Design and implementation of Wisdom classroom management system based on voice control

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Abstract. This paper implements a wisdom classroom management system. In response to the difficulties of traditional campus equipment management, this system can automatically collect the status of electrical appliances in the classroom and analyze the data to provide equipment status diagnosis and early warning functions. At the same time, the Raspberry Pi provides a visual 3D management interface for the terminal. In addition, the system also introduces the voice recognition function in deep learning to control the equipment in the classroom more conveniently.

1. Background
With the advent of the Internet era, the evolution from traditional mode to the intelligent era in all professions and trades. For the university, as an individual, it is necessary to walk in the forefront of the times. The traditional teaching methods have been updated day by day and become more intelligent. However, the campus management is facing the dilemma of traditional equipment and old management mode, which is unable to innovate progress. In this system, the state of electrical appliances in the campus classroom is investigated and the current data is analyzed. The wisdom classroom management platform can monitor and manage the traditional electrical appliances in the classroom. It achieves not only the integration and implementation of the intelligent classroom, but also facilitating the management of the classroom, so as to achieve the concept of energy conservation and environmental protection. Finally, the system presents a visual interface with Raspberry Pie as the control end, and carries a voice recognition system for more intelligent management.[1]

2. Means of realization

2.1. Hardware technology
For the console developed by Raspberry Pie 3B, which added pcf8591 to realize software simulation model carrying, reed sensor is responsible for the communication of traditional household appliances, Risym temperature measurement module is responsible for temperature collection, Risym camera extension module and photo resist sensor are responsible for monitoring and light sensing, because of the forbidden option of voice input in Raspberry Pie 3B's own interface, it needs external ld3320 voice module to enrich functions, the final product is the experimental simulation classroom, so we use small electric fan and light emitting diode to simulate the electrical appliances in the classroom.
2.2. Development tool
The Thonny tool that comes with the Rasbain system is convenient as a primary Python IDE, therefore, the module control and information collection of this system are completed by Python language. The front-end Web interface is based on HTML 5 and is implemented using CSS 3 style with Javascript interaction. The server selected Websocket server based on Node.js, database is based on Mysql.

3. Core technology

3.1. Sensor Network Technology for the Internet of Things
Figure 1 shows that system is simply divided into two parts to understand: control and acquisition: control and collection. The core of the whole Internet of Things technology is that sending and collection of instructions are all completed by the server. All sensors in the Raspberry Pie collect and process data every five seconds and save it to the specified MySQL database. The front-end interface extracts data from the server to manage the state of the wisdom classroom.

![Figure 1: Figure with system design drawing](image1)

3.2. Visual interface technology
The front-end interface communicates with the server through the interface of socket.js. After obtaining the data, the highcharts function and JS algorithm are used to process the data and draw the line chart of the visual interface. On the other hand, JS algorithm is mainly used to analyze the fault data in the fault processing with the Hill sorting, because Hill sorting can be more effective in combination with real-time error information to the relevant information of the fault is calculated quickly to reduce the consumption of the algorithm to the system.

3.3. Speech recognition technology
Speech recognition has been widely used in many product lines. In order to improve and enrich the practical models of the system, wisdom classroom management platform has also added an intelligent management mode, which uses automatic management and voice management better than traditional manual management. Speech recognition technology mainly uses Cloud Speech API of Google. This set of speech recognition methods can be achieved by several methods, among which the python platform can be called directly based on this project as a convenient method, simply download and configure the related voice packages, then complete the related key application. [2] As shown in Figure 2, the final effect is shown in the form of Transcript array voice to text. Because of the simple instructions of classroom management, the voice control can be completed by matching the command fields. To further enhance speech recognition, Confidence array variables can be invoked for precise management.[3]

![Figure 2: Figure with Speech recognition code](image2)
4. System design and experimental model

4.1. System functions

Figure 3 tells that the system is divided into two modes, the manual mode mainly uses the Raspberry Pie as the control end to control the electrical appliances in wisdom classroom. The timely control of the equipment not only solves the intelligent management of the classroom, but also avoids resources waste to realize the campus concept of low-carbon and environmental protection. In the intelligent mode, the system can automatically judge the current classroom state, it realizes the automatic opening and closing of various electrical appliances through the collection of sensor data.[4] At the same time, speech recognition technology is added to make the operation more convenient.[5]

4.2. Data connection

The database is designed with Mysql. There are 7 groups of contacts after E-R diagram-to-relationship model, which correspond to 7 tables in the database, user table, data table, fault table, current meter, manual control table, smart mode table and voice command table. Figure 4 shows the data table. In the Raspberry Pie, the sensor module data is stored in TXT file format, and then written to the database in real time through Python script. The entire data connection PC and Raspberry Pie are in the same LAN, and the Web interface hangs on the PC 3000 port, using Socket.js Interface technology communicates, while server and Raspberry Pie execute SQL statements to access and upload data to the database against port PC 3306.
4.3. Fault diagnosis technology and algorithm

Another core difficulty of wisdom classroom management system is the failure diagnosis and maintenance of electrical appliances. Failure declaration and judgment of traditional classrooms often have a large cycle, which has a certain impact for the course. The wisdom classroom fault diagnosis function can be prospective and preventive to minimize the impact of equipment in classroom. The whole device failure function is completed in two steps. Firstly, AD module is used to read the data. Figure 5 is the case of lamp failure. The data is converted into value variable. Then, the different current value ranges are used to judge whether the device is faulty. Finally, the fault data is inserted into the database.

```python
bus.write_byte(address, A3)
value = bus.read_byte(address) * 3.3 / 255 - 1.7
if value > 1.5:
    now_time = dt.datetime.now().strftime("%H")
    sql = "insert into damage(temp.light.door.camera.time)values (NULL, 1, NULL, NULL, now_time)"
    cursor.execute(sql)
    db.commit()
```

Figure 5. Figure with Lamp Failure Reference Code

Then we get the corresponding fault data, owing to the Highcharts function can not directly match the fault data, we need to use the JS algorithm in the server to parse the data first. The main process of parsing is to judge the time and the point of failure, at the same time, it needs to match the data in the fault point and data table to find the fault data. As shown in Figure 6, a failure view is created using the Highcharts function and sent it to the web page.

![Figure 6. Figure with Failure View Demo](image)

4.4. Experimental models and tests

As shown in Figure 7 for the final product, the lower end of the middle position is a simulation classroom model with using CSS 3Made in 3D, the contents of the classroom are air conditioning, door lock, and light, which correspond to electric fan and the light emitting diode respectively. The monitor screen of the camera is inserted in the lower right, temperature data collected by the temperature sensor is used
Socket.on(), the function is successfully received as a medium and displayed as a dynamic line chart at the top of the middle of the page. Data collection on both sides also truly reflects the current classroom state. The whole experimental model more realistically restores the real scene of the classroom and realizes the wisdom classroom system which based on voice control.

![Figure 7](image)

**Figure 7. Figure with Management system of wisdom classroom**

### 5. Conclusion

The wisdom classroom management system based on voice control can solve the drawbacks of backward management methods, waste of resources, and delay in failure reporting brought by traditional classrooms. The introduction of wisdom classrooms can truly transfer the intelligent era into the campus, in the premise of reducing manpower, it can greatly improve the management and utilization efficiency of classrooms. The subsequent introduction of in-depth learning algorithm combined with data collection and analysis can make each school's classroom management more targeted and intelligent.

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