**Executive Summary**

In the convoy project, the company (OJO) is required to make a self-contained robot which is part of a convoy, moving in a single line. The convoy has a leading robot, the rest of the robots in the convoy have to follow the way lead by the leading robot. The self-contained robot has to follow the robot in front of it and when an external command is given, to leave the convoy, it should leave the convoy and rejoin the convoy as a last member of the convoy. The self-contained robot has to signal while leaving the convoy and also signal for the time period it is the last robot in the convoy.

The solution to the problem is approached in a way that it is in full accordance with the set standards and the end product is effective, robust and reliable. The problem can be divided according to the three states of the robot which are following the front robot, leaving the convoy and being the last robot in the convoy. The objective for the first **s**tate is that the robot should follow the front robot (or the path set by front robot) until the front robot leaves the convoy or the robot itself gets the command to leave the convoy. For the former objective robot also has to look for the next robot to follow. To follow the robot, the company uses the relative distance (between front robot and itself) and the relative angle information, which is determined by sensors, and uses the change in their values to adjust the speed and direction of the robot. After the ‘following robot’ sees the leaving signal it stops following the leaving robot, maintains its moving path by maintaining its previous direction and increases it speed until it identifies next robot to follow. For the second state, the objectives are to identify the leaving command, indicate that the robot is leaving, choose an optimal path for leaving (to avoid collision), identify the last robot and rejoin the convoy. After the leaving command is identified by using filters, the leaving signal has to be turned on by the leaving robot. The leaving robot will then find the optimal direction of leaving by using relative distance and relative angle information and get out of the convoy and slow down its speed. For example, if convoy is turning in the left direction the robot leaves from the right side. After it leaves the convoy the robot maintains its speed and maintains side to side distance of 10 cm (as in standards) by using relative side distance information. After the identification, the leaving robot joins the convoy as the new last robot and turns off the ‘leaving’ signal and turns on the ‘being last robot’ signal simultaneously after it is 20 cm away from the previous last robot. For the third state, the objectives are to transmit ‘being the last robot’ signal, identify the new last robot and turn off the signal. To identify the new last robot the proximity information at a distance of 20cm (as set in standards) is used. If a robot is in the proximity range the signal of being the last robot is turned off otherwise it is always transmitting the signal.

The company plans to carry out some tests to ensure the validity of the solution. The test plans include testing of motors speed with full weight, battery discharge rate with load consuming max power, accuracy of the sensors for distance and angle measurement, response time of control unit and the accuracy of detected shape in image processing.

The total cost of the end product is estimated to be $150 which is within the range of provided budget ($200). The company intends to provide necessary documents such as technical specification sheet, a user manual along with the end product (self-contained robot), battery and leaving command signal transmitter.