Projects and Accomplishments

I. Software

Project 1:
Human-Net Object Detector – (YOLOv4 Algorithm)

Introduction:

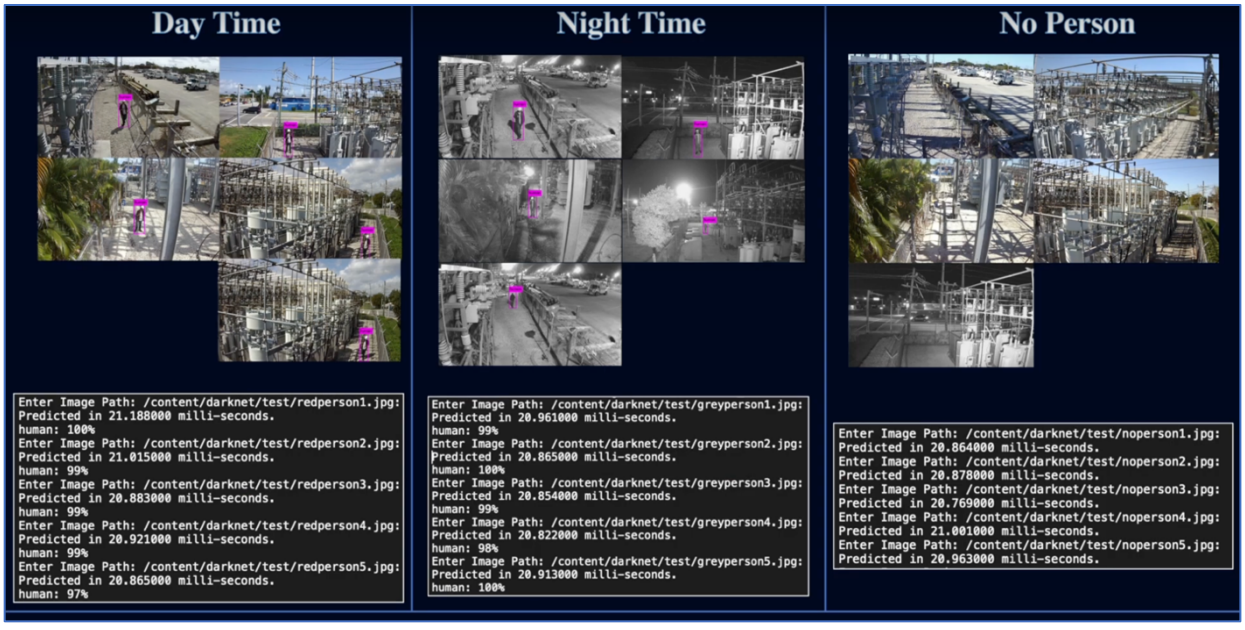
Python based object-detection code written using the DarkNet framework and the Yolov4 algorithm. Visually detects humans at two configurations of 48FPS at 97.7% accuracy or 22FPS at 99.5% accuracy. The model's accuracy was increased from 87.5% by retraining the model, identifying null images, and specifically focusing on objects and patterns which caused false positives. The implementation of the model was additionally applied to detecting fruits and their ripeness levels in fruit picking robots.

Links:

1) GitHub: https://github.com/nitinrameshuf/humannet
2) Youtube: https://www.youtube.com/watch?v=_Wt_G-o3Pug

Proof of Concept:

The model predicts the presence of humans in the environment, in the day and the nighttime. The main challenge was to detect humans who were very far from the field of vision, this was solved in the following iterations of the algorithm. Average time of image prediction being 20.88 mili-seconds.



Project 2:
GoAlchoholGo Android App

Introduction:
Android app created for alcohol addiction recovery, sobriety test and progress tracking. The application establishes a baseline using the accelerometer sensor when under normal use and then uses this data to compare the accelerometer readings when the person is under the influence of alcohol and this allows us to determine if the person is in a drunk state.

Sensors: Accelerometer and Gyroscope.

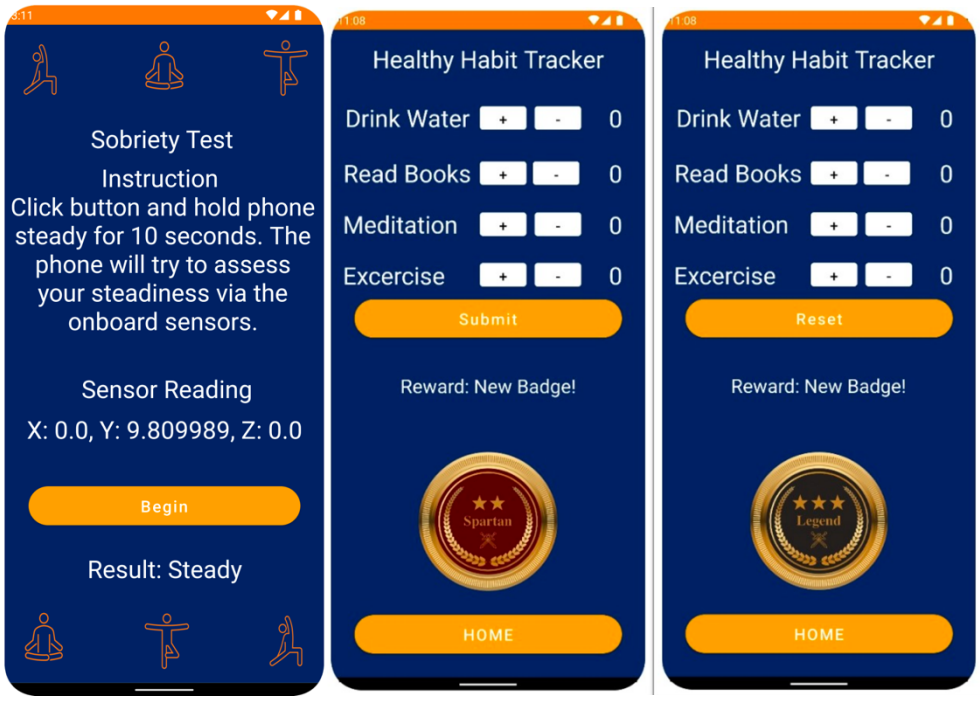
Supervising Professor: Dr Sumi Helal

Research Paper:
https://github.com/nitinrameshuf/papers/blob/5b29ef7c0b9f2a603a1c19cadb0967f2a6bf152d/Alcohol_Behavior_Mod_Paper.pdf

Links:
1) GitHub: https://github.com/nitinrameshuf/GoAlcoholGo
2) Youtube: https://www.youtube.com/watch?v=lmQFz_T_um0

Proof of Concept:

The health-based tracking and evaluation application provides features to the health with respect to alcohol consumption and the tracking user behavior using onboards such as accelerometer, gyroscope etc.



Project 3:
PyCes Static Analysis Tool

Introduction:
Python based static analysis tool. Analyzes Python code and frameworks like Django, Flask, TurboGears etc for security vulnerabilities and generates a HTML or PDF report. Customizable to detect custom insecure patterns and bugs.

Links:
GitHub: https://github.com/NitinPark/PyCes

Note: Software created and released for use by the open-source/Linux community.

II. Hardware

Project 1:
PerkoBot – (Fruit Picking Robot)

Introduction:
Robot created at university of Florida for the purpose of autonomous agriculture harvesting. The robot hardware runs a Nvidia Jetson Xavier with pressure sensitive robot arm for picking fruits from trees. The robot is detects fruits and assess the ripeness level and calculates the most efficient way to pick the fruit.

Professor: Dr Christophe Bobda

Supervisor: Maxamillion Panoff

Accomplishments:

I have created the object detection module for the robot. The algorithm used is Yolov4. The robot was training was conducted with multiple fruits and labeled at different ripeness levels to accurately identify the fruits which are ready for picking. This lightweight machine learning module can be run at different FPS (Frames per second) to run on both high end and low end processors.

Project 2:
TaffyBot – (Exploratory Robot)

Introduction:
TaffyBot is created for the purpose of exploration. The robot uses a host of onboard sensors to determine if the location it is currently exploring is ready for human arrival.

The robot can perform the following:

a) Temperature, Humidity and Barometric scan
b) Spectrometry Analysis of Soil samples
c) Radiation analysis by Geiger counter
d) Terrain analysis by visual detection

Proof of Concept:

Accomplishments:

The robot has been completed created by me from the ground up The part were as follows:

1) Metal body fabrication is made to order from China.
2) Designed on CAD software TinkerCAD.
3) Chassis is 3D printed on Ender 3 v2.
4) Depth Camera: Intel RealSense D415
5) Sensors: CompElectronics
6) Movement Style: Track mode – 45-degree incline
7) Power: 12v Lithium Ion Boosted

The robot can move over obstacles and small rocks owing to the 45 degree incline tracks and middle order weight distribution. The upward wind pull by the chassis fans allows to cool the processors and not melt the underlying PLA at high clock cycles.

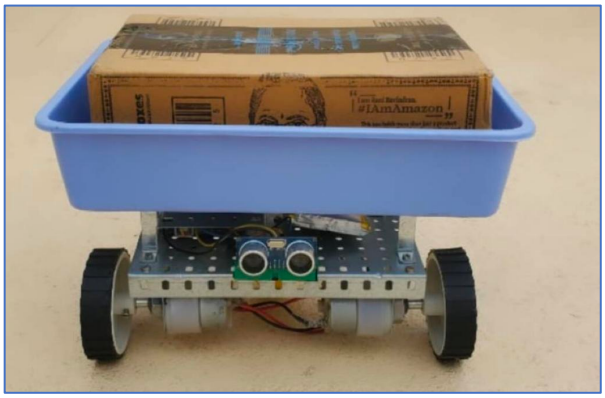
Future Enhancements:

Onboard Drone to aerially map the location in a dot matrix method and guide the robot over large obstacles.

Project 3:
WalBot – (Package Delivery Robot)

Introduction:
Robot created during the pandemic to allow no-contact mode of package delivery in my house. The robot moved from the house to main gates to get the packages and returns to the house to get the package sanitized and give it to me.

Proof of Concept:



Accomplishments:

This is one of my earlier robots and it helped me understand the mechanics of movement. Out of box, low cost solutions were implemented to ensure the robot had correct wheel alignment.