Multi-functional Intelligent Car With Wireless Communications

Huang Mengtao[1,a], Wei Lu[2,b]

[1]School of Electrical and Control Engineering, Xi'an University of Science and Technology, Xi'an, 710054, China

[2]School of Electrical and Control Engineering, Xi'an University of Science and Technology, Xi'an, 710054, China

[a]we_itianlu@126.com, [b]330618752@qq.com

Keywords: Microcontroller; Wireless communications; Multi-functional; Smart car.

Abstract. With the development of human science and technology, modern life rhythm speeding up, people's demand for intelligent in improving. Using intelligent machines instead of manpower, reduce human labor burden and improve the work efficiency has been becoming the current hot.

Taking STC12C5A60S2 single-chip microcomputer as main control chip, with nRF905 wireless communication devices finished the design of the multifunctional intelligent car system with wireless communications. Smart car tracking, remote control, free walk of obstacle avoidance, and other functions. In the console can realize the switch of each mode, through the nRF905 send instructions to control the car running mode, in the car to use TCRT5000 infrared photocell tracking sensor, using E18-D80NK photoelectric sensor for obstacle avoidance sensors, using DHT11 temperature and humidity data acquisition module, and will gather information through wireless module back to the console.

Introduction

Wireless communications intelligent robot is a self-organizing, self-run, self-planning and realization of intelligent robots can wireless communicate with and control human-computer platform. It can replace human labor to improve work efficiency, can replace people working in dangerous, hostile work environment and inaccessible areas, while the environment information can be detected in real time, and real-time data back to the human-computer platform that allows the platform to remotely monitor environmental conditions.

The user can choose the car in the console mode of operation, namely the tracking mode, remote control mode, walking free obstacle avoidance mode and speed mode, at the same time can understand the field of environmental temperature and humidity information in real time.

The system design

The design is divided into two parts, including a vehicle body and the console. In the console, customers can choose the car running mode, the operating mode including: self-tracking mode, remote control mode, automatic obstacle avoidance walking mode, speed mode. Through the console, in accordance with the need to select the operating mode. When selecting a tracking mode, the car will follow the pre-set orbit autonomous walking, the car is equipped with temperature and humidity sensor， which can collect temperature and humidity information and sent it back to the console via a wireless transceiver module. When you select remote mode, the console control the car's running condition and route, straight, backward, turn left, turn right. Selecting automatic obstacle avoidance walking mode, the car go straight, if it encounters obstacles will turn left 90 degrees. When selecting speed mode, you can set the speed of the car through the console, the speed is divided into three files, corresponding to low, medium, high speed.The system design is shown in Fig.1.

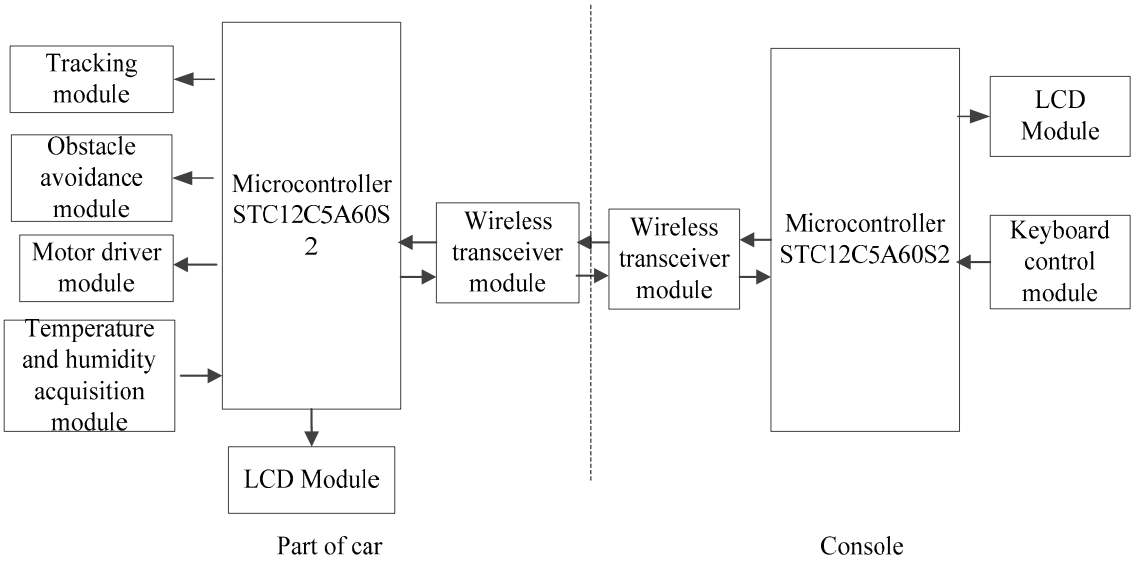


Fig.1. The system design principle of the frame

Hardware design

The hardware design is based on system design based on the overall program. From the two parts to introduce the design, namely the car part and console parts. Trolley terminal is divided into seven modules: SCM minimum system, nRF905 wireless transceiver module, motor drive module, the tracking module, obstacle avoidance module, temperature and humidity acquisition module, LCD module. The console includes minimum system microcontroller, nRF905 wireless transceiver modules, LCD modules and case module. I will focus on the following modules.

nRF905 wireless transceiver module.nRF905 chip integration within these modules have power management, crystal oscillators, low noise amplifiers, power amplifiers frequency synthesizer, and so on. Manchester encoding / decoding is done by the on-chip hardware. nRF905 interface circuit is shown in Fig.2.

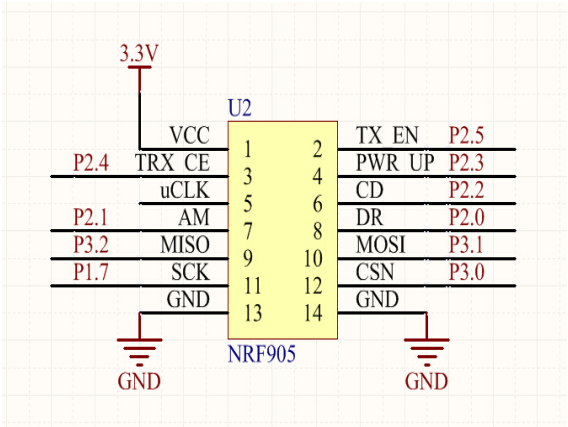


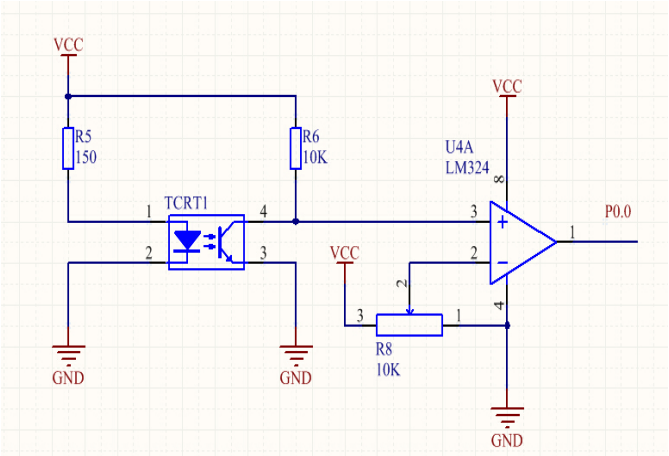
Fig.2. nRF905 interface circuit

The design adopts DHT11 digital temperature and humidity sensor.DHT11 is a temperature and humidity sensor,which contains the digital composite signal output . It applies dedicated digital module technology and the temperature and humidity sensor technology.DHT11 has the extremely high reliability and excellent long-term stability. It has excellent quality, super fast response, strong anti-interference ability, high cost performance.

Tracking avoidance module. Tracking using TCRT5000 infrared, photoelectric infrared receiver reflection on black and white lines, will produce different voltage values. By the comparator, when

the photocell detects the black line and white line, we make it output high and low levels, respectively. Tracking module circuit is shown in Fig.3.

Obstacle avoidance module uses photoelectric sensors E18-D80NK, the output state is high or low, normal output is high, an object is detected output low. Obstacle avoidance module interface circuit is shown in Fig.4.



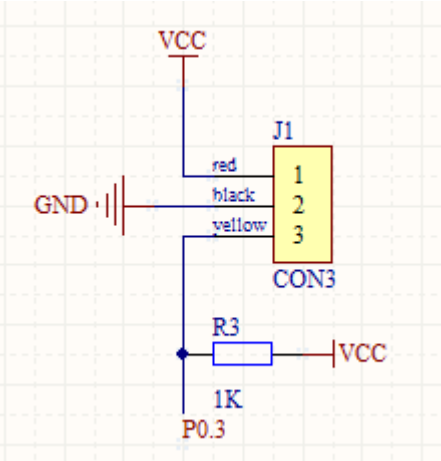


Fig.3. Tracking module circuit diagram Fig.4. Obstacle avoidance module circuit diagram

LCD module. Different from the car side, because the console has sufficient resources of microcontroller IO, console LCD read and write data using parallel communication. Thus PSB pin requires set high, VO pin is connected to the middle pin on the potentiometer.

Software Design

The design process is divided into two parts, namely console program and car-side program.

Car-side program. Through wireless transceiver module, the car receives commands from the console to select the operating mode, simultaneously send the collected information back to the console. When turned on, the car first initialized ,displays the initial screen, then wait for an instruction sent from the console, select the operating mode, run in accordance with the requirements of the model. When the car in tracking mode or automatic obstacle avoidance walking mode, the collected information is sent back to console via the wireless transceiver terminal. As shown in Fig.5.

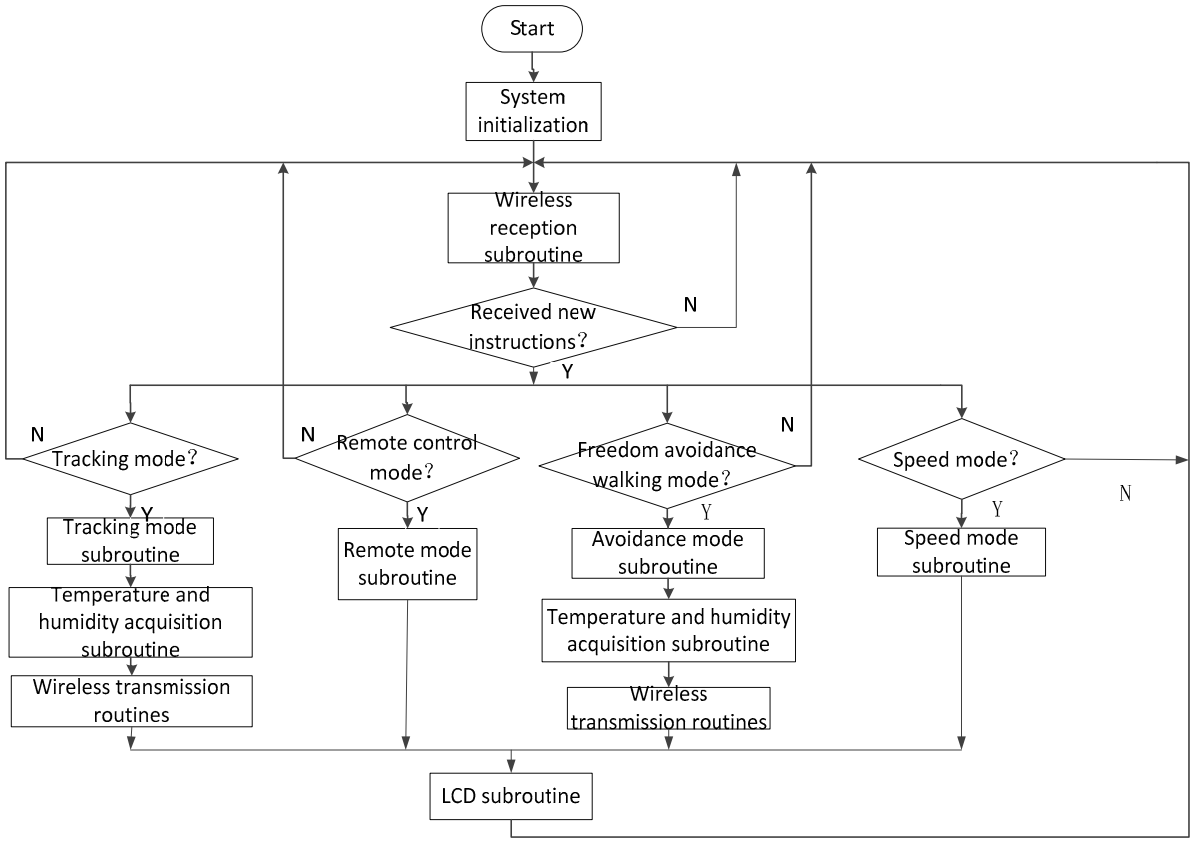


Fig.5. Car-side's the main flow chart

Console software design. Console is a control terminal of the whole system, a command transmitting terminal of each module, while receiving environment collecting information from a remote terminal. Console is mainly used to send control commands as well as receive temperature and humidity information sent back by the car terminal. Core software system design is the main program; call each subroutine in the main program to perform different functions. As shown in Fig.6.

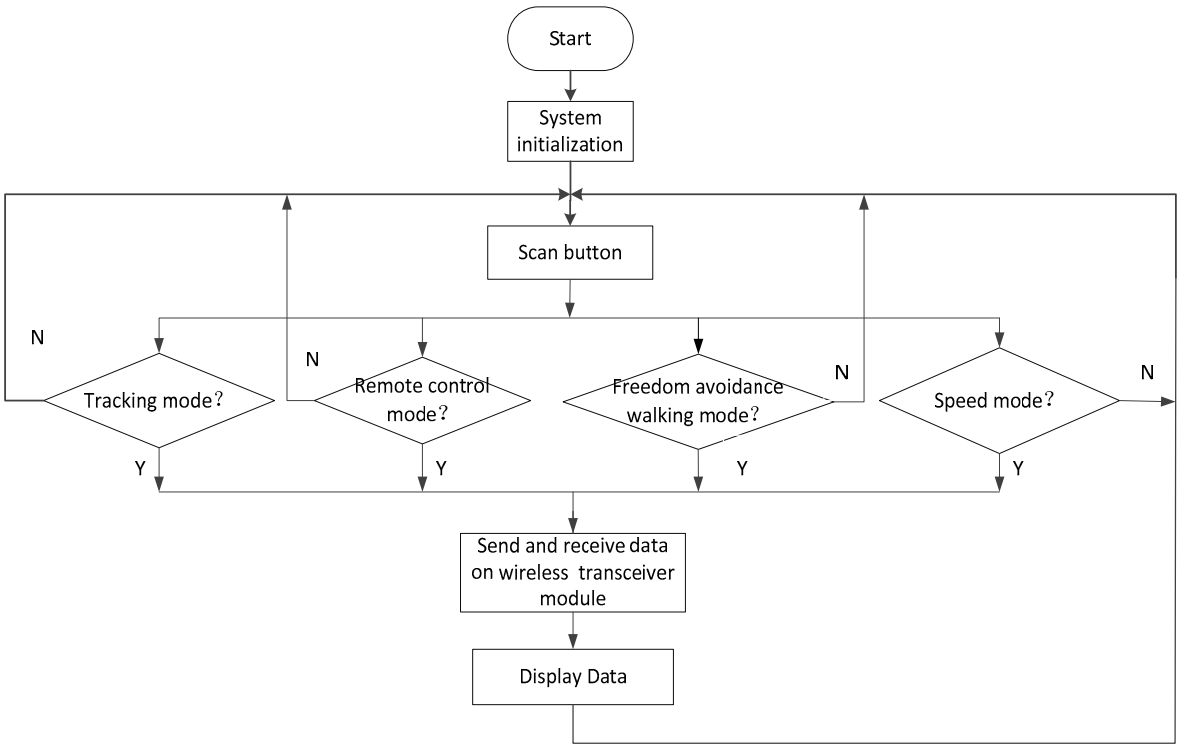


Fig.6. Console main program flow chart

Summary

The system is a smart car based on wireless communications, including the intelligent control, remote control, environmental information collection functions. The system Design is so simple and easy to operate. It is a versatile car and has important significance for people to explore an unknown environment.

References

[1]Zheng Feng.51 SCM typical application development paradigms Guinness[M]. Beijing: China Railway Publishing House,2011.10

[2]Sun Huanming.51 microcontroller c program application example explanation[M]. Beijing: Beijing University of Aeronautics and Astronautics Press,2011.3

[3]Xiaoming Wang. motor microcontroller control[M]. Beijing University of Aeronautics and Astronautics Press,2011.25(7):40-42

[4]Yibin Zhu,Xuelong Hu,Yafeng Zhu.Autonomous robot car tracing design[J]. Foreign Electronic Measurement Technology, 2006,25(7):40-42

[5]Jianping,Wu,Zhanguo Yin.IR reflective sensor and then tracing autonomous car navigation application [J] . Chinese testing technology, 2004, 30(6): 21-23

[6] Roland Siegwart,Illah Reza Nourbakhsh,Davide Scaramuzza.Intelligent Robotics & Autonomous Agents Series[M]. MIT Press; 2nd Revised edition 2011.3