THE INFORMATION SYSTEM OF THE HUNVEYOR-10 ON THE MDRS. Z. Istenes [1], H. Hargitai [2], I. Tepliczky [3],. [1]University Eötvös Loránd, Faculty of Informatics, H-1117, Budapest, Pázmány Péter sétány 1/C., Hungary (istenes@inf.elte.hu), [2](hhargitai@gmail.com), [3](tepi@mcse.hu),

Introduction: We created a portable and autonomous meteorological station, called HUME / HUNVEYOR-10, for the 71st. mission of the Mars Desert Research Station (MDRS) [1] located in the desert of Utah. The objective of the meteorological station was to measure continuously (24/7) meteorological data, to take videos and to transmit these data via Wi-Fi connection. The meteorological station worked successfully during the visit of the Hungarian crew from 13/04/2008 to 26/04/2008 [2] [6].

Requirements: This project had several constraints: first of all, the meteorological station had to be autonomous and portable, the deadline was very close and finally, the budget was very tight and low.

We designed and constructed a custom hardware and software system to fulfill these requirements.

Description of the system hardware: The whole system is composed of three subsystems: first the power subsystem, then the meteorological data acquisition subsystem and finally the computer subsystem.

The power subsystem. The meteorological station had to be fully autonomous, the power was supplied by a 10W solar cell and a standard (12V) car battery connected with a charge controller.

The meteorological data acquisition subsystem. The different meteorological data was processed by a Campbell Scientific CR23X data logger unit [3]. The data logger measured 19 parameters in every 10 seconds, then stored the 5 minute mean, maximum and minimum. The data logger switched the computer on and off, using a switching box, after every 30 minutes for 5-5 minutes.

The computer subsystem. The computer subsystem parts are: the mini-ITX standard 170x170mm Intel D201GLY2 motherboard [4], the passively cooled 1,2GHz Intel Celeron 220 processor soldered into the motherboard, the 1GB DDR2 memory, the 80GB 2,5" SATA hard disk. One PCI Wi-Fi card with external antenna and an USB camera was also connected to the computer. The voltages required for the computer subsystem was provided by a special, tiny, wide input voltage range M3-ATX power supply [5].

Power considerations. The data logger running continuously, consumed very few energy (less than 1W). The computer subsystem having the highest energy consumption (approx 25W) was only switched on for 5 minutes, every 30 minutes, but only when it was not too dark for the videos (22-05h). The Fig. 1. shows the battery voltage fluctuation (5 minutes maximum and minimum values) during 48 hours. When the computer was switched on (even for 5 minutes) the battery voltage dropped down more than 0.7V. The solar cell charged the battery at midday's. At night, when the computer was not switched on, the battery dropped the voltage very slowly (approx. 0,01V/night). Monitoring the battery voltage permitted to mantain the power system's load and charge balance.

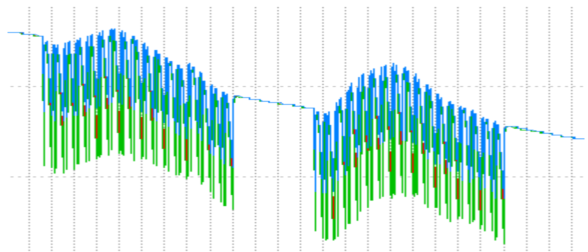

Fig. 1. The battery voltage fluctuation.

*Budget considerations***.** As seen in the Table 1. we spent only approximately 420 USD for the power and the computer subsystems. The meteorological subsystem: the data logger and the measurement sensors were all borrowed from the Meteorological Department of our University.

The power subsystem reused a car battery which already served at the MDRS station. The Wi-Fi card and the webcam were also borrowed ones.

We finally decided to use the 80GB SATA hard disk instead of a Solid State Disk. The Solid State Disk would have been a better choice for a better shock resistance and power consumption but it's price was out of our budget.

Power subsystem	
Solar cell, 10W	100 USD
Charge controller	25 USD
Computer subsystem	
Mini-ITX motherboard	65 USD
Memory, DDR2, 1GB	10 USD
M3-ATX power supply	70 USD
Hard disk, 80GB, 2,5", SATA	40 USD
Miscellaneous	
Box for the subsystems	90 USD
Switching box (home customized)	20 USD
Total:	**420 USD**

Table 1. The costs of the used materials

Description of the systems software's: Three main software worked together: the data acquisition program running on the data logger, the data retrieval program to get the data from the data logger running on the computer and the computer communication program. The data logger data acquisition program was made with "EDLOG". This program set up the different meteorological sensors, gathered and processed their data. A Windows XP operating system was running on the computer. During the operating system boot, (amongst others) a service was started to schedule different actions on the meteorological station. First, a 60 second video shoot was started. Parallel to it, the data logger data retrieval program was started, which tried to connect to the data logger via a serial port and then transferred the data logger data to the computer hard disk. Another program tried to establish a Wi-Fi connection with the MDRS base computer and when the connection was successful it started to synchronize the meteorological data and videos with the MDRS base computer. The computer on the MDRS base was connected to the internet with a very unreliable satellite connection, therefore the meteorological station computer was (sometimes) also accessible via the internet. When both the Wi-Fi and the satellite connections were established then the meteorological station's computer started to upload the most important data to a Hungarian server computer. During the mission, we successfully tested the remote (from Hungary) reprogramming of the meteorological station data logger.

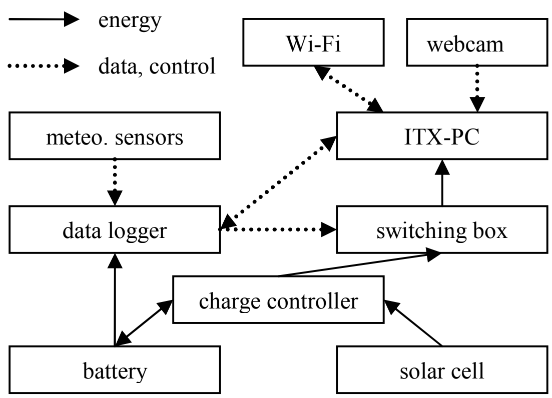

Fig. 2. The meteorological station main components and their energy, data and control connections.

Software selection considerations. We used the Windows XP operating system, since the data logger data retrieval program was based on Windows and the mission crew knew it well. We would have preferred to use Linux operating system on the meteorological station's computer, but due to the short time, we had no time to write a data retrieval program for Linux. In our next project when the meteorological station had to operate not for only 5 minutes but for a longer time (3 months), we decided to use the more reliable Linux system and we wrote a special data logger data retrieval program for Linux.

To keep the deadline, we used already existing, free programs for the scheduling, for the video recording, for the data transmission and for the remote desktop access. This gave us a rapid but satisfactory solution.

Conclusion: Later on, this information system was slightly modified and was successfully reused in a similar project These projects showed well, that it is possible to create a portable, autonomous, low budget information system for meteorological stations. The system components were simple, relatively cheap and modular both for hardware and software elements.

This information system could be a good "base" for other similar projects in the future.

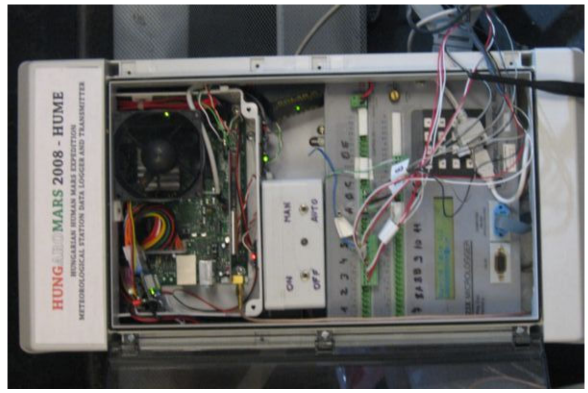

Fig. 3. Assembled in a box: the data logger (right), the switching box (middle) and the computer (left).

References:

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