Research and Design of the teaching platform architecture based on IOT

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Summary
In view of widespread application of Internet of things (IOT) in education, this paper analyzed the whole architecture of IOT. According to the basic architecture of IOT, a teaching platform architecture based on IOT was proposed and studied. Finally, the technical problems which should be faced through the process of widely application of IOT into educational practice were analyzed.

Key words:
IOT;Architecture;Teaching platform;Application

1. Introduction

Internet of things (IOT) is a network which combines all kinds of information sensors with the Internet. More and more attention is paid to the IOT after the Wisdom Earth of IBM, the Action plan of European Union and "Experience China" proposed by Jiabao Wen in 2009, which will bring another new informationization tide to information industry all over the world.

2. The definition of IOT

The definition of IOT was firstly put forward by the Massachusetts institute of technology in 1999. It is a network which connects things with the Internet through information sensors such as radio frequency identification (RFID) [1] and realizes the intelligent recognition and management. IOT is 'the Internet of things connected things', which is constituted by two meanings. Firstly, the Internet is the core and foundation of IOT. IOT is an expanded network based on the Internet. Secondly, everything is the client of IOT. All information interchange and communication among all things is classified as the IOT. It was pointed out by the International Telecommunication Union in its 2005 annual report that the objective of information and communication technology had developed from connecting anybody to connecting anything at anytime and anywhere. Furthermore, connection of all things forms the IOT [2].

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3. The basic architecture of IOT

According to data flow and process mode in the network, IOT can be divided into three layers: the apperception layer, the transport layer, the application layer [4].

3.1 The apperception layer

The apperception layer, also known as the information identification layer, bases on the two dimensional code, RFID and sensor to achieve object recognition and perception monitoring. The RFID [3] system identifies and collects the information of marker stored on the labels via radio frequency signal, sends the information to computer information management system, and communicates between the marker and computer. Among all objects labeled with markers, the objects have their own mutual perception ability and make information communication among different objects in their own local space.

3.2 The transport layer

The transport layer, also known as the network communication layer, accesses to IOT via the existing Internet, mobile communication network and satellite, which realizes the further processing and transmission of data. Data security is a core problem in the network communication of IOT. During transmission, data are vulnerable and could be changed. Also conflict, congestion and retransfer of data would happen. Therefore during data transmission, data fusion and safety control technology should be involved to improve fault-tolerance of the network and ensure the reliability of data. In the transport layer, a global and open identification standard using the Electronic Product Code [5] assigns a unique code for each object. The application of this unique code realizes the combination of RFID technology and communication network, which can transmit the aggregate information via the transport layer and realize to the objects trace and backtracking.

3.3 The application layer

The application layer, also known as the terminal transact layer, is control terminal of inputting and outputting, which includes computer, mobile phone and server terminal and realizes storage, mining, processing and application of information sent by the transport layer. IOT terminal has three parts: sensor interface, the central processing module and external communication interface. And the IOT terminal is the intermediate equipment of the apperception layer and the transport layer which is in charge of data receiving, processing and integration. It can identify the information of the marked objects which are monitored through information process, analysis and statistics and achieve ‘communication among things’. In the treating process, problems arise from the essential elements will prevent network terminal from collecting accurate and reliable information, which would further induce failure in ‘communication among things’.

4. Design of the teaching platform architecture based on IOT

4.1 Research of the teaching platform architecture based on IOT

1. Building intelligent teaching environment based on IOT

Building teaching environment based on IOT can connect the real world with the virtual world, which further effectively support human-computer interaction, human-things interaction and the social interaction among individuals. The introduction of IOT makes every object of learning environment has the characteristics of digitalization, networking and intelligentization. Integration of the virtual and physical learning environment promotes the process of information collection between the teacher and student and adjusts accordingly to supply intelligent teaching environment and resources. For example [6], the students’ computer screen brightness can be adjusted according to the light intensity if there is light sensor in the classroom. Students can also use computation equipment to read local or remote data from the sensor embedded objects for the current study in classroom.

2. Building virtual experimental environment based on IOT

The application of IOT can provide a virtual, shared and intelligent experimental teaching environment. For example, each experiment equipment has digital properties and use descriptions. When the experiment equipment is incorrectly used, alarm system starts automatically. The experimenter can telecontrol laboratory equipment connected to IOT in another place. For example, teachers can control teaching equipment in the remote laboratory at any time in the process of teaching and real-time display the experiment process and results in class teaching through the network video equipment. The students can also real-time control the remote equipment and get the right results of the experiment.

3. Building open teaching management system based on IOT

Using support from RFID core technology of existing IOT, the RFID tag is assigned to every student during establishing the teaching management system. With this tag teacher can use IOT system and automatically analyze the students’ study information. For example [6], the teaching management department can use RFID technology to analyze the students' learning and attendance situation, which helps students work offices to develop the ideological and political work accordingly. Furthermore, flexible study model based on IOT also can be established. Based on the characteristic of the integrity and the traceability of IOT information, students can modify or complete the study of a certain course according to their own study plan at any time, choose teaching from a certain teacher at any time. Also students can connect to the online examination system and finish the test during the exam. At the same time, IOT provides support environment for students' regular networking study, amateur study and cooperative study, and expands the learning space with rich resources, and helps students' independent study which will meets the need of students’ individualized study. Students can explore any interested problems and solve them via IOT.

4.2 Design of the teaching platform architecture based on IOT

According to the fundamental architecture of IOT and the research of teaching platform architecture based on IOT, the new teaching platform architecture based on IOT can be further subdivided into perception equipment, access unit, access network, middleware and application(Figure 1).

Perception equipment consists of all kinds of sensors, data collection equipment and wireless sensor network.

Access unit includes data terminal equipment which can transmit data from sensors directly to communication network and IOT gateway equipment which can connect wireless sensor network and communication network. Strictly speaking, IOT gateway should be an equipment of crossing the perception layer and the transport layer.

Access network refers to the existing communication network, including 2G/3G and cable broadband, etc.

Middleware is the platform system which provides the basic public service ability for IOT application.

The application layer is various kinds of teaching application based on IOT, including virtual experimental

environment, online learning, online examination and online homework submitting and so on.

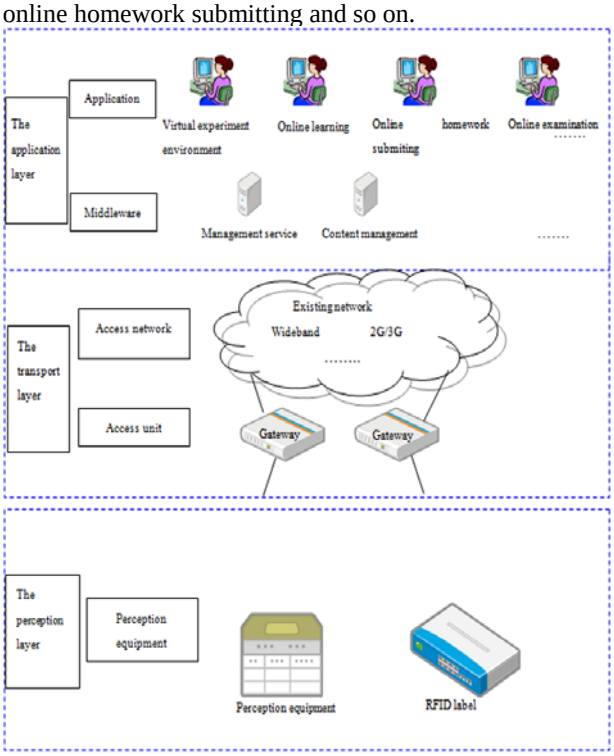

Figure 1 The teaching platform architecture based on IOT

5. The problems need to be solved

Although IOT makes for forming multiple, innovative products and application in the teaching process, there are still many problems to be solved for its widely application in education practice at present.

5.1 Formulation of data exchange standard in unified HTML type

Without data exchange standard in unified HTML type is still the bottleneck of IOT. The main problems of IOT are the problem between data expression, exchange and process standard and the middleware architecture of application support. At present a lot of standards have been raised, such as the ONS/PML standard system from EAN and UCC, NGTP standard protocol and the software architecture from information communication industry and M2MXML, EDDL, BITXML, oBIX and so on. Many standards for sensing layer data format and model have been established too, such as TransducerML, SensorML, IRIG, CBRN, EXDL, TEDS, etc. At present, the challenge in front of us is how to integrate these standards and realize a data exchange integrated application standard for a unified HTML type IOT.

5.2 Assurance the privacy safety of the teaching application

Association between individuals, teaching equipments and individuals with teaching equipments becomes more and more intensive after the application of IOT in teaching process. Extensive utilization of information acquisition and exchange equipment greatly expands the amount of teaching information collected. However, it is still a problem need to be solved that which information is the privacy of the teachers and students and should be protected among these massive data.

5.3 Cost problems of IOT in the teaching application

IOT uses RFID, which core is the chip. At present, the chip used in the teaching platform based on IOT is still very expensive. To effectively solving this problem, we need to enhance the technical level and reduce chip cost gradually.

6. Conclusion

At present, IOT has already caused the great attention from the industry, education and other fields. The application and development of the teaching platform architecture based on IOT is not only a technical problem. It involves many respects. The author expects this paper could provide some useful help for the researchers and educators who are concerning IOT teaching.

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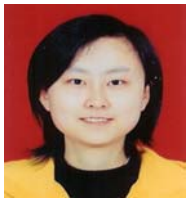

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