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Accelerated Gene Discovery Through Automated Hydroponics

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Agriculture is one of the most important sectors of the economy for every nation in the world. But crop production is not projected to meet the growing needs of a world population approaching 10 billion by the year 2050. Furthermore, the use of fertilizers and intensive agriculture practices is unsustainable for the world ecosystem in the long term. More sustainable and resilient crop traits and variants are needed to combat this. Hydroponics, or growing plants in nutrient solution, has been an important way to study and express phenotypes for gene discovery of such crop traits and variants. However, the process is error prone and very labor intensive. Solution changes and phenotyping are manually. This summer, through the generosity of the Cherng Summer Scholars Program and the Honors College, I designed an automated hydroponics system to be used in conjecture with high-throughput phenotyping to quickly identify important phenotypes and related genotypes within the model organism *Arabidopsis Thaliana*. An automated hydroponics system was developed from a combination of 3D modelling, embedded systems design, and plant biology. It collects PH, dissolved oxygen, and conductivity from the solution over time of an experiment through use of high-precision sensors. It also captures images at a time interval using a high-resolution camera that can be image processed to quantify phenotypes using computer vision. A test experiment for the sensors was conducted. A phenotype was failed to be seen so the experiments will be conducted again. This system will be a great addition to the Mendoza lab's research and other research within the Life Science Center.