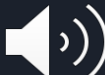WATER SAVER

Evan Glazer (CPE)

Muhammed Siddiqui (EE)

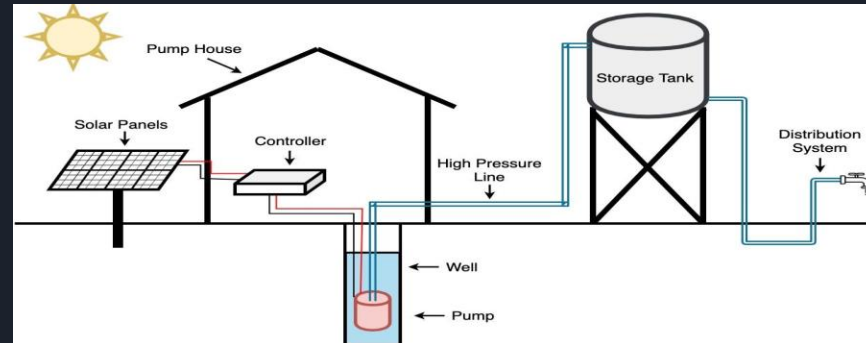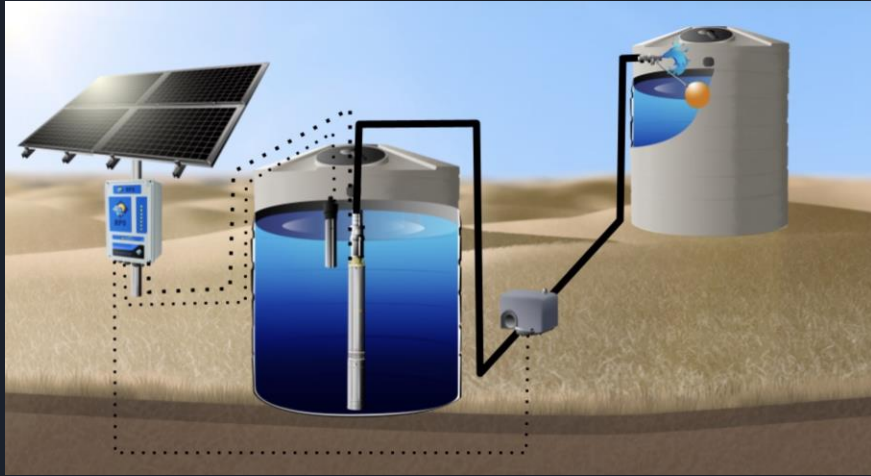Mohammed Bazrbachi (EE)

Mina Samaan (EE)

Overview

Parts selection: Sensors

Name\Feature	Purpose	Connection Type	Reason for Choosing
Hoya red water sensor	Detecting rain	Direct to Nano	Space-efficient, easy integration
MH sensor series	Detecting rain	Direct to Nano	Space-efficient
Orbit 57069N	Detecting rain	Direct to system	
Waterproof Ultrasonic Sensor	Measuring water level	Direct to Nano	Direct connection to Nano, no WiFi
YoLink LoRa	Measuring water level	Requires WiFi	Need wifi to connect
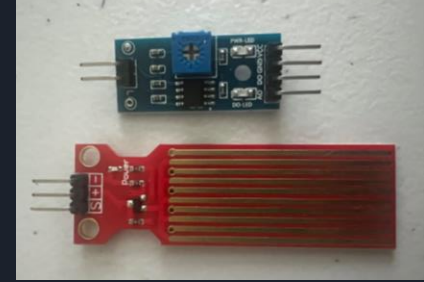
Parts selection: Water Pump

Selection\Feature	Space Requirement	Control and Flexibility	Reason for Selection
Float Switch	Requires more physical space	Limited (on/off only)	Initial option considered
5V Relay	Compact	Greater control (PWM, logic control)	Selected for compact size, control, and current handling

Parts selection: Water Tanks

| Selection\Feature	Tank Size	Project Realism	Feature Application
Initial Plan (Small Tanks)	1 gallon	Less realistic	Limited
Revised Plan (10-Gallon Tanks)	10 gallon	More realistic	Comprehensive

Raspberry Pi VS Arduino NANO ESP32

Selection\Feature	WiFi Connectivity	Overall Advantages	Reason for Choosing
Raspberry Pi	Does not connect to WiFi	Versatility, community support	Initial choice
NANO ESP32	Integrated WiFi	Lower power, integrated connectivity, smaller size, lower cost, faster boot	Easier setup and usage
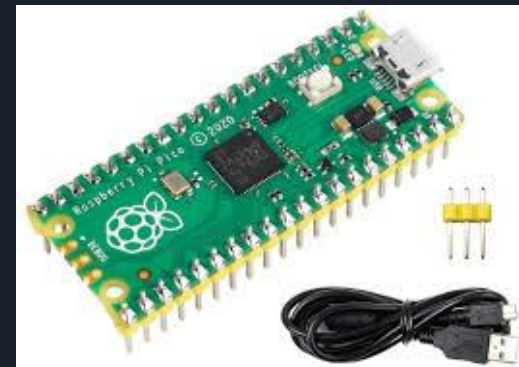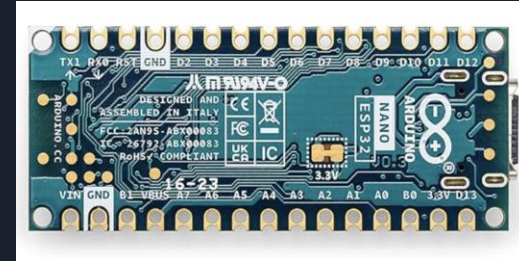
Parts selection: Solar Panel

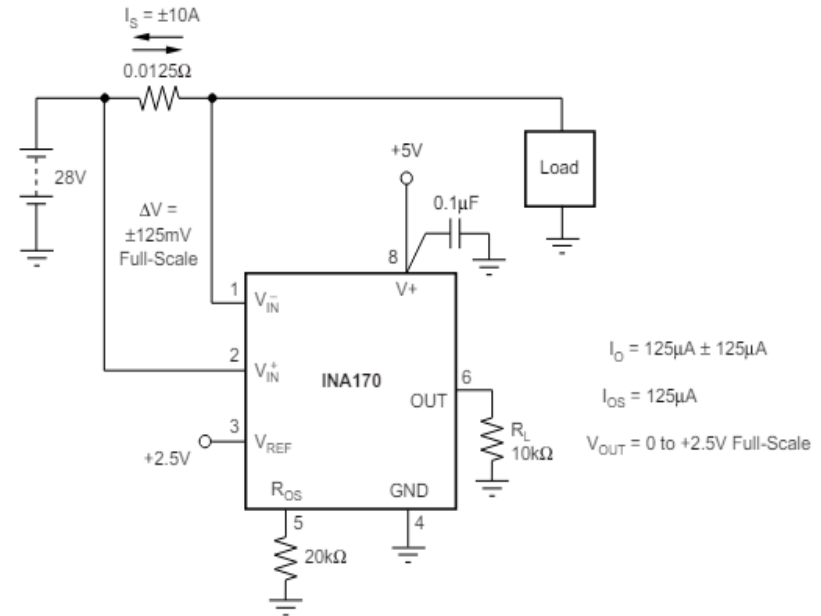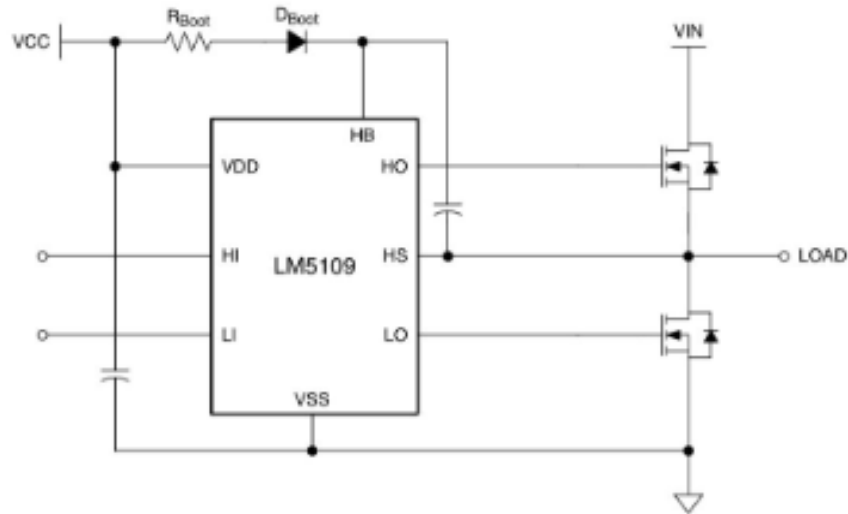| Selection\Feature	types of solar panel	Dimension	Come with voltage controller
12V 20W panel	Monocrystalline	16"L x 13.1"W x 0.8"H	Yes
5v 200mA	Polycrystalline	4.33"x 2.36" (L*W);	No
5v USB panel	Monocrystalline	6.85"L x 6.46"W x 0.58"H	NO
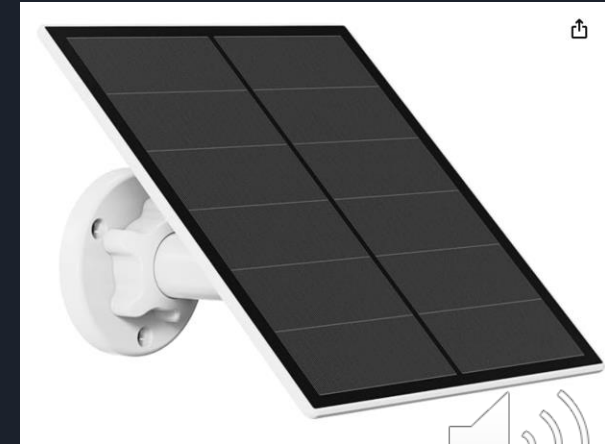
Data sheet : The Simulation of PCB design
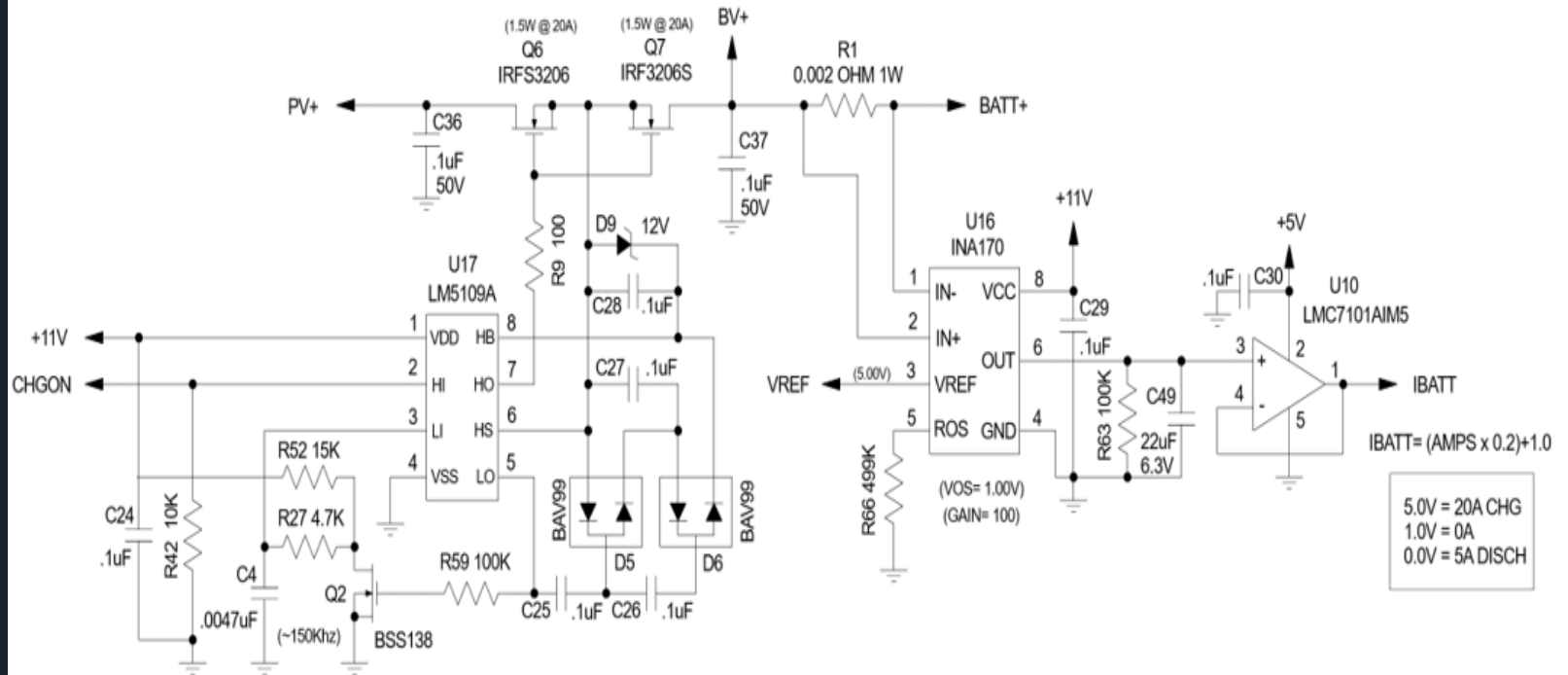## Approved by Dr. Weeks from Texas Instrument

Simplified Application Diagram

Power simulation for the PCB design:

Approved by Dr. Weeks

The five volts and the 11 volts simulation:

Approved by Dr. Weeks
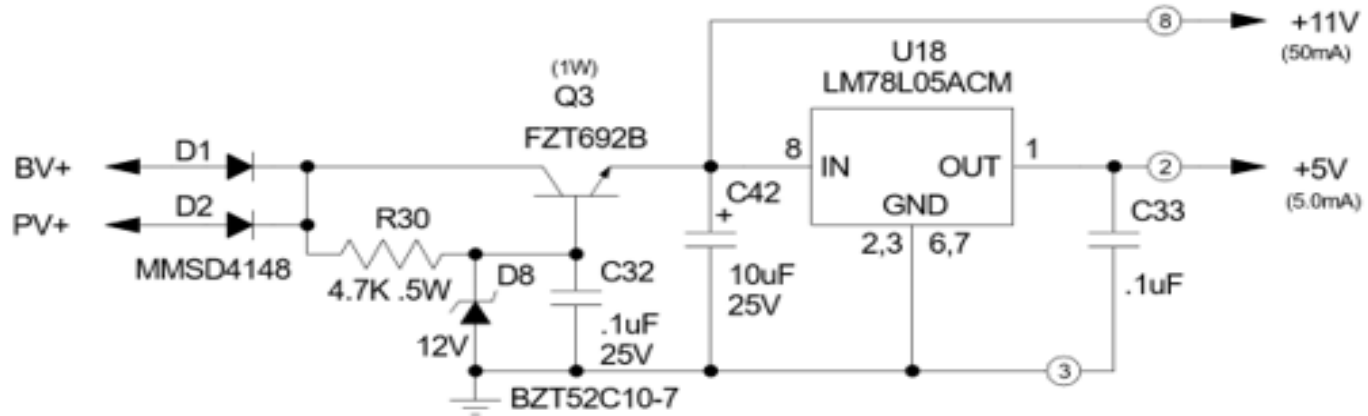
Output Schematic
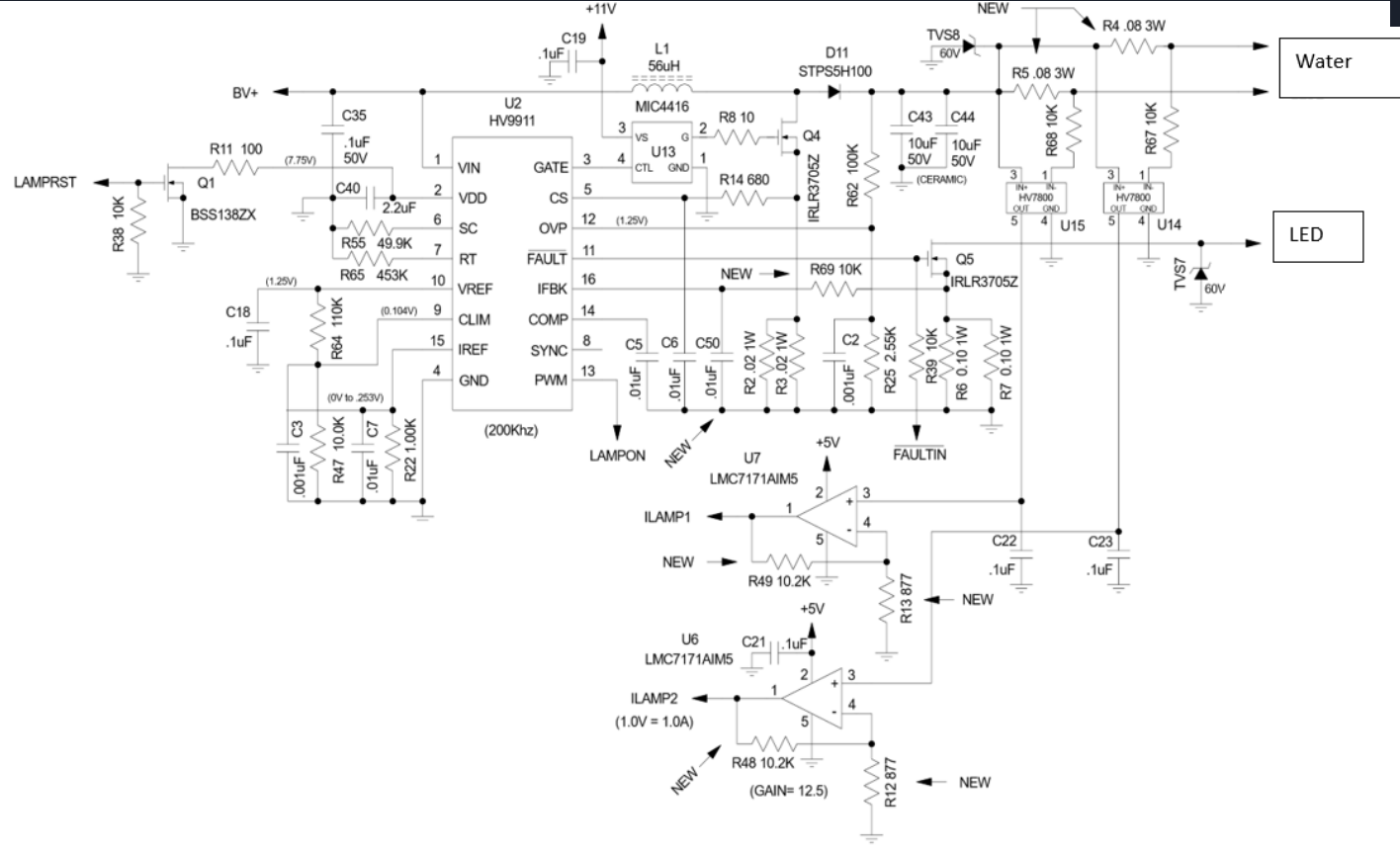
PCB Design
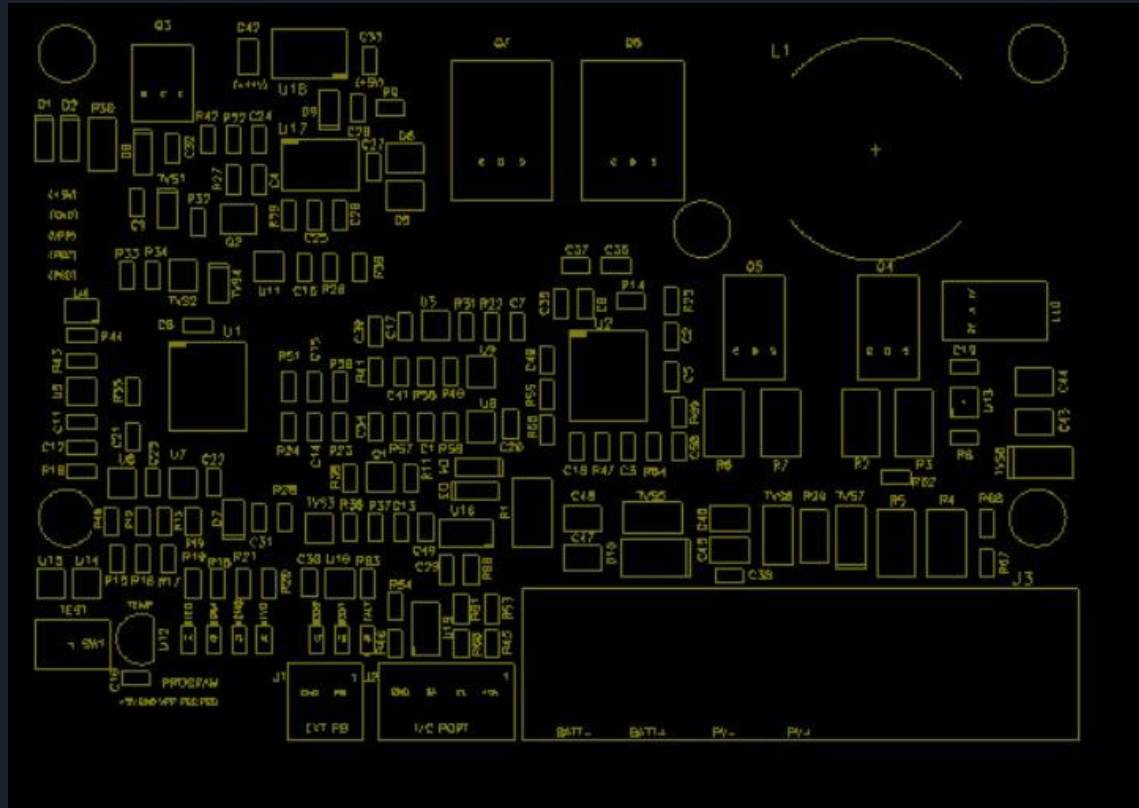
Software Design: Web Application

Technologies	Supported Operating Systems	Features	Programming Language	Cost
React JS	Web, and Mobile	Reusable components State management Routing Largely supported community Hot reload	Javascript	Free
Vue JS	Web, and Mobile	Framework includes state management and paradigm Components Routing Mid-size supported community Hot reload	Javascript	Free
Vanilla JS	Web, and Mobile	Complicated state management Complicated routing Less supported community	Javascript	Free

Software Design: Web Stack

Web Stacks	Technologies	Programming Language	Database	Operating System
MERN	MongoDB, Express JS, React JS, Node JS	Javascript frontend and backend	MongoDB	Cross platform for windows and linux requirements
LAMP	Linux, Apache, MySQL, PHP or Python	Python or PHP, and Shell/Bash	MySQL	Linux
Custom Stack	**React, Postgresql, Flask Python, Linux**	**Javascript, Shell/Bash, and Python**	**Postgres**	**Cross platform for windows and linux, but preferably Linux**

Software Design: Database

Databases	Data Storage	Key Features	SQL or NoSQL	Data Representation
Postgres	**Stored as rows in a table and relational database with schemas**	**Supports large databases and is easily scalable for larger applications.**	**SQL**	**Structured rows in table**
MongoDB	JSON-like documents with schema-less pattern	Horizontal scaling approach to have json based documents to query.	NoSQL	Mixed Data in JSON Document
MySQL	Stored as rows in a table and relational database with schemas	Supports large databases and is easily scalable for larger applications.	SQL	Structured rows in table

Software Design: Hosting Platform

Hosting Platforms	Is there a free tier?	Key Features	Featured Customers	Cost
AWS	**Yes - 12 Months**	**Cloud computing, Cost Effective, VPC, High Availability, DNS, CDN.**	**Sony, Adobe, Facebook, Netflix**	**~$2/month**
Azure	Yes - 12 Months	Cloud computing, Cost Effective, VPC, High Availability, DNS, CDN.	Verizon, Samsung, Pixar, eBay, Xerox	~$20/month
Digital Ocean	Yes - 2 Months	Automatic scaling and container deployment.	Payload, Tango, Playflow	~$50/month

Software Design: Infrastructure
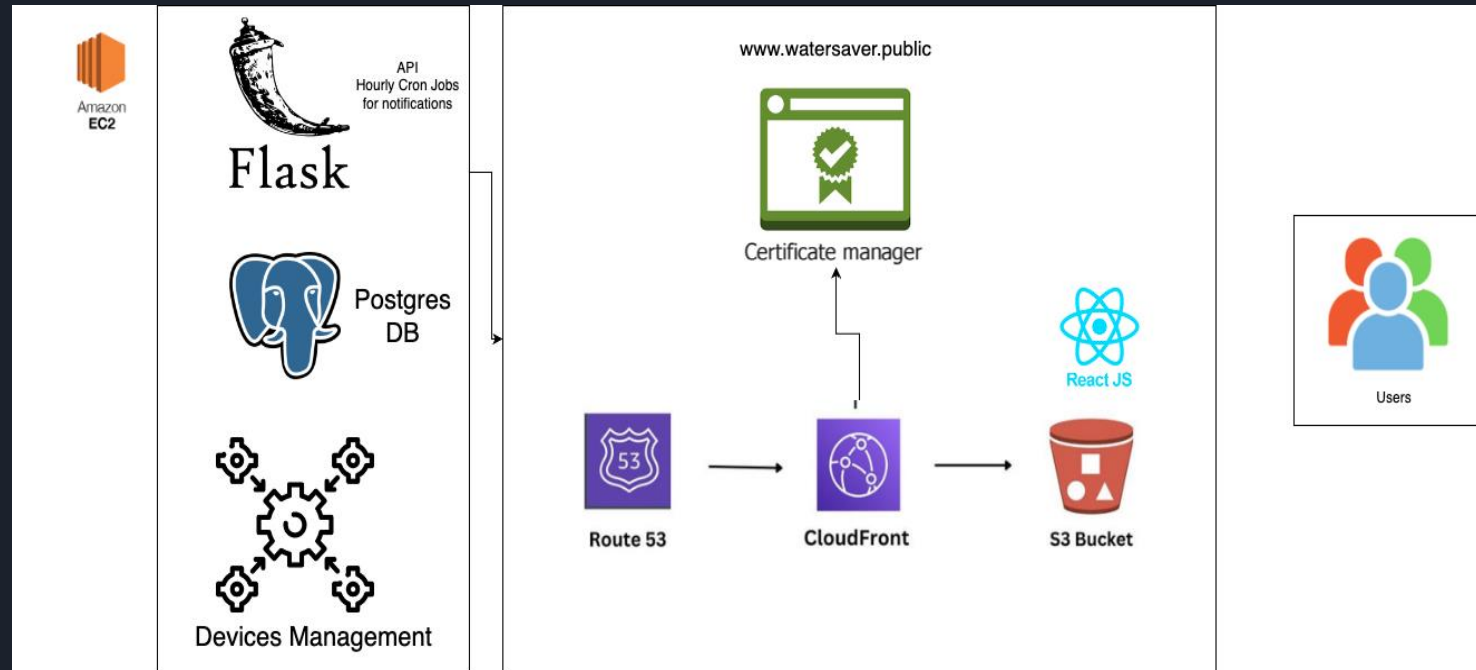
Software Design: UI

Application Flow Chart

Application UI

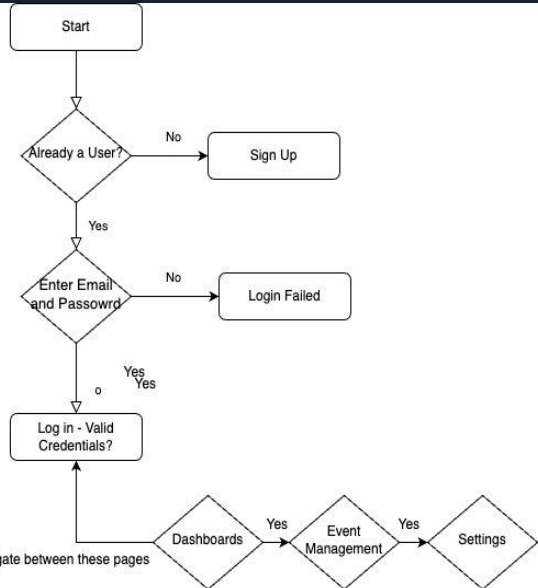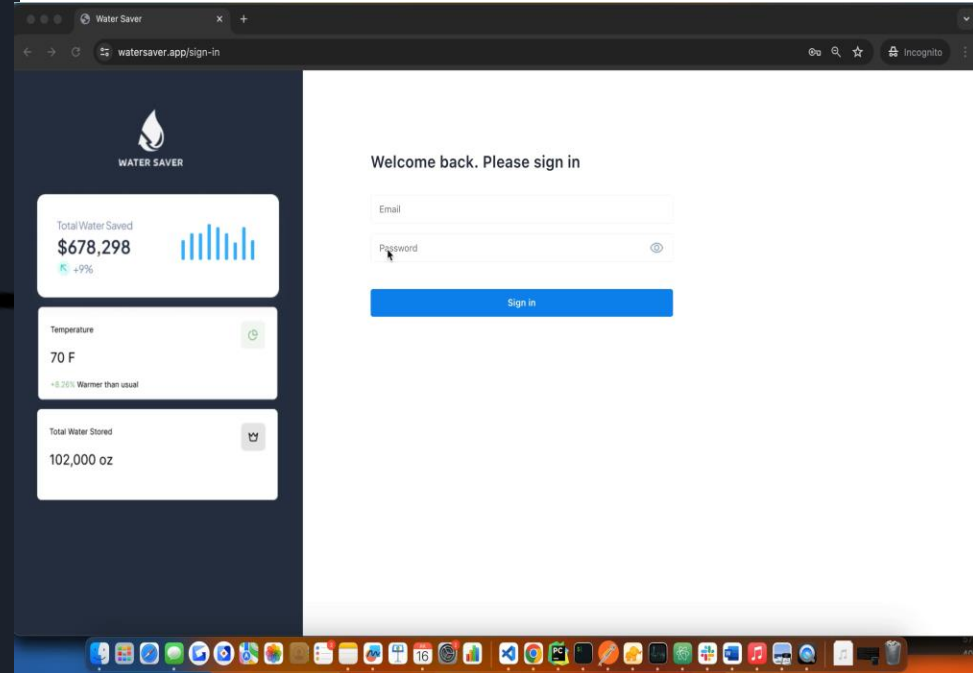# Software Design: Brand Guidelines

Brand Legend

Typography

Typefaces	Readability, legibility, and appropriateness for the target audience.
Hierarchy	Use variations in font size, weight, and style to create visual contrast and structure.
Spacing	Proper spacing helps improve the flow of text and enhances the overall reading experience.
Consistency	Use a limited set of typefaces and styles to create a cohesive and harmonious design language.

Colors

Color Palette	Choose primary and secondary colors that complement each other and evoke the desired emotional response.
Accessibility	Ensure that the chosen color palette meets accessibility standards and guidelines, making the design inclusive and usable for all users, including those with visual impairments.
Consistency	Establish guidelines for color usage and ensure adherence across all design assets and touchpoints.

Brand Guideline

WATER SAVER

Typography

SF Pro

Semi Bold   Medium   Regular

Aa Bb Cc Dd Ee Ff Gg Hh Ii Jj
Kk Ll Mm Nn Oo Pp Rr Ss Tt
Uu Vv Xx Yy Zz

0123456789 -?*=()'&^%$#!:,

Color

#2A3547

#EAEFF4

#2196F3

#9C27B0

#D32F2F

Brand Guideline

Software Design: Webhooks API
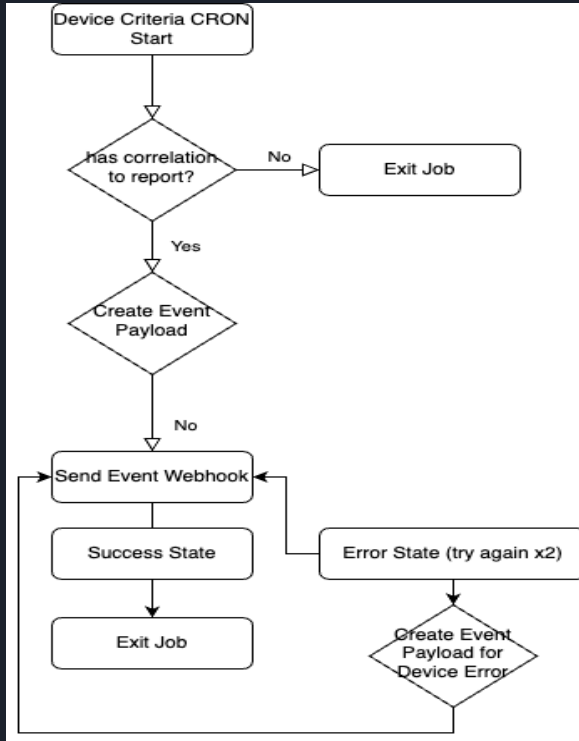
The microcontroller ESP32, is connected to sensor devices in this project and the device will utilize a crontab that will start at scheduled times and report data to raspberry pi pico.

Initial Conditions:

☐ If it recognizes a detection level where it should trigger an event then it should create an event payload to send to the event webhook from the Flask API.

☐ If it becomes unsuccessful after creating the payload it should try to retry the sending process and then create a specific device error payload to send to get to an exit state machine.

Battery Supply:

Comparisons of 2 batteries

- Rechargeable Battery Selection.

| Feature	Mighty Wax	Amazon Basics
Recharge cycle	Up to 2100	N/A
Pre charge	Yes, Built in	No
Initial Cost	Higher	Lower
Charging Time	10 Mins	30 Mins
Shelf Life	20 years	10 years
Suitability	Low and high drain	Low drain only(remote controls
Best For	Reliability(long life)	Budget Friendly Budget

12 Volt Battery

- Mighty Wax Battery
- 1.Proven performance and reliability
- 2.Comprehensive technical information available
- 3.Delivers at least 1.5V over an extended period
- 4.Exceptional energy density and longevity
- 5.Lightweight and compact design.

Buck Converters Benefits

- Efficient voltage regulation
- Steps down input voltage to stable output voltage
- Compact size and high efficiency
- Simplifies system design and maintenance.
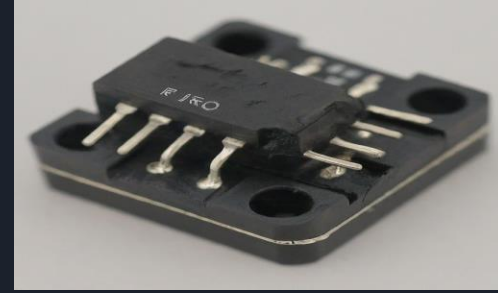
Feature	Buck	Flyback	Resonant
Function	Step down voltage	Step up and step down	High EffeciencyVoltage
Efficiency	High	Moderate	Very High
Complexity	Simple	Moderate	Complex
Size	Compact	Moderate	Complex
Cost	$2.49	$5.79	$6.99
Best for	Low to medium voltage	Low to medium power	High Power Application

Combined Performances

- Mighty Wax Battery+ buck converter = reliable power
- 3.Meets performance requirements
- 4.Optimizes cost and energy efficiency
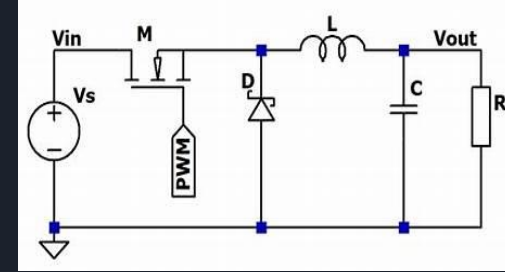
Factors	Buck	Linear Power	Resonant	Flyback
Advantages	Cost Effective	Simple low noise	High Efficiency	Step up functionality
Disadvantages	N/A	Lower Efficiency larger size	Overly Complex	Unnecessary step-up functionality
Decisions	Best choice for step up AC/DC conversation	Not chosen	Not chosen	Not chosen

Project Status: Budget

Item	Quantity	Used for the project	Unit Cost	Total	Notes
Electrical Circuit Board	12	3	$10	$120	Multiple iterations are considered
Rain Water sensor	5	1	$1.48	$7.44	
Water level sensor	10	2	3.406	$34.06	
Water tanks	4	2	$10	$40	
Solar panel	1	1	$32	$32	
flexible water tube	1		$28.68	$28.68	
Battery	1	1	$24.48	$24.48	
Digital screen LCD 20x4	6	1	$5.68	34.06	
Water filter	1	1	$4.55	$4.55	
relay	7	1	$3.034	$21.24	
DHT11	5	1	$2.13	$10.64	
Green conector box	50	1	$0.34	$17.03	
Buck convertor	10	3	$1.34	13.41	
Water tempreature sensor	3	1	$4.61	$13.82	
ESP32	4	1	$10.11	$40.46	
Hose clamp	1	1	$2.64	$2.64	
Water pump	1	1	$94.2	$94.2	
Faucet pipe adapter	1	1	$9.72	$9.72	
Pla for 3d printer	2	2	13.83	27.67	
Components	1		$20	$20	1 box include (Capacitors, resistors, and other components)
AWS EC2 m5.large Instance	$0.096 per hour		$0 - Free Tier	$0	
AWS RDS (DB, S3)	$0.096 per hour		$0 - Free Tier	$0	
Domain, SSL	1		$10	$10	
IoT Devices	1		$50	$50	
IoT Sensors				$30	
	125	23	361.95	706.1	
	Total Estimated Value:		$361.95	Prices might get different components availability awhen it will arrive	

Total Cost: $361.95

Original Estimated Total: $706.10

Budget Saved from Original Estimates: $344.14

Work Distribution

Mina
Sensors
Embedded
Water level sensors
Rain sensor
Microcontroller

Mohammad
PCB
Motor and Battery
Solar Panel
Charging

Evan
Front and back end
Infrastructure
User experience
Embedded

Muhammad
Output of PCB
management of IC's
Boost converter

Evan	Mohammad	Sensors
Embedded Part	PCB and Microcontroller	Muhammad
Coding	Mina	Motor and Battery
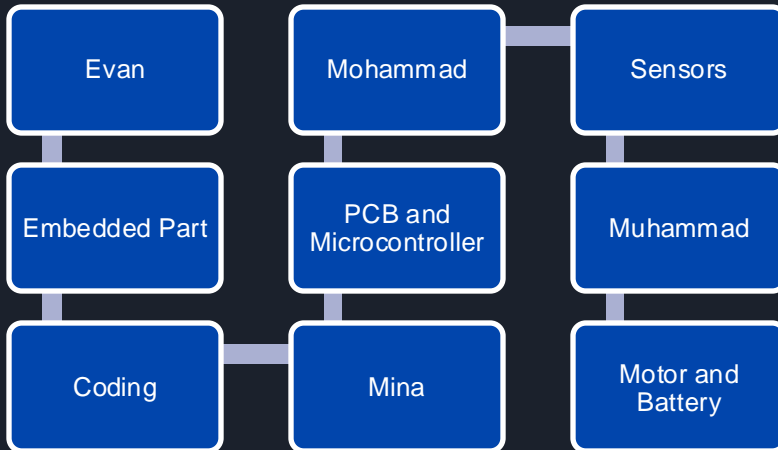
Legend

Mina Samman (EE)

Evan Glazer (CPE)

Muhammad Siddiqui (EE)

Mohammed Bazrbachi (EE)

Project Status

- **Schematic built**
- **ESP32 selected**
- **PCB tested**
- **Website operational**
- **Cooling system installed**
- **Efficiency improved**

Conclusion

- Water Saver is a culmination of teamwork and collaboration among electrical and computer engineering students.
- This project allowed us to apply the knowledge we gained in our degrees to a real-world application.
- Collaborating as a team enhanced our teamwork skills and taught us valuable lessons in time management and communication.
- The team approach also enriched the final project by incorporating diverse perspectives from each member's background.
- Through this collaborative effort, we developed Water Saver, a system that addresses water scarcity challenges in both developed and developing countries.