Automatic plant fertilization

Kalle Elmér

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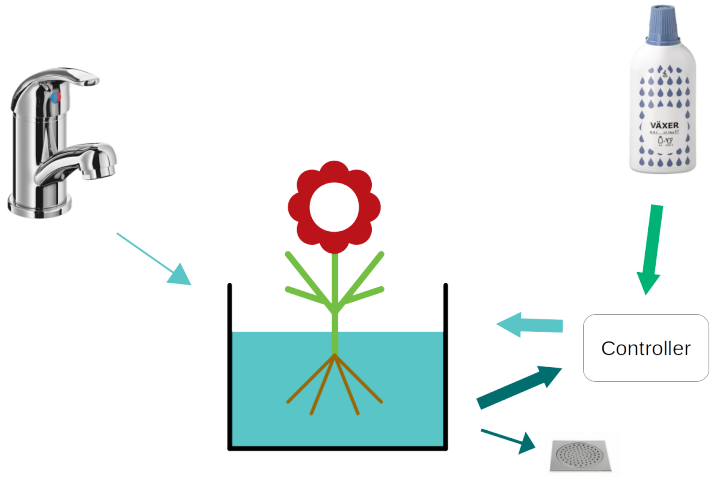
Conventional agriculture uses soil, just like in nature, but it is also possible to have plants growing in a mixture of water and nutrients. The amount of nutrients should not be too high or too low. In this project, a simple measurement device was used to control nutrients for lettuce in a small indoor garden. If scaled up to a commercial installation, this method could save labor and reduce the environmental impact.



The picture above shows how an automatic controller was used to keep the nutrient mix fresh by adding a little bit of nutrient concentrate at a time. The plants absorbed the added nutrients as they grew, and the levels automatically remained in range, without manual work. The controller used simple and low-cost electronics to measure the electrical resistance of the water. Since nutrients in water are dissolved ions, they conduct electricity, making this possible.

Greenhouses offer plants a protected environment. This makes it possible to grow more crops in a smaller area, and to extend the growing season. If artificial light sources and heating are used, it is even possible to have fresh produce in the

darkest months of winter. Hydroponics is a good method because it requires little manual work. Instead of handling solid soil, the nutrient solution can simply be transported by electrical pumps.

The automated control system that resulted from this thesis can manage the nutrient solution automatically. This means that even less manual work is required. In the end, a commercial version of this system could allow farmers to produce large amounts of fresh vegetables at a competitive price. The method is also good for the environment because the nutrient solution is reused. This means that smaller amounts of nutrients are released into lakes and rivers. In turn, this will reduce the overfertilization that right now is harming ecosystems in many parts of the world.

A somewhat surprising result was the simplicity of the regulator; the design used was no more complex than a thermostat. It only had the modes *on* and *off*, adding nutrients whenver the concentration fell below a certain level. In comparison, work on the measurement sensor took a lot more time and effort. It was shown to be unexpectedly sensitive to environmental disturbances, in particular changing temperature. This meant that the weather outside affected the measurements because the room was heated by sunlight.