CHEMISTRY EXPERIMENT MEASURING (pH) OF THE "PLANETARY" SOIL BY THE HUSAR-5 NXT-BASED ROVER MODEL OF THE SZÉCHENYI ISTVÁN HIGH SCHOOL, SOPRON, HUNGARY.

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Introduction: The Széchenyi István Gimnázium High School joined to the Hunveyor-HUSAR program in 2008 by constructing the HUSAR-5 model. The rover had the first experiment to build: measuring the chemical characteristics of the soil on the surface of a planet by using the indicator method [1-2]. We report about the construction and experiments carried out by the rover.

Construction of the rover and the experiment: the basis for the rover was a field-rovering car model. We constructed to it two arms and a pump on the rover both from LEGO elements. On the first arm we placed a wireless camera, which could rotate around 360°-and also could bend down. The role of the second arm was to stretch and place the indicator ribbon to the surface and move it along a distance to contact with the wet soil. The role of the pump was to pour water on the soil surface. The basic principle was that water dissolves important chemical components from the soil and the indicator ribbon reports the main chemical characteristics of this chemistry, first the pH of the soil.

Fig. 1. On the front of the rover there is an ultrasonic sensor of the obstacles before the rover. Upper arm). There is also the camera (right up) and there is the arm moving the indicator ribbon. The ribbon is rolled from one wheel to the other wheel while the arm is contacting the surface and soil. Camera observes the changes on the indicator ribbon colour.

The direction of the rover was programmed by the Mindstorm NXT set elements (Language: Mindstorms NXT G). In its motion the rover was supported by an ultrasonic sensor which observed the obstacles standing before the rover.

On the back of the rover are the two „brains", which control the movements and the motors of operation of the arms and they also receive the signals of the sensors. The water container is on the top of the rover.

Description of the experiment: The rover continuously observes the rocks on the surface in front of it. The NXT controls this program by the ultrasonic sensor. There is a movement program to turn the obstacle left side then return to the original direction and advance for a determined time. Then the rover stops, the camera turns around 360° degrees and then moves forward on the arm in order to give detailed panorama of the surface right in front of the rover. Then moves a bit forward and initiates the pump for pouring water for 15 seconds on the soil bottom of the rover, just on the surface which was earlier observed by the camera. The next step is that the rover return back from the wet surface. During this motion the second arm touch the surface to contact it and the indicator ribbon. Next step is that the first arm brings the indicator ribbon to the view of the camera to observe the changes. The camera continuously transmits the view. The program in recent conditions needs an observer in the "terrestrial control room". (See the A, B, C, D, E, F, G, H, I image series.)

The experiment in images: We show the steps in the images of the student observer, however, at the final image is made by the on board camera of Husar-5.

A

Arrival to soil experiment site.

B

Camera observes the soil.

C

Pouring water onto the soil.

D

Indicator arm touch the soil. Indicator ribbon arm rolls the ribbon.

E

Husar-5 moves backward to prepare observation of the rolled indicator surface, which holds the information about the pH of the soil.

F

The result on the indicator ribbon.

G

Camera arm moves to see result.

H

Control room student observes on the screen the measured color, and…

I

…he can compare the measured value with the standard color set of the pH-values. (Languages: Labview: on the terrestrial control computer, MSWLogo: for the transliteration of color to pH-value.)

Further developments: In order to build a full automatic system we want the following image making system. A signal trigger image making and sending to the Hunveyor-5 computer (via bluetooth), there it I stored and snet to the senter. First we plan to solve it by mobil phone contribution.

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