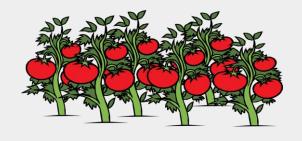
Automated Gardening System







Alyssa Macias

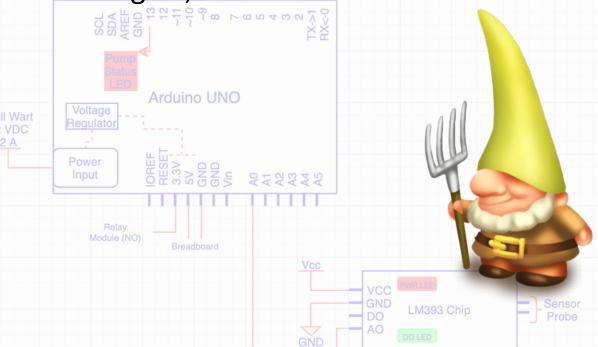
Joshua Clark

Curtis Scott



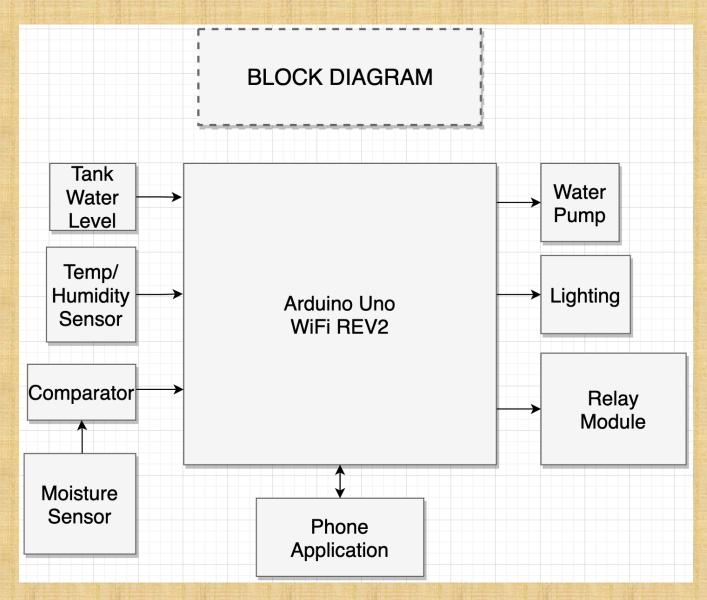
Our group wanted to make an autonomous irrigation system for tending to plants. The idea was first introduced by Alyssa who was concerned about her grandfather's ability to take care of his garden. This idea led to us to decide to build a user-controlled system for taking care of plants autonomously. In order to achieve this goal, our kit will include

Water plants when needed
Monitor soil moisture
Monitor ambient temperature/humidity
Monitor water level in reservoir
Control lighting based on plant's needs
An app to allow user control via Wi-Fi

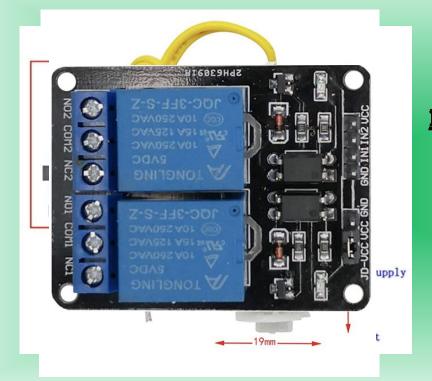


Tank Water

Automated Irrigation System



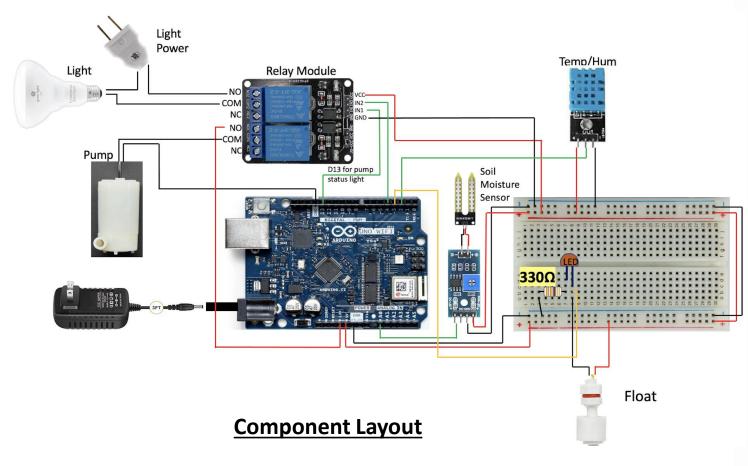
Components



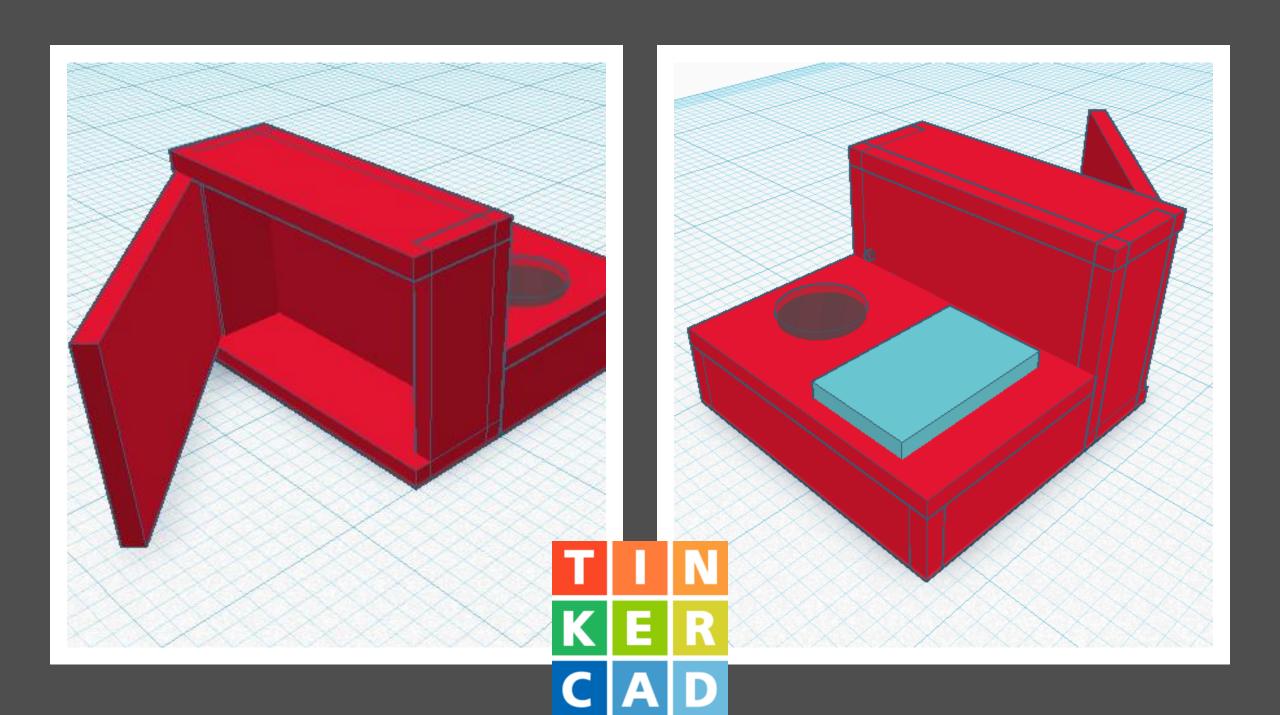
Michaiome Gradian Sensor:

- -Buylant Centilgy #21/21/20@ @ P,ut/n p5%
- Philippin Third the State of the State of
- 8 6 6 y poding in place of the river it will be a kiewiitry.
- ~1 gal/resistance)

Developmental Designs

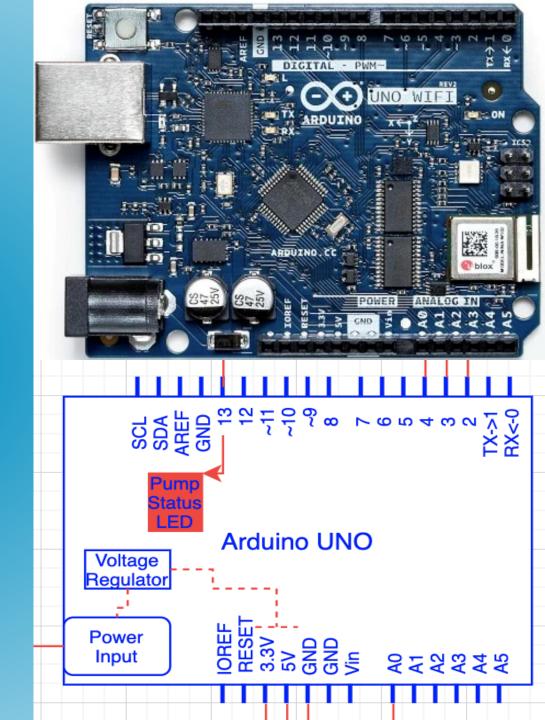


```
void loop() {
 /////// MOISTURE SENSOR AND PUMP OPERATION
 moisture = analogRead(A0);
                                                          // assigns variable to read moisture
 int percentMoisture = map(moisture, wet, dry, 100, 0); // Convert to %
 Firebase.setFloat(firebaseData, path_M, percentMoisture); // set moisture on FB
 Serial.println(firebaseData.dataPath() + " = " + percentMoisture); // print to serial link
 if (Firebase.getString(firebaseData, path_A)) {
   automatic = firebaseData.stringData();
                                                          // check if pumpRun is ON
   if (Firebase.getString(firebaseData, path_MR)) {
     manualRun = firebaseData.stringData();
                                                          // check if in Auto or Man
     Serial.println("auto is in " + autom
     Serial.println("manRun is in '
     if (automatic.indexOf("Manual
       if (manualRun.indexOf("On")
                                                            $ 1 9:48
         digitalWrite(13, LOW);
                                                                        mp on until Off or in Auto
       else {
         digitalWrite(13, HIGH);
                                                                        pump off
     else {
                                                                         manual
       if (percentMoisture < moistu
                                                                        re is too low
         digitalWrite(13, LOW);
                                                                         on
                                        Automatic - Manual
         delay(pumpRunTime);
                                                                        time
         digitalWrite(13, HIGH);
                                        Light
                                                                        ump off
                                      Soil Moisture:
                                                           58 %
       else {
                                                           73 °F
                                      Temperature:
         digitalWrite(13, HIGH);
                                        Humidity:
                                                                       viously in manual and on
                                       Water Level:
                                                       Normal
 /////// TEMP/HUMIDITY SENSOR (
  int chk = DHT11.read(DHT11_PIN);
 float tempF = (DHT11.temperature
                                                                         to F
 float h = DHT11.humidity;
                                                                        iable
 Firebase.setFloat(firebaseData, pa
                                                                        FB
 Serial.println(firebaseData.dataPa
                                                                       rial link
 Firebase.setFloat(firebaseData, pa
  Serial.println(firebaseData.dataPa
 /////// TANK WATER LEVEL SENSOR OPERATION
 lowWater = digitalRead(3);
                                  Garden Gnome App
 if (lowWater == HIGH) {
   Firebase.setString(firebaseDate
   Serial.println("LOW TANK LEVEL", rieuse retili tunk. 2, 7/ print in serial link
 else {
   Firebase.setString(firebaseData, path_W, "Normal"); // send data to FB
 /////// LIGHT OPERATION
 if (Firebase.getString(firebaseData, path_L)) {
   light = firebaseData.stringData();
   Serial.println("light is in " + light);
   if (light.index0f("0n") != -1) {
                                                                       // if On
     digitalWrite(4, HIGH);
                                                            // turns light on
     Serial.println("Grow light is On.");
                                                            // print in serial link
     digitalWrite(4, LOW);
                                                           // send data to FB
 Serial.println("");
 delay(500);
```



Arduino UNO Wi-Fi Rev 2

- **Very compatible open-source microcomputer**
- **Offers 20 separate input/output pins (digital and analog)**
- New ATmega4809 microchip to perform high speed analog to digital conversions
- Built-in Wi-Fi and Bluetooth connectivity thanks to the NINA-W10 chip
- Includes the ECC608 crypto chip creating secure wireless communication because of its cryptographic processor





Garden Gnome App

```
when FirebaseDB1 .DataChanged
 tag value
do call FirebaseDB1 ▼ .GetValue
                                                             initialize global tempF to ( " " " "
                                " /Temperature "
                                                             initialize global 몌 to 📙 " 🔳 "
             valuelfTagNotThere
                                 " 🛈 "
                                                             initialize global moisture to ( " " "
   call FirebaseDB1 ▼ .GetValue
                                                             initialize global LowWater to
                                " /Humidity "
                                                             initialize global Automatic to
             valuelfTagNotThere
                                 " 0 "
   call FirebaseDB1 ▼ .GetValue
                                                             initialize global PumpRun to " " " "
                                " /LowWater "
                                                             initialize global Light to | " | "
                                " 0 "
             valuelfTagNotThere
                                                             call FirebaseDB1 ▼ .GetValue
                                                              tag value
                                " /Moisture
                                                             do 🔯 if
                                                                            get tag 

= ▼ 

" (/Temperature "
             valuelfTagNotThere
                                                                  then set global tempF v to get value v
when Automatic_Manual .Changed
              Automatic_Manual - On - = true -
                                                                             get tag = " (/Humidity "
    then call FirebaseDB1 - .StoreValue
                                                                  then set global h v to get value v
                                        " /Automatic
                                                                             get tag = " (/LowWater)
                          valueToStore
                                      " Manual '
                                                                  then set global LowWater ▼ to | get value ▼
         set Pump ▼ . Visible ▼ to true ▼
             Automatic_Manual - On - = false -
                                                                             get tag = " (/Moisture)
    then call FirebaseDB1 .StoreValue
                                                                  then set global moisture ▼ to get value ▼
                                        " /Automatic "
                                                                 set tempF ▼ . Text ▼ to get global tempF ▼
                          valueToStore ... " Automatic "
                                                                  set h ▼ . Text ▼ to get global h ▼
          set Pump . On to false
                                                                  set LowWater ▼ . Text ▼ to get global LowWater ▼
          set Pump ▼ . Visible ▼ to false ▼
                                                                 set moisture ▼ . Text ▼ to get global moisture ▼
when Light .Changed
               Pump . On . Ev true .
                                                                            Light ▼ . On ▼ = ▼ true ▼
    then call FirebaseDB1 - .StoreValue
                                                                  then call FirebaseDB1 .StoreValue
                                        " /PumpRun
                                                                                                tag [ " /Light "
                          valueToStore ( "On "
                                                                                        valueToStore | "On "
               Pump . On . = false
                                                                            Light ▼ . On ▼ = ▼ false ▼
    then call FirebaseDB1 ▼ .StoreValue
                                                                  then call FirebaseDB1 ▼ .StoreValue
                                        " /PumpRun
                                                                                                     " /Light "
                          valueToStore ( " Off "
                                                                                                     " Off "
                                                                                        valueToStore
```

After using the water pump, our water reservoir is low and now the Garden Gnome App is warning us that the water reservoir needs to be refilled. Thanks to the built-in float sensor incorporated into the reservoir lid, the user will be warned if the water level runs low. By simply filling up the reservoir with water, the float sensor will inform the user that the water reservoir is full.



Budget



Quantity	Name	Description	Cost
1	Housing Structure	Wooden Frame	200.00
3	Arduino Board	UNO Wi-Fi Rev2	124.17
3	Power Supply Adapter	9V Power Supply	28.50
1	Extension Cable	6 ft	6.50
3	Water Level Sensor	Gikfun M8	26.04
3	Relay Module	5V, 2-Channel	19.77
5	Water Flow Tubing	PVC 1meter, 6mm	7.50
3	Submersible Water Pump	3V, 80oz/min	8.85
2	Temp./Hum. Sensor(2pk)	DHT11	12.78
1	Soil Moisture Sensor(5pk)	YeeKees	7.99
3	Digi-Key LED(Red)	630nm (Vd=2V)	8.85
3	Digi-Key 330ohm Resistor	+/-5 (0.25W)	0.30
3	Light Socket	Generic	13.98
3	LED Grow Light	GE 9W, 120V, Red	29.13
3	Water Tank	6.3 QT	6.00
misc	Wires/Jumpers	-	30.00
		Estimated Total	530.36

Possible Extensions

If the "Garden Gnome" project is granted the CSUB Student Research Scholars Program, we can expand our project by:

- controlling more plants or ideally an entire garden of various types of plants
- including a more sophisticated system that would specify each plants needs without the use of programming
- potential Bluetooth capability for local operation control
- using a cloud-based system for user control anywhere there is an internet connection
- allowing the user to control multiple facilities at one type



Acknowledgments

- Special thanks Professor Mostafa Abdelrehim for guiding our group through our project and providing insightful ideas to this build.
- Special thanks to Cal-State Bakersfield and their incredible staff and faculty for giving us the resources to achieve our goals.
- Special thanks to *Best Cabinets* for building our Garden Gnome Kit housing.





