



UNIVERSITY OF
ILLINOIS
URBANA-CHAMPAIGN

Garden Guardian

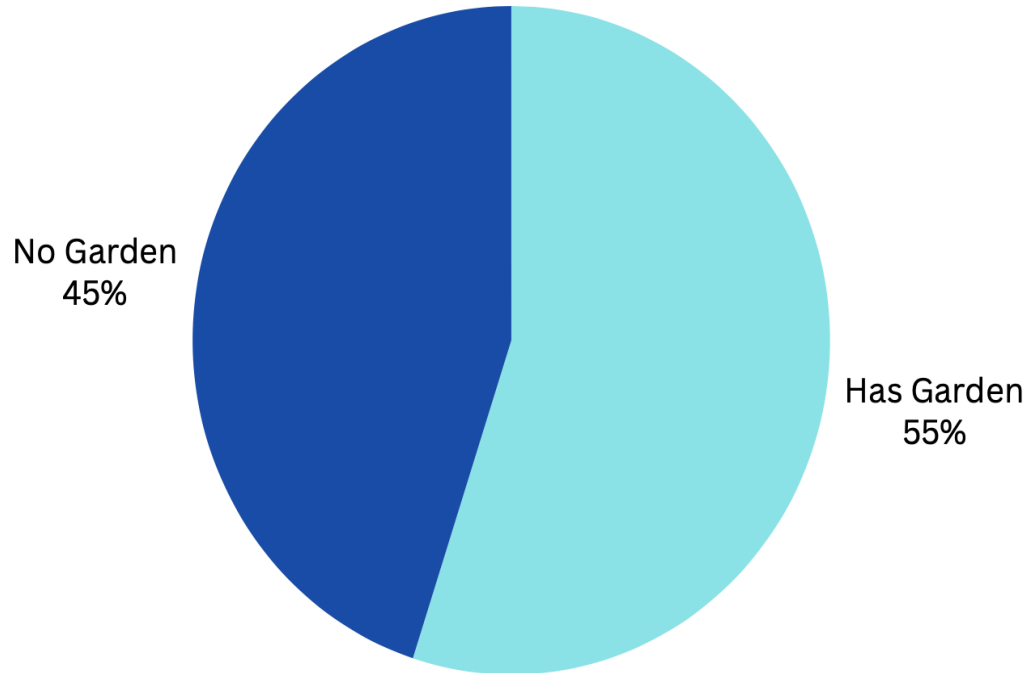
Team 7

Nick Hartmann, Aleah Gacek, Claire McGrath

April 29, 2024

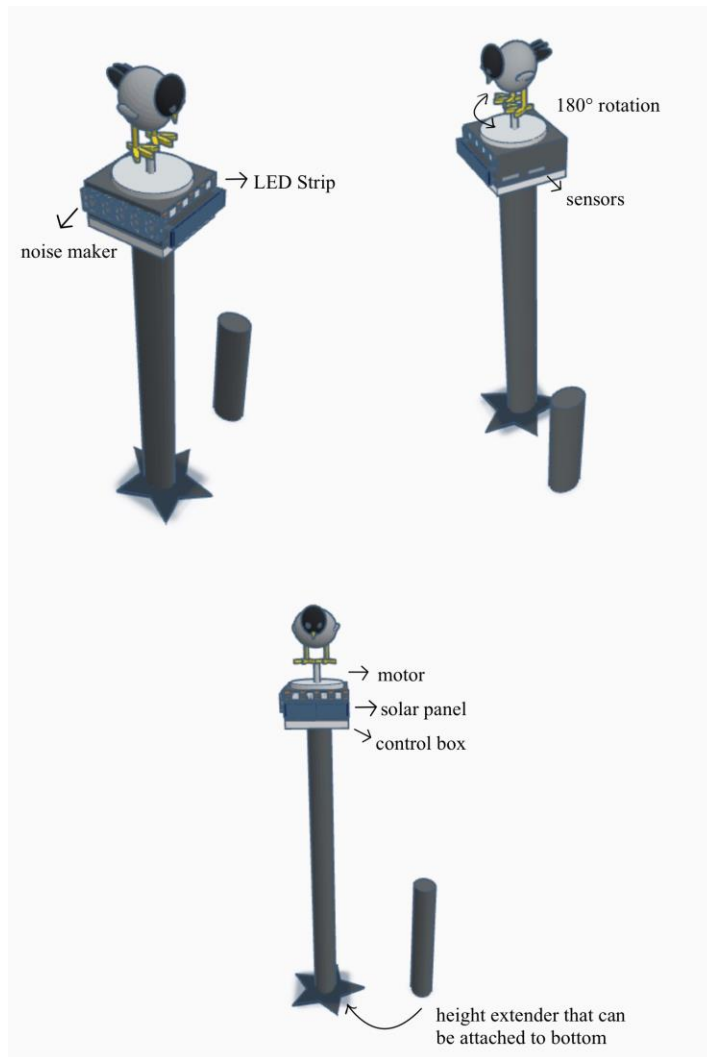
1. **Problem and Solution**
2. **Design, High Level Requirements, & Block Diagram**
3. **Subsystems Requirements & Verifications**
4. **Successes and Challenges**
5. **What Would We Do Differently?**
6. **Further Work**

- **Animals intruding and damaging gardens**
- **Existing solutions all with own limitations**



- **Portable deterrent device**
- **Works 24 hours a day**
- **Solar powered**



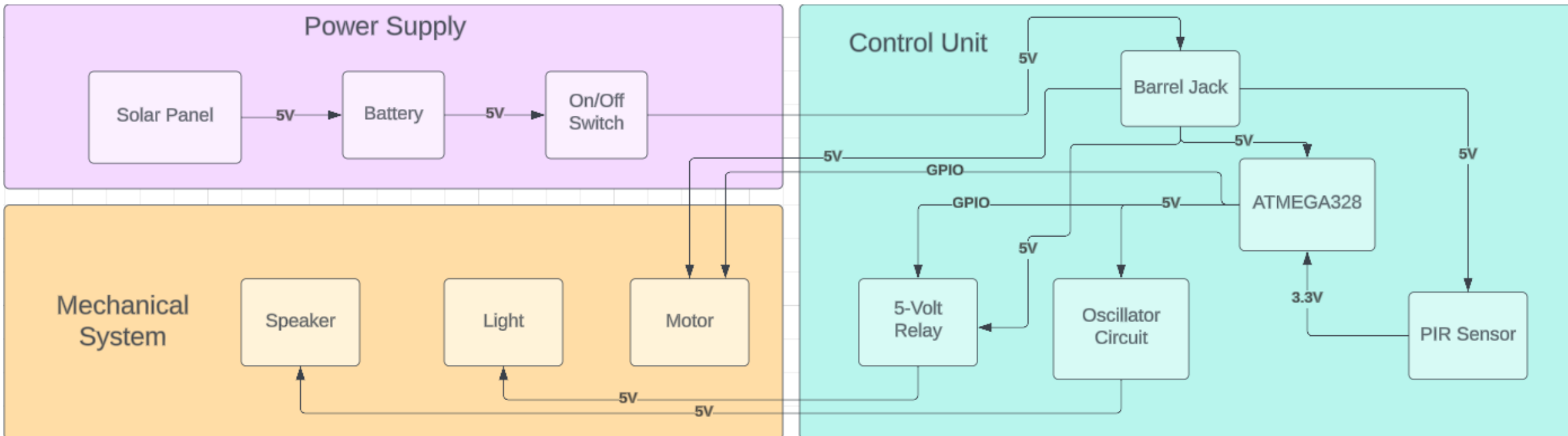


Features

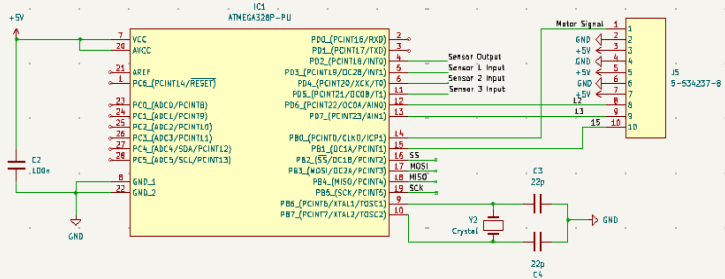
- Stand
- Height
- Solar Panel
- Control Box
- LEDs
- Buzzers
- Motor
- Bird

- 1 Detect motion up to a seven-meter radius and sends a signal to initiate deterrent.
- 2 Determines where the motion is coming from and rotates the front of the bird to face this direction, at a range of 180° rotation and 70 RPM.
- 3 Solar panel can power the device and all its needs at 5 Volts and 10 Watts, without an external power source.

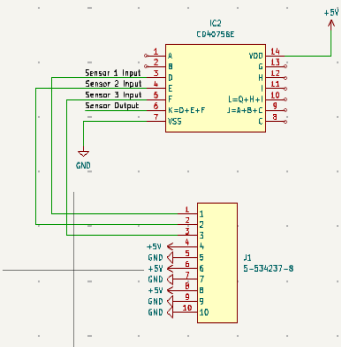
Block Diagram



Microcontroller



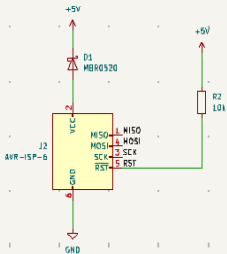
OR Gate



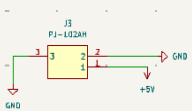
Mounting Holes

- H1 MountingHole
- H2 MountingHole
- H3 MountingHole
- H4 MountingHole

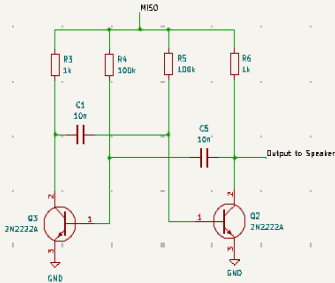
ISP



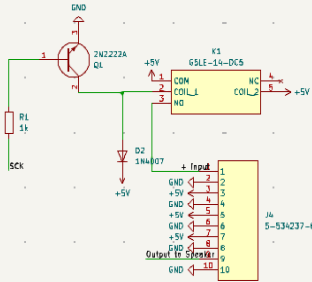
Barrel Jack Connector



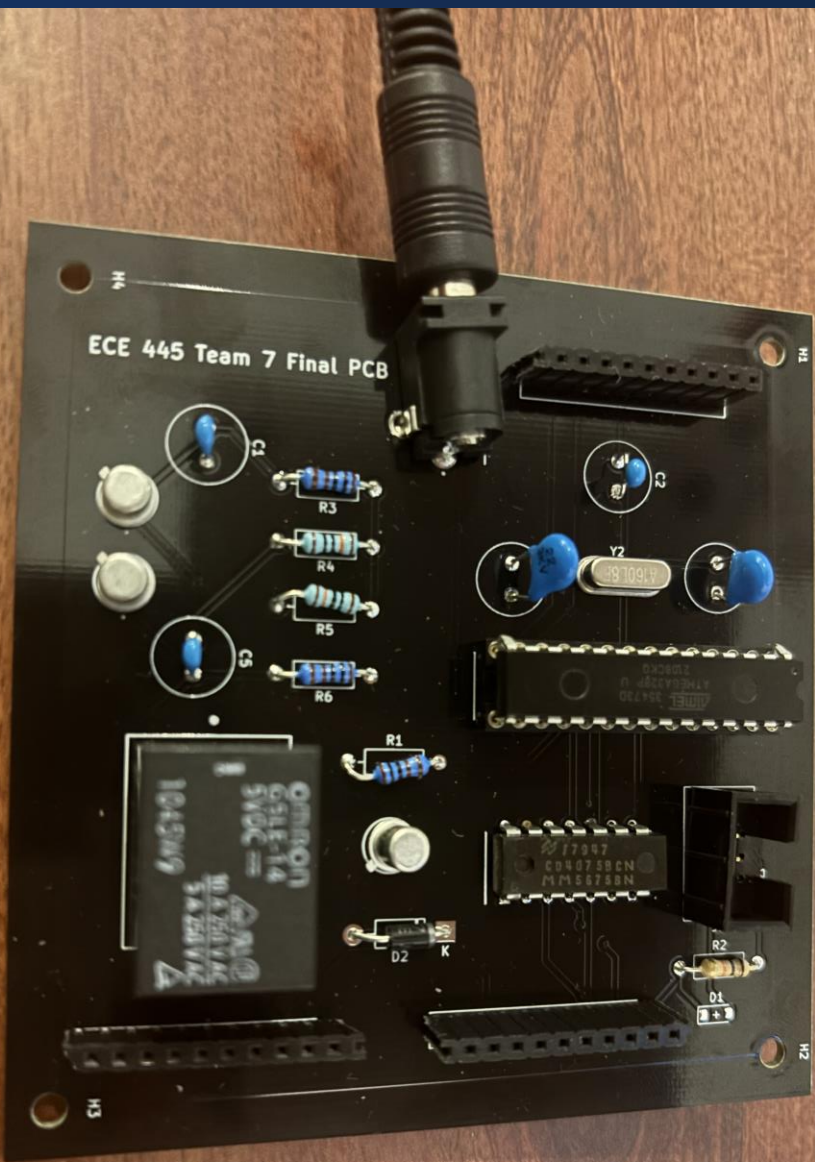
Oscillator Circuit



5V Relay



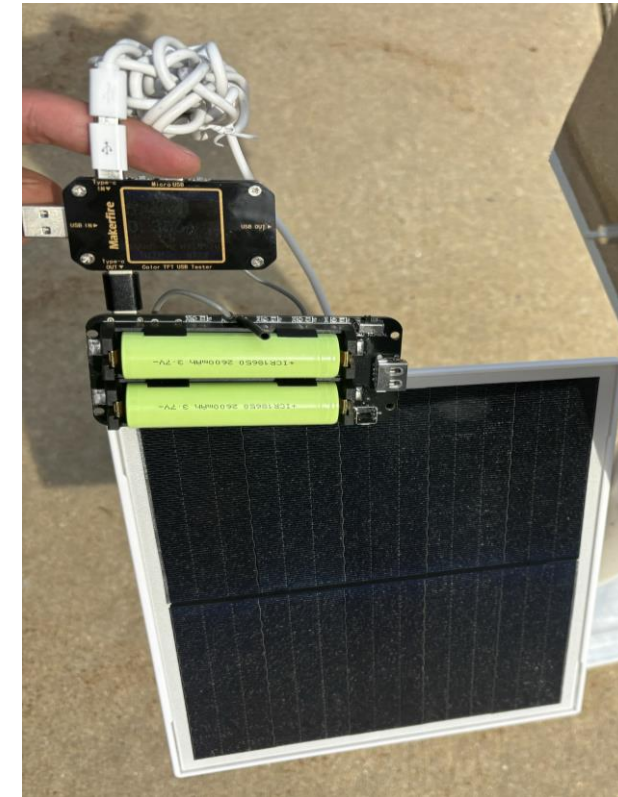
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Size: A3	Date: Rev: 1/1
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1 - Power Supply Subsystem



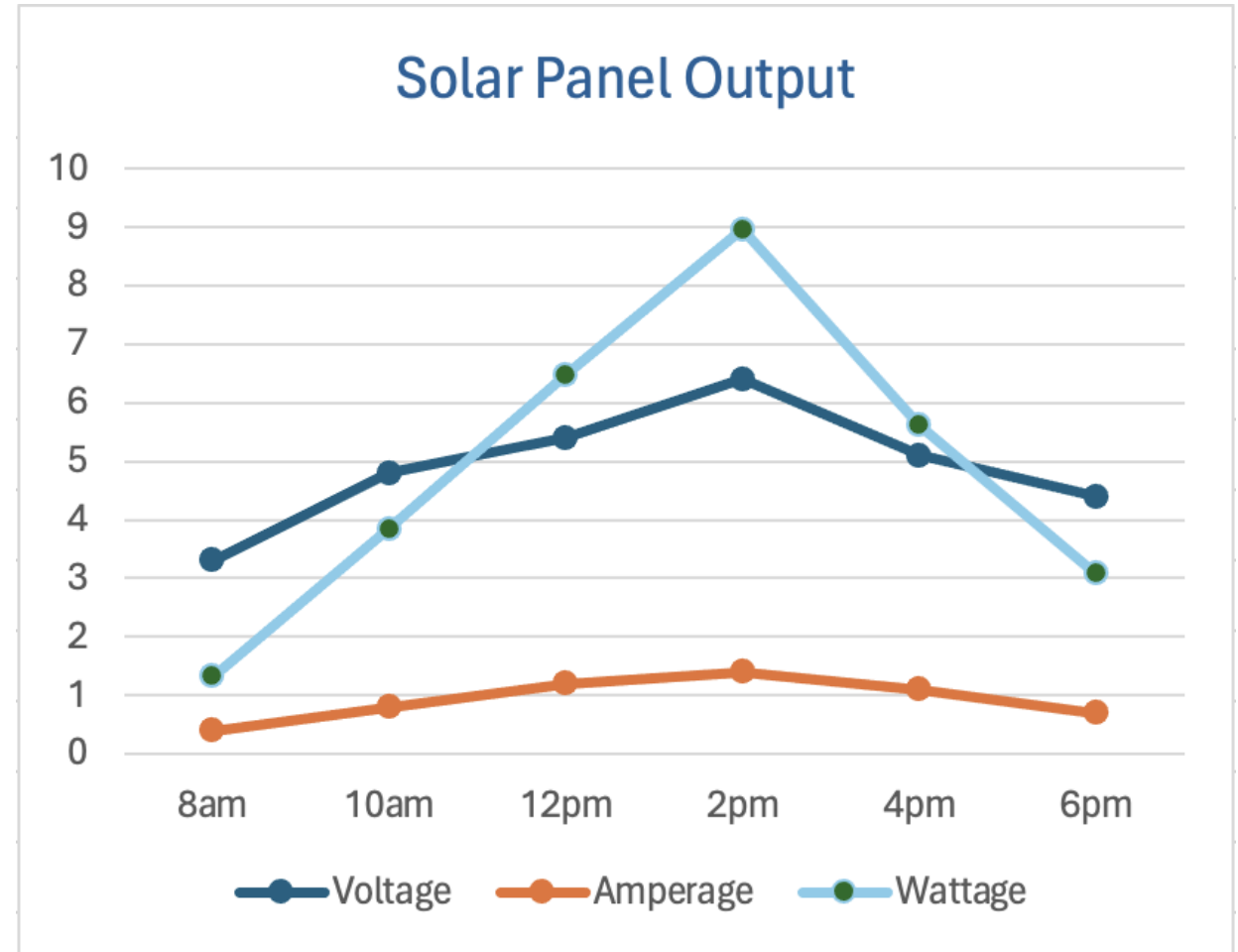
- **Solar Panel rated for 10W and 5V**
- **Battery holder**
- **Lithium rechargeable batteries**
- **Connected to barrel jack on PCB**
- **Supplies 5V for entire system**



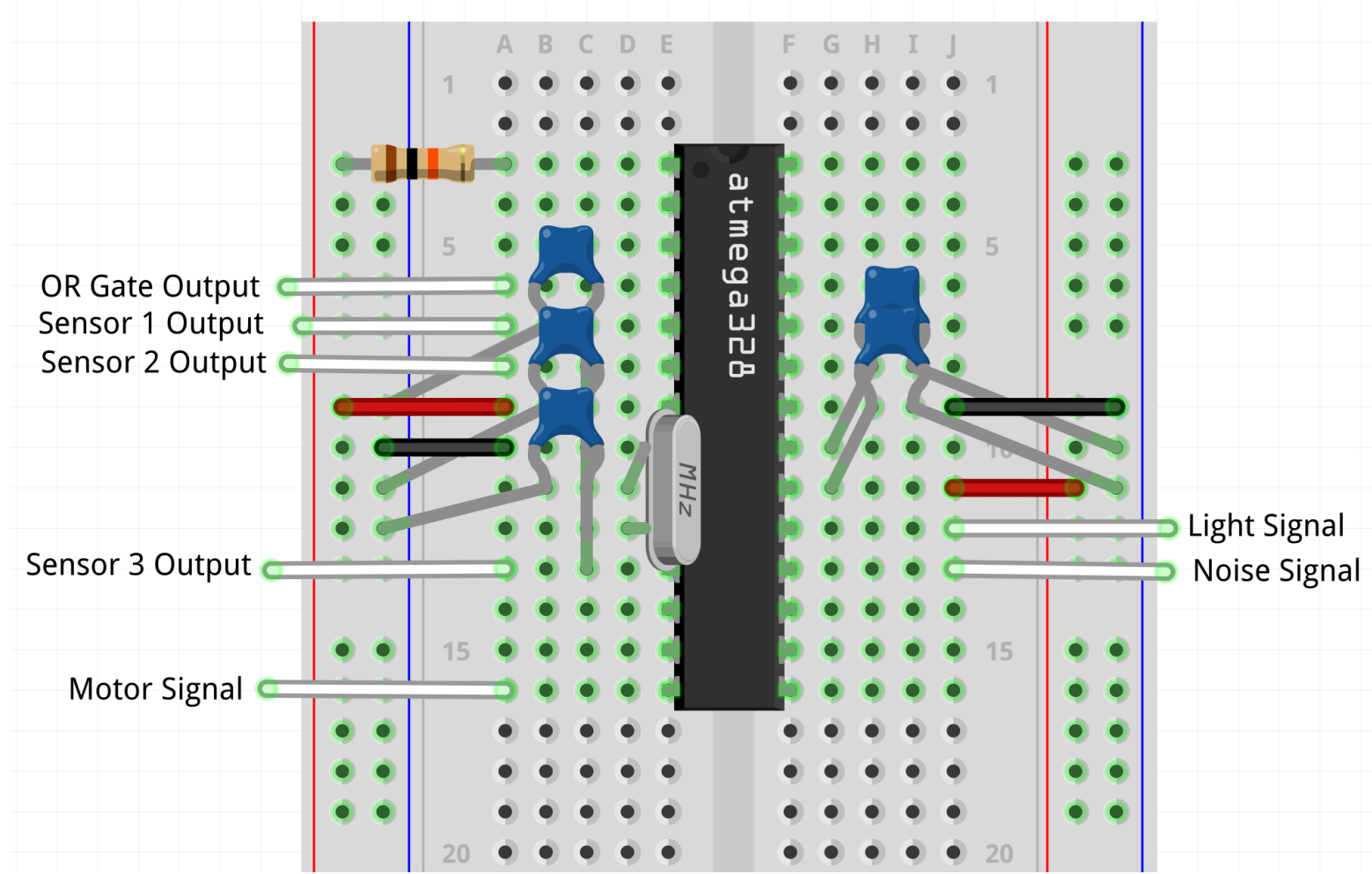
Drawing 6.04 V, 0.420 A, and 2.54 W

Requirements

- Solar panel must be able to supply all power needed for the device
- Battery receives and stores power from solar panel and has voltage of at least 3.7V +/- 5%
- 3.7V source can provide 5V +/-5%



- **ATMega328P chip**
- **AVR-ISP**
- **Crystal Oscillator**
- **Decoupling capacitors**
- **PIR Sensors**
- **Triple OR gate**



Requirements

- PIR sensor can detect motion up to 7-meter radius away
- Microcontroller can tell whether it is day or night
- PIR sensor out remains high for 1 second after no motion is detected

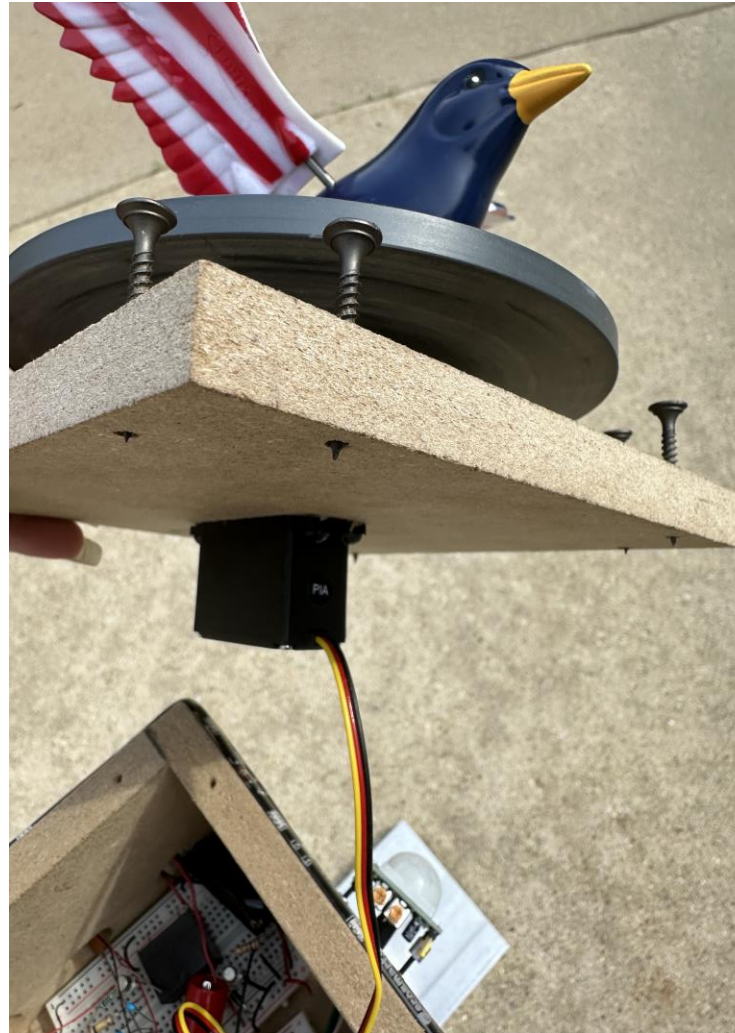
```
16:10:18.510 -> Turn on Buzzers - daytime  
16:10:18.546 -> Move 90 degrees to sensor 2  
16:10:19.513 -> Turn off LEDs  
16:10:19.546 -> Turn off Buzzers
```

Serial Monitor Output

3 - Mechanical Subsystem



- **Motor**
- **LED Strips**
- **Noise Buzzers**
- **5-volt relay**
- **Oscillator Circuit**

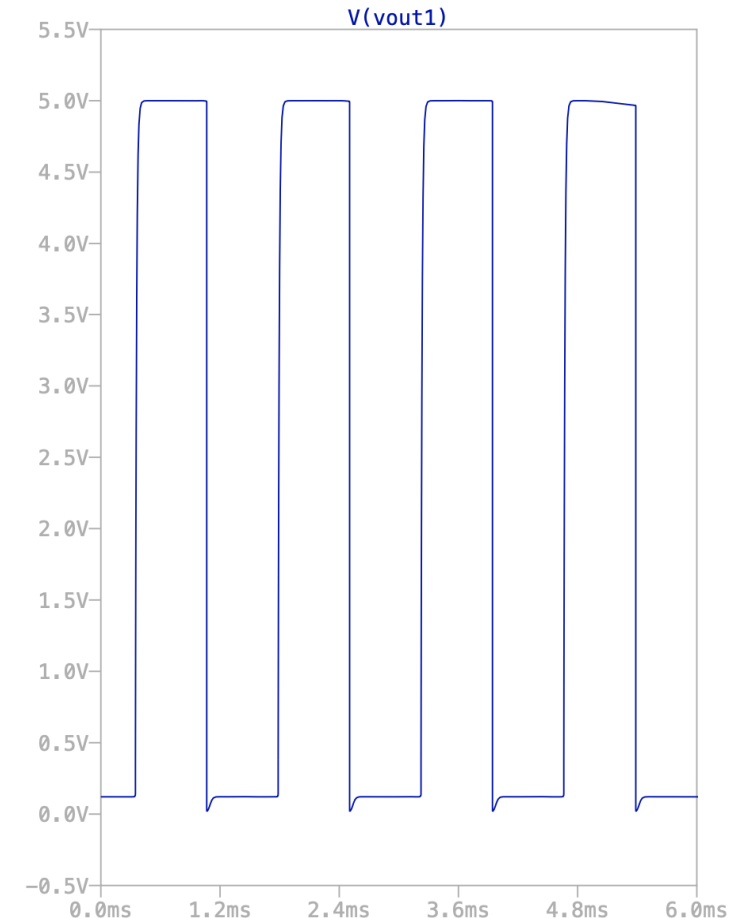


Requirements

- Noise buzzer emits high pitch sound
- Light turns on/off
- Motor rotates correct number of degrees

```
16:25:25.229 -> Turn on LED - nighttime  
16:25:25.260 -> Move 90 degrees to sensor 2  
16:25:26.215 -> Turn off LEDs
```

Serial Monitor Output



Oscillator Circuit Output

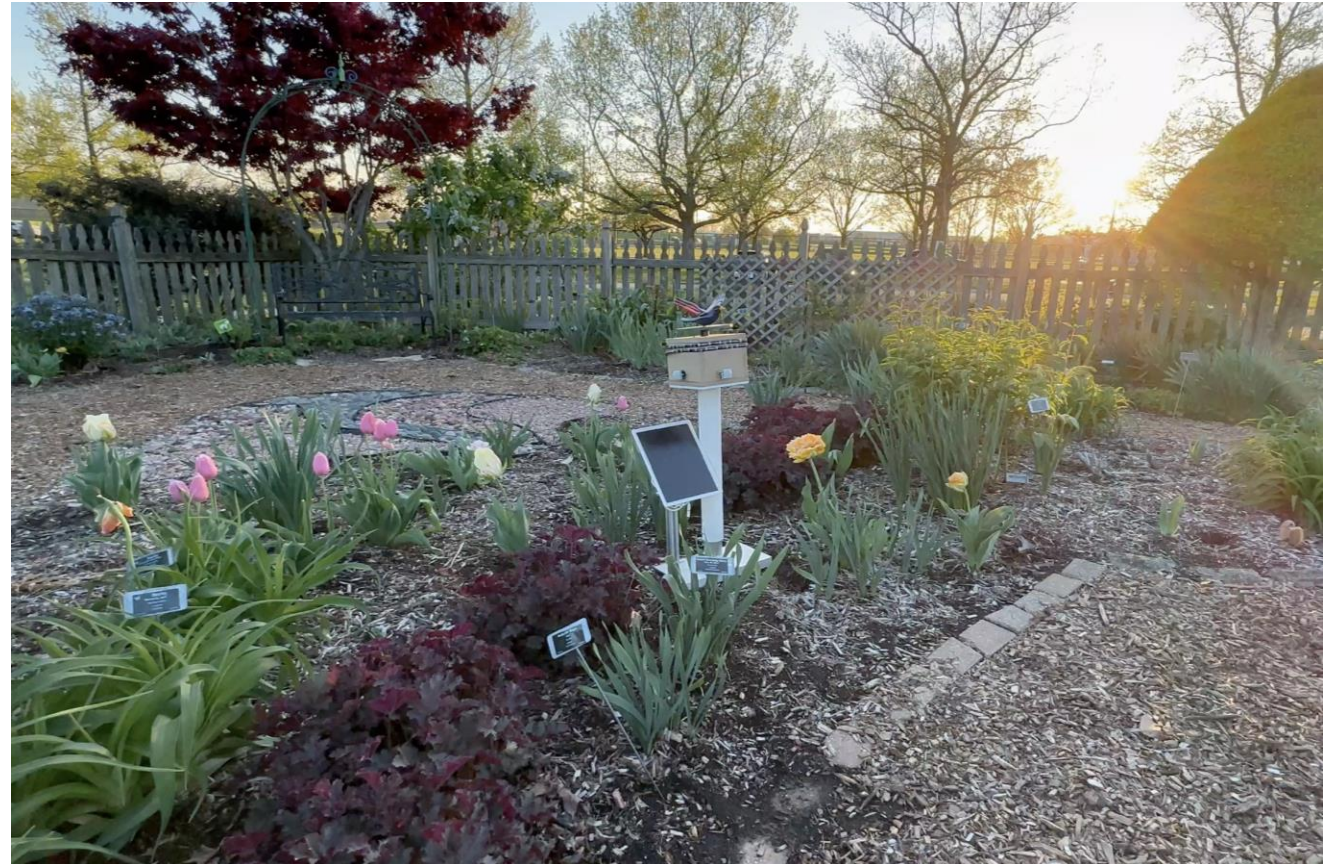
- **Time Intervals**
- **PIR Sensors**
- **LEDs vs. Buzzers**
- **Motor**

```
16:34:11.685 -> Turn on LED - nighttime  
16:34:11.717 -> Move 180 degrees to sensor 3  
16:34:11.749 -> Attach Servo Motor  
16:34:11.783 -> Rotate 180 degrees  
16:34:12.736 -> Detach Servo Motor
```





- **High-Level Requirements**
- **Subsystem Integration**
- **PCB experience**
- **Collaboration & Teamwork**



PCB Integration



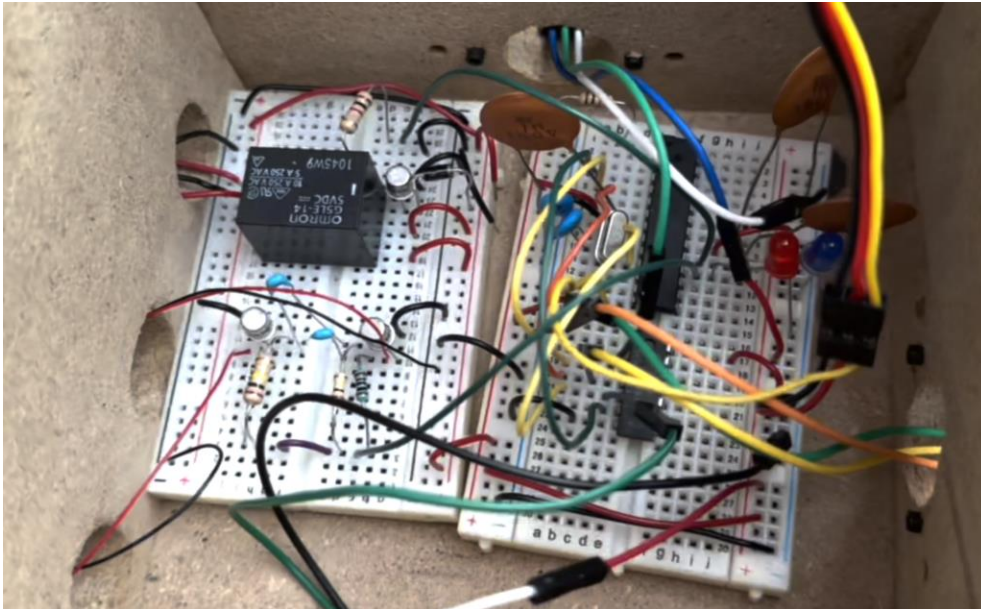
Battery Module



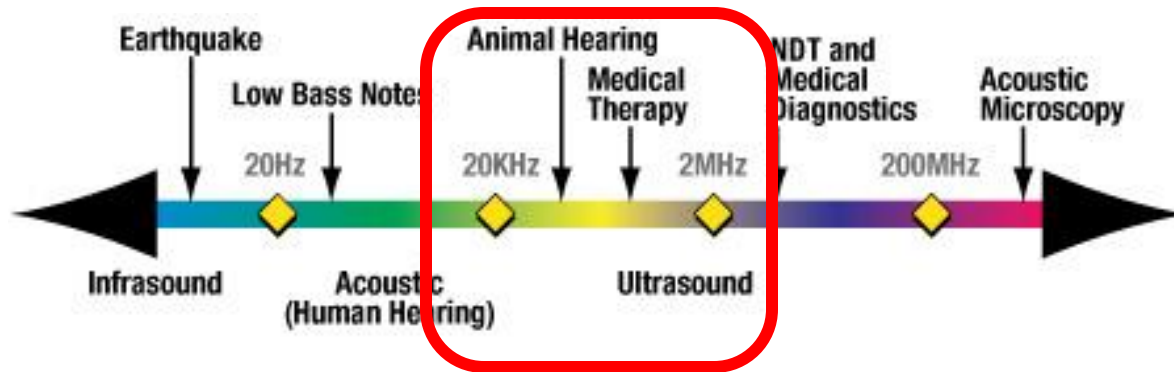
What Would We Do Differently?



- **Streamline PCB Troubleshooting Process**
- **Mitigate Sun Interference with PIR Sensors**
- **Enhance Parts Procurement Efficiency**



- Enhance Animal Deterrence
- Expand Device Field of View
- Implement Day/Night Detection





Thank you!

Any Questions?

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The Grainger College of Engineering

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