HUSAR-8 ROVER SWARM COLLECTIVE ACTIVITY AROUND HUNVEYOR-8: PLANETARY ROBOTICS AT THE KECSKEMÉT COLLEGE, GAMF FACULTY, HUNGARY. Pásztor A.[1], Simon T.[2], Nagy Sz.[3], Bérczi Sz.[4], [1,2]Kecskemét College, GAMF Faculty, H-6000 Kecskemét, Izsáki út 10., Hungary, [1](pasztor.attlia@gamf.kefo.hu), [2](smntms@gmail.com) [3,4]Eötvös University, Institute of Physics, Dept. Materials Physics, H-1117, Budapest, Pázmány Péter s. 1/a. Hungary (bercziszani@ludens.elte.hu) .

Introduction: The GAMF Faculty at Kecskemét College began a student robotics program in order to develop teaching programming and trigger student personal activity. The group joined to the Hunveyor-HUSAR program in 2008 by constructing the HUSAR-8 model with a special preliminary basis. We recognized that planetary science is an excellent triggering expression for students to develop the robots toward increased measuring capability by adding sensors, and navigation on the field trip, and giving many real problems for using their skills in problem solution.

Earlier we worked with LEGO Mindstorms NXT and RCX rovers and began to build a system, where several rovers act in mutual connection and communication with a direction and control center. We report about the construction and experiments with the Husar-8 rovers with the Hunveyor-8 lander models.

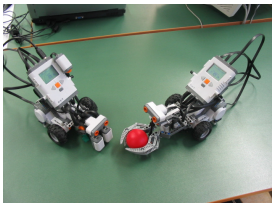
Kecskemét College, GAMF Faculty: at our College we teach mechanical engineering and information technology. In teaching programming we use some robots for example LEGO Mindstorms NXT and RCX robots. With the help these robots the education can be more effective, spectacular and interesting. During the lessons with the helping of robots the students can use the previously studied theories in practice [1].

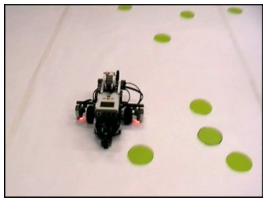
In course problems are abstract and many times artificial. The teaching activity intensively increased by adding natural conditions and planetary surface tasks where the problems are natural, complex and exciting.

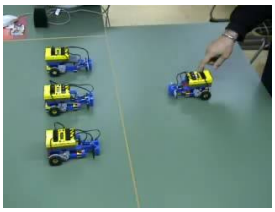
Construction and experiments: In the Concise Atlas of the Solar System booklets [2] we could follow the basic principles in Hunveyor construction [3].

However, we preferred the moving rover units and Husar-8 swarm was in the focus of our recent works. In nowadays the „relatively" new scientific researching field of Artificial Intelligence is the swarm intelligence. Several researchers work at attitudes and habits of those animals which live in colony of the nature and they try to adopt their notes for the robot groups. The autonom robots begin a multi agent system, communicate and cooperate with each others for the sake of some cause as the animals.

Swarm intelligence: This study is dealing with how did we get from the simple programmable mobile robots communicating tasks to the simulation of robots which imitating some animals' food collecting habit at the Kecskemét College faculty of GAMF at the Department of Information Technology.


Cooperation in catching


Individual search activity


The joint work begins

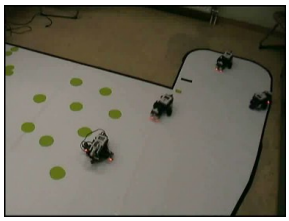

Search action collectively

Fig. 1. Husar-8 rovers in the room tests.

In this research we have used the ants' food collecting habit. With the help of simple NXT robots in a simulated area the robots began to group system and collected some objects (foods). They were communicating with each other via blue tooth and they used some sensors as touch, light and ultrasonic to the tasks. The first robot rovered through the territory, memorized the object's coordination then returned to the ''anthill'' communicated the coordination to the others. The swarm of robots then converted the Descartes coordinates into Polar ones and started to go to the right direction. Robots did these tasks more effective and quickly together [4] (Fig. 1.). This kind of "cellecting" program will be used for planetary work, when special types of rocks or meteorites are the objects to be collected.

Experiments in the "planetary surface": This simulation can be good base of the HUNVEYOR and connection with HUSAR experiments. This simulation consist of the following steps: some special rovers, from a concrete place (start point), start in different directions and individually or in teamwork they look for special rock types and first they observe them, send the information to each other, then they collect (if they can) small samples and return with them to the start point.

Swarm strategies: In another task the robots start to go into different directions and take with them measuring instruments so they can measure and map the data from a big area.

With the developing new sensors [5] and making perfect communication channel can make colony with more and more robots [6]. These tasks can be solved with low-intelligent, cheap robots instead of high-intelligent expensive ones. So even if some of them may be out of order the mission can be successful. This is in contrast with the case of using only one high intelligent and substituted robot. In this task one of the most difficult problems is the programming of returning of robots to the start point. Somehow they must remember the way they covered. To solve this problem, the planetary surface navigation is a useful test environment.

Fig. 2. Field works between rocks at early winter. Leaves form special obstacles for the small rovers.

Fig. 3. Field works of Husar-8 swarm on the snow. This kind of "snow-sand" is also comparable with the real sand soils.

Summary: In GAMF Faculty at Kecskemét College the robotics program uses swarm strategy in the field work robotic operations. This swarm strategy has benefits if they are used in planetary science field works. In the vicinity of Kecskemét, there are sand dunes, where we begin to try the HUSAR-8 models in a free air demonstrations. We recognized that planetary science is an important factor to teach robotics.

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