### Design 1: A soil-based controlled environment

Design 1 uses soil to provide a medium for plant growth. Soil is essential for the plants such as high value crops. One of the main factors is that it supports the roots to keep them upright. Another one is that it stores and provide nutrients and mineral.

Planting a plants such as high value crops requires enough sunlight, temperature, humidity, water, soil and nutrients. Considering the different parameters affecting the growth of the plants, the designers also put in consideration the constraints for the design. These constraints are the economic for the developmental cost, manufacturability and performance

#### Economic

|  |  |  |  |
| --- | --- | --- | --- |
| **Components** | **Price** | **Quantity** | **Cost** |
| Raspberry Pi | ₱2700.00 | 1 | ₱2700.00 |
| Arduino Uno | ₱500.00 | 1 | ₱500.00 |
| Full Spectrum LED | ₱1972.00 | 1 | ₱1972.00 |
| DHT11 | ₱105.00 | 1 | ₱105.00 |
| Peltier | ₱235.00 | 2 | ₱470.00 |
| Fan and Heatsink | ₱700.00 | 4 | ₱2800.00 |
| Soil Moisture |  |  |  |
| Humidifier | ₱490.00 | 1 | ₱490.00 |
| Steel | ₱200.00 | 1 | ₱200.00 |
| PVC pipe | ₱180.00 | 1 | ₱180.00 |
| Relay | ₱50.00 | 4 | ₱200.00 |
| Resistors | ₱1.00 | 10 | ₱10.00 |
| LED | ₱2.00 | 5 | ₱10.00 |
| LCD | ₱3248.00 | 1 | ₱3248.00 |
| Sprinkler | ₱430.00 | 1 | ₱430.00 |
| Acrylic Glass | ₱1095.00 | 1 | ₱1095.00 |
| Rubber Matts | ₱495.00 | 1 | ₱495.00 |
| Carbon Dioxide Generator | ₱1500.00 | 1 | ₱1500.00 |
| **TOTAL** |  |  | ₱13705.00 |

#### Manufacturability

The Raspberry Pi (RPi) as illustrated on Figure 3.8 functions as the server of the system. The required power supply of the RPi is at least 700mA at 5v for

#### Performance

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#### Project Design

The Raspberry Pi (RPi) as illustrated on Figure 3.8 functions as the server of the system. The required power supply of the RPi is at least 700mA at 5v for

#### Circuit Design

#### Power Computation for Design 1

#### Specification and Cost of Materials

|  |  |
| --- | --- |
| **Components** | **Specification** |
| Raspberry Pi | * Broadcom BCM2835 SoC * 700 MHz ARM1176JZF-S core CPU * Broadcom VideoCore IV GPU * 512 MB RAM * 4 x USB2.0 Ports with up to 1.2A output * Expanded 40-pin GPIO Header * Video/Audio Out via 4-pole 3.5mm connector, HDMI, or Raw LCD (DSI) * Storage: microSD * 10/100 Ethernet (RJ45) * Low-Level Peripherals: * 27 x GPIO * UART * I2C bus * SPI bus with two chip selects * +3.3V * +5V * Ground * Power Requirements: 5V @ 600 mA via MicroUSB or GPIO Header |
| Arduino Uno | * ATmega328 microcontroller * Input voltage - 7-12V * 14 Digital I/O Pins (6 PWM outputs) * 6 Analog Inputs * 32k Flash Memory * 16Mhz Clock Speed * Includes a 50cm USB cable |
| Full Spectrum LED | * Plug Type:SAA * Material:  plastic, Aluminum alloy * Power:45W * LED type: 2835 * LED quantity:165red + 60 blue * Voltage:AC 85V-265V * Lumen: 260-312LM * Lrradiation area:5-8 Square meters * Beam angle:180 degree * Diameter:310mm * Length:310mm * Net Weight:950g |
| DHT11 | * Humidity measurement range: 20%~90%RH * Humidity measurement error: ±5%RH * Temperature measurement range: 0~60°C * Temperature measurement error: ±2°C * Working voltage: DC 5V * Digital signal output |
| Peltier | * Model: TEC1-12706 * Size: 40mm x 40mm x 4mm * Operates from 0~15.2V DC and 0~6A * Operates Temperature: -30 to 70 * Max power consumption: 60 Watts * Net weight: 22g |
| Humidifier | * Type:Evaporative Humidifier * Classification:Humidification * Humidification Method:Mist Discharge * Application:<10㎡ * Function:Ultrasonic Sterilize * Operation Method:Keyboard Type * Noise:<36db * Use:Household * Humidity Control:Touch-tone * Water-shortage Power-off Protection:No * Installation:Mini * Timing Function:No * Mist Output (gallon / day):30-40ml/h * Power Type:USB * Mist Outlet Quantity:One * Voltage (V):DC5V * Capacity:400ML |
| LCD | * 7” Touchscreen Display. * Screen Dimensions: 194mm x 110mm x 20mm (including standoffs) * Viewable screen size: 155mm x 86mm * 70 degree viewing angle * Screen Resolution 800 x 480 pixels @ 60fps * 24-bit color * 10 finger capacitive touch. * Connects to the Raspberry Pi board using a ribbon cable connected to the DSI port. * Adapter board is used to power the display and convert the parallel signals from the display to the serial (DSI) port on the Raspberry Pi. |

### Design 2: A hydroponics controlled environment

Design 2 uses blah, blah, etc. as the medium to keep the plant upright. It uses only water and nutrients fertilizer to cultivate plants. The nutrients needed for the plants to grow are mixed in the water. With this design, the water is the main factor for the distribution of nutrients. The water runs using a water pump and will flow all throughout the plants.

The designers came up with design 2 by considering the constraints set on the previous chapter. These constraints are economic, manufacturability and performance.

#### Economic

|  |  |  |  |
| --- | --- | --- | --- |
| **Components** | **Price** | **Quantity** | **Cost** |
| Raspberry Pi | ₱2700.00 | 1 | ₱2700.00 |
| Arduino Uno | ₱500.00 | 1 | ₱500.00 |
| Full Spectrum LED | ₱1972.00 | 1 | ₱1972.00 |
| DHT11 | ₱105.00 | 1 | ₱105.00 |
| Peltier | ₱235.00 | 2 | ₱470.00 |
| Fan and Heatsink | ₱700.00 | 4 | ₱2800.00 |
| Humidifier | ₱490.00 | 1 | ₱490.00 |
| PH sensor and PH solution | ₱7650.00 | 1 | ₱7650.00 |
| Salinity Sensor and Solution | ₱9997.00 | 1 | ₱9997.00 |
| Steel | ₱200.00 | 1 | ₱200.00 |
| PVC pipe | ₱180.00 | 1 | ₱180.00 |
| Relay | ₱50.00 | 4 | ₱200.00 |
| Resistors | ₱1.00 | 10 | ₱10.00 |
| LED | ₱2.00 | 5 | ₱10.00 |
| LCD | ₱3248.00 | 1 | ₱3248.00 |
| Acrylic Glass | ₱1095.00 | 1 | ₱1095.00 |
| Rubber Matts | ₱495.00 | 1 | ₱495.00 |
| Carbon Dioxide Generator | ₱1500.00 | 1 | ₱1500.00 |
| **TOTAL** |  |  | ₱33622.00 |

#### Manufacturability

The Raspberry Pi (RPi) as illustrated on Figure 3.8 functions as the server of the system. The required power supply of the RPi is at least 700mA at 5v for

#### Performance

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#### Project Design

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#### Circuit Design

The Raspberry Pi (RPi) as illustrated on Figure 3.8 functions as the server of the system. The required power supply of the RPi is at least 700mA at 5v for

#### Power Computation for Design 1

The Raspberry Pi (RPi) as illustrated on Figure 3.8 functions as the server of the system. The required power supply of the RPi is at least 700mA at 5v for

#### Specification and Cost of Materials

|  |  |
| --- | --- |
| **Components** | **Specification** |
| Raspberry Pi | * Broadcom BCM2835 SoC * 700 MHz ARM1176JZF-S core CPU * Broadcom VideoCore IV GPU * 512 MB RAM * 4 x USB2.0 Ports with up to 1.2A output * Expanded 40-pin GPIO Header * Video/Audio Out via 4-pole 3.5mm connector, HDMI, or Raw LCD (DSI) * Storage: microSD * 10/100 Ethernet (RJ45) * Low-Level Peripherals: * 27 x GPIO * UART * I2C bus * SPI bus with two chip selects * +3.3V * +5V * Ground * Power Requirements: 5V @ 600 mA via MicroUSB or GPIO Header |
| Arduino Uno | * ATmega328 microcontroller * Input voltage - 7-12V * 14 Digital I/O Pins (6 PWM outputs) * 6 Analog Inputs * 32k Flash Memory * 16Mhz Clock Speed * Includes a 50cm USB cable |
| Full Spectrum LED | * Plug Type:SAA * Material:  plastic, Aluminum alloy * Power:45W * LED type: 2835 * LED quantity:165red + 60 blue * Voltage:AC 85V-265V * Lumen: 260-312LM * Lrradiation area:5-8 Square meters * Beam angle:180 degree * Diameter:310mm * Length:310mm * Net Weight:950g |
| DHT11 | * Humidity measurement range: 20%~90%RH * Humidity measurement error: ±5%RH * Temperature measurement range: 0~60°C * Temperature measurement error: ±2°C * Working voltage: DC 5V * Digital signal output |
| Peltier | * Model: TEC1-12706 * Size: 40mm x 40mm x 4mm * Operates from 0~15.2V DC and 0~6A * Operates Temperature: -30 to 70 * Max power consumption: 60 Watts * Net weight: 22g |
| Humidifier | * Type:Evaporative Humidifier * Classification:Humidification * Humidification Method:Mist Discharge * Application:<10㎡ * Function:Ultrasonic Sterilize * Operation Method:Keyboard Type * Noise:<36db * Use:Household * Humidity Control:Touch-tone * Water-shortage Power-off Protection:No * Installation:Mini * Timing Function:No * Mist Output (gallon / day):30-40ml/h * Power Type:USB * Mist Outlet Quantity:One * Voltage (V):DC5V * Capacity:400ML |
| PH sensor | * pH probe * pH Range: 0-14 (Na+ error at >12.3 pH) * Speed of Response: 95% in 1 second * Isopotential point: pH 7.00 (0 mV) * Offset: +/- 0.20 pH * 3 buffer solutions and storage solution * 38400 baud rate default |
| Salinity Sensor | * Measuring Surface: Platinum black coated platinum * Body material: Epoxy * Max Temperature: 0-70 Degrees C * Max PSI: 1379 kPa (200PSI) * Conductivity readings +/- 2μs/cm * Full Conductivity range from 0.55 µs/cm to 500,000+ µs/cm * Temperature dependent or temperature independent readings * Total dissolved solids (TDS) referenced to KCL * Salinity is derived from the Practical Salinity Scale (PSS-78) * Data output is a comma separated string: μs, TDS, Salinity * Single reading or continuous reading modes * Simple RS-232 connectivity (voltage swing 0-5v) * Simple instruction set consisting of only 6 (not including calibration) commands * 3.3V - 5V operational voltage |
| LCD | * 7” Touchscreen Display. * Screen Dimensions: 194mm x 110mm x 20mm (including standoffs) * Viewable screen size: 155mm x 86mm * 70 degree viewing angle * Screen Resolution 800 x 480 pixels @ 60fps * 24-bit color * 10 finger capacitive touch. * Connects to the Raspberry Pi board using a ribbon cable connected to the DSI port. * Adapter board is used to power the display and convert the parallel signals from the display to the serial (DSI) port on the Raspberry Pi. |

### Design 3: An aeroponics controlled environment

Design 3 uses no growing medium at all. In this design, the plant is placed into something that can hold them up into the air. The water in this design will be the main factor for the plant’s growth. The nutrients that the plants will be needing are mixed into the water. The plants grow by misting rich nutrients water. Plant roots in this system are suspended in a dark enclosure, while a nutrient-dense solution is sprayed on the roots at certain intervals.

With regards to the design, the designers also weighted the effects on the constraints set on the first chapter. These constraints are economic, manufacturability and performance.

#### Economic

|  |  |  |  |
| --- | --- | --- | --- |
| **Components** | **Price** | **Quantity** | **Cost** |
| Raspberry Pi | ₱2700.00 | 1 | ₱2700.00 |
| Arduino Uno | ₱500.00 | 1 | ₱500.00 |
| Full Spectrum LED | ₱1972.00 | 1 | ₱1972.00 |
| DHT11 | ₱105.00 | 1 | ₱105.00 |
| Peltier | ₱235.00 | 2 | ₱470.00 |
| Fan and Heatsink | ₱700.00 | 4 | ₱2800.00 |
| Humidifier | ₱490.00 | 1 | ₱490.00 |
| PH sensor and PH solution | ₱7650.00 | 1 | ₱7650.00 |
| Salinity Sensor and Solution | ₱9997.00 | 1 | ₱9997.00 |
| Steel | ₱200.00 | 1 | ₱200.00 |
| PVC pipe | ₱180.00 | 1 | ₱180.00 |
| Relay | ₱50.00 | 4 | ₱200.00 |
| Resistors | ₱1.00 | 10 | ₱10.00 |
| LED | ₱2.00 | 5 | ₱10.00 |
| LCD | ₱3248.00 | 1 | ₱3248.00 |
| Acrylic Glass | ₱1095.00 | 1 | ₱1095.00 |
| Rubber Matts | ₱495.00 | 1 | ₱495.00 |
| Mist Nozzle | ₱28.25.00 | 20 | ₱565.00 |
| Carbon Dioxide Generator | ₱1500.00 | 1 | ₱1500.00 |
| **TOTAL** |  |  | ₱34182.00 |

#### Manufacturability

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#### Performance

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#### Project Design

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#### Circuit Design

The Raspberry Pi (RPi) as illustrated on Figure 3.8 functions as the server of the system. The required power supply of the RPi is at least 700mA at 5v for

#### Power Computation for Design 1

The Raspberry Pi (RPi) as illustrated on Figure 3.8 functions as the server of the system. The required power supply of the RPi is at least 700mA at 5v for

#### Specification and Cost of Materials

|  |  |
| --- | --- |
| **Components** | **Specification** |
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| Arduino Uno | * ATmega328 microcontroller * Input voltage - 7-12V * 14 Digital I/O Pins (6 PWM outputs) * 6 Analog Inputs * 32k Flash Memory * 16Mhz Clock Speed * Includes a 50cm USB cable |
| Full Spectrum LED | * Plug Type:SAA * Material:  plastic, Aluminum alloy * Power:45W * LED type: 2835 * LED quantity:165red + 60 blue * Voltage:AC 85V-265V * Lumen: 260-312LM * Lrradiation area:5-8 Square meters * Beam angle:180 degree * Diameter:310mm * Length:310mm * Net Weight:950g |
| DHT11 | * Humidity measurement range: 20%~90%RH * Humidity measurement error: ±5%RH * Temperature measurement range: 0~60°C * Temperature measurement error: ±2°C * Working voltage: DC 5V * Digital signal output |
| Peltier | * Model: TEC1-12706 * Size: 40mm x 40mm x 4mm * Operates from 0~15.2V DC and 0~6A * Operates Temperature: -30 to 70 * Max power consumption: 60 Watts * Net weight: 22g |
| Humidifier | * Type:Evaporative Humidifier * Classification:Humidification * Humidification Method:Mist Discharge * Application:<10㎡ * Function:Ultrasonic Sterilize * Operation Method:Keyboard Type * Noise:<36db * Use:Household * Humidity Control:Touch-tone * Water-shortage Power-off Protection:No * Installation:Mini * Timing Function:No * Mist Output (gallon / day):30-40ml/h * Power Type:USB * Mist Outlet Quantity:One * Voltage (V):DC5V * Capacity:400ML |
| PH sensor | * pH probe * pH Range: 0-14 (Na+ error at >12.3 pH) * Speed of Response: 95% in 1 second * Isopotential point: pH 7.00 (0 mV) * Offset: +/- 0.20 pH * 3 buffer solutions and storage solution * 38400 baud rate default |
| Salinity Sensor | * Measuring Surface: Platinum black coated platinum * Body material: Epoxy * Max Temperature: 0-70 Degrees C * Max PSI: 1379 kPa (200PSI) * Conductivity readings +/- 2μs/cm * Full Conductivity range from 0.55 µs/cm to 500,000+ µs/cm * Temperature dependent or temperature independent readings * Total dissolved solids (TDS) referenced to KCL * Salinity is derived from the Practical Salinity Scale (PSS-78) * Data output is a comma separated string: μs, TDS, Salinity * Single reading or continuous reading modes * Simple RS-232 connectivity (voltage swing 0-5v) * Simple instruction set consisting of only 6 (not including calibration) commands * 3.3V - 5V operational voltage |
| LCD | * 7” Touchscreen Display. * Screen Dimensions: 194mm x 110mm x 20mm (including standoffs) * Viewable screen size: 155mm x 86mm * 70 degree viewing angle * Screen Resolution 800 x 480 pixels @ 60fps * 24-bit color * 10 finger capacitive touch. * Connects to the Raspberry Pi board using a ribbon cable connected to the DSI port. * Adapter board is used to power the display and convert the parallel signals from the display to the serial (DSI) port on the Raspberry Pi. |