

#### **High Frequency Deer Deterrent** Jeffery Williams Morgan McVay Alex Bernstein Florida State University Panama City College of Engineering

#### FLORIDA STATE UNIVERSITY



### **Our Mission**

- To design a device powered by clean energy to greatly reduce damage/fatalities caused by deer on other animals on highways.
- Average of 175 200 deaths and over 10,000 injuries occur yearly in the US
- Odds of hitting a deer are 1 in 116 in the US
- Accidents peak during mating season in the months of October – December
   [1]

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**Methods** 











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- PV panel converts solar radiation to DC power
- Power from the PV panels is charged using a charge controller
- A timer circuit turns on a raspberry Pi once every 5 min
- Raspberry Pi takes a picture via a camera
- Using Artificial Intelligence, it is determined if the picture contains a deer
- If a deer is detected, A high frequency signal is produced to deter deer?
- Image in converted to an RF signal, transmitted, received, and then converted back to an image
- Image and data is stored at main location



#### **Circuit overview**







## Methods

### Solar Design

- Solar panel placement
- Solar radiation date for area
- Hardware chosen

Month	Average W/m <sup>2</sup> /Day
Jan	442.60
Feb	520.81
Mar	553.42
Apr	554.10
May	582.39
Jun	595.48
Jul	584.74
Aug	588.67
Sep	514.98
Oct	522.30
Nov	471.14
Dec	420.36



#### Methods

## Amplifier circuit Design

- Producing proper Pulse Width Modulation (PWM)
- Amplifies input voltage
- High temperature, Fast Switching, with a voltage of 55V





## **Methods**

 
 Convolutional
 64
 3 × 3 / 2
 128 × 128

 Convolutional
 32
 1 × 1
 1× Convolutional 64 3×3 Residual

nvolutional 128 3 x 3 nvolutional 64 1 x 1 3×3/2

Convolutional 256 3 × 3 / 2 32 × 32 Convolutional 128 1 × 1 8× Convolutional 256 3 × 3 
 32 × 32

 Convolutional
 512
 3 × 3 / 2
 16 × 16

 Convolutional
 256
 1 × 1
 1

 Convolutional
 512
 0 × -1
 0

Convolutional 1024 3 × 3 / 2 8 × 8 Convolutional 512 1 × 1 4× Convolutional 1024 3×3 Residual

Convolutional 128 3 x 3

8× Convolutional 512 3×3

Residual

 $128 \times 121$ 

 $64 \times 64$ 

 $16 \times 16$ 

 $8 \times 8$ Olahal

#### Programming

- Yolo v3
- Convolutional neural network
- Interpreting output













## Results

- A high frequency sound was achieved between 27kHz and 32kHz
- System is powered by solar and can work for up to two days without any sunlight
- Artificial Intelligence computer vison was able to successfully detect objects



## **Discussion & Conclusions**

#### future directions:

- Company
- Deer/other testing
- Building database
- Becoming more efficient on deterring deer within a 100mile road coverage



## Thank You!



# References

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involving deer:

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