The hardware design of the patrol car for oil and gas field remote monitoring

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Abstract

Now for its dangerous, with oil and gas field is mainly artificial monitoring. If it has accidents, people may not be able to escape. With the development of information technology, the embedded system, unmanned technology, and communication technology and so on, that mature gradually. These technologies have been comprehensively developed in the consumer products. Such as industrial control, traffic control, information appliance, family intelligence management system, electronic commerce, environmental engineering, robot. This project focuses on the unmanned technology, to design a car with automatic identification of road, automatic driving, video acquisition and other functions of the unmanned patrol car. It can solve the current shortcoming of oil and gas patrol car must be driven by people.

Keywords

Embedded system; ARM; Monitorin; system; MCU.

1. Research purpose and significance

This project is helpful to unmanned technology research, for future oil and gas field in unmanned technology is a new breakthrough, through this project developed a car with automatic identification of road, automatic driving, automatic obstacle avoidance, video acquisition, GPS satellite positioning functions in one of the unmanned patrol car driving.

Development of the car's success can be solve the oil field at present must be human testing, slow speed, maneuverability is not strong weaknesses, staff just sitting in the control room inside can track patrol vehicle location information, and through patrol car camera observed oil and gas around the scene of the situation, and the oil and gas field in hazard detection.

2. The overall design of the system (Fig. 1)

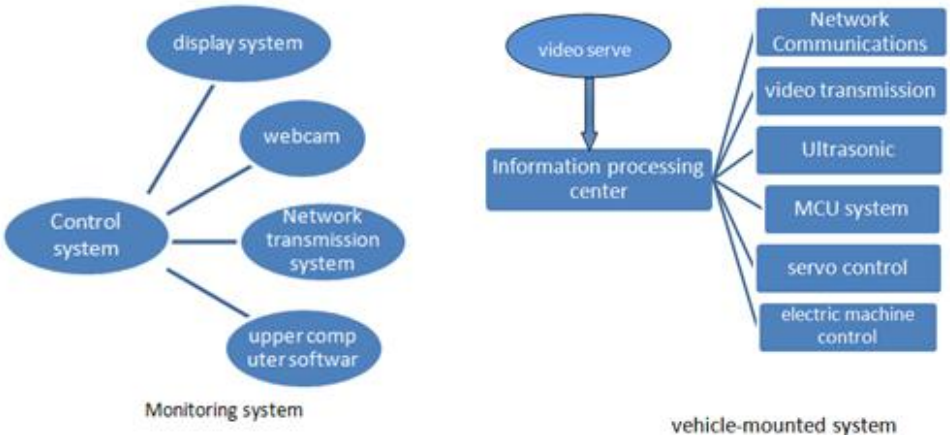

Fig. 1 the overall scheme of the system

3. Hardware design of System

3.1 Hardware design of System

The system consists of ten parts: the main control, camera, component circuit, motor, steering, motor drive, ultrasonic, display, power and auxiliary debugging.

3.2 MCU module function

MK60DN512ZVLL10 master module: Using the Freescale 32 bit microprocessor of Kinetis 60, It integrates a variety of practical and more commonly used functional modules, easy to use, powerful. The MCU is also the key of the whole control system. The slave computer program will complete the control of the car according to the instructions received. Communication with the MCU to the server is used to complete the video server and mobile terminal, through a router or other network, in the custom protocol is able to complete the data exchange, so, in the case of network connectivity, remote control system is realized.

3.3 The camera

In this material, in order to complete the image acquisition and transmission, my choice is a webcam. Through the network using TCP / IP protocol to transmit video and audio. A total of two models using by web camera: without the PTZ traditional CCTV camera and with the PTZ camera.

3.4 The circuit element

power-supply module:

(1) Because the network video server needs 12V/2A external point power supply, the battery voltage is about 7.2V, so it needs a boost module, which makes the voltage to achieve the required value (Fig. 2 and Fig. 3).

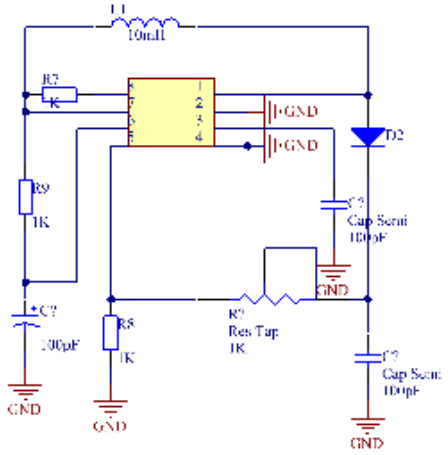

Fig 2 12V step-up circuit

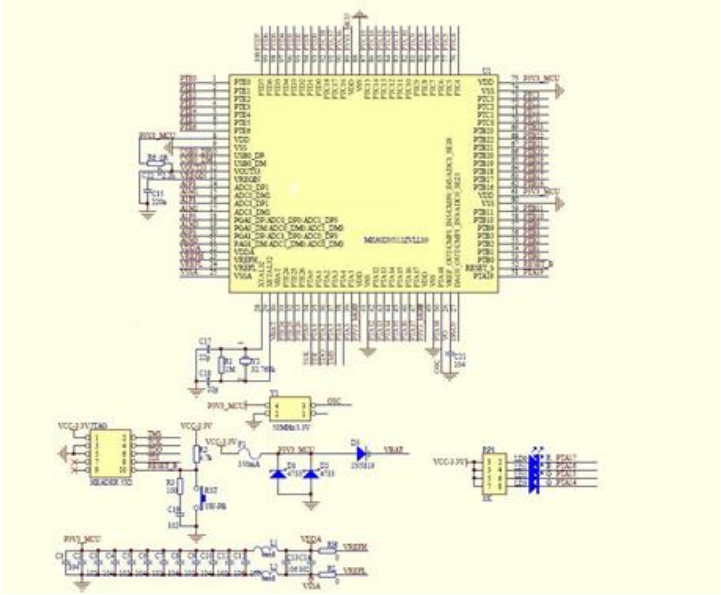

Fig 3 the minimum system

(2)For the control system of the patrol car, The Freescale company K60, the working voltage is about 3.3V, belongs to the typical type of low power consumption, flash write voltage is 1.71-3.6V, the high speed kernel, its performance can reach 1.25 Dhrystone MIPS /MHz. This series provides high performance MAC, in the industrial automation of precision, real-time requirements, this fully meet the requirements.

(3)Due to use the speed and direction of K60 single-chip control of the car, so the need for the microcontroller 3.3V voltage, we use the ASM1117 chip (Fig. 4).

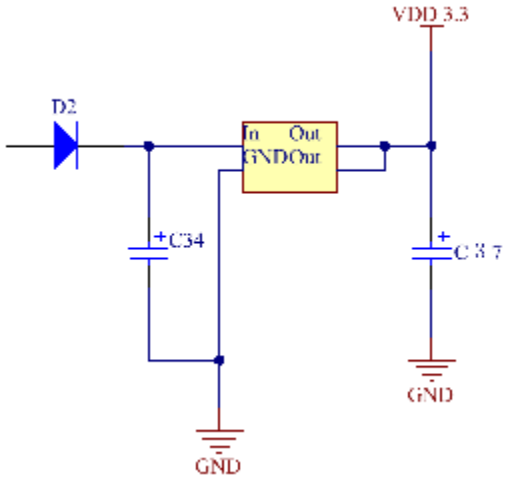

Fig. 4 3.3V voltage

（4）Due to the steering of the car need to use digital steering gear, so we need to provide 5V voltage for the steering gear, when we use the ASM1117 chip (Fig. 5 and Fig. 6).

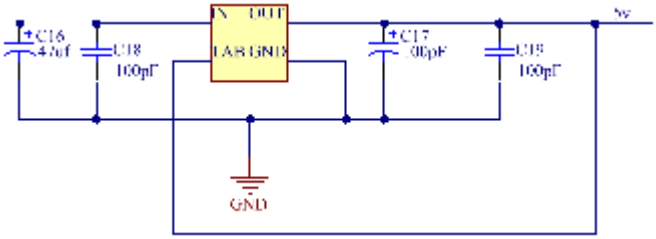

Fig. 5 5V voltage

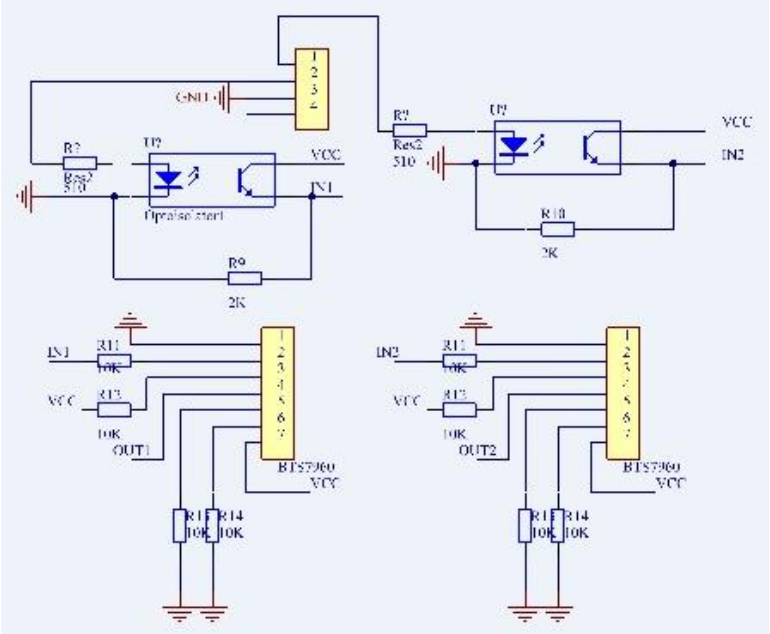

Fig. 6 motor drive

3.1 Electric motor

For the need for a larger power patrol car, the average speed of the car, it is necessary to achieve the car's acceleration and braking ability is relatively strong, so relatively speaking, the speed of the car will be faster.

In order to make the car to adapt to more terrain, then the power should be equipped with as much as possible. And the speed of the motor is positively correlated with the voltage at both ends of the motor.

3.2 Ultrasonic distance measurement

The module detects the distance of the surrounding object from the vehicle body during the running of the patrol car, thereby maintaining a safe condition. Ultrasonic module ranging generally up to 4 to 2 meters, measurement accuracy can reach 3mm; module includes ultrasonic transmitter, receiver and control circuit.

The test distance is half of the high level duration and the speed of sound. At the same time, if there is no return signal, it can be determined that there is no obstacle around (Fig. 7 and Table 1).

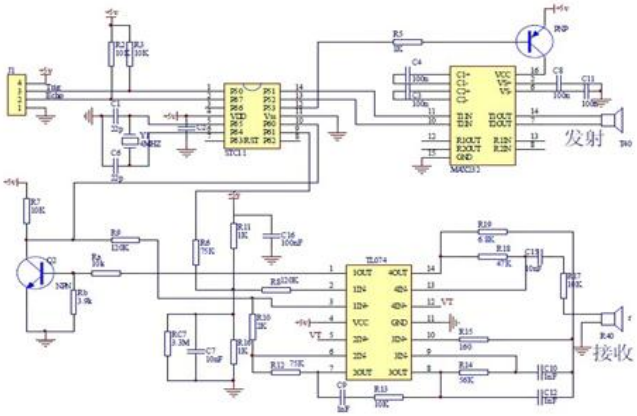

Fig. 7 ultrasonic circuit

Table 1 ultrasonic parameters

Electrical character	HC_SR04 Ultrasonic module
Working voltage	DC5V
Working current	15ma
Working frequency	40KHz
Farthest range	4m
Nearest range	2cm
Measuring angle	15 degree
Input trigger signal	TTL pulse of 10us
Output response signal	Output TTL level signal, and the range of the ratio
Specifications	45*20*15mm

3.3 Indicate

The display module of the vehicle system can clearly display the parameters of the terminal, and the debugging time is more convenient. At the same time can also show some additional information to inform the user of other related information.

On display there are many devices, such as 160212864, no5110, TFT color display. But taking into account the price, the use of convenience and other comprehensive aspects of the situation, we chose the no5110 display.

(1). high performance-price ratio.
(2). Simple interface.
(3). Fast speed.
(4). 5110 can be shared with the K60 the same voltage, that can work at low power, for the limited supply of equipment is very suitable.

4. Conclusion

The project can track the location information of the patrol car in the control room, control the operation of the patrol car and monitor the surrounding environment information of the patrol car. The car is equipped with remote video transmission system and remote wireless data transmission system, through the communication system real-time acquisition patrol vehicle position information and video image information, according to the collected information remote monitoring and the patrol car was necessary to control.

The project to build the platform of embedded technology, intelligent vehicle control technology, network communication technology, remote control technology in-depth exploration and also exhibits the unmanned technology advantage and the monitoring system of the suitability, HD, intelligent, autonomous navigation set in one of the real show in front of us, and the risk of oil and gas field serves the purpose of inspection and monitoring.

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