SYNERGY PUBLISHING PTE. LTD.

Modern Electronic Technology
https://ojs.s-p.sg/index.php/met

REVIEW

Smart Classroom Design on the Basis of Internet of Things Technology

Lei Zhang*

Zhongkai University of Agriculture and Engineering, Guangzhou, Guangdong, 510225, China

ARTICLE INFO

Article history
Received: 16 November 2018
Revised: 29 March 2019
Accepted: 8 April 2019
Published Online: 16 April 2019

Keywords:
Internet of Things technology
Smart teaching base
Design
Realization

ABSTRACT

Internet of Things technology is a new type of network technology emerging in the new economic era. It has played a good role in various industries and provided new opportunities for the reform and optimization of the education industry. This paper takes the intelligent teaching base on the basis of Internet of Things technology as the research object, introduces the connotation of the wisdom teaching base with reference to relevant literature materials, analyzes the research background of the wisdom teaching base on the basis of the Internet of Things technology, expounds the design method of smart teaching base on the basis of Internet of Things technology, and analyzes the function realization and application of intelligent teaching base on the basis of Internet of Things technology.

1. Introduction

In the early 21st century, China's leaders regarded the Internet of Things as the key point of China's industrial development, providing a basis for the large-scale promotion and application of Internet of Things technology. The education and teaching platform on the basis of the Internet of Things technology is mainly through the design of the wireless communication module, and the original education and teaching base as the platform for the organic integration of product development and experimental teaching modules. Through the design and operation of the intelligent teaching base on the basis of the Internet of Things, the development efficiency of the overall education industry in China can be effectively improved. Therefore, it is very important to conduct an appropriate analysis of the intelligent teaching base on the basis of the Internet of Things technology.

2. Overview of the Smart Teaching Base

The Smart Teaching Base, also known as Smart Classroom, Future Classroom, etc., is an important component of the Smart Campus solution. The smart teaching base is an enhanced education and teaching base. It can realize the intelligent regulation and control of audio-visual equipment and seamless access of resources through the application of high-tech software and hardware equipment, which provides a basis for the improvement of overall classroom education and teaching management efficiency.

**Corresponding Author:*
Lei Zhang (1983),male, master degree, experimenter;
Correspondence address: Zhongkai University of Agriculture and Engineering, No. 388, Guangxin Road, Baiyun District, Guangzhou, Guangdong, 510225, China;
E-mail: zhanglei3563425@163.com.
Research direction: information security, food safety traceability, agricultural Internet of Things;

 DOI: https://doi.org/10.26549/met.v3i1.1221

3. Research Background of Smart Teaching Base on the Basis of Internet of Things Technology

Under the background of IBM's concept of smart earth, relevant professional scholars in China have further explored the construction of "smart teaching base" on the basis of Internet of Things technology. For example, Jian Yan, et al. proposed the overall design policy and layered design method of the campus Internet of Things infrastructure; Yonghua Zhou, et al. proposed the use of advanced information technology such as the Internet of Things to build a "smart teaching base" overall solution. [1,2] The above scholars' comments and elaboration of the "smart teaching base" research theory laid a solid theoretical foundation for the construction of smart teaching base on the basis Internet of Things technology.

4. Smart Teaching Base Design on the Basis of Internet of Things Technology

4.1 Principle of Smart Teaching Base on the Basis of Internet of Things Technology

The smart teaching base on the basis of the Internet of Things technology mainly uses the PLC controller as the terminal control module. Through the temperature, illumination detection, infrared detection, humidity data acquisition and wireless receiving signal acquisition, the internal data information of the teaching base can be obtained. Then, using the Internet of Things technology, the basic environment facilities such as lights and curtains in the teaching base can be automatically adjusted. Such as lighting energy control, automatic temperature and humidity adjustment, safety monitoring and warning, curtains opening and closing.

4.2 Physical Structure of Smart Teaching Base on the Basis of Internet of Things Technology

From the physical level of analysis, the smart teaching base on the basis of the Internet of Things technology mainly includes three modules: the sensing control layer, the information transmission layer, and the practical application layer. The sensing control layer can be further divided into an intelligent controller, a teaching base controller, and other types of sensors. The intelligent controller is the main channel for the transmission of the main control equipment and auxiliary equipment information of the whole teaching base; and the teaching base controller and intelligent sensor are the main basis for the self-control of the education and teaching base.

The smart teaching base transmission layer on the basis of the Internet of Things technology mainly uses the wireless LAN as a channel to interact with the application layer servers for effective data information.[3]

The smart teaching base application layer on the basis of the Internet of Things technology mainly realizes real-time sharing of data information of each teaching base controller by using the wireless LAN technology in each teaching base by setting the smart teaching base server.

4.3 Design Goals of Smart Teaching Base on the Basis of Internet of Things Technology

The smart teaching base is designed to transform the education and teaching base into a comprehensive self-control system on the basis of the use of Internet of Things technology and intelligent equipment under the premise of multimedia classrooms and professional training classrooms. Firstly, in the design process of the conventional hardware setting, it should be ensured that the smart teaching base has an electronic whiteboard, a short-focus projector, a physical exhibition stand, a wireless microphone, a smart processor, a high-definition digital television, an audio device, an electronic school bag and the like.

Secondly, in the process of setting up the internal environment of the teaching base, the internal temperature of the teaching base should be controlled by the Internet of Things sensing technology to be around 22.0-25.0 °C; while in the teaching base, the lighting and power lighting design module can use the FRID technology to set the intelligent adjustment of light intensity. .

Finally, in the teaching internal teaching resource transmission module, the smart teaching base on the basis of the Internet of Things technology should have the FRID embedding device inside, so that the PC teaching information of the course teaching staff can be automatically transmitted and displayed.

4.4 Design of Smart Teaching Base on the Basis of Internet of Things Technology

Firstly, the human body position detection mode is set. The human body position detection is the main component module of the smart teaching base intelligent sensing device. It can timely adjust the lighting, electric fan and other devices through the analysis of the distribution information of the personnel inside the teaching base. Considering the construction cost and control efficiency of smart teaching base, in the process of setting the human body position detection mode of the smart teaching base on the basis of the Internet of Things technology, the sin-

DOI: https://doi.org/10.26549/met.v3i1.1221

gle bus mode can be adopted to divide the overall human body position detection mode into a detection module and a main control module, and the two are in the form of a single bus serial networking. The main control module mainly includes a single bus interface unit, an infrared detection unit, a ZigBee wireless transmission unit, a main control unit MCU and the like; the detection module mainly comprises two modules: an infrared detection unit and a single bus interface unit.

In the actual operation process, the main control unit MCU can collect the infrared detection unit operation data through the single bus interface unit. And through the ZigBee wireless transmission unit and the internal functional equipment of the teaching base for information exchange. During the operation of the main control unit, the infrared detection unit could timely sense the number of people gathered in each area of the smart teaching area; and the single bus interface unit can build an efficient information interaction channel between the main control module and the detection module.

Secondly, in the lighting control module, Chinese scholars have done a lot of research and development. For example, the design of Lang Zhou, et al. has realized a device on the basis of the Internet of Things technology to accurately identify the movement and static characters in the teaching base to control the on/off of the lights, and effectively realize the intelligent control of the internal lighting of the teaching base.[4] According to the changes in the internal use of the teaching base, the internal lighting control methods of the teaching base have also changed. Therefore, in the process of setting up the lighting control module of the teaching base, the multi-level stereo teaching base lighting control model can be constructed by combining the human body detection sensor distribution mode to realize the intelligent remote control of the internal lighting of the teaching base. The teaching base will be divided into several modes: examination, self-study, idle, and class. Using the policy control mechanism, the overall control strategy is set to: control strategy = ({teaching base, time period, use, control method, week})

The teaching base control method is mainly: control mode = (automatic control / semi-automatic control / full open / full closure)

In the "automatic control" mode, the internal lighting device of the teaching base will automatically adjust according to the illumination level of the teaching base and the location of the crowd; In the "semi-automatic control" mode, the teaching base lighting device can open the manual intervention channel in the terminal control module button unit on the basis of the terminal control, so that the distribution base of the teaching base can be reasonably adjusted according to its own needs; In the "full open" mode and the "full closure" mode, the internal lighting devices of the teaching base are located in the manual control module, and the terminal automatic control module cannot intervene. That is, the user can manually define the lighting control according to changes in the internal use of the teaching base. For example, for a long-term idle teaching base, it can be set to a "full closure" state.

5. Realization of Smart Teaching Base on the Basis of Internet of Things Technology

5.1 Composition of Smart Teaching Base on the Basis of Internet of Things Technology

Smart teaching base on the basis of Internet of Things technology mainly includes lighting distribution and remote alarm indication, control panel and sensor display, module display and other aspects. The lighting distribution and remote warning indications of the teaching base mainly include different types of indicator lights, such as light warning instructions; The control panel and sensor display mainly include several modules such as photosensitive sensor, nine-key panel, wind control panel, infrared sensor, multi-function touch screen, temperature and humidity sensor; The module display mainly includes several modules such as AC touch device, relay and PLC control device. The above modules can be connected to different types and color wires to realize the full circuit control of smart teaching base.[5]

5.2 Function Setting of Smart Teaching Base on the Basis of Internet of Things Technology

The smart teaching base function module on the basis of Internet of Things technology mainly includes networking functions, security anti-theft and remote warning of teaching base, automatic distribution and control of teaching base lighting, environmental monitoring and self-adjustment of teaching base. The networking function module mainly uses the network communication port in the terminal PLC controller to perform reasonable setting of the controller and the computer server in the same network segment of the same router. Combined with the mobile smart terminal touch screen application, effective network transmission is realized. During the operation of smart teaching base, the teaching staff can use the mobile intelligent terminal or computer server to control all network interfaces to ensure the smooth progress of classroom teaching.

The security base and remote warning of the teaching

 DOI: https://doi.org/10.26549/met.v3i1.1221

base are mainly through the reasonable setting of the door closing and arming function. If there is no light in the teaching base area or the door and window are opened without any reason, the remote control can be closed by computer software. If there is an illegal intrusion in a time other than classroom teaching, the computer terminal server and the intelligent terminal will also have an alarm message, so that the staff at the teaching base can be informed in time.

In the operation process of the education and teaching base on the basis of the Internet of Things technology, the terminal control module can perform independent power control on all lighting devices in the teaching base according to a preset program. And automatically open and close according to the standard of work and rest. At the same time, according to the internal illumination of the teaching base, the curriculum, the work schedule and the number of people, the system terminal control module can also monitor the running status of each lighting device in real time, and transmit the relevant information to the intelligent control terminal via the internal network of the teaching base, so as to ensure sufficient lighting supply and lighting energy management effects. In the teaching base lighting self-distribution and control module, according to the scope of education and teaching base and the number of people, different control modules can be used. For an education and teaching base with a large scope and a large number of people, the number of people can be controlled by sub-regional control. For an education and teaching base with a small distribution area and a small number of people, a static human body induction centralized control method can be adopted. Through the application of different control methods, during the normal operation of the teaching base, the system terminal control module can effectively determine the lighting information of each module and reasonably adjust the internal light intensity and strong illumination area of the teaching base.

The environmental monitoring and self-regulation of the teaching base mainly consists of setting different types of sensing elements inside the teaching base, such as temperature and humidity sensor elements, infrared sensing elements, carbon dioxide gas sensing elements, smoke sensing elements, and the like. By monitoring the internal illumination, carbon dioxide concentration and temperature and humidity of the teaching base in real time, the bad air condition inside the teaching base can be sensed in time, and the prevention and control adjustment is automatically carried out.[6] If the internal light intensity is higher than the standard value in the teaching base, the terminal control module will automatically execute the electric curtain closing procedure; when the carbon dioxide concentration in the teaching base is higher than the standard design value, the terminal control module will automatically execute the ventilation opening procedure to ensure that the teaching base teaching work goes smoothly.

6. Software and Hardware Settings of Smart Teaching Base on the Basis of Internet of Things Technology

Firstly, in the process of setting the structure of the human body position detecting unit, the overall teaching base can be divided into corresponding number of detecting sub-modules according to the existing application situation of the teaching base. A reasonable setting of the detection module or the main control module is then carried out in the ceiling area above the corresponding detection sub-module. At the same time, the detection module and the main control module are connected in a single bus serial connection manner. Through the single-bus periodic polling, combined with the detection module networked operation, the application running information of the teaching base can be fed back in real time.

Secondly, in the process of setting the software parameters of the actual teaching base, it can be reasonably adjusted according to the changes of specific operational requirements. For example, in the "Reminder Service" setting process, on the basis of the curriculum information, 30min or 60min can be set in advance to provide the course start time and teaching location for the course teaching staff or learners.[7]

7. Application Effect of Smart Teaching Base on the Basis of Internet of Things Technology

According to the previous design requirements, a teaching base uses TI CC2531, stm32F108, CC2531 to design and implement all intelligent sensors, intelligent control devices and intelligent applications, and realizes effective control of various smart teaching base application modules, which provides a good basis for the improvement of the operational efficiency of the teaching base. Course faculty members can directly use the IC card to conduct remote operation of the equipment at the beginning of the prescribed course, effectively avoiding the frequent influence of the property manager on the efficiency of the multimedia course.[8] At the same time, using the campus card, the course learners can also automatically punch the card, providing a basis for the course management personnel to know the learning situation of the course learners in time; In the self-study course, the course learners can automatically query the existing number of self-study

DOI: https://doi.org/10.26549/met.v3i1.1221

teaching bases and self-study teaching bases with the help of the smart guidance service, and improve the resource utilization efficiency of the self-study teaching base; In the process of routine teaching management, through the application of Internet of Things technology, environmental information can be detected on the basis of sensors. Combined with the operation of air conditioners, fans, curtains and lighting devices, the established control scheme is set up, which effectively improves the utilization efficiency of equipment resources within the teaching base.

8. Conclusion

In summary, the classroom education teaching work is an important component of the education industry, and in the process of modern technology development, the past education and teaching base can no longer meet the needs of contemporary education and teaching. Therefore, in the process of comprehensive reform and optimization of the education and teaching industry, educational institutions should increase the application of new technologies such as Internet of Things technology, and organically integrate intelligent teaching and intelligent control of teaching bases. Through the reasonable setting of environmental monitoring self-regulation, lighting self-distribution control, remote warning and other functional modules, thus providing guarantee for the smooth development of classroom education and teaching work.

References

[1] Jian Yan, Jinsong Gui. Design and Realization of Smart Teaching Base Based on Internet of Things Technology[J]. China Electro-chemical Education, 2016 (12):83-86. (in Chinese)

[2] Yonghua Zhou. Design and Realization of Smart Teaching Base System Based on Internet of Things[J]. Electronic Technology and Software Engineering, 2018(9): 256-257. (in Chinese)

[3] Jun Liu. Design of Smart Teaching Base in Colleges and Universities Based on Internet of Things Technology[J]. Journal of Shaanxi University of Technology (Natural Science Edition), 2017, 33(5):52-57. (in Chinese)

[4] Lang Zhou, Zhe Lin, Xiaofang Hu, et al. Design and Realization of a Smart Teaching Base Based on Internet of Things[J]. Wireless Communication Technology, 2014, 23(4): 53-56. (in Chinese)

[5] Pengyi Zhang, Zhaojun Liu. Design of Smart Teaching Base IoT Teaching Platform Based on PLC Control[J]. Shandong Industrial Technology, 2017(17):76-76. (in Chinese)

[6] Shunyong Zhao. Design and Research of Smart Teaching Base Based on Internet of Things[J]. Journal of Fujian Computer, 2017, 33(2):124-126. (in Chinese)

[7] Huanzhi Qiu, Yongcan Chen, Chaosheng Fan, et al. Analysis of Smart Teaching Base System Based on WiFi Internet of Things Technology[J]. Enterprise Technology Development, 2016, 35(3):62-63. (in Chinese)

[8] Enhao Zhou. Design and Realization of Smart Teaching Base Internet of Things System in Colleges and Universities[J]. Modern Electronic Technology, 2018, 41(2):30-33. (in Chinese)

 DOI: https://doi.org/10.26549/met.v3i1.1221