Food Deserts: Developing a Self-Sustaining Greenhouse

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The purpose of this project was to assist food deserts through growing healthy foods easily and affordably with a self-sufficient greenhouse. The solution to this problem had three main parts: providing adequate ventilation to prevent mold and bacteria, ensuring stable temperatures and adequate light, and providing plants with a consistent water supply. I incorporated knowledge of computer science, biology, CAD design, robotics, and engineering to accomplish this goal. I created digital models that can be 3D printed to reduce costs in the manufacturing process, then I used these models to create a physical prototype of this design. The ventilation system opens when the greenhouse senses temperature increasing by too much. The water levels are maintained with a bumper switch that activates a motor to cut off or start the water supply to fill the main container. I used Arduino IDE, Javascript, and Python to program these systems. I simplified these processes as much as possible to reduce the costs and the maintenance of parts. I chose to grow wheat grass, which has a short root system, although the same concept can be applied to deep root plants because they benefit most from being watered at the base of the root system. After testing the greenhouse, I found that the humidity levels stayed within a healthy range throughout the experiment and the temperature was predominantly the same as the control group. I designed an app to help users easily access the relevant information to them, including temperature and light levels. By 3D printing most parts, the cost of the product will be low, and there is no user intervention required to grow plants. It can be used for families living in food deserts or on a larger scale to provide for a community.

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