V.I.S.T.A

Vent Intelligence System for Temperature Adjustment

Senior Design Group 34

Sponsored by Dr. Qun Zhou Sun

The Team

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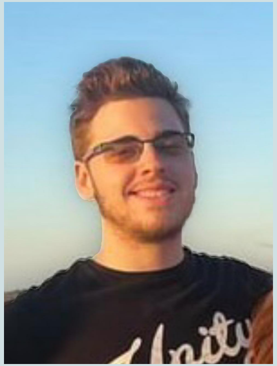

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Motivation and Background

- Power and energy consumption
  - Heating or cooling unnecessary areas of a home or building
  - Different temperature preferences among people

- Smart thermostats
  - Typically an expensive solution
  - Difficult to install
  - Must fit exact measurements of an AC vent

- Fans/heaters
  - Inexpensive but unreliable
  - Electric fans circulate dust
  - Electric heaters are fire hazards
  - Window AC units are a security issue

- Why VISTA?
  - Combines the inexpensiveness of traditional methods with the sophisticated technology of a smart thermometer

Goals and Objectives

Main Objective: Create a semi-autonomous system that will decrease loss and overall energy cost of a home/building by responding to sensor data

Goals:

- Build a smart ventilation system that reduces energy consumption of a home/building.
- Create a smart vent system that can be remotely controlled and function autonomously.

Objectives:

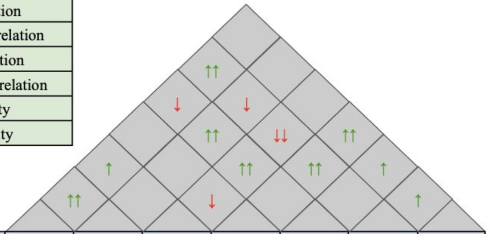
- Implement a mechanical device to open and close vent louver autonomously.
- Detect and respond to room temperature and occupancy.
- Detect and respond to room humidity level.
- Enable users to set parameters of device operation via a mobile device.

Engineering Specifications

VISTA Specifications	
Hardware	
Room occupancy accuracy	Occupancy indication with 90% accuracy
Response time	Less than 5 minutes
Durability	Device lifetime greater than 2 years
Dimensions	Shall not exceed 11” x 3” x 9”
Weight	Shall not exceed 5 pounds
Affordability	Less than $600
Power supply	
Battery Life	Battery life shall exceed 3 months
Average Power (Wattage)	Shall not exceed 3 mW
Software	
Communication rate	Shall be 2400MHz
Network Range	At least 50 ft.
Energy Usage	
Home energy usage [17]	Reduced home energy usage by a 5%

House of Quality

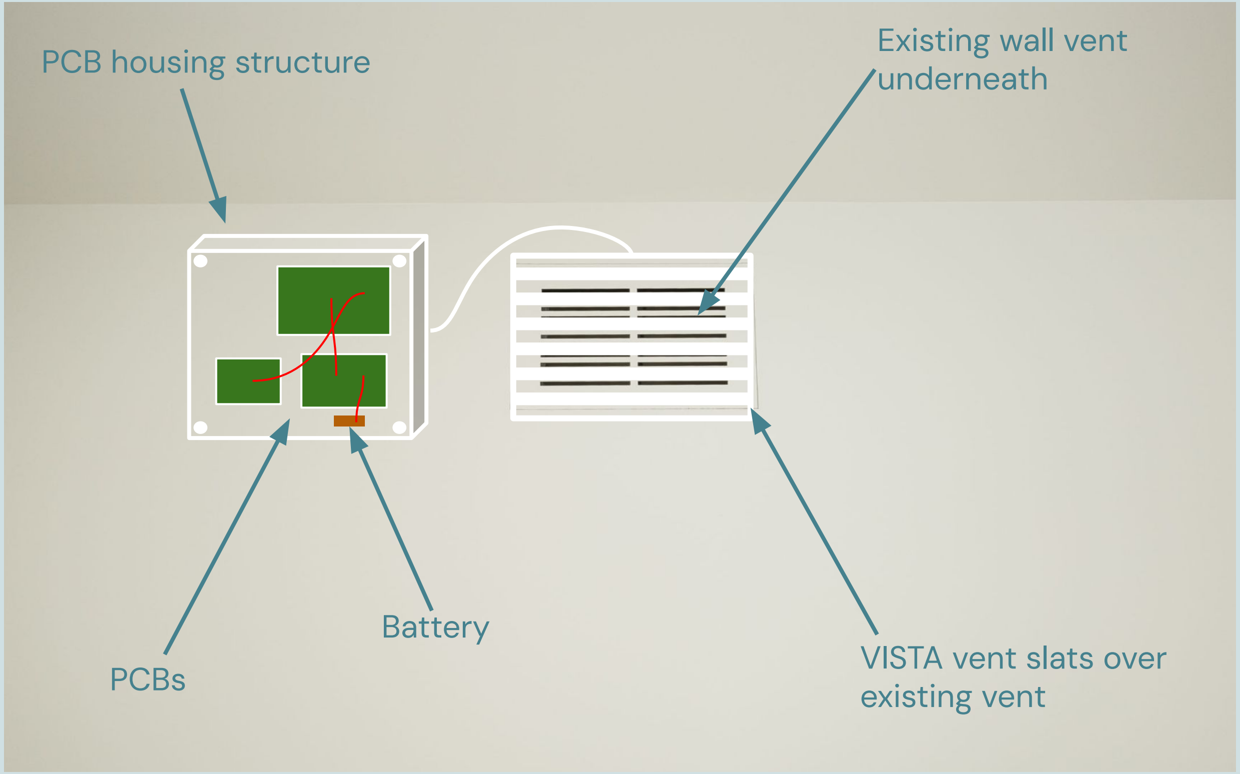
Symbol	Description
↑	Positive Correlation
↑↑	Strong Positive Correlation
↓	Negative Correlation
↓↓	Strong Negative Correlation
+	Positive Polarity
-	Negative Polarity



Engineering Requirements			Actuator Force	Average Power Consumption	Dimensions	Response Time	Energy Efficiency	Production Cost	Durability
Marketing Requirements			+	-	-	+	+	-	+
	Battery Life	+	↓	↓↓	↓			↓	↑↑
	App Features	+						↑	
	Energy Cost Reduction	+	↑			↑	↑↑		
	Weight	-			↑				
	Reliability	+					↑	↑	↑
	UI/UX Design	+						↑	
Targets for Engineering Requirements			Can exert up to 10 pounds of force	<= 3 mW	L: 11" W: 3" H: 9"	< 5 minutes	Will reduce energy usage by 5%	<= $400	Will last up to two years

- Engineering Requirements include: power consumption, dimensions, durability, cost, etc.
- Marketing requirements include: battery life, weight, reliability, user interface design, ect.

Initial Product Mockup



Final Product

3D Printed PCB Housing

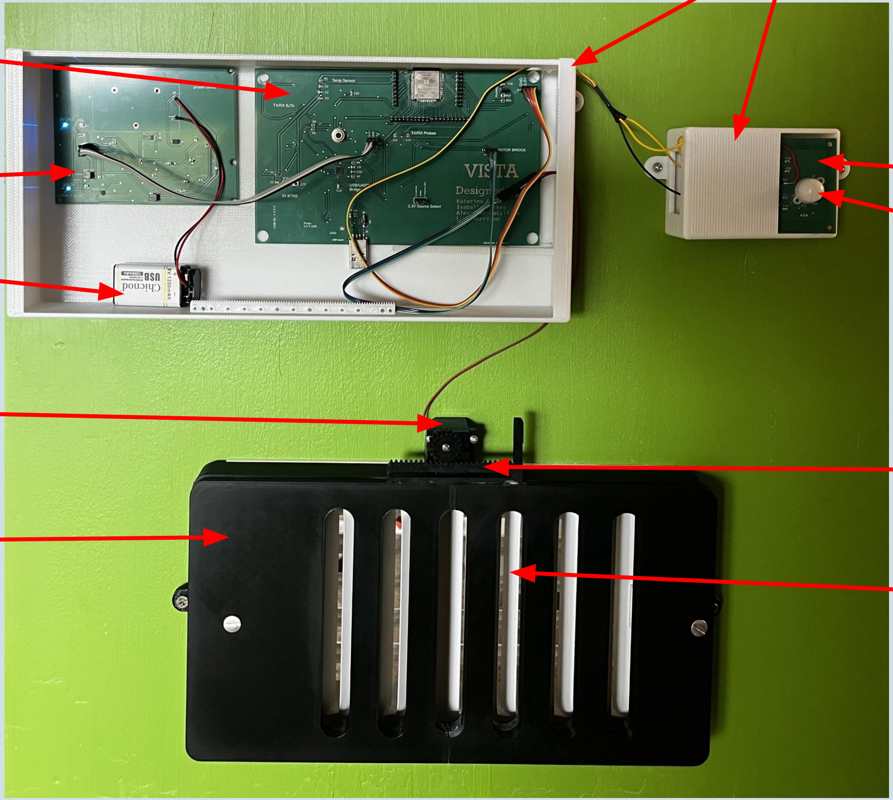
Main Components Board

Power Board

9V Battery

Occupancy Sensor Board

Lens



Servo

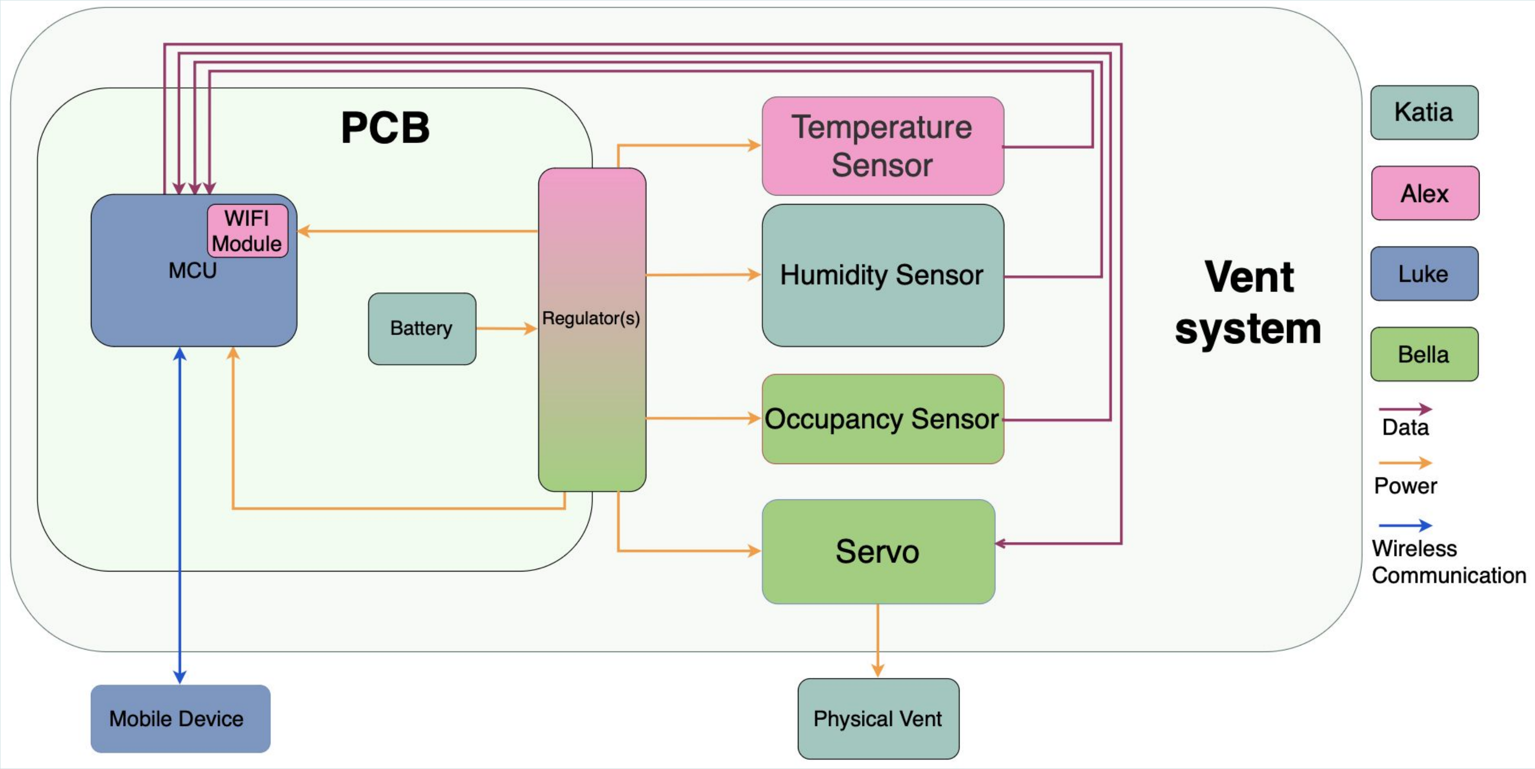
3D Printed Rack and Pinion

3D Printed Sliding Vent

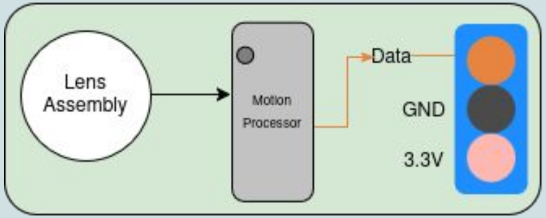
Existing Wall Vent Underneath

Hardware Comparison & Selection

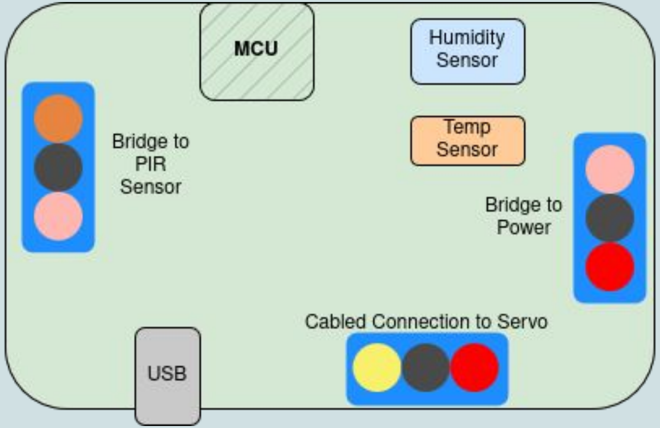
Hardware Diagram



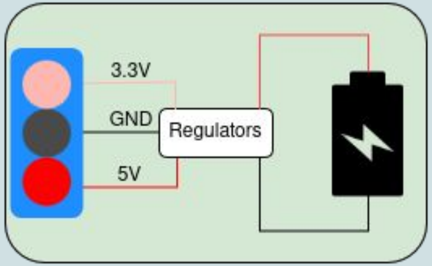
Hardware Design



PIR Sensor Board



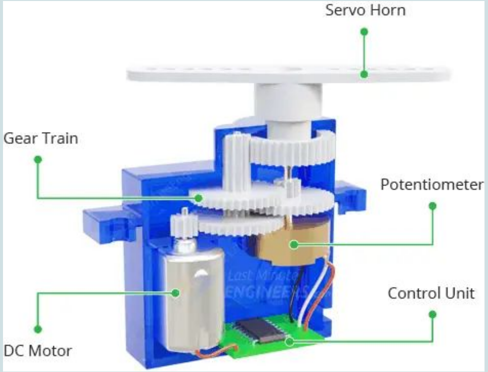
Main Components Board



Battery

Mechanical Control

Comparison Criteria	Linear Actuator	Servo	Linear Solenoid
Accuracy		X	
Speed		X	
Energy Efficiency	X		
Simplicity			X
Integration	X		X
Temperature resistance		X	
Size		X	
Rotational capability		X	



Source: lastminuteengineers [14]

- Servo will control the opening and closing of the vent
- High speed, precision, and accuracy
- Biggest issue: energy efficiency. However, the servo will not be continuously running

Servo

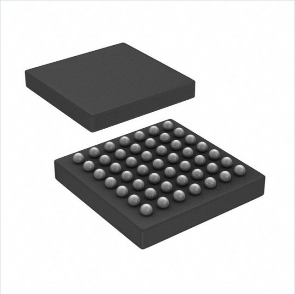
Comparison Criteria	SG90 Micro [79]	FS90R Micro [80]	SG92R Micro [81]	DS3218 [82]	ES08MAII [83]
Operating Voltage	4.8 V	4.8 V	4.8 V	4.8 V	4.8 V
Torque	1.8 kg/cm	1.3 kg/cm	2.5 kg/cm	19 kg	1.6 kg/cm
Operating Speed	0.1 s/ 60 degrees	0.5 s/ 60 degrees	.1 s/ 60 degrees	.16 s /60 degrees	.12 s / 60 degrees
Gear Type	Plastic	Plastic	Plastic	Metal	Metal
Rotation	180 degrees	360 degrees	180 degrees	270 degrees	180 degrees
Weight	9 g	9 g	9 g	60 g	12 g
Dimensions (L x W x H)	22.2 x 11.8 x 31 (mm)	23 x 12.5 x 22 (mm)	23 x 12.2 x 27 (mm)	40 x 20 x 40.5 (mm)	23 x 11.5 x 24 (mm)
Price	$7.50	$7.50	$15	$53 (for 4)	$7.75

Source: Digikey [13]

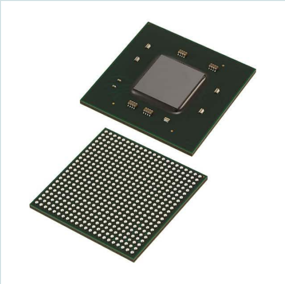
- FS90R allows continuous rotation that can be set with code to move the vent far enough to fully open/close
- Lightweight, low cost, and power efficient compared to competitors

Controller Type

Comparison Criteria	MCU	FPGA
Energy efficiency	X	
Ease of use	X	
Processing capability		X
Affordability	X	
Versatility/Reconfigurability		X
Computation time		X
Simplicity	X	
Integration	X	
Size/Weight	X	



VS

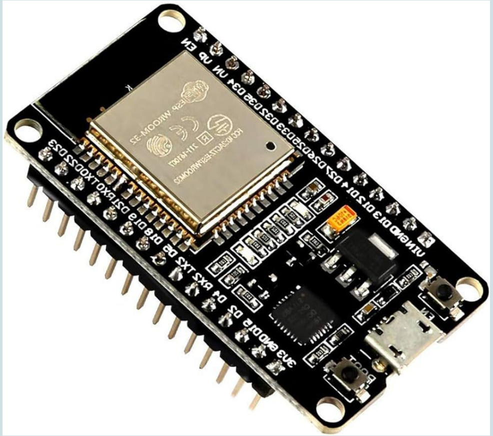


Source: szcomponents [15]

- FPGA capabilities go beyond the needs of VISTA
- MCU is simple, small, and energy efficient

Controller Type: MCU

Comparison Criteria	Arduino Uno	ESP32-D-WROOM	STM32L475VGT6	nRF5340
Chip	ATmega328P	ATmega328P	ARM Cortex-M4	Arm Cortex-M33
Memory Size	32 KB	32 KB	1 MB	
RAM size	2 KB	2 KB	128 KB x 8	512 KB
Flash memory	32 KB	32 KB	32 KB	1 MB
Clock speed	16 MHz	16 MHz	16 MHz	64 MHz
Power Consumption	Low	100-200 mA	Ultra-low	3.2 mA
Bluetooth	No	Yes	No	Yes
Supply voltage range	6 - 20 V	3.3 - 3.6 V	1.71 - 3.6 V	1.7 - 5.5 V
Operating temperature	-40 - 85℃	-40 - 125 ℃	-40 - 125 ℃	-40 - 105 ℃
Cost	$1.61	$3.05	$9.67	$7.27



Source: Amazon [4]

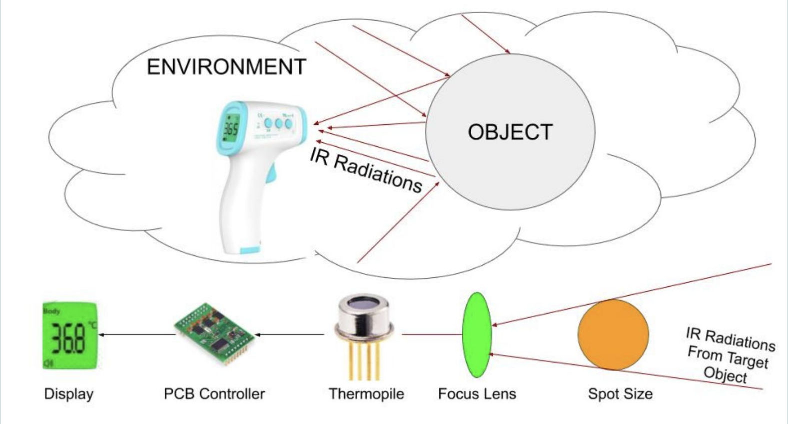
- Excellent wifi capabilities, supply voltage range fits needs of other components, inexpensive, high processing speed, many peripherals, development board makes testing and debugging easy

Temperature Sensor

Comparison Criteria	Thermistor	Infrared	Semiconductor
Accuracy	X	X	
Contactless Sensing		X	
Ruggedness	X		X
Digital Output (depends on specific part)	X	X	X
Additional Installation	X		
Additional Structural Design Considerations	X		

Thermistor

Semiconductor



Infrared
Source: smlease [2]

- Infrared: Thermopile sensor -> absorbs infrared energy radiating from bodies -> converts to heat -> converts to electrical signal
- Advantages: contactless, remote, no additional installation necessary

Temperature Sensor: Contactless Infrared

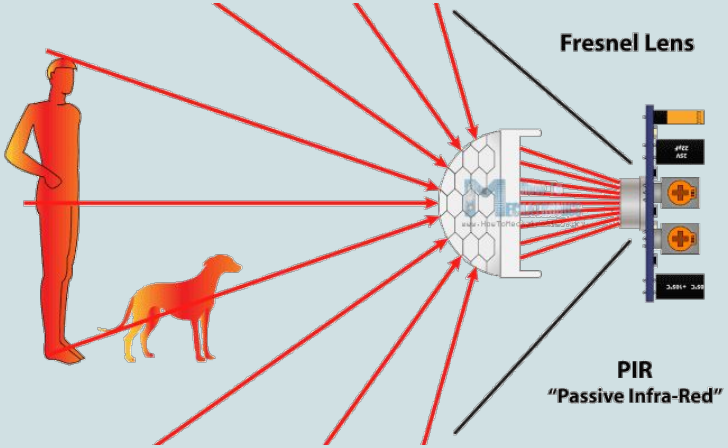
Comparison Criteria	Melexis Technologies MLX90640/90641 Series	MLX9061 Series	TE Connectivity G-TPMO-102
Accuracy	X	X	X
Interface		X	
FOV	X		X
Cost	X	X	X
Power		X	

Source: Digikey [11]

- Low power capabilities < 2.5mA
- Different lens sizes available: from 35° all the way down to 5° (angle of view visible by lens)
- Small/compact design
- Simple schematic

Occupancy Sensor

Comparison Criteria	BLE sensor	Passive Infrared	Thermocouple
Energy efficiency	X		
Different Modes		X	
Size	X		
Accuracy		X	X
Distance		X	
Environmentally compatible		X	
Fast Response			X
Integration Simplicity		X	X



Source: yxlighting [12]

- HIgh accuracy in a wide range to capture an entire room
- Low power consumption (sleep modes)
- Simple, lightweight, easy to install

Occupancy Sensor: Passive Infrared

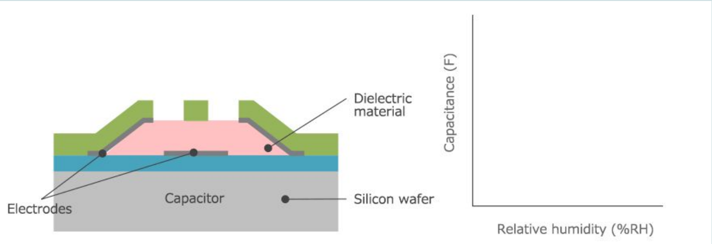
Comparison Criteria	AM312 mini [97]	HC-SR505 mini [98]	Grove PIR sensor	Adafruit Part 189 [100]
Digital Signal	Yes	Yes	Yes	Yes
PCB Dimensions	12 x 24 mm	10 x 23 mm	33 x 24 mm	25 x 33 mm
Power Consumption	< .1 mA	<50 uA	150 uA	15 mA
Field of View	100 degrees	<100 degrees	120 degrees	120 degrees
Detection Range	3-5 meters	3 meters	6 meters	6 meters
Ambient Temperature Range	-20 to 85 C	-20 to 85 C	-20 to 80 C	-20 to 85 C
Object Temperature Range	-20 to 70 C	-20 to 70 C	0 to 80 C	-20 to 70 C
Integration	Through Hole	Through Hole	PCB daughter board	Through Hole
Price	$8.69	$9.50	$34.87	$9.95

Source: seeedstudio [8]

- Wide detection range
- Large field of view
- Easy integration to PCB

Humidity Sensor

Comparison Criteria	Capacitive	Resistive	Psychrometric
Stability/Accuracy	X		
Wide Humidity Range	X	X	X
Temperature Resistance	X		
Chemical Resistance	X		
Quick Response Time	X	X	
Environmentally Friendly		X	
Interchangeable		X	
Remote Use		X	
Small Size	X	X	
Condensation Resistance			X
Recovery Time	X		

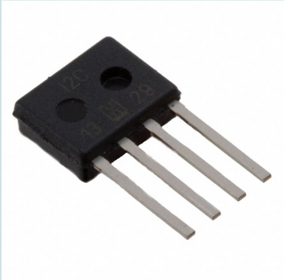


A visual representation of moisture absorption, resulting in a change in relative humidity therefore a change in capacitance
Source: alpsalpine [3]

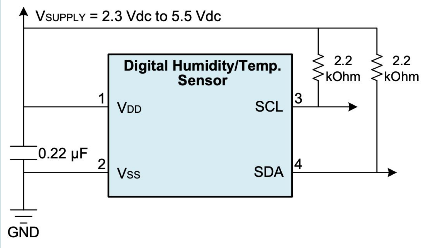
- High accuracy and stability
- Quick response time and recovery time

Humidity Sensor: Capacitive

Comparison Criteria	HIH8120-021-001	SHT30-DIS-P2.5KS	HDC2080DMBR
Supply Voltage Range	2.3-5.5 V	2.15-5.5 V	1.62-3.6 V
I2C Compatibility	Yes	Yes	Yes
Accuracy	±2 RH	±1.5 RH	±2 RH
Stability	High	High	High
Mounting	Through Hole	Surface	Surface
Response Time	6 sec	8 sec	8 sec
Package/Case	4-SIP Module	8-VFDFN Exposed Pad	6-WDFN Exposed Pad
Resolution	14 bit	16 bit	14 bit
Operating Temperatures	-40°C ~ 125°C	-40°C ~ 125°C	-40°C ~ 85°C
Price	$16.87	$4.44	$2.90



HIH8120-021-001



SIP 4 Pin Typical Application Circuit
Source: Digikey [9]

- Quick response time, large operating temperature range, suitable supply voltage range
- Despite the price, through-hole was preferred to allow room for error

Power Distribution

Component	Supply Voltage	Supply Current	Power Consumption
ESP32	3.3 V	240 μA - 300 mA	0.0264 - 0.99 W
Servo	5V	0 - 550 mA	2.75 W
Temp Sensor	5V	1.3 - 2.0 mA	6.5 - 10 mW
Humidity Sensor	3.3V	0.6μA - 1mA	1.98 μW - 3.3 mW
Occupancy Sensor	3.3V	5-7μA	16.5 - 23.1 mW

Power Source

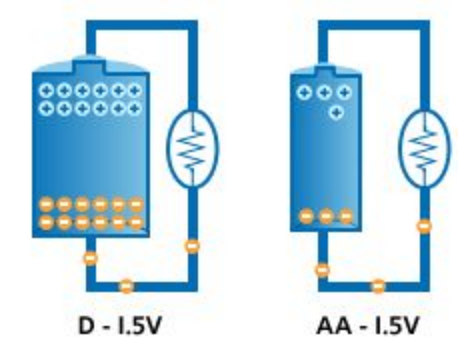
Comparison Criteria	Lithium-ion	Lead acid	Alkaline	NiMH	Wall Connection
Affordability		X	X		
Efficiency	X	X	X	X	
Disposability			X	X	X
Long life cycle	X		X		X
Environmentally friendly			X	X	X
Temperature resistant			X		X
Lightweight	X		X	X	X
High energy density	X		X	X	
Self-discharge rate	X	X	X		
Rechargeability	X	X	X	X	X

Source: Shutterstock [1]

- High energy density meaning long shelf-life
- Despite environmental friendliness of Alkaline, Li-ion has much greater lifespan

Power Source: Lithium Ion Batteries

Comparison Criteria	AA	C	D	9V
Lifespan		X	X	X
Affordability	X	X	X	X
Energy Capacity		X	X	
Small size	X			X
High voltage				X
Temperature resistant		X	X	X
Durability		X	X	X



Lifespan difference between AA and D batteries
Source: Ausgrid [7]

- Compact yet high voltage
- Rates similarly in other aspects in comparison with alternatives

PCB

Comparison Criteria	HASL Lead	HASL Lead-Free	Immersion Silver/Tin	OSP	ENIG
Solderability	X	X	X		X
Environmental Durability	X	X	X		X
Handling Durability (skin oils)	X		X		X
Manufacturing Consistency	X	X		X	X
Flatness		X	X		X
Cost	$	$$	$$$	$$	$$$$

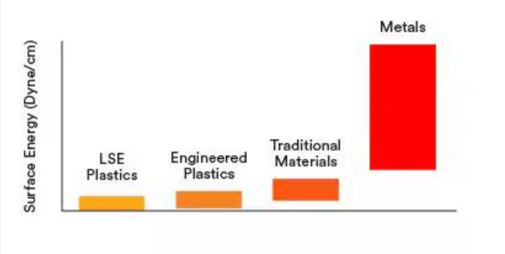
Comparison Criteria	PCBWay	JLC- PCB	Elecrow	Seeed Studio
PCB(s) Price	$5.00	$3.30	$6.90	$12.90
PCB Assembly Cost	$129.32	$0.00	$42.00	$25.83
Cheapest Shipping Cost	$23.21	$18.06	$10.35	$26.66
Discounts/Promotions	-$100.32 Assembly -$23.21 Shipping	Free Assembly on First Order	None	-$13.33 On Shipping
Final Quote	**$34.00**	**$21.36**	**$59.25**	**$52.06**
Estimated Delivery Time	2-4 Business Days	2-4 Business Days	2-5 Business Days	3-5 Business Days
Customer Support	Fair	Fair	Poor	Good
Reputation	Good	Good	Poor	Fair
Manufacturing Quality	Good	Good	Good	Good

- Minimize cost
- Reliable under environmental fluctuations, enduring repeated heating and cooling from the vent.

- Minimize cost
- Fastest turn-around

Mounting

Comparison Criteria	Wood/Concrete Screws	Machine Screws (Pre-existing holes)	Rubber Adhesive	Acrylic Adhesive	Silicone Adhesive
Cost	$	$	$$	$	$
Strength	+++	+++	++	+	-
Ease of Installation	-	+	++	++	-
Durability	+++	+++	++	+	-



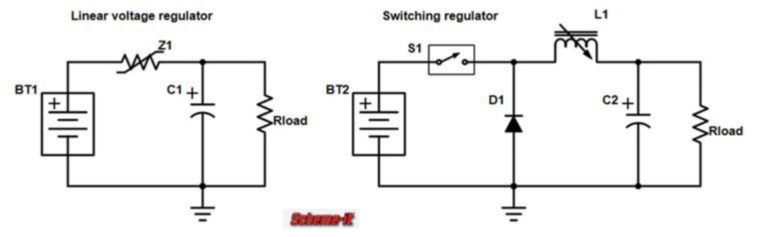
Source: 3M [16]

- Minimal installation complexity
- Adaptable to variety of existing vent designs
- Reliable for long term use

Utilizing existing mounting holes ensures the VISTA will comply to standard vent sizes
CommandBrand Adhesive Strips will ensure strong seal against frame of vent to reduce leakage

Regulator

Comparison Criteria	Linear Regulator	Switching Regulator	Zener Regulator
Simplicity	X		X
Size	X	X	X
Efficiency		X	
Wide Voltage Range		X	
Low Power Loss		X	
Cost	$	$$	$



Source: Digikey [5]

- Low power dissipation and efficient
- Allows for a wide range of voltages

Regulator: Switching

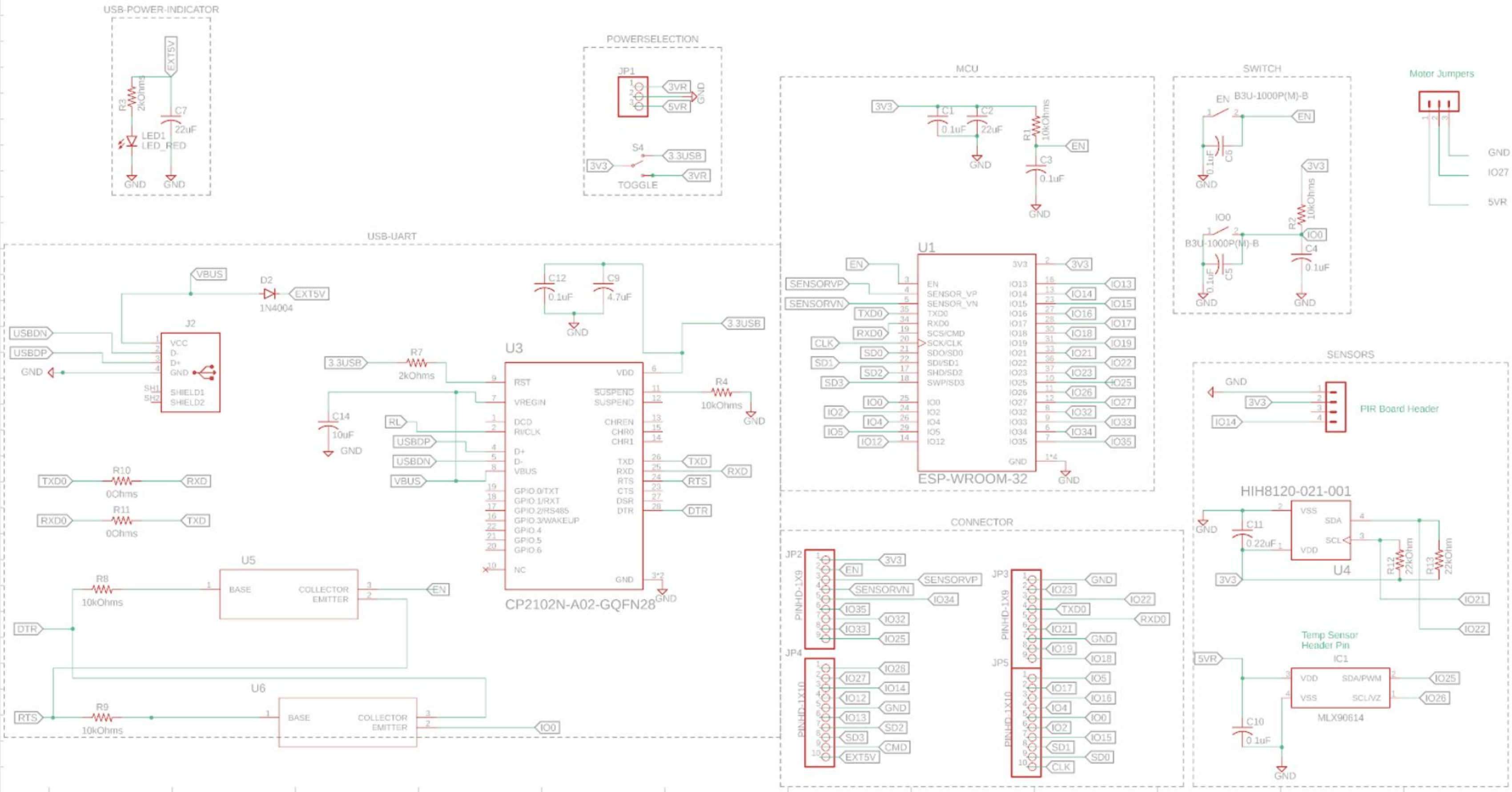
Comparison Criteria	TI TPS562201DDCR	Diodes Inc AP64060	TI LM2576T
Input Range (V)	4.5 - 17	4.5 - 40	7 - 40 V
Output Range (V)	0.76 - 7	0.8 - 12	4.8 - 5.2 V
Ripple Tolerance (%)	.02%	<0.1% at 12V	< 0.1%
Cost	$0.35	$0.93	$1.60
Idle Current Draw	~100 μA	90 μA	5mA
Max Output Current	2 A	600mA	3 A

Linear

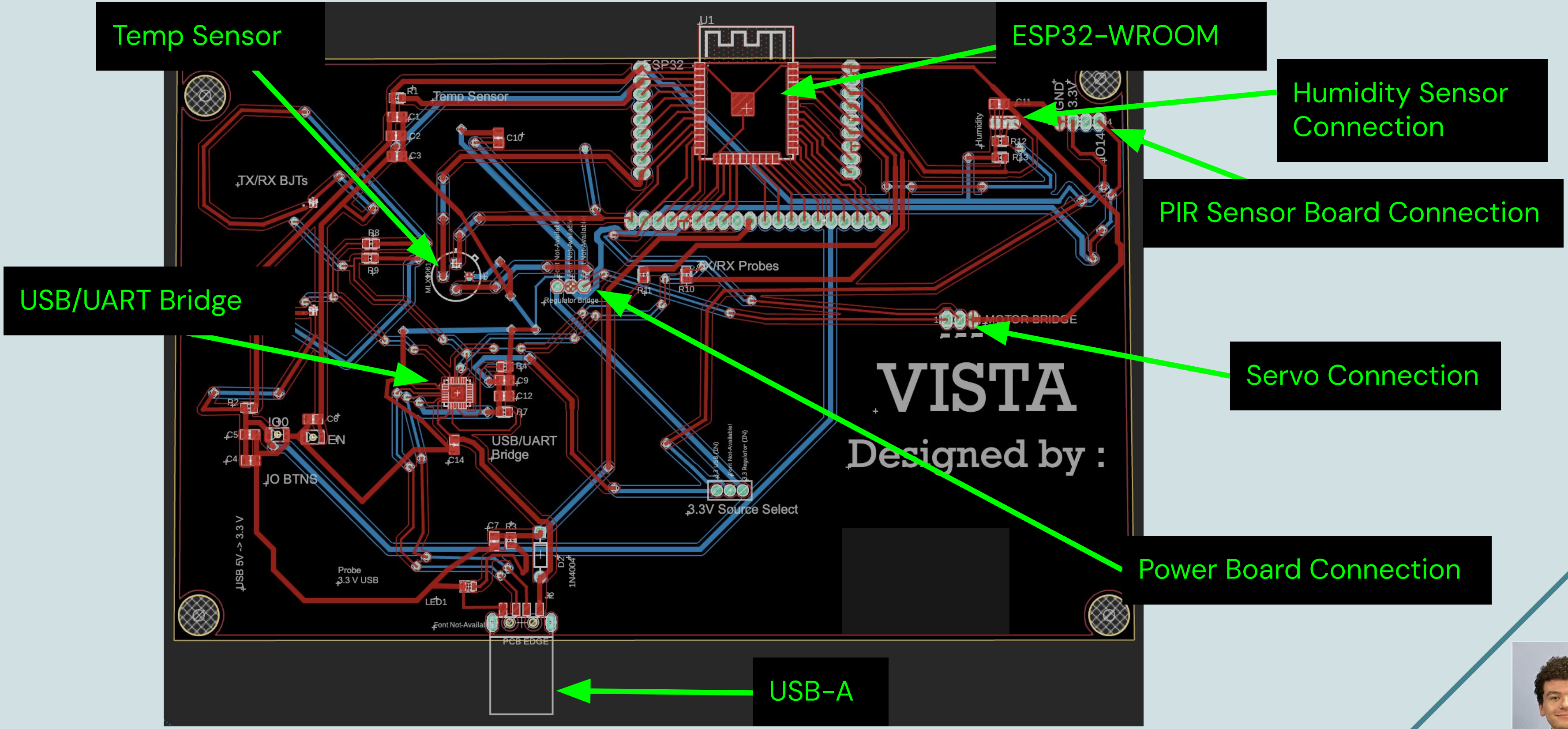
TI LM1117-3.3
4.5 - 15 V
3.2 - 3.33 V
.03%
$1.01
5 mA
800 mA

- High max output current
- High quality datasheet

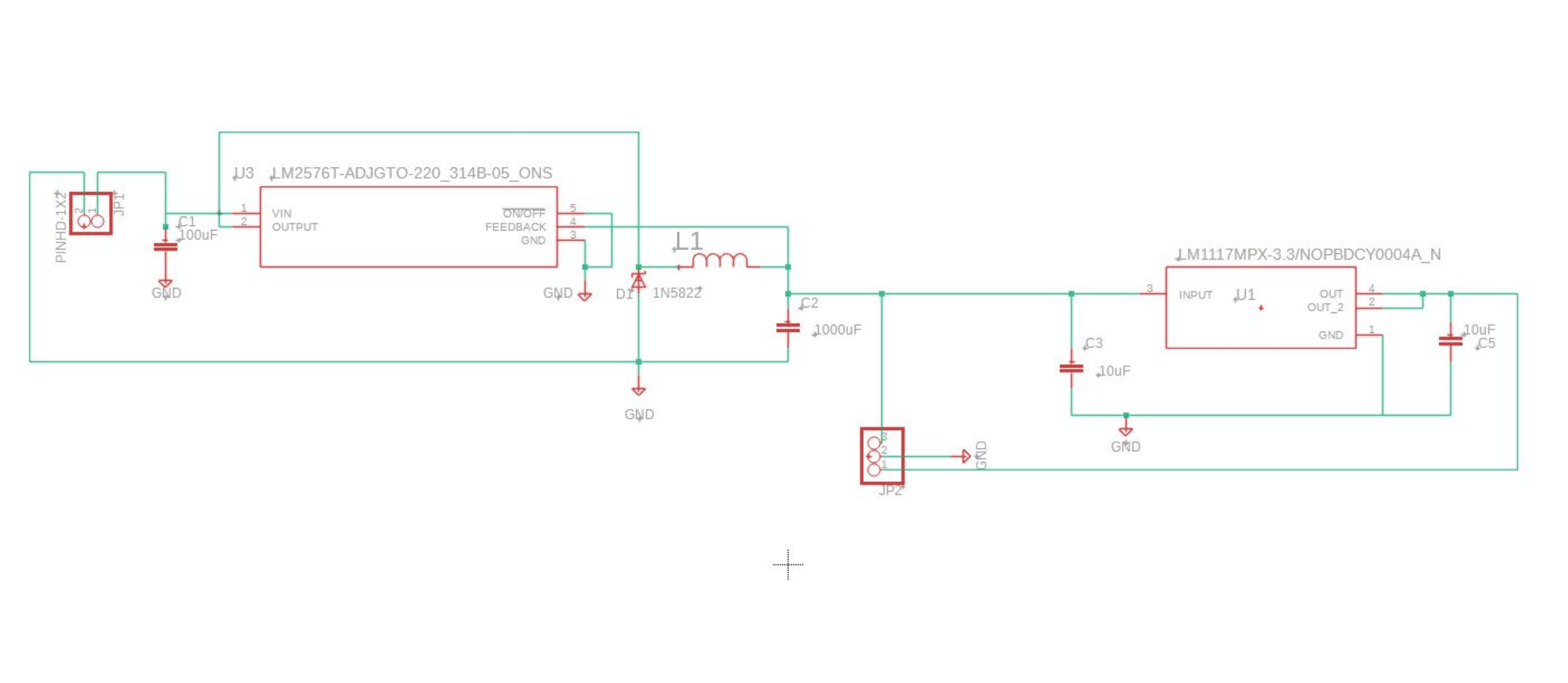
Main Components Board Schematic



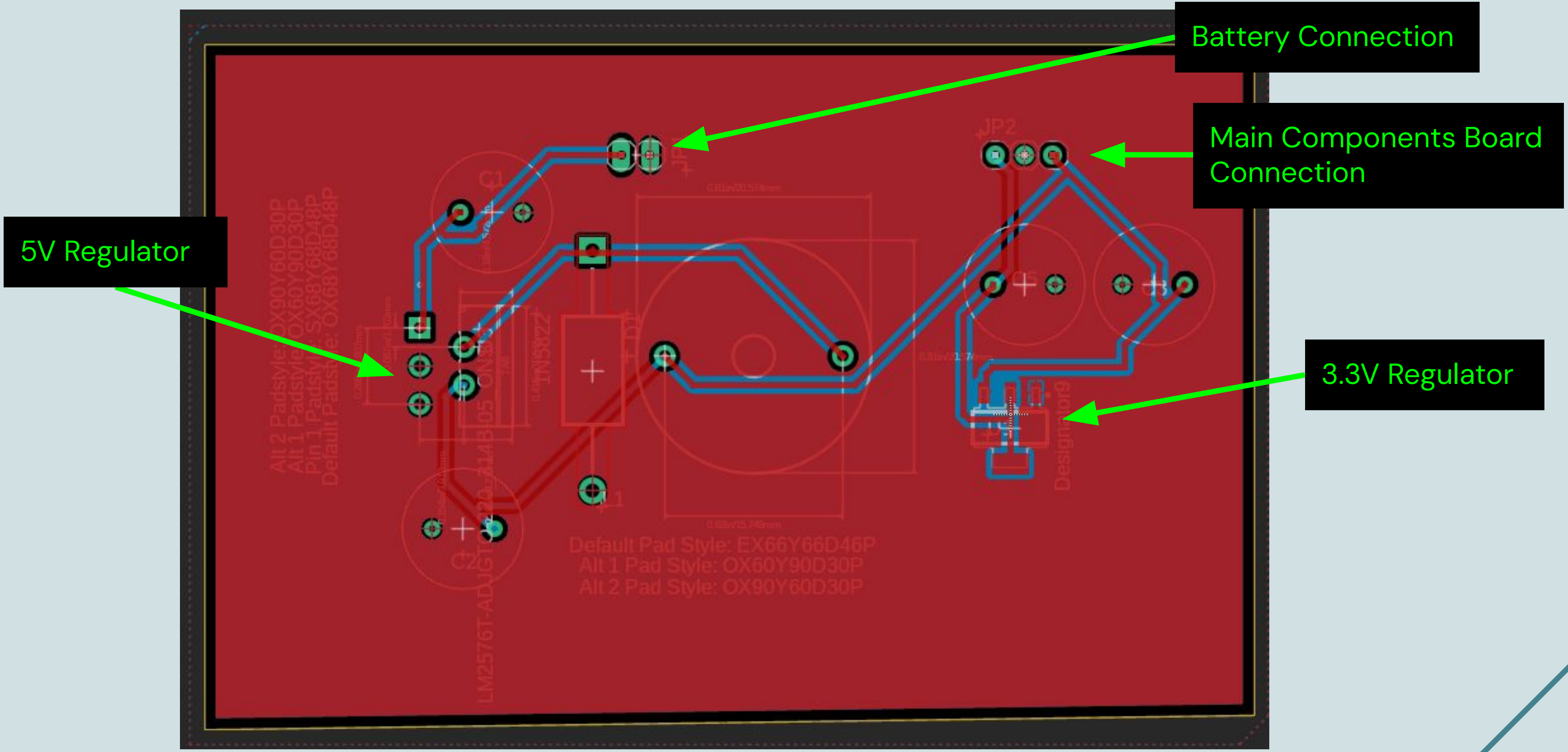
PCB Design- Main Components Board



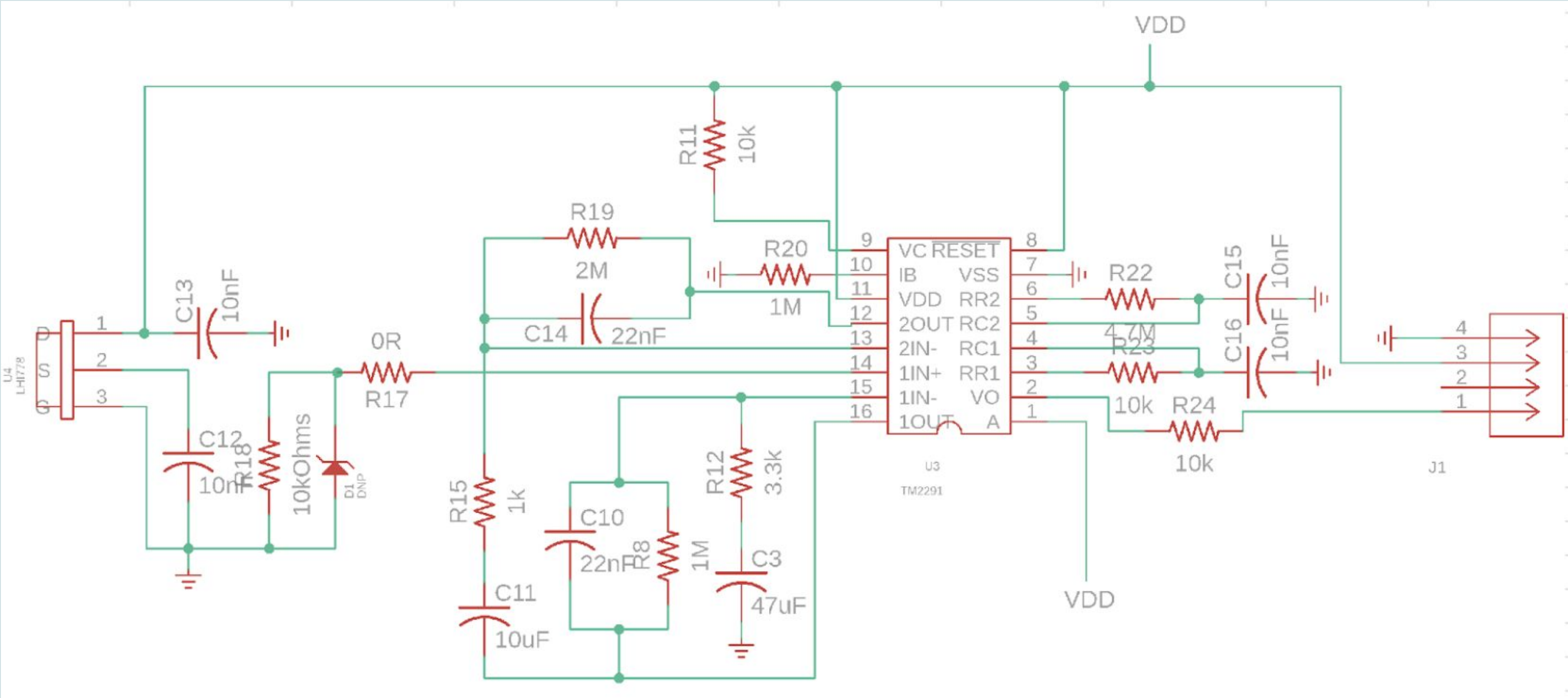
Power Board Schematic



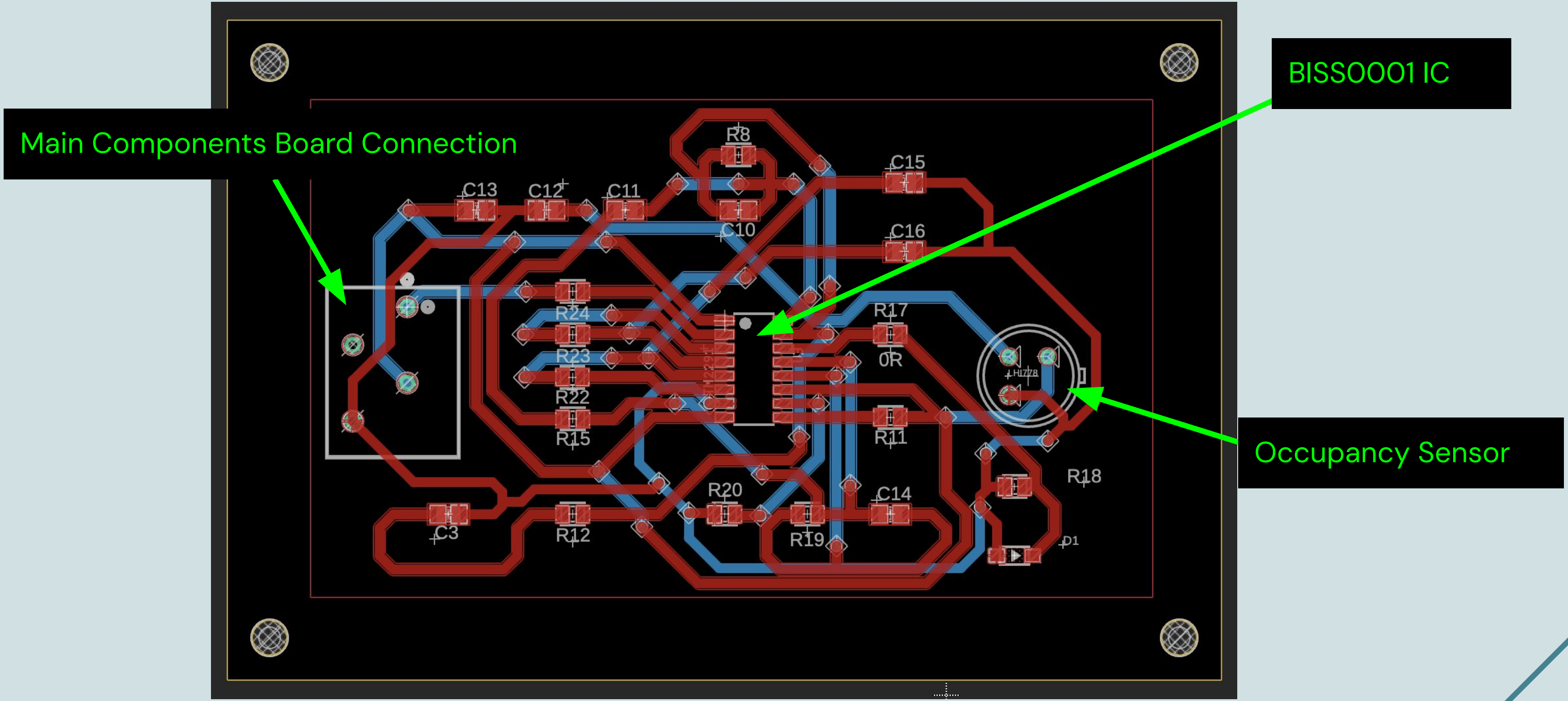
PCB Design- Power Board



Occupancy Sensor Board Schematic



PCB Design- PIR Sensor



Communication Selection

Wireless

Comparison Criteria	Wifi	Bluetooth	Zigbee
Data transfer size	X		
Flexibility	X		
Communication Range	X		
Security			X
Malleability			X
Energy efficiency		X	

- Highest data transfer size
- Widest range
- Ease of use

Wireless: Wifi

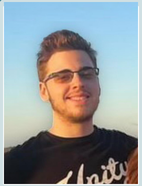
Comparison Criteria	ISM43362-M3G-L44 [117]	WiFi HT40	SPWF04SA [119]
Standard	IEEE 802.11 b/g/n	IEEE 802.11 b/g/n	IEEE 802.11 b/g/n
Frequency	2.4 GHz	2.4 GHz	2.4 GHz
Throughput speed	54 Mbps	150 Mbps	54 Mbps
Low Power Modes	Yes	Yes	Yes
IOT interface	Yes	Yes	Yes
UART/SPI	Yes	Yes	Yes
Size	14.5 x 30 (mm)	12 x 12 (mm)	26.92 x 15.24 x 2.35 (mm)
Price	$10.33	Included in MCU price	$8.95

- Highest speed
- Smallest for PCB design
- Cheaper
- Overall best option

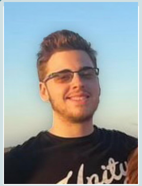
Wired

Component	I2C	SMBus	UART	PWM	ADC	Digital Read
Temperature Sensor	X	X				
Humidity Sensor	X	X				
PIR Sensor					X	X
Servo				X		
ESP32	X	X	X	X	X	X

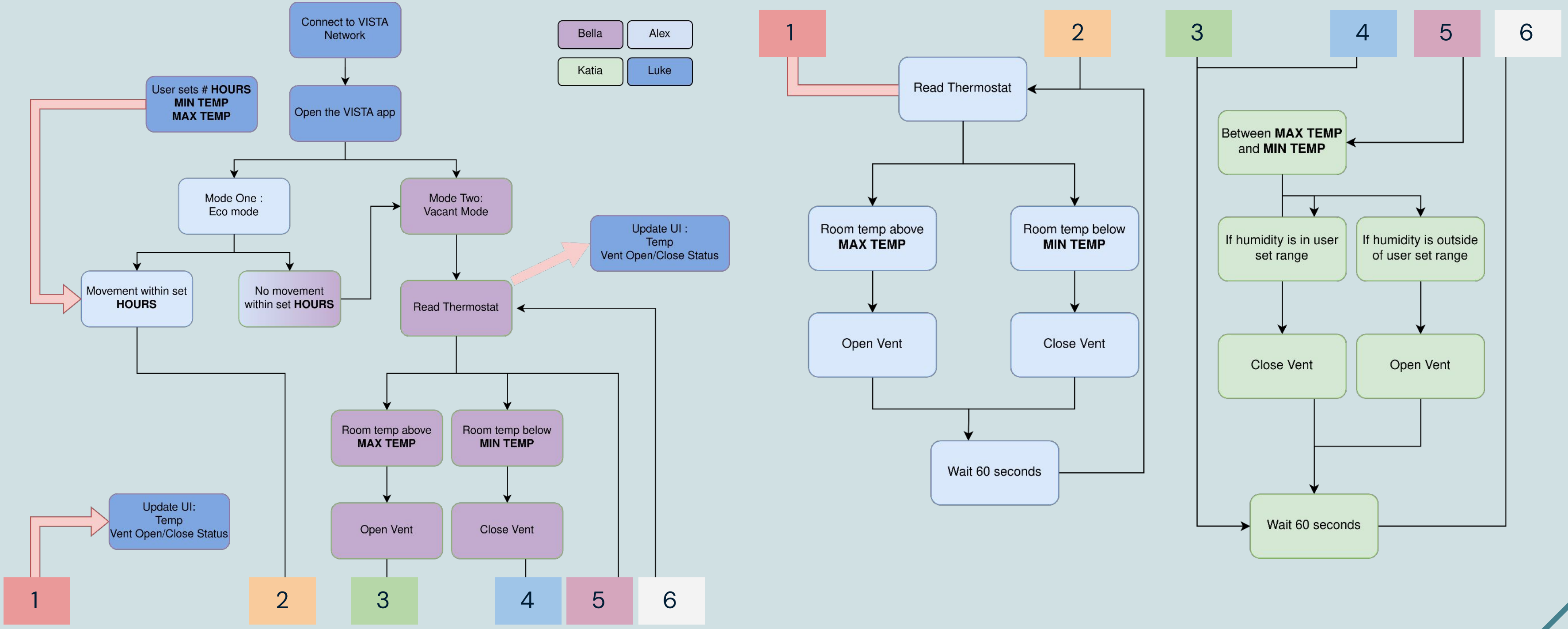
- Temperature and humidity sensors have the option to be read from either I2C or SMBus
- I2C was chosen because it was easiest to implement.
- Servo is controlled using a pulse width signal sent from the ESP
- PIR sensor read from an ADC pin on the ESP32

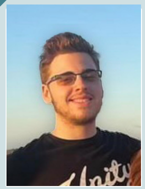


Software Selection

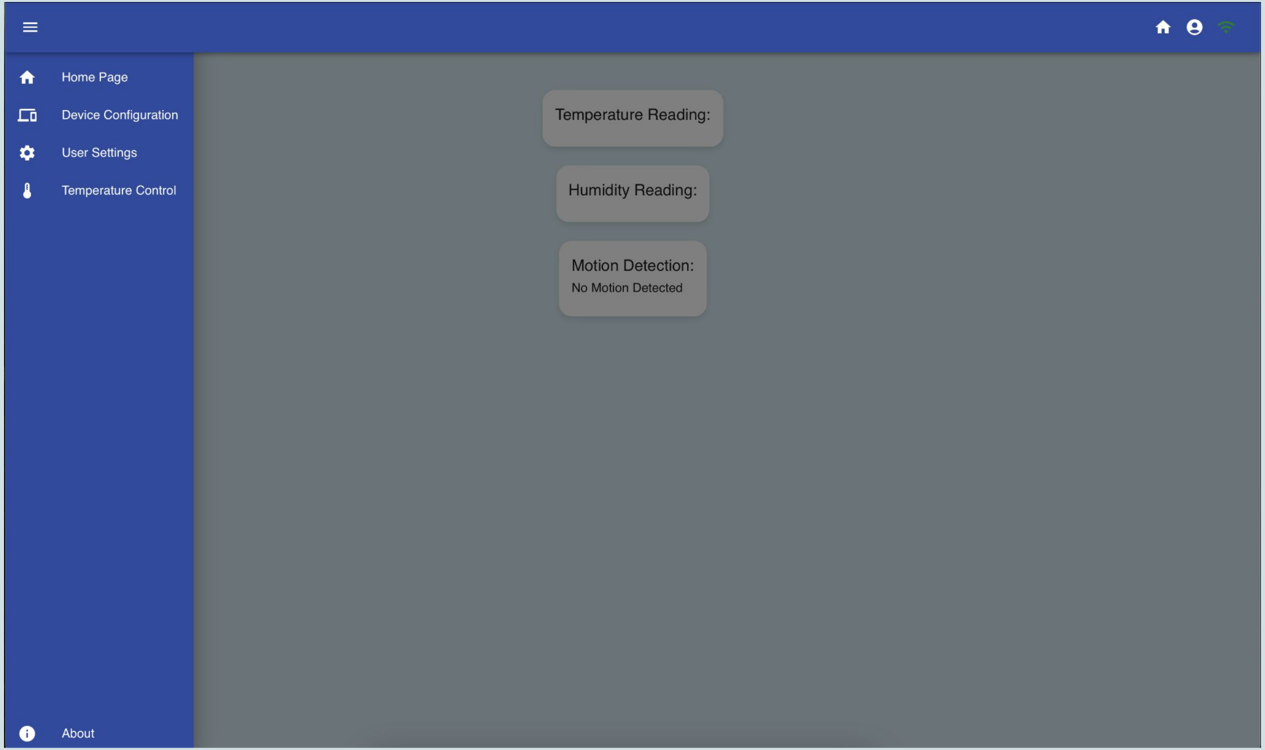


Software Diagram

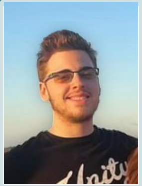




User Interface



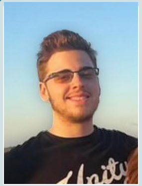
- Read the status of the VISTA's available sensors from the Home page
- Change the device settings, such as toggling eco mode, minimum and maximum temperature from Device Configuration
- Adjust user controls, reset the VISTA to factory settings inside of User Settings
- Set the desired temperature inside of Temperature Control



User Interface

Language	Performance Overhead	Development Time	Rich UI Elements	Browser Support
Javascript	-	+	++	++
C#	++	-	-	+
Python	+	++	+	-

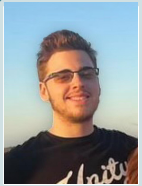
- Good balance between implementation and browser support.
- Quick development time, easy to learn



User Interface: Javascript

Frontend Framework	Performance Overhead	Maintainability	Library Support	Fast UI Updates
React.js	+	++	++	++
Angular.js	++	+	+	+
Vue.js	-	-	-	-

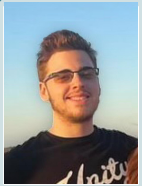
- Popular UI Library
- Extensive Support



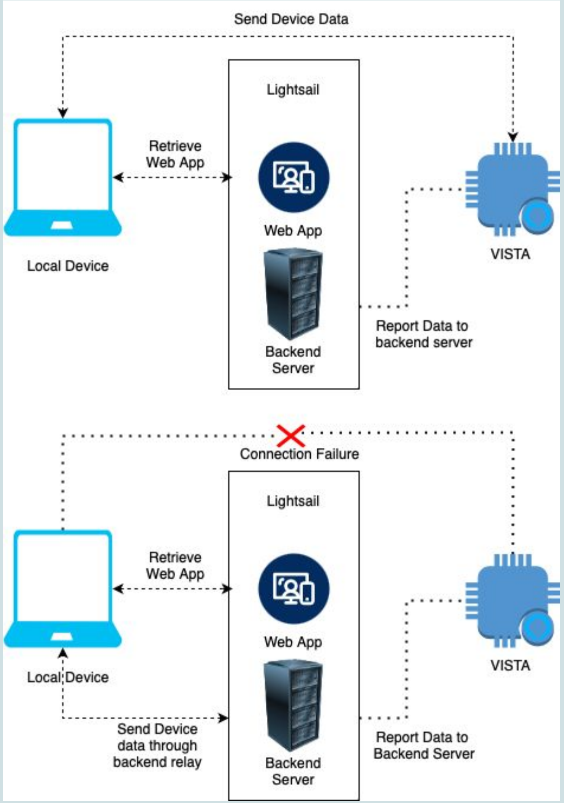
Web App Technology

Web App Technology Comparison (libraries)	**Arduino WebServer**	**ESPAsyncWebServer**
HTTP request frequency requirement	Low (better)	High (worse)
Implementation Simplicity	High	Low
Asynchronous Implementation	Internal through FreeRTOS	None

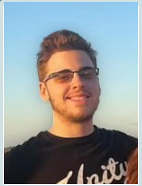
- Using Arduino WebServer library to service HTTP requests to the ESP32 (from frontend or backend), and to send HTTP requests to backend.
- Implementation simplicity and asynchronous implementation already in place using FreeRTOS tasks.
- Device does not need to send/receive HTTP requests often enough to justify it.



Web App Technology



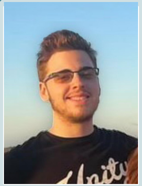
- Goal: Allow for VISTA communication to work during most browser configurations and internet connectivity status.
- Some browsers restrict access for HTTP request to a local device on LAN (CORS Policy)
- Solution: Forward requests through a Lightsail-hosted Backend
- Lightsail amazon server will host the VISTA Backend using Node.js
- Backend will host various endpoints, such as the heartbeat endpoint, various data points (current temperature, device mode, humidity status)
- Backend will host a SQlite database for storing device name, IP address(for frontend connection), device connectivity status, and various data points such as the temperature and humidity data.
- On situation where ESP32 cannot connect to the React app, the web app will utilize this backend relay.



Backend

Database	Storage	Scalability	Simplicity	Speed
Sqlite	-	-	++	++
MariaDB	+	+	+	+
PostgreSQL	++	++	-	-

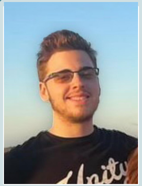
- Great for Simplicity
- Lightweight, ideal for low-storage applications, such as IoT and embedded applications
- More complicated functionality, such as concurrent data accesses and extended SQL commands not required for this project.



Software Development: RTOS

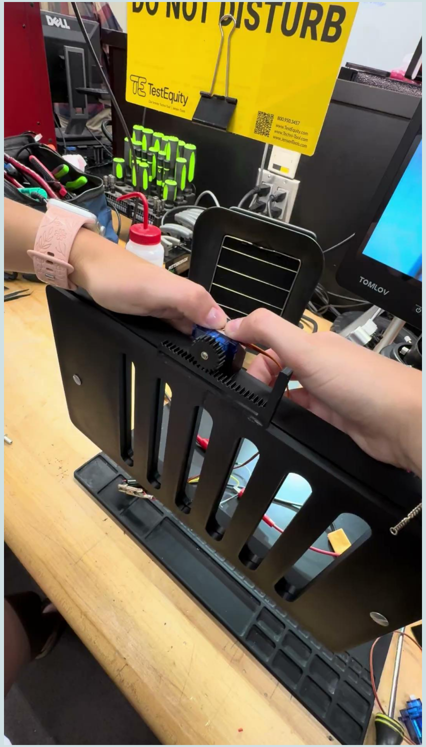
RTOS	Power Management	Memory Overhead	Performance Overhead	Extensive Documentation	HTTP Support
FreeRTOS	-	-	-	++	-
Zephyr OS	++	+	+	+	+
Mbed OS	+	++	++	-	++

- FreeRTOS requires less power management
- The operating system is lightweight because memory and performance overhead requires less to operate
- Extensive documentation



Prototyping and Testing- Servo

Servo Trials	Time Taken to Respond	Successful Open/Close
Trial 1	3.5 sec	Yes
Trial 2	19.8 sec	Yes
Trial 3	20.5 sec	Yes
Trial 4	28.3 sec	Yes
Trial 5	24.7 sec	Yes
Trial 6	26.2 sec	Yes
Trial 7	3.4 sec	Yes
Trial 8	20.9 sec	Yes
Trial 9	22.4 sec	Yes
Trial 10	17.6 sec	Yes



Temperature Readings

Temperature Trials	Actual Temperature	Measured Temperature	Error
Trial 1	74.4 ℉	74.25 ℉	0.2%
Trial 2	74.4 ℉	77.3 ℉	3.89%
Trial 3	74.4 ℉	78.06 ℉	4.91%
Trial 4	74.3 ℉	76.35 ℉	2.75%
Trial 5	74.3 ℉	75.18 ℉	1.18%
Trial 6	77.4 ℉	81.48 ℉	5.27%
Trial 7	77.5 ℉	81.23 ℉	5.41%
Trial 8	77.5 ℉	79.86 ℉	3.05%
Trial 9	77.6 ℉	79.9 ℉	2.96%
Trial 10	77.8 ℉	79.9 ℉	2.7%

- Average error of 3.23%
- Testes in multiple environments
- High accuracy

Humidity Readings

Humidity Trials	Actual Humidity	Measured Humidity	Error
Trial 1	53 %RH	53.5 %RH	0.94%
Trial 2	53 %RH	53.4 %RH	0.74%
Trial 3	52 %RH	53.2 %RH	2.3%
Trial 4	52 %RH	53.34 %RH	2.58%
Trial 5	52 %RH	52.91 %RH	1.75%
Trial 6	33 %RH	27 %RH	1.81%
Trial 7	33 %RH	26.66 %RH	1.88%
Trial 8	35 %RH	27.42 %RH	2.25%
Trial 9	33 %RH	27.17 %RH	3.74%
Trial 10	33 %RH	27 %RH	3.55%

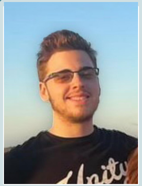
- Average error of %
- Testes in multiple environments
- Accuracy within acceptable range

Challenges Faced-Hardware

Hardware Challenge	Solution
PIR sensor IC presented faulty functionality in not properly filtering data.	Connected to IC pin and used ADC in software for internal logic.
Servo rotational movement was difficult to combine with moving vent slats of physical design.	Physical vent design consists of two sliding pieces, and servo turned into rack and pinion.
PCB housing crafted from wood was difficult to cut and build accurately with available tools, and PIR sensor lens needed to have visibility.	Created 3D model for PCB housing structures, and PIR sensor was put in separate structure to allow angling of lens.
Power board had design flaw- inductors too far away caused too much noise in voltage signal and ESP32 was getting constant brownouts.	Redesigned power board to have switching regulator from 9V to 5V, and linear from 5V to 3.3V. Milled board last minute.

Challenges Faced- Software

Software Challenge	Solution
Connection to the ESP32 from an external web app was sometimes challenging depending on outside variables.	Add the backend relay functionality in case there is a failure for the ESP32 to connect to the web application directly.
Using a PWM signal to control a continuous rotation servo was challenging, would occasionally spin out of control.	Add a small delay after spinning the servo, send a duty cycle of 75% to tell the servo to stop spinning.
On the web application, determining whether to grab data from the ESP directly or from the backend relay was difficult.	Include heartbeat API endpoints, ESP32 upon startup and continuously will POST to a backend endpoint. The connectivity status of the ESP32 can then be retrieved using this endpoint
It was challenging to write code that was power efficient. This was important in making sure that there were no brownout issues with the main power board.	Incorporated an idle mode, where the ESP32 will turn off all WiFi for a small amount of time. During this time, few tasks run, such as reading the sensors, but doesn't respond to requests or send requests to the backend.



Administrative Content- Budget

Part Name	Company	Price
Components	Amazon, Sparkfun	$179.10
Components	Digi Key	$385.93
PCB	JLC	$120.17
Vent/ Housing	Home Depot	$46.53
Prototyping materials	Home Depot & Ace Hardware	$64.55
Total Cost		$796.28

Administrative Content- Work Distribution

Electrical Engineering	Responsibilities
Katerina Brown	Hardware design- battery
	Hardware design- humidity sensor
	Hardware design- controller type
	Hardware design- physical vent system design

Electrical Engineering	Responsibilities
Alexander Hatzilias	Infrared sensor system
	Communication between thermostat sensor and vent PCB
	Hardware design- Mounting design and structure
	Hardware design- temperature sensor

Computer Engineering	Responsibilities
Luke Morrison	Operating system
	User interface that interacts with vent system
	API between the user interface and the vent system
	Software design- programming language

Electrical Engineering	Responsibilities
Isabella Polkey	Hardware design- regulator
	Hardware design- servo
	Wireless communication protocol selection
	Hardware design- occupancy sensor

Progress/Completion Plan

3/14

Midterm Demo

Initial prototype determined, functionality in progress.

3/20

Software Integration

Full integration of code with hardware, debugging

3/29

Mechanical Device Construction

Final prototype of vent system and PCB housing printed and functional.

4/5

Final Filming

Update CDR to become Final Presentation, re-record for Final Demo Video and Showcase Video.

4/11

Meet with Reviewers

Meeting with reviewers to discuss progress and completion before live demo.

4/15

Final Review

Final fixes and tweaks are completed. VISTA functions as specified by project proposal requirements

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