



CALIFORNIA SCIENCE & ENGINEERING FAIR 2018 PROJECT SUMMARY

Name(s) Deepro F. Pasha	Project Number 38176
Project Title Intelli-Drip: A Sensor Based Autonomous Feedback Control System for Commercial Irrigation	
Objectives/Goals The project objective was to automate water management in commercial irrigation using feedback control systems to save water. The automation was dependent on moisture availability in the soil for plants. Weather related parameters were used to validate the moisture levels. A combination of the appropriate hardware design, analysis and programming was used to accomplish the project goal.	Abstract
Methods/Materials Raspberry Pi 3 Version B, Ribbon Cable for GPIO, 40 pin breakout board, Breadboard, Relay Module, HDMI Monitor, Mini Pump, Small Reservoir, Cauliflower Plants, Drip Irrigation System, Jumper Wires, Soil Moisture Sensors and software: Python 3, Raspbian were used in this project. Ten cauliflower plants as experimental group and ten other cauliflower plants of same age as control group were planted in pots for the experiment. The control plants had a manually operated drip irrigation system. The experimental plants had the newly designed autonomous feedback control system for irrigation. Soil moisture sensors were connected to the experimental and control plants and data was collected and used for determining level of moisture availability in the soil for plants. Using the dry and wet moisture pulses each sensor was calibrated to calculate soil moisture level in percent. Weather data were collected and used to validate the soil moisture readings from sensors. An algorithm was developed on the Raspberry Pi using Python programming language to analyze the collected soil moisture and weather data to find out optimum time and amount of water to irrigate. Based on the analysis, a signal was sent to control the pump automatically to water the experimental plants.	
Results The daily water savings per plant (20.4%) found from this experiment can be extended to estimate the water savings for commercial irrigation to an acre of cauliflower crop field. Considering average spacing of 18 inches, and 19,360 cauliflower plants, the total water savings per day is approximately 1,597 liters/day/acre and for a 70 days cauliflower season, the total water savings can be 111,790 liters/acre/season or 29,535 gallons/acre/season.	
Conclusions/Discussion A control system based on a closed loop feedback system using moisture pulse was designed and operated in this project for irrigation. The control system triggers the pump on and off automatically based on the criteria set in the developed software.	
Summary Statement In this project, a sensor based autonomous feedback control system was designed and operated to control irrigation and save water using combination of appropriate hardware design, analysis and programming.	
Help Received I designed, analyzed and created the system myself but my science teacher helped me to understand how to set up the experiment.	