MOBILE ROBOT WHICH AVOIDS OBSTACLES

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ABSTRACT: This paper proposes a solution for a mobile robot project, which moves in a certain space with obstacles that must be avoided

ДВИЖЕЩ СЕ РОБОТ, ОТБЯГВАЩ ПРЕПЯТСТВИЯТА

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РЕЗЮМЕ: Този доклад предлага проектно решение за подвижен робот, който се движи в определено пространство с препятствия, които трябва да бъдат избегнати.

1. Introduction

An important problem of the mobile robots which must be solved is planning the moves or to generate a trajectory which must consider the working space, with the obstacles within and, the shape, structure (fixed or mobile), dimensions of the robot.

For a mobile robot, planning the moves implies creating some algorithms of automated and continuous calculus of the trajectory, so that the robot to move from a position to another and to avoid collisions with other fixed or mobile objects.

The study of the movement grows in complexity as the working space in which the robot moves is more populated with other objects and if the movement is three-dimensional.

If the robot has a fixed base, the shaping of the working space is simpler.

But the difficulty of the study for this case increases with the number of liberty degrees of the robot.

2. Robot description

The mobile robot on which we'll debate in the paper has is composed of a metallic or plastic chassis, four driving wheels, a sensorial system and the control electronic system.

The four wheels are driven by two boosters: one for the two wheels on the left and the other one for the two wheels on the right of the chassis.

The sensorial system has to detect the objects which are in front of the robot and with which it could collide during movement. It is composed of three pairs of infrared sensors (three emitters and three receivers) positioned in the front side of the robot, as shown in figure 1.

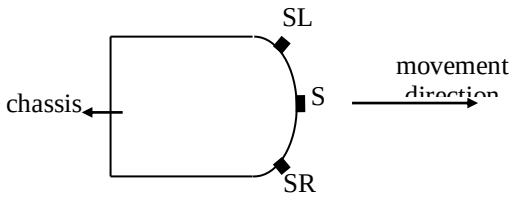

Fig. 1

The middle sensor, S, allows the detection of the objects in front of the robot. The lateral sensors are mounted under a certain angle from the forward moving direction.

They detect objects situated on the right side (SR) and on the left side (SL) of the robot, with which it could collide.

If there is an object close to the robot (risk of collision), the infrared radiation flux from the emitter is reflected (by the object) towards the receiver.

The electrical scheme of the sensor's charge is shown in figure 2.

The control electronic circuit has the scheme in figure 3 and is composed of: PIC 16F84 microcontroller, the power driver of the two boosters (meaning Darlington transistors BD681 and 2 relays). The two relays are used to switch the way of rotation of the two boosters.

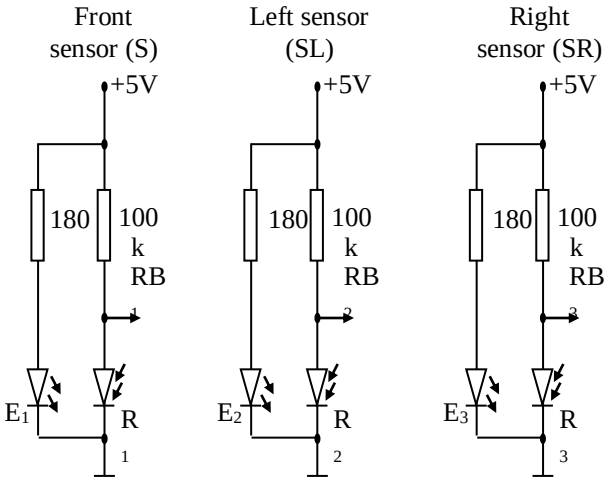

Fig.2

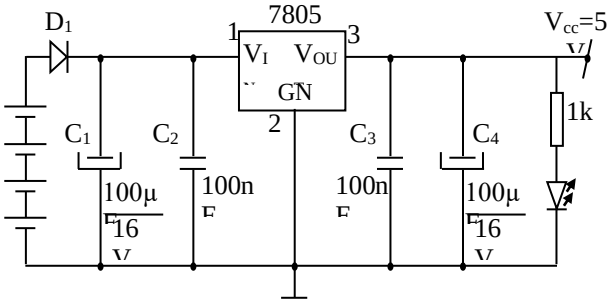

Fig.3

The electronic circuit is powered by a continuous power source at a 6V voltage (4 batteries of 1,5V) through a continuous voltage establisher with the 7805 circuit (electrical scheme in figure 4).

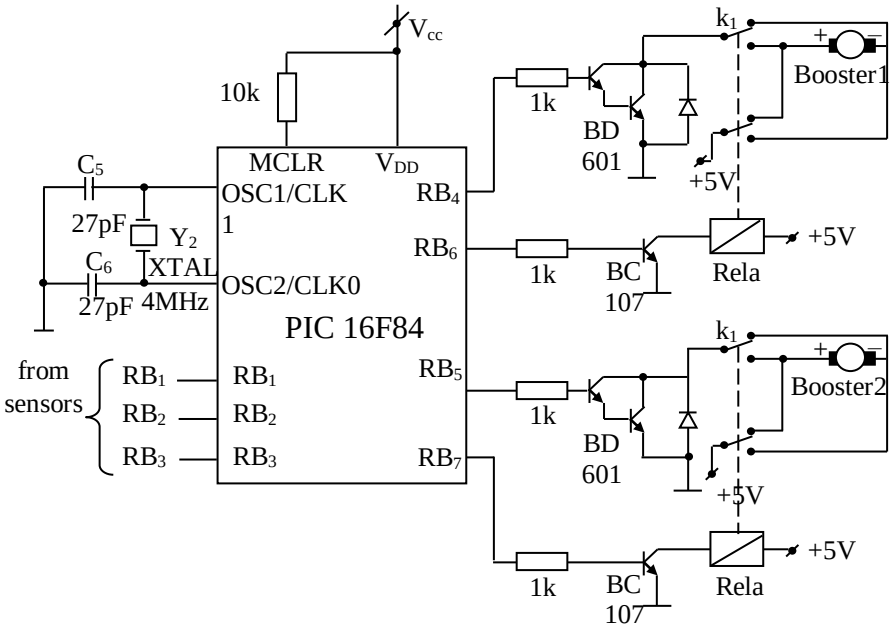

Fig.4

In the PIC 16F84 microcontroller is written the program used for the robot's command, or better said, of the two boosters.

The program is written in assembly language or in the mikroPascal language, after the logical scheme presented in figure 5.

Initially, the robot is commanded to move towards, which means that both boosters are charged with the polarity in figure 3. Testing the sensors S, SR and SL gives information about the presence of objects in the moving direction of the robot. For a big dimensions robot, each sensor has many emitter-receiver pairs to 'see' small objects.

If S = 0, SR = 0, and SL = 0 then in front of the robot is an object at least as big as its frontal side. In this case, the robot receives command to head backwards, T temporized, and both boosters are charged with reverse polarity through the action of the two relays. After the T temporization is done, of backwards movement, the robot is lead to swerve temporized right, with the same T temporization, if the sensor SR = '1' (there are no objects 'seen'). On the contrary, when the sensor SR = 0 (there are objects), the robot must swerve temporized left if the sensor SL doesn't 'see' objects (SL = '1'). When SL = 0, the robot makes another temporization backwards.

In order for the robot to swerve left, only the booster which drives the right wheels is charged and for the robot to swerve right, only the booster which drives the left wheels is charged, and so on.

3. Conclusions

This mobile robot is simple and economical to be made, and with a low cost. It can be used in many domains, but mostly in the areas with high toxicity (where the lives of people can be affected) for material transport. It can be used in the military domain for security to transport materials in the limited access areas. Also, if a vacuum cleaner is attached to the robot, it may maintain a clean precinct.

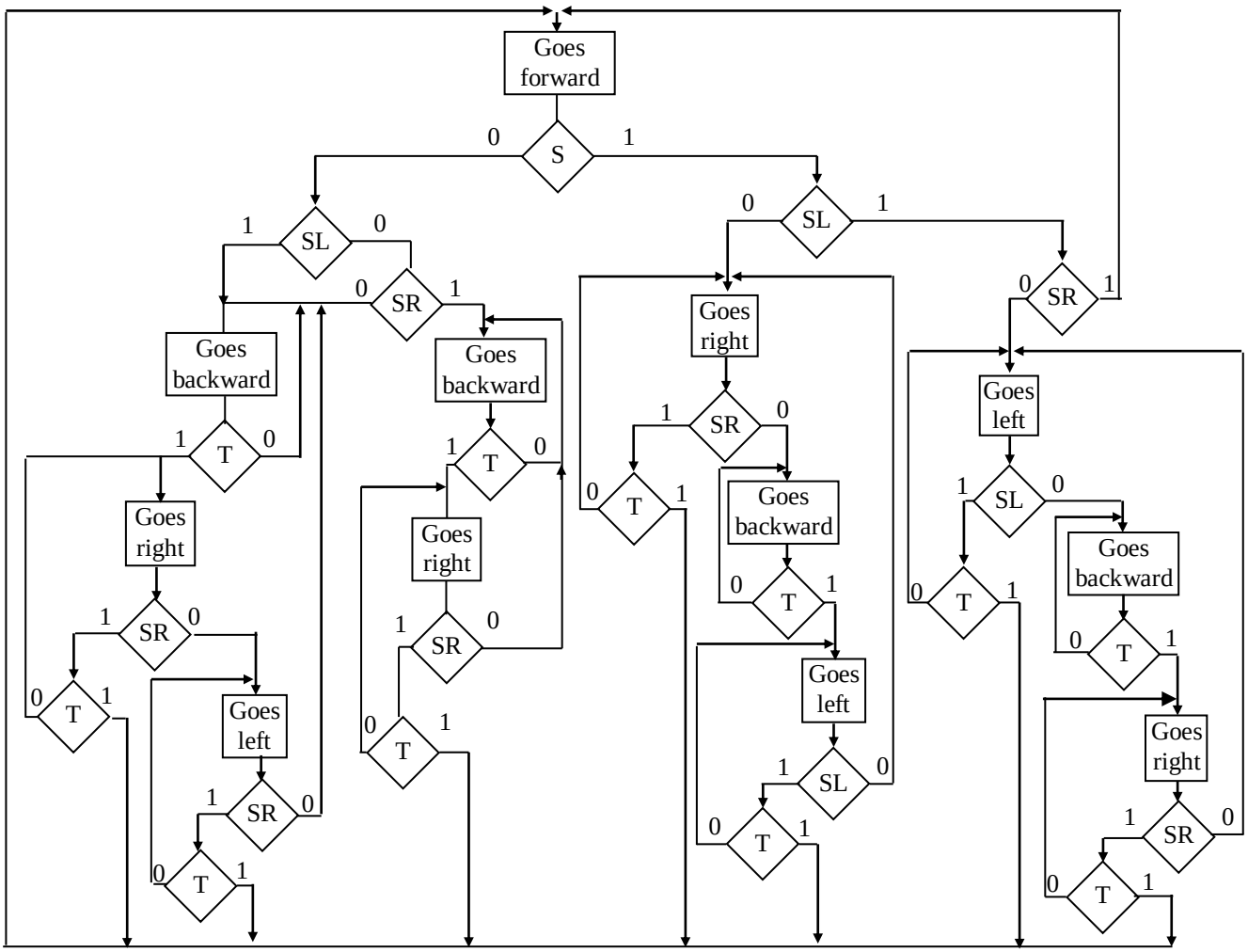

Fig. 5

4. References

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Recommended for publication by the Editorial staff