Psychology Research, December 2019, Vol. 9, No. 12, 497-503
doi:10.17265/2159-5542/2019.12.002

Education System & Emerging Technologies

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The Internet has evolved from connecting people and later videos, photos, and text to more recently physical objects. Using sensors, physical objects can "talk" (transmit data) to each other and even command each other to perform a physical act. As things and people become more connected, such objects will also become part of social networks, much in the same way that people tag photos on Facebook. In this way, the value of such objects will increase for both research and learning. The IOT and Cloud computing technologies can provide solutions for the above mentioned problems in education system. Cloud computing enables users to control and access data via the Internet. The main users of a typical higher education cloud include students, Faculty, administrative staff, Examination Branch, and Admission Branch. All the main users of the institution are connected to the cloud. Separate login is provided for all the users for their respective work. Teachers can upload their class tutorials, assignments, and tests on the cloud server through which students will be able to access all the teaching material provided by the teachers via Internet using computers and other electronic devices both at home and college and 24X7. This paper focuses on the integration of Cloud and IOT for education system. Connected devices can help make life easier for students with special needs. Many of the daydreams for IOT in education involve students taking advantage of new technologies to complete cool new projects.

Keywords: the IOT and cloud technologies, education system, implementation

Introduction

The Internet has evolved from connecting people and later videos, photos, and text to more recently physical objects. Using sensors, physical objects can "talk" (transmit data) to each other and even command each other to perform a physical act. As things and people become more connected, such objects will also become part of social networks, much in the same way that people tag photos on Facebook. In this way, the value of such objects will increase for both research and learning (Sankpal, Kawalkar, Bhattu, Parnaik & Sagar, 2014).

The Education System is mainly moving around the books, exams, marks, and grades, where the creative learning lies far miles away. Teachers teach within the syllabus, students study that part only, which gives exams and it's all over! But change occurred by creative thinking and deeper thinking. Cloud computing is an exciting development in educational Institute. Students and administrative personnel have the opportunity to quickly and economically access various application platforms and resources through the web pages on-demand. Students in science classes might use RFID to tag sample specimens in the wild so they can take notes without leaving the classroom. Textbooks could be scanned to receive instant additional resources and

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assignments. Despite the fact the IOT is above all else about creativity, these common suggestions do not do it justice. Another way to understand the impact of IOT on education is through the use of sensors. For example, Super mechanical's Twine7 product—a small box described as "the simplest way to connect stuff to the Internet"—allows users to link almost any physical object to a local area network. Twine integrates sensors with a cloud-based service, allowing for easy setup. Just point Twine to a Wi-Fi network and sensors are immediately recognized by the web app, which reflects what the sensors see in real time. Even people with no knowledge of software coding can receive text and email updates on whatever items or environments the box is sensing. Figure 1 shows how the data from various sources are collected and stored in a cloud through sensors.

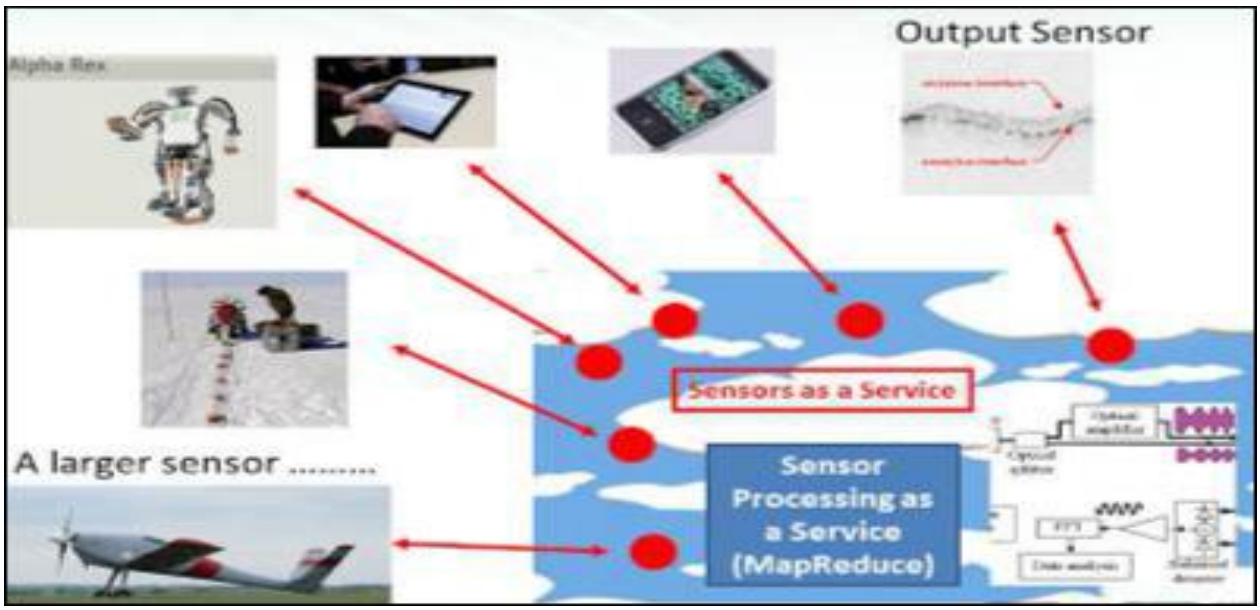

Figure 1. Bringing sensor data to the cloud.

The 2013 Horizon Report predicts that smart objects will become ubiquitous in higher education by 2017 and it happened truly. With such user-friendly technology like Twine already on the market, this may come sooner for higher education, and sensor kits will be used extensively in the future (Botta, de Donato, Persico, & Pescape, 2014).

Related Work

Need for Implementing the IOT and Cloud Computing

The two worlds of IOT and Cloud have seen an independent evolution. However, plenty of common advantage is the result of their integration, which has been identified in literature, to predict the future. On the one hand, the Internet of things can benefit from cloud almost unlimited capacity and resources to make up for the technical constraints. Specifically, cloud computing can provide an effective solution to realize management of Internet services and composition and use of things or data applications. Cloud computing can benefit from the Internet of things, on the other hand, by extending its scope to deal with things in the real world more distributed and dynamic way, and to provide new services on a large number of real life scenarios.

The four pillars of IOT create a need for an education system that empowers a new generation of digital citizens who understand the technologies that underpin IOT, the societal impact of widespread adoption, and

the right application of the information that is captured. Higher education programs must ensure that the next generation of engineers understands how to design and build technological systems that reflect our altered expectations of openness and participation. In the area of computer science, the challenge is in developing new forms of scalable education that accommodate large numbers of students around the world, attract potential students with various interests, and deliver an innovative curriculum that reflects the radical changes in computing technology.

IOT and Cloud computing technologies can provide solutions for the above mentioned problems in education system. Cloud computing enables users to control and access data via the Internet. The main users of a typical higher education cloud include students, Faculty, administrative staff, Examination Branch and Admission Branch. All the main users of the institution are connected to the cloud. Separate login is provided for all the users for their respective work. Teachers can upload their class Tutorials, assignments, and tests on the cloud server through which students will be able to access all the teaching material provided by the teachers via Internet using computers and other electronic devices both at home and college and 24X7 (Botta et al., 2014).

The education system will make it possible for teachers to identify problem areas in which students tend to make mistakes, by analyzing students' study records. In doing so, it will also allow teachers to improve teaching materials and methods. This will not only make it possible for students to use online teaching materials during class but they will also be able to access these materials at home, using them to prepare for and review lessons. Utilization of cloud computing systems will reduce the cost of operation because servers and learning materials are shared with other colleges. Many aspects of these services and tools may be migrated to the cloud and consumed directly over the Internet.

Implications of IOT in Education

Educational jurisdictions and institutions can no longer rely solely on their core competences and teacher knowledge. Instead, they must embrace—not prohibit—the devices that learners bring into the classroom and allow students to use them as learning tools to capture intelligence faster and accelerate learning.

The proliferation of mobile devices will also enable educational institutions to collect data to interpret a learner's behaviors and activities. Used intelligently, such data will result in personalized learning targeted to individual needs, learning styles, and aspirations. There are myriad uses for technology in education, but many are piecemeal and *ad hoc* with little informed thinking. IOT has the potential to integrate technology with learning in many ways.

The Four Pillars of IOT in Education

IOT in education is in the early stages, but some institutions are leading the way in showing how IOT can be used effectively in educating young people and the public at large. This section explores the impact each pillar has on education and what is needed to support, build, and scale some of the practices currently being planned or adopted.

People. Today, most people connect to the Internet using multiple devices and social networks. It is too soon to predict the channels people will use to connect to the Internet in the future—what is certain is that through such channels, people will be hyper-connected. The education sector must understand how people connect to the Internet to increase their learning and apply their knowledge as a result. Time to mastery will be

key knowledge gained today that will be used tomorrow. Those learners who thrive will stay current and ahead of the pack. In the words of author Alvin Toffler there will also be those who know how to "learn, unlearn, and relearn." Finding the right people with and from whom to learn will be crucial: As each individual becomes a "node" on the network, people will need to know how to connect, not just to the work of leading experts, but to peers who have similar passions and interests. In this way, people will share ideas, discuss research/the latest developments in their area of study, and develop increasingly connected communities of practice. Experts in a specific area will be sought to teach classes anywhere in the world, and sharing information via streaming or live video will become the norm.

The advent of open online courses like OEDB, COURSERA, EDX, Massive Open Online Courses (MOOCs) are another step toward global education. These are aimed at large-scale interactive participation and open access via the web. Some of the world's leading universities are making their top professors available free of charge, and online forums that are linked to MOOCs will become spaces for new networks to develop and grow, connecting people from all walks of life and giving education to those who do not have access to high-quality content or instructors in their own locale.

Process. Process plays an important role in how people, data, and things work together to deliver value in the connected world of IOT. With the correct process, connections become relevant and value is added because the right information is delivered to the right person, at the right time, in an appropriate way. Ensuring that young people have access to learning opportunities that meet their needs will make education more efficient, improve time to mastery, and motivate learners. Such opportunities will also increase student retention and the application of new knowledge, which is vital for future success in both work and society. Much value can be derived from feedback on a student's performance. For example, a learner studying 10th-grade geography could observe his or her ranking in real time against all learners studying the same level geography. The process could eliminate examinations used to measure and compare learners' performance and achievement. The model of measurement could be accurate at any moment in time, providing ongoing, targeted, and personalized feedback on what a learner must do to improve his or her understanding and performance (Botta et al., 2014).

Data. As things connected to the Internet evolve, they will also become more intelligent, thereby providing more useful information. Rather than just report raw data, connected things will soon send higher-level information back to machines, computers, and people for further evaluation and quicker decision making.

The implications of this in education are enormous. For example, as part of their studies, learners could tag physical objects, collect data about those objects, and then feed that information to other programs for analysis, improving the accuracy of their research. Learners could also access data from research initiatives, monitor programs on oceanography or climate change, or watch animals in their natural habitats via live webcams then collect data on their movements through sensors attached to the animals' bodies. The authenticity of such data will have a huge impact on learners' interests. Furthermore, collecting data remotely will also help people reduce their carbon footprints through fewer field trips.

Research has shown that access to real-time information and engagement with experts truly impacts learning. In addition to ensuring accurate research and working with and manipulating real data, learners could also contribute their content to data banks, becoming members of expert communities in various research projects—from climate change, species identification, and archaeology to more. Sharing datasets with others

around the world will enhance and extend students' learning experience, authenticating their research through active engagement with other researchers (Sankpal et al., 2014).

Things. Things are physical items that can be connected to both the Internet and people via sensors. Sensors give things a "voice": by capturing data, sensors enable things to become context-aware, providing more experiential information to help people and machines make relevant and valuable decisions. For example, smart sensors are being used today in bridges to monitor temperature, structural integrity, and traffic density in real time. In this way, students can learn physics using their portable devices to collect and observe the bridge at peak traffic times. Capabilities like these have huge implications for learning and the potential to help transform pedagogical practices. Imagine if things could talk to each other, forming a community of things—objects will exhibit certain behaviors based on stimulus from their surroundings. If things could share information that improves their functionality, sensors could be embedded into everyday items enabling them to upload information to the Internet.

In education, IP-enabled sensors could be attached to artifacts such as the Allosaurus skeleton to monitor temperature readings, condition, or location of the object in real time, providing a constant stream of information to archaeology or history students/departments. In research, there has never been a better way to study hard-to-reach animals than with sensors. The information can be made available to educators, helping them provide live data to learners to increase their understanding and update them on the latest findings and research.

Key Factors for Successful Implementation of IOT in Education

IOT has huge potential in education. Three main factors must be addressed to ensure widespread and successful adoption.

Security. IOT security will become an enormous issue across all markets—particularly in education. Without assurances, pervasive development of IOT will not take place across educational institutions. Information must be available—yet confidential—when needed, with the owner of the information deciding which people, groups, or organizations may have access to it. Embedded devices will lead to complex networks of people and things in both the public and private sectors. Such devices will likely create new relationships among people and computers. Balance must exist between understanding the positive impacts discussed in this paper and generating awareness about the risks to privacy and security. Both educators and learners will need to have a better understanding of ethical issues and the risks of IoE, as well as ways to mitigate those risks. Personal and communal data will need to be treated differently, and the individual's privacy will have to be respected.

Data Integrity. Integrity of data must also be assured, as well as its accuracy, authenticity, timelines, and completeness. Success will be predicated on an "open platform" that allows all partners to work together to use the same baseline technologies. Educators will need to work closely with government to ensure the development of IoE in education; at the same time, government must preserve the safety and security of its citizens.

Education Policies. Policies that encourage adoption of technology in the classroom and its effective integration into curricula are crucial. Such policies must include sound change management practices among educational institutions to reduce the barriers to technology adoption and increase its scale. Professional development programs for educators should incorporate IoE tools to encourage early adoption and help

educators develop innovative methodologies and appropriate pedagogies for the learning environment.

Applications of Cloud IOT Paradigm in Education System

By leveraging asset intelligence, educational organizations stand to see value added in the following areas.

Enhanced Learning Experiences and Outcomes

The pressure is on to prepare students for an increasingly competitive workplace in a hyper-connected world. With the IOT, institutions can improve educational outcomes by providing richer learning experiences and by gaining real-time, actionable insight into student performance. Whether it's a tablet they brought from home or a school-issued laptop, more and more student learning is taking place on wireless devices. These online lesson plans have the potential to feature highly engaging interactive content. However, they also have the potential to "crash" archaic internet networks. To prepare, schools must upgrade to secure, high-speed wireless networks that can accommodate bandwidth-intensive programs being run on a multitude of devices (Sankpal et al., 2014).

This investment will pay off in spades. With e-learning applications, students can work at their own pace, which allows the teacher to provide one-to-one instruction to those who need it most. Additionally, assessments can become more seamless, less manual, and time-intensive. Educators no longer have to grade every exam or feed Scantron sheets into a machine. Instead, they can spend time focusing on the learning activities that have the biggest impact on students. Finally, when connected to the cloud, these e-learning technologies can collect data on student performance, which can then be used to improve lesson plans in future years.

Improved Operational Efficiency

Educational institutions are comprised of many moving parts. In order to succeed in what they do, they must be able to keep track of students, staff, and resources, all while keeping costs in check. This is possible by leveraging enabling technologies that can easily keep track of people, assets, and activities. Previously elusive resources—such as projectors or lab equipment—can be equipped with RFID readers so that their hereabouts are visible at all times. Real-time visibility means teachers no longer have to spend valuable time looking for these items and can instead focus on more important tasks like teaching and planning curricula. Additionally, educators can monitor the condition of their resources in real time so that if need be, items can be replaced with minimal disruption to the school day. Tracking devices can ensure that students are accounted for in real time, minimizing time-consuming activities like recording attendance. With RFID-equipped backpacks, students can be automatically checked in as they board the bus. Similarly, the proliferation of smart ID cards and wristbands means students can be automatically marked "present" when they walk through the classroom door. With mobile computing solutions, operational roadblocks can be dealt with in real time. A maintenance worker who stumbles upon a broken vending machine can use a handheld device to notify school officials of the problem, der the parts needed, and/or request additional repair services—while in the field (Sankpal et al., 2014).

Safer Campus Designs

School officials are under increased pressure to ensure their campuses are safe. A surge in school emergencies over the last several years, along with the growing fears over bullying and violence, means it's more important than ever to keep students safe. The IOT's ability to track objects, students, and staff, and to connect devices across campus (es) brings a new level of safety to institutions.

A GPS-enabled bus system means that bus routes can be tracked, so that parents and administrators can

know where a given bus is at any given time. In addition to making the school journey safer for students (and a lot less stressful for parents), students can be notified when the bus is near their pickup location; no more waiting outside for a late bus.

ID cards and wristbands allow educational organizations to store the last-known location of a student or visitor, helping to ensure the right people are accessing the right areas on campus. They also enable cashless payments at the school cafeteria or campus store, which creates a more streamlined transaction and has the potential to discourage bullying and theft. Finally, the convergence of campus communications allows staff to react more quickly in an emergency situation. By connecting laptops, smartphones, and two-way radios, staff can instantly talk, text, or send an email to any other device in the network. For example, a security guard who spots a fight can notify teachers and administrators immediately, with one simple action. Now, help can come right away, and an escalation of violence can be avoided.

The IOT stands to dramatically change the way institutions operate, protect valuable assets, and enhance student learning at every level. In addition to the immediate benefits outlined above, educational institutions can harness long-term value from these technologies by analyzing the resulting data to better plan resource allocation, curricula, and safety procedures in the years to come.

Conclusion

There is tremendous value in connecting the unconnected with intelligent networks across education. This paper demonstrates the integration of IOT and Cloud and the potential impact on making education more relevant, engaging and motivating learners, and enabling faster time to mastery. However, to realize the benefits from connecting people, processes, data, and things, reliable connectivity and continuous access must be guaranteed. Additionally for IOT to be accepted, both policymakers and educators must be well-prepared not only to exploit, but also to understand potential risks.

Author

Ajit Singh is a teaching professional of Computer Science as well as an author. He has being teaching professionally for nearly 20 years, having begun his career at Patna University, India. He is particularly interested in writing academic research papers in the field of Computer Science.

References

Botta, A., de Donato, W., Persico, V., & Pescape, A. (2014). On the integration of cloud computing and internet of things. *A survey, Future Generation Computer Systems*. Retrieved from http://dx.doi.org/10.1016/j.future.2015.09.02

Sankpal, L. J., Kawalkar, A., Bhattu, S., Parnaik, G., & Sagar, A. (2014). Cloud computing in education system. *International Journal of Advanced Research in Computer and Communication Engineering, 3*(2).