This research work may provide comprehensive information on the IoT.

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