



Koło Mechatroniczno - Robotyczne przy Zespole Szkół Technicznych w Grudziądzu

działalność wspierają:



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Zajęcia pozalekcyjne:
• Projektowanie i wydruk 3D
• Budowa autonomicznych pojazdów miniSumo
• Budowa konstrukcji robotycznych Freestyle

• Programowanie sterowników
• Programowanie Arduino i Android
• Wyjazdy na turnieje i targi

Class robot construction report MiniSumo "NEMO 03"

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1. Introduction and assumptions of the "NEMO" project:

The project of building a minisumo robot "NEMO 03" is a continuation of the series project the "NEMO" minisumo robot family. Built by Artur Willchowski and Jan Sobiecki from the Technical School Complex in Grudziądz. The "NEMO" family of robots, starting with "NEMO 01", is a proprietary series of robots constructed by the above-mentioned designers during school and outside school activities. The greatest achievement of the project was winning the 1st place at the international minisumo robot competition in Prague as part of the "Robotic Day 2018". To date, the series of robots is constantly modified and improved with new versions, using the experience gained.

2. "From design to implementation":

Before starting the work, the robot's designers decided to give the robot features that would be its strengths and make these goals a reality. They decided to focus primarily on proven methods used in previous versions of the robot. Those are:

a) Angled steel plow: it is the front plate of the robot, which is tilted by 45 degrees does not work as a push plow, but as a ramp, which aims to undermine the opponent's vehicle pushing against the robot from the front and throwing it off balance or completely pushing it out of the ring. This time the plow has been thickened by almost 2 mm compared to the previous generation of the robot.



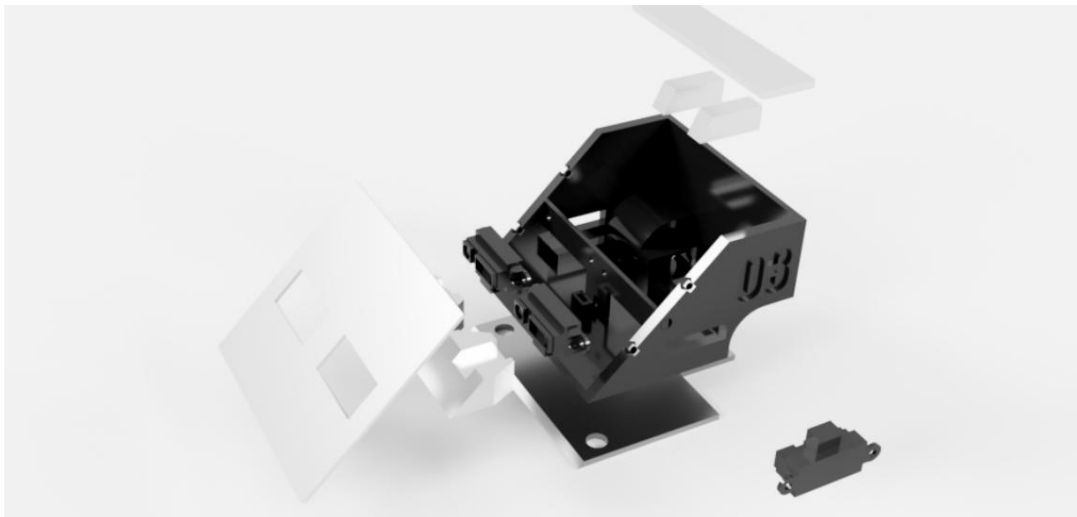
NEMO 03 in the projection, visible "plow" with rectangular openings for motion sensors, which were placed inside the robot.

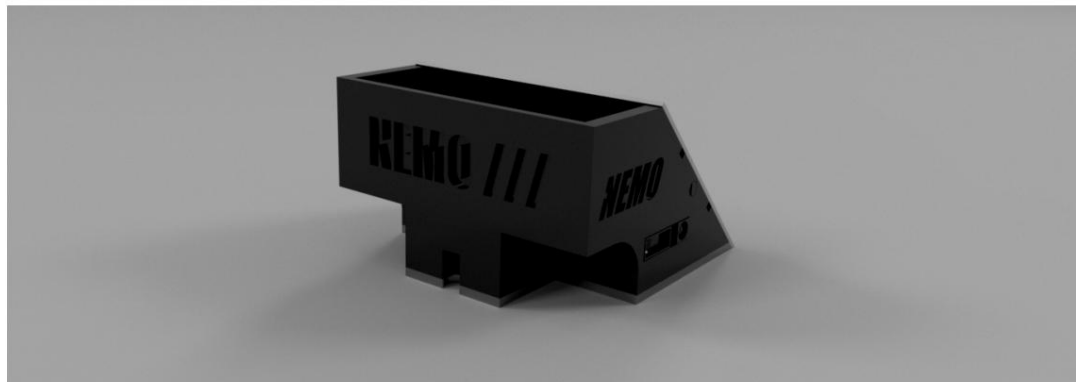
b) Pololu 50: 1 motors: these are the standard motors used in MiniSumo robots along with 50: 1 gear that gives the robot high speed while maintaining high torque.

c) Steel base: the authors of the project decided to use it as a kind of "floor" steel sheet with a thickness of 4 mm (in the previous version of the robot, the base plate was less than 2 mm) is a great advantage, it allows you to achieve two very important advantages of the robot, they are:

- Low center of gravity, thanks to which the robot is very resistant to any attempts to disturb the balance and possible overturning caused by the opponent's robot hitting the side.
- The steel plate has a large loading mass with little use of the usable area, which can be used to locate additional sensors instead of additional loads in the form of glued weights.

d) Housing printed in the technology of 3D printing (FDM method) with the use of black PLA filament, designed by Jan Sobiecki using the Autodesk program - Fusion 360. For a better visualization of the finished model, the author of the project made the so-called "Renders", i.e. a visualization of the finished model, along with the application of colors and physical values on the given materials to determine the estimated mass model before it is built.





e) Sharp GP2Y0A41SK0F (Analog) sensors: used many times, they never failed. Their greatest advantage is the inability to cheat them. These sensors work by detecting the infrared emission of a given object within their view range. Regardless of the color, structure of the object and even its temperature, these sensors are able to detect this object. However, when examining the sensors, it was noticed that dark colors (Black) are detected later than lighter objects (White, Yellow, Red). After taking measurements, they showed that black objects were imperceptible to the sensor about 30-40 mm further than white or yellow objects. The difference, however, is so small that most likely it does not affect the direct combat of robots.

f) Silicone tires: Just like on the road, tires are very important in robot fights. The most important thing is that the robot should have perfect grip with the ring, so that its wheels do not slip and, in the event of a collision, they effectively move the opponent to the edge of the ring. The constructors decided to use modeling silicone, which is also easy to mix and gives great grip to the wheels on the surface of the ring. The key to victory is also washing the tires each time before the fight to clean them of any dirt. Technical acetone is the best in this regard.

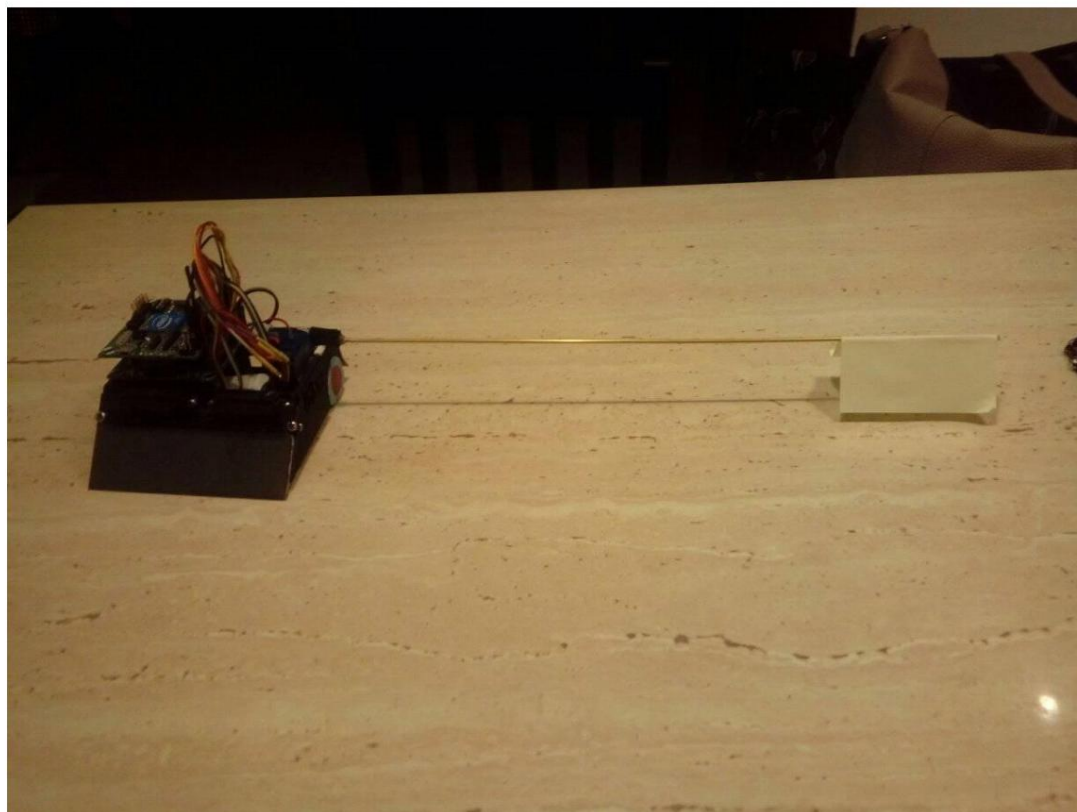
g) SIMS board: It is the brain of the whole robot, it is responsible for executing the program user on the basis of data collected from sensors. The program written in a simple SummoBlockly program by Artur Jestchowski was improved so that the robot could cope with any situation in the ring and additionally extended it by several maneuvers for the "NEMO 03" robot when specific conditions occurred in the ring (e.g. when the sensors did not detect any movement, the robot with spins at a moderate speed in the place "looking" for an opponent, at any moment being ready to give a quick frontal blow)

h) 7.4 V LI-PO battery: This is the power bank for the motors, sensors and robot boards. Without it, it is essential for the robot to function.

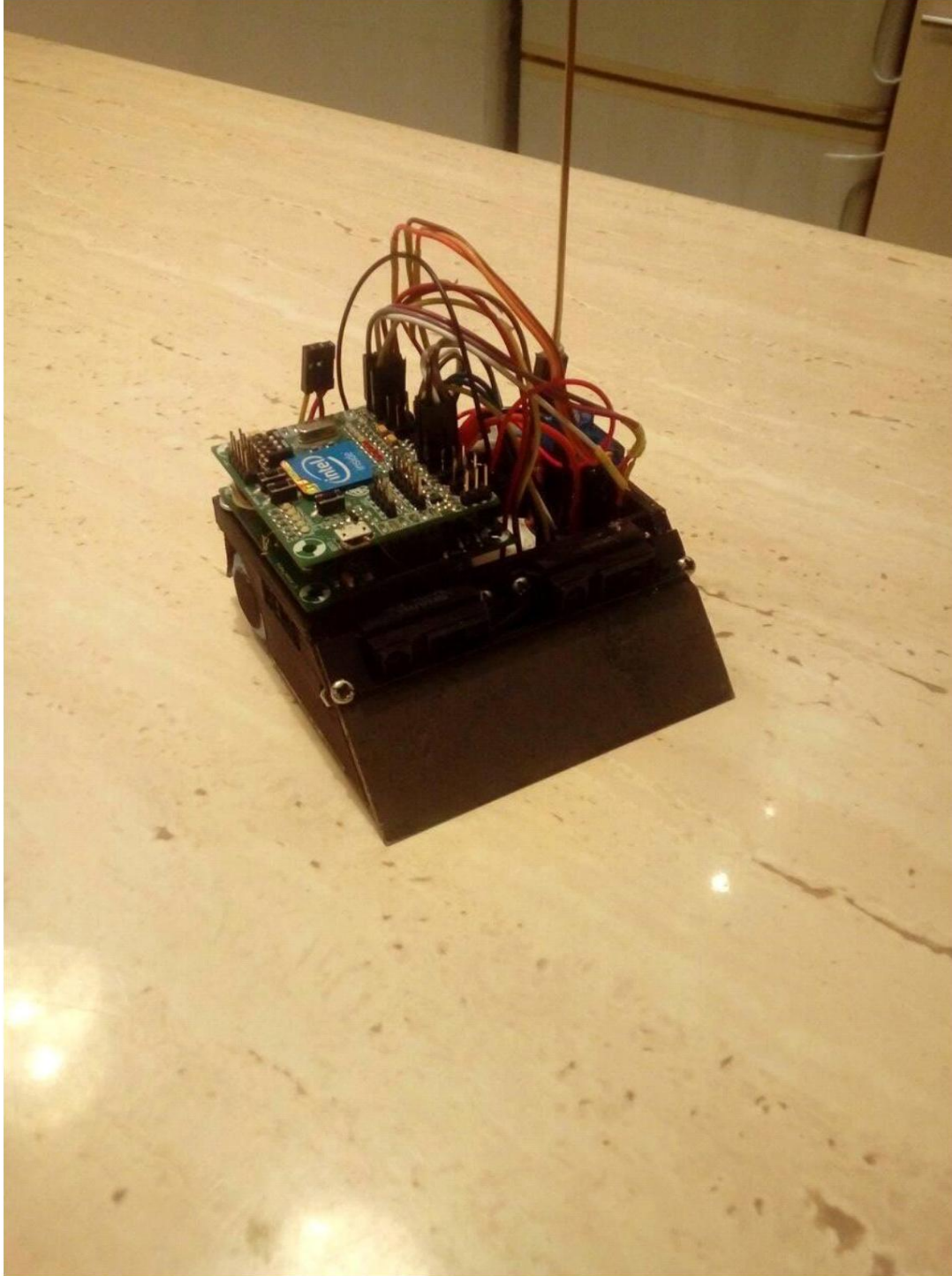
i) Ground sensors, standard reflection sensors to alert the robot to its entrance in the dangerous area of the ring edge, the written user program in this case ordered the robot to perform a maneuver to escape from the dangerous place.

3. Innovations:

Due to the steel plate used as the base of the "NEMO 03" robot and the choice of optimized dimensions of the casing, it made it possible to introduce the robot's secret weapon, which was to be a kind of folding "Cloth for a bull", but in this case the "bull" would be the enemy's robot. How would that work? The SG 90 modeling servo placed inside the robot, at the moment of the beginning of the fight, receives an impulse from the plate to lower the wire with the "flag" at its end, the operation would be aimed at deceiving the opponent's robot, which would mistake the flag for its target, driving with full force into the thin wire a piece of paper or other light material, the robot would at best fall out of the ring immediately.



In the picture above you can see the mentioned "flag" in the "Fight" mode



In the picture above you can see the mentioned "flag" in the "Waiting" mode

