DESIGNING OF TRAJECTORY OF THE MOVEMENT OF UAV WITH THE AVOIDANCE OF OBSTACLES

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At present, unmanned aircrafts (UAV) are widely used in civilian areas. In this case, the movement of the aircraft can occur within the urban development, mountain relief, etc., thereby assuming the existence of possible obstacles for movement in airspace. Thus, the task of planning a route that avoids collisions with obstacles is relevant for various scope of applications of UAV.

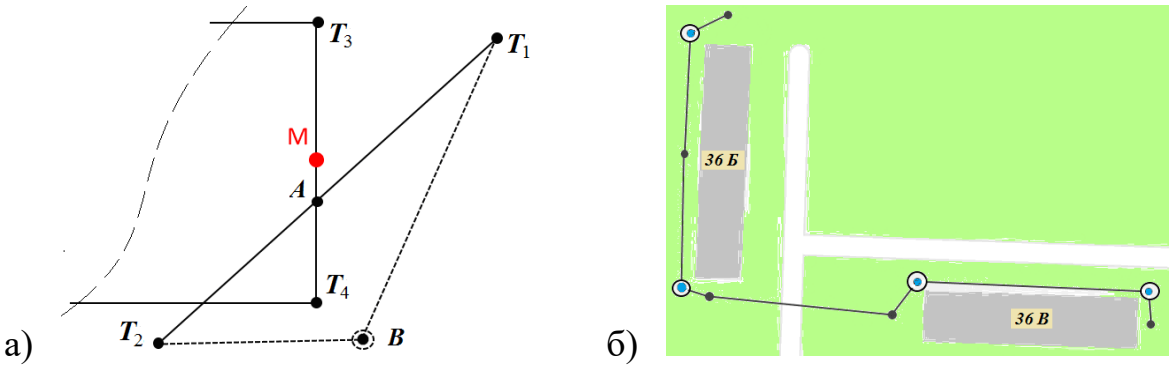
In the report, the problem of constructing the trajectory of a UAV, enveloping obstacles with known coordinates is considered, taking into account the order of visiting the points specified on the map.

The coordinates of the intersection of the flight trajectory with the obstacle contours $A(x_a, y_A)$ (the point of possible collision) are defined as:

$$\begin{pmatrix} x_A \\ y_A \end{pmatrix} = \begin{pmatrix} [(x_4-x_3)(x_1y_2-x_2y_1)-(x_2-x_1)(x_3y_4-x_4y_3)]/[(x_4-x_3)(y_2-y_1)-(x_2-x_1)(y_4-y_3)] \\ [(x_4-x_3)(y_4-y_3)(y_2-y_1)-(y_4-y_3)(x_2-x_1)-(x_3y_4-x_4y_3)]/(x_4-x_3) \end{pmatrix},$$

where $x_i, y_i, i=\overline{1,4}$ – the coordinates of the points T_i, shown in Fig. 1,a. Note, that the points T_1, T_2 are specified in the flight task and are required to visit, and the T_3, T_4 points are known and belong to the contour of the obstacle. When an obstacle is detected, the coordinates of the additional point *B* are calculated, to which the following section of the trajectory is build.

To simulate the work of the proposed algorithm, a program was written in the java-language, the result of which is the trajectory of the UAV, enveloping the obstacles indicated on the map. An example of how the program works is shown in Fig. 1,b.



a) construction of point B to fly over the obstacle;
b) the resulting flight path.

Figure 1 – Construction of the flight trajectory.

The developed algorithm can be applied in the areas related to the delivery of light cargo, protection of forests and reserves, with control and protection of fuel storage facilities, etc.