Hydroponics System

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Description

This project involves the design of a hydroponics system using custom electrical subsystems, including a power supply, LED driver, pump control circuit, and a dedicated microcontroller for sensor data collection and system timing. The system will monitor environmental conditions of electrical conductivity of the water pH and temperature. Sensor data will be measured through ADC. These subsystems will work together to create a stable, self-monitoring environment for plant growth.

Inputs:

- 120V AC mains power for internal power supply conversion

- Manual user inputs switches for system adjustments

Outputs:

- Variable brightness light

- Variable water flow

Specifications:

- The power supply must output $3.3V \pm 0.1V$ at least 500 mA, with ripple less than 50 mV for the 3.3V rail at rated current and output a 12V rail

- The LED driver must support at least 1A continuous current at 12V reliably with dimming control

- The pump driver must switch on and off at, at least 2A per pump at 12V reliably

- The temperature sensing circuit must detect changes in ambient temperature with $\pm 1°C$ accuracy over 10-30 °C

- The Electrical Conductivity and pH signal conditioning circuits must provide stable analog output with a signal to noise ratio greater than 20dB

- Uses a Custom PCB