BATS

Group 15 – Up to bat

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Problem Statement

A need exists for researchers to analyze the effectiveness of bat boxes using a device that can collect data on total visits and is easily mountable, all while maintaining the safe and accessible roosting site a bat box provides. Additionally, both the device and the box need to be low maintenance and cost-effective for research.

Interpreted Needs

Group	Interpreted Needs	Importance [See Definitions Table below]
Bats	Box is a suitable temperature, dry, dark, and safe roost site under the conditions of southern Ontario between April and October.	4
	Device cannot interfere with bat roosting or structural stability of bat house.	4
	Box has an open space below with grippy panel for bat access.	5
Analysts	Device can estimate bat house usage accurately and robustly.	5
	Device can also check other data (time, temperature, etc.)	2
	Data collected is organized in a way that can easily be analyzed.	2
	Clear identification of what is being tracked.	4
Maintenance	Requires minimal maintenance at most once per month.	3
	Is easily installable and has its data accessible by non-engineers (users).	3
	Device can be installable onto existing bat boxes of varying sizes.	3
	Has a way to inspect whether bats are present in box.	2
Customer	Is affordable to scale.	3
	Can survive the conditions of being near bats and being in southern Ontario between April and October without needing to be replaced or repaired.	3
	Box is scalable for larger and smaller designs.	1
	Box and device have a long lifespan (10+ years).	2

Requirements

Box is a suitable temperature, dry, dark, and safe roost site under the conditions of southern Ontario between April and October.
Device cannot interfere with bat roosting or structural stability of bat house.
Device can estimate bat house usage accurately and robustly.
Device can also check other data (time, temperature, etc.)
Data collected is organized in a way that can easily be analyzed.
Clear identification of what is being tracked.
Requires minimal maintenance at most once per month.
Is easily installable and has its data accessible by non-engineers (users).
Device can be installable onto existing bat boxes of varying sizes.
Is affordable to scale.
Box and device have a long lifespan (10+ years).

Sensor Benchmarking

/	HC-SR501 PIR	HC-SR04	GP2Y0A51SK0F
Brand	Stemedu	UNIVERSAL-SOLDER	Sharp Global
Detects	Motion based on heat	Interference	Interference
Wavelength	**Passive IR**	**Ultrasound**	**Active IR**
Power Usage	65mA*5V	2.8mA*5V	12mA*5V
Range	3 metres –7 metres	2cm-500cm	2cm-15cm
Size	32mmx23mmx28mm	45mmx15mmx20mm	27mmx10.8mmx12mm
Cost	$18 CAD / 5 parts	$13 CAD / 5 parts	$21 CAD / 2 parts
Mass	12grams	8.5grams	2.7grams

Design A

Sensors and Data collection:

- IR sensor at entrance of bat box

Mounting mechanism:

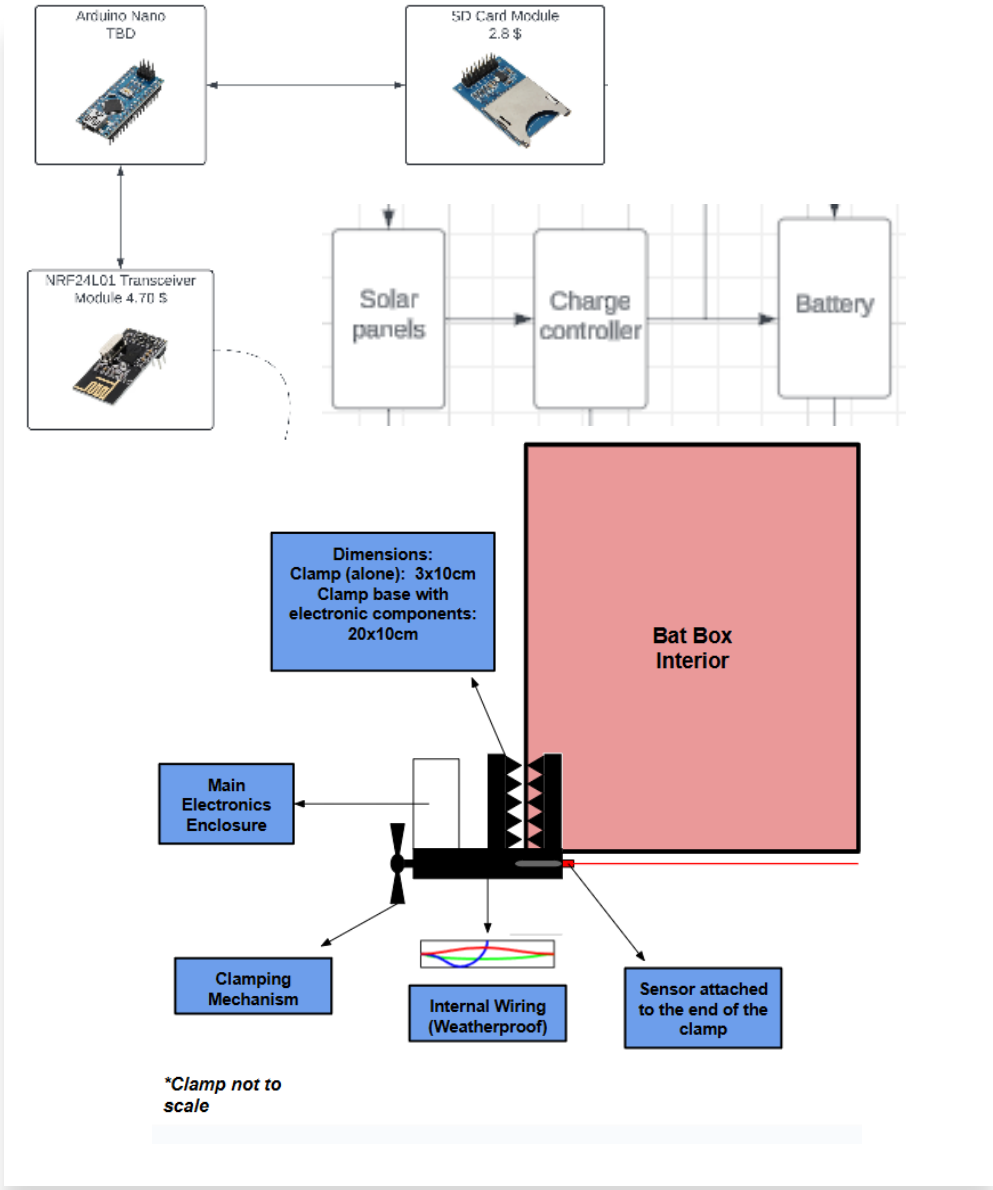
- Device is housed in a clamping mechanism
- Clamping mechanism contains an enclosure for electronic components

Power:

- Solar power in conjunction with a 12V Lithium-Ion battery

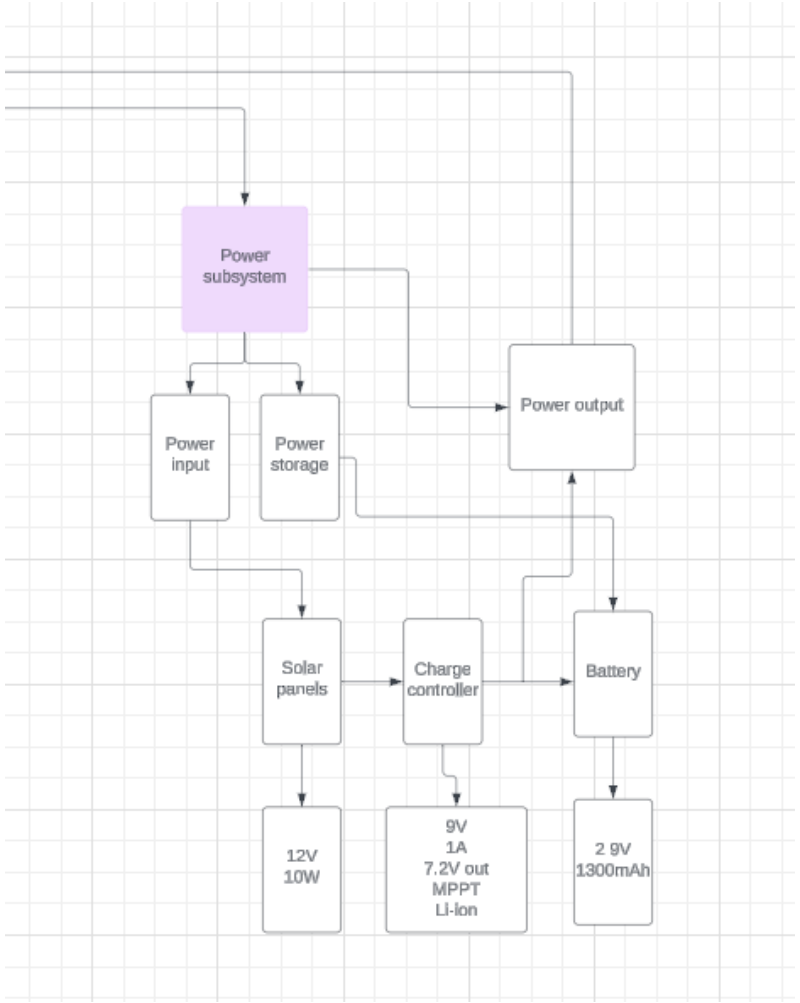
Data storage and communication:

- Wireless communication using a transceiver
- Handheld device
- Option to extract SD card



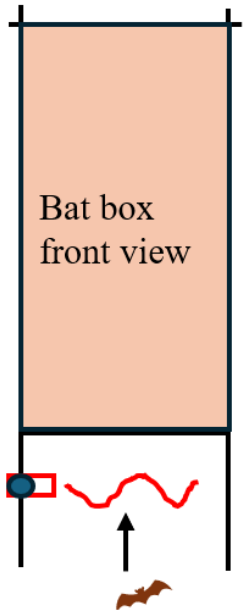
Design A: Closer Look

Power Generation and Storage

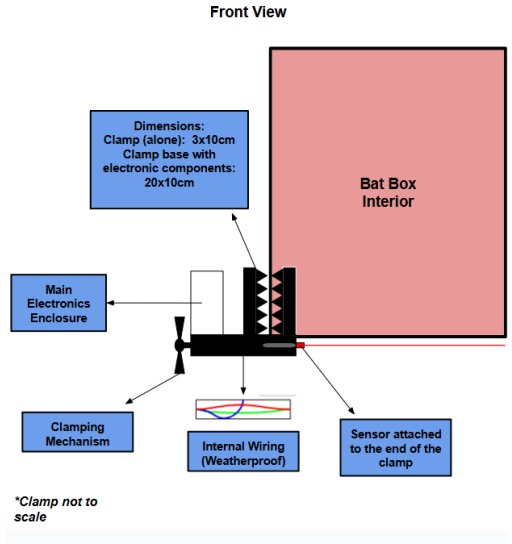


Sensors and Data Collection

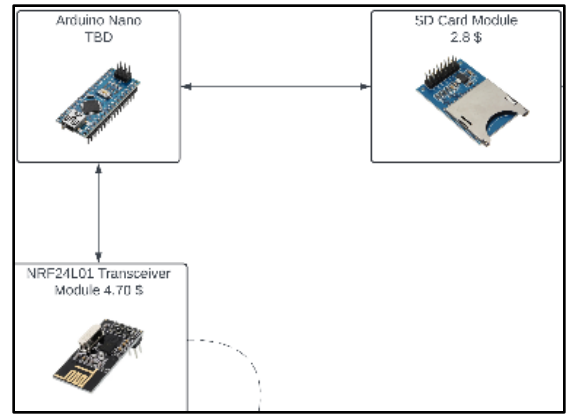
One IR sensor at the entrance



Mounting Mechanism



Data Storage and communication



Design B

Sensors and Data Collection:

- Includes temperature and light sensors
- Through-beam IR sensor

Mounting Mechanism:

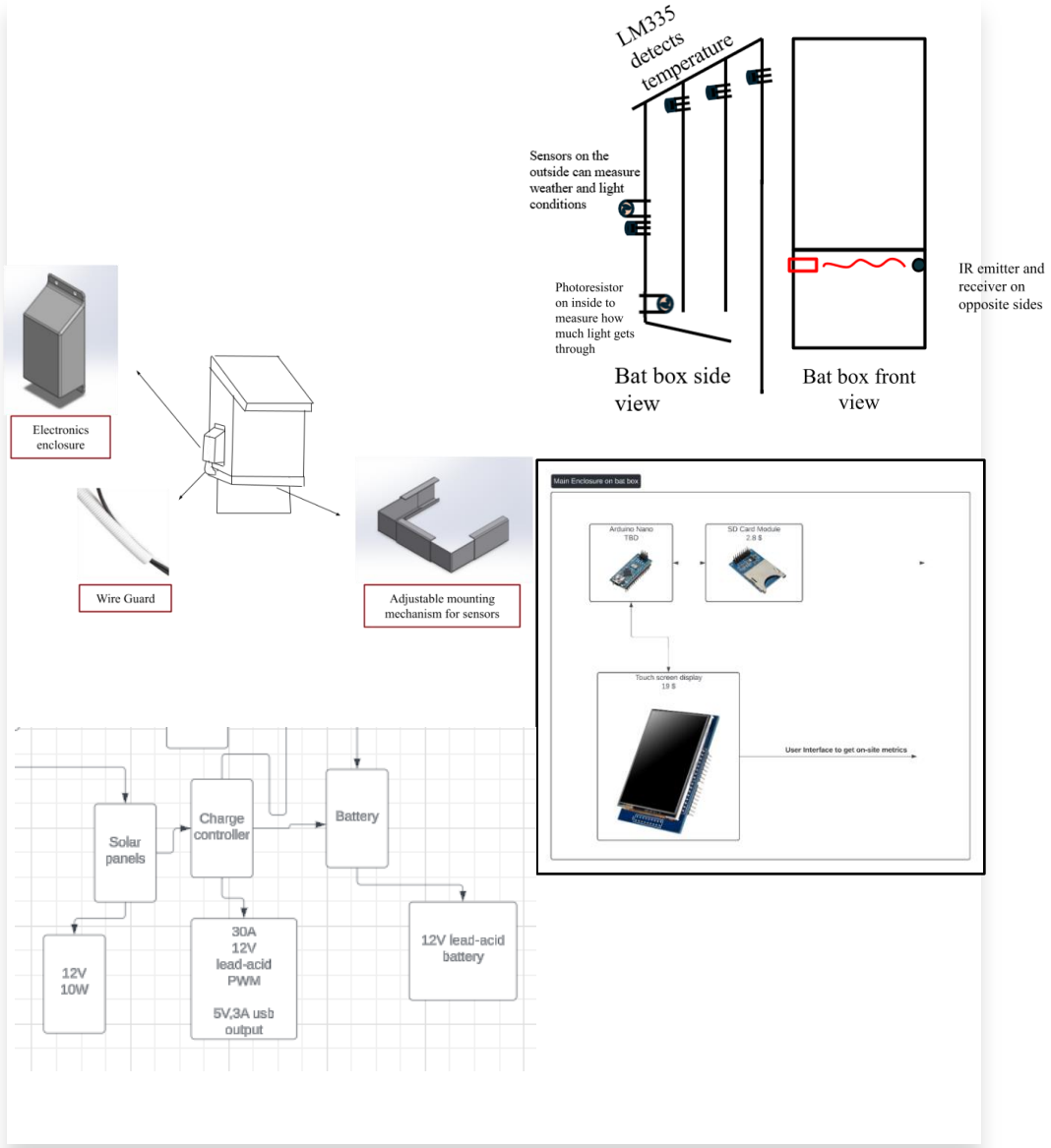
- Adjustable mechanism that is secured to the opening
- Consists of three sides with parts capable of sliding in and out
- Electronics enclosure attached to side

Power:

- Solar panels in conjunction with a 12V Lead-Acid battery

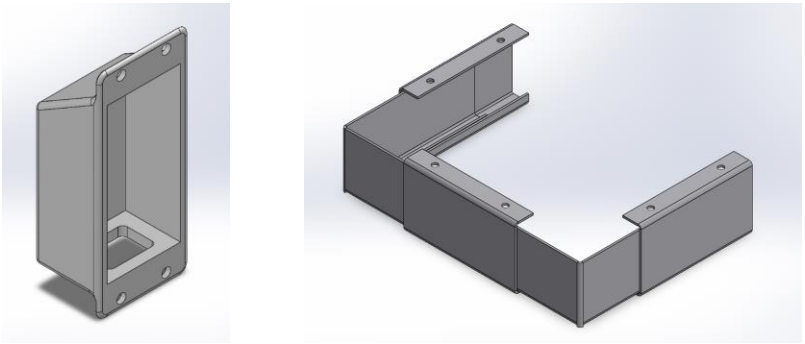
Data Storage and Communication:

- Access to SD card within side enclosure
- SD card used for long term storage

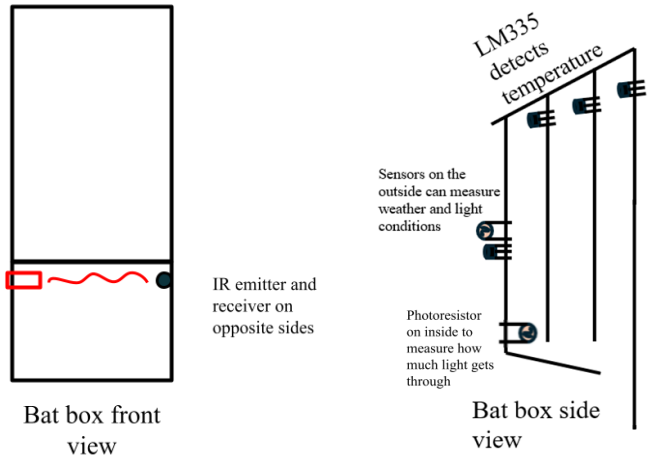


Design B: Closer Look

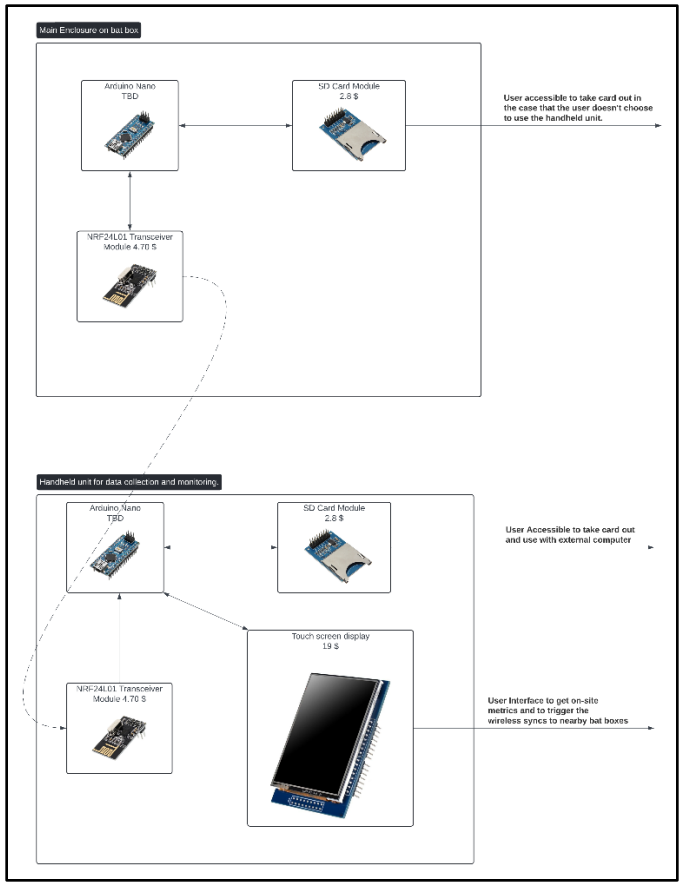
Mounting Mechanism



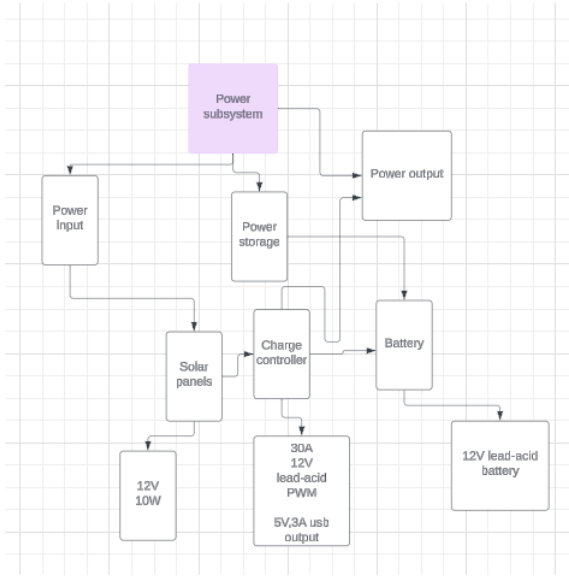
Sensors and Data Collection



Data Storage and communication



Power Generation and Storage




Q&A and Feedback