Real-time monitoring software for electric vehicle battery power based on WeChat applet

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Abstract. Batteries are an important part of contemporary automobiles. With the increase in the output of family cars and the development of science and technology, the demand for batteries in the automotive market is increasing rapidly. A major problem with existing car batteries is that it is difficult for users to obtain information about the current battery power in real time, especially when driving away from vehicles and cars, there are huge safety hazards; therefore, a real-time monitoring of car battery power is researched. The system has important practical significance.

Keywords: Battery, WeChat applet, OneNet, real-time monitoring, remaining battery.

1. Background and significance of the study

The normal operation of the battery plays an important role in the normal operation of the car engine and the normal operation of the electric appliances on the car. It is difficult for car drivers to monitor the power of the car battery in real time before getting on the car, which leads to the fact that the driver often finds that the car battery is insufficient when getting on the car, causing great inconvenience. At the same time, during driving, the driver cannot accurately determine the battery level, which brings great risks to the members of the car. Therefore, real-time monitoring of the battery power of the car not only brings great convenience to the driver's daily driving, but also guarantees the safety of the lives of the members in the car.

In order to achieve this goal, this paper designs a real-time monitoring system software for car power based on WeChat applet. The WeChat applet that has emerged in recent years is easy to use. Users do not need to download the App corresponding to the mobile phone platform, and can run directly in the WeChat application. Therefore, this article chooses the WeChat applet as the platform for the software to carry out related processing operations.

The battery information collection module is responsible for the collection of information related to the car battery. The MCU is responsible for processing the relevant algorithms to obtain the remaining battery capacity of the battery. The wireless WiFi module is responsible for the connection with the router, and the router is responsible for transmitting the wireless WiFi module. The data is uploaded to the OneNet cloud platform, and the OneNet IoT platform is responsible for establishing a connection with the WeChat applet, and users can perform real-time monitoring through the WeChat applet. Due to the huge market ownership of automobiles and the good user base of WeChat applets, this system software has good prospects. This is shown in Figure 1.
2. System related technology overview

2.1. WeChat applet
In the WeChat public platform, "small program" refers to a new open capability. Through a simple and efficient application development framework and supporting components and APIs it provides, it can help developers develop applications that can run in WeChat. A service with a native APP experience, which is usually called a WeChat applet. The applet can be used without downloading and installing, and the user can open the application through the search or scan function in WeChat.

The mobile terminal is currently divided into two major mobile operating systems, Android and Apple. Compared with the traditional mobile APP that needs to be developed to adapt to the two different systems, the appearance of the WeChat applet can integrate the two well, and one-time development meets the use of multiple platforms lowers the development threshold.

2.2. OneNet IoT Platform
The OneNet IoT platform developed by China Mobile is positioned as a PaaS service to build an efficient and stable application platform between IoT applications and real devices.

The main functions of the OneNet IoT platform in this system are:
1) Provide API to connect with applets and hardware devices;
2) Receive and save the data uploaded by the power collection module;
3) Receive, forward, and save request commands, control commands and related data sent by the applet.

3. Software design

3.1. Software requirements analysis

3.1.1. Establish a connection with the IoT platform. The WeChat applet uses the HTTP protocol and uses the API provided by the OneNet IoT platform to send data requests to the OneNet IoT platform, obtain related device information, and establish a connection with OneNet.

3.1.2. Real time monitoring
This software needs to realize real-time monitoring of the remaining power of the car battery. The user can obtain the relevant information of the remaining power percentage on the WeChat applet interface, which is convenient for the user to monitor the power information of the car battery in real time.

3.1.3. View historical data. The user can query the historical data of the remaining power of the car battery, and the applet sends a data query request to the OneNet Internet of Things platform server for the user to judge the status of the car battery.

3.1.4. Threshold setting. The user can manually set the alarm threshold when the battery power of the car is lower than a certain level.

3.1.5. Alarm function. When the remaining power of the car battery is lower than the alarm threshold set by the user, an email is sent to the user's mailbox to remind the user to charge in time. If the user's
mobile phone is not connected to the Internet, a text message is sent to the user's mobile phone number to remind the user to charge.

3.1.6. Check the network. This software needs to detect the current network of the user's mobile phone and feedback the detection result to the alarm function module.

3.1.7. Remaining battery life prediction. This software can use related algorithms to predict the remaining service life of the battery based on the collected car battery information, so that the user can replace it with a new battery.

The use case diagram about the user is shown in Figure 2.

Figure 2. Use case diagram about the user

3.2. Software architecture overview
The design framework of the WeChat applet adopts a modular design, and is divided into corresponding modules according to functional requirements, including a connection establishment module, a real-time monitoring module, a value setting module, an alarm module, a network monitoring module, and a life prediction module.

3.2.1. Establish connection module. The establishment of the connection module corresponds to the establishment of the connection function with the Internet of Things platform. The main implementation method is to query the API provided by the OneNet Internet of Things platform through the HTTP protocol, establish a data transmission connection with the OneNet Internet of Things platform, obtain device information, and request data from OneNet, In the WeChat applet interface, it is mainly reflected in the system prompting to establish a connection with the OneNet IoT platform. If it fails, it will report the corresponding error and the corresponding solution.

3.2.2. Real-time monitoring module. The real-time monitoring module is responsible for real-time monitoring of the remaining battery power and viewing the historical data of the remaining battery power. The remaining battery power percentage information transmitted by the device is displayed on the applet interface. The remaining power percentage is higher than the alarm threshold set by the user. The status display, lower than the alarm threshold set by the user, is displayed in red status, and a message that the battery is too low is sent on the interface to remind the user to charge in time.

The user can view the historical data of the remaining power of the battery. When the user queries the remaining power information of the battery at a certain time, the applet sends the request information to the OneNet server, and the server looks up the corresponding information in its own database and gives feedback. The server finds successfully, and transmits the queried information to the applet
interface for display. If the search fails, the user is fed back to the user that the information sought does not exist.

Users can delete unwanted historical data, select unwanted historical data, and send it back to the OneNet database for deletion.

3.2.3. Numerical setting module. The user can set the alarm threshold of the remaining power. The user sets the alarm threshold of the remaining battery power through the small program. The small program transmits the information to the OneNet database, and the data is saved by OneNet. When the real-time monitoring module and the alarm module send it when data is requested, the data of the alarm threshold is transmitted.

3.2.4. Alarm module. Whether the user applet is online or offline, the alarm module can operate normally. The OneNet server detects that the percentage of the remaining battery power transmitted from the device is lower than the alarm threshold set by the user stored in the database, and sends an alarm to the user. According to the parameters transmitted by the network monitoring module in the server, the user’s mobile phone network will be sent to the user’s mobile phone. An alarm mailbox is sent, and when the user's mobile phone network is offline, an alarm message will be sent to the user's mobile phone to remind the user to charge in time.

3.2.5. Network monitoring module. To monitor the network status of the user's mobile phone, the `onNetworkStatusChange()` function provided in the official development document of the WeChat applet is mainly used-monitor network status change events, and transmit the parameters returned by the function to the OneNet server.

3.2.6. Life prediction module. The battery voltage, current and temperature collected by the equipment are transmitted to the OneNet server through the WIFI module of the single-chip microcomputer. The Arrhenius formula is used to establish a battery life prediction model, and the calculated battery life prediction data is transmitted to the applet interface for execution Display for the user to predict the battery life of the current battery.

The overview architecture of this software is shown in Figure 3.

![Figure 3. overview of the software architecture](attachment:image.png)

3.3. Software process design
The software can be divided into two parts to introduce the software process according to the use scene, one is the user operation process, and the other is the software alarm process.

3.3.1. User operation process. Since the applet is carried in the WeChat App, there is no need to enter the user’s account and password. After the user authorizes the WeChat account to log in to the applet, the applet interface is initialized. The applet uses the HTTP protocol and the API provided by the OneNet IoT platform to provide The OneNet server sends a data request, and after establishing a data connection with OneNet, it obtains the relevant information of the battery provided by the device.
After entering the operation interface of the applet, the user can monitor the relevant information of the battery power in real time, query the historical data of the battery power, set the alarm threshold of the battery, and query the prediction of the remaining life of the car battery. This is shown in Figure 4 below.

![Diagram](image)

**Figure 4.** Block diagram of the user operation process

### 3.3.2. Software alarm process

When the applet monitors that the remaining power of the car battery is lower than the threshold set by the user, check the network status through the OneNet server. If the network is good, send an alarm email to the user's mailbox, otherwise send an alarm message to the user to remind the user to charge in time. The alarm process flow is shown in Figure 5.

![Diagram](image)

**Figure 5.** Software alarm process flow chart
4. Summary
The normal operation of the battery plays an important role in the normal operation of the car engine and the normal operation of the electric appliances on the car. However, it is difficult for car drivers to monitor the power of the car battery in real time before getting on the car, which leads to the fact that the driver often finds that the car battery is insufficient when getting on the car, causing great inconvenience.

In order to solve this problem, this paper proposes a real-time monitoring system software for car battery power based on WeChat applet. This article analyses the research background and importance of the system in detail, fully analyzes the feasibility of the system, and gives a detailed introduction to the related technologies involved in the system, from software requirements analysis, software architecture overview, software process design, etc. The design process of the software is introduced.

References
[1] Zou Yongchang. Design and implementation of automotive smart battery system based on the Internet of Things [D]. Chongqing University, 2019.
[2] Liu Fang, Lin Sumin, Shan Yuyang. Design of low battery alarm system for automobile battery based on lm741 [J]. Hubei Agricultural Sciences, 2019, 58 (11): 118-120.10.14088/j.cnki.issn0439-8114.2019.11.029.
[3] Gu Yiwen. Android-based battery online monitoring system software development and algorithm research [D]. Shanghai Jiaotong University. 2019.
[4] Zheng Chaoya. Design and development of information technology answering system based on WeChat applet [D]. Central University for Nationalities, 2019.
[5] Li Hao. Design and implementation of an intelligent recommendation ordering system based on WeChat applet [D]. Nanjing University of Posts and Telecommunications, 2020.
[6] Chen Xiaodong. Research and implementation of flower shed temperature control system based on onenet cloud platform [D]. Liaoning University. 2020.
[7] Yang Jixi, Jiang Chaoyu, Yang Xueping. Battery health assessment and life prediction in battery management system [J]. Times Auto, 2021 (05): 139 - 140.
[8] Yang Jie, Li Qingjie. Research on the development of online monitoring equipment based on WeChat applet cloud service and Raspberry Pi [J]. Electronic Quality, 2019 (11): 45 - 49.