EDUCATIONAL RELATIONSHIPS THE DEVELOPMENT OF THE HUNVEYOR 13 INFORMATICS ARCHITECTURE R. Cseh[1], T. P. Varga[2], Sz. Bérczi[3], T. N. Varga[3], [1]TavIR Project Development, H-1181 Budapest, Vándor Sándor u 12. Hungary (csehrobert@tavir.hu), [2]VTPatent Kft. H-1111 Budapest, Bertalan L. u. 20. Hungary, (info@vtpatent.eu) [3]Eötvös University, Institute of Physics, Dept. Materials Physics. H-1117 Budapest, Pázmány P. sétány 1/a. Hungary (bercziszani@ludens.elte.hu, vargatn@caesar.elte.hu)

Background: During education on space research the demand often comes up for modeling various tests of planetary surface in Terrestrial conditions. This is a suitable way of transferring the knowledge about space research and related technical fields in a complex and efficient way. In the scheme outlined by us, we offer a possibility of demonstrating and a way of sorting out different concrete technical, technological problems in the development of the Hunveyor 13 architecture.

This work requires a complex approach of several branches of science and technologies: robotics, information technology, transmission and control techniques, mathematical and physical modeling, system organization, and from scientific fields of astronomy, geology, astrophysics.

The traditional demonstration devices used in education are suitable in general for showing a single concrete problem, but there are also compilations suitable to demonstrate several relevant tests. It is difficult to ensure systems for educational purposes, which can be used in a flexible and diverse purpose way.

Our goals: To establish such an informatics architecture of space probe development system, which is suitable for the tentative modeling of a piece of the planetary science education. Particularly: The architecture should be suitable for transferring of the teaching material; Informatics architecture should join the level of knowledge of the age group; It should be appropriate for transmitting complex knowledge in conformity with the given level of knowledge; Several professional branches could be connected by it.

Our proposal: A space probe model system on several levels, proportioned hierarchically on basis of functions, where the number of levels can be formed in a flexible way, the number of levels are not limited either way, up or down, and certain blocks of function are handled as functional units.

The basis of realization is the model scheme developed in connection with HUNVEYOR 13, in which there is a distant unit (in the Earth, or on orbital path), there is a fix unit of planetary surface (HUNVEYOR), and there is at least one mobile unit moving on the surface (HUSAR).

Feasibility study: In general: first an engineering task-analysis, then a synthesis in connection with the tasks are needed. The main steps, aspects to be considered during the planning of the system are the following: Task analysis, Determination of functions, determination on system level, Allocating the devices.

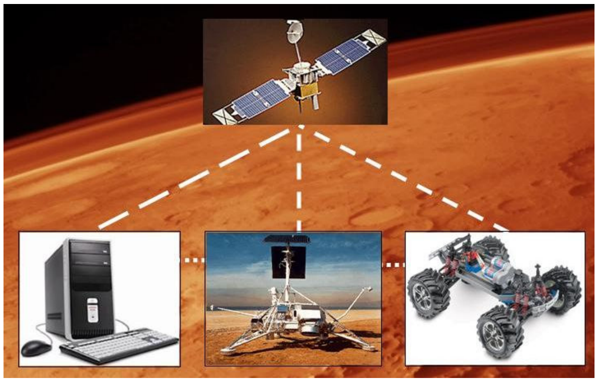

Fig. 1 Complexity and system approach in the Hunveyor 13 model informatics architecture

The practical informatics task: Communication, test, data forwarding, data receipt, storing, planning and realization of controlling tasks between the units of the complexity system (Fig 1.) should be conform with the given target task.

Levels of realization: *Low:* Connection between the end points, elementary tasks, *Medium:* Modular partial units with independent data processing capacity, or autonomous part, independent functional realization, *High:* The single partial units keep in touch with each other, compile the data received locally, evaluate the data and carry out the tasks on basis of them.

Our results: During the realization of educational tasks a new knowledge, and synthesis - built on the level of the age group and on the already acquired knowledge, - can be achieved. Our model system compared with other systems used in education is suitable to form earlier an attractive scientific approach and a scientific technological outlook even in the first school years. Resulting from the modular system, the Hunveyor-13 educational system uses free protocols widely used in information technology, as well as known application techniques. It is ensured by Internet availability, where participants can freely and in a systematized way publish their findings.

Demonstration of a specific experiment: We will show an example, how to define target tasks in connection with a specific experiment, how to build up by functions, partial units and how to draw the conclusions. The specific experiment is the demonstration of the surface effects of a Martian dust storm.

Observable phenomena: Change of the intensity of radiation, change of temperature, change of transparency of the atmosphere, strength of wind, dried solid material, particle size of dust, quantity and particle size distribution of deposited dust, the course in time of the phenomenon. Units of observations: fix planetary unit, mobile units.

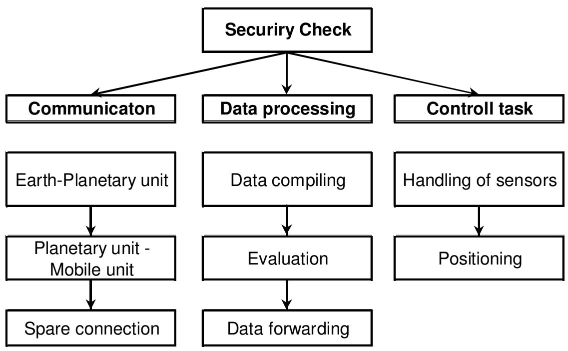

Fig. 2 Task analysis of the informatics architecture

Our informatics architecture model makes it possible to apply several observing units compared to a central observation point, located in different places in different times, which can be rearranged dynamically conforming with the given task.

The necessary sensors: sensor of illumination, sensor of temperature, sensor of pressure, optical measuring device, wind gauge, laser source and sensor.

Description of test: A reference surface area of the fix or mobile units should be designated for the observation of the quantity of the delivered dust. Solid material, and the quantity of dust carried there could be determined from the extent of shading of the surface. A strain gauge is suitable for measuring it, which gives a signal proportionate with the mass of the dust deposited on it. A diffraction optical measuring device is suitable for the determination of the particle size of the dust, as well as the characteristics of the levitating dust. Measuring of wind flow takes place with Bernoulli tube or Pitot tube. Determination of wind direction by sonic anemometer.

Specific task analysis of the experiment: Communication tasks: two-way, between the unit in Earth, and the fix planetary unit, as well as between the planetary surface unit and the mobile units. Reserve connection for the own communication of the mobile units, respectively between the unit in Earth, and the mobile units. Data processing: compiling data, evaluation, forwarding data to the joining units. Control tasks: handling sensors, positioning mobile units. Running of security check protocols: periodic checking of conditions of devices, sensors, units.

Conclusion: When analyzing the findings, two groups of phenomena can be distinguished: Measurements influencing Hunveyor and measurements made by Hunveyor. The processes effecting Hunveyor are the processes of the environment. Such as atmospheric flows, dust deposits resulting from those, warming up resulting from light input, or electric charging resulting from both effects. These phenomena also belong to the subject of environmental science.

The measuring technologies built on Hunveyor are the subject of important analysis. They represent the planned system of Hunveyor, the apperception of technological processes represented by equipment as well. Such as are the frame elements, the systems from mechatronics systems, interior information technology and electronic systems to the systems of certain measuring intervening sensors. The analysis of both systems include educational benefits.

The use of Hunveyor system makes possible to examine the processes of the equipment of a test space probe and the environmental processes around Hunveyor together with the students. During the common analysis the two types of process groups are compared. During the comparison of these two complex process groups the basic knowledge of science subjects, chemistry, physics, biology, geology appear in a synthesis. The Hunveyor informatics architecture system makes the students see both the part and the whole during its building, demonstration and operation of a complex simulation, and the students get gradually acquainted with it during the job and the analyzing processing of it.

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