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BUILDING ROBOT TO SOLVE A MANIPULATING TASK IN ROBOCON COMPETITIONS

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Nowadays, there are many competitions held in different branches of science. Students of SFU regularly take part in them. While preparing for one of the ROBOCON competitions, students create robots to solve one of the suggested tasks.

To prepare for the competitions it is necessary to know the competition requirements; to acquire the information in the field of the chosen task; to design three models of the robots to be presented at the competitions; to build the models of robots, that were designed, and, finally, to produce the software for them.

To solve the problem it was necessary to provide vertical and horizontal motion. Also, we were to solve the task of choosing drive types for the wheels. Other tasks that we had to solve were as follows:

- to find a material
- to choose the wheels
- to provide suitable power supply
- to choose a type of gears.

We settled on electromechanical drives, because they are of low cost, low weight, easy to install and have encoders, which are very useful for determination of the position in space. To limit the weight we chose aluminum as a material of the base. We use the aluminum profile to provide necessary weight and rigidity of the construction. We made the wheels plastic, and covered them with rubber. The plastic wheels were fixed on the axis of a drive by the faucet, spline and a nut for additional fixing. We solved the problem of power supply unit: from the standpoint of flexibility. The lead accumulator appeared to be more flexible for work than the lithium one, but the lead accumulator had a greater weight. Finally we decided on the lithium accumulator as in operation the weight was more important than flexibility. We made a reduction gear to provide the desired movement speed and torque consumption. Parts of gear box were made from steel and could hold rather high load.

One robot had manual control and other two were program-controlled. To perform the manual control we created a gamepad-type manipulator. It had analog type- tactile sensors to make the control process simpler.

The orientation in space was organized by means of some sensors and encoders. The infrared sensors were installed on the base of the robot. Together with encoders that was enough to define the position in space with high precision.

Our work resulted in an electro-mechanical robot, with four-drive moving base, on which we installed the platform with the manipulators. This platform could move up and down on the vertical surface. The vertical movement was provided by the screw-nut drive. Besides, the robot was provided with different kinds of end-effectors: one with actuated gripping device, and the other three had passive grippers with the load-lifting capacity up to 10 kg. The actuated mechanical gripper employed movable, finger-like levers, which were paired to work in opposition to each other. These grippers provided high accuracy. Using three robots in one work cell at the same time greatly increased the time of performing the task, but on the other hand the risks of the emergency situation became higher. The robots used the wireless communication Bluetooth to synchronize their work and to avoid collisions.