Design of Garbage Classification System based on RFID

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Abstract. In order to solve the problem of municipal solid waste and improve the recycling rate of resources, an intelligent garbage classification system is designed. The reader can identify the electronic tag on the garbage bag, automatically judge and open the corresponding garbage bin cover, which can be recycled or non-recyclable, so as to achieve the effect of garbage classification. At the same time, through the built-in distance, temperature and humidity sensors in the dustbin, real-time monitoring of whether the garbage is full, whether there is fire, etc., and the detected information is transmitted to the background through the network, and the alarm will be given in case of abnormality. It can reduce the workload of property cleaning staff and prevent the occurrence of fire and the spread of bacteria.

Keywords: Garbage Sorting, Reader, RFID Tag, Sensor

1. Introduction

On March 30, 2017, the general office of the State Council transmitted the implementation plan of the domestic waste classification system issued by the national development and Reform Commission and the Ministry of housing and urban rural development to deploy and promote the domestic waste classification. According to the survey, more than 60% of the municipal solid waste is mainly produced by the secondary pollution of residential garbage [1-3]. Therefore, urban waste treatment is a major project, which needs the majority of residents to classify and put the garbage produced by their families. A kind of intelligent garbage sorting system is designed to gradually establish the good habit of garbage sorting and putting. Household garbage bags with RFID tags can be divided into two categories: recyclable and non-recyclable. Residents put the domestic waste into the corresponding garbage bags and put them into the corresponding garbage recycling bins to achieve the effect of garbage classification. At the same time, the built-in sensor in the dustbin can real-time monitor whether the garbage is full or not, whether there is fire or not, and the detected information is
transmitted to the background through the network. If it is abnormal, the alarm will be given, which will greatly improve the situation of random dumping of garbage in the past, reduce the pollution to the environment and improve the utilization rate of resources [4-6].

2. System Design

The design of intelligent garbage sorting system is mainly divided into two parts: hardware design and software design. The hardware design includes the design of peripheral circuit and motor module of RF system; the software design includes the reading and writing of IC card, module initialization and LCD display. The block diagram of intelligent garbage classification system is shown in Figure 1.

![Figure 1. Block diagram of waste classification system](image)

In the figure, Arduino single chip microcomputer is the control core, and the radio frequency card is read out by mifire rc522 RFID module. Through the display in LCD1602, Arduino controls the motor action to realize the function of garbage classification; through the ultrasonic module, smoke sensor and buzzer, the functions of garbage bin overflow alarm and fire alarm are realized.

The most application of mq-2 smoke sensor is to connect with single-chip microcomputer. In the actual application process, heating is a normal phenomenon. The detection range of mq-2 is extremely wide. The detection range of the mq-2 sensor for methane is 5000 ~ 20000 ppm. The reference voltage is obtained from the resistance in series with mq-2, and the digital voltage is obtained after AD conversion. The methane concentration is obtained through the proportional relationship [7-8].

The RFID reader used is the serial port read-write module of mifire rc522. Mifire rc522 is a series of high integrated read-write card chips used in 13.56MHz contactless communication. The chip uses advanced modulation and demodulation concepts to support a variety of radio frequency card read-write operations under 13.56MHz. It is easy to Using original chip to design card reading circuit, and also it has low cost [9-11].

The working process of the system is shown in figure 2.
Is there smoke? Y N
Is he bin overflowing? Y N
Alarm and display information in LCD1602

N Is the tag near? Y
Read the garbage information in the garbage bag and display the classification results
Open the corresponding trash can

End

3. System Test Results
When residents use garbage bags with electronic labels, when they are close to RFID readers, the reader will identify the garbage classification information in the card, so as to control the opening of the corresponding bin cover. Recyclable and non-recyclable garbage bin covers are represented by numbers, 001 for recyclable garbage and 002 for non-recyclable garbage. The test results are shown in figure 3 and figure 4 respectively.

Figure 2. The working process of the system

(1) System initialization, each module is ready to work.
(2) The smoke sensor detects whether there is smoke in the box. If so, it will start the buzzer alarm module to give an alarm and display it in the LCD1602 LCD.
(3) If there is no smoke, the ultrasonic ranging module will continue to detect whether the garbage can is full. If it is full, it will display the garbage full container in LCD1602.
(4) If it is not full, RFID reader is used to detect the electronic tag on the garbage bag to judge whether the garbage bag is close. If it is close, the information in the electronic tag on the garbage bag is read, and then the garbage classification information is displayed in LCD1602, so as to decide whether to open the cover of recyclable garbage bin or the cover of non-recyclable garbage bin, so as to achieve the purpose of garbage classification.

Figure 3 a). Recyclable liquid crystal display
The system uses white paper box to simulate the garbage bin, blue electronic tag simulates the recyclable electronic tag on the garbage bag, and RFID reader identifies the recyclable classification information in the card to control the opening of the corresponding bin cover. The data information 001 and recycled are displayed in LCD. It shows that the system has realized the function of RFID classification.

The system uses white paper box to simulate the garbage bin, white electronic tag card to simulate the non-recyclable electronic tag on the garbage bag, and RFID reader identifies the non-recyclable classification information.
classification information in the card to control the opening of the corresponding bin cover. The data information 002 and recyclable information are displayed in LCD. It shows that the system has realized the function of RFID classification.

4. Conclusion
An intelligent garbage sorting system based on RFID is designed, which is divided into two categories: recyclable and non-recyclable. The residents put the domestic waste into the corresponding garbage bags and put them into the corresponding domestic waste recycling bins, so as to achieve the effect of garbage classification. At the same time, the built-in sensor in the dustbin can monitor whether the garbage is full or not, whether there is fire, etc., and the detected information is transmitted to the background through the network, and the alarm will be given in case of abnormality, which can cultivate the residents' good habit of garbage classification and release, and greatly improve the level of garbage classification management.

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