Solution Integration Approach using IoT in Education System

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Abstract *- While several institutions contributes significantly to technology, the leveraging this has been limited due to technological challenges and also cost implications. Internet of Things based cloud systems has a tremendous potential to enable educational institutions to leverage the advances in the cost effective cloud systems.This paper describes the various technologies that can be used for collecting data, managing them on the cloud and using analytics for maintaining the overall campus infrastructure. A high level architecture to connect these various technologies to the cloud is also proposed. This would enable a centralized system, which can address e-learning, student tracking and security, in-campus and indoor navigation, and also student management.*

Keywords - *IoT in Education, IoT gateway, e-Learning, Student Tracking, In-campus Navigation, MQTT.*

I. INTRODUCTION

A system of gadgets like sensors and associated hardware, incorporated with the fundamental programming and the Internet frames, the Internet of Things (IoT), based on the International Telecommunication Union's Global Standards Initiative. As per Gartner, There will be25 billion connected things or devicesin use by end of 2020. The Internet of Things (IoT) is the following period of development innovation and informative applications all through the next decade. While capacities are extending there are as yet different troubles and confined application framework for utilizing these headways inside an e-learning condition. IoT and eLearning should be used to teach more people in ICT and furthermore specialized fields.Internet of Things is being incorporated to eLearning with a specific end goal to improve the learning knowledge for an advancededucation system. The IoT represents an expansion of the mastering the learning environment and will impart substantial quality to the education system.

II. WHY THIS WORK IS IMPORTANT?

Even though IoT is most across the board in the business world, it has prominentimplications for education. Technology is coming into the traditional classrooms as well. These are expected to launch education systems also into the world of IoT.

E-learning elements and stages have been under expanded weight because ofcommentators and government in light of completion rates, costs, employment, and career readiness.The learning systems can be improved by using new advances to decrease costs, and enhance the end-to-end following of general learning. This paper comprises the potential of IoTto transform education system, current challenges, major use cases, proposed architectureand its descriptions.

III. NEED FOR ENABLING IOT IN EDUCATION SYSTEM

In 2008, the quantity of things associated with the Internet exceeded the quantity of individuals on Earth. In any case, that is still less than 1% of all the physical things on the planet today.Gadgets, sensors, machines, toys, notwithstanding apparel can interface with the Internet. Our savvy gadgets converse with us, and we argue. Does this have any application to educating system? IoT is surging ahead in various zones and domains, like assembling, medication and transportation, yet shouldn't something be discussed about education sectors? We are living in a period of IoT creating a great impact on every single thing of life. How this innovation going to have a major effect in education system?

IV. IOT TO TRANSFORM EDUCATION SYSTEM

IoT will empower students to associate with instructors and access to full-time instructive tools.It will alsopromote interactions and cooperation with educators and multiple students. Parents can track their wards progress by accessing the reporting from the learning analytics through the IoT framework.

The second point is that IoT can help schools streamline operations, like attendance, online tests and assignments, results, learning progress reports, fee alerts, which can be easily automated. It can

likewise cut down significantcosts.Utilized carefully, it can likewise turn into a stage to direct exams.

The third point is that, with IoT possibly, we can accomplish a stage that with basically the hit of catch a lockdown system can be begun which can be used as a piece of occurrence of an emergency. In case of a crisis, IoT systems can alert police, send alarms to fire stations and hospitals and also to the administrative block of the campus.IoT and cloud systems make surveillance automated and easy.

The fourth point is that IoT will bring advantages to students with unique requirements. Specialized software can help understudies with particular issues. For example, it can perceive visually impaired or hearing weakened understudies and roll out improvements in like manner, for instance, expanding text dimension or more visual snippets of information. It will also help instructors to save time, to upgrade the educating background.

At the "Interaction System Based on Internet of Things as Support for Education", it was expressed that IoT could give inspiration and could permit understudies to be perky. IoT additionally permits instructors to show understudies as per their aptitude. Instructors can pick the fundamental materials to suit understudies. Students can learn at their own pace as indicated by theircapabilities, so they are not constrained by a one-estimate fits-all program.

V. CURRENT CHALLENGES

Different gadgets utilize unrelated and heterogeneous technologies like Wi-Fi, BLE, Zigbee, USB etc. Existing solutions are customized and restrict reusability and scalability. Now there are no central control frameworks. All systems like smoke detection, movement recognition and firing identification act as isolated systems. Problemspecific custom implementations are not adaptable or flexible to solving overall integration requirements and furthermore expanding needs. For eg;adapting a USB based camera system to a Wi-Fi enabled or IoT framework is not a trivial task.

VI. MAJOR USE CASES

A. Content on mobile

It concentrates on the ideas driving a suite of systems and apparatuses for information sharing. The course incorporates an encouraged and collaborative approach, using a blend of learning materials and asynchronous collaboration tools. Learners have week-by-week due dates to accomplish activities and assignments, yet they are permitted to timetable review sessions whenever amid that week. Learners can get to sessions, exercises for dialogs or to share reflections and resources.

Courses comprise of intuitive lessons, including content, pictures, animations and communications. Specific instructional frameworks are utilized, for example, depicting, logical examinations, representations, demand and practice with reinforcement feedback. Additional advantages join associations with online assets, prescribed perusing, work helps and a glossary.

B. GPS& GSM Integrated Tracking System

A parent's more terrible bad dream is tykekidnapping. Another equally difficult nightmare is their kid straying, or mysteriously absent. That is the reason GPS tracking for children can be a parent’s best companion. The institutions can track children’s movementsusing GPS & GSM integrated tracking system when they stray out of the assigned geospatial limits using geo-fencing.

A GPS tracker for children gadget is a small monitoring tool that can be set in your child’s pocket, knapsack or coat. Satellite based positioning can be used to know the location of achild. A GPS tracker for children gadget can likewise be set unnoticeably in spots, for example, your kid's stroller, enabling monitoring of a child through a GPS tracker.

Advantages of GPS Tracking:

- SMS notifications can be sent to the guardians about the arrival of school bus.
- Adequately manage every day transportation operations and precisely track ridership.
- Vehicle administration group can monitor the rider status through a reporting mechanism.
- Constantly streamline transport routes as indicated by ridership.
- When a student misses the bus at boarding or arrival points, automatic security alarms can be sent to the parents and driver.
- Over speed cautions.

C. Security Surveillance and Tracking System

In recent years, schools and colleges are not any longer the safe places as were previously thought they were, and anything could possiblyoccur. It is essential to create a safe environment for students, employees and facilities. Also, there needs to be systems to investigate any untoward incidents that may occur.

Education organizations should have a security monitoring systems, which can deal with fire, security, and communications systems**.**Institutions must plan and install complete security solutions for classrooms, educational and administrative buildings, sports and athletic edifices and other educational facilities.

While we talk making use of surveillance systems to guard schools, we are not just discussing about unexpected and inappropriate school incidents. Additionally, these systems can enable watching their children from anywhere, with remote viewing.

D. Student Tracking System

Student tracking system helps to monitor student's general accomplishment in scholastics. We have to make use of smart attendance systems that track the tyke's attendance using a simple smart card that transmits the parent's mobile a SMS that the child has attended all class hours.

School automation systems are providing a large group of services to screen and track the child's academic progressing, a host of bio metrics,Retina, Vane detector, Touch screen based devices and many more as per our requirement.The solution is primarily focused at enhancing the student safety as well as creating a more disciplined environment for a better performance in studies.

VII. PROPOSED ARCHITECTURE

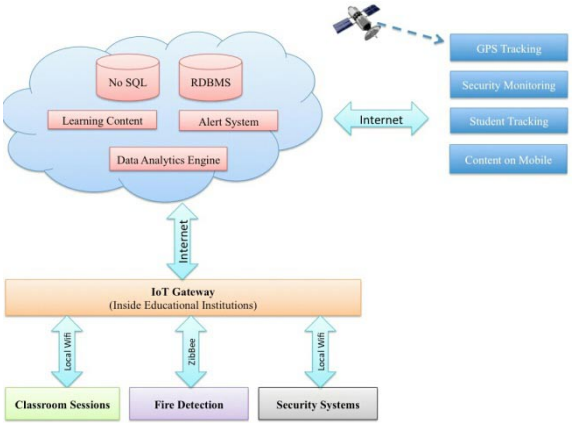

Fig 1: write something

VIII. DESCRIPTION OF ARCHITECTURE

End client level information accumulations from classroom sessions, fire detection systems and security systems can be associated with IoT Gateway using local Wi-Fi or ZigBee or RFID or BLE.We can screen and additionally track the understudies by embedding a RFID on their ID. The architecture mainly comprises of connected devices, IoT Gateway, IoT cloud servers,Data Analytic Engine and a reporting system.

A. IoT Gateway

IoT gateway is the bridge between IoT devices and the Internet. Sensor devices push data to cloud through an IoT gateway. The gateway aggregates sensor data, translates between various sensor protocols, processes sensor data and then sends it to cloud servers and applications for processing and analytics. IoT gateways abstract conceptual the medium of correspondence and furthermore give a safe channel, which is fundamental for the transmission of this information.

It performs several critical functions such as device connectivity, protocol translation, data filtering and processing, security, updating, management and more. New generation technology IoT gateways also can run application code to process incoming statistics and offer intelligence. The gateways are generally deployed within the enterprise or the institution and sits at the boundary of edge systems like devices, controllers, sensors on one side, and the cloud on the other.

B. IoT Cloud

IoT frameworks are empowered by cloud-based systems to give processing power, storing and networking. The incoming data being large and unpredictable, using the cloud systems becomes mandatory, to have scalable and cost effective solutions.Cloud infrastructure provides scalability of performance, storage,compute power and Internet bandwidth by dynamically provisioning the systems as necessitated by the usage levels.Since the systems can be shutdown or scaled down automatically when the load reduces, such auto-scaling system outcomes in effective cost management.Software or hardware load balancers, together with the auto-scaling supplied by the cloud infrastructure handles this automatically.

C. Data Analytics Engine

The massive data generated from IoT cloud can be analysed in the cloud with big data solutions to gain insights and patterns of usage and behaviour of machines and humans. This business intelligence in turn allows us to predict forthcoming growth in data demand and deploy additional resources accordingly. These patterns are then analysed, and if found irrelevant, then accordingly the information is send to the user, to control & monitor their devices from remote locations. These apps push the important information on hand-held devices & help to send commands to Smart Devices.

Information retrieved from various systems must be pushed into IoT cloud. Mass information from classroom sessions and surveillance data from digital camera systems are pushed into IoT cloud utilizing HTTPS protocol. Event based monitoring inputs like fire detection and checking secured territories can be pushed into IoT cloud using MQTT protocol.

IX. PROTOCOLS IN IOT

A. *Device Protocols*

1) ***ZigBee*****:**ZigBee is a radio based wireless protocol used to create personal area networks with small, low-power digital radios, which can be used for data collection in a low power low bandwidth situations. Though its low power consumption limits data transfer range to fewer than 100 meters line of sight, it enables larger ranges by enabling building a mesh network with intermediate devices. Being a low power consumption device, it can provide extended battery life. It also provides security using 128 bit symmetric encryption. All these make this an ideal technology to use within a large private campus to feed data into the central gateway.

2) ***MQTT (Message Queue Telemetry Transport):***MQTT is a publish-subscribe messaging protocol that was developed for resource-constrained devices. In this protocol, several devices or services can publish a message with a topic, and all the other devices or services subscribed for this topic will get the message sent. It is apublish-subscribe-based "lightweight" messaging protocol for use on top of the TCP/IP protocol. Designed for a connection with remote locations where a "small code footprint" is required or the network bandwidth is limited. It is a perfect solution for IoT implementations. Being a TCP/IP based solution, it enables transmitting larger data packets as well.

Since MQTT is based on a central broker, the gadgets utilizing MQTT customer is extremely lightweight, and in this manner consumes lower battery. Also, being lightweight, it is faster and provides higher throughput, and also a lower bandwidth usage. MQTT is designed for low latency, assured messaging and efficient distribution. It well suited to use cases where:

- connectivity is intermittent
- bandwidth is at a premium
- an enterprise application needs to interact with one or more phone apps
- phone or tablet apps need to send data reliably without requiring code retry logic

Limitations of MQTT Protocol

No Message Queuing

A Queue can store all the messages until a consumer takes it. The protocol only speaks with Topics. The specification doesn't mention any queue concept. A topic doesn't store messages itself. So, if the consumer device was not connected to the broker system when the message was published, the device will never receive it. In real world scenarios involving numerous interconnected gadgets, intranets and Internets, there can be occasions of lost connectivity and this will be a significant issue.

No TTL (Time-To-Live) in message

The protocol does not allow adding a TTL attribute per message. So if you use the "*clean Session*" parameter, the message will be held indefinitely in the broker. This can create a log of messages on the broker, and can impact the overall performance. This can also use up disk space if messages are persisted with.

No Authentication model

MQTT has a very simple security model. At present, it permits utilizing username and discretionary secret key just for validation. At present, it permits utilizing username and optional secret key just for validation. The normal suggestion for encryption and transport security is TLS, even now this is not typicallysuitable for the little gadgets because of their lower processing power.The specification does not describe nor suggest any authentication model.

3) ***Bluetooth****:*Bluetooth is a short-range wireless technology for exchanging data over short distance between mobile devices, computers and other devices. A piconet is a system of gadgets connected using Bluetooth technology. A network is setup with one device as master and all other devices act as slaves. Piconets are set up automatically as Bluetooth devices enter and leave radio vicinity.

BLE based beacon technologies (EddyStone, iBeacon) can be used for indoor or even in-campus navigation in conjunction with the mobile phone. This can provide voice-assisted guidance for visually challenged individuals. This framework can likewise be utilized to broadcast localized information when interested parties are around the vicinity of an event, similar to gatherings or social celebrations.

B. *Cloud Communication Protocols*

*1)****HTTP/HTTPS***:Hyper Text Transfer Protocol Secure (HTTPS) is the secure version of HTTP, the protocol over which data is interchanged between

the browser and the website or server that is being accessed. It presents bidirectional encryption of communications between the client and server using SSL certificate. Thus protects against eavesdropping and tampering with or forging the contents of the communication. HTTPS provides authentication of the website and associated web server with which one is communicating, which protects against man-in-the-middle attacks. Cloud services leverage HTTPS to provide REST based APIs or Web Services to access the cloud services.

X. CONCLUSION

The IoT can strip away fundamental obstacles in education, as an instance, financial status, geology, language, and physical location. Joining training with innovation is not just about bringing learning resources or making less difficult and quicker – it's about quality, impact, and group acknowledgment too.

Future work will focus on incorporating the investigation on technologies and their adaptability for IoT. In addition, it will include architecting a generic IoT cloud and gateway for empowering remote devices and clients over cloud for implementations in education system. Discover approaches to help in enhancing the security levels while utilizing MQTT for machine-to-machine collaborations. And furthermore need to create pluggable interfaces for supporting multiple communication technologies like Wi-Fi, BLE and ZigBee and for supporting device protocols to enable cameras, sensors & computing devices, GPS devices, Mobile devices and so forth.

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