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DESIGN AND DEVELOPMENT OF AN AUTONOMOUS CAPILLARY-BASED HYDROPONIC SYSTEM FOR PLANT GROWTH FOR DEEP SPACE MISSIONS

Abstract

Nutrition is essential to staying healthy in any given environment. As more and more deep space missions are being designed, it is imperative to find better sources of fresh nutrition. Recent studies have shown that the body absorbs nutrients from fresh food better than packed/preserved food. Fresh food has also been shown to help keep people mentally fit. So it is imperative to make sure astronauts get fresh food in space. In our paper, we have a two-fold approach, the growth system and the software application.

Our goal is to develop a hydroponic system that is effective and simple to replant for growing vegetables and other plants in space to meet the demands of upcoming deep space missions. The existing systems have provided a wealth of data that can be used to develop effective and easy-to-use deep-space plant growth systems. Our model will supply fresh nutrient-rich plants for astronauts 3-4 weeks after launch. The system will take advantage of the capillarity of water in space to provide and remove water from the root system. The system will be closed-looped, with humidity and temperature controlled by increasing or decreasing the amount of water in the growth chamber.

One of the main differences from the current APH system, which has a set amount of fertiliser in the medium and can lead to issues over time, is that we will also monitor the EC and PH of the water so as to provide a method to give the plants only the needed amount of fertilizer. For instance, if a plant receives too many nutrients, the leaves develop burn marks; if it receives too few nutrients, the plant won't develop to its full potential; and if the fertiliser is in the medium, there is nothing we can do about it; however, if it is in the water, we can reduce the amount present.

The system will also be built to fit inside an International Standard Payload Rack (ISPR). We will create a system that is autonomous and capable of determining the age and health of the plants. This will help us optimize plant growth and improve resource management.