OntarioTech UNIVERSITY

2019

Design and Development of a Smart Agricultural Cultivation System

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Meet the Team

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Modification Team Lead

Rasel Khan

Design Team Lead

Jesus Umali

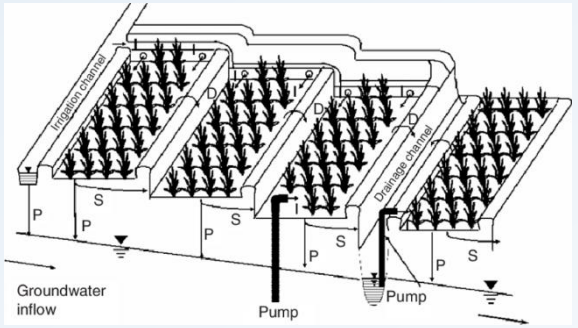
Project Control Manager

Problem Statement

- Excess water consumption by certain systems
- Cost - Additional manual labour
- Data Collection: (must be monitored)
  - Water
  - Humidity
  - Light
  - Temperature
- Excess power consumption
  - Water pumps running unnecessarily

Current Systems

- Subsurface Irrigation
  - Weather has minimal effect on performance
  - Initial installation is costly
  - Repair is costly



- Drip Irrigation
  - Efficient at saving water
  - Uneven water distribution
  - Roots can get dehydrated due to water not being able to pass through

- Sprinkler Irrigation
  - Cheapest to install
  - High operating cost
  - Water distribution depends on scheduling

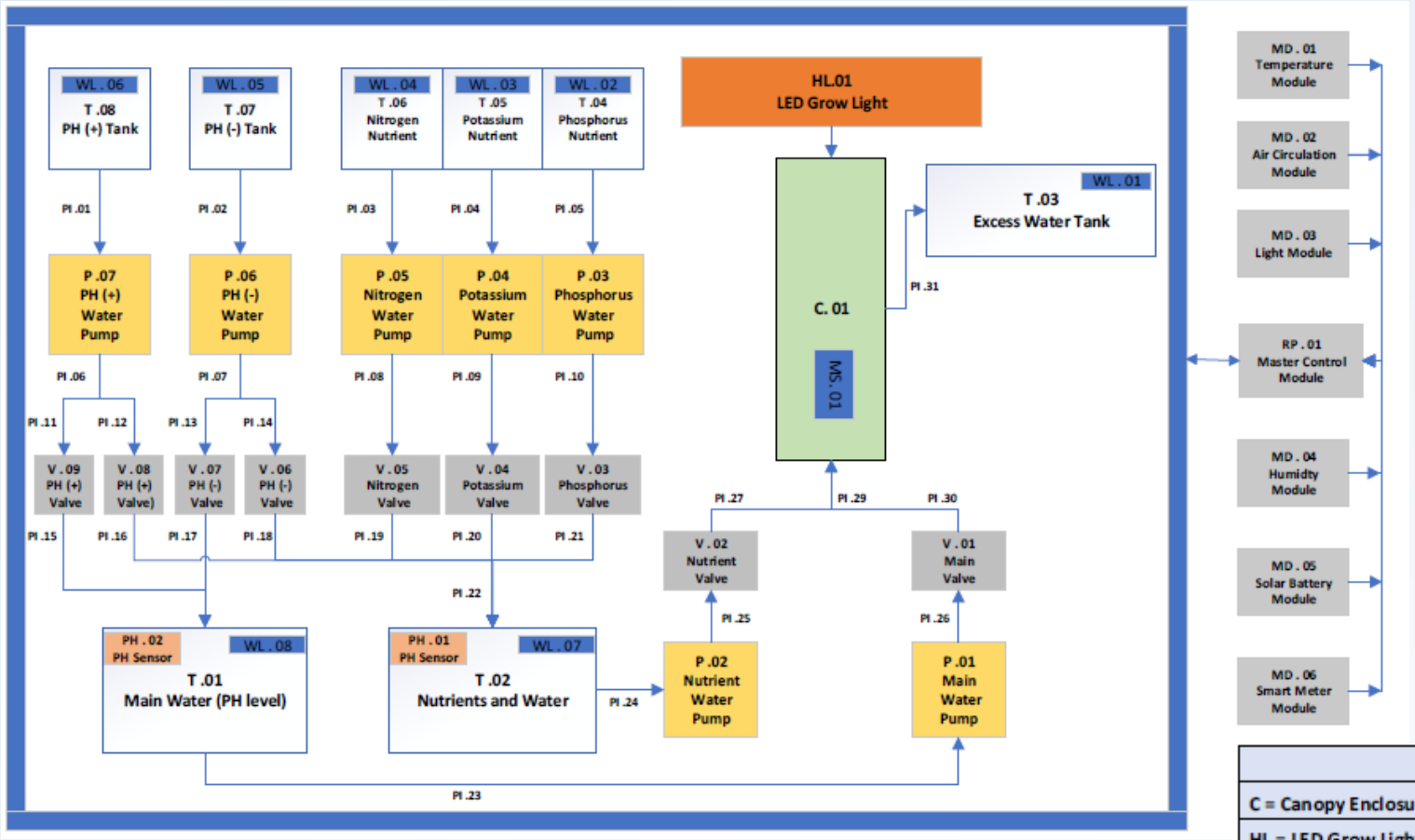
Our Project

- Automated irrigation system – scalable approach
- Real-time consumption data (power, lighting, water) and historical data
- Website to control system and for user interface
- Temperature + humidity control

Project Objectives

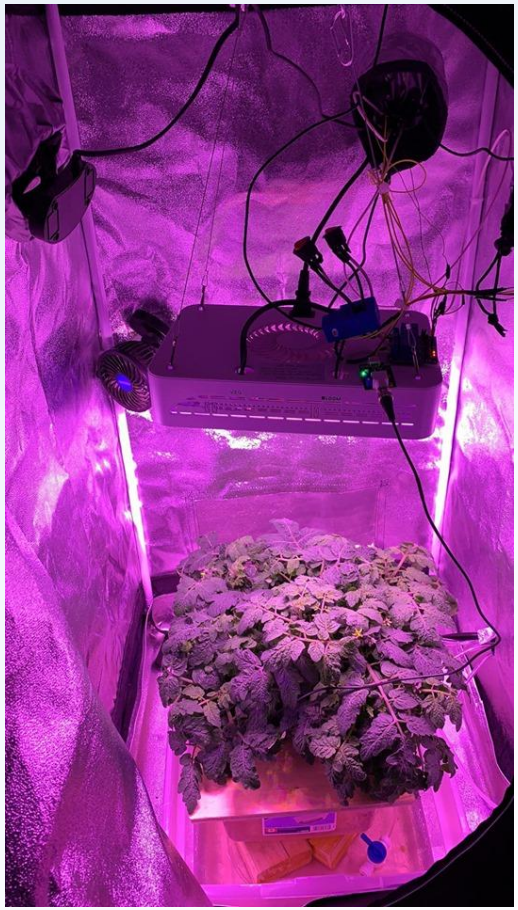
- System must be controllable via Website
- System must be able to read data reading from components
- Components must work harmoniously with microcontroller
- Parameters set must be maintained automatically by the system
- Renewable energy sources should be used where applicable

Engineering Design and Analysis

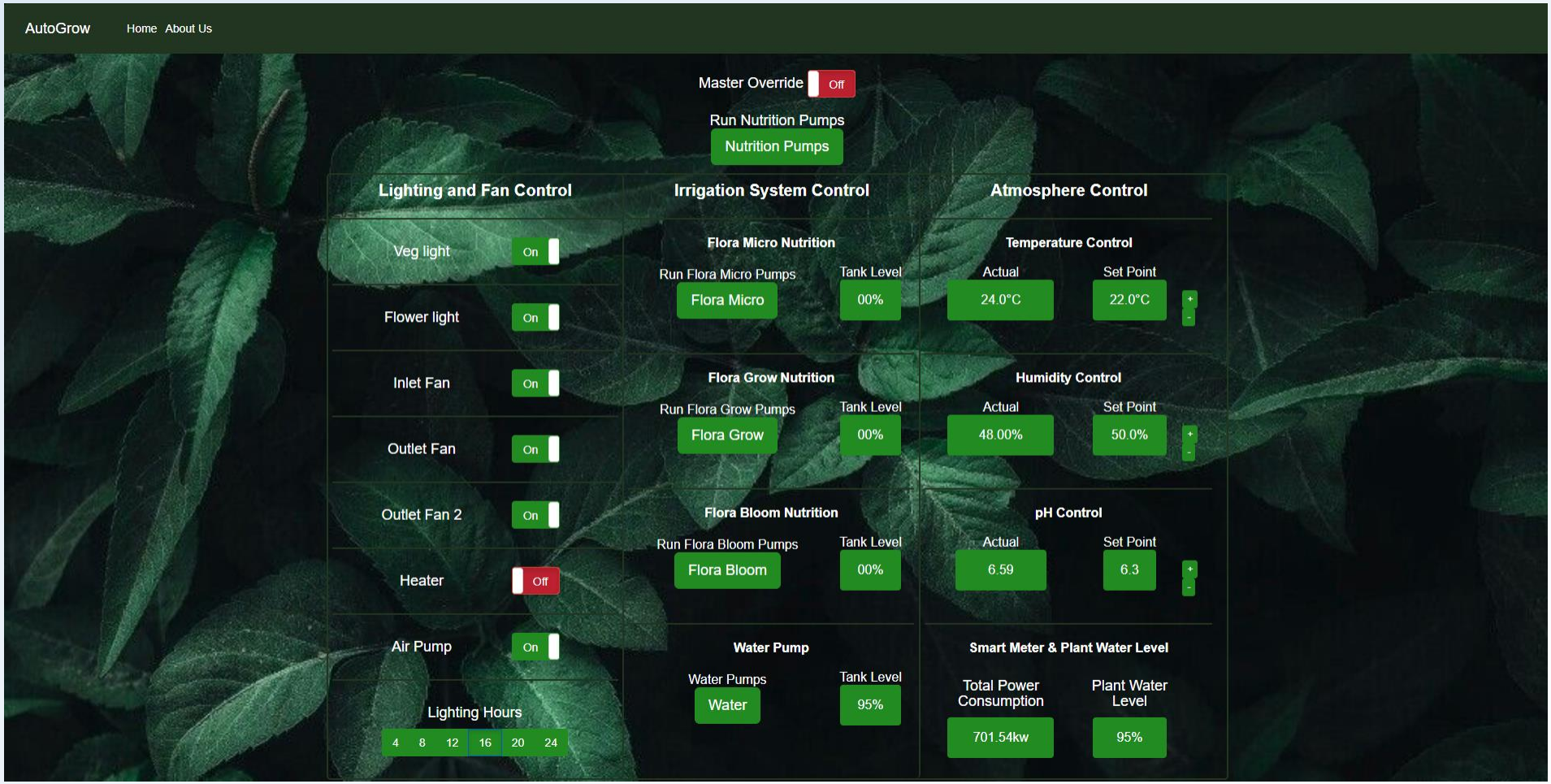


LEGEND	
C = Canopy Enclosure	PI = Pipe
HL = LED Grow Light	RP = Rasberry Pi Module
MD = Control Module	T = Tank
MS = Moisture Sensor	V = Electronic Valve
P = Pump	WL = Water Level Sensor
PH = PH Sensor	

Physical Product

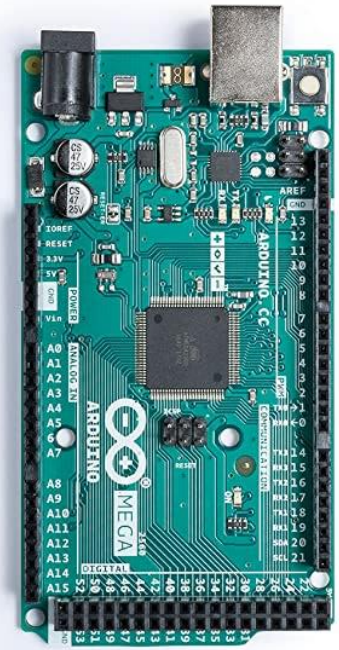


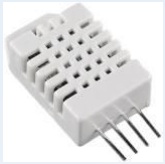
Software


AutoGrow
Home
About Us
Master Override
Off
Run Nutrition Pumps
Nutrition Pumps
Lighting and Fan Control
Veg light
On
Flower light
On
Inlet Fan
On
Outlet Fan
On
Outlet Fan 2
On
Heater
Off
Air Pump
On
Lighting Hours
4
8
12
16
20
24
Irrigation System Control
Flora Micro Nutrition
Run Flora Micro Pumps
Flora Micro
Tank Level
00%
Flora Grow Nutrition
Run Flora Grow Pumps
Flora Grow
Tank Level
00%
Flora Bloom Nutrition
Run Flora Bloom Pumps
Flora Bloom
Tank Level
00%
Water Pump
Water Pumps
Water
Tank Level
95%
Atmosphere Control
Temperature Control
Actual
24.0°C
Set Point
22.0°C
Humidity Control
Actual
48.00%
Set Point
50.0%
pH Control
Actual
6.59
Set Point
6.3
Smart Meter & Plant Water Level
Total Power Consumption
701.54kw
Plant Water Level
95%

Software

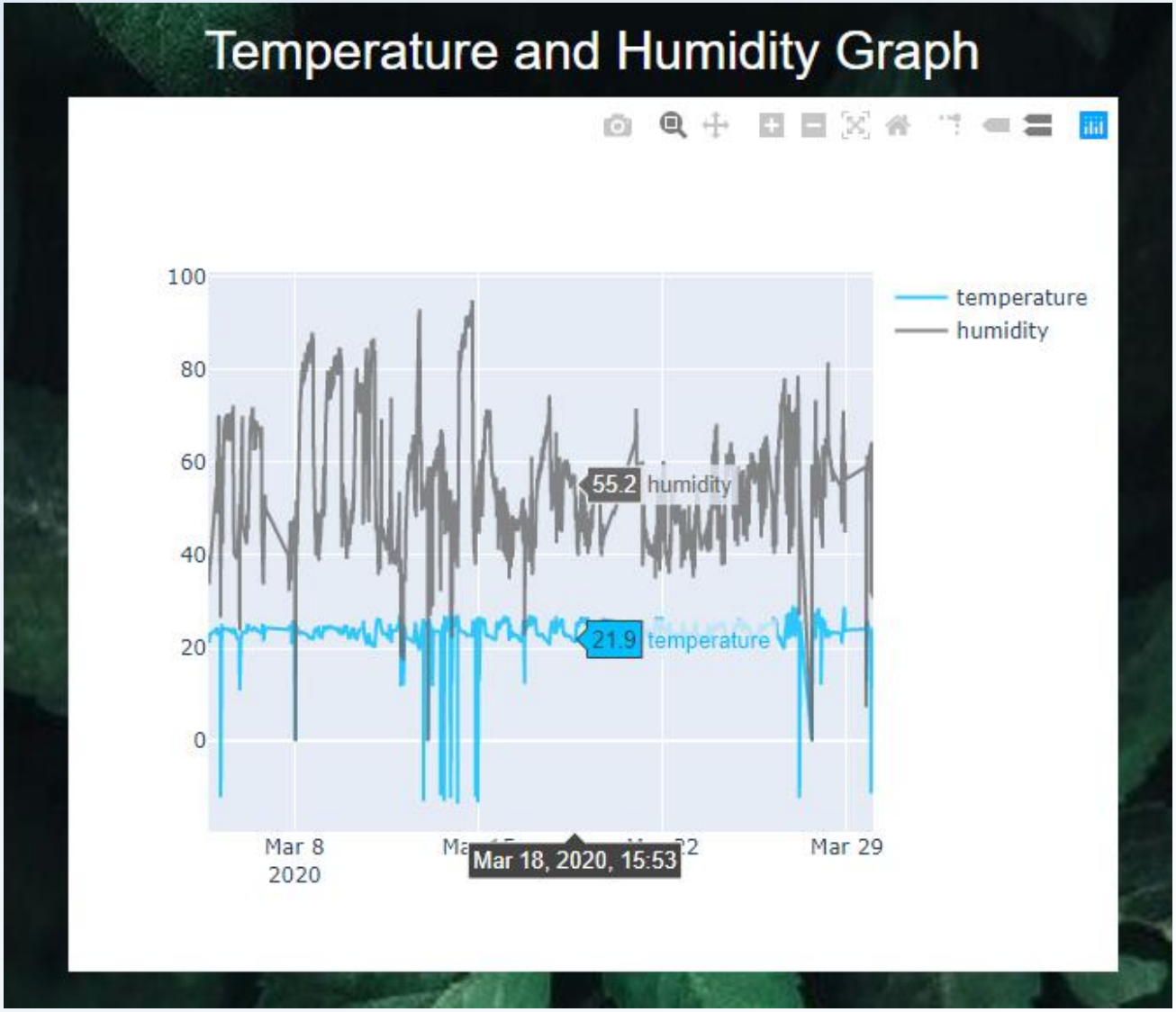
python & django



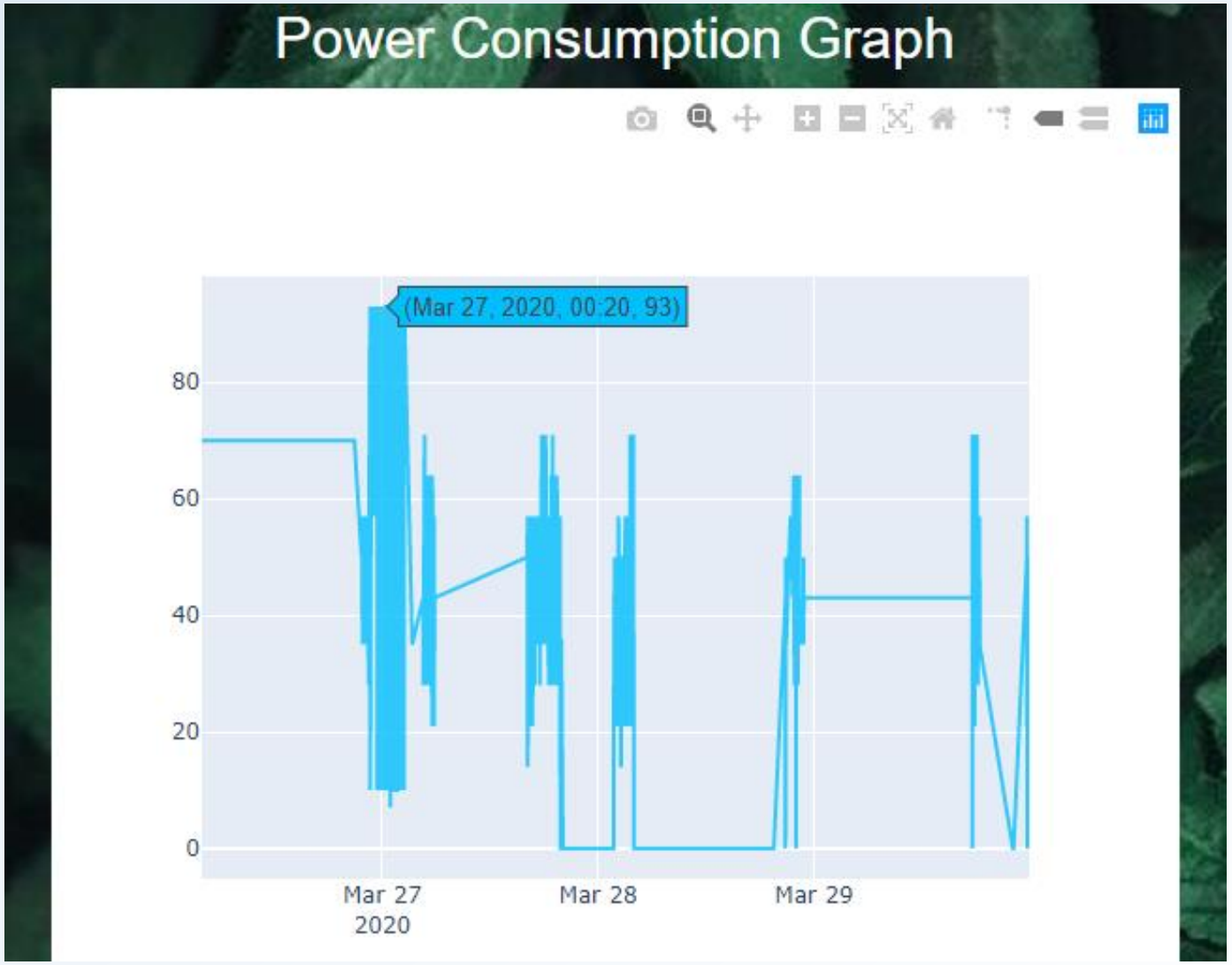


SQLite3
SQL
database
engine

Software


Temperature and Humidity Graph
100
80
60
40
20
0
temperature
humidity
55.2 humidity
21.9 temperature
Mar 8
2020
Mar 18, 2020, 15:53
Mar 29

Software


Power Consumption Graph
(Mar 27, 2020, 00:20, 93)
80
60
40
20
0
Mar 27
2020
Mar 28
Mar 29

Product Testing

- User Case Defined:
  - PH level is maintained
  - Water level is maintained
  - Humidity and Temperature levels are maintained
  - Light functions according to schedule
  - Ventilation functions according to set parameters
  - Website functionality corresponds with component functionality
  - Smart Meter provides power consumption data with accuracy within +/- 5% tolerance

Results

- Test Passed:
  - Water level is maintained
  - Humidity and Temperature level maintained
  - Light functions according to schedule
  - Ventilation functions according to set parameters
  - Website functionality corresponds with component functionality
  - Smart Meter provides power data with accuracy within +/- 5% tolerance
- Test Failed:
  - PH level is maintained (was not implemented)

Demo

Demo link provided in Chat

Acknowledgements

- Special thanks to
  - Dr. Sood – Faculty Advisor
  - Dr. Qusay Mahmoud – Course Coordinator
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Thank You!