50th STUDENT CONFERENCE (E2)
Student Team Competition (3-GTS.4)

Author: Ms. Tania Ramírez González
Instituto Tecnológico de Costa Rica (TEC), Costa Rica, taniaramirez@estudiantec.cr

Mr. Facundo Daniel Mendoza Solano
Costa Rica Institute of Technology (ITCR), Costa Rica, xblcn97@estudiantec.cr
Ms. Darling Mora
Costa Rica Institute of Technology (ITCR), Costa Rica, darlingpmr19@estudiantec.cr
Ms. María Francini Mora Chacón
Instituto Tecnológico de Costa Rica (TEC), Costa Rica, franmorach@estudiantec.cr
Mr. Sebastián Solano
Instituto Tecnológico de Costa Rica (TEC), Costa Rica, sebasolano15@estudiantec.cr
Mr. Carlos Andre
Costa Rica Institute of Technology (ITCR), Costa Rica, candre@estudiantec.cr
Mr. Steven Cornejo
Costa Rica Institute of Technology (ITCR), Costa Rica, steven.corne22@estudiantec.cr
Ms. Amanda Castro Vargas
Instituto Tecnológico de Costa Rica (TEC), Costa Rica, amanda.cv@estudiantec.cr
Mr. David Josué Bolaños Jiménez
Universidad de Costa Rica, Costa Rica, davidjosue.bolanos@ucr.ac.cr
Mrs. Rosmery Giselle Valle Rodríguez
Costa Rica Institute of Technology (ITCR), Costa Rica, rosemaryvalleop@estudiantec.cr
Mr. Sebastián Vargas
Instituto Tecnológico de Costa Rica (TEC), Costa Rica, sebasvm@estudiantec.cr

BIODOMO PROJECT: AN AUTOMATED AEROPONIC HERMETICALLY CONTAINED SYSTEM TO GROW CROPS UNDER HARSH ENVIRONMENTAL CONDITIONS

Abstract

Food sources have always been one of the main limitations for survival in environments with extreme conditions, and space exploration is no exception. From this need arises the Biodomo Project, attached to TECSpace, a student-run space research community at TEC. This project was conceived by students from the biotechnology, agricultural, mechatronics and electronics engineering careers of the Technological Institute of Costa Rica, allowing the creation of a multidisciplinary and socially diverse environment that enables more people to dive into aerospace research.

The objective of the project is to create a farming system completely isolated from the external environment, which can meet the caloric and nutritional needs of the human being, using the least number of resources possible and that requires the minimum human intervention for its operation. To achieve this, an aeroponic system will be implemented, so that the integration of a water pump allows the constant reuse of the nutrient solution for the plants and thus reduce economic expenses without putting the productivity of the crop at risk. In addition, the configuration in towers that are independent from each other allows to cultivate multiple types of crops in a space-efficient way.

Furthermore, the plants come from an in vitro culture where strong symbiotic interactions between mycorrhizae and roots are encouraged, which allows the plants' resistance to possible pathogenic attacks to

be increased. In addition, an array of sensors will be implemented to monitor in real time all the relevant parameters for plant growth, such as the temperature, pH levels and electrical conductivity of the nutrient solution, as well as the temperature, humidity, and CO2 levels of the air inside the hermetic system. Based on feedback from the sensors, necessary adjustments will be made to the system automatically to obtain ideal conditions for crop growth without the need of frequent human intervention, which prevents contamination and ensures consumer food safety. These adjustments include changing illumination levels, replenishing the solution's nutrients, and regulating temperature and humidity levels, among others.

On a separate note, the planet is currently experiencing a food crisis where climate change has put the food security of the population at risk, as soil fertility has been greatly reduced and climatic conditions have been altered. With this project, we can create a key solution to ensure food security, offering the possibility of growing a large amount of food in small spaces, with external environmental conditions being irrelevant.