

Research on WSN Teaching Model Based on Competition Project

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Abstract. With curriculum reform of the IoT (Internet of Things) engineering profession in agricultural colleges and universities, the professional core curriculum of "Wireless Sensor Networks (WSN)" teaching reform has become a research hotspot of teachers. We focus on the service for the application of large agricultural areas, the reasonable curriculum arrangement, and innovative the experiment content, improve the teaching effect, and introduce the diversified assessment. We organize students to participate in various professional competition and improve students' interest in learning, cultivating practical ability and innovative spirit, so as to deepen the impression about the understanding of theoretical knowledge. After the teaching practice at two grades students, the result of practice has proved that the project-driven teaching model plays a very good effect.

Introduction

On November 17, 2005, held in Tunis, the World Summit on the Information Society (WSIS), the International Telecommunication Union (ITU) released the ITU Internet Report 2005: "the Internet of things ", the English referred to as IOT.

Things can be the network physical world and information of human existence, the separation of the physical world and information space Internet integration, represents the development trend of future network. IBM believes that the IT industry in the next phase of the task is to make full use of the new generation of IT technology in all walks of life. Specifically speaking, IoT is to embed sensors in the power grids, railways, bridges, tunnels, highways, buildings, water supply system, dams, oil and gas pipelines, and other facilities [1].

In 2010 year, the Ministry of Education of China issued a notice to declare that the IOT professional becoming a new professional in the universities, and thirty-three universities enrolled new students of this professional. Tianjin Agricultural University (hereinafter referred to as "my school") on 2013 formally was approved to establishment the undergraduate professional, named "Engineering of IoT", and the enrollment is sixty every year.

The main technologies of IoT engineering include three apartments, Wireless Sensor Network (WSN), Radio Frequency Identification (RFID) and cloud computing. Specially, the WSN is the key technologies, as the emerging next generation network. The WSN is considered one of the most important technology in twenty-first Century [2].

As a new professional content of WSN for the students of "Engineering of IoT", the teaching methods, experimental project content, teaching mode and so on, are doing in an exploring process to many agricultural universities. We first taught this course in 2014. With some practice and exploration of the course, we have achieved a certain experience.

Course Teaching Situation and Problems

"Wireless Sensor Networks" course is a complicated content, relates to wireless communications and networking, embedded principle and technology, the principle and technology of sensor^[3]. So

teaching this course for the undergraduate students is a great challenge. Because of the following aspects:

Lack of Suitable Textbooks for Agricultural College Students

In recent years, many colleagues have write relevant teaching textbooks, which mainly includes several parts as follows: wireless self organization network theory, wireless sensor network architecture, routing protocol, MAC layer protocol, positioning technology, time synchronization technology, wireless network security, etc.. These contents are difficult to understand for the agricultural college undergraduate students.

Lack of Uniform Standards of Experimental Equipment

Because most IOT experimental equipment companies have been set up in recent years, there have been a variety of experimental platform[4]. For example, some experimental platform use CC2430 chip as the experimental basis of ZigBee network, others use CC2530 chip as the experimental basis of ZigBee network, etc. Experiment platform, development environment, technical standards are not unified, and the experimental equipment is not perfect. This situation has brought many difficulties for the WSN teaching process.

Lack of Professional Teachers

The apparent lack of professional teachers, especially in agricultural colleges.

Combined the Agricultural IoT, Determine the Teaching Content Reasonably

The agriculture IOT mainly refers to using of the wireless self-organized network and wireless sensor nodes which collected the real-time environmental information to determine the environmental conditions and variations of parameters.

In the field of agricultural environment monitoring, wireless sensor network has the advantages of other technologies specially.

Main Application of Agricultural IoT

China is a large agricultural country. Using the networking technology to solve the "three rural issues" is a good opportunity and undoubtedly. Networking applications in the field of modern city-agriculture includes: monitoring for irrigation of crops, livestock and poultry environmental conditions, soil and climate change, collecting temperature, wind, humidity, atmosphere, rainfall, soil moisture, soil pH, and science to predict, help farmers disaster reduction, disaster, scientific planting, and improving agricultural comprehensive benefits.

Teaching Content and Class Distribution

The WSN course of our school is processing at the second semester of the second school-year. This course has 24 class-hours of theoretical teaching and 8 class-hours of experimental teaching. It's pre-courses including "computer network", "C++ program design". How to use the limited class-hours enable students to master the knowledge is the goal and direction of content and experimental curriculum reform of our project content.

In order to create the establishment of undergraduate agricultural professional networking knowledge system, we carefully designed the experiment-item teaching contents. The content of experiment- item is shown in Table 1.

Table 1. Experiment-item Teaching Contents.

Chapter	Content	Class-hours
1	The wireless sensor network and its application in the field of Agriculture	2
2	Fundamentals of wireless communication and wireless networks	4
	The wireless sensor network architecture and protocol stack	2
	Brief introduction of positioning technology, time synchronization and security technology	2
3	CC2430\CC2530 and the commonly used micro sensor	2
4	IAR Embedded Workbench for 8051 installation and use	2
	Software development environment and emulator	2
5	Light water program principle	2
	The timer program principle	2
	The temperature sensor data acquisition program principle	2
	Control relay program principle	2
Exp 1	Water- lights, buttons to control water- lights	2
Exp 2	The use of timer T1	2
Exp 3	The use of temperature sensor DS18B20	2
Exp 4	Relay module	2

An Example of Competition Project

In recent years, in order to improve the students' ability to adapt to the society, the education departments and companies have organized IoT application competition of innovation design and competition [5].

In November 28th of 2015, the third session competition of the Tianjin City College Student Iot innovation about engineering application and design contest was opened at Tianjin Agricultural University. The major theme of this competition was "Things change world, innovation achievements dream". The competition was sponsored by the Tianjin Municipal Education commission.

Contents

Here, we gave an example of competition project which named "Underwater video & image monitoring system for fish based on WiFi wireless network". The major function of this project include video(or images) acquisition by a waterproof camera, video-data communication by WiFi modular and serial port, digital images process by a personal computer(PC), the design and development of the upper computer software, etc..

The hardware include a system on chip (SoC) of RE5330f, a normal USB Web camera, a WiFi protocol router, and a personal computer with the Windows 7 operating system. The software of development environment include QT4.8, IAR Embedded Workbench 8.1, Serial port to USB translator, Dreamware CS6, MySQL and phpMyAdmin for PHP5.3, and Apache etc..

Measures

Due to the limited class-hours of the experiment, only by the experimental class-hours to cultivate students' proficiency in sensor network programming was not realistic. Therefore, the agriculture IoT laboratory was opened for the IoT engineering professional, with a special experimental teachers guidance and answering, to provide students with practical ability of hardware conditions and the software develop environment of the competition project.

In order to improve students' practical ability about system design and development, a project-develop team was established just as a workgroup of the competition project. In the process of project implementation, each team members to complete its own task. On the other hand the need

of communication or coordination with other team members to complete the overall function of the project implementation were solve by the stage-leader of the team. In the end of the project, each member of the team had to written a detailed report and summary report about the project.

Development Process and Awards

The design and development of the competition project took a total of 3 months, from August to October, 2015. First month, we completed the design of whole system. In this stage, one student member of the team was specified as the leader of the team, and the important software for system design was PowerDesigner 16.5. Next month, we completed the embedded code of the hardware which was called "System of Chip". The majorly chip model is RE5330f. In this stage, another student of the team was specified as the leader of the team, and the important software for firmware program was IAR Embedded Workbench 8.1. Last month, we developed the upper-computer application system which was called "Fish behavior real-time monitoring system by WiFi network". The tool of development software was DreamWare CS6, MySQL and phpMyAdmin for PHP5.3, and the software for internet information service was Apache3.1.

After more than 3 months of hard work, the competition project won the three prize at the city-level, third session competition of the Tianjin City College Student IoT innovation about engineering application and design, 2015.

Summary

"Wireless sensor networks (WSN)" course is a very practical course. We have improved classroom teaching content, enriching the teaching methods, to improve the teaching effect, stimulate the students' interest and enthusiasm in learning. Our students not only to consolidated the learned professional knowledge but also improved the application ability and innovation ability.

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