HUNVEYOR-4 CONSTRUCTION AT KANDÓ KÁLMÁN ELECTRICAL ENGINEERING FACULTY OF BUDAPEST POLYTECHNIK, SZÉKESFEHÉRVÁR, HUNGARY. Hudoba, Gy.[1], Sasvári G.[1], Kerese P.[1], Kiss Sz.[1], Bérczi Sz.[2] [1]Budapest Polytechnik Kandó Kálmán Faculty of Electrical Engineering, Inst. of Computer Technology, H-8000 Székesfehérvár, Budai út 45., Hungary, (hudoba@szgti.bmf.hu). [2]Eötvös University, Dept. G. Physics, H-1117 Budapest, Pázmány P. s. 1/a. Hungary.

Abstract: We report about the construction and main system characteristics of the fourth **H**ungarian **Un**iversity Sur**veyor** at Székesfehér-vár, Budapest Polytechnik Kandó Kálmán Faculty of Electr. Eng. Inst. of Computer Tech. Hungary.

Introduction: The university and college minimal space probe construction program was initiated at the Eötvös University, in 1997 [1-5]. There the Hunveyor-1 had been built with camera and telescopic arm instrumentation, and they later developed a rover, test-field around, internet connection and simulator.

Individual Hunveyors were built with their own electronic and experiment constructions in Pécs University (Hunveyor-2), the Berzsenyi College (Hunveyor-3), too. Our realization is based also on individual solutions and we report the recent state of the work [6-11].

Frame: Our frame is a little bit smaller than the earlier Hunveyors. We have frame from aluminum, with square cross section of 20 × 20 mm size (and 2 mm thickness of the tube wall). Over the riveted clip support of the connections we used hardening plates and epoxy-glue for fastening. Some other cross section profiles (10 × 10 × 1 mm square and 20 × 3 mm ribbons) were also used in making the frame strong. The result was a light-weight skeletal structure. The whole frame consists of about 100 pieces (except the rivets and the bolts). For further mounting, holes (D=3,2 mm) were bored at every 40 mm distances in the frame bars (about 160 holes in the whole frame). There was a disadvantage of our solutions: we could not form „spatial" nodal points like the earlier constructions, therefore our tetrahedral frame form seems rigid as compared to Surveyor, or the earlier Hunveyors [2].

Fig. 1. The frame of the Hunveyor-4.

The electronics: The operating system of Hunveyor-4 is a Debian GNU/Linux 3.0 Woody system. We planned minimal energy consumption therefore only the most necessary processes are run. The camera connects by an USB port to the computer. The direction and control of the camera movements are solved by the motherboard's parallel port. The image of the camera is stored in the server of the space probe. Also this server communicates with the web-server and sends the image from the web-camera to the server [2, 13].

The internet connection: Our aim was to realize an electronic structure of the Hunveyor -4 experimental space probe which can be directed and operated through the internet. We also intended to develop and enlarge the system.

The operation by a server was planned to run in the following way: Before login the web-client user registers through an interface. All users get a process-number, (for parallel use). He or she can preoccupy an interval for his/her use of the Hunveyor-4 system. (For example 1 hour every day, for two weeks). Other users can reach the data only, but not the modules for operation.

Connection between web server and the Hunveyor-4: The main characteristics of the connection btw. the probe and the web server is flow of data through the channel. The web server sends the necessary parameters to the probe (i.e. camera angular position) and then the probe (after confirming the request) sends the image and the other telemetric measurements.

The random connection failures (*the probe can not be reached)* are handled on the server. The future new modules need the modification of the program of the server although more servers may work parallel also.

Recent realization: (Jan, 2003) The web server is ready, the time schedule works (for a limited number of devices). The camera (Logitech Quick-cam express) is in work for image analysis. The PC operation system of the probe is ready. Till the 34th LPSC probably it will work with the camera. (Fig. 2.)

Rover: It extends the possibilities of the lander. The direction is controlled by a PIC microcontroller according to the routine of the central unit. The microprocessor works with two way communication btw. the central unit and the lander [5, 7].

Motion: It has a four-wheel drive. The motors are DC motors and are controlled individually. This may be done over the internet as well.

Communication: The rover communicates in radio frequencies by a BlueTooth instrument. To extend the small effective radius of the BlueTooth the rover car-

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ries and places to the ground small relay stations. This way the communication is continuously possible even behind the obstacles [13].

Energy support system: The rover has a 12 V, 7Ah capacity accumulator. Over short distances this power is enough for operations [15].

Scientific instruments:

Temperature: A thermistor measures, the voltage fall through the thermistor is proportional with temperature. This is measured by a microcontroler through a 10 bit AD converter. Input. Considering the non-linear characteristics, the digital data are transformed to temperature units in the central unit.

Spectrometer: Using a spectrometer the composition of the soil can be calculated. In the measuring head four (different wavelengths) LEDs are placed. They, one after the other, lights the surface and the reflected light is measured by a phototransistor. We periodically switch on and off the light sources in the spectrometer in order to exclude the effect of the natural lighting. On the output of the phototransistor only the alternating component is analyzed. The output of the phototransistor connects to the input of an AD converter [8].

Radiation: We also place an instrument to the rover in order to measure the background radiation. The impulses are conducted to the input of a microcontroler, which counts them and summarize them [10].

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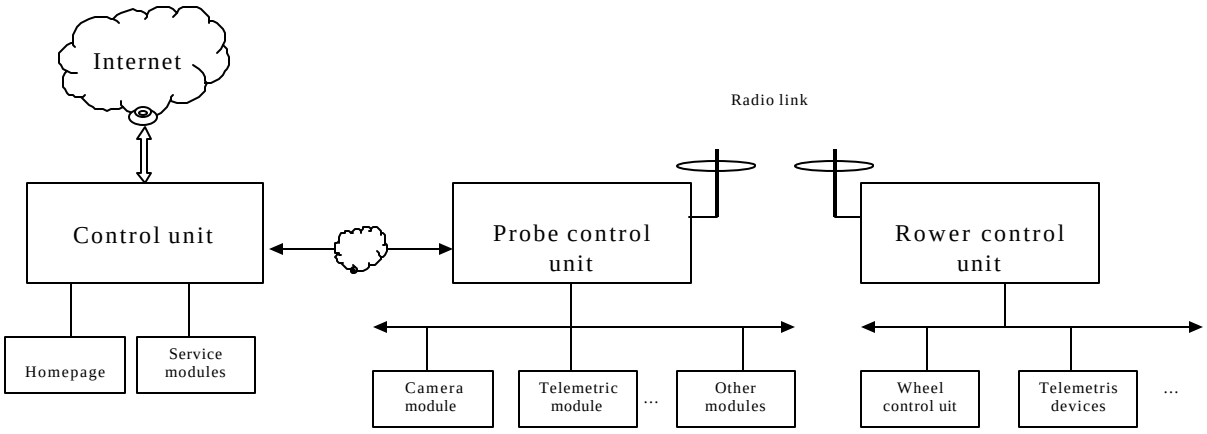

Fig 2. Block diagram of the main system units of the Hunveyor-4 experimental university space probe.