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IoT based Cloud Integrated Smart Classroom for smart and a sustainable Campus

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Abstract

In this era of smart classroom technology, students are more demanding innovative university campus life, and willing to use innovative learning methods. IoT and Cloud computing technologies can provide solutions for smart and a sustainable campus to improve learning methods of the students and improve the efficiency of everyday activities in the Institution. This paper focus on the IoT paradigm in the teaching process with the integration of Cloud for education system. IOT in education provide student to learn new technologies that helps the students to create new ideas and logical for the social problems. IoT based cloud computing technology provide intelligence system, unified campus portal services, security and maintenance system. The digitally connected campuses enhances student learning and environmental sustainability. Students can use smartphones, PDA to access their homework assignments and test performance through online portals. Video can be uploaded in the cloud, online video Lecturing enables Students to attend classroom lectures remotely. IoT devices are used to track students who Skip their classes, send alerts help students to concentrate academic work regulary, and to find lost personal items. Through Digital devices payments can be made easy at cafeteria, office and in other admin activities. The hardware component of IoT consists of microcontroller board, sensor module, wireless and wired connections. Using the software module the information to and from sensor modules is processed and transmitted to cloud storage. This paper describes how efficiently IOT and Cloud Infrastructure restructure the traditional education and learning methods.

Keywords: IoT; Cloud Computing; E-learning; Online classroom;

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Nomenclature

AC	Air Conditioner
AI	Artificial Intelligence
GPS	Global Positioning System
IoT	Internet of Things
ID	Identity Card
PDA	personal Digital Assistant
RFID	Radio Frequency Identification
WIFI	Wireless Fidelity
5G	5th Generation Network

1. Introduction

Recently, Internet of Things and Cloud computing gains the attention of the universities to develop smart campus [1]. Several peripherals, infrastructure and facilities are connected in a Smart Campus that provides smart lighting, security, tracking, efficient utilization of resources including manpower, electricity, water etc [2,3]. Traditional classroom model requires equal time to be spent on both teaching and managing the workflow of the classroom. Mentoring and monitoring the academic related activities of the student becomes tedious. Faculty and the management of the institution faces hurdles to monitor the student academic closely. Thus, in order to achieve maximum utilization of the class hours, a new system is needed to take care of the workflow which highly reduce the time of faculty not to stick with managerial works and to increase the time of teaching and interaction with students [4]. This paper displays a technology that utilizes IoT along with cloud technology and application development platform to reduce the secondary work of mankind. This implementation let faculty to focus more on the primary work that is, teaching and to focus less on managing the workflow of the classroom.

2. IoT and Cloud based Smart Classroom

A literature review [5-8] shows the various IoT and Cloud based Smart Classroom Systems.

Internet of Things based Smart Classroom Environment system uses customized ARM Microcontroller. This system used for resource management, attendance monitoring, or faculty management. Using ID cards and wristbands, the location of the learner or guest was tracked. This smart classroom system also deals with intelligent parking system, dynamic ticketing system, etc. [5].

Another system uses touch-based interface and cloud-based framework storage system for a smart bench in a smart classroom was accessed through RFID security system. These interfaces are provided in each bench in the class through which the Students will interact with notepad which helps them to take notes while listening to the class and it also help them for easy understanding and resource virtualization. This new technological advancement led to a change in education system [6].

For Optimizing Classroom Usage, A Smart Campus was developed that describes the implementation of IoT and AI Technologies. The system includes sensing methods for measuring class possession for the lecture halls across campus. The system features are collecting live occupancy, collecting attendance patterns for 250 courses over two sessions, identification of conducted, cancellation of lecture hour and tests. It also uses Artificial intelligence techniques for attendance prediction. The system has a methodology for an optimal classroom allocation by predicting students attendance [7].

Smart Campus Teaching Platform based on the 5G network implementation model is used to establish an online teaching platform. To obtain the student location information and monitor his presence in classroom, localization algorithm is utilized. The smart classroom was implemented using 5G network technology to improve the speed for student check-in time calculation and data transmission [8].

Some technologies like RFID, IoT, Artificial Intelligence and cloud storage system can be effectively used to create Smart Classroom. Sensor to cloud data transmission may incur additional delay and security challenges. The system should offer an intelligent sustainable cloud computing [9-11].

This paper describes how efficiently IoT and Cloud Infrastructure restructure the traditional education and learning methods using the cloud storage for handling smart application through which interaction between teacher and student, between the various objects and IoT Sensors.

3. Proposed System

The proposed IoT based cloud computing technology provide smart campus, security and maintenance system to help teaching, scientific research, management of staff and students, attendance monitoring, homework or assignment monitoring, online billing, finding of lost books, laptop or necessary objects. Students and Faculty can use smartphones, PDA for teaching learning process. Through the smart campus system payments can be made easy at cafeteria, office and in other admin activities. Online / offline video Lecturing enables Students to attend classroom lectures remotely if they skip their classes. The hardware platform of the system consists of many sensor modules with wired, wireless communication and Information from the sensor is processed by the software module and stored in cloud. Smart networking devices like gateways, routers, switches, WIFI router are deployed as the core of cloud network. The proposed system methodologies that enhances teaching learning and other administrative activities is shown in fig 1.

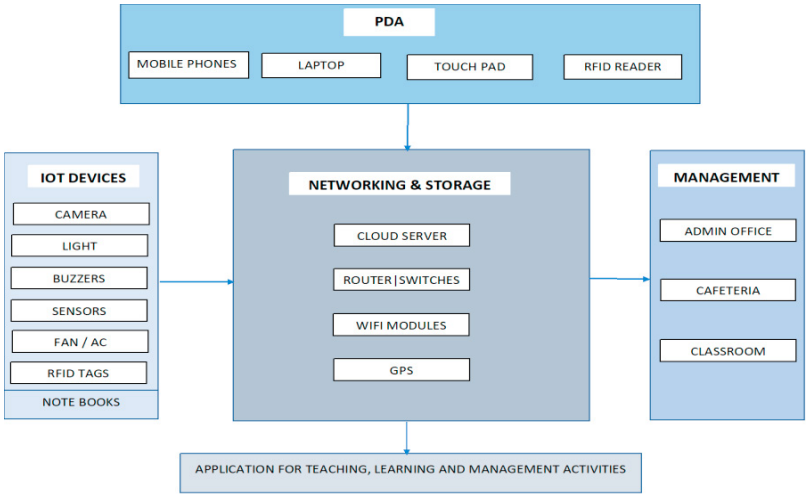


Fig. 1. IoT based Cloud Integrated Smart Classroom.

Any connected computational Smart devices with IoT creates an efficient intelligent virtual classroom environment that provides knowledge delivery at anytime and anywhere through remote access. The application for proposed Smart classroom is shown in fig 2.

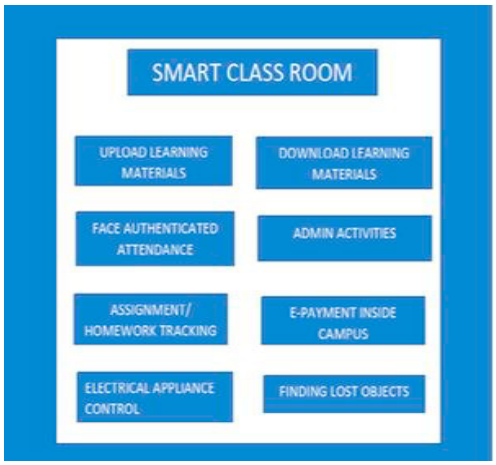


Fig. 2. Proposed Application for Smart Classroom.

Location tracker systems is used to find the lost personal items with RFID tags. Non erasable RFID tags are associated with the laptop, notebooks etc, the lost objects can be found by tracking their location with IoT. The visitor to the campus is given the IoT enabled visitor ID Card. So that he can track the location of the office, Cafeteria with GPS module. The infrastructure of a smart campus environments includes an IoT based RFID reader and buzzer alert system controlled by a Microcontroller. This subsystem will monitor the students and take necessary action as programmed. Data from multiple sources like camera, GPS, RFID tags are sensed and collected. The IoT technology enables direct interactions among these sources along with routers, gateways etc.

Automatic update of Student Attendance using facial recognition open.cv open source application is utilized. When the student enters the class, the camera will capture the face, extract the objects, produce 3D points from the camera video, compare with the database to find similar image from cloud server and mark their presence and absent status automatically. The student's attendance monitoring feature enable the faculty to check and track the daily, monthly and overall attendance. The faculty can add the reasons for their absence. The notification of the absence of a student is also sent to the parent or guardian. The Face authenticated Attendance system is shown in fig 3a.

Attendance, homework, assignment management is easily implemented with this system. Faculty members will be authorized to post assignments with due dates. Notifications will be sent to student's registered email ID. Students can post their assignments answers in the cloud. List of Student names with their ID number who submit work on time will be automatically monitored and sent to the faculty.

Automatic Controlling of Lights, fans, camera in classrooms is enabled with IoT. To control light, Fan, AC and other electrical appliances, student movement detection is identified using the sensor. When the students enter the class the lights, Fans will be switched ON automatically. If they leave the classroom, the sensor will trigger the microcontroller and waits for a time period. If no human movement detected and the classroom is empty the microcontroller is triggered to switch off the lights, Fan and AC. Thus, the electrical energy is saved with the proposed smart classroom. The controlling of electrical appliances is shown in Fig 3b.

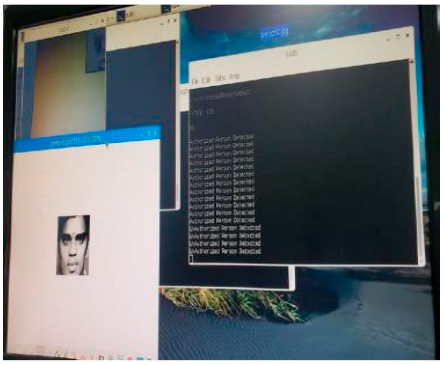
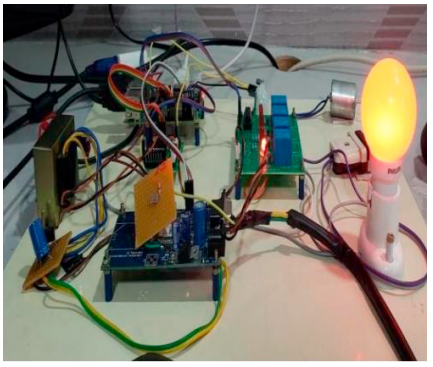


Fig. 3.(a) Face authenticated Attendance system.



(b) Electrical Appliances Controlling.

Classroom activities are managed with IoT and the system permits the students who complete the allotted work in the scheduled time. Student ID cards are enabled with Radio frequency identification (RFIDs). RFID for each registered username will be stored in the system. A RDIF reader along with a buzzer system controlled by a microcontroller will be fixed in front of every classroom. The RFID list corresponds to the students who submitted the assignment before due date will be transferred to the RFID reader. Students who completed the work on or before the due date will only be allowed to enter the classroom. If a student tries to enter the classroom without submitting the assignment, the buzzer will alert the student to meet the faculty mentor.

4. Conclusions

The IoT based Cloud Integrated Smart Classroom for smart and a sustainable Campus will be an evolution in the educational environment resulting in high efficiency and effectiveness of classroom teaching methodology. This system will bring sincerity among student community to complete the work on time. Faculty and the management can spend more time on teaching and learning instead of spending time with managing and monitoring the workflow of the classroom. Thus, the proposed education system model provides intelligent, economic and environmentally sustainable campus.

References

[1] Srinivas, Voore Subbarao and Pavithr.(2019) “A SURVEY ON INTERNET OF THINGS BASED SMART, DIGITAL GREEN AND INTELLIGENT CAMPUS.” IEEE 2019 4th International Conference on Internet of Things: Smart Innovation and Usages: 1-6

[2] Karan Phougat, Sachin Wakurdekar, Samarth Pruthi and Mohit Sinha. (2017) “An IOT approach for developing Smart Campus.” International Journal of Innovative Research in computer and communication Engineering, 5(4) :7405-7412

[3] Pagliaro F, Mattoni B, Gugliermenti F, Bisegna F, Azzaro B, Tomei F and Catucci S. (2016). “A roadmap toward the development of Sapienza Smart Campus.” In Proceedings of the International Conference on Environment and Electrical Engineering, Italy: 1–6.

[4] Nie, X(2013). “Constructing Smart Campus Based on the Cloud Computing Platform and the Internet of Things.” In Proceedings of the 2nd International Conference on Computer Science and Electronics Engineering (ICCSEE 2013), Hangzhou, China: 1576–1578

[5] Asim Majeed and Mahmood Ali.(2018) “How Internet-of-Things (IoT) Making the University Campuses Smart?.” IEEE 8th Annual Computing and Communication Workshop and Conference (CCWC): DOI: 10.1109/CCWC.2018.8301774

[6] Sumeet Bajaj, Shreyas Kumbhakarn and Apeksha Bandekar.(2018) “SMARTBENCHES IN CLASSROOM.” International Conference on Inventive Research in Computing Applications (ICIRCA 2018).

[7] Thanchanok Sutjarittham, Hassan Habibi Gharakheili, Salil S. Kanhere and Vijay Sivaraman.(2019) “Experiences with IoT and AI in a Smart Campus for Optimizing Classroom Usage” of IEEE INTERNET OF THINGS JOURNAL 1 :1-13

[8] Xin Xu, Dan Li, Mengyao Sun, Shichao Yan, Shujiang Yu, Gunasekaran Manogaran and George mastorakis. (2019) “Research on Key Technologies of Smart Campus Teaching Platform Based on 5G Network” Special Section on Roadmap To 5G: Rising To The Challenge, 7 : 20664 - 20675

[9] Liu, M and Li L. (2018). “The construction of smart campus in universities and the practical innovation of student work.” Proceedings of the International Conference on Information Management & Management Science, Chengdu, China :154–157.

[10] Zhicheng D and Feng L. (2019). “Evaluation of the Smart Campus Information Portal” in Proceedings of the 2nd International Conference on Education and E-Learning, Bali, Indonesia: 73–79.

[11] Pompei L, Mattoni B, Bisegna F, Nardecchia F, Fichera A, Gagliano A and Pagano, A (2018). “Composite Indicators for Smart Campus: Data Analysis Method” Proceedings of the IEEE International Conference on Environment and Electrical Engineering: 1–6.