A Context Aware Framework for Smart Learning

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ABSTRACT

The use of smart classroom technologies has increased in recent years with the rise of new learning styles. Some of these technologies include interactive whiteboards, computers, and smartphones.There are many benefits of using smart learning technologies in the classroom. It has been proven to increase engagement, boost motivation and make lessons more interactive.With its incorporation into classrooms, students can take responsibility for their own learning through the act of problem-solving and increased autonomy. This paper proposes prototype system named 'smart classroom technology integration model' (SCTIM). This system may actively provide learners with a range of personalized support, such as learning advice, comments, recommendations, and learning aids.

Keywords: smart learning (SL), context aware(CA), learning, ubituitous, adaptive. mobile learning (ML).

INTRODUCTION

The researchers in the domain of education and computer science have tried to improve intelligence of learning systems. The researchers in the early 1980s have been working on Intelligent Tutoring Systems (ITSs) it integrates the method of artificial intelligence into informative 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." Many learning systems have also been integrated as web-based learning systems by way of the internet and the World Wide Web have increased in popularity [1]. 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 [2]. In recent years, due to the quick development of smartphones and wireless communication networks, people may now access digital data and easily communicate with computer systems regardless of their location or time. Researchers describe ML as "a technique of learning that utilises mobile and wireless communication technologies" [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 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].

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 behaviour 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.

Despite the benefits of context-aware ubiquitous learning, the technology is still not up 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 [6]. 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. A smart learning environment attempts to assist students in gaining knowledge while they are engaged in recreational activities. It takes on the character of a wise friend who looks for opportunities to advise learners in their daily lives while taking into consideration their requirements and preferences.

Rest of the paper is organized as follows. Section 2 presents the literature review of context aware mobile learning, ubiquitous learning, 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.

LITERATURE REVIEW

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.

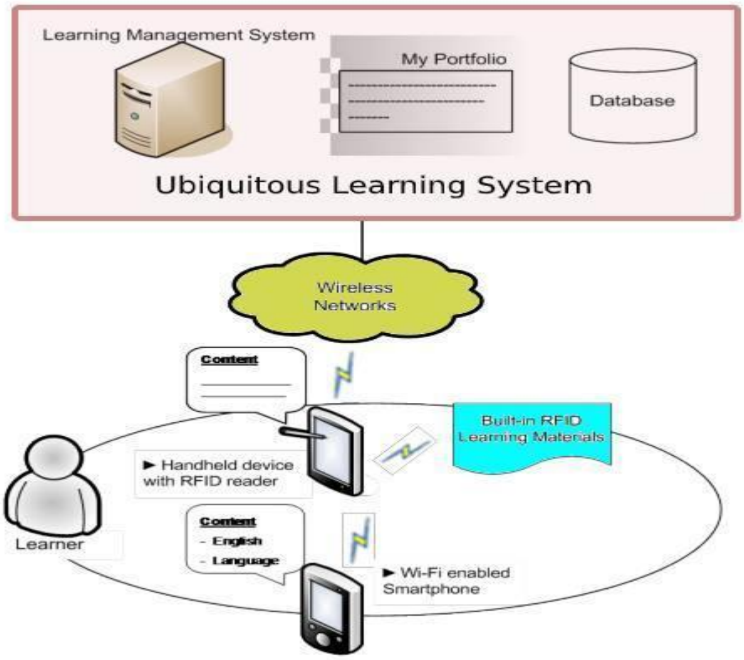

Figure (1) Concept of ubiquitous learning

Recent research has focused on the technological improvement of u-learning, notably CA ubiquitous learning [7, 8], as well as framed a navigation support problem to find instructional methods for diverse students for CAUL also suggested new map reading provision procedures based on learning and steering efficiency, inferring that the optimization methods can facilitate better learners' efficacy.

A smart learning environment's definition, requirements, and methodology

With regards to setting mindful omnipresent learning, settings incorporate co-operations among students and environments; in this manner, "SL environments" are innovation upheld learning environments that adjust and offer suitable help (e.g., direction, criticism, clues, or apparatuses) perfectly positioned and brilliantly founded on individual students' requirements, which can be determined by breaking down their learning conduct [6]. It's crucial to take note of education keen education atmosphere doesn't suggest understudies need partial available energy; rather, no set learning plan is utilized to supplant recreation exercises. While understudies are occupied with sporting exercises, a SL environment attempts to help them in acquiring knowledge. It assumes the persona of an insightful companion who searches out potential chances to advise students in their day to day routines while considering their necessities and inclinations

Therefore, coming up next are some of the potential rules for a SL environment:
(1) A keen knowledge setting mindful; student's circumstance settings student's true environmental elements are seen, meaning that the system can give learning support in light of the student's on the web and genuine status.

(2) A SL environment can give students immediate and versatile help by examining their requirements from a few viewpoints just the on web certifiable circumstances wherein they are situated. Furthermore, it may effectively furnish students with an assortment of individualized help, like learning direction, criticism, tips, and learning helps, in view of their necessities.

(3) A SL environment can change the UI (i.e., how data is introduced) and subject substance to individual students' very own issues and education position. The UI doesn't need to be a conventional computer. All things being equal, students can utilize mobile devices, before level pervasive calculating organizations fixed customary items to cooperate with the learning environment. Therefore, adjusting the UI to match the necessities of students in a SL environment is a troublesome assignment.

The aforementioned noticed clever education setting characterized as being slightly setting mindful (i.e., just on the web certifiable conditions of students remain careful setting education), slightly versatile then slightly modified (i.e., teaching method situated direction isn't thought of). Subsequently, it just covers the most important standards for academics and system designers to think about when establishing SL environments. The framework of a SL environment, as portrayed in Fig 8, comprises of the accompanying modules:

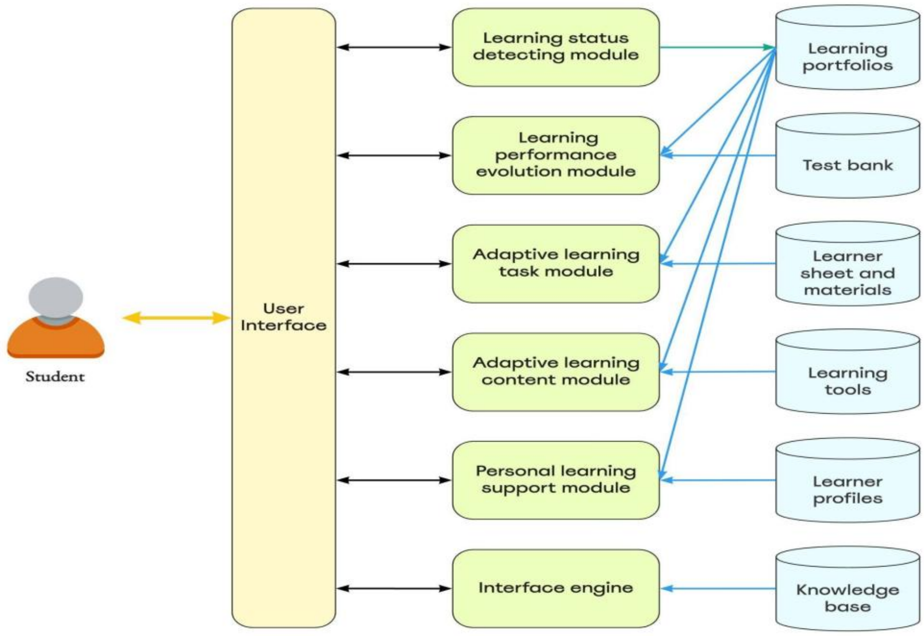

Figure (2) Framework of a smart learning environment

Technologies that make smart learning possible
The formation of SL environments is being sped up by the quick improvement of computer and communication innovation. The pervasiveness of mobile devices, (for example, smartphones and tablet computers), remote communication organizations, and detecting innovations has met essential necessities for evolving shrewd education settings somewhat recently. Learning systems may recognize and assemble true learning settings of students just as their co-operations with the internet learning environment using these innovations. In any case, these present well known innovations may not be sufficient for a SL environment [9]. For example, understudies learning utilizing phones or tablet computers while walking around the road could be perilous, regardless of

whether there are genuine objectives pertinent to some urgent learning goals around them [10]. Furthermore, while understudies are monitoring true goals, it could be hard for them to peruse the connected directions from mobile devices. Some common detecting innovations have limitations that could detour establishing keen knowledge setting. Perusing QR cryptograms inactive RFID labels, for example, needs students' participation. Learning system must choose the option to stand by till the understudies scan the right codes or labels. Furthermore, most certifiable focuses in our regular routines need codes or labels; in this situation, the learning system can't effectively remind students to take note of the objectives that may merit contemplating. The advancement and developing prevalence of Augmented Reality (AR), computer vision, and discourse acknowledgment advances have opened up much more opportunities for making learning environments smarter.

AR is an innovation that empowers students to see both genuine world and computerized world data simultaneously [11Despite the fact that AR in addition movable advancements have similar equipment, advantages AR go a long way past "convenience" and "openness" of learning assets; rather, AR considers the exact joining of fundamental significant extra material (e.g., computerized data otherwise simulated items) continuous perspective on certifiable targets; moreover, it takes into account constant cooperation among genuine and virtual articlesSpecialists have adulated such an incorporated genuine and virtual show and association innovation as a potential procedure to establishing more impressive and strong learning environments.The innovation of acquiring and dissecting images to decipher the image, for example, numerical and symbol data, or articles in the images, is alluded to as computer vision. Learning systems that use computer vision technology can distinguish real-world things around learners and actively provide learning support if necessary. On the other hand, speech recognition technology allows students to connect with learning systems in a more comfortable and efficient manner, such as issuing orders to obtain information or browse web pages, or inputting data to answer questions or communicate with peers.

Moreover, accessibility of Google likewise presents an incredible opportunity to utilize augmented reality, computer vision, and voice innovations to establish optimal smooth learning surroundings. Additionally, Google be the head-mounted computer through optical showcase. They permits clients for getting to computerized materials and collaborate with certifiable things without hefting one more gadget around with them. More critically, it lets clients to utilize regular language voice commands to communicate with application programs. Google Glass is relied upon to become the primary gadget for working with SL with regards to anytime and wherever learning. Many other mobility-unrelated technologies can also assist in the creation of smart learning environments. For example, analytics tools could be used to measure the value of a given learning opportunity by combining a student's personal ambitions. In forming groups, social-awareness technologies could connect an individual's experience with that of the crowd.

The Smart Classroom Technology Integration Model

Sensors and devices are the underpinning of a SC. Engineers must use an assortment of methods to get to different devices for getting precise data otherwise performs control activities in SCs. A simple assignment requires sophisticated activities. The normal in-entryway temperature in a SC can be gotten remotely in a true situation. Different communication advances, like simple network organization, transmission control, user datagram protocols were sequential statement, and Modbus sequential infrastructures convention, must utilized to recover temperature levels from various sensors, like the forced air system, a significant level of the environment sensor, also simple computerized infection sensor. It may not be a not kidding issue in designing labs temporarily, yet main issue in maintaining and running campus of wide SC program over long haul since significant expense of incorporation and maintenance. Accordingly, in this subsection, an Odroid XU4-based innovation coordination model is accommodated the comfort of SC building and SC application expansion with respect to computer innovation. The proposed innovation mix paradigm has four layers

- Device integration level (DIL) is the main layer.
- Basic operation (Layer 2)
- Combo operation (CO) (Layer 3)
- SC Application (Layer 4)

The recommended design builds up a bunch of common standards for remotely getting to fundamental innovations from the top layer. In bottom layer and top layer of technique, shows capacities and meanings of each layer are clarified. Fig 8 portrays the layering idea; layer 1,e DIL, is bottom of the recommended model. Inside the setting of a SC, the Odroid XU4 was helpful for implementing every immediate gadget communication, with recovering data after devices also sending control needs to the devices. The communication cycles can be implemented in any of the Odroid XU4 programming dialects.

The Basic Operation Layer is the model's subsequent layer. The centre exercises of a SC were characterized in this layer, as displayed in Fig 3. On Odroid XU4 sheets, each of the characterized tasks has been implemented in web administration which utilizing python, flask [12,13]. The fundamental control guidelines for equipment associated with activity has conjured through related flask course when a simple SC work, like stopping the forced air system, is called through the web administration demand. All immediate gadget communications layer-1 be masked to clients and requests utilizing this layer. Clients and applications can lead essential SC activities depicted in this layer by sending HTTP demands. Essential activities are joined to create a combo activity and 3rd layer, the CO Layer. This layer ought to characterize and implement tasks that involve executing more than one fundamental activity characterized in layer 2, as displayed in Fig 8. Subsequently, a focal web server with data base network is required. This layer can be assembled utilizing any web server, web application, or data base innovation. Layer 2's essential cycles must be recorded in the data base. On the focal server, combined activities ought to be executed as web administration calls. The layer-2 activity for pulling down projector screen and layer-2 activity for switching out lights which is closer to the projector screen that summoned through relating layer-3 of web administration request when a combo activity, for example, mood killer lights and pull down of the projector screen which is close from projector screen. Clients and applications can direct any SC tasks indicated in this layer by making HTTP solicitations to the focal server. Moreover, SC application coating is the model of top layer and SC application contains rationales otherwise methods for determining how SCs ought to be controlled. Applications connected with client setting, authentication, approval, UI, voice command, participation control, entryway access control, AI-set off activities, management-set off activities, sensor-set off activities, and planned activities should be generally implemented in this layer, as displayed in Fig 3.

Figure 3portrays every one of the levels in this model, just as the apparatuses of all layer also cooperate among components by an various layers. Layer 1 handles the communication between multiple devices and the Odroid XU4 in a SC. Layer 1 may have unmistakable control conventions or communication norms for sensors or devices with the same capacity. Layer 2 permits a capacity, like turning on the number one climate control system, to be characterized as a fundamental activity for each SC has been implemented in an interface of web application. Subsequently, regardless of whether the control conventions for forced air systems in SCs vary. While send widespread interface of web application through parameters, for example, , focal control applications, classroom id that may in any case switch on the forced air systems in every single SC. In layer 3, fundamental tasks are recorded in the data set. Thus, fundamental activities in layer 2 can be utilized to make combo tasks in layer 3. Accordingly, layer 3 can undoubtedly make and implement a combined activity to switch off climate control systems in every SC. Therefore, teachers, administrators, and programming designers just need to focus on implementing layer 4 SC applications that are undeniable level or complicated, like AI applications. For example, under the proposed engineering, an instructor planning setting mindful applications for SCs can get sensor data by means of ordinary interface calls of web application gave at layer-3 also gained data for oneself created request continuously. At the point when the setting mindful application chooses to control different devices in SCs, the fitting interface calls of web application characterized in layer-3 can be utilized to start related combination tasks. In layer 1, the instructor doesn't have to realize any control subtleties.

Supporting Measures for the Proposed Architecture

In terms of fundamental innovation reconciliation, the developed technique has reasonable innovation coordination technique which has been useful for significant level also wide SC campus applications. This paradigm isn't intended to manage troubles like security, systems administration, or everyday tasks. Accordingly, this engineering incorporates secondary measures that effectively execute the proposed classroom technique and innovation combination model in smart campus programs.

- Gadget control organization, layers 1 and 2 of the techniques, also normal organization, is layers 3 and 4 of techniques that contain some degree rationally isolated in SCs.
- Each classroom ought to contain personal private organization gadget control; also setup of isolated organization of all classrooms ought to be equal.
- In SCs, the gadget control organization, of layer 1 and 2 of technique, and normal organization, of layer 3 and 4 of techniques, ought to some degree rationally isolated
- Each classroom ought to contain personal private organization in gadget control; also arrangement of secluded organization each classroom ought to be steady.

Figure 3shows an organization passage between layers 2 and 3, indicating that the proposed model's organization plan for gadget control depends on IP organizations, with every classroom contain personal IP network in gadget control also organization traffic random for the classroom gadget switch being isolated through the organization of gadget control. Moreover, main justification behind isolating the control network from the remainder of the organization is security. Both public computers and Internet of Things (IoT) devices are helpless. IoT gadget providers, then again, don't regularly give system patches as habitually as working system merchants. Regardless of whether an IoT gadget has another security fix, it needs powerful means for mass-sending security fixes to IoT devices, like automatic updates. Accordingly, placing public computers in the classroom and SC IoT devices on the same organization is extremely hazardous and not recommended. Numerous SCs utilizing contain same IP network in gadget control that additionally energized by recommended design, and that means that each SC ought to contain private organization in gadget control, with isolated organization setup being identical in every classroom. The effectiveness of classroom application creation, gadget activity, and management are the primary explanations behind this guideline. Because every classroom will have just a single private organization arrangement, the use of IP addresses for devices in the control organization ought to be carefully arranged. For example, assuming each classroom's projectors utilize 192.168.50.100 and each classroom's Odroid XU4 sheets, that is liable to control projector under similar classroom, utilize 192.168.50.2, that are program also setup to send control guidelines by control Odroid XU4. Then, controlled projector was utilized every classroom deprived of modification. Odroid XU4 sheets in multiple SCs that assume the same part and perform the same capacities ought to have the same IP setups. This guideline additionally applies to Layer 1 devices in various SCs that have the same model number and perform the same capacity. Accordingly, with this approach, gadget arrangement and gadget control methodology programming endeavours are diminished, and the main organization setup for gadget control that shifts from classroom to classroom is the outer IP address under NAT entryway of all classrooms. Consequently, focal control contains server simply essential for realizing every classroom's outer IP address to send layer 2 activity orders to that classroom.

In spite of the fact that there could be no further requirements for network security and management in the proposed engineering.

•Encouraged toward employ Secure Sockets (SS) section encrypt for defending interface calls of web application.
•Recommended for fusing methods, for example, keys of API to manage admittance to layer 2 and 3 activities while implementing the proposed engineering.
• Port-based and IP admittance regulator rules to control admittance for interface calls web application ought to execute or set up.
•Programming based network statement interpretation answers in an private organization passages by all classroom are recommended for future arrangement adaptability and simplicity.
•Auto enrolment capacities on Odroid XU4 sheets are recommended to auto-enlisting activities of layer 2 of focal web server.

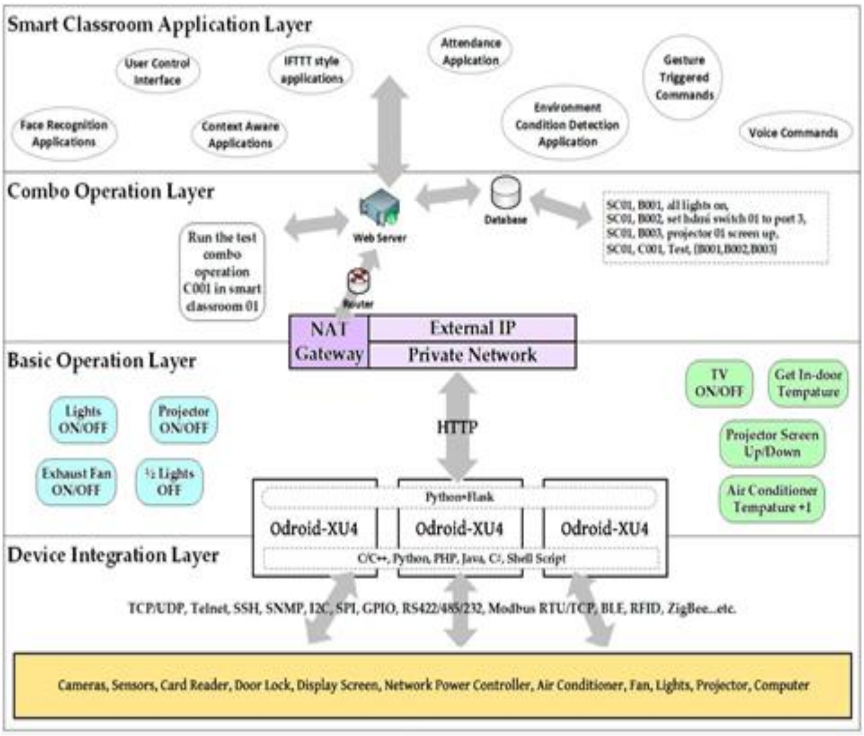

Figure 3- The smart classroom technology integration model.

CONCLUSION

This study has provided a full wireless system that includes everything from the smartphone host user to the end appliances used by a student or faculty member at a university, college, or school. Furthermore, several aspects of smart learning, such as methodology and technology, have been investigated. According to their application in a smart learning environment, four layers of model framework design have been outlined. The system architecture can be integrated using technology to create software and hardware systems, as well as a user interface consisting of a smartphone and PC that is easy to use for students. The future work will be on the architectural design of the proposed model and implementation.

REFERENCES

[1]. Hwang, Gwo-Jen. "Definition, framework and research issues of smart learning environments-a context-aware ubiquitous learning perspective." *Smart Learning Environments* 1.1 (2014): 1-14.

[2]. Kumar, B.A., Sharma, B. & Nakagawa, E.Y. Context aware mobile learning: A systematic mapping study. Educ Inf Technol **26,** 2033–2052 (2021). https://doi.org/10.1007/s10639-020-10347-5

[3]. http://iasle.net/about-us/background/

[4]. Andone, D., Holotescu, C., &Grosseck, G. (2014, November). Learning communities in smart cities. Case studies. In Web and Open Access to Learning (ICWOAL), 2014 International Conference on (pp. 1-4). IEEE.

[5]. International Conference on Smart Learning Environments Call for Papers, retrieved from http://www.ask4research.info/icsle/2016/cfp.php.

[6]. Hwang, Gwo-Jen, Chin-Chung Tsai, and Stephen JH Yang. "Criteria, strategies and research issues of context-aware ubiquitous learning." *Journal of Educational Technology & Society* 11.2 (2008): 81-91.

[7]. Yin, C., Ogata, H., Tabata, Y. & Yano, Y. (2010). JAPELAS2: Supporting the Acquisition of Japanese Polite Expressions in Context-Aware Ubiquitous Learning, Mobile and Ubiquitous Technologies for Language Learning. International Journal of Mobile Learning and Organisation, 4(2), 214- 234

[8]. Chen, Chih-Ming, and Yi-Lun Li. "Personalised context-aware ubiquitous learning system for supporting effective English vocabulary learning." *Interactive Learning Environments* 18.4 (2010): 341-364.

[9]. Wu, Po-Han, Gwo-Jen Hwang, and Wen-Hung Tsai. "An expert system-based context-aware ubiquitous learning approach for conducting science learning activities." *Journal of Educational Technology & Society* 16.4 (2013): 217-230.

[10]. Lai, C. H., Yang, J. C., Chen, F. C., Ho, C. W., & Chan, T. W. (2007). Affordances of mobile technologies for experiential learning: the interplay of technology and pedagogical practices. Journal of Computer Assisted Learning, 23(4), 326-337.

[11]. Dyson, L. E., Litchfield, A., Lawrence, E., Raban, R., &Leijdekkers, P. (2009). Advancing the mlearning research agenda for active, experiential learning: Four case studies. Australasian Journal of Educational Technology, 25(2), 250-267

[12]. Scott, Kristopher, and Rachid Benlamri. "Context-aware services for smart learning spaces." *IEEE Transactions on Learning Technologies* 3.3 (2010): 214-227.

[13]. Oliveira, Eduardo, Paula Galvao de Barba, and Linda Corrin. "Enabling adaptive, personalised and context-aware interaction in a smart learning environment: Piloting the iCollab system." *Australasian Journal of Educational Technology* 37.2 (2021): 1-23..