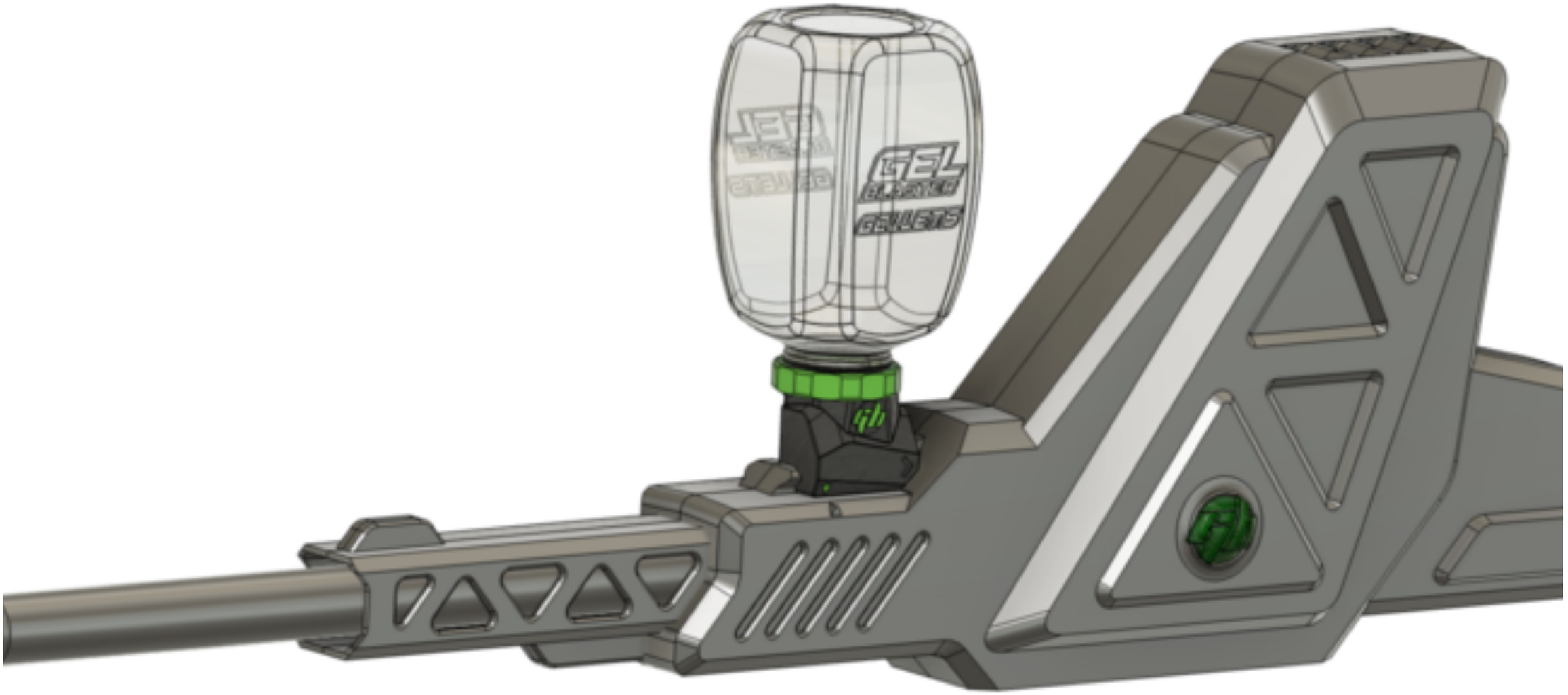
“Wingman” AI GelBlaster Surge based turret incubation proposal

GO PLAY!



Wingman?

NVIDIA JETSON POWERED, ARTIFICIAL INTELLIGENCE ENABLED ROBOTIC OPPONENT

Guinn Partners 2018 State of The Drone Industry report

The vision

As a long time Guinn Partners adjacent resource formally going back to Rocket-Squad days, informally to 3DR Texas timeframe, I'd like to request incubation assistance for a robotic GelBlaster based turret project currently known a “Wingman”. Given the specialization in emerging technology, enabling technologies, drones, mobility, & outdoor sporting goods this project is perfectly positioned to help further demonstrate all of the things Guinn Partners is already known for being best in class at. Potential outputs of this project incubation include:

GelBlasters STEM SDK educational kit for learning industry standard AI models

- Competition robotics
- GelBlasters game product payload to tie into future smart sensor product line
- Pre loaded GelBlaster proprietary AI targeting / game play / scoring logic code
- Virtual Opponent for GelBlasters events! Stick on wall, put on tripod, mount to ceiling!
- No friends with you? Face off against a robotic opponent!
- "Go Play" by yourself, prop up the turret, and virtual target, hone your skills.
- Rank amongst peer players attempting to defeat the turret in their own environments!
- Score accurately against the e-target, and collect e-badges, and achievements.

Proprietary ROS1 & ROS2 logic blocks for reuse in commercial consulting / incubation

- Reusable logic is created at each step of research & development
- Think 'Cable Cam' reimplemented in ROS, available to *all* ROS enabled platforms.
  - ✦ Add auto targeting to any existing payload on a gimbal as long as it has a camera
  - ✦ Example: Robot quadruped dog, with a camera platform on its back doing scripted cinematic sequences that include aiming a camera at a “target” aka “POI” for a shot.

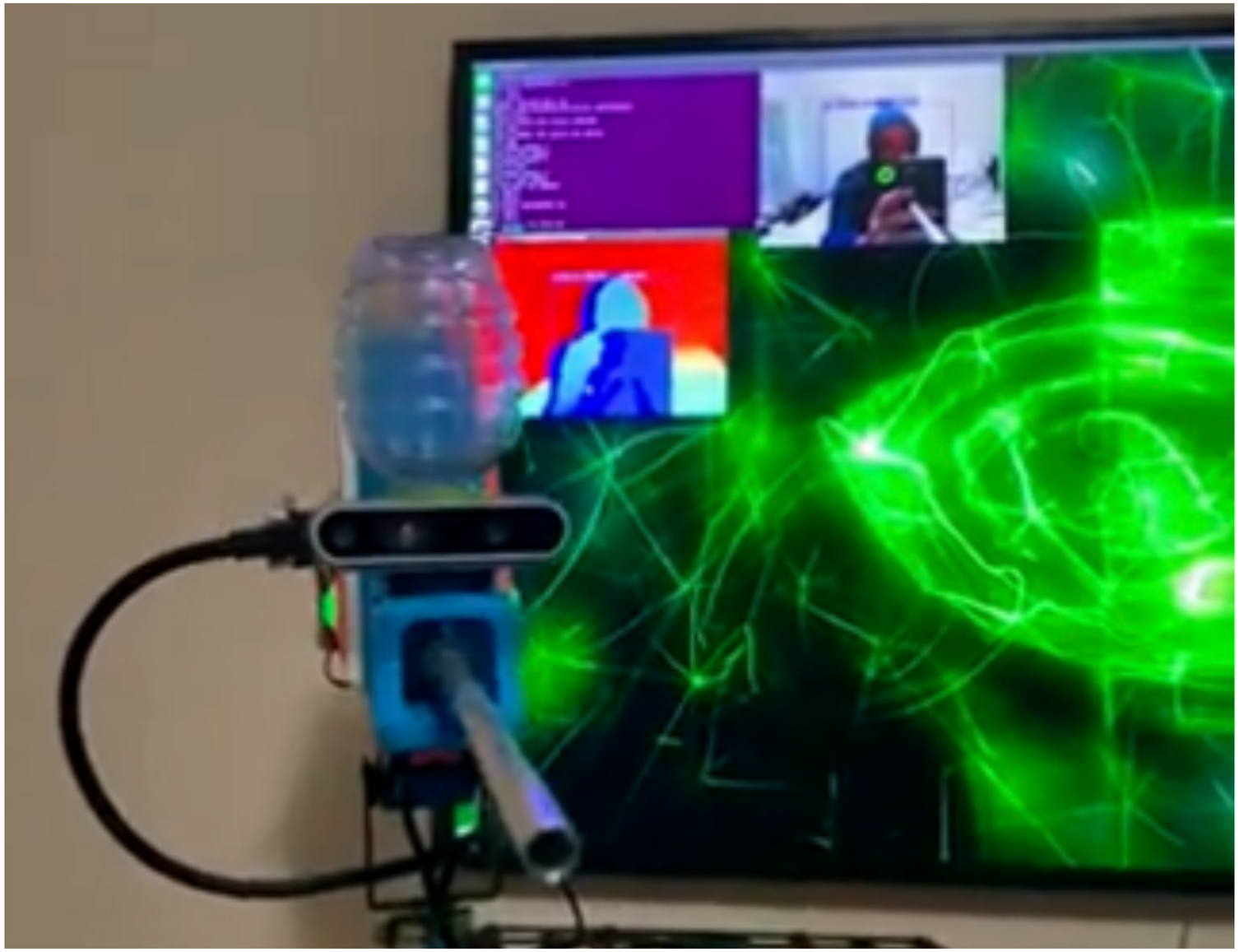
WHERE HAVE WE BEEN? WHERE DO WE WANT TO GO!?

Rapid Prototyping for the win

We've been grinding, and hustling, while pushing to our Git repo along the way as we go. Our quest has brought us down many paths, all involving our incremental learning.

Making an AI enabled turret is a non-trivial task, and is in fact quite daunting when you dive into the minute technical details involved. We've got a backlog of ideas, and tasks on a card wall, and we've been slowly working through them. At each step we must familiarize ourself with new technologies, their nuances, and ways to work around small hurdles. Every step requires poise, and focus, as well as a stream of resources to enable our team to succeed. Raw passion has been our primary fuel, alongside the desire to both learn, and teach.

Unfortunately passion doesn't pay for the expensive sensors, or compute platforms we need to keep our momentum. This is where Guinn



Step 1.5 turret version in John Cherbini's lab

Partners comes in, simply put the Wingman project needs your incubation, and we are asking for it in the form of a "match" on our R&D costs moving forward. Below is a table showing the existing project expenditures. Matching our investment

input would allow us to both expand our team, and the pace at which we are able to develop capabilities subsequently resulting in proprietary knowledge and code that Guinn Partners can reuse in the near future.

Item	Quantity	Cost	Purpose
Time tracking across all prototype phases			
2-3 hours average input per day Mon-Fri. [John Cherbini & Kevin Finisterre]	6 months x 2 men	<waived>	Write code!
4+ hours average input per day Sat-Sun. [John Cherbini & Kevin Finisterre]	3 months x 2 men	<waived>	Write code!

The current project phases derive their naming convention from Sega's Arcade division that was historically responsible for the "Model 3"platform used in the late 90's. Our phases have been named "Step 1", "Step 1.5", and "Step 2" accordingly.

```
Sega Model 3
PowerPC 603e + tilemaps + Real3D 1000 + 68000 + 2x SCSP
Preliminary driver by Andrew Gardner, R. Belmont and Ville Linde

Hardware info from Team Supermodel: Bart Trzynadlowski, Ville Linde, and Stefano Teso

Hardware revisions
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Step 1.0: 66 MHz PPC
Step 1.5: 100 MHz PPC, faster 3D engine
Step 2.0: 166 MHz PPC, even faster 3D engine
Step 2.1: 166 MHz PPC, same 3D engine as 2.0, differences unknown
```
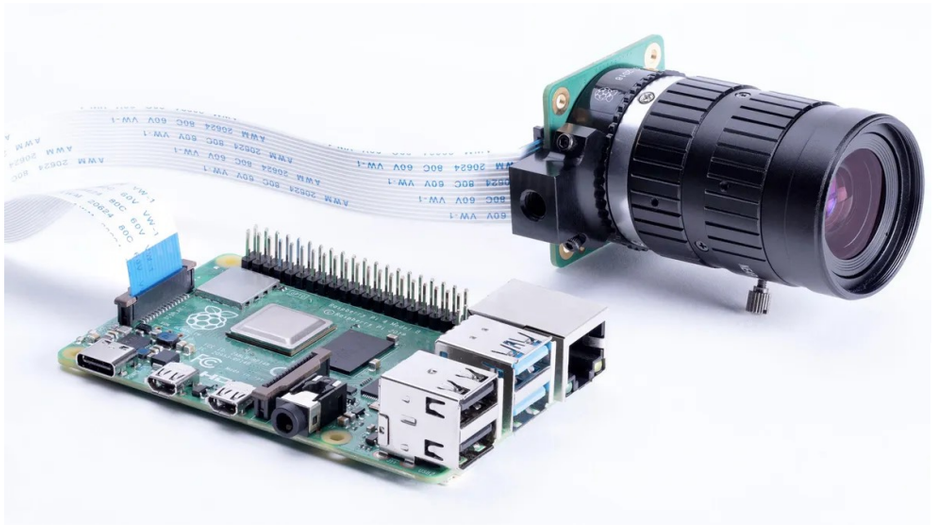
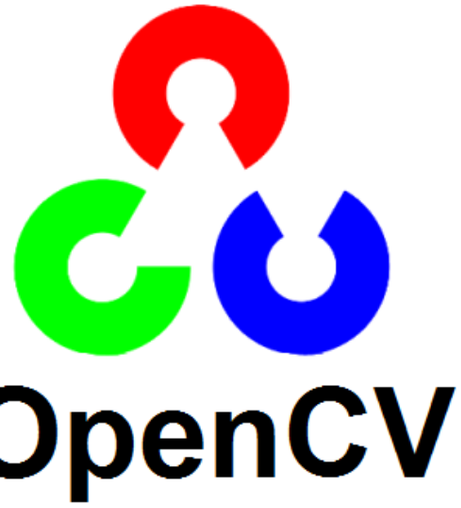
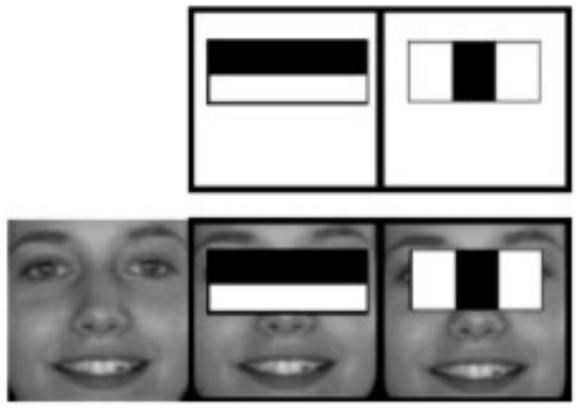

Step 1 for us represented the initial phase of converting ideation into reality. All logic at this level was ad-hoc absorbed from existing "I made my nerf gun shoot me in the face" style projects that had been making the viral rounds on social media. Raspberry Pi4 was fairly new at this time, and we used this project as an excuse to explore the Raspi4 landscape. OpenCV + Haarcascade was the root of logic at this phase. We used both stepper motors, and Dynamixel variants for initial proof of concept. Camera choices had not yet been standardized so we were using RasPI HD camera, and a Logitech webcam for the first prototypes.





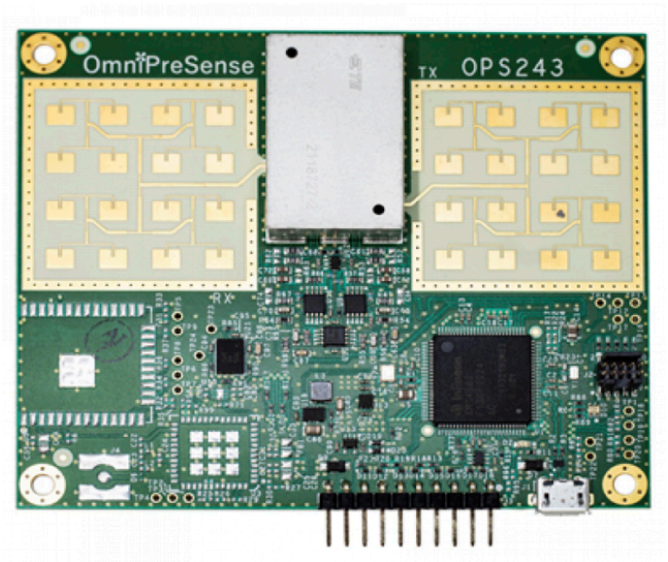


Item	Quantity	Unit Cost	Purpose
Step 1 Prototype phase			**Proof of Concept**
Raspi4 https://www.raspberrypi.com/products/raspberry-pi-4-model-b/	1	$44.99	Compute Platform tests
Raspi4 High Quality Camera https://www.raspberrypi.com/products/raspberry-pi-high-quality-camera/	2	$49.99	Vision System tests
6mm wide lens https://www.adafruit.com/product/4563	1	$24.99	Vision System tests
16mm telephoto lens https://www.adafruit.com/product/4562	1	$49.99	Vision System tests
SanDisk 512G https://www.westerndigital.com/products/memory-cards/sandisk-extreme-pro-uhs-i-microsd#SDSQXCD-512G-GN6MA	2	$139.99	Compute Platform tests
Toby Tripod https://joby.com/ca-en/compact-advanced-tripod-for-smartphone-and-camera-jb01763-bww/	1	$119.99	Supporting hardware
Volessence 5000 battery https://www.amazon.com/Volessence-50000mAh-Laptop-Portable-Charger/dp/B07RNZZXRM	1	$125	Supporting hardware
MX-28T servos https://www.robotis.us/dynamixel-mx-28at/	4	$289	Motion Control
U2D2 Power Hub Board Set https://www.robotis.us/u2d2-power-hub-board-set/	2	$18.99	Motion Control
U2D2 https://www.robotis.us/u2d2/	2	$32.99	Motion Control
Dynamixel brackets https://www.robotis.us/fr07-s101-set/	4	$14.99	Motion Control
drv8825 Stepper Driver & Stepper motors	2	$14.99	Motion Control
Adafruit Huzzah32	2	$19.99	Fire Control system
Adafruit Non-Latching Relay Mini https://www.adafruit.com/product/2895	6	$7.99	Fire Control system
ESP32 Thing+ https://www.sparkfun.com/products/20168	4	$24.99	Fire Control system
Realsense D455 https://store.intelrealsense.com/buy-intel-realsense-depth-camera-d455.html	2	$419.99	Vision System tests
Realsense D435i https://store.intelrealsense.com/buy-intel-realsense-depth-camera-d435i.html	2	$345	Vision System tests
2-way all in one single servo Dynamixel https://www.robotis.us/dynamixel-xl430-w250-t/	1	$49.99	Motion Control
Gelblasters Surge XL https://gelblaster.com/products/surge-xl	5	$89.99	Fire Control system
Inland 1.75 mm ABS https://www.microcenter.com/product/485643/inland-175mm-black-abs-3d-printer-filament-1kg-spool-(22-lbs)	2	$16.99	Supporting hardware

Step 1.5 came with the realization that all the viral videos were rooted in the same limitations. One being frame rate of RasPi platform, and the second being a lack of GPU. We took a cue from both robotic quadruped vendors, and academia by deciding to go with Intel Realsense cameras, and Nvidia Jetson Nano hardware for the compute package. From there we went on to getting YOLO v7, and “pose” algorithms working with CUDA. Pytorch & Pyvision, and TRT based code took the primary focus. We also looked for a cheaper alternative to Dynamixel brand, and landed on HiWonder serial bus servos as a potential option.

Item	Quantity	Cost	Purpose
Step 1.5 Prototype phase			**Refined Control**
Hiwonder LX-225 Serial Bus Servo/25KG High Torque/Data FeeDback https://www.hiwonder.com/products/hiwonder-lx-225-serial-bus-servo-25kg-high-torque-data-feedback	2	$17.99	Motion Control
Hiwonder brackets https://www.amazon.com/dp/B07PQ12TXS	2	$12.99	Motion Control
Hiwonder Serial Bus Servo Controller Communication Tester https://www.hiwonder.com/products/serial-bus-servo-controller	4	$39.99	Motion Control
Hiwonder HTD-45H High Voltage Serial Bus Servo 45KG Torque with Three Connectors and Data Feedback https://www.hiwonder.com/products/hiwonder-htd-45h-high-voltage-serial-bus-servo-45kg-torque-with-three-connectors-and-data-feedback	2	$24.99	Motion Control
Jetson Relay boards https://www.amazon.com/dp/B08SCPQJZ6	3	$24.99	Fire Control system
Replacement IO-board-B https://www.amazon.com/dp/B0B7ZXDLL6	1	$99.99	Compute Platform tests
Jetson Nano https://www.amazon.com/Yahboom-Jetson-Nano-4GB-Board/dp/B09T37PPRF	2	$239	Compute Platform tests
Jetson Tx2 NX https://www.amazon.com/Yahboom-Jetson-Development-N-VIDIA-Performance/dp/B09Y53TWQJ	1	$519	Compute Platform tests
Xavier NX https://category.yahboom.net/products/nx-sub	2	$899	Compute Platform tests
Xavier AGX https://www.amazon.com/NVIDIA-Jetson-Xavier-Developer-32GB/dp/B083ZL3X5B	2	$1860	Compute Platform tests
NVME storage https://www.amazon.com/Transcend-TS128GMTE110S-128GB-Solid-State/dp/B07CXC32T2	3	$24.99	Compute Platform tests

Step 2 has focused on comparing gains from moving processing to the “edge” for primary detection, and seeks to explore correlation algorithms, and sensor fusion techniques. This phase will potentially be using CUDA with the stronger Jetson Xavier,. Our original solutions will be used on the main compute, in tandem with “edge" processing on Luxonis OAK camera platform. This phase will additionally show the team forcing ourselves over to ROS based logic as a huge focus. Sensors from FLIR, OmniPreSense, Luxonis, and Livox are the the base of the current sensor suite.



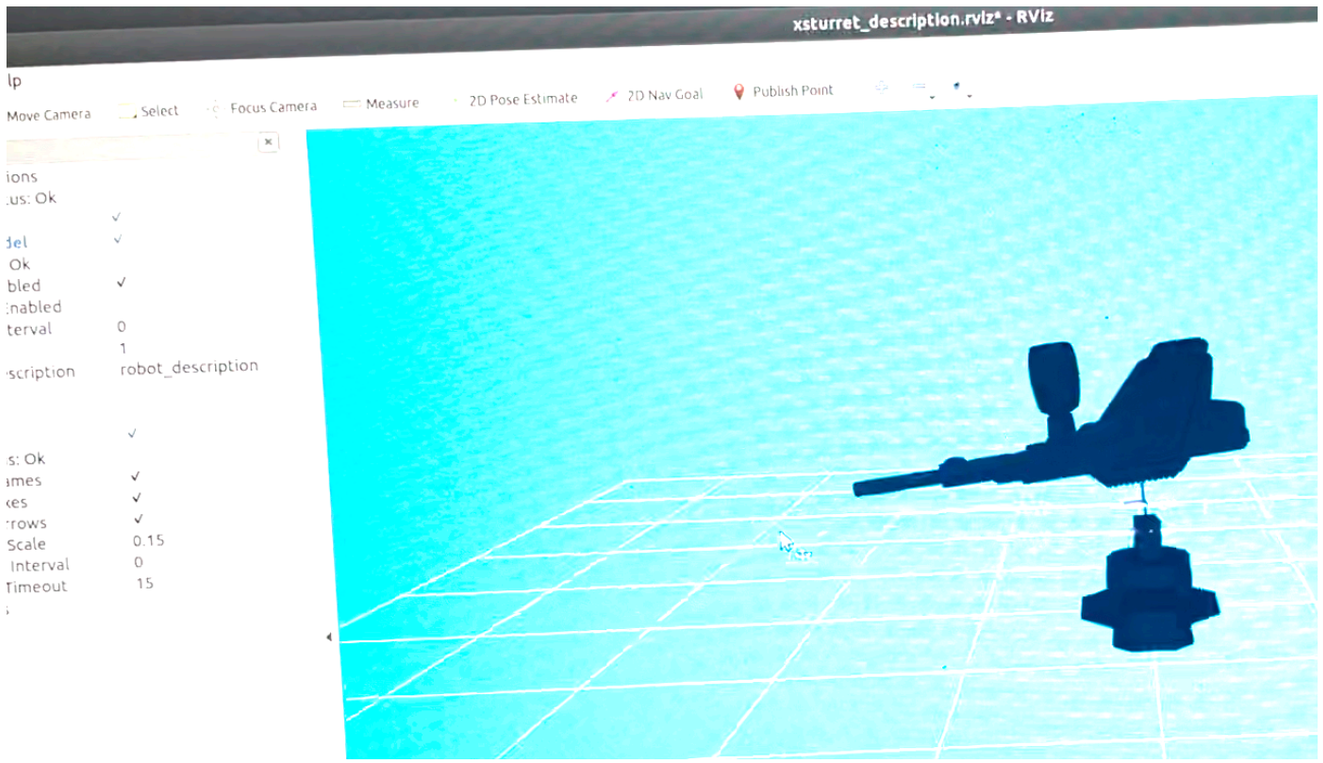
Luxonis

XAVIER

OmniPreSense

Item	Quantity	Cost	Purpose
Step 2 Prototype phase			**Edge Detection**
Oak-D S2 https://www.amazon.com/dp/B0B5TV1G9R	2	$319.99	Vision System tests
Oak-D Pro https://www.amazon.com/Luxonis-Oak-D-Pro-Fixed-Focus-Robotics-Camera/dp/B0BQ5N681J/	1	$439.99	Vision System tests
Oak-1 Max https://www.amazon.com/Luxonis-Oak-1-MAX-Robotics-Camera/dp/B0BP89H9V7/	1	$249.99	Vision System tests
ChatGPT Plus https://openai.com/blog/chatgpt-plus	12	$20	Tech Support!
PhantomX turret (dynaimixel based) https://www.trossenrobotics.com/p/phantomX-robot-turret.aspx	1	$209	Motion Control tests
Livox Mid-360 https://www.livoxtech.com/mid-360	1	$749	Vision System tests
GetThermal Lepton 3.5 https://store.groupgets.com/products/flir-lepton-3-5	1	$438	Vision System tests
OmniPresence OPS243 https://omnipresense.com/product/ops243-doppler-radar-sensor/	1	$209	Vision System tests
J5 create 360 webcam https://en.j5create.com/products/jvcu360	1	$110	Vision System tests
Logitech C920S webcam https://www.amazon.com/Logitech-C920S-Webcam-Privacy-Shutter/dp/B07K95WFWM	1	$69.99	Vision System tests

Step 2.1 will be applying all the lessons learned, by further honing and tuning the underlying platform. Both hardware, and software will undergo several more release candidates. The goal will be to move from desk / contrived testbeds to real use *anywhere* the platform is setup. Utilizing ROS based simulation will be key to moving forward at a more rapid pace. Gazebo, and MOveIT will be among the first tools implemented. This is also the point at which we'd like to standardize on a kit we can send potential team members as a hardware SDK / influencer pack.



GAZEBO

MoveIt

ROS 2™

Item	Quantity	Cost	Purpose
Step 2.1 Prototype phase			**Lessons Learned Tune**