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# Life detection module on the Mars rover

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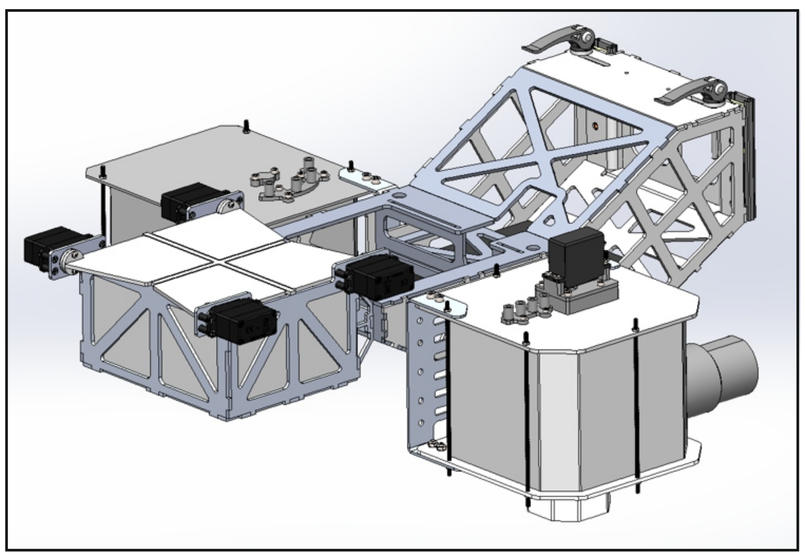
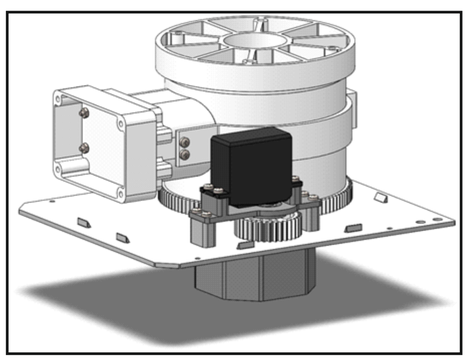
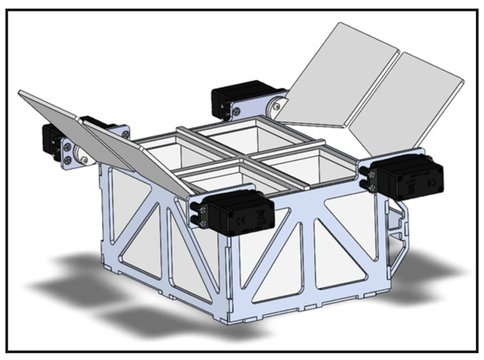
The subject of the invention is working out of life detection module on the Mars rover. The system consists of four core modules. All parts (without mechanical and electronic devices) were prepared using additive manufacturing.

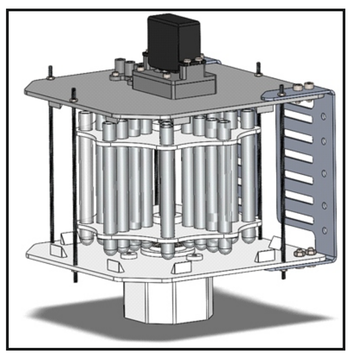
The soil and rock samples are collected by the rover using the special manipulator claws resembling a digger and placed inside four containers (first module). Servomechanisms are used to control flaps opening and closing each container, triggered remotely using the computer control panel. Every container is filled with previously prepared distilled water and tightly separated from another, securing the water from potential leaks. The solution, which appears as a result of mixing a sample with water, is then transported using electric pumps and pipes, with filters used for avoiding clogging them, to modules two and three.



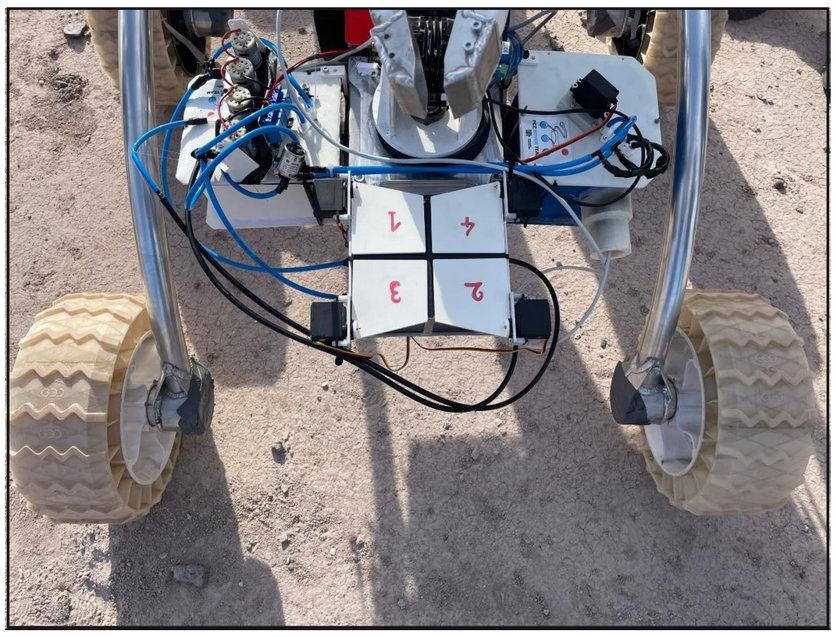


The second module consists of a revolving container equipped with previously prepared test tubes containing several chemical reagents, such as the ninhydrin test used for detecting aminoacids as well as probes with Hanna tests for N, P and K amounts. The test tubes are organized in a circular revolving frame, receiving the solution consecutively. Moreover there is mounted a camera with a small light, which allows us to view all the colorimetric processes remotely.





The third module contains a similar revolver allowing the samples to be properly oriented, however, instead of colorimetrical reactions, it serves spectrophotometry. The central spectrophotometer (SparkFun AS7265X) is surrounded by cuvettes filled with sample solution transported from the initial container. Spectral analysis is conducted remotely thanks to our control panel and analysis software. It allows us to precisely compare any changes in cuvette content color, for example – any minimal traces of a ninhydrin reaction, which might indicate presence of amino acids.




The fourth module – a luminometer – is used manually at the base (modules 1-3 are onboard the rover). This device, using special swabs, indicates any presence of living matter within several minutes.


**The perfection of the life detection module on the Mars rover was confirmed in the operational test during the University Rover Challenge 2023 in the USA, where the PCz Rover Team with the Modernity rover during the Science Mission scored 98.31 points out of possible 100.**

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