Intelligent carrier vehicle based on STC89C52RC microcontroller

Jiaxin Cao [1, a], Hongyang Wan g[2,b], Hao Wu[2,c]

[1]School of Mechatronics Engineering, Shenyang Aerospace University, Shenyang 110136, China

[2]College of Innovation and Entrepreneurship, Shenyang Aerospace University, Shenyang 110136, China

*corresponding author e-mail: a473113839@qq.com, b1076033093@qq.com, c1512326257@qq.com

Abstract

The research content of the invention relates to various functions such as automatic following, automatic obstacle avoidance, manual control, voice recognition control of the intelligent carrier vehicle, and the initial realization of intelligence. It adopts a variety of control functions, and has automatic obstacle avoidance, recognizable automatic follow two automatic driving functions, plus a variety of sensors such as flame sensors, so that the smart car can adapt to a variety of complex environments. The software part is developed by technicians except for the mobile phone APP. The test shows that the functions of the smart car are working normally and all have achieved the expected results, which provides reference value for further development of the more intelligent machine car.

Keywords

Intelligent carrier vehicle, STC89C52RC microcontroller.

1. Introduction

The intelligent carrier vehicle is a high-tech complex that uses sensing, computer, communication, navigation, artificial intelligence and automatic control to achieve environmental awareness, planning decisions and automatic driving. In the process of understanding nature, transforming nature, and promoting social progress, we human beings constantly create a variety of tools for human services, and smart cars as a representative of such intelligent unmanned equipment have epoch-making significance. Smart cars have gained many applications in military, civilian and scientific research. The technology of smart cars can be applied to intelligent technology assemblies such as unmanned vehicles, unmanned intelligent production lines, unmanned warehouses, and intelligent service robots. Smart carriers are also ideal for replacing many human tasks in complex environments where humans cannot function effectively. People working in these sinister environments must take strict protective measures, and intelligent unmanned equipment can enter or pass through these dangerous areas to perform corresponding work without the need for strict protection like humans. At present, some developed countries have adopted the intelligent unmanned equipment production competition as a strategic means of innovative education.

In a sense, the technology of intelligent equipment reflects the level of comprehensive technical strength of a country, and the smart car is the prototype of such intelligent equipment. The development of its control system will help promote the intelligent unmanned equipment control system. Development, while providing more favorable testing methods for the development of its development work.

2. Proposal of the program

The main body of the intelligent vehicle body is plastic wine box and acrylic board. It adopts metal green disk and crawler as the carrying system. The power supply uses 2800mAh rechargeable lithium battery. The powerful high-torque stepping motor and drive module form the trolley drive system. A variety of technologies are integrated to enable three manual controls and two auto-load functions. They are Bluetooth control function, infrared remote control function, voice control function, automatic obstacle avoidance function and automatic follow function. In addition to this, three major features are implemented, namely voice prompt function, character display function and carrying function.

In addition to the voice control function, all other control and automatic functions are realized by the same single-chip microcomputer. In the process of use, the function can be switched by the touch sensor installed on the smart car. The voice control function is controlled by a single single-chip microcomputer, and the switch needs to be switched when used. he main body of the intelligent vehicle body is plastic wine box and acrylic board. It adopts metal green disk and crawler as the carrying system. The power supply uses 2800mAh rechargeable lithium battery. The powerful high-torque stepping motor and drive module form the trolley drive system. A variety of technologies are integrated to enable three manual controls and two auto-load functions. They are Bluetooth control function, infrared remote control function, voice control function, automatic obstacle avoidance function and automatic follow function. In addition to this, three major features are implemented, namely voice prompt function, character display function and carrying function.

mechanical claw rotation angle for 0°to180°). At the same time, when the center axis of the object is not in the same line as the axis of the mechanical claw, we can rotate the second steering machine to achieve 360°clamping.

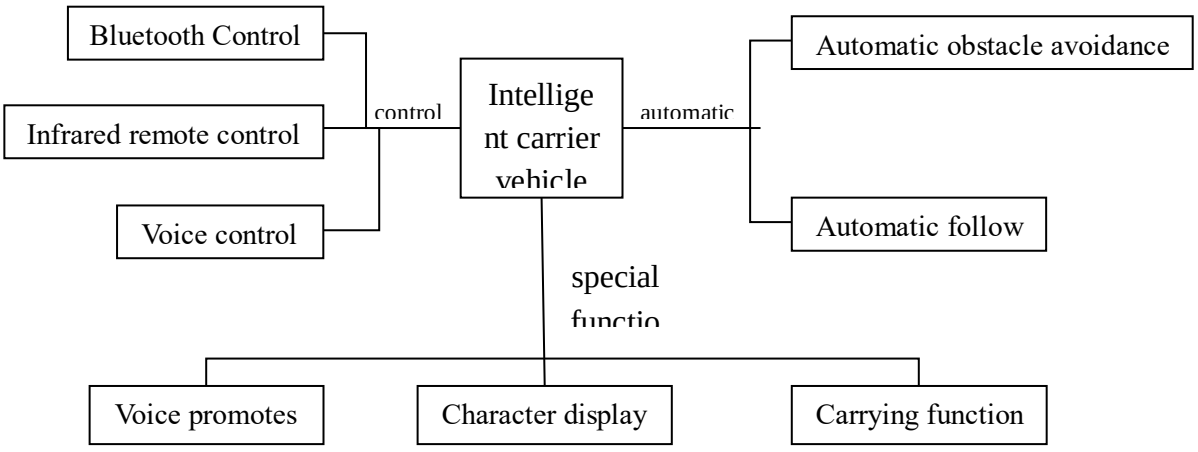

Figure 1. Functional Chart

3. Function display

Structural principle

Bluetooth control

The smart car Bluetooth remote control uses HC-05 as the Bluetooth control chip. The BLK-MD-HC-05 Bluetooth module is designed for smart wireless data transmission and uses the British CSR BlueCore4-Ext chip, which complies with the V2.0+EDR Bluetooth specification. This module supports UART, USB, SPI, PCM, SPDIF and other interfaces, and supports SPP Bluetooth Serial Port Protocol is an open global specification for wireless data and voice communication. It is based on low-cost short-range wireless connection, and establishes a special connection with the mobile

device communication environment to transform the mobile phone into a remote control. People's lives bring infinite convenience.

Infrared remote control

The transmitting circuit of the external remote controller uses infrared light emitting diodes to emit modulated infrared light waves, and the infrared receiving circuit is composed of infrared receiving diodes, transistors or silicon photo cells. They convert the infrared light from the infrared emitter into a corresponding electrical signal and send it to the post amplifier. The transmitter is generally composed of an instruction key (or an operating lever), an instruction encoding system, a modulation circuit, a driving circuit, a transmitting circuit, and the like. When the command button is pressed or the joystick is pressed, the command encoding circuit generates a desired command code signal, and the command code signal modulates the carrier wave. After the power is amplified by the drive circuit, the modulation command code signal is sent out by the transmitting circuit.

The receiving circuit is generally composed of an amplifying circuit, a modulating circuit, an instruction decoding circuit, a driving circuit, an executing circuit, and the like. The circuit receives the modulation coded command signal from the transmitter and amplifies the demodulation circuit. The demodulation circuit demodulates the modulation command coded signal, that is, the modulation command coded signal is restored to the coded signal. The instruction decoder decodes the encoded instruction signal, and finally the drive circuit drives the execution circuit to implement operational control (mechanism) for various instructions.

Voice control

In order to achieve automatic tracking of specific targets, the intelligent carrier vehicle uses STC1108XE microcontroller as the control core, and realizes voice control with LD3320 chip.

The chip integrates a speech recognition processor and some external circuitry, including AD, DA converter, microphone interface, sound output interface and more. No need to connect any auxiliary chip such as Flash, RAM, etc., directly integrated in the existing products can realize voice recognition / voice control / human-machine dialogue. A true single-chip speech recognition solution is provided. Within the LD332X, there is an efficient non-specific human speech recognition search engine module and a complete non-specific human speech recognition feature library, as well as hardware optimization and acceleration design for speech recognition.

The basic instructions used in this design are “go ahead”, “fall back”, “parking”, “turn left”, “turn right” and “tip”, which can control the movement and voice prompt function of the car separately.

Automatic obstacle avoidance

The ultrasonic module used in the smart carrier is HC-SR04. The HC-SR04 ultrasonic ranging module can provide 2cm-400cm non-contact distance sensing function, and the ranging accuracy can reach up to 3mm. The module includes ultrasonic transmitter, Receiver and control circuit. The STC89C52RC single-chip microcomputer is used as the control center of the trolley, and the obstacle detection is realized by the steering gear and the ultrasonic module installed on the head of the trolley. This design function is that the trolley encounters an obstacle in the process of travel and can transmit the signal obtained by the sensor to the single-chip microcomputer to react, realize the obstacle avoidance function, and can do the labyrinth trolley.

Automatic follow

The control system consists of the STC89C52RC microcontroller minimum system and its outer edge circuit. The control vehicle executes the ultrasound module in the event that the direct infrared transmit receive module first receives the infrared wave execution signal provided by the transmitter. When receiving the same acoustic wave as the filter frequency, the corresponding distance algorithm is calculated by the microprocessor, and the specific position of the following target is determined according to the liquid level value returned by the ultrasonic module. To control the mobile system's programmable PWM speed tracking for specific targets. Target positioning system

The positioning system consists of an ultrasonic module and an infrared module. An ultrasonic wave is placed above the front end of the vehicle, and two ultrasonic waves are placed under the vehicle.

The center axis is used as a reference point, and the left and right offsets are respectively 65 degrees. The infrared receiving tube is placed 2 cm to the left and right of the center axis, and the infrared receiving tubes are placed on the left and right axes of the car. In the process of tracking the target of the car, the user carries the infrared transmitting tube. When the infrared receiving tube at the front end of the car receives the infrared signal, it is judged as the "master", and the distance returned by the ultrasonic wave on the front end of the car and the two ultrasonic waves below is determined according to The three-point positioning algorithm determines the position of the target, and cooperates with the obstacle avoidance function of the infrared sensor at the rear end of the vehicle to realize automatic follow-up of the designated character.

The basic flow of the automatic follow-up function ultrasonic execution flow chart is as follows:

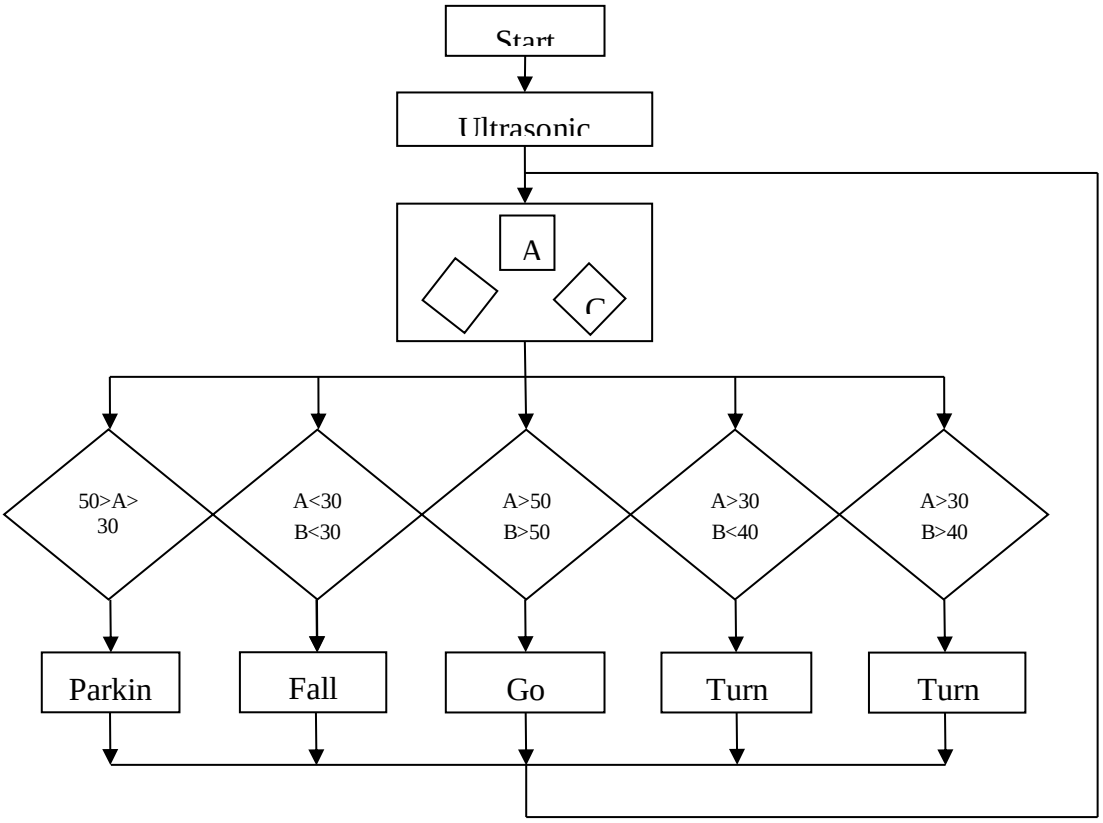

Figure 2. Automatic follow function flow chart

Special function

Voice prompts

In order to realize the audio playback function for a specific target, the car uses the STC microcontroller as the control core, and uses the DS1820 recording and playback module to implement the voice prompt function, which mainly has the following features:

Easy to use 10 seconds voice recording and playback.

High quality, natural voice reproduction.

Can be used as a megaphone module.

With loop playback, jog playback, single-pass playback.

Can be controlled by single-chip microcomputer, or can not be connected to the single-chip using the button control.

At the same time, the remote control and voice control can be used to start the recording and playback module. In the obstacle avoidance function, the car will automatically start when it encounters an obstacle four times.

Character display

The character display function is a special feature of the car, which can be used to display slogans, patterns, etc., located behind the car. Mainly through the LED dot matrix display, the LED dot matrix sub-module composed of a single LED is used to form a large LED dot matrix module. The dot matrix module we use is 16×16.

Carrying function

As a smart car, the car has a certain amount of space to carry some items. The work can be extended to the express delivery industry, which can greatly reduce the labor of the courier; we can also promote our design to the shopping malls of large shopping malls to realize intelligent shopping carts and provide great convenience to customers.

The carrier is propelled by the track, which can take complex terrain, and the cabin is designed with a shock absorption system, which effectively slows the jitter during the transportation and achieves a certain carrying function.

Fire source detection and automatic avoidance

In order to realize the suspicion function of dealing with complex environment and improve the safety of smart cars, the invention designs the fire source detection and automatic avoidance function. When the smart car travels, it encounters the fire source in front and can automatically detect, alarm and actively evade.

The flame sensor uses a characteristic that is very sensitive to flame infrared rays, uses a special infrared receiving tube to detect the flame, and then converts the brightness of the flame into a level signal of high and low changes, and inputs it into the central processing unit, and the central processing unit performs the change according to the signal. The corresponding program processing.

The flame sensor can detect flames or light sources with wavelengths ranging from 760 nm to 1100 nm. The sensitivity can be adjusted by the blue digital potentiometer in the figure. Output form: DO digital switching output (0 and 1) and AO analog voltage output. The flame probe converts the change of the intensity of the external infrared light into a change of the current, which can be reflected by the A/D converter as a value change in the range of 0 to 255. The stronger the infrared light is, the smaller the value is; the weaker the infrared light, the larger the value. The smart car flame sensor is installed in the front position and uses the DO digital switch output. When the fire source is detected, it outputs 0, otherwise it outputs 1. When the fire source is detected, the car will automatically trigger the sound alarm device on the car to make a “drip” sound, then it will go backwards, select the appropriate path to turn according to the data of the ultrasonic feedback, and proceed.

The specific program flow chart is as follows:

4. Innovation and application

This work uses infrared remote control and Bluetooth remote control, which can easily realize remote control within 30 meters. It can be used at the same time with mobile phone app. It is easy to operate and easy to get started.Integrate the cleaning, disinfection and collection devices into a single machine.

The load-bearing parts of the carrier are concentrated in the rear, close to the center of gravity of the car. After a lot of experiments, the stability of the car has been greatly improved.

The voice can be used to control the car to carry out basic actions such as forward, backward, and turn, as well as some characteristic actions. Make possible for the realization of stunts. Voice control allows the operator to better accomplish his or her own intent.

A trunk and a carrying case are left at the rear of the car and can be used to carry items. As the technology matures, other modules can be installed on the basis of the future to facilitate upgrades.

The LED dot matrix module is installed behind the car body to display various texts and pictures, which has a good visual impact.

Can broadcast the classic lines in "Wandering Earth", "10 million roads, safety first, non-standard driving, two tears of loved ones." Played a safety warning effect.

Using the touch sensor for function switching, convenient and fast, user experience is good.

Smart car integrates multiple control technologies to cope with complex environments. You can replace people in high-risk areas to perform tasks such as investigation, transportation, obstacle avoidance, and rescue.

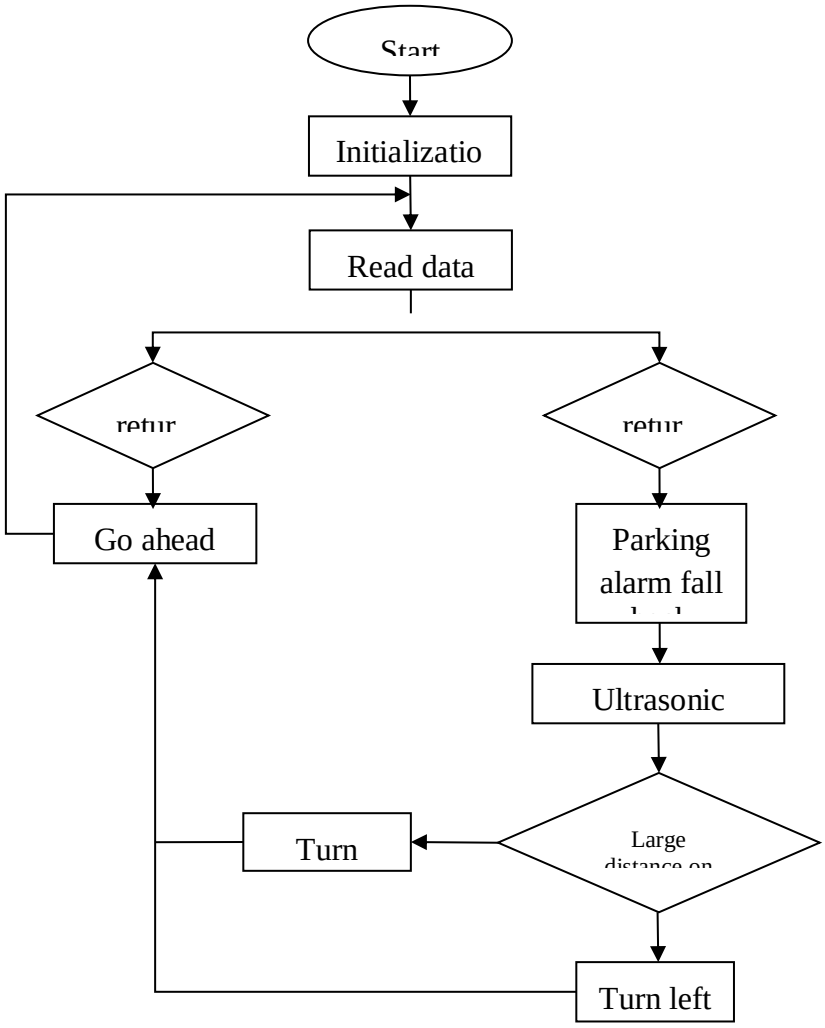

Figure 3.Flame sensor program flow chart

5. Conclusion

The products we designed and researched involved intelligent vehicle follow-up, automatic obstacle avoidance, manual control, voice recognition control and other functions, and initially realized intelligent. It adopts a variety of control functions, and has automatic obstacle avoidance, recognizable automatic follow two automatic driving functions, plus a variety of sensors such as flame sensors to make the smart car adapt to a variety of complex environments. This work can be used as a basic model for various scientific research, with a large research space, suitable for intelligent research and development in various fields.

With the rapid development of computers and microelectronics technology, the development speed of intelligent technology is getting faster and faster, the intelligence of various devices in life is getting higher and higher, and the scope of application of intelligent technology has also been greatly improved. Expansion. At the same time, the development of today's highly intelligent robotics technology has been applied to many fields such as archaeology, exploration, and national defense.

With the increasing contribution of intelligent technology to the social economy and people's livelihood, countries have paid more and more attention to the research of intelligent technology. At present, almost every time in various electronic competitions in the country, there are competition topics in smart carriers. The major universities in the country also attach great importance to the research of smart car projects, which shows that the project has great research significance.

References

[1] V. Yu. Teplov, A. V. Anisimov. Thermostatting System Using a Single-Chip Microcomputer and Thermoelectric Modules Based on the Peltier Effect[J] ,2002.

[2] Yeager Brent. How to troubleshoot your electronic scale [J]. Powder and Bulk Engineering. 1995.

[3] Meehan Joanne, Muir Lindsey. SCM in Merseyside SMEs: Benefits and barriers[J]. TQM Journal. 2008.

[4] J. Huang: Intelligent vehicle design based on fuzzy control [J]. China Science and Technology Information, 2010.20.

[5] G. Li, X. J. Meng, X. H. Wang, C. Q. Wang. Application Status of Domestic Ultrasonic Ranging Research[J]. Science and Mapping Science, 2011(07):60.

[6] Z. D. Zhao. Production of multi-functional remote control smart car[J]. Vol. 4 (2011).

[7] Y. L. Li et al. Research and Design of Smart Cars [J]. Science and Technology Guide to Enrich, Vol. 26 (2011).

[8] T. J. Chen. Intelligent Control Theory and Application [M]. Beijing: Tsinghua University Press, 2009.1.

[9] Y. G. Zhang, X.Y.Peng, Y. Peng. Principle and application of single chip microcomputer [M]. Higher Education Press, 2011.5.