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DETERMINING THE EXACT POSITION OF AUTONOMOUS ROBOTS USING A MULTICAMERA SYSTEM

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SUMMARY

Determining the exact position is currently a major problem of modern robotics. To accurately determine the position in practice utilizes a combination of several sensor systems. In our work we deal with control and navigation the Roomba robots, controlled by multicameras system with own algorithm for control. Quality of navigation we evaluated by subsequent processing of graphical outputs (curves).

INTRODUCTION

To determine the exact position of the mobile robot, we use a camera system consisting of 24 cameras located at a height of 3.2 m on a 5.33 x 6.8 m frame, where the coverage of the operating area is 97.6%. These are Flex 13 cameras with the following parameters:

- Frame Rate: 120 FPS
- Horizontal FOV: 42°, 56°
- Resolution: 1280 x 1024
- Interface: USB 2.0

Such a deployment allows the scanned area to be covered so that a plurality of cameras can see the object from various angles. This, of course, increases the accuracy of determining the exact position. In fig. no. 1 we see the creation of a surface that is covered by at least three cameras. Next to this, we can see the design of these cameras.

The structure itself, as calibrated in the UJS robotic laboratory, can be seen in the following figure. However, under this construction, we are not able to utilize the entire space, but for reasons well known in fig. no. 1, the active area is reduced to 3.38 x 4.8 m.

In order to navigate the mobile robot in this space, we had to make the camera system robot visible. This was done by three markers that very well reflect the light energy in the spectrum, which is well detectable for cameras. Since the number of markers allows not only to see a mobile robot (each such marker is a separate point), it also determines the direction and angle of rotation of the mobile robot.

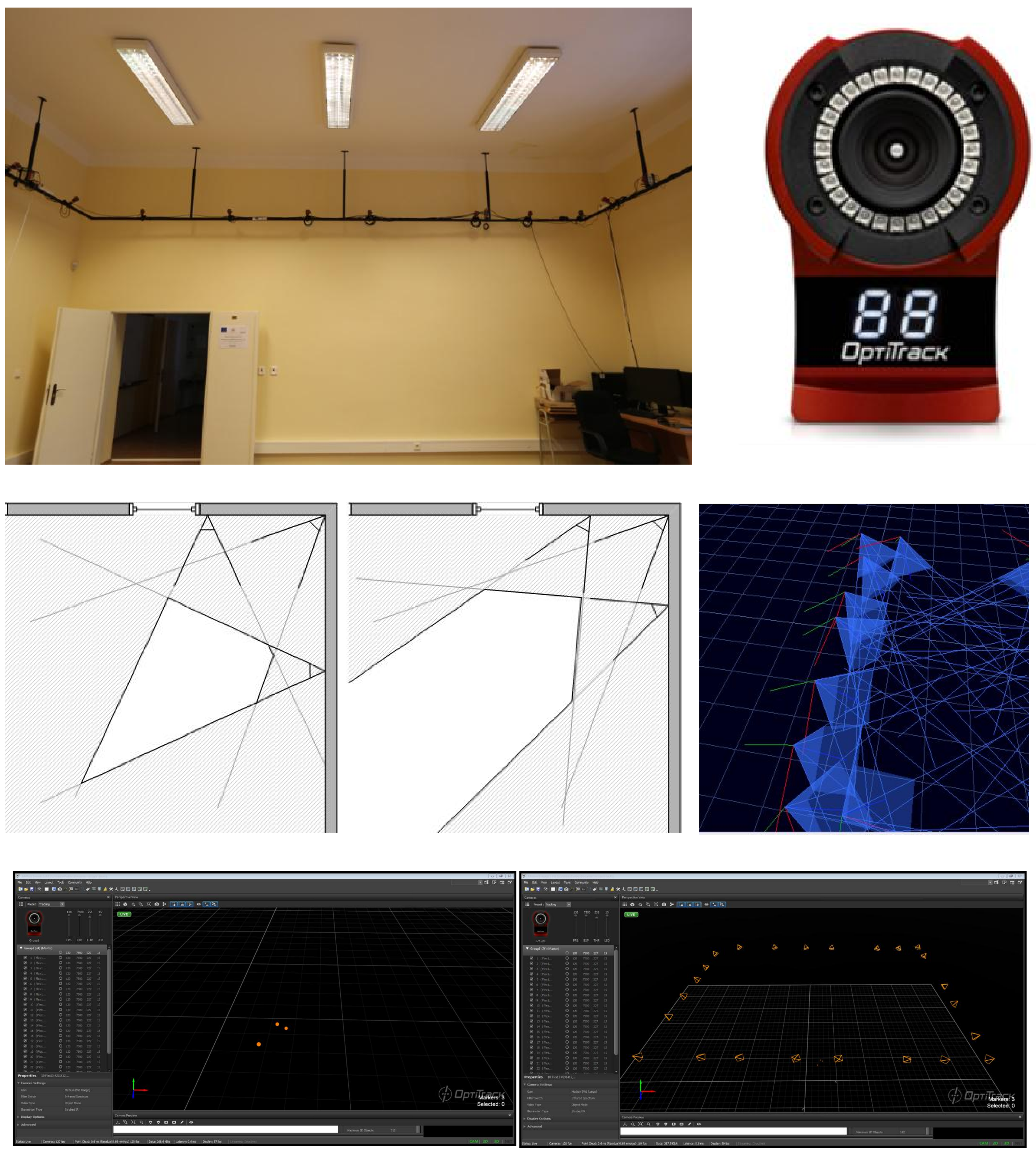

Fig. 1. Camera settings and total space coverage.

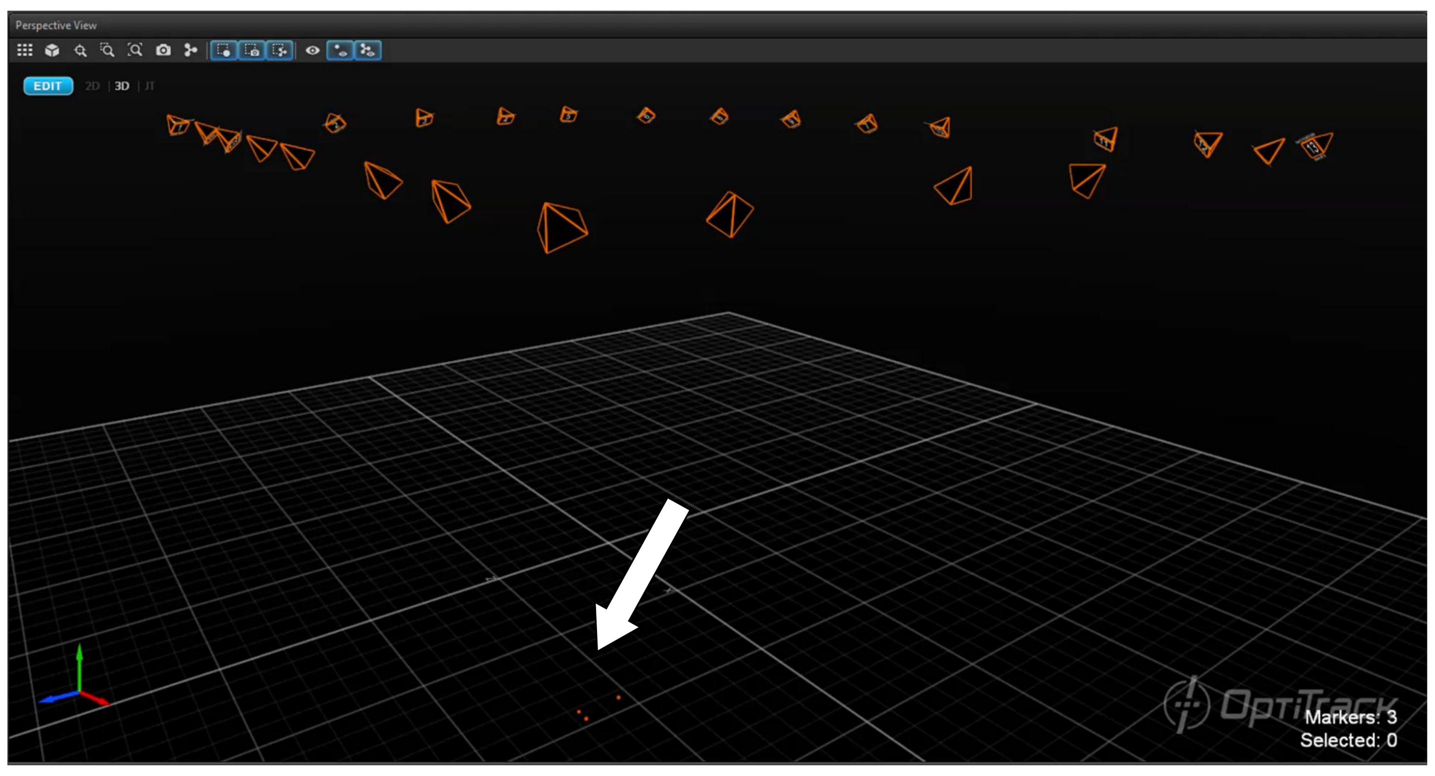

Fig. 2. Camera system (*top*) and mobile robot with markers (*arrow*) in the OptiTrack environment.

Fig. 3. Results obtained with camera *CANON eos 5d.*

CONCLUSION

Optical navigation methods have a number of advantages. We can also take advantage of the multi-camera system in intelligent spaces, where their application provides many advantages. From the point of view of autonomous navigation, we use mainly the coverage of the operating space by several cameras, which almost eliminates the requirements for collision control in the navigation of mobile robots - cameras see an obstacle, even behind the obstacle.

The three markers used to visualize the mobile robot clearly show the rotation and direction of movement of the mobile robot. The motion detection rate is dependent on the camera system and the evaluation software. We used the Motiv as a software environment.

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LITERATURE

1. DEVECSERI, V. Tracking Motion Capture User Guide. Budapest : Budapest University of Technology and Economics, 2016.
2. iRobot® Roomba 500 Open Interface (OI) Specification. http://irobot.lv/uploaded_files/File/iRobot_Roomba_500_Open_Interface_Spec.pdf
3. Viktor Devecseri. Optikai alapú Motion Capture rendszer fejlesztése etológiai kutatások céljára. Master's thesis. Budapest : Budapest University of Technology and Economics, 2011.
4. SCHIPKE, K. 2015. Medical Thermal Imaging for Preventative Screening in: Foundation for Alternative and Integrative Medicine. [online]. <http://www.faim.org/medical-thermal-imaging-for-preventative-screening>. (16-03-2016).
5. ŽÁRA J. a kol: Moderní počítačová grafika, Computer Press, 1998.