Orientation of the mobile robot in space greenhouses using probabilistic automata and stimulating learning

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The method of solving the problem on orientation of the mobile robot based on the use of probabilistic automata. Worked out the theoretical component of probabilistic automata, greenhouses as fields to move the robot. On the basis of theoretical studies created software that allows you to calculate the path of movement of the robot in space greenhouses in view of possible obstacles.

Probability, orientation of the mobile robot, greenhouses, stimulating learning.

The purpose of research - the creation of algorithm and software orientation of a mobile robot in a greenhouse block that has a certain stochastic nature of obstacles.

Materials and methods of research. According to the analysis of modern systems of orientation in space robots and machine learning tools compared different algorithms for finding the optimal path, given the weak formalization conditions in the problem statement.

The results of research. To implement the algorithm should be set some conditions for its successful implementation:

- moving the mobile robot in the greenhouse, and must go through certain checkpoints determined by the operator;
- as the robot during the movement between the rows of plants located on the rails, its actions are limited to the time forward or backward;
- check on the rails by means of color marking deposited on the floor of the greenhouse (Figure 1);
- there are obstacles on the route the robot determines its ultrasonic sensor, if it is possible to get around it, then made maneuvering when it is impossible to reach a certain goal robot beeps and sends a message to the operator, and proceeds to the next target;
- to facilitate the orientation of the conditional space greenhouses are divided into sectors; changing sector robot monitors with color labels on the pots of plants.

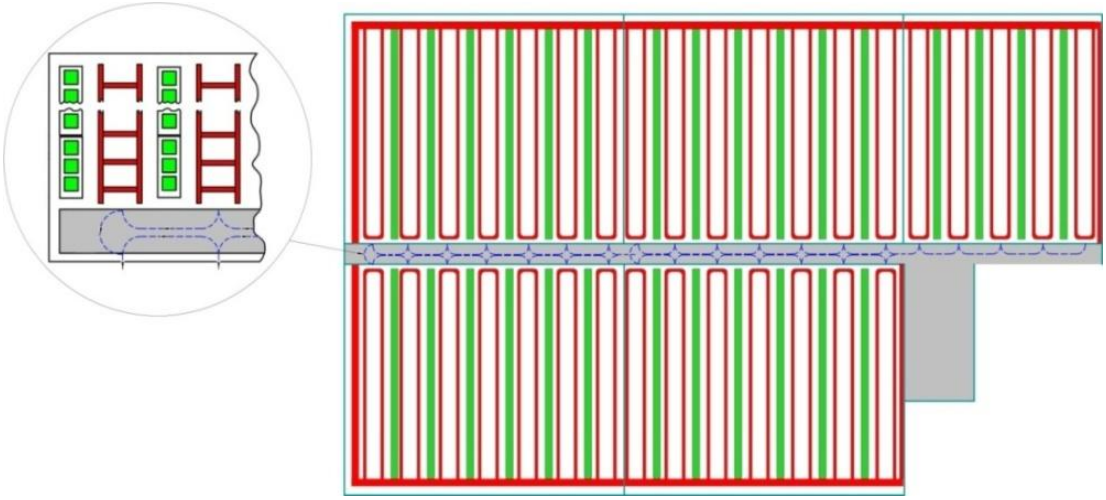

Figure1. Visual plan greenhouses and markup to facilitate orientation of the robot

To demonstrate the operation of the algorithm to calculate the motion of the robot to the left block greenhouses. The figure shows the red cell to which the robot cannot call, green - target cells, defined by the operator.

Train the mobile robot according to the described algorithms obtain the automaton model of the problem is a stochastic transition matrix. Rows of this matrix correspond to the cells - the state of the mobile robot, the bars - possible actions. Thus, the stochastic transition matrix associates with each pair of state - action value of the probability of the action. Is the probability of a stochastic transition matrix calculated by the identity (1):

$$p_j = \frac{R(s_i, a_j)}{\sum_{k=0}^{n_i} R(s_i, a_k)}, \qquad (1)$$

For successful completion of the route algorithm should be trained to gain experience of trial and error. With the accumulation of experience and the number of unsuccessful attempts to time the route is reduced and the amount received on the contrary growing ranks.

Conclusions: Given the stochastic nature of the possible obstacles in the greenhouse, it is advisable to guide the mobile robot in space block greenhouses, use probabilistic machine learning algorithms. After training, the performance of the algorithm is greatly increased stimulating learning and enables the mobile work independently move to block the greenhouse, avoiding obstacles.