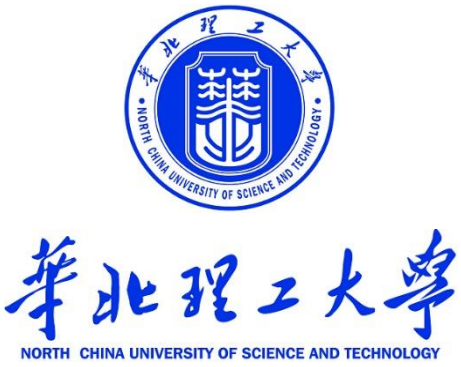
学 号：**201614420112**



翻译文档

TRANSLATION

设计题目：**基于 Arduino 倒车雷达的设计与实现**

学生姓名：刘佳玮

专业班级：16 计算机科学与技术 1 班

学　　院：人工智能学院

指导教师：曾屹　高级实验师

2020 年 06 月 12 日

摘要

近些年，随着司机和车辆数量的迅速增长，道路变得越来越拥挤，停车条件也随之越来越困难。尤其是在特定的黑夜、道路拥挤和大雾环境里，司机开车的难度更是增加很多。但倒车雷达大大降低了驾驶员的体力和脑力消耗，司机只需要坐在车内就可以了解车辆周围的环境，为在视线受阻、地面环境恶劣的情况下倒车停车提供了很大的安全性，从而提高行车安全，降低司机很多安全隐患。

Arduino对于任何一种小型控制或监视应用来说AVR处理器都是理想的选择。它们包含有一组内置的片上外设，还可以在片外扩充附加功能。具有的丰富接口可以利用多种通信机制对周边I/O设备进行编程进而完成逻辑控制，编写出比较复杂的程序，完成功能多样化的作品。

在实现倒车雷达系统的过程中，硬件系统将作为软件正确运行的载体。本次设计的倒车雷达硬件系统包括：（1）制动系统由电机模块和电机驱动模块组成，负责驱动车辆完成前进、后退和转向等功能；（2）测距系统由超声波模块组成，负责实现障碍物的检测和测量与障碍物距离的功能；（3）通信系统由蓝牙模块组成，负责数据的收发功能，即接受 PC 端上位机发来的控制指令数据，将超声波的测量的距离数据发送回 PC 端；（4）供电系统由 7V 和 9V 两种电池组成，因为 Arduino 的输出电压无法驱动电机，所以制动系统需要单独的供电系统。因此供电系统分为两部分，分别为 9V 电池负责给主控芯片供电，和两组电压 7V 的电池负责给电机模块供电。

因此软件系统可划分为两个大类，分别为硬件层的软件设计和 PC 端的软件设计。硬件层包括三个模块：感知功能模块、通信功能模块和控制功能模块。其中，感知功能由超声波模块构成，负责探测与外部障碍物的距离，用于给驾驶员提供辅助信息；通信功能模块由蓝牙模块和 PC 端上位机组成，由 PC 端上位机借助串口发送控制指令的数据到蓝牙模块，Arduino 读取蓝牙的数据进而控制车辆完成相应指令；控制功能模块由 Arduino 构成，根据 PC 上位机端发送的指令进入倒车模式、控制车辆运行、紧急制动和退出倒车模式，控制车辆的运行。PC 端软件包括两个模块：显示功能模块和通信功能模块，显示功能模块负责 PC 端上位机实时显示倒车影像；通信功能模块负责发送控制指令和读取 Arduino 端发送的距离数据。

在倒车开始时，用户开启倒车功能，系统通过脉宽调制技术降低车辆的运行速度，同时感知功能模块开始运转。将车辆后侧距离障碍物的距离数据通过通信功能模块反馈给用户，对用户的倒车起到一定辅助作用。当距离感知模块探测到与障碍物的距离小于安全距离时，车辆将采取紧急制动的措施并非继续执行驾驶

员发出的控制指令，由系统强行制动保证车辆和人身安全。而停车的另一情况为倒车结束，此时车尾与障碍物距离过近，驾驶员可确认停止倒车，退出倒车模式，此时倒车正式结束。待到下次倒车开始时，驾驶员可以选择是否开启倒车雷达。

在驾驶员正常驾驶和不开启倒车雷达的情况下，系统将关闭倒车雷达的超声波模块和制动中断等功能。一方面，降低系统功耗，节约资源保护环境；另一方面，在正常驾驶的过程中，难免遇到堵车等情形，不关闭倒车系统可能会导致车辆的意外停车现象，带来潜在的交通隐患。因此只有确认进入倒车模式时才开启超声测距功能，而在倒车结束后需要关闭超声测距功能。

在详细设计完各个模块的功能后，最终将实物与理论相结合，制作实际的倒车雷达系统。之后对系统的运行进行模拟实验，发现具有良好的性能。不仅能够准确的接收 PC 上位机端发送的指令并按指令执行；且在倒车期间能及时减速，实现在水平正方向 5cm-100cm 的距离较准确测距，对于车体后方的形状规则的障碍物有一定的提醒作用，并在遇到危险情况时能及时制动。本设计具有成本低，集成度高等优点，对于辅助驾驶员倒车有很好的帮助作用，因此具有一定的理论价值和实用价值。

Abstract

In recent years, with the rapid growth of the number of drivers and vehicles, the roads have become more and more crowded and parking conditions have become more and more difficult. Especially in certain dark, congested roads and foggy conditions, driving becomes more difficult. However, the reversing radar greatly reduces the physical and mental consumption of the driver. The driver only needs to sit in the car to understand the surrounding environment of the vehicle, which provides great safety for reversing and parking under the condition of blocked sight and bad ground environment, thus improving driving safety and reducing many safety hazards for the driver.

Arduino is the ideal AVR processor for any small control or monitoring application. They include a set of built-in on-chip peripherals and can be augmented with additional functionality off-chip. With rich interfaces, it can use various communication mechanisms to program peripheral I/O devices and then complete logical control, write more complex programs, and complete works with diversified functions.

In the process of realizing the astern radar system, the hardware system will be used as the carrier of software running correctly.

The hardware system of reversing radar in this design includes :(1) the braking system is composed of a motor module and a motor drive module, which is responsible for driving the vehicle forward, backward and turn. (2) The ranging system consists of an ultrasonic module, which is responsible for the detection and measurement of the obstacle distance; (3) The communication system is composed of Bluetooth module, which is responsible for the sending and receiving function of data, that is, receiving the control instruction data from the upper computer on the PC side, and sending ultrasonic distance data back to the PC side; (4) The power supply system is composed of 7V and 9V batteries. Since the Output voltage of Arduino cannot drive the motor, the braking system needs a separate power supply system. Therefore, the power supply system is divided into two parts, namely, 9V battery is responsible for supplying power to the main control chip, and two groups of batteries with a voltage of 7V are responsible for supplying power to the motor module.

Therefore, the software system can be divided into two categories, namely hardware software design and PC software design. The hardware layer includes three modules: sensing module, communication module and control module. Among them,

the sensing function is composed of ultrasonic module, which is responsible for detecting the distance from external obstacles and providing auxiliary information to the driver; the communication function module is composed of Bluetooth module and PC upper unit; the PC upper unit sends the data of control instructions to Bluetooth module by means of serial port, Arduino reads the data of Bluetooth and then controls the vehicle to complete the corresponding instructions, the control function module is composed of Arduino, which can enter the reversing mode, control the operation of the vehicle, emergency braking and exit the reversing mode, and control the operation of the vehicle according to the instructions sent by the PC upper computer. The PC software includes two modules: display function module and communication function module. The display function module is responsible for the real-time display of reversing image on the PC upper computer; the communication function module is responsible for sending control instructions and reading distance data sent by the Arduino.

At the beginning of reversing, the user turns on the reversing function, and the system reduces the vehicle's running speed through pulse width modulation technology, while the sensing function module starts to operate. The distance data of the rear side distance obstacle is fed back to the user through the communication function module, which plays a certain auxiliary role in the reversing of the user. When the distance sensing module detects that the distance from the obstacle is less than the safe distance, the vehicle will take emergency braking measures instead of continuing to follow the control instructions issued by the driver. The system will force the braking to ensure the vehicle and personal safety. When the rear of the vehicle is too close to the obstacle, the driver can confirm to stop reversing and exit the reversing mode, and then the reversing officially ends. When the next astern begins, the driver can choose whether to turn on the astern radar. Under the condition that the driver is driving normally and the reversing radar is not turned on, the system will turn off the ultrasonic module and brake interrupt functions of the reversing radar. On the one hand, reduce system power consumption, save resources and protect the environment; On the other hand, in the normal driving process, it is inevitable to encounter traffic jams and other situations, not turning off the reversing system may lead to the unexpected parking phenomenon of the vehicle, bringing potential traffic hazards. Therefore, the ultrasonic ranging function should be turned on only when the astern mode is confirmed, and the ultrasonic ranging function should be turned off after the reverse.

After the function of each module is designed in detail, the actual reversing radar system is finally made by combining the real object with the theory. After the simulation experiment of the system, it is found that the system has good performance. Not only can accurately receive the instructions sent by the PC upper computer side and execute them according to the instructions; In addition, it can slow down in time during reversing, so as to achieve accurate ranging from 5cm-100cm in the positive horizontal direction. It also has a certain function of reminding obstacles with regular shape behind the car body, and can brake in time in case of danger. This design has the advantages of low cost and high integration, which is very helpful to assist the driver to reverse, so it has certain theoretical value and practical value.