

BASKETBALL SMART REFEREE CAM

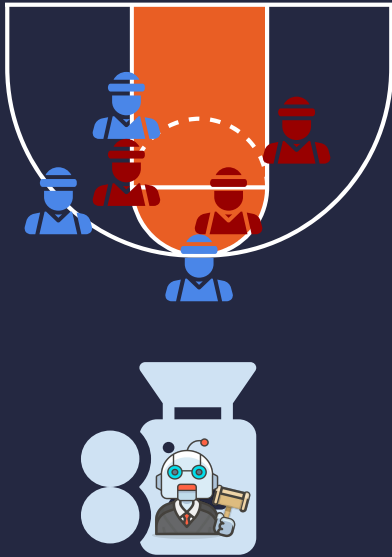


PROBLEM



Pickup basketball needs
officiating

SOLUTION



Autonomous referee camera

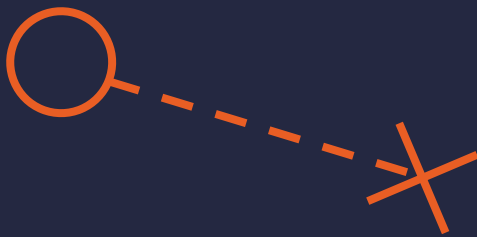
- Allows players to focus on the game
- Unbiased and objective officiating
- Live score tracking

TIMELINE



*stretch objective

00



DATA COLLECTION



DATA COLLECTION

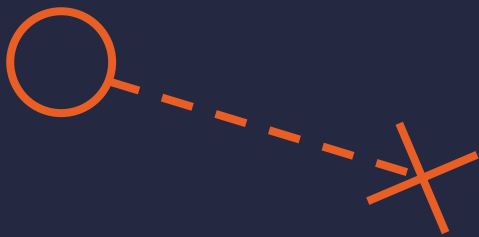


Regular shooting around



1-on-1 with team colors

01



OBJECT DETECTION



CV TOOLS



ROBOFLOW

Pre-trained Yolo models
and APIs to use them



EASTSAM

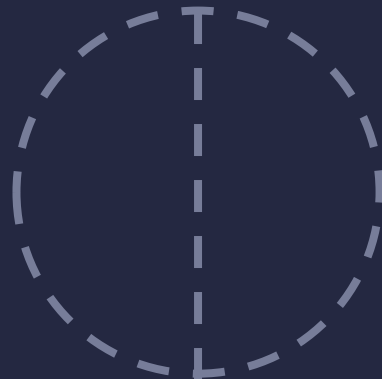
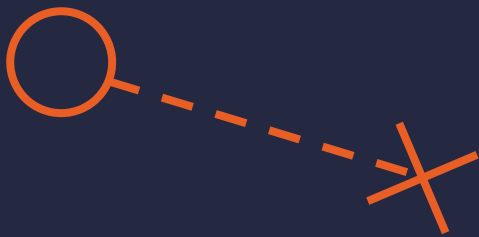
A CNN Segment Anything
model to outline any object
shape

BALL DETECTION



*GIF reduces framerate and quality of actual video significantly

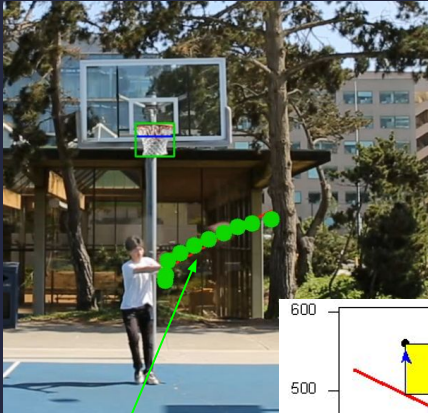
02



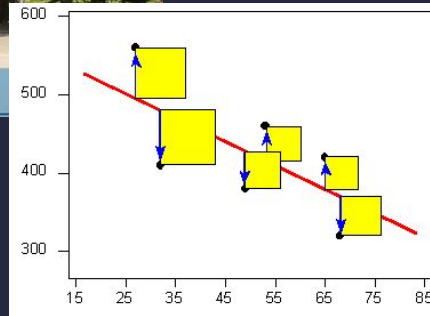
COUNTING BASKETS



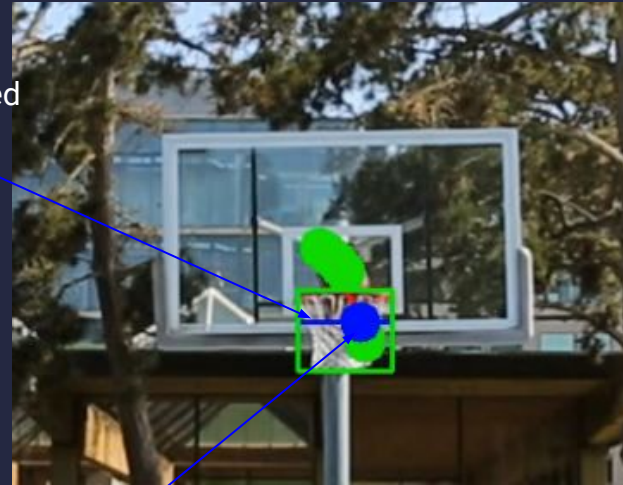
BASKET MADE ALGORITHM



10 ball locations
based off recent
frames



Detection line centered
in rim bbox



Intersection of ball
trajectory and rim line

POINTS (INITIAL BUILD)



03



TEAM DETECTION

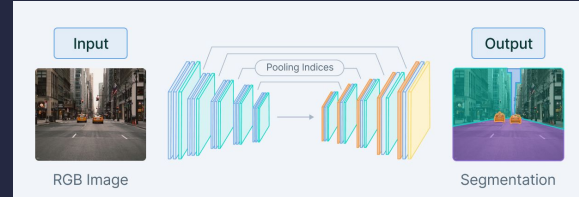




WARNING

THIS NEXT SLIDE MAY POTENTIALLY TRIGGER SEIZURES
FOR PEOPLE WITH PHOTOSENSITIVE EPILEPSY

PLAYER SEGMENTATION



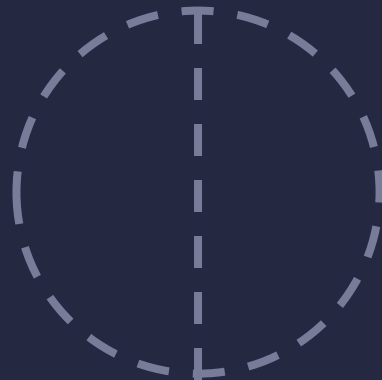
*GIF reduces framerate and quality of actual video

TEAM SCORE TRACKING



*GIF reduces framerate and quality of actual video significantly

04

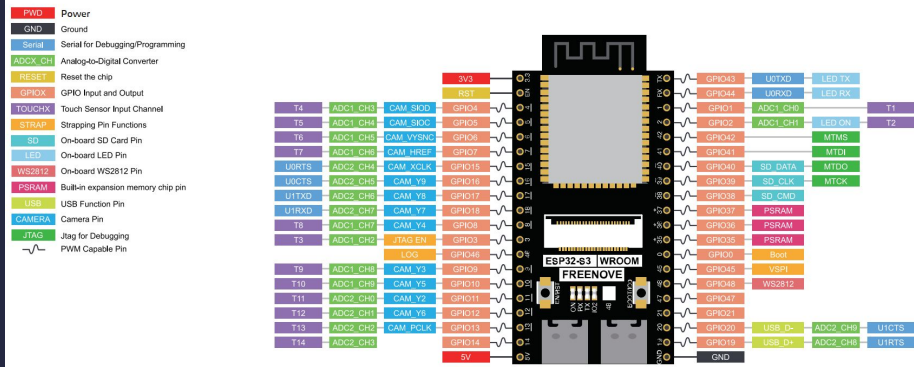


REAL-TIME IMPLEMENTATION



REAL-TIME IMPLEMENTATION

FREENOVE ESP32-S3 WROOM Pinout



Hardware:
ESP32-S3 Wroom 1 by
Freenove

Purpose:
Stream to router so that
python file can grab stream

FREENOVE ESP32-S3-WROOM CAM Board
Arduino IDE, Onboard Camera Wireless
Detailed Tutorial, Example Projects
Visit the FREENOVE Store
4.5 stars (4,812) 144 ratings | Search this page
Amazon's Choice in Single Board Computers by FREENOVE
100+ bought in past month
Best Price on Amazon
\$19.95
Get Fast, Free Shipping with Amazon Prime
FREE Returns
Get \$10 off instantly. Pay \$0.00 \$19.95 upon approval for
Brand FREENOVE
Operating System Embedded
CPU Model None
CPU Speed 240 MHz
Graphics Card Dedicated

STREAMING

Add gif of running
python file using
camera stream/ or
playable video

CHALLENGES



OBJECTIVE 01

- Learning the Roboflow API
- Processing the video with Python



OBJECTIVE 02

- Determining how to count made baskets
- Deciding correct heuristics (window size)



OBJECTIVE 03

- Discerning between players of team colors



OBJECTIVE 04

- Figuring out how to stream over Wi-Fi
- Refactoring code to use live stream input instead

MISSED OBJECTIVES/LIMITATIONS

Non-robust Yolo predictions creating false detections



Ball being in front of rim



Player boxes overlapping each other



Team colors only in black/white



SUMMARY



WHAT WE'VE DONE

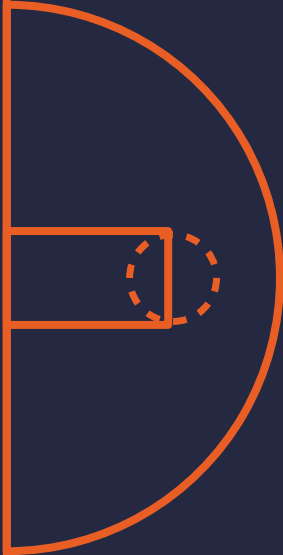
- Basketball, rim, and player recognition
- Scoring detection with decent accuracy
- Team color detection

FUTURE PLANS

- Optimization and fixes
- 3 point vs 2 point detection
- Foul detection
- First marketable MVP(?)



THANKS



DO YOU HAVE ANY QUESTIONS?