

## Research on Mobile Learning Model Based on Internet of Things

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**Abstract.** With the rapid development of the mobile technology, mobile learning has been widely used around the world. Through using the technology of Internet of things, analyzing the relevant learning theory, aiming at the problems of learning and combining with unique advantages of the mobile learning theory, this paper constructs the mobile learning model in order to improve the effect of mobile learning for learners and meet their needs of exchange and cooperation and personalized learning.

### Introduction

Nowadays, the traditional education way, such as classroom education and network education, has not been able to meet the increasing demands of the learners because of its multiple restrictions on the place, time and equipment. With the rapid development of the mobile computing technology, a new way of learning comes into being, which is mobile learning [1]. Based on the study of digital learning, mobile learning can effectively combine with mobile communication technology to achieve learning anytime and anywhere. With mobile learning being mobile in form, being interactive in content, and being digital in the way of implementation, learners in an open learning environment can freely access to knowledge, and enhance their capacities of learning.

### Internet of Things

The Internet of things [2] refers to a network which collects any objects or process in real time for monitoring, connecting, and interacting by using the technology of sensor, RFID, GPS and so on, and gets information about their physical, chemical, biological and location, and achieves the links between things and things as well as between people and things through a variety of possible network access, and realizes intelligent perception, identification and management of goods or processes. The Internet of things has been applied in many areas, such as intelligent transportation, culture and education, environmental protection, public safety, home safety, which has greatly changed our lives and work.

In the field of education in China, the new curriculum reform puts forward "give full play to the advantages of information technology, advocate students to conduct autonomous, cooperative, inquiry learning, reform teaching contents, teaching methods and interaction ways between teachers and student, and provide rich and colorful education environment and strong learning tool for students' learning and development requirements", which provides great support for the application of the Internet of things in the field of education in China.

## **Mobile Learning Based on Internet of Things**

Mobile learning applications based on Internet of things[3], are to build a mobile learning environment with the Internet of things. By adopting the sensor, RFID, M2M, connection point, base station and other related technologies, the mobile learning devices are connected to the learning resources, so that a number of interactive exchange can be achieved, and learning breaks through the barriers of time and space, the interactive activities between teachers and students are strengthened, as well as are strengthened between students and students. This new type of network teaching way not only can be used for teaching in the classroom to complete effect evaluation, real-time problem solving, voting and other auxiliary activities, but also support having an outdoor life and learning for the learners, especially for context awareness learning. The development of mobile learning based on Internet of things has completed the seamless connection between study and life, which is conducive to the development of students' creative thinking ability and interactive ability, so that it can be used as a way to realize lifelong learning.

The application of Internet of things in mobile learning has been studied by scholars at home and abroad. Two key technologies of the Internet of things, that is, the sensor and electronic tag, which can provide enough support for mobile learning, there are cases in this area. The use of a learning way needs to adapt to the learning theory, so the use and research of mobile learning should be guided by the learning theory.

A blended learning model[4]is the development trend of future learning, which selects and combines all elements of learning (learning styles and strategies, learning resources and Technology) reasonably, and can optimize the learning effect. Mobile learning under the Internet of things presents a variety of learning models, yet they are different from the ordinary blended learning model. At present, the study on the blended learning model of Internet of things is not much, literatures is also very rare both home and abroad.

In the following we construct the blended mobile learning model based on Internet of things in order to explore a systematic way of learning “students- mobile terminal – things of internet - study and evaluation”, to build a platform to make learners more convenient to learn with the Internet of things, to provide practical experience for the improvement of mobile learning way, to promote the rapid development of mobile learning, to provide a theoretical basis for the deep development of the Internet of things.

### **Context Awareness Learning**

By using RFID tags, sensors and other intelligent sensing devices, mobile learners use the wireless communication to learn at any time and any place, integrating into real life environment.

the context awareness technology [5] is an important foundation for the realization of interpersonal context interaction and relationship between people and things, which is used to monitor the environment around the learners and perceive the learners' emotional health status and get information about the learners' interests, hobbies, etc. by means of the RFID and sensor technology.

Context awareness being applied in classroom teaching of physics, chemistry, botany, animal science, and etc., learners can have a close interaction with real environment in the process of learning with a sense of immersion, and easily access to learning information leading to improving the learning interest and learning efficiency for themselves.

In foreign language learning, the interactive learning environment of context awareness offers the language learning environment for the two parties or multiple parties to participate in the exchange. The foreign language learning platform based on Internet of things can make the interaction between students and the other end of the network to carry out a real communication practice, the computer converting the students' sound language and body language, emotion and so on to the system image, sound and students' state.

### Application Scenarios of Mobile Learning Based on Internet of Things

Mobile learning based on Internet of things can be applied to the intelligent classrooms [6], laboratories, libraries, museums, zoos, botanical gardens and other real environment, application scenarios of mobile learning based on Internet of things are shown in Fig. 1.

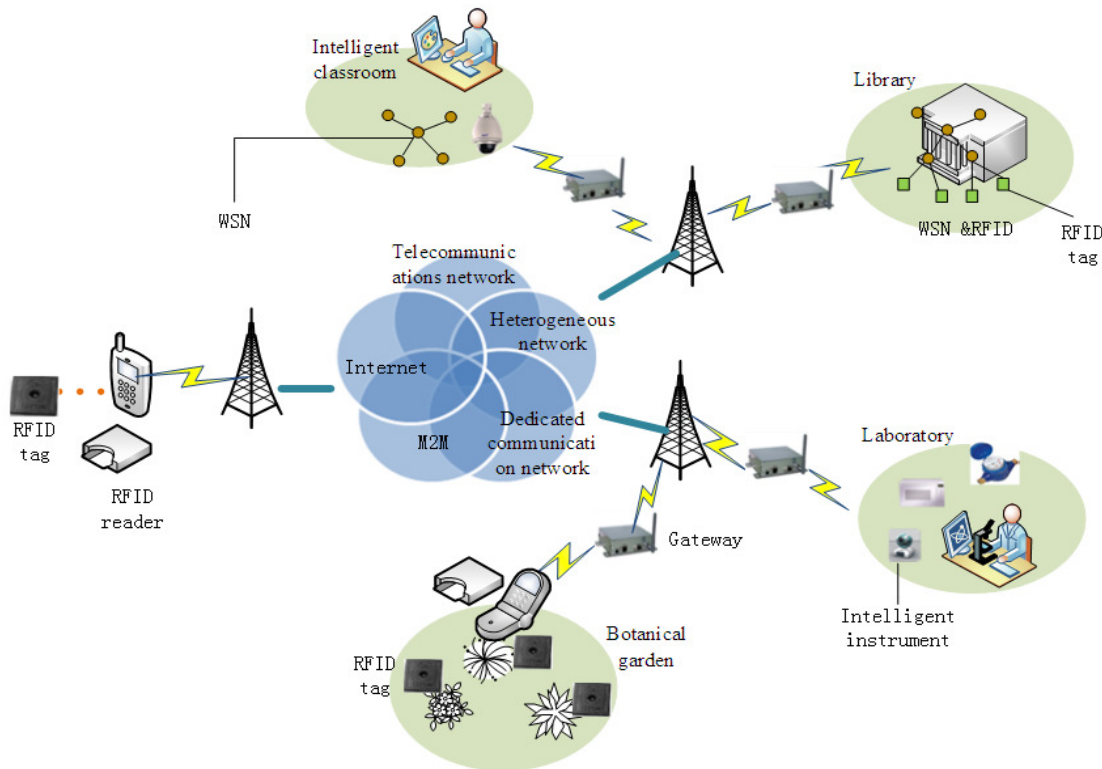


Figure 1. Several application scenarios of mobile learning.

For different application scenarios, the learning process is not the same. Each Learner can study anywhere and anytime by using a mobile phone with a RFID readers, customize the learning plans and customize the learning contents for autonomous learning in the intelligent library, and remotely operate the intelligent devices in the intelligent laboratory deployed by smart sensors, moreover, interactive learning of context awareness can be carried on in an intelligent classroom, while it is in the museum, zoo, botanical garden, etc. that according to the situation of learners learning can be recommended by the RFID tag. Intelligent sensors in intelligent learning environment can be divided into two categories: one is the emotional health sensors, including smart watches sensors, temperature sensors, and pressure sensors which realize the function of the thermometer, barometer and altimeter, and acceleration sensor and voltage sensor which can perceive student's quiet degree and concentration degree and realize the interaction feedback based on the student gesture in the classroom. The second

is the environmental sensors, including light sensors, IP cameras and audio sensors. Among them, the light sensors can control the lights on each seat to meet everyone's specific needs and emotional needs, while the IP cameras and audio sensors monitor the environment as well as analyze the subtle facial expressions and voice with the fine video and audio, which is provided for emotional management application module to analyze and generate positive feedback. The data from these sensors are transmitted to the gateway via WiFi/Bluetooth, and then applied to the intelligent environment.

### Construction of the Mobile Learning Model Based on Internet of Things

With Internet of things technology, using wireless communication network and the existing WIFI network, and mapping the related demand to specific functional modules, a hierarchical structure model of mobile learning based on Internet of things technology is constructed, of which the basic framework is shown in Fig. 2.

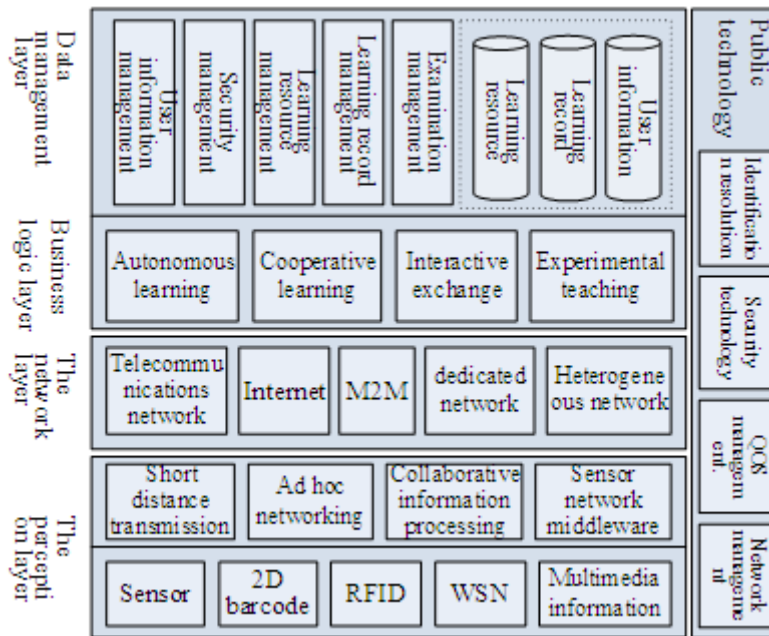


Figure 2. Mobile learning model based on Internet of things.

The model is composed of four layers, which is the perception layer, network layer, business logic layer and data management layer from bottom to top. Internal modules of each layer work independently and cooperate with each other, which jointly offer technical support for mobile learning of learners. The functions of each layer are described as follows:

(1)The perception layer

The perception layer includes sensors, RFID tags, 2D barcodes, wireless sensor networks, and electronic product codes(EPC), which is used to implement intelligent identification, information collection and automatic control for the physical world, and connects physical entities to the network layer and the application layer through the communication module.

(2)The network layer

The network layer mainly achieves the transmission of information, routing and control, such as the extension of the network, access network and core network. The network layer

can rely on the public telecommunications network and the internet, can also rely on the dedicated communication network.

### (3)Business logic layer

The business logic layer is used to accept the application request of the perception layer, and select learning services for information processing, and carry out computing services, including multiple learning modules and effect evaluation modules, between which information and data can be exchanged.

In order to satisfy the learning needs of learners, the learning model adopts the blended mobile learning model, which includes autonomous learning, collaborative learning, interactive exchange and experimental teaching. it is the combination of Internet of things technology and the mobile learning theory that improves the effect of learners' mobile learning and meets the needs of learners' exchange and cooperation and personalized learning.

① Autonomous Learning: with the RFID tag, GPS chip and mobile phone map on the mobile terminal equipment, the module can monitor the learners, identify learning environment, and perceive mobile learning surrounding for the learners real time. At the same time the module supports the learners' request of customized learning to customize interface, content, and remind services, reminds the learners of learning at the appropriate time and the place, and pushes the learning resources actively to the mobile learners to meet their needs of personalized learning.

② Cooperative learning: learners can be divided into several learning groups according to their own wishes. Although the cooperative group is spontaneous and loose, learners in different regions participate in the study to discuss learning together. Teachers can also organize discussions, monitor the process of collaborative learning, evaluate the effects of collaborative learning, and can effectively guide the learners when the learners are unable to achieve their learning goals through collaboration or self-learning.

③ Interactive exchange: when a learner is interacting with a teacher, the teacher can answer the questions in the process of learning timely, can also timely adjust the learning plans and learning contents, and take the pertinence measures of teaching in terms of the feedback information of the learner.

④ Experimental teaching: a learner can use a mobile device to display the experiment scene, and can remotely control, operation the related instruments and equipment in the experimental field to achieve ubiquitous connectivity between people and things, to achieve the experimental operation and processing of experimental data, etc. through Internet of things, to complete various scheduled experiment projects.

### (4)Data management layer

The data management layer is used to provide users with data sources, including user information management, security management, learning resource management, learning records management and examination management.

The user information database is used to record the unique information of the mobile learners and their basic information, including test scores, ability growth and other achievements, interest preferences and other user information. The learning resource database is used to store a large number of optimized learning record information for mobile learning, courseware resources, examination questions database, knowledge base, and related system operation data, etc.

## **Conclusions**

Mobile learning based on Internet of things is an extension of traditional mobile learning and will be a good development prospect, which can make learning come into real life. This paper constructs the mobile learning model based on the Internet of things, which provides a convenient and effective learning platform for the mobile learners. Taking learning experience of the mobile learners as the center and providing wireless communication, abundant learning resources, effective exchange and collaboration, the model improves the effect of mobile learning for the learners to a great extent and meets the learners' needs of the personalized learning.

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