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Context Aware Smart Learning: Analysis and Research issues

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ABSTRACT

Smart phones are becoming essential parts for students, the recent advancements in information technology provides huge facilities through mobile and make the daily life simple. Students are spending hours scrolling through social media feeds. Even schools are installing apps to boost student engagement. But none of these solutions are quite enough. We all know that devices like smart phones can act as distractions in schools. This has led to a lot of lost productivity, and disappointment among students and teachers alike. Teachers report that it's hard to keep the attention of their young audience, even when they try to incorporate technology into their lesson plans. context aware smart learning is the solution that you've been waiting for, context aware smart learning analyzes student behavior for warning signs, and blocks distracting content so students can focus on the important things in class. The purpose of the paper is to give a complete overview of the papers published on context aware mobile, ubiquitous, adaptive learning, which serves as the base for new researches in this area. Also presents the improved model for context aware smart learning.

Key words: context, context aware, mobile, ubiquitous, smart, adaptive, learning

INTRODUCTION

Researchers in the domain of education and computer science have tried to improve the intelligence of learning systems. The researchers in the early 1980s, have been working on intelligent tutoring systems (ITSs) that integrate artificial intelligence methodology into educational practices. Because its aim is to assist in the learning activities of every individual student by customizing learning interfaces or material as per their requirements, ITSs are also known as "adaptive learning systems." Learners may use mobile devices to access educational materials, and the currently existing mobile phones even allow them to participate in the regular learning activities which are outside of the classroom . Because of the rapid growth of mobile devices and wireless communication networks in recent years, people may now access digital information and easily communicate with computer systems regardless of their location or time. Researchers describe mobile learning as "a technique of learning that utilizes mobile and wireless communication technologies" [1]. Researchers have been able to create context-aware adaptive learning methods because of significant advancements in computer science and education, as well as improved information technologies such as IoT,sensors and wireless communications. The context in this study is defined by a prior researcher as a collection of things that make up the learner's circumstance [2].

In smart learning, the word "smart" refers to characteristics that are similar to those associated with a "smart" person. Just a few of these attributes are the ability to "adjust in innovative and inventive ways to new or unexpected situations," engage "in appropriate preparation before making a decision or executing an action," and participate "in doing things that are usually efficient and effective" To put it another way, "being clever" is described as "an action or decision involving careful planning, cunning, inventiveness, and/or a desired outcome." [3] Intelligent learning is a subject that is constantly growing. Academics, for example, investigate how smart learning might be converted into "Smart Cities" and "Smart Learning Cities," where individuals are hyper connected through wireless and mobile communication technologies, and encouraged to be creative and entrepreneurial. They want to see how such communities may help individuals improve their quality of life while also saving money [4]. Context-awareness is described as the process of identifying context elements through different techniques, such as collecting the data through sensors, user input, and converting the gathered data into higher level knowledge that forms the user's context, which may be helpful in a variety of applications. The target application determines how these context data are utilized. In some instances, the user is simply given the context data as is (for example, temperature in a weather app), while in others, the application's content and behavior are automatically changed based on the context data in a process known as adaptation (e.g. location-aware language learning application). Gams et al. [5] differentiates between context-awareness and adaptability as characteristics of ambient intelligence systems that are only concerned with the user's context. Rest of the paper is organized as follows. Section 2 presents the literature review of context aware mobile learning, ubiquitous learning, and adaptive context aware learning environments, context aware smart learning issues listed in section 3. In Section 4, describes the proposed system and finally we conclude the paper in section 5.

2 LITERATURE REVIEW

Context aware mobile learning (CAML) is the usage of movable devices for exploiting beginners' surroundings also offer knowledge materials are tailored to the learner's specific circumstances [2]. Context is one of the major fields of research interest in mobile computing, depending on the nature of devices. Application developers use mobile devices for capturing the operator context and deliver facilities are suitable for users when they change environments. The learners use mobile devices like smartphones with android or IOS systems, tablet PC, or iPad, such learning process is called ML. The main aim of the ML is to provide adjustable access to learning resources by overcoming the constraints like time and space, and further the CA Mobile Learning (CAML) provides learning support to the learners though the mobile devices which adapts to synchronise needs of each individual learner.

The learning application in CAML observes the surrounding environment to collect context data and dynamically adjust to learning materials. General adaptability, scaffolding, navigation, and communication and engagement are the four categories of CAML. Automatic adaptability to learning activities is provided by general adaptation. Scaffolding offers advice or customised suggestions. Navigation suggests appropriate learning activities depending on the user's current location. Interaction between peers is facilitated through communication and interaction, which allows for cooperation [2]. Because of the rapid growth wireless communication systems as well as the mobile devices approval over the past decade, people may now access digital data and communicate with computer systems regardless of their location or time [1]. Smart learning, like other emerging subjects like e-learning, smart education, smart teaching, smart-e-learning, clever technology, SCs, clever universities, and smart society, is still in its early stages. SL is a challenging mix SL environments and new technologies and techniques like ML and also universal learning.[3].

In smart learning, the word "smart" refers to characteristics that are similar to those associated with a "smart" person. Just a few of these attributes are the ability to "adjust in innovative and inventive ways to new or unexpected situations," engage "in appropriate preparation before making a decision or executing an action," and participate "in doing things that are usually efficient and effective" To put it another way, "being clever" is described as "an action or decision involving careful planning, cunning, inventiveness, and/or a desired outcome." [3] Intelligent learning is a subject that is constantly growing. Academics, for example, investigate how SL might be converted into "Smart Cities" and "SL Cities," where individuals are hyper connected through wireless and mobile communication technologies, and encouraged to be creative and entrepreneurial. They want to see how such communities may help individuals improve their quality of life while also saving money [4].

Despite the benefits of CA universal learning, technology still not up to standard in terms of enhancing conventional, technology-enabled learning, referred to in this research as "smart learning." Learners can access the required numerical capitals communicate through learning organizations at some time too from first location in a SL environment, and also actively supports them with hints, supportive tools, essential learning guidance, supportive tools, learning suggestions at right time, in right place, and also in right format. A SL organization, in essence, is a technology-enhanced learning system that may encourage students to study in the real world while still having access to digital resources. It is more than simply putting an intelligent teaching system in a ubiquitous, CA learning environment, however. There are a number of features that set this unique learning approach apart from a hybrid of the two. In the parts that follow, you'll find detailed definitions of the phrase "SL environment" and its structure, as well as a differentiation of SL environments, CAUL environments, plus smart teaching systems. Important SL technologies and research issues are also presented to encourage academics and educators focused implementing and developing clever knowledge systems along with studying challenges.

The learning application in CAML monitors the surrounding environment to collect context data and dynamically adjust to learning materials. General adaptability, scaffolding, navigation, and communication and engagement are usually categorized as the main four differentiators of CA ML. General Adaptation offers the automated learning capabilities that are required for use in practice. Scaffolding offers guidance, advice, or ideas tailored to the individual. Navigation gives appropriate learning tasks to users who are located near one another. When engaged in communication and engagement, peers offer each other with opportunities for cooperation.

To the best of our knowledge, there is no previous study that offers an overview of existing studies in this area. This prior research included analysing twenty-four created CA ML apps published in the literature to produce a body of knowledge on this subject. CAML apps were solely evaluated on their development aspects in this research.

The word "intelligent tutoring system" (ITS) mentions route for a system that simulates a human tutor using artificial intelligence methods to enhance learning by offering greater assistance for the student [6]..ITSs are included in the category of "adaptive learning systems" [7,8]. Adaptive Hypermedia Systems (AHS), for example, offer customised learning by linking educational materials to hyperlinks and adapting presentation styles or learning pathways [9]. The wider category of Adaptive CA Learning Environments (ACALEs), scheduled which concentrate in this study, includes intelligent tutoring systems and adaptive hypermedia Systems that are aware of the learner's context. One of most desirable characteristics any learning environment is its efficiency, capacity for engaging student, and effectiveness.

When a learning environment accomplishes these qualities by being CA as well as adaptable to the learner's requirements and inclinations, it is referred to be "smart" [10,11]. As a result, SL environments (SLEs) and ACALEs may be viewed as overlapping. As a result, some of the ACALEs included by this study may be classified as smart settings (for example, a smart museum learning environment) [12,13,14,15], but for consistency's sake, we refer to them just as ACALEs.

The wideness of the classification of smart environments, including adaptive CA systems [16], is shown by car infotainment systems and smart television systems it adjusts operator interface towards operator's behavior. Because learning materials and activities in ACALEs are customized to fit the learner's present circumstances, they may increase learning efficiency when compared to conventional classroom-based learning methods. In customised learning, a learning environment's ability to recognise the learner's context and modify its behaviour appropriately is critical [17]. ACALEs are born with certain talents. Numerous research area of adaptive in addition CA learning [18,19,20,21,22,23,24] indicate that using ACALEs has beneficial impacts on learning and teaching over domains and levels, including but not bounded to efficiency, support, immersion, interaction, motivation and effectiveness. In the literature, many potential criteria for SL environments have been proposed [3]:

Learning systems in a CAUL environment (CAULE) conscious of schoolchildren's where about and education status in real life through sensing technologies, allowing them to offer customized advice or support. Various physical world limitations must be taken into consideration when designing learning pathways for people for example education environment leads pupils for observing and study as of actual objectives. By considering the significance of actual education goals and conservational limitations, an optimization problematic intended for generating customized education pathways real world near optimize scholars' education effectiveness is developed. [8]. Chen et al. developed a CA ubiquitous learning system (CAULS) based on wireless networks, RFID, embedded handheld devices, and database technologies to detect and study the real-world learning behaviours of learners. The model's results show an increase in student grades and a significant effect of CA ubiquitous learning (CAUL). The experimental findings indicate that the innovative method presented in the study[10].

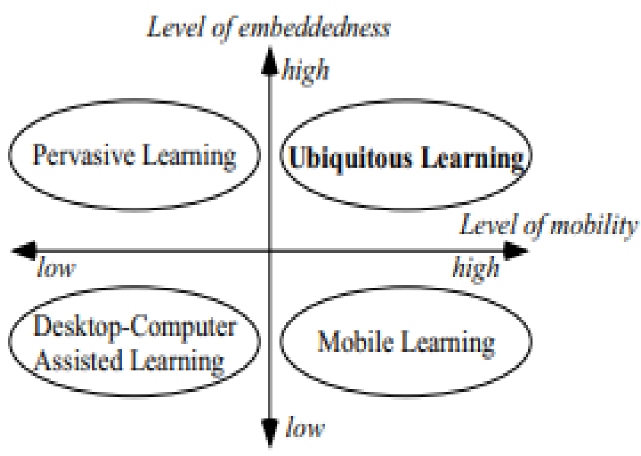

Figure (1) comparison of learning environments based on [36]

May enhance a learner's learning goals. Furthermore, the empirical study's findings show that the majority of students' grades increased substantially.

The superb commitment of the effort deliberate planning of exploration distributed space of setting mindful ML. Bimal Aklesh Kumar et al. d provided a survey of research conducted on CAML by counting and categorizing contributions by examining research conducted and setting the direction for future research in this field [25]. A thorough mapping research based on the criteria provided by [26,27] was used. Vallejo-Correa et al. introduced an efficient Mapping evaluation it spotlights on setting mindful examination too this viewpoint for education procedures in ubiquitous learning (u-learning) and ML (m-learning) and proposed structure of an Omni channel engineering in place of educational conditions now m-learning, utilizing understudy setting analysis [9].

Xinyou Zhao et al. [14] proposed Personalized Adaptive Content System for CA ML to provide adaptive contents based on device capabilities and learner experience, and the results show that the CA ML system can increase learning efficiency and interest. They described the hardware, software, and browsing capabilities of ubiquitous devices, as well as AdSense.

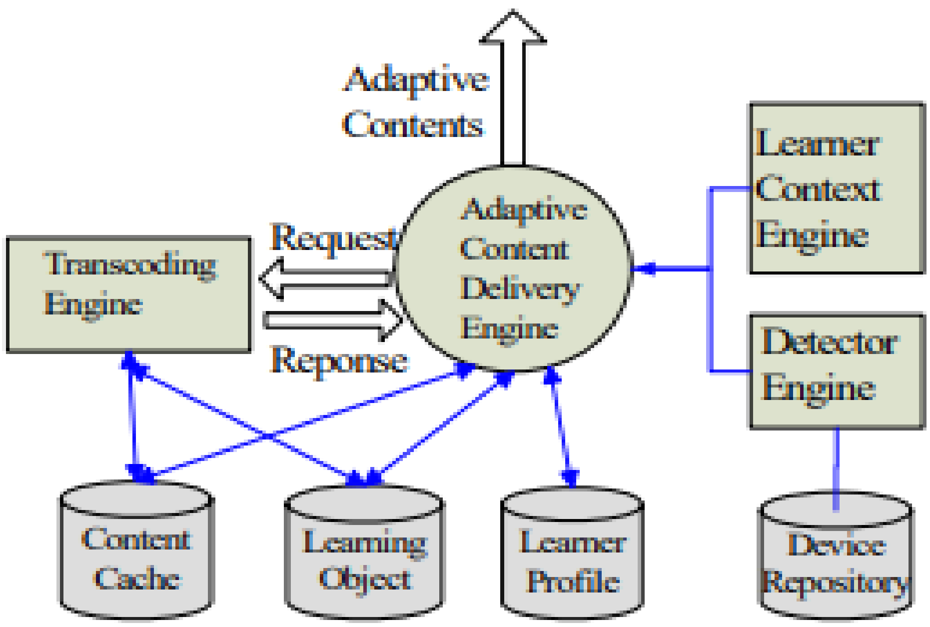

Fig 2 Adaptive content architecture[14]

Current state of ubiquitous learning

The table below displays results of survey on ubiquitous learning. The majority systems relied on proprietary designs that were tailored to individual use case or projects. Many systems, as shown in Table I, used cutting-edge technology such inexpensive microcontrollers and passive or active sensors. In addition to cities [28], museums [29], besides gardens [30], quick response encryptions then RFID stayed utilised allow to communication among objects and learners trendy variety of settings. Learners were given unimportant microcontrollers similar Raspberry Pis, also Arduinos together inexpensive devices, assist them appreciate by what means they perceived environment. Several learning designs were used, varying after uncomplicated school children learning nearby natural ecosphere [31] to apprentices understanding in what way the architecture of carnal place influences how they perceive it.

Table 1 Breakdown of existing UL systems

System	Edge Device	Sensing Element	Network	Messaging	Database
EULER	Phone	QR Code	WiFi	HTTP	Not Specified
Natural	Phone	QR Code	WiFi	HTTP	Not

Science					Specified
IoT Based UL	PDA	RFID,Camera	WiFi,3G	Web Select	SQL
OBSY	Raspberry Pi	Sensor,Camera	WiFi	HTTP	Not Specified
LOCH	Phone	GPS, Camera,mic	PHS	HTTP	Not specified
HELLO	Phone	QR Codes	WiFi,WCDMA	HTTP	SQL
PCAR	Smart watches	QR Code, GPS	WiFi	Not specified	Not specified
Smart education mesuem	Smart phones	QR Codes, RFID,NFC,	WiFi	HTTP	Not Specified
IoTFlip	Google gear, google glass,smart phone,	Smart meter, wearable health monitoring sensors,	WiFi 3G,4G/LTE	Not specified	Local edge device memory
GAIA	Raspberry pi,ardaino	Sensors	WiFi Ethernet	MQTT	Not specified
PCULS	Phone	WLAN,Localization	WiFi	SMS,HTTP	SQL
SMILE	PC	Sensor,GPS	WiFi	XMPP	Not Specified

While many projects used IoT hardware, the way different components were linked and interacted with one another was repeatedly done utilising existing traditional internet protocols and topologies. Hyper Text Transfer Protocol (HTTP) [32] for example, most widely used protocol for the communication layer among existing Internet-based systems, as shown in Table I. To transmit results, evaluations, and comments among groups of learners and instructors, most systems depended primarily on peer-to-peer communications. This kind of peer-to-peer, and frequently one-to-many, communication, on the other hand, is incompatible with HTTP, which was intended for request-response architecture. Extensible Messaging and Presence Protocol (EMPP) [33] in addition distribute protocols identical Message Queueing Telemetry Transport (MQTT) [34] were utilised in a few applications. The initiatives that used procedures fixed so as focus was happening peer-to-peer interactions [[35] [36] or wide-range, efficient communications (e.g., [37]). In addition, technical performance concerns such as reaction time, etc. were seldom considered in most projects. In conclusion, several current ubiquitous learning applications made use of resource-limited edge devices and sensors. Peer-to-peer event-based communication paradigms were also used in many applications to promote collaborative learning among students. These two developments indicate that IoT designs might be good candidates for systematically constructing such systems.

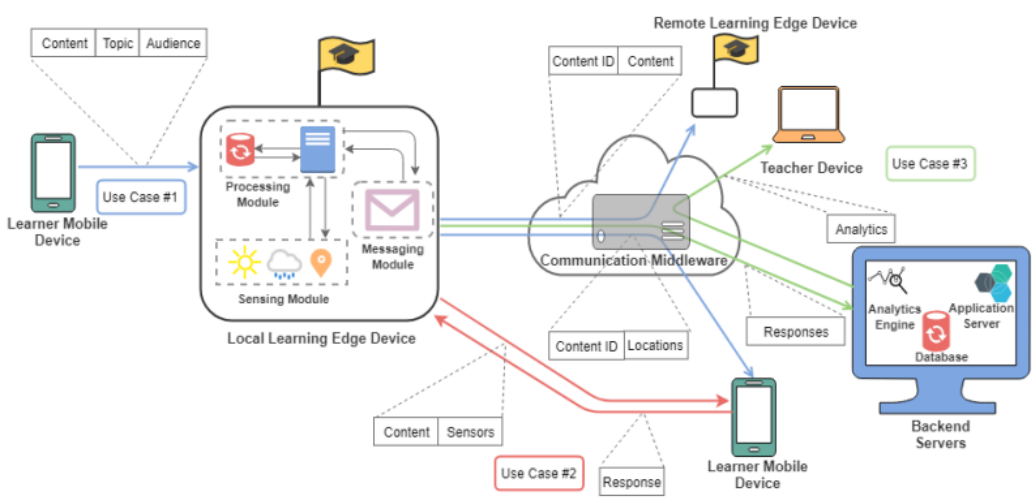

Figure3 Proposed architecture by [38] for ubiquitous context aware learning system

Ken Sakamura and Noboru Koshizuka[39] proposed a novel ubiquitous learning system that makes use of common small nodes with computing and/or communication potentiality, such as smart phones, handheld terminals, contactless smart cards, sensor network nodes, RFIDs (Radio Frequency ID identification), and so on. That, by fully leveraging ubiquitous computing technology, allows learners to study at any time and from any location. The primary goal of this study is to create and implement a new ubiquitous computing architecture called Ubiquitous ID Architecture, which allows for different CA data services to be provided at any time and in any location. The authors introduced ubiquitous computing technologies for efficient and effective ubiquitous learning, such as real-world bookmark system, learning navigation system, and exhibition capsules, with the first example being ubiquitous learning with our everyday objects such as food and medicine, and the second example being learning from different places.

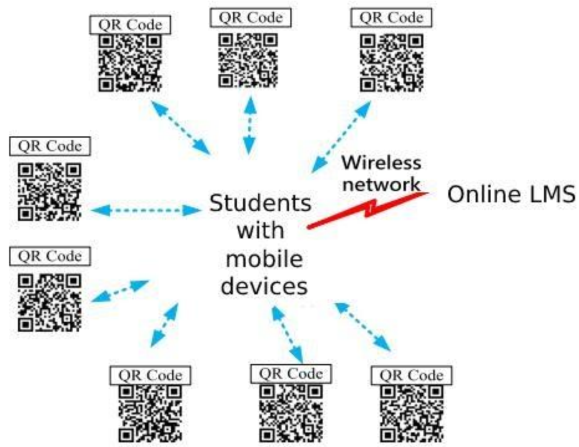

Figure (4) Structure of u-learning environment

Context-aware ubiquitous learning

A new learning scenario known as CA ubiquitous learning has been proposed as a result of the speedy growing wireless networks, sensor skill. Educators have recognised the relevance and need of placing scholars in real-world knowledge contexts for decades [1]. Students may find it challenging to apply textbook data to solving practical problems if they do not learn and practise in authentic environments [1]. Accordingly, a few scientists have attempted to establish learning environments that mix true circumstances with computerized world assets to give understudies direct true encounters while as yet giving satisfactory learning help. Setting mindful pervasive learning is a method that permits understudies to gain from their environmental factors with the assistance of a learning system that utilizes mobile, remote communication, and detecting advances.

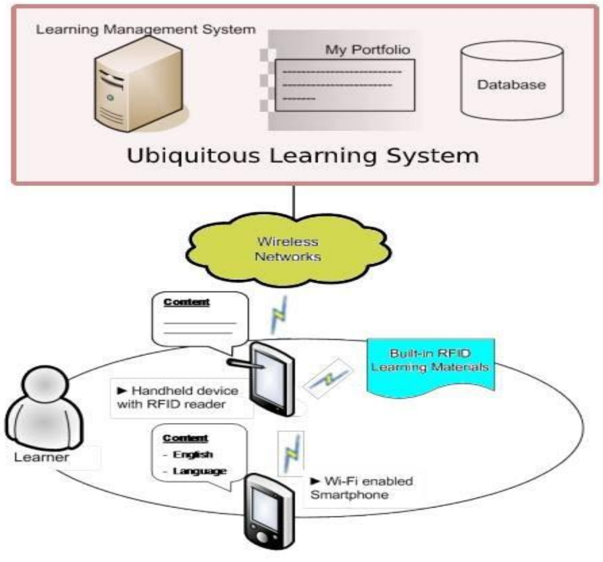

Fig. (5) Concept of ubiquitous learning

In the literature, many potential criteria for smart learning environments have been proposed [3]:

In a smart learning environment, the learner's position or the conditions of the learner's real-world surroundings are recognized, allowing the system to give learning support depending upon the learner's online and real-world status.

A smart learning environment may offer learners immediate and adaptive help by analyzing their requirements from a variety of perspectives (e.g., learning performance, profiles, learning habits, and personal characteristics), as well as the online and real-world environments in which they are situated. In addition, based on the needs of the learners, it may actively provide them with a range of personalized support, such as learning advice, comments, recommendations, and learning aids.

In a smart learning environment, individual learners' personal traits (e.g., learning styles and preferences) and learning status (e.g., learning performance) may be accommodated by adjusting the user interface (i.e., how information is displayed) and subject material. It is not necessary for the user interface to be a standard computer. Instead, learners may interact with the learning environment through mobile devices (such as tablet computers, smartphones with android or IOS), wearable sensor devices (such as a digital wrist watch, or Google Glass), or even ubiquitous computing systems integrated in everyday objects. As a consequence, changing the user interface in a smart learning environment to meet the needs of learners is a challenging job.

3.Research issues in smart learning

(1) Expansion of SL environment executed backgrounds: The fast advancement of computerized innovations such as computer vision, mobile, discourse acknowledgment, augmented reality, and wearable improvements also investigation advances like learning inspection and public mindfulness advances) gives an assortment of choices to executed SL technique in light of various educational resolutions also pedagogical hypotheses. Subsequently, proposing executed frameworks for SL framework utilize for creating advances is a critical and troublesome errand.

(2) Analyses and understandings of ebb and flow educational hypotheses for SL environments: SL is a pristine idea to learn; subsequently specialists and educators may propose new pedagogical thoughts in light of existing speculations like constructivism, motivational hypothesis, the innovation acknowledgment model, mental burden hypothesis, and multimedia plan hypothesis

(3) SL and assessment methodologies: The clever educational style as smart learning, present innovation improved knowledge and calculation techniques may should be reconsidered and amended. Furthermore, new learning standards may introduce chances to analyse for fostering the novel ways to help the students in acquiring knowledge and settling issues in reality more adequately and effectively.

(4) Innovative learning and preparing applications in the new learning mode: According to a few audit studies, advancements have been seldom applied to specific courses or domains, like expressions, plan, and physical education [43; 44]. Analysts will actually want to concentrate on new submission areas which try for applying current learning settings, on account of new advances and learning thoughts.

(5) Learning performance and discernment assessment: Researchers can utilize more data about students' learning performances and insights to establish more compelling SL environments. Learning achievement, problem-tackling capacity, technological acknowledgment motivation of learning, degree, learning demeanour, self-efficacy and consistency are some of the elements that can be assessed. Meanwhile, it's important to see what SL environments mean for learning presentation and perspectives on understudies through various learning graces, mental graces, and additional individual features.

(6) Additionally, learning design and learning conduct investigation: Investigators and educationalists can assemble extra successful education apparatuses also procedures by having an intensive handle of students' practices and learning designs in incorporated genuine world and virtual-world settings. Because a SL environment can record each element of an understudy's learning exercises, specialists can acquire significant and intensive data by concentrating on these activities. More importantly, academics might perform long haul monitoring and examinations of learning practices to see more with regards to the social impacts of new educational innovation.

4 Proposed System

The proposed system smart classroom technology integration model is shown in the below figure (9), The suggested architecture establishes a set of common principles for remotely accessing underlying technologies from the top layer.

From the bottom layer to the top layer of this model, the functions and definitions of each layer will be explained in upcoming publication.

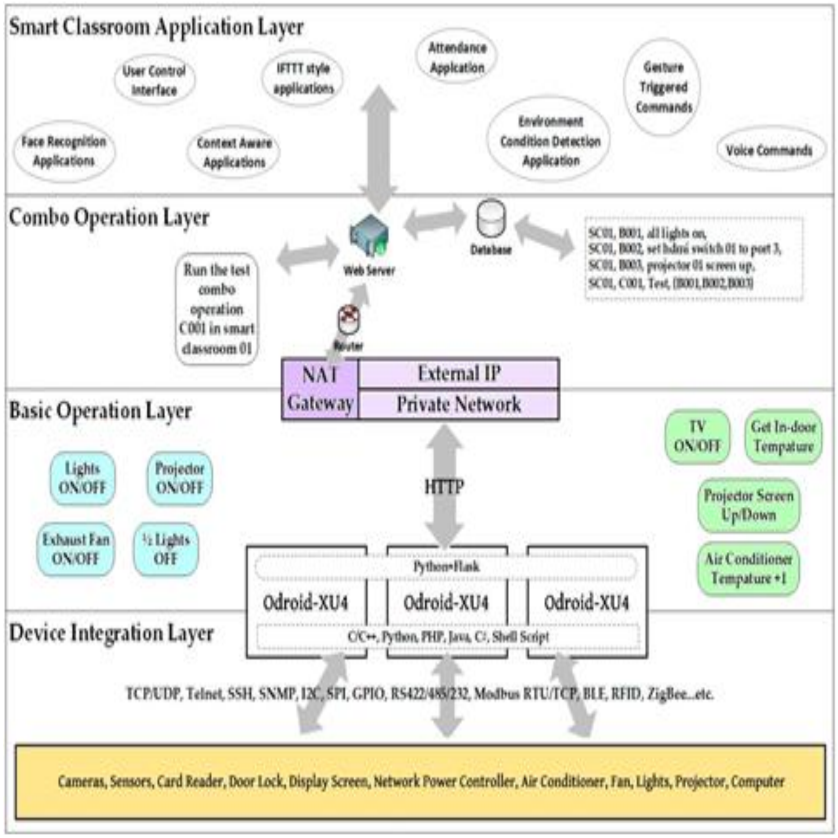

Figure (6) system smart classroom technology integration model

CONCLUSION

In this paper, we present the overview of mobile, ubiquitous, adaptive and smart learning, and importance of context aware smart learning. Also presents the existing works in this domain and point out the issues. Finally presents the proposed systemsmart classroom technology integration modelThe detail implementation of the system will be published in upcoming paper.

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