

Modification of Algorithms to Control of Mobile Object

M. Todorova¹

Abstract – The paper presents an algorithm for following the line of the mobile object. The results are analyzed. The paper suggests improvements in the algorithm. Several sensors are used to solve this task. The type and accuracy of the sensors are allowed to obtain the information which is transformed of kind that helps to manage and control the process of movement. The sensors that used are analogue and digital type. The robot is discussed as a complex technical system.

Keywords – robot, robot control algorithms, sensor, mechanical system, working process.

I. INTRODUCTION

Robot as a mobile object can be seen as a complex technical system which consolidated several subsystems. Its management is possible as the fundamental characteristics are taken from different measurement devices. Different types and numbers of sensors are used. A information that coming from the sensors determine the color of the surface on which the robot moves. The sensor determining the color of surface is shown in Fig.1.

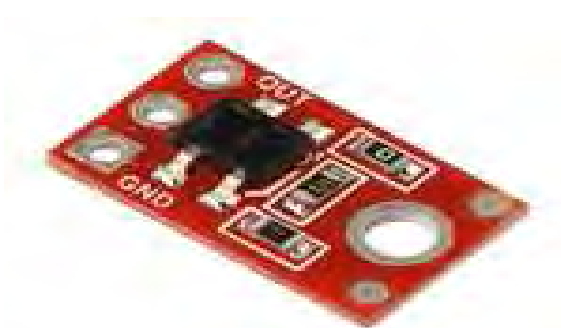


Fig 1. Surface color sensor

Using of optical reflective sensors such as RPR220 register reflected light from the surface to a distance of 8 mm. These sensors are used for the registration of black and white stripes.

¹Maya P. Todorova, Technical University – Varna, Computer Sciences Department, 9010 Varna, Bulgaria, E-mail: mayasvilen@abv.bg

II. FUNCTIONAL STRUCTURE OF MOBILE OBJECT

The process that is operated as well as the structure of the robot depends on the type and number of used motors. The created model is based on two reversible dc motors. It can be classified as multi-engine machine. Functional structure of the robot is shown in Fig. 2.

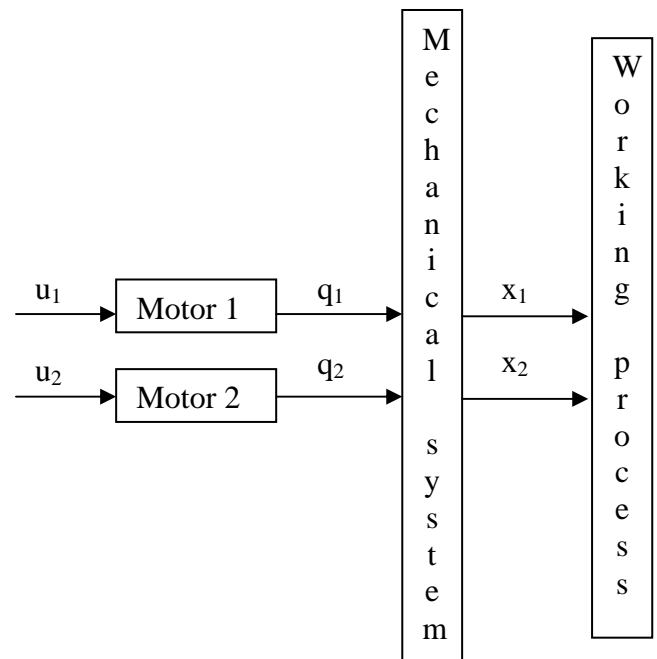


Fig 2. Functional structure

The input parameters are u_1 and u_2 . The coordinates that put in motion one mechanical system are q_1 and q_2 . The coordinates of the operating conditions of the robot are x_1 and x_2 . Both motors are set in motion independently. Dynamic relation between them is realized when the system is brought from a state of rest in motion. The input parameters u_1 and u_2 manage the transformation of energy into the motors. Used motors are direct current. For them u_1 and u_2 are applied to the input voltage. Mechanical system is a multitude of mechanisms subordinate to general objective laws. [1]

III. ALGORITHM FOR FOLLOWING THE LINE

For realization of this algorithm can be use one, two, three or more sensors. The sensor reads 1 when it is on a light surface and 0 when it is on a dark surface. The number of

used sensors is of great importance for obtaining more accurate results. The results are presented and analyzed. The advantages are indicated by using more number of sensors compared to use of smaller number. The basic disadvantages are pointed.

A. Resolve the task by using one sensor

The basic disadvantages in solving the task by using one sensor are:

- Very slow speed - The movement of robot which is realized is represented in Fig. 3.

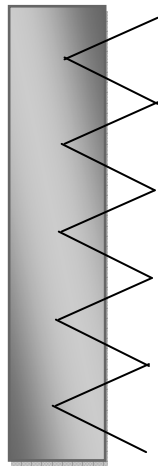


Fig. 3. Crablike movement of a robot with one sensor

- The robot can be in only two position. The two states of the sensor 0 and 1 are the reason of that.
- In case of loss of the line is impossible the robot to position on the line again.

B. Resolve the task by using two sensors

The combinations of states of both sensors are four:

- 00 - range between the ends of the line
- 11 - outside of line
- 10 - right side of the line
- 01 - left side of the line

Right side of the line and left side of the line are presented in Fig. 4

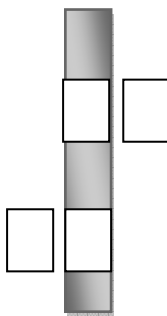


Fig. 4. Position on two sensors

Advantages:

- The information that incoming from sensor 1 leads to control the motor 1. The information that incoming from sensor 2 control the motor 2.
- When the sensors are located at a small distance, the robot tends to follow a line. When distance is greater are reported variations in the behavior of the robot.

Disadvantages:

- Low speed of movement.
- In case of loss of the line is impossible the robot to position on the line again.

C. Resolve the task by using three sensors

Combinations of states of three sensors are 000,010,001,100,011,100,101,110,111. In Fig 5 are shown the following combinations:

- 011 - the line is in leftmost position;
- 101 - central position;
- 110 - the line is in rightmost position;

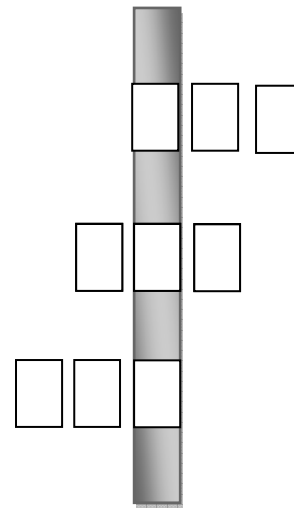


Fig. 5. Position on three sensors

Advantages:

- The border on the line can be determined by the robot.
- In case of loss of the line, it can be detected from the robot.
- Higher speed to movement of robot;
- More precise is made a turn.

Disadvantages:

- Low speed when make the turns [2].

The algorithm is related with the positioning of the robot on the line. Robot is driven when is supplied voltage to both motors. The data that come from the sensors is processed and verified. If the received data are with value 101, the robot continues to move forward, because it is on the line. If the mobile object is located at the leftmost or rightmost position of the line then have to be maneuvered with a sharp turn to the left or right, because the robot can lose the line. The maneuvers are carried out by controlling the voltage of both the engines. A part of the algorithm is shown in Fig. 6.

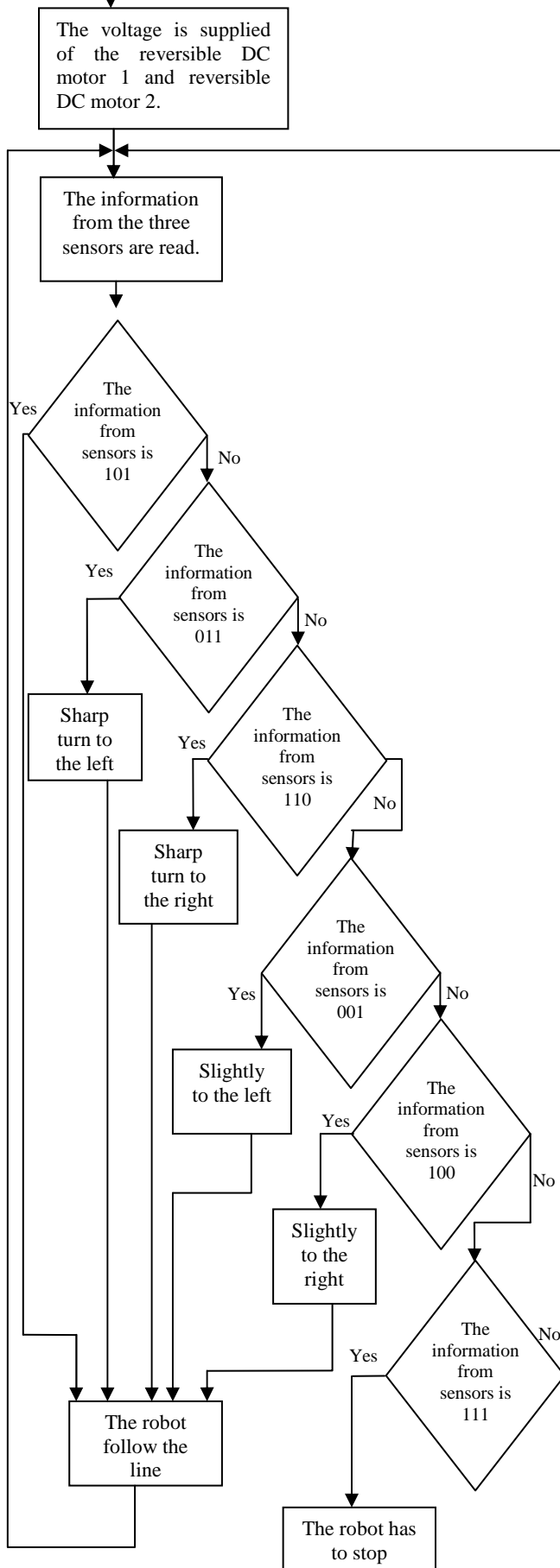


Fig. 6. Block diagram of algorithm for following the line.

C. Resolve the task by using five sensors

Combinations of states of five sensors are thirty-two (2^5) - (00000, 01111, 11110, 11111, 11011...) [3]

Advantages:

- The precise motion control the robot following the line.
- When changing the combination of the signals can be easily programmed logical decisions which to be taken by the robot to correctly move.

IV. CONCLUSIONS

The task for following the line can be resolve with using three sensors. For more precise control of the robot must be used five sensors. The presented algorithm describes the process of movement of the robot in a line. Effectiveness and accuracy of the algorithm depends on:

- The type and number of sensors;
- The type of engines;
- The information that coming from sensors. It has to be correctly processed.
- The maneuvers such as turn left and right have to be tested.

REFERENCES

- [1]. доц. д-р инж. Стефан Русев Генчев, Лекции, Тема - Функционална структура на машините и уредите
- [2]. <http://ironfelix.ru/modules.php?name=Pages&pa=showpage&pid=113>
- [3]. Дипломна работа, дипломант И. Иванов, научен ръководител доц. д-р инж. Недялко Николов
- [4]. Priyank Patil, Department of Information Technology, K. J. Somaiya College of Engineering Mumbai, India, "Line following Robot"
- [5]. Harris, Tom. "How Robots Work", <http://science.howstuffworks.com/robot.htm>.
- [6]. www.pololu.com.
- [7]. www.microchip.com – PIC18F6585 Data Sheet – 68 pin High performance 64 KB Enhanced Flash Microcontroller with ECAN module – 2004