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Teenagers create smart irrigation system with focus on food security in communities

The STEM project uses technologies such as artificial intelligence, robotics, rainwater harvesting, and the development of a mobile application.

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COMMUNITY/CITY
Colón

SCHOOL
Colegio José Guardia Vega

PROJECT NAME
Megaton Plants

STEAM AREAS
Science and Technology

OTHER AREAS OF KNOWLEDGE
Sociology

The province of Colón is an economic center of Panama, having the second largest free trade zone in the world, where import and export goods are sold tax-free. In addition, the most important ports in logistics and international cargo in the country are located here. But this could not prevent a socio-political problem in 2022 when a massive strike limited the arrival of food to the region. From the difficulty, the idea arose: to create an automated irrigation system with sensors to make it easier for people to grow their vegetables, guaranteeing greater food security in the communities.

This is how the "Megaton Plants" project was born, a finalist in 2023 of Solve for Tomorrow Central America and the Caribbean region, which brings together 11 countries: the Dominican Republic, Costa Rica, Panama, Guatemala, Honduras, Nicaragua, El Salvador, Ecuador, Venezuela, Belize, and Barbados. "We saw the need, when we saw the prices of food coming from gardens skyrocket and many times there were no vegetables to buy," recalls the mediator teacher Alba de Delgado. "We also seek to create a culture of planting," she adds.

The José Guardiola School is one of the first commercial schools in the province of Colombia and was where the teacher also studied. Since 2001, she has been a teacher at the school and also acts as an auditor and Executive Secretary. Today she teaches project formulation and

evaluation. “I have always liked the adventure of trying new things and when I heard about Solve for Tomorrow, I thought it was great,” she said. Excited by the idea of participating, the teacher motivated her students as well.

The five young people involved were students in the last year of compulsory schooling, the 12th grade, and were 17 and 18 years old. In Panama, students do baccalaureate courses, focusing on specific areas of knowledge, such as careers. From this team, two students were trained in IT, one was in Tourism and the other two students were in Commerce. In the different areas, they are used to Project-Based Learning; whether with 3D printing or artificial intelligence, for example. Before participating in Solve for Tomorrow, the team did it in a competition with the Ministry of Education, but they had not yet developed the prototype, they were just dabbling in the idea. They did not make it to the final and this left them discouraged; some of them were no longer interested in continuing with this project. However, the five students decided to go ahead and apply for Solve for Tomorrow.

Eureka moment!

The discovery of what the prototype structure would be like came about while the students were playing a video game. “They were playing a qualifying game with crazy cars and some of them were spraying water and that was when they commented that they could propose a solution through robotics with sensors,” recalls the teacher. Thus, the name “Megaton Plants” refers to the fusion of robotics with plants.

“The experience was important for their independence and autonomy. The students had divided up the roles, they organized themselves. Each one saw their potential and it was a very pleasant coexistence,”

says Delgado.

Research in books and the field

Initially, the young people did scientific research on livestock development and talked to people who were engaged in this rural activity. “It is easy to find a producer near us and ask him what he does, how irrigation works, and even go to stores that sell agro-industrial inputs and be able to ask him questions,” Delgado explains.

They also learned what natural products they could use for plant growth, as well as how to ensure automatic irrigation so that people could have their vegetable gardens without much work and allow production to take place even when they were not at home. The students also cared about offering a sustainable solution: they created containers, such as 3D-printed boxes at the school, that allow rainwater to be collected.

The materials list included sensors, wiring, solar panels, and batteries, among other supplies for the robotic part. “To test the prototype, they used batteries, but they had the option of charging it through solar panels so that it would recharge itself,” she explains. In the end, everything cost around 100 dollars.

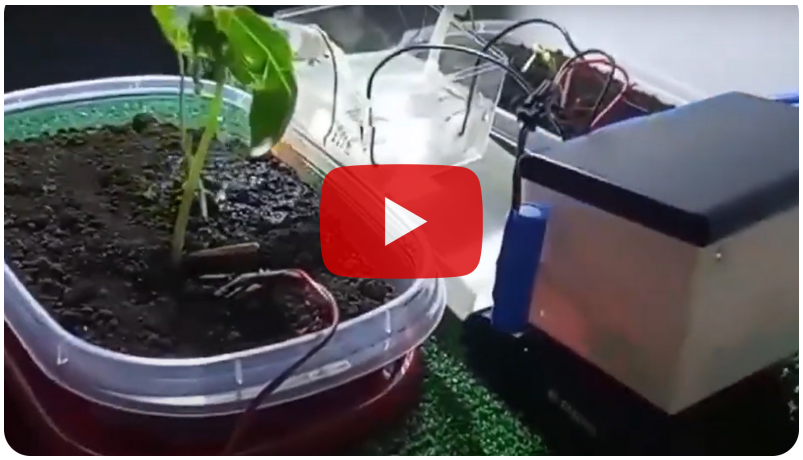
Adjusting the programming

STEM (Science, Technology, Engineering, and Mathematics) knowledge was crucial to achieving the “Megaton Plants”. With what they had already learned in school about robotics and programming, they could get the robot to move in space, but for this project, they needed to adjust the sensors to detect whether the soil was dry or not. To do this, they trained artificial intelligence to analyze the sensor data and be able to determine the water needs of the cultivated plant.

For the test, they used fast-growing vegetables, such as bell peppers and tomatoes. “They were looking for plants that, due to their similarity, had the same water needs at the time to be put in the same box,” the educator describes.

With the result of the prototype, Delgado notes that the project can be reproduced on a larger scale. “Even in public and private schools that have green areas where we can teach children from an early age how to make their gardens,” she says.

Finally, the teacher also stresses the importance of family support in this process. There was no time to devote to the project during class hours, so they often had to work at other times. “I am grateful that the parents were very involved,” she says.



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Explaining!

Sometimes, when doing a STEM project for social impact, it is often challenging to get ideas off paper and turn them into reality. For the teenagers, putting their plan into a text was a challenge. They had to write an essay to present the proposal to Solve for Tomorrow and according to Delgado, they had difficulty in reaching an agreement and defining priorities. “You could see the disappointment, the restlessness, the anxiety. I told them to calm down, breathe, and think about one thing at a time. In the end, it was satisfactory, you could see that each one gave their best,” she recalls.

Focus on practice!

Take a look at the teacher’s guide on how to facilitate the creation of an automated sensor-based irrigation system with students

1 Empathy

To start the project, the first step was to identify a food security vulnerability in the community: with the massive strike that Panama suffered in 2022, it became clear how dependent the population was on the arrival of food from outside the city.

2 Definition

To solve this problem, the group of students thought of a way in which the community itself could ensure to produce its food. That is why they thought of creating a way to encourage and facilitate the home gardens creation.

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3 Ideation

One of the challenges making it difficult to put this idea into practice is that having a garden requires care with irrigation, for example. So they thought they could use their knowledge on robotics to develop an automated irrigation system.

4 Prototype

To assemble the prototype, they made 3D-printed boxes at school that capture rainwater, and they also needed sensors, wiring, solar panels, and batteries, among other supplies. To test the prototype, they used batteries, but they had the option of charging them through solar panels to achieve self-charging. The final cost was about 100 dollars.

5 Testing

For testing, they used fast-growing vegetables, such as bell peppers and tomatoes. They looked for plants that, due to their similarity, had the same water needed to put in the same box. According to the plant, they adjusted the sensors to detect whether the soil was dry or not and trained the artificial intelligence to analyze the sensor data and determine the water needs of the cultivated plant. With the result of the prototype, Delgado observes that the project can be reproduced on a larger scale.