Design and Manufacture of Mobile Intelligent Garbage Bin

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Abstract

This paper designs a mobile intelligent ash bin by automatic tracking based Arduino microcontroller. Arduino microcontroller is the core to control, with the voice of the way to open and close the lid, realize the trash tracking using reflective photoelectric sensor to detect black line, using voice broadcast sound to remind pedestrians to avoid the use of LCD1602 display, temperature and humidity. Finally, the intelligent garbage can goes forward and backward, turns, runs, prompts and displays the temperature and humidity according to the black line on the ground. The design of the intelligent garbage can meets the practical requirements and has certain reference value in application.

Keywords

Arduino MCU; Intelligent Ashbin; Tracking; Voice Broadcast.

1. Introduction

We are currently experiencing a fast development of Smart Cities [1-6]. The Smart City is a concept that has been widely used to describe the umbrella of new trends and goals pursued to make cities more efficient. The emergence of electronic smart products has brought great convenience for our life. Intelligence can be operated automatically in accordance with the mode set in a particular environment instead of artificially manage. Intelligence can be in a particular environment in accordance with the mode set in front of us to automatically operate, it does not require us to artificially manage, we can achieve the goal set in front of us, it is a wide range of applications, such as industrial control, scientific exploration, smart home and other fields. Smart devices are a kind of electronic smart products. Due to the good interactivity of such smart products, the controllability can be automatically operated according to the mode set by people and is also welcomed by people. In addition, the smart device can also be applied to many aspects of dangerous search, robotics and the like, and has a very good development prospect especially in the robot. Therefore, the research on smart devices not only has great practical significance, but also has a very broad application prospects and market value. Intelligent devices involved in a wide range of disciplines, the most basic smart devices involves the sensing technology, electrical technology, electrical control technology, intelligent control and other disciplines. Its own is a versatile, easy-to-control integrated electronic device that integrates a wide range of functions such as environmental awareness, planning and decision-making, and automatic control. Trash cans currently on the market have a number of drawbacks. For example, garbage collection is always not timely and, moreover, it needs to be manually moved or transported to a designated refuse storage location by a garbage truck. For the development and research of smart devices, it is very meaningful for them to have the ability to load rubbish and transport rubbish, make ordinary rubbish bins turn into smart rubbish bins, and make people's daily life become more intelligent[7,8].

Therefore, this paper studies a mobile smart trash can monitor the temperature and humidity of the current environment from time to time and display it, so that users can always determine the environmental conditions around the trash can prevent the virus and other health problems; The voice control method is adopted to open and close the lid, which effectively solves many inconveniences

when the user trashes the garbage, and can follow the preset route to realize the automatic movement function .

2. Overall Design

The device is driven by the front wheel. The front wheel is driven by a motor on both sides. The motor drive chip controls the rotation and stop of the front two wheels to achieve the purpose of steering control. The rear wheel is a universal wheel which plays a supporting role in steering. In addition, two infrared photoelectric sensors are installed at the front end of the chassis of the device, so that the device can follow the track according to the situation detected by the sensor. The overall design block diagram is shown in Figure 1.

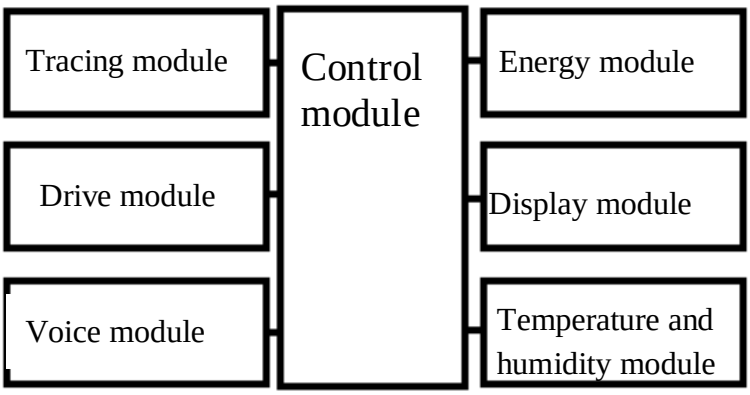

Fig. 1Design frame illustration

3. Design and Implementation of Hardware System

3.1 Control Module

As shown in Figure 2, the Arduino UNO development board is chosen. The design of the development board is very simple, including an Atmega 328 AVR microcontroller, a 16 MHz crystal oscillator and a 5 V DC power supply. It also has 14 digital input/output ports (6 of which can be used as pulse width modulation (PWM) output), 6 analog inputs, a USB port, a power socket, an analog input port and a reset button. Basic parameters: processor ATmega328; working voltage 5V; input voltage 6-20V; digital IO pin 14 (of which 6 are PWM output); analog input pin 6; IO pin DC current 40 mA; 3.3 V pin DC current 50 mA; Flash Memory 32 KB (ATmega328, of which 0.5 KB is used for bootloader); SRAM 2 KB (ATmega328); EEPRO; M 1 KB (ATmega328); working clock 16 MHz.

Fig.2 Arduino UNO development board

3.2 Energy Module

Using two 3.7V rechargeable batteries, the voltage of 7.4V rechargeable square battery is lowered and stabilized to 5V, then the power supply is provided to the single chip computer system and LCD1602 and other chips. In addition, four 1.2V rechargeable battery packs are used to supply power

for DC motor. Under this power supply mode, the single chip computer and sensor work steadily, the DC motor works well, the LCD display is stable, and can work for a long time.

3.3 Drive Module

A special motor driver chip L298N is used to control the DC deceleration motor. L298N chip (Fig. 2-3) is a full bridge driver chip with high voltage and large current. A chip L298N can control two DC deceleration motors separately. At 6-46V voltage, it can provide the rated current of 2A, and has an overheating automatic switch. Break and current feedback detection function is safe and reliable. The chip is controlled by TTL level. By changing the input level of the chip control terminal through the output level of IO port of MCU, the forward, reverse and stop operation of the motor can be realized. In addition, in order to ensure the normal operation of L298N, 8 1N4007 are also installed. Using this chip as motor drive, the driving capacity is large, the operation is convenient, the stability is good, and the performance is excellent.

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Fig. 3 infrared distance sensor physical map

3.4 Tracing module

An infrared reflector phototube (TCRT5000) is used to complete the system tracking. As shown in Figure 4, TCRT5000 is an integrated reflective photodetector. The sensor consists of a high emission power infrared photodiode and a high sensitivity phototransistor. Its emitter is a GaAs infrared light emitting diode, while the receiver is a high sensitivity, silicon planar phototransistor. It is based on the principle of light reflection. When light shines on white paper, the reflectivity will be relatively large. On the contrary, when light shines on black objects, the amount of reflection back is relatively small, so that the direction of black tape track can be judged. Using infrared emission, the external visible light has little influence on the received signal. Using infrared tube to detect the black line boundary, then using LM393 to compare the detected signal, sending it to MCU for processing. The photoelectric pair transistor has simple circuit and stable working performance. Whether in the dark or strong light, the system can work stably and adapt to the external environment.

Fig. 4 TCRT5000 physical map

3.5 Display Module

The LCD screen has the characteristics of low power consumption, rich and clear display content, large display information, fast display speed, friendly interface, simple use and so on, and has been widely used, and the peripheral circuit is relatively simple.

3.6 Voice Module

Using the MP3 voice broadcasting module as shown in Figure 4 for text broadcasting, it is easy to operate, can be triggered by low level, and the price is relatively low.

Fig. 5 voice broadcast module physical map

3.7 Temperature and Humidity Module

The DHT11 Module shown in Figure 6, i.e. the temperature and humidity module, is used to collect temperature and humidity. The advantages of this module are fewer ports and lower price. DHT11 is a digital temperature and humidity sensor, which includes a resistive humidity sensor and an NTC temperature sensor. The sensor has the advantages of good stability and strong anti-interference ability. It is suitable for detecting and testing equipment, automobiles, medical treatment and so on. The device has four pins, one pin for the power foot; two pins for the serial data pin, single bus; three pins for empty foot, no connection; four pins for the ground foot. The data transmission mode of the device is bidirectional single bus, which adopts single bus data format, and the communication time is about 4 ms. A complete data transmission is 40bit and high priority first out. The data format is 8 bit humidity integer data + 8 bit humidity decimal data + 8 Bi temperature integer data + 8 bit temperature decimal data + 8 bit calibration data. Transfer correct check data = 8bit humidity integer data + 8bit humidity decimal data + 8bi temperature integer data + 8bit temperature decimal data.

Fig. 6 DHT11 physical map

4. System Design and Implementation

The control module is mainly the control of the whole system, but also undertakes the tracking module, display module, voice module, drive module, temperature and humidity module of the relationship and control. Fig. 8 is a flowchart for controlling the main program.

In the flow chart of the main program in Figure 8, the MCU is initially initialized, including the LCD initialization and so on. Then through the infrared detection module to determine whether the garbage is full, such as full, then track forward, and voice broadcast, if detected stop line then stop. The overall debugging of the module is carried out according to the module.

First, test the operation of the power supply, and whether each module can get good power supply. Second, check whether the singlechip can program and work normally. After the installation of the photocell, adjust the potentiometer to select the appropriate reference voltage according to the test data.After many debugging, the system can basically meet the design requirements, can be faster and

more stable along the black road surface. The design of the intelligent movable garbage bin physical map is shown in Figure 9.

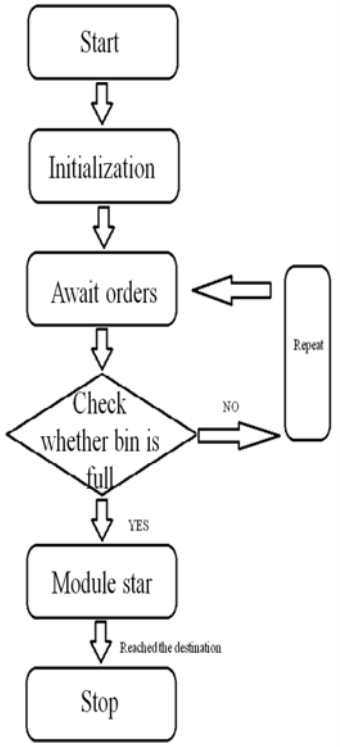

Fig.7 Flow chart of working

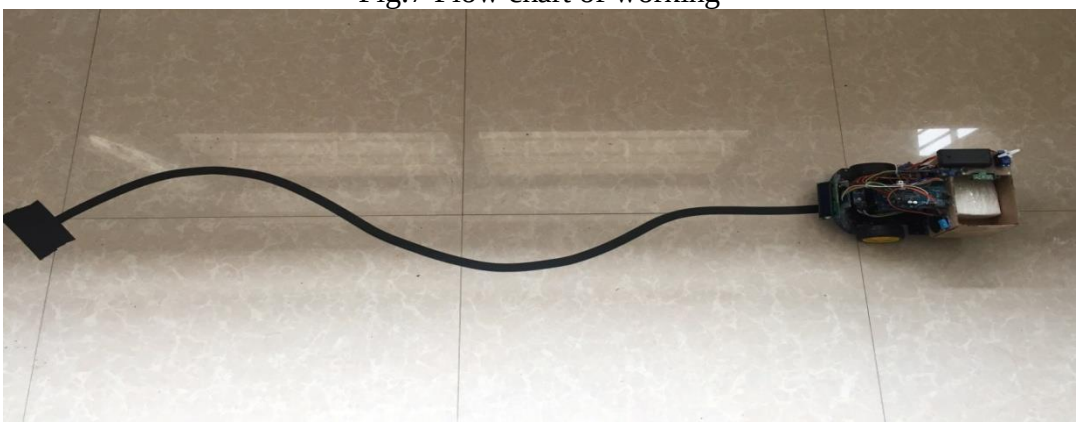

Fig. 9 physical map of intelligent movable garbage bin

5. Conclusion

This design adopts the idea of modular design, by Atmega328 as the core control chip, infrared reflective photoelectric tube system for detection, tracking, the surrounding environment of intelligent ashbin using sound sensor module to complete the opening and closing of the garbage bin, using voice broadcast module for reminding avoid broadcast, display the temperature and humidity of the mobile intelligent trash. The coordination between various modules meets the control requirements well. All the original functions have been realized, and the temperature and humidity of the current environment can be monitored and displayed. The voice of the way to open and close the lid, after full automatic tracing to the designated location. The sample can be used as an example to study the singlechip for college students, and it can also be used as a reference for the design and development of the intelligent device.

Acknowledgements

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