

## A novel design of intelligent tracking maze car

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**Abstract.** This paper discusses a control system for intelligent tracking. It takes STC89C52 as control core, the infrared tube ST118 for road information acquisition sensor, and will collect back the information analysis and processing, output the corresponding duty cycle of the PWM wave as a motor drive signal, controls the operation of the motor drive full bridge motor through the L298N composition, can independent tracking to reach the destination. After arriving at the destination, according to the stored in the advancing process of intelligent vehicle information, through the handling of these historical data, constructs the road model, and correctly find the optimal path is returned, and quickly return to. This process is completed in nobody's participation, reflect the intelligent control.

### Introduction

Along with the progress of the society, intelligent is the inevitable trend of the development of science and technology. The wheeled robot will be in the field of traffic, national defense, scientific exploration occupies an important position, so must be intelligent. Therefore, the research of making an efficient intelligent car is of important theoretical value and practical significance, for example, that the smart car automatic into the possession of dangerous goods building, timely and rapidly items will be taken away from the building, greatly reduce the losses resulting.

Intelligent vehicle is a comprehensive set of system environment perception, planning decision and other functions in one, can the safe running of the vehicle along a certain path. It develops today, already contains a mechanical, electronic, computer, automatic control, signal processing, sensor and other disciplines of knowledge, intelligence is higher, it is widely used in industrial and domestic fields. However, to achieve such an automatic control system is a complex process, it relies on the motion system, and have powerful control system to ensure the stability and efficiency of the whole system.

The self-tracking car is such a system to simplify the body, but it contains a basic module in common, namely, the sensor module, power module, main control module and the motor drive module. Intelligent car through the analysis and processing of information perception, path planning, and then make a decision, the drive motor, the final completion of the tracking task.

### The hardware design

To complete the self-tracking task, hardware design should have the power module, sensor module, motor driver module, and the main control module. The power supply module is the energy source, it will give each module of the intelligent car provides the required electric power. The sensor module is used for sensing the path information, and will be useful feedback to the main control chip in the form of electricity. The current minimum as the main control chip can provide, not enough to drive the motor, so the need for motor drive module, the control signal is converted to motor output torque. The main control module is the core of the system; it controls the harmonious operation of each part. Fig. 1 is shows functional block diagram.

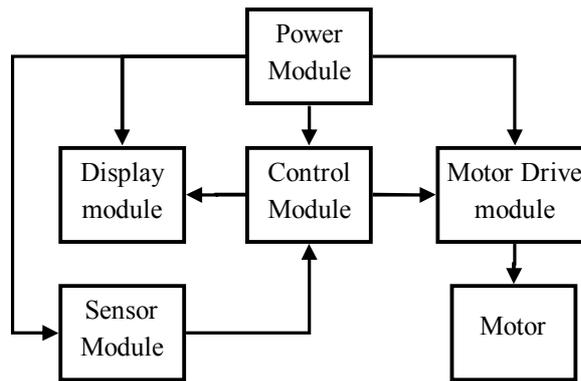


Figure 1. Functional block diagram

**The example of maze.** As shown in Fig. 2, the intelligent car from the starting point, independently running along the black line, cannot leave the black line, successfully reached the destination, and select the optimal path to return to the start and finish of self tracking function.

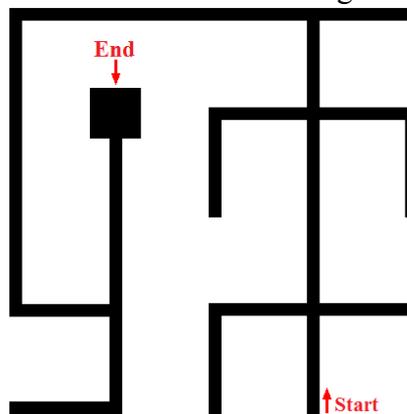


Figure 2. The example of maze

**The sensor layout.** According to the road characteristics, the road contains a "straight", "T-junction", "crossroads", "corner", "dead end", "end point", and "starting point", design a reasonable position sensor correctly is very important, which determines the intelligent car could complete tracking task, and determines the degree of vehicle speed to a large extent. Therefore, we consider the following three kind of scheme.

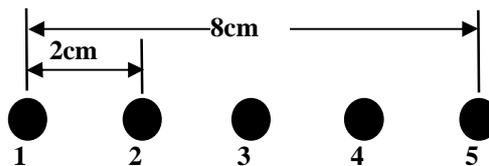


Figure 3. The sensor along a straight line

As shown in Fig. 3, the sensor adopts the lined the route. To do so is very easy to detect the "straight", "T-junction", "angle" and "starting point", and the arrangement is simple, the hardware is easier to realize, but encountered the crossroads and end could not distinguish, therefore should take the other scheme.

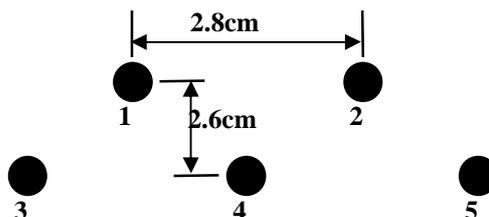


Figure 4. The double row arrangement

As shown in Fig. 4, the double row arrangement, it can discriminate various roads correctly, But when the car in a straight line, with some difficulty processing, resulting in intelligent car can not run smoothly.

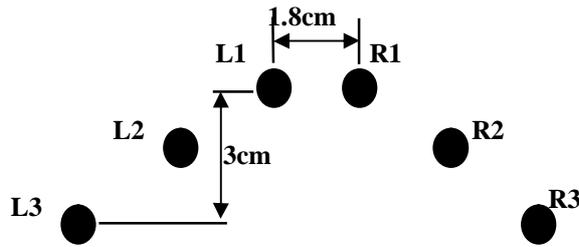


Figure 5. The optimized arrangement

The arrangement shown in Fig. 5 is adopted, which combines the advantages of the previous two schemes, can correctly identify the various cases of road, also can obtain multiple groups of deviation, according to L2, R1, L1, and R2, which can smoothly control the speed and steering. Therefore, we ended up using this arrangement.

### The software design

**The software flow.** The intelligent car during the running process, in accordance with the sensor on the road information acquisition, and the information in the form of voltage and sent to the main control chip, and then the main control chip according to the returned information analysis and processing, finally make the right to control the motor processes to perform. The software flow chart of system is shown in Fig. 6.

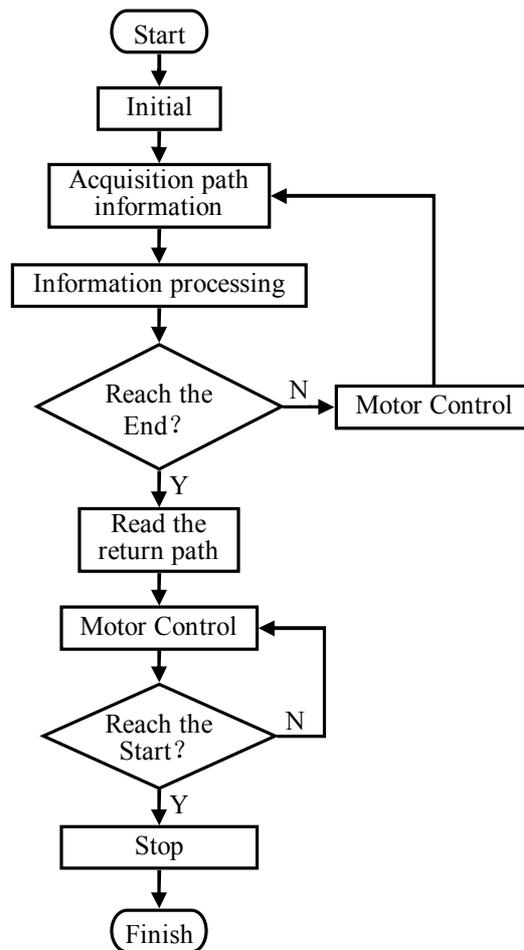


Figure 6. The software flow chart

**Path memory algorithm.** Because after reaching the end, intelligent car will return to the starting point, it needs to analyze according to the path traversed by the method of memory, so the path is very important. The path contains the "straight", "intersection", "crossroads", "corner", "dead end", "end point", and "starting point", and other elements.

Combined with the layout of sensors, we define an array variable  $MRY[j]$ , used to store the information of each node in turn, and the use of the method of memory as shown in the table 1 (the left hand rule).

Table 1. The method of memory

Sensor status	Direction	Memory
$L3==1$	Left	$MRY[j] = 1$
$L3==0 \ \&\& \ R3==1$	Right	$MRY[j] = 2$
$R3==1 \ \&\& \ (L1==0 \    \ R1==0)$	Straight	$MRY[j] = 3$
All is 0	Return	$MRY[j] = 4$

**Intelligent back to the starting point.** According to the value of the sensor, it can judge the end easily, the sensor according to mark the end of black, and return high level. At this point, you can route information to the storage of the. The basic idea is to delete the leaf cutting treatment branch ", is the necessary path information through the delete, finally leaving only a recent return path.

From the first node memory, if not met the head ( $MRY[j]==4$ ), will retain the original information, otherwise it is proved that a section of the road is not go (as a dead end road), then judge the last node and a node, and then processed, as shown in table 2.

Table 2. The method of memory

Last node	Next node	Memory
Left 1	Left 1	$MRY[j-1]=2$
Left 1	Straight 2	$MRY[j-1]=3$
Left 1	Right 3	$MRY[j-1]=4$
Straight 2	Left 1	$MRY[j-1]=3$
Straight 2	Straight 2	$MRY[j-1]=4$
Right 3	Left 1	$MRY[j-1]=4$

All the conditions are shown in Table 2, if the use of the expression, as in Eq. 1.

$$MRY[j-1] = MRV[j-1] + MRV[j+1] \quad (1)$$

At the same time, each cut off a dead end ( $MRY[j-1]=4$ ) corresponding to  $j-2$ , because each of these junctions are composed of two nodes. When the treatment to the last node, the optimal path of  $MRY[j]$  array stored information is returned. As a result, has realized the optimal path selection, to return to the starting point in the shortest time

## Summary

This paper discusses an intelligent tracking control system. It cans autonomously tracking to reach the destination, and according to the process of the stored information and correctly returns back to the original place through the optimal path.

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