Absolute Water

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***Abstract* — The automation of mechanical systems has increased the level of convenience in conducting menial but regular tasks. This project studies the automation of residential irrigation systems through the integration of low-cost sensors and connection to local weather systems. It decreases water waste caused by over watering and decreases the amount of work necessary to maintain a properly watered residential landscape. This paper reviews and analyzes similar techniques and irrigation systems most commonly used. Constraints, implementations, comparisons, and results are also discussed to pinpoint the pros and cons of the given methods.**

***Index Terms* — Wireless mesh networks, irrigation, solar power generation, motion detection, meteorological radar microprocessors, automation.**

I. Introduction

Here in America, tendency to take things for granted is familiar; being a first world country there is easy access to many resources. There is food, water, shelter and even opportunities everywhere in America. Society today has become one of taking more than is needed and not caring about the aftermath. Absolute Water is a system that allows us to take into consideration our water usage. Possibly saving millions of gallons each year. With these savings, it can be used to export to countries that do not have access to water and it can also be used during disaster relief projects. No over/under watering just optimal watering. These are the main motivations for Absolute Water.

After coming up with Absolute Water, the thoughts of other things that can included in the system came about. Older sprinkler systems usually have their controls on the outside of the house or sometimes in the garage. This sometimes inconvenience the owner of an irrigation system by having them stop what they are doing just to reprogram the system. What if the homeowner is not going to be home for a few days? How would the homeowner adjust the settings if needed? The idea of making use of a mobile app which will enable the user to change the settings remotely whenever and wherever there is an internet connection. Being able to monitor irrigation activities is something that the user is unable to do 24/7. So, with an application you can monitor everything. The user can cut-back on watering during rainy seasons and increase on sunnier and drier seasons.

This project is to design an irrigation system that would turn off when it detects either rain or an object in its field of view. With detecting rain, the system will turn off all its sprinklers directly at the base. It will remain off until it has stopped raining or soil sensors have measured certain saturation levels. Maximum saturation by rain will leave the system off until the next cycle. If saturation has not reached its maximum level after a shower, then the irrigation system will turn back on to reach maximum saturation. With detection of an object like a human or an animal, each sprinkler will cut off at its head as oppose to shutting off the entire system.

Rain detection will use a moisture sensor along with a Wi-Fi module. The Wi-Fi module will allow the system to communicate to the local weather station for weather updates. These updates will work in conjunction with the rain sensor to turn on/off the system. An example of this application is when there is a high chance of showers at 7 pm. This will cause the system to readjust its schedule time that may have been at 5 pm, to not turn on at all. Allowing the system to not engage at all for these sort of forecasts saves on what would have been overwatering. In times where there is a weather forecast of showers lower than a certain percentage, the system will have to differentiate between having the system entirely off or on for a small duration. Given that it does not always rain with a certain weather forecast, implementing a moisture sensor and a Wi-Fi module for weather updates will be system of checks and balances.

Motion detection is a relatively new feature in smart irrigation systems. Proximity sensors will be placed at the base of each sprinkler head. Connections will be made to a GPIO pin that will then send a signal high to a relay to close an actuator that will be placed within each individual pipe or zone pipe. Having calculated the maximum distance that each a sprinkler waters thus will enable Absolute Water to be adjusted to detect roughly 10-15% outside of it. This will allow moving objects like vehicles, pedestrians, or animals to be able to walk on the side walk and or driveway without getting wet.

The system will be designed keeping in mind a relatively low production and operating cost. With easy installation as well. The use of solar technology will permit Absolute Water to keep operating cost down. Having implemented soil hygrometers, these sensors will need to monitor the soil 24/7 which will continuously consume power from a 3.7 V Lithium-ion rechargeable battery. Sensors will use solar cells to recharge these batteries. The actuators will use its own 3.7V rechargeable battery that will be stepped up to a minimum working voltage of 9V via a dc-dc step-up converter.

So, keeping in mind the primary motivation of conserving resources, this project can pay off with long-term use. Also, it has the potential to extend into bigger markets rather than just residential.

II. Goals and Objectives

The general purpose of Absolute Water is to provide homeowners with a low-cost, automated, water-saving, set it and forget it type of sprinkler/irrigation system that will properly water residential landscapes. The main feature of the Absolute Water system is the ability to automatically shutoff when there are passing objects, or people in the target watering area of the sprinklers. This is for convenience of passersby who have no intention of getting wet and for water conservation where water meant for the landscape is not being wasted on people or objects.

A major goal of the system is to make it easy to use for irrigation system users with experience ranging from novice to expert. The ease of use objective is implemented in many design aspects of the system such as automation which was mentioned earlier. Automation reduces the amount of necessary manual interaction with the system by taking advantage of low-cost sensors. The sensors allow the system to be stopped and started either remotely by a command signal, or by the data readings of other sensors. This allows mitigation for situations such as when a sprinkler head breaks and needs to be shutoff while allowing the others to still maintain there watering areas, when soil moisture readings have reached proper thresholds for the amount of water necessary in specific areas, when objects or people pass by, or when the sprinklers need to be shut off due to rain conditions. This touches on another objective which is the remote control of the system.

The system will be able to turn on and off at the behest of a user using a web/mobile application. By providing remote access, users can for whatever purpose turn the system on or off from their phones anywhere that they have a wireless connection. Some situations that require remote control shouldn’t need to be handled by the user, even if it can be done from a mobile device.

Absolute Water will be connected via wifi to the internet. It is also specifically connected to the local weather station for the area which allows it to monitor weather conditions. During rainy conditions, the system will not activate, and if it is already activated, will turn off. This feature helps to conserve water that would otherwise be wasted when the landscape is already being watered naturally. In the case that the rain does not last and properly water the yard, the soil moisture sensors is a supporting structure that will tell the system when areas of the lawn have reached unacceptable dryness levels and will turn the system on. The wireless connection along with the help of data collected from sensors provide realtime monitoring of the lawn or yard where metrics are aggregated and sent to an online database called ThingSpeak. This database gives a visual of the metric data to the user who can then use them to make educated decisions about when to water their lawns and graph out how their lawns behave over time.

Lastly, in concurrence with the goal for the system to be low cost, the system will also take advantage of renewable energy through the use of solar panels. Though not entirely powered by the panels, the system collects energy from the sun during the day and stores it into batteries. This reduces the amount of energy taken from the home and makes it low power in comparison to traditional irrigation systems.

III. Hardware Design

Absolute Water system hardware consists of multiple sensors including motions sensors, soil sensors, rain sensor, relay, actuator and flow meter. Other components include wireless communication modules, power supply, and an apparatus of the entire system. The two areas they may be found in is either the base, which is at the pump or the sprinkler, which is at one of the sprinkler stations. The selected devices in this section will be expanded on in detail for by their functionality, the necessity for it being part of the entire system and the specifications of them.

A. Stations

The Absolute water as stated consists of multiple stations. The base will handle components that deal with the water pump. Found near the water pump where the sprinkler starts. The remaining stations will be located at the sprinkler stations. Since we didn't want wires running long distances to control components at alternate places is why these separate stations were created. We will elaborate theses in sections.

Base station: The base station is located at the water pump. From the base station you will have a connection to the home Wi-Fi which is one of major reason for it to be close to the home. The base station also communicates to the sprinkler stations. The base has ports for the rain sensor and relay as well.

Sprinkler stations: The sprinkler station is located at the sprinkler heads. From the sprinkler stations data is collected then sent to the base station. Components connected at the sprinkler stations include the soil sensor, flow meter, relay, actuator, and motion detector.

B. Components

Components selected for the Absolute Water system, each had their purpose. The components were used to either collect data or to control a system function. In this section we will discuss the use of our major components which include the, relays, rain sensor, soil sensors, actuator, flow meter, and motion detector .

Relays: The system uses a SRD-05VDC-SL-C relay. It has three high voltage terminals (NC, C, and NO) which connects to the device you want to control. The other side has three low voltage pins (Ground, Vcc, and Signal) which connect to the controlling PCB. Inside the relay is a 120-240V switch that's connected to an electromagnet. When the relay receives a HIGH signal at the signal pin, the electromagnet becomes charged and moves the contacts of the switch open or close the system. At the base it is used to control turning on and off the water pump. From sprinkler it is used to control the actuator opening and closing.

Actuator: . Normally, the valve is closed. The actuator runs on 12V DC with a minimum of 6V which will reduce the speed of it opening. The system runs this with 9V to have it at an amount that would open the valve at a suitable time without the need for a full 12V power. The valve opens when the 9V DC is applied to the two terminals, then water can push through. The valve has a gasket arrangement inside, so there is a minimum pressure requirement of 0.02 Mpa (3 PSI). The actuator was disassembled and had the spring removed to reduce pressure requirements. The flow of water can only go in one direction.[2]

Motion detector: AM312 Human Sensing Module: Based on passive body infrared technology digital intelligent automatic control products, high sensitivity, reliability, widely used in various types of automatic induction electrical equipment. 5V power consumption with internal use of digital signal processing, pit interference strong[3]. Field of view of approximately 120 degrees and range of up to 7 meters, which is more than enough for this project. This will be located at the sprinklers to detect moving object passing the sprinkler.

Flow meter: G1 2inch DN15 transparent water flow meter uses flow sensor indicator counter to track the flow of liquid. Flow meters allow you to monitor the amount of fluid flowing through a pipe. This meter will be placed at the base for each zone. The project will be using them as a way to tell if a pipe has been damaged. A broken pipe will have an increase in the flow rate of the water due to a drop in resistance. Below is a flow meter that is being considered for this project. The flow meter will be found at the sprinkler station.

Soil sensor: The soil sensor works to measure the resistivity when applying moisture to it. As moisture is added the resistivity drops. So, in order to test this theory, we connected it to a multi meter dry and it gave a resistance of 65 MΩ +/- 10MΩ once water was applied the resistance dropped to 29KΩ +/- 10MΩ. Based on the information collected we can decipher that the moisture sensor works and that we should have the stopping value be 40KΩ in order for the soil to not be over watered. As the project progresses we will run more accuracy tests to perfect the value required. The test will include watering a plant for 30mins to see what value the soil sensor gives. We checked for the optimal depth of the soil sensor based on being in ground and if it has any effect on the circuity. When placing the soil sensor underground at depth of 6in it was still able to measure the moisture to drop to 30KΩ after being watered for 30 min. It was required to spray the soil sensor with resin to avoid corrosion. When doing this the resistance started at 30MΩ instead of the 60MΩ originally. Based on the information collected we now are informed the sensor will work for the task given of measuring moisture in the ground. The next way of testing was plugging it to the board

To connect the analog pin a voltage divider was required so the 5V was not returning the voltage to the MSP430 due to the MSP430 only being able to input 3V. Once connected we ran a code to see if it would to calculate moisture based on the voltage changed. This can be found at the sprinkler station.

Rain Sensor: The rain sensor works like the soil sensor measuring resistivity. In order to measure it we tested it by submerging it in water to see if the resistance dropped. Then allowed it dry to see if the resistivity increased. We also attempted to test it by using a spray bottle to mimic rain. Using this method allowed us to know how sensitive the sensor was to getting wet. It seems to be a useful component to what we need but will need an encasement as we fear the connectors will be affected by the rain. This will be found at the base station.

C. Enclosure

The enclose for the components of the Absolute Water system required enough space to hold the required components as well a way to be in close proximity of its required location. The case was fabricated using .09 thick clear pvc. The system used the clear pvc for display purposes, in order to see the components inside. In real world application this would not be the material used. The size of both the base and sprinkler stations were the same and in this section details regarding details of there fabrication.

Base station enclosure: The base station was made with a cut 2" x 6" clear PVC on the sides totaling 4. The top and bottom has a 6"x 6" clear PVC. The sides and bottom is glued using plastic glue. The top is glue to two acrylic hinges that are glued one of the PVC 2” x 6” sides spaced at 3” both on the same side. Inside the base enclosure you will find the holes made for the wires of the solar panels on the top. Four solar panels are attached to the top of the enclosure that route to the solar charging unit inside leading to the boost converter and battery. The base station enclosure also has holes to connect the rain sensor.

Sprinkler station enclosure: The sprinkler station enclosure is similar in size to the of the base station enclosure. It was made with clear 2” x 6” clear PVC on the sides totaling 4. The top and bottom has a 6”x 6” clear PVC. The sides and bottom is glued using plastic glue. The difference in the top and bottom of the sprinkler station enclosure you will find a 1” diameter hole in the center to have the 1/2” pipe go though. There is a split in the center of the top to allow opening and closing the case without effecting the pipe in the center. Holes for the solar panels similar to the base and extra holes on the bottom for the flow meter and actuator wires connecting to the PCB.

C. Power

For the power system of the Absolute Water, a few considerations needed to be thought of before the various components. The main processor, the ESP8266, needed a voltage of 3.3V. There were several other components that demanded various other DC voltages such as 5V and 9V. To effectively obtain these desired voltages, careful thought had to go into a good design for the power system that can suit all of the needs of the system. After extensive research, it was determined that the best option was to utilize a 3.7V 3000MAH rechargeable Lithium-ion battery and step it up to 5V and 9V via standalone boost converters. To obtain the 3.3V, a linear regulator (LM316) was utilize onto the PCB. The boosted 5V was would feed into the 5V bus on the PCB, which would be divided to in to line voltages. One voltage would stay at 5V and the other would be stepped down to 3.3V.

This project is meant to be environmentally friendly by utilizing solar panels to recharge the 3.7V batteries. The panels that were chosen were 2V monocrystalline cells and delivered and actual output voltage of 2.10V and an output current of approximately 100mA. Four panels were placed in series to get tested output voltage of 6.7V. The major reason for using four panels in series was for a worst scenario of a cloudy day. After testing on a sunny day with two in series for a voltage of 4.3V, which would suffice for the charging the 3.7V battery, this configuration proved to not work on a cloudy day. Having four panels on a cloudy day, allowed for the battery to get charged at a voltage of 4.1V. These panels would be placed into a solar charge circuit which would stabilize the power coming from the panels and restrict back current from the battery to the panels. This would destroy the panels. On a fully depleted battery, it took 12 hours to recharge the battery to a voltage of 3.9V.

Two things are worth noting. The reason for the lithium-ion battery and the setup for the of the boost controllers. Lithium-ion batteries were chosen because of their better charge density of batteries amongst that size and they do not suffer from the phenomena of charge memory. This causes a battery to have less capacity. With lithium ion batteries, they are able to be charged with partially depleted instead of being first fully discharged. One drawback to these batteries are their temperature tolerance. They are not as strong compared to NiCd batteries. At very low temperatures, the lithium ion batteries many not work correctly and at very high temperatures they are at risk of exploding. A simple design can be implemented in order to avoid these temperature intolerances. The last thing worth nothing is that the charge controller that was acquired for this project called for a single cell lithium battery. Designing for this constraint called for placing two booster converters in parallel. Both which saw the same input voltage of 3.7-4.1V but varied respectively at their outputs. The design ran very well for a substantial amount of time with not issues.

D. PCB Design

The design of the PCB was based off the Adafruit Feather HUZZAH with ESP8266. Absolute water system used this board to breadboard and prototype the system. Once all pin connection were used and voltage and GPIO pin connections were designated. The schematic was striped of excess components. The Absolute Water system found this board to useful based on the optional charging regulator and linear voltage regulator on the board stepping down the voltage from 5V to 3V. Some components required 3V like the esp8266 and others required the use of 5V like the relays. This schematic was created using the Eagle circuit software. In this section we will elaborate the schematic of the base and sprinkler stations.

Base Station Schematic: At the Base Station the Absolute Water system has two ESP8266 WIFI modules. These modules are the heart of the base. One of the ESP8266’s is used for connection to WIFI while the other is used for connection to the mesh network. Both of the modules communicate via the TX and RX pins. To program these modules output pins are place on the board to connect to a external USB serial converter. The voltage coming into the board is 5V which supplies power to the relay, and rain sensor. That 5V rail steps down to 3.3V to supply the required power to the esp8266 and two extra optional pins. The base also has option charging for 3V batteries.

Sprinkler Station: At the Sprinkler Station of the Absolute Water system we have one ESP8266. The ESP8266 is used to connect to other sprinkler stations as well as the base. Pin connections to program are found on the board to be programed to an external UART serial converter. The PCB has connection to the soil sensor, relay, flow meter, and motion detector all require 5V. The ESP8266 required 3V which was found from the 5V once stepped down by the linear regulator found on the PCB. Extra connection are placed on the board in case of issues which others. The power coming into the board will be 5V, the board contains a 3V connection which can be used for rechargeable battery with the use of a charging regulator.

E. Wi-Fi Module

The ESP8266 Wi-Fi module was implemented in the design as the primary method of communication throughout the wireless network. The decision to use the ESP8266 came after careful consideration of numerous RF modules, Bluetooth modules, and other Wi-Fi modules. During the research phase of Absolute Water, it was discovered that the ESP8266 was also capable of handing the tasks assigned to the MCU. Thus, our final design utilized the powerful Wi-Fi module as the microcontroller unit and the primary method of communication.

For each Absolute Water system, there will consist of one base unit (with proximity to the irrigation pump) and multiple sensor units, attached to each of the sprinkler heads. The base unit is equipped with two ESP8266s. One whose purpose is to maintain a constant connection to the user's home network, that way the system has reliable and consistent connection to the internet. This module also handles the logic behind operating and polling the rain sensor and relay. The other ESP8266 on the base unit is to server as a connection to the mesh network that connects all the sensor units. The two modules on the base unit communicate via a UART serial connection. The hardware for the base unit is designed in such a way that the connection between the two modules can be switched on for operating mode and switched off for programming mode. This is because during the programming process of each module, the RX and TX connections are required, meaning the two modules cannot be connected at this time.

As previously stated, the Absolute Water system utilizes a mesh network. This basically means that each node in the network can act as both a client and an access point. Since the ESP8266 was capable of this, it helped in our hardware decision. The mesh network is ideal for Absolute Water because it is self-configurable, self-healing, and most importantly, scalable. The self-configurable aspect allows new nodes, or sensor units, to be easily added or removed from the network. The self-healing aspect of a mesh network insures that if there was a connection error within the network, the data packet will not only be re-routed automatically, but it will be routed in the most efficient path to its destination. Lastly, the scalability aspect is extremely important in a smart irrigation system. This allows for various landscape sizes and designs. The only requirement went implementing the network is to place a sensor unit within range of another sensor unit. This is extremely convenient compared to a star network topology, where each one of the sensor units would need to be within range of the root node, or base unit.

IV. Software Design

A. Microcontroller Software

The microcontroller software was created using the Arduino IDE to program each of the ESP8266s. The software for each of the sensor units is all the same other than a slight variation to assign unique IP addresses. The sensor unit software begins with initializing the pin modes on the ESP8266 to input for the motion sensor, flow meter, and the soil moisture sensor. The pin mode for the relay is set to output. During the setup loop, the ESP866 is configured into an access point, this way any client can connect to it. The flow meter is set to read and calculate data values upon an interrupt triggered by changing data. This way, when the system is off, and the meter reads 0, there will be no need to check the value. During the loop that runs continuously, each sensor is polled, and those values combined into a string that will be the data packet sent through the mesh network, and ultimately reach the base unit. The most important function that is called in the endless loop, is *printToClient ().* In this function, the ESP8266 (in access point mode) will detect any client sending a request, such as the base unit asking for the data packet. Once a client is detected, the constructed data packet is sent. The logic that is programmed into the sensor units also will insure a zone-shutoff in the following cases: a soil moisture reading is consistent with saturated values, motion is detected, or a flow meter reading indicates a broken pipe or sprinkler head. All these functions are aimed to increase convenience and decrease water usage.

The base unit, which consists of two ESP8266s, holds more responsibility with respect to software and connectivity. One ESP8266 is dedicated provide a connection to the mesh network of sensor units, and the other is responsible for maintaining a connection to internet, controlling the relay that powers the entire system, and polling the rain sensor. The ESP8266 that is connected to the mesh network, is first configured in client mode. In the infinite loop, the ESP8266 will attempt to connect to each sensor unit in the network. If a connection is successful, the base unit will request the data packet containing all the sensor data. Once the data packet is received, the ESP8266 will send that packet to the other ESP8266 through a UART serial connection. This process is continuous, as it iterates through each node in the network. The ESP8266 that is connected to the local WI-FI network, is configured in client mode. It will first search for the configured SSID and attempt to connect. Once connected, the infinite loop will run where the first task that is executed is to check if there is an incoming data packet from the UART serial connection. If there is a packet, the data is parsed, and a HTTP POST command is created containing these values. The data is then sent to the cloud analytic platform, ThingSpeak where is can be displayed and analyzed. The next task in the infinite loop is to check if the rain sensor needs to be polled (approximately every 10 seconds). If so, the ESP8266 will take in the analog data and compare that to a set threshold, if the threshold is reached, the relay is triggered, and the system will stop all watering. The next task is to check the cloud platform for any commands. This serves as the primary method of communication from the user to the system. Numerous command can be loaded in to queue that exists in ThingSpeak. For example, a schedule can be created so that every Monday morning a "TURN_ON" command will be loaded into that queue. Once the ESP8266 sends an HTTP GET request to the queue, the command is executed and erased from the queue. Once the ESP8266 receives a command, it is parsed the appropriate action is performed such as trigging the relay.

B. Mobile Application Software

In developing the mobile app, we defined our target users as homeowners, renters, building managers, anyone who would manage an irrigation system in a residential or commercial environment. In the app design phase developers will produce artifacts such as wireframe, site maps, and user diagrams using tools such as Balsamic and InVision. The purpose of this is to focus the design and provide a foundation on which to build upon providing guidance for the code and making sure the final product considers all requirements, use cases, and remains user friendly. Major infrastructure used for development include the Ionic framework and Cordova. The ionic framework has HTML, CSS, and Javascript components that allow developers to rich, beautiful, and interactive applications that can be viewed on across multiple platforms. Ionic boasts the ability to work on PCs, iPhones, and Androids seamlessly. The components were specifically designed for the web. Cordova provides backend capabilities such as the Native implementation of mobile device features. Without it, features such as the camera and microphone wouldn't be accessible. The plugins that Cordova has also allows for integration with other softwares and tools such as Google's Firebase database for logging in and authentication. Other important aspects of the application include the use of various APIs. Specifically the APIs from OpenWeather and ThingSpeak. OpenWeather is the free weather station database that pulls and stores weather data from various weather stations in locations around the world. Using this information the app will be able to visually represent those weather conditions reducing the need for any other weather applications on a user's device and also use the weather information to determine whether the irrigation system should turn off due to rain conditions to conserve water. ThingSpeak is an online database the will be utilized to store sensor data and relay commands sent from the application to eh physical system. When the Turn On or Turn Off buttons are pressed from the mobile application, the command is sent via HTTP using REST calls from the application to ThingSpeak where it is placed in a queue. The system which will be listening to ThingSpeak also via HTTP will pull the commands and parse them to properly execute the command that was stored in the queue.

When a user first opens the application they will be greeted by the home screen where they'll find buttons to manually turn the system on and off. The page will have the custom icon of Absolute Water designed by the entire team located at top of the page in the center. All navigable pages are listed in the side menu accessible through the hamburger menu to the top left of every page. The set of pages include Home, Data, Weather, Schedule, and About. The Data page will show useful data that's has been collected from the sensors and sent to ThingSpeak such as the soil moisture levels. Information like this can alert the user of abnormally dry areas of their lawn based on the zone the data has come from. The Weather page has been discussed earlier and will include weather data taken from OpenWeather. The Schedule page acts as a useful calendar where users can place watering events that they would like to schedule in the future. Users can then check back whenever they like to give themselves a reminder of when they need to water their lawns. The About page discusses details about the application itself such as the version currently being used. Further implementation goals include creating a login and sign up page for authentication that will help further automate the setup process of the system.

V. CONCLUSION

Absolute Water is smart irrigation system aimed to increase convenience and usability and decrease water usage and power consumption. Absolute Water is equipped with state of the art technology that insures users that they are maintaining their landscape effectively efficiently.

Absolute Water is equipped with rain sensors, so the system will shut off automatically during a rain storm. This saves immense amounts of water that other irrigation system do not account for. Motion sensors are used to detect pedestrians within proximity to a watering zone. Instead of getting soaked on your way into your house, Absolute Water will keep you dry while also saving water. Flow meters are embedded in the irrigation infrastructure so that not only will users be able to track water usage down to the individual sprinkler head, but in the case of a broken pipe, the flow meter will trigger an emergency shut off in that zone. Soil moisture sensors are used to track which areas are being watered at the optimum moisture levels, which areas dry, and which are being overwatered. The internet of things that make up the Absolute Water system is designed in a mesh network topology. This allows the network to be self-configurable, self-healing, and scalable. Absolute Water also uses solar energy to charge the embedded power source, decreasing residential power consumption and increasing efficiency. Absolute Water also includes a web application that is mobile compatible where users can monitor their irrigation system in real time, set daily, weekly or monthly watering schedules, and view local weather data.

The Absolute Water Team

Donald (Kyle) Miller is a Computer Engineering major from UCF. Through his education and working as a CWEP at Lockheed Martin for two years, he has acquired much experience with a range of software, hardware and programming languages. He enjoys developing small projects focused on home media and automation. Kyle is currently in the process of interviewing at multiple defense contracting companies, where he hopes to find a suitable career path to grow as a software engineer.

Kenyatta Hakeem Samuels is an Electrical Engineering major at UCF. During his time at UCF, he has acquired a co-op with GE Power Conversions and an internship with POWER Engineers Inc. Also, he has had the opportunity to be involved as a mentor and member of the National Society of Black Engineers (NSBE) and a member of Tau Beta Pi Engineering Honor Society. He has accepted an offer at Black & Veatch for protection and controls. He plans on obtaining his FE within 6 months post-graduation and eventually obtaining his PE. After two years of work in Orlando, he plans on moving back to New York to grow more as an individual and as a professional. The most important thing that he has learned during his university years is that don't matter how hard things may get, never give it. Circuits may catch fire, code may have many errors, exams may not be in the favor of the individuals taking it, and so on but never give up. Failure allows for the biggest growth as an individual. So, do not worry that something does not work as planned. Learn from it and keep pushing through.

Winston Baptiste is an Electrical Engineering major at UCF with a minor in Technological Entrepreneurship. Through his last year and half in UCF he has interned as a Co-Op in Orlando Utilities Commission. Post-graduation he plans continuing his employment within the company working as a Lighting Distribution Engineer and hopes to obtain his EIT certification in the near future leading to his PE. After completing this project he plans on utilizing his new found PCB design skills as a hobby.

Marc Simon is a First-Generation Haitian American student with a mind on entrepreneurship and inclination towards technology. His interest in computers began in Highschool working as an IT technician and was further developed through 2 years of internships and the computer engineering program at UCF. Besides those Class projects, engineering clubs, and competitions such as his participation in the Thales Arduino Competition have helped Marc's knowledge of software tools, programming languages, and teamwork expand and grow. Marc has signed a full-time employment offer from General Dynamics Mission Systems as a Software Engineer, pending his graduation.

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