

# AME 498/598

Final Project Pitch

# Instructions

- Use 1-2 slides for each group/individual project
- Bullets points
  - Motivation
  - Problem Statement
  - Methods
  - Expected Results
- Use diagrams/pictures/data flowcharts as necessary.

# My super project

## Motivation

Why do this project?

## Background (optional)

## Proposal

- Deliverables
- Timeline
- Budget/equipment

## Results

- Cost metrics
  - power/bandwidth/frame rate/efficiency

# Joseph G.'s Project - IoT Shed

## Motivation

- Problem: Opening/closing shed roof when it rains outside
- Solution: Automate opening/closing the shed roof slits when rain is detected
- Solution: Use ESP32 to also automate other tasks & provide easy interface

## Proposal

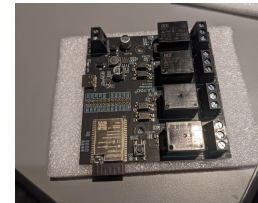
- Deliverables
  - Short video demonstrating everything working
  - Documentation (B.O.M., references, etc.) & code on GitHub
  - Instructions so anyone could replicate it
- Timeline
  - Week I: Create server/website & connect to database, get equipment
  - Week II: Test each sensor individually then combine all sensors and code
  - Week III: Transmit data to website & store in database
  - Week IV: Integrating, testing & debugging, finalizing documentation
- Budget
  - \$250

## Results

- Cost metrics
  - Power: Everything runs on a 12V battery
  - Price: No more than shown budget
  - Sensor/actuators/website work as intended autonomously
- Takeaway from Project
  - Using ESP32 and an array of sensors & actuators
  - Creating a server for a website w/ a database using HTML, CSS, Javascript, NodeJS, MongoDB

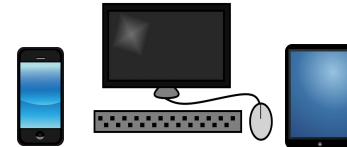


# Joseph G.'s Project - IoT Shed



Server  
(Website)

↑ Request  
↓ Response



Clients

# Harrison Hong

## Motivation

- I want to be able to monitor soil moisture of house plants. This adds convenience as you could easily find out if the plants need water and have them be automatically watered.

## Materials

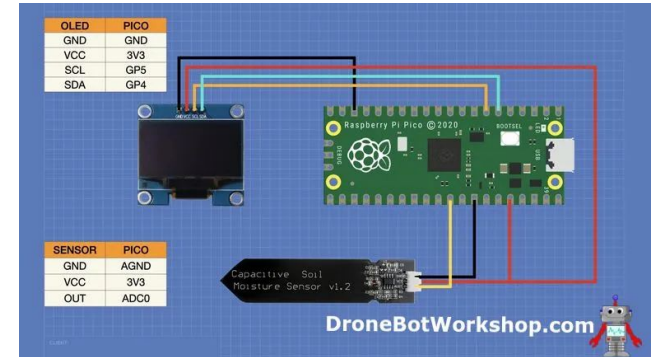
- Capacitive moisture sensor connected to a microcontroller (ESP32)
- [Water Solenoid Valve \(12V\)](#) takes in water from a bucket
- 12V Power Adapter
- [Relay](#)
- 

## Proposal

- The moisture sensor will connect to the microcontroller which will send data to a server. The data readings will be output into a graph. Valve will switch on to water the plants based on readings.

## Results

- Metrics will include latency of the readings, framerate, and cost of setup/maintenance



# Cristian Munoz Project

## Motivation

### Parking sensor on car WITH distance display showing

Typically cars have a parking sensor that notifies the driver with a noise if they're too close or too far, similarly I thought of creating something in that realm but with a display showing the actual distance of the object in front of the vehicle so you aren't guessing how far you are.

## Proposal

## Results

- Cost metrics
  - power/bandwidth/frame rate/efficiency

# Ritik Patel - Smart Parking Spot Finder

## Motivation

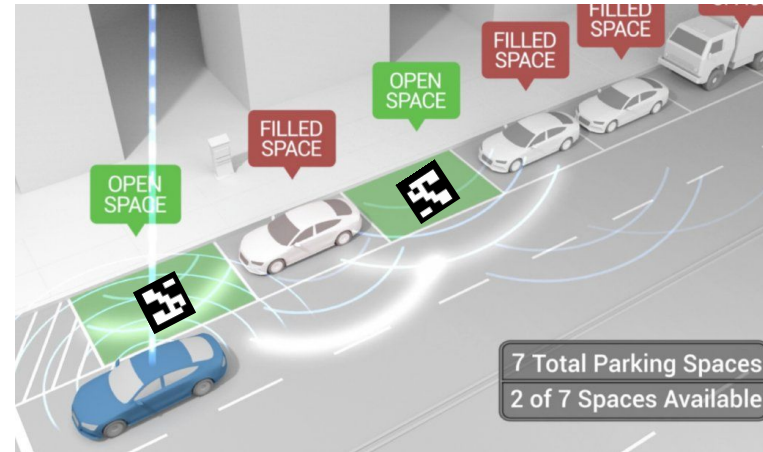
- Many people including myself have been late for a meeting, class, etc. due to spending too much time looking for a parking spot.
- This Project would demonstrate a way for drivers to know which spots are available as soon as they enter the lot/garage.
- I want to create a user friendly interface for drivers to easily understand how the system works

## Proposal

- Deliverables
  - Video demonstration on how the project works both from the user end and on the back end
  - Parking lot model with camera setup connected to ESP32 chip
- Budget/equipment
  - Should be under \$100
  - Aruco markers to identify each parking spot
  - Camera(most likely will use webcam for better quality)
  - ESP32
  - Garage/Lot model
    - Poster Board, Printable stickers, paint
  - Tripod or 3D printed camera stand

## Results

- Cost metrics
  - Each time driver/user enters, request is sent for updated screenshot and log of parking spaces





# Connor Nail's Project

## Motivation/Background

For my research I have built a custom robotic arm that is designed to mimic the motion of a user's arm. The user provides inputs to the arm through the use of an Oculus VR Headset and controllers.



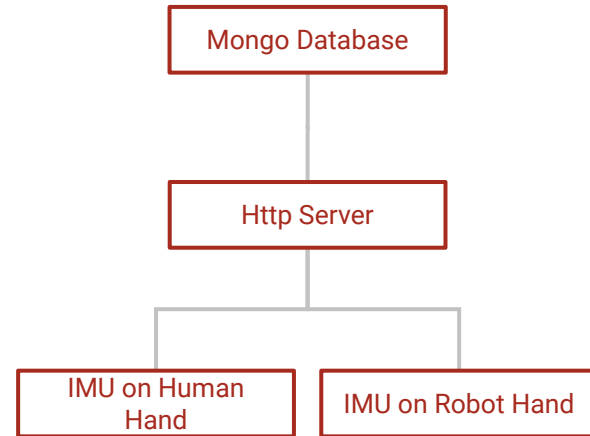
# Connor Nail's Project

## Proposal

- Deliverables:
  - 2 IMUs will be used to track the position and orientation of both the robotic arm and the users human arm. This data will be sent through a websocket server on an ESP32 to a http server and then to a mongo database. Analysis will then be performed on the data to validate the accuracy of the system.
- Timeline:
  - Completed by the end of the semester
- Equipment:
  - 2 IMUs
  - 1 ESP32 micro controllers
  - Robotic arm system

## Results

- Cost metrics
  - Similarity of position and orientation data
  - Frame rate of data collection



# Brandon Evan's Project

## Motivation:

- To create a web app controlled LED lighting system.
- Want to use a web app a user can remotely control led color, pattern, duration, and (tentative plan) sync pattern to music.

## Deliverables:

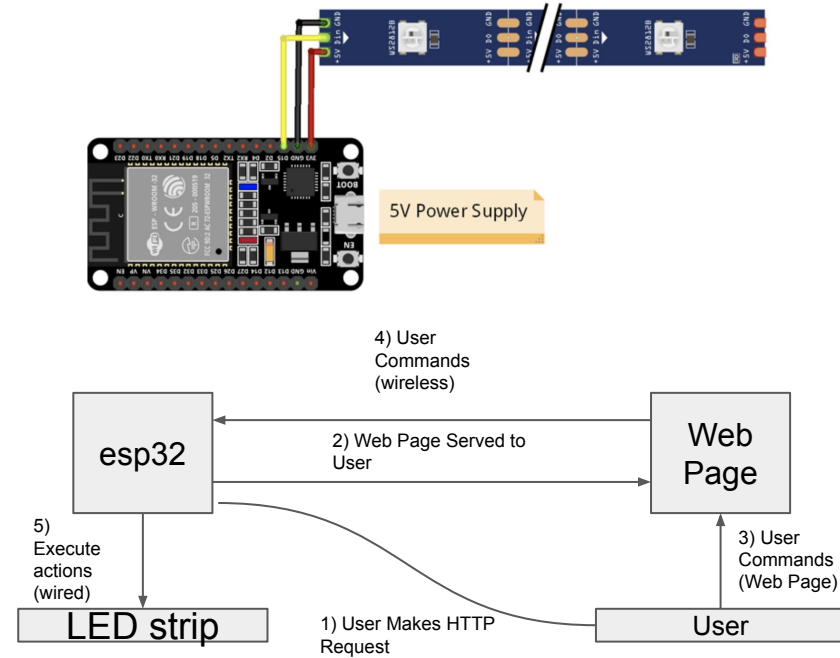
- Esp32 controlled NeoPixel led strip mounted to the ceiling with wifi communication.
- Web pages to allow for color and pattern control of the led lights.

## Method:

- ESP32 will be an async web server on a wifi network serving the web pages to clients.
- Webpages served by esp32 will use HTTP to control leds.
- Any device on same wifi network as esp32 web server enters esp32 ip address in address bar to access led control web pages.

## Results:

- User entered commands should correctly display on the led strip.
- Led should stay on last command until a new one is received.



# Ishrat Lallmamode's Project

## Motivation

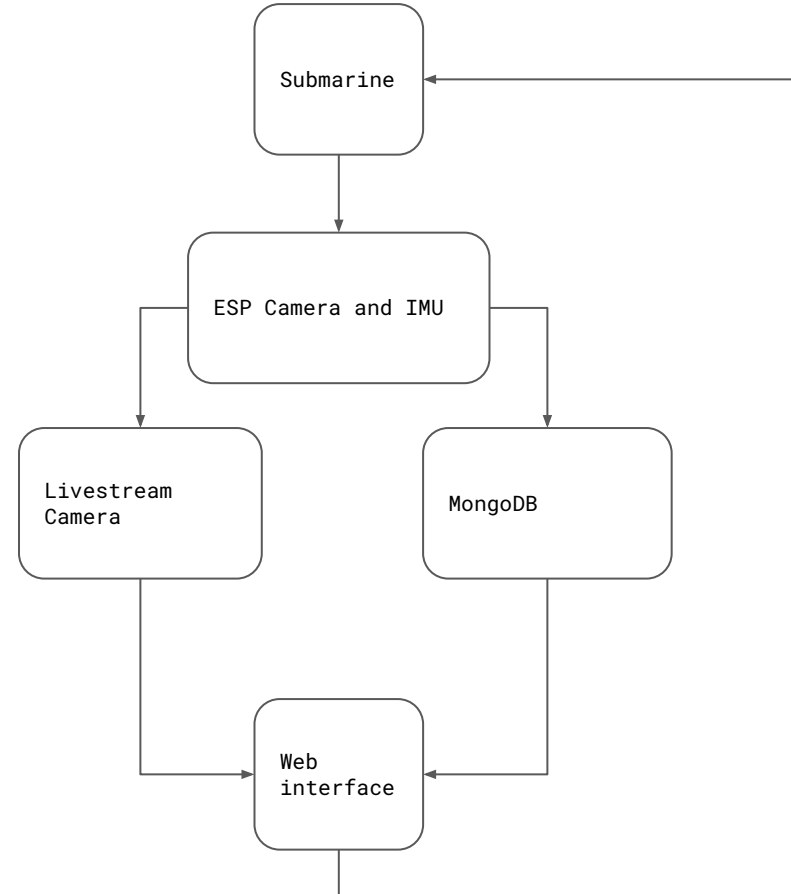
I want to be able to stream camera and IMU data from a chip from a lego submarine to a front-end interface for viewing data and streamed video

## Proposal

- Deliverables: Stream Camera and IMU data from a submarine
- Method: See Diagram

## Results

- Quality data streaming and web control interface



# Poojith's Project

## Motivation

As an extension to one of my projects, the aim of this project is to create a system, that can predict an optimal crop suitable to a soil based on the soil conditions like pH, water content, its nutrients etc. and climatic conditions.

## Proposal

- Deliverables

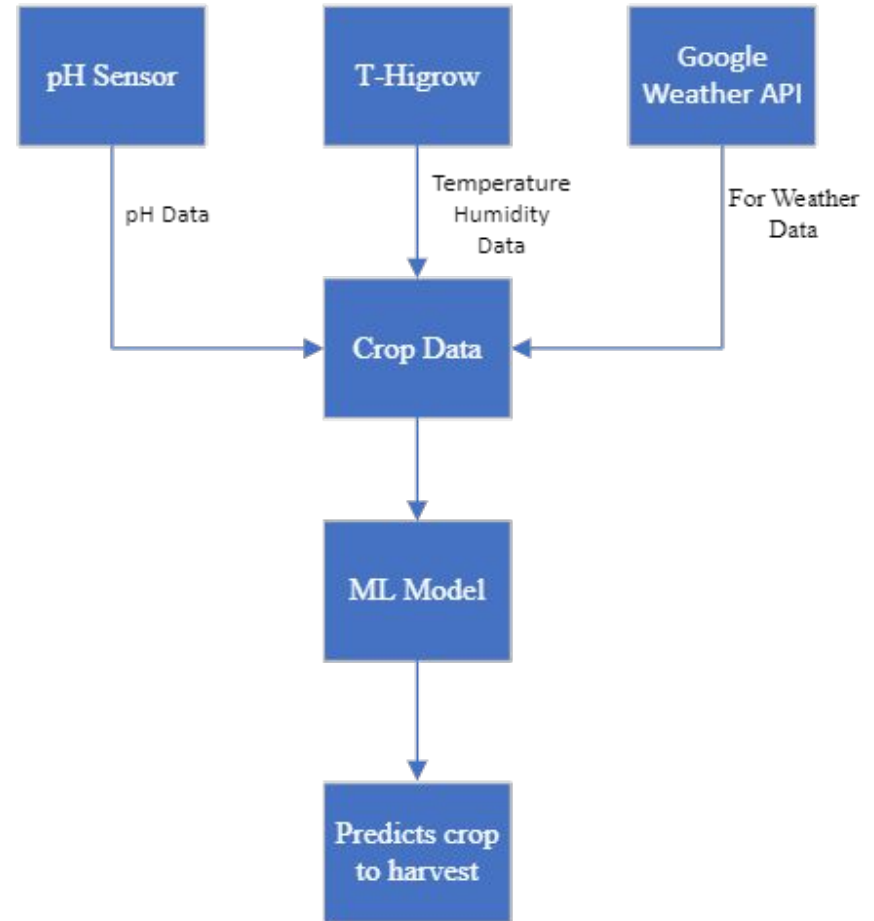
ESP32/Arduino controlled sensors with Google API to predict rainfall and get past year weather data and finally run this through a ML model (PoC) to predict harvest type

- Equipment

ESP32/Arduino/Raspberry pi, pH Sensor, T-Higrow ESP32, Solenoid Valve, Relays or Transistors (as switch)

## Results

- Predict the type of crop to be harvested for greater profit



# Venkat Rebba's Project

## Proposal

Send a notification with a picture if any unknown person enters the home territory

## Methods:

- Use a face-detection AI model on the RPi3 board that has access to a camera.
- Upload image to GCS to trigger an automatic message to Discord

## Equipment:

- RPi3
- Camera

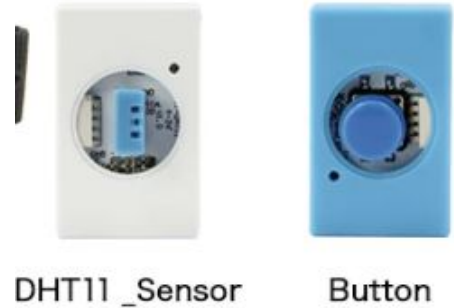
## Results:

Automatic Message to Discord



# Ke D's Project - Door Alert

- Motivation  
In my life, I have found that if there is no doorbell installed, then sometimes people may not hear the knock on the door, especially if one lives in a house rather than an apartment. And Door alert can also alert people if a stranger is trying to enter the house.
- Method  
ESP32/Arduino, Camera, Button, T-Watch Door Contact sensor
- Results  
A doorbell with a button as well as a camera. The doorbell can be connected to the occupant's cell phone, and the phone sends an alert if someone presses the button.



# Shawn Hutchison's Air Quality Monitor Project

## Motivation

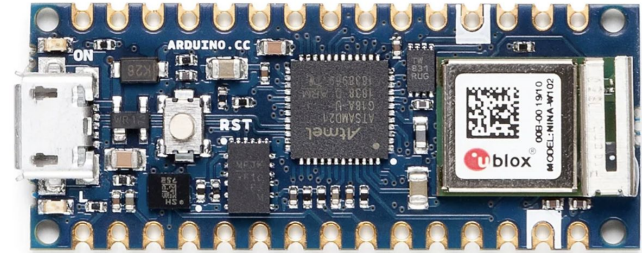
- Poor air quality can have long-term negative effects on allergies and health in general.
- Unless the air is obviously toxic, many can live/work in environments with poor quality air and be completely unaware that the low air quality is negatively affecting them.

## Proposal

- Build an Arduino based air quality monitoring system with local and hopefully remote sensing capabilities.

## Results

- An air quality monitoring system which shows Temperature, Relative Humidity, CO2/VOCs and general dust/particulate levels.
- Display air quality locally via integrated screen or colored light indicator.
- Display air quality levels online via dashboard.





# Luke Buneo Project

## Motivation

- Utilizing a sensor for home application in preventing floods and leakage, ultimately preventing damage.

## Proposal

- ESP32/Arduino, and a custom laser cut enclosure to host sensor and electronics.

## Results

- Preventing flood damage



# Noah Toth and Noah Youngs Project

- Motivation
  - We thought using a breathalyzer and face recognition will be fun
- Problem Statement
  - The project is a prototype model of an access control device that would recognize employees and check if they are coming into work drunk
- Methods
  - MQ3 Analog Alcohol Sensor
  - ESP32-CAM with OpenCV Face Recognition
  - Cheap NFC Door lock mechanism
- Expected Results
  - The door or cabinet will be unlocked only when
    - Employee is identified and alcohol is not detected



# Qyania Jimenez's Project

## Motivation:

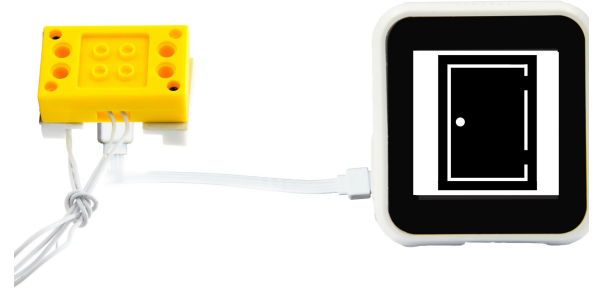
- To create an security system designed specifically for a bedroom
- The security system would consist of a camera and be able to sense if the bedroom door is opened
- I want to create this project to aid people who live with a housemate who invades their personal space i.e. bedroom

## Proposal:

- Deliverables: ESP32-CAM and T-Watch Door Contact sensor

## Results:

- If the bedroom door is opened the camera will start recording or snap a picture for the owner to look at



# Mohan Pushadapu's IoT Project

## Motivation

To keep track of family members whereabouts, and it looks like a fun project.

## Background (optional)

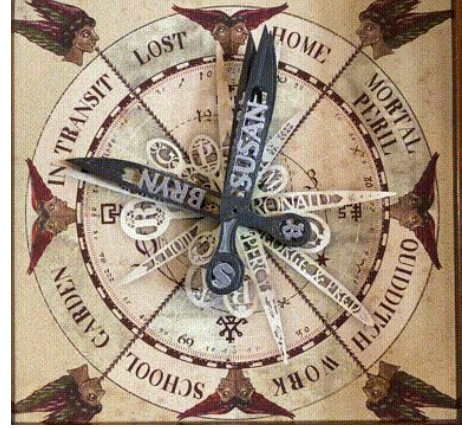
Inspired from the Weasley's clock from Harry Potter. Will show locations of people based on their mobile location.

## Methods

- Will use ESP32 or Rpi to control the watch, communication will be done by cloudMQTT.
- Multiple hands in the watch will move individually with a gear latching mechanism.

## Results

- Will be able to show the location of multiple people on a clock.



# Vihari's IoT Project - Smart Parking (Edge AI - CV)

## Motivation:

- To reduce the time to search for an empty slot in a parking lot.
- Create a lightweight Edge AI solution which can be run on a ESP32

## Problem Statement:

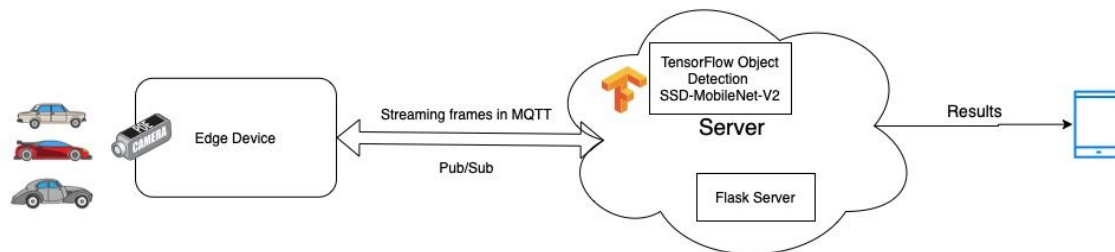
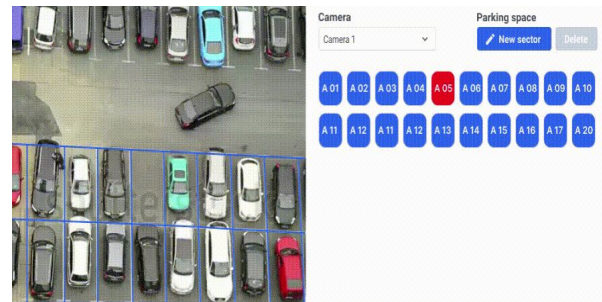
- Average time to search for a spot in a mall is ~10 mins
- Current camera based solutions require powerful Edge devices

## Methods:

- Tensorflow Object Detection Model - SSD MobileNetV2
- MQTT messages to the web server
- Stream the detected results using Flask - Webserver

## Expected Results:

- A real-time inference of the free spaces
- A web UI to show the free spaces



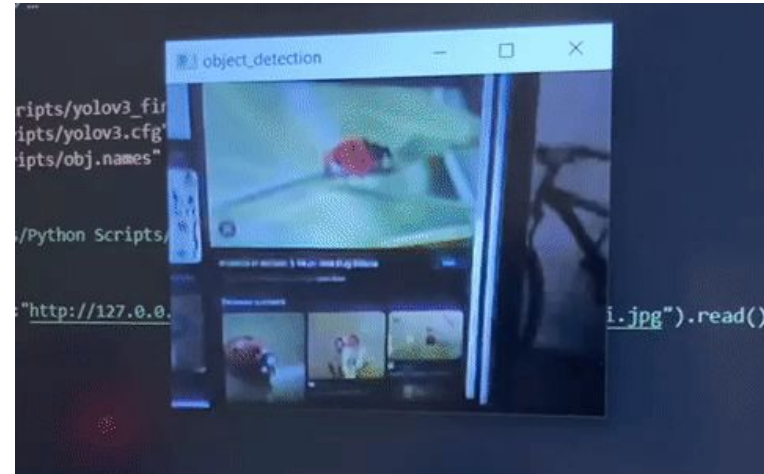
# Manan Luthra- Smart Pest/Insect Detection System

## Motivation

- Pests are a huge threat to agriculture
- According to a study by Food and Agriculture Organization of the United Nations, pests destroy up to 40 percent of global crops annually. Each year, plant diseases cost the global economy over \$220 billion, and invasive insects at least \$70 billion.

## Problem Statement

- Developing a smart pest/insect detection system using ESP32 Cam and PIR sensor

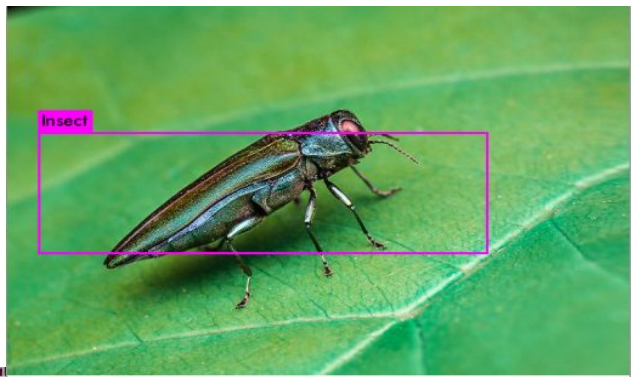


## Methods:

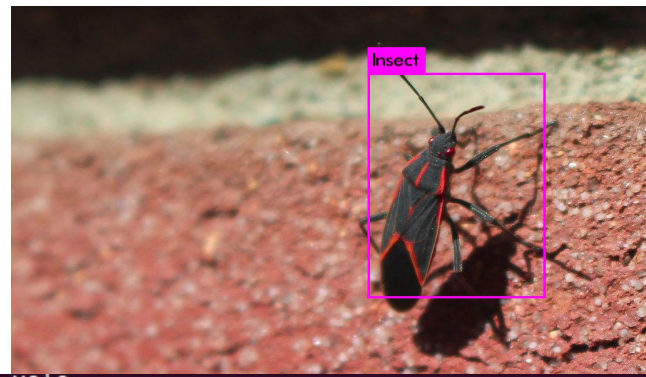
- Computer vision:
  - Trained YOLOv3 (a real time object detection system) on a custom dataset of insect images using Darknet (an open source neural network framework)
  - ~800 images - 4000 iterations
- Arduino IDE
  - Captured images from the ESP32 cam when PIR triggered
  - Images sent to SPIFFS (Flash File Storage) and then to a web server
- OpenCV
  - OpenCV requests the URL, the last image saved in the SPIFFS is sent
  - Uses YOLO detection model with the custom weight files
  - Google API to send images to Drive (pydrive)

```
manan@manan-Lenovo-ideapad-530S-15IKB:~/darknet$ ./darknet detector test data/obj.data cfg/yolov3.cfg backup/yolov3_final.weights data/pest.jpg
```

layer	filters	size	input	output	
0 conv	32	3 x 3 / 1	416 x 416 x 3	-> 416 x 416 x 32	0.299 BFLOPs
1 conv	64	3 x 3 / 2	416 x 416 x 32	-> 208 x 208 x 64	1.595 BFLOPs
2 conv	32	1 x 1 / 1	208 x 208 x 64	-> 208 x 208 x 32	0.177 BFLOPs
3 conv	64	3 x 3 / 1	208 x 208 x 32	-> 208 x 208 x 64	1.595 BFLOPs
4 res	1		208 x 208 x 64	-> 208 x 208 x 64	
5 conv	128	3 x 3 / 2	208 x 208 x 64	-> 104 x 104 x 128	1.595 BFLOPs
6 conv	64	1 x 1 / 1	104 x 104 x 128	-> 104 x 104 x 64	0.177 BFLOPs
7 conv	128	3 x 3 / 1	104 x 104 x 64	-> 104 x 104 x 128	1.595 BFLOPs
8 res	5		104 x 104 x 128	-> 104 x 104 x 128	
9 conv	64	1 x 1 / 1	104 x 104 x 128	-> 104 x 104 x 64	0.177 BFLOPs



```
106 yolo
Loading weights from backup/yolov3_final.weights...Done!
data/pest.jpg: Predicted in 0.496573 seconds.
Insect: 100%
```



```
106 yolo
Loading weights from backup/yolov3_final.weights...Done!
data/pest1.jpg: Predicted in 0.365050 seconds.
Insect: 76%
```



# Brian Montenegro's - Guitar Tuner IoT Project

**Motivation:** Building a guitar tuner that populates a GUI, returning the specific musical note upon receiving feedback, responds via audio cues in the measurement of a musical note, with the desired Hz and following/trailing cents.

**Problem Statement:** Create a more immersive stringed instrument tuning experience.

**Methods:** ESP32/Arduino audio interface, T-Watch Sensor Kit for visual cue

**Expected Results:** Populate accurate musical notes with desired measurements in cents

# Ishan Vyas' Project

## Motivation

According to ASU, over 75000 students are enrolled on Tempe campus. ASU Tempe campus has two big libraries and they are still crowded. I have seen and experienced this problem of not finding a place to study at any of the libraries. People usually waste a lot of time finding a place. I see this as a problem and IoT has a solution over it.

Solution: A smart human body counting system which will keep a track of people entering a space and will live update on the server. Users can access the server to find out where there are empty places.

## Proposal

- Idea : Detecting people with esp32 cam and OpenCV

## Deliverables

- Video demonstration of the working of the system.
- Web server and web app (using node js) which can be accessed by the user to find a empty location.

## Results

- Each time a person enters or leaves the specific space in the library, data will be recorded and will be updated on the server.
- Users will get status about the empty and crowded spaces in the library.

# Sowmik's Project - Changing Menus

- Motivation
  - To show how global warming has affected our food menus over the last 200 years
- Proposal
  - Using a low power display to show menus spanning from 1890 - 2020
  - The menus change depending on the position of the potentiometer which corresponds to the year
- Deliverables
  - To have the project displayed at Emerge Festival 2022: Eating at the edges.
- Results
  - Got the menus switching using a potentiometer connected to the e-paper display
  - Successfully demonstrated the project at Emerge 2022

# Aniruddha's Project- terrain mapping

- Motivation: I have always been captivated by the vast universe we live in and I have always been curious when it comes to discovering new planets and/or comets and studying them.

- 

- Proposal:

- An esp32 uC connected with camera which captures images and using semantic segmentation it will identify what kind of terrain the camera is observing.

- Equipment:

- Esp32 microcontroller
  - camera module

- 

- Results:

- The system is able to correctly detect the terrain from the camera feed.

# Xijing Zhang's project, Home Security System

## Motivation

Improve your home's security level in an easy, low-cost way

## Proposal

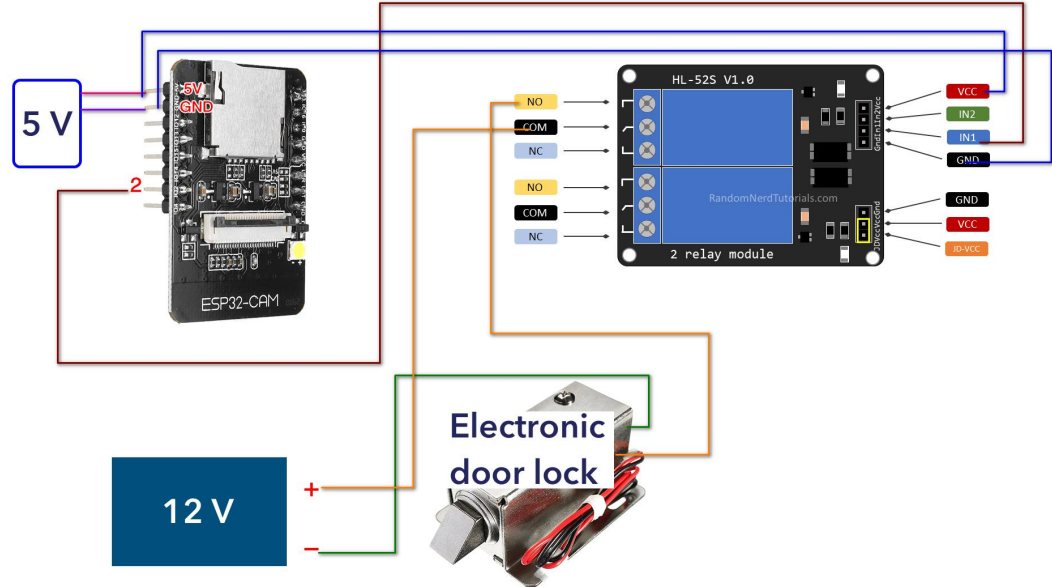
- LILYGO® TTGO T-Camera ESP32 V1.6.2
- Electronic door lock
- Relay module
- 12v power supply

## Results

- A home security system with facial recognition

## Hardware

- (1) ESP32 cam
- (2) Electronic door lock
- (3) Relay module
- (4) 12v power supply



# Subrahmanya S K Teja Madduri - Smart segregation

Motivation : Segregation of items is a difficult task based on size and is very time consuming in supply chain industry this will be a small effort to reduce the work and automate the process.

Proposal:

- Create a segregating machine

Items:

1. RPI3
2. OpenCv code to measure and segregate the objects
3. Known size of aruco tag

Results:

- A good segregation of items based on size.



# Aman Dadheech's Project - AQI Measurement

- Motivation
  - Air quality has a crucial impact on health. Air quality index can demonstrate the severity of pollution caused by industries and this is what we aim to measure.
  - Personal motivation: I am from Delhi, one of the most polluted cities in the world and hence this was the inspiration behind the selection of this project.
- Proposal
  - Create an AQI measurement device that can display data collected on a web server.
- Method
  - Using ESP8266 to integrate different sensors to measure air quality index.
  - Push data onto a local web server.
- Expected Results
  - Displaying PM2.5, PM10, altitude, temperature, pressure,
  - Creating a database to have a record of all data collected