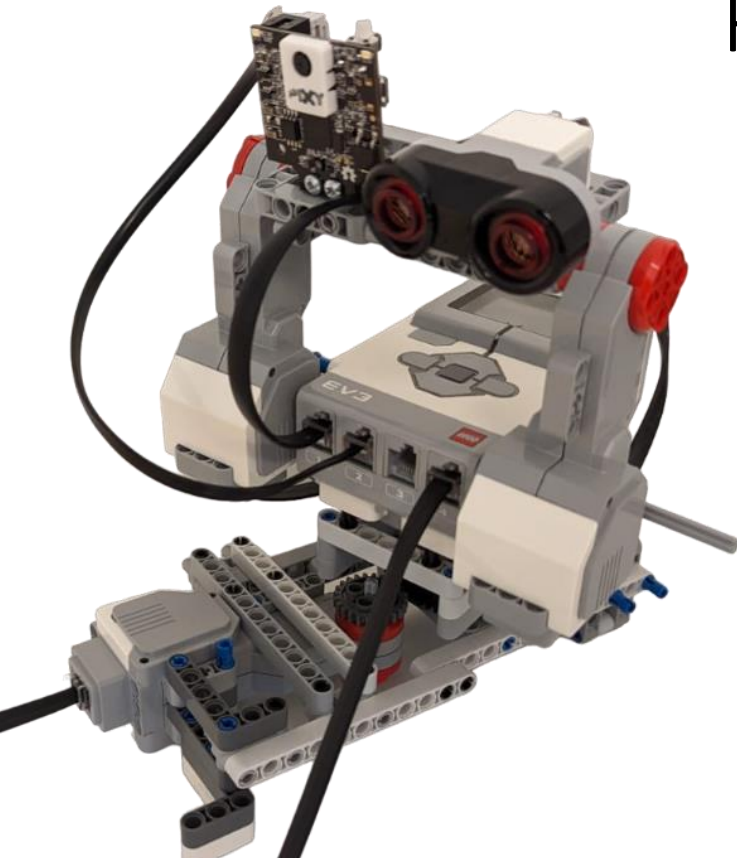# Project Anti-Drone system

Progress report bronze level
RedADS
11/12/2023

Team

Project Manager
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Software Chief Engineer
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Hardware Chief Engineer
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Test chief engineer
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Software Engineer
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Bronze solution : General architecture

Specification/functions:

Bronze
1. The System shall move 180° on Z axe and 90° on X axe.
2. The System shall detect a target located at minimum 5cm in front and up to 1,5m.
3. The System shall measure the distance of the target (assuming that it's size is known).

Silver
1. The object shall compute the angle and align the turrent to prepare to shoot at the target.
2. The System shall shoot down (hit) the target up to 1,5m radius from the turrent.

Gold
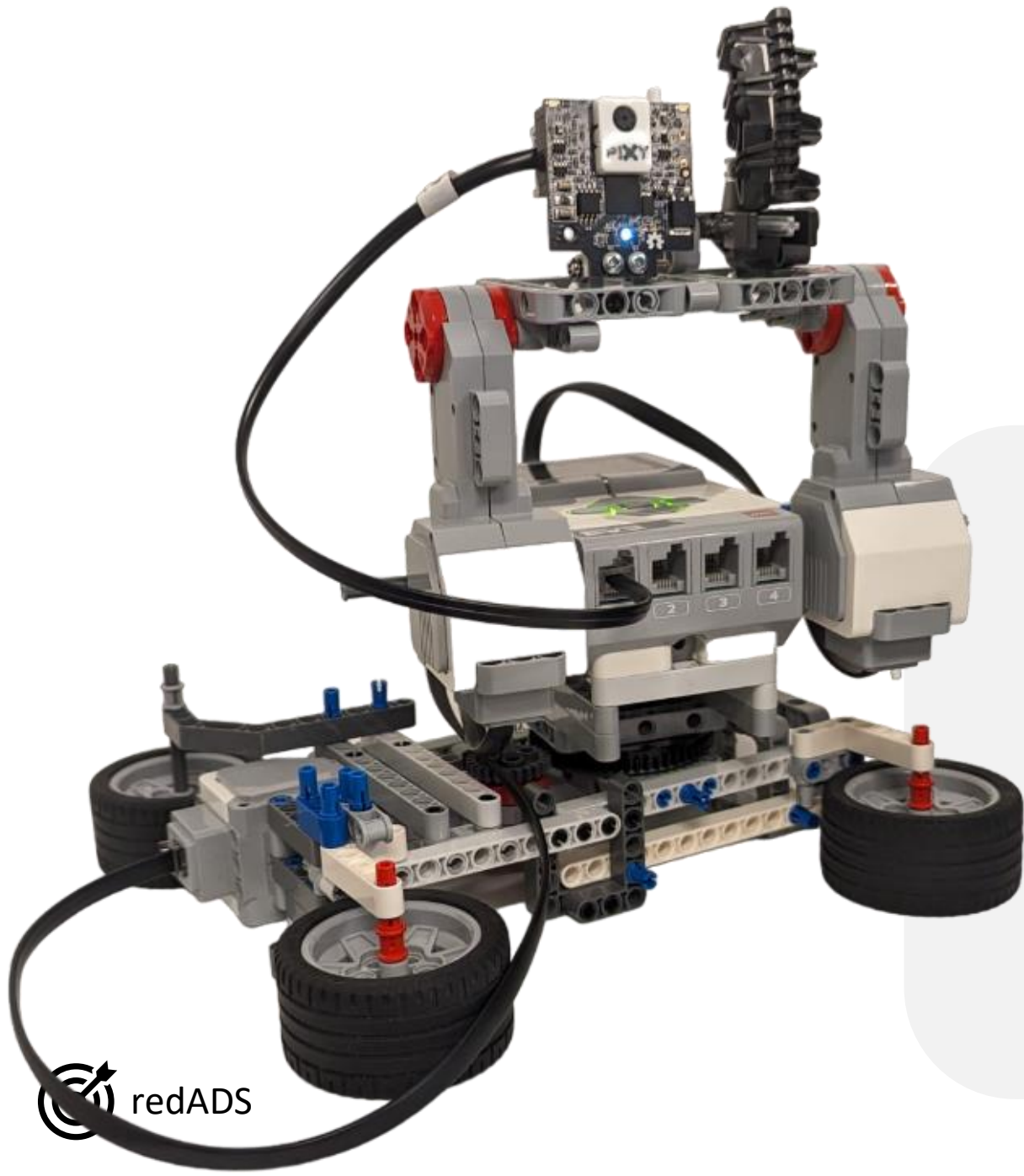1. The system shall communicate with the PC of the user to report status and outcome of the mission

Design :
SSYS 1 : Motion (4 motors, 1 pressure laucher)
SSYS 2 : Sensor (1 Ultrasonic sensor, 1 camera)
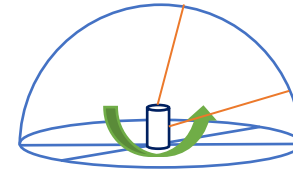**SSYS 3 :** Calculator (1 Lego Mindstorm Brick)

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Bronze Level
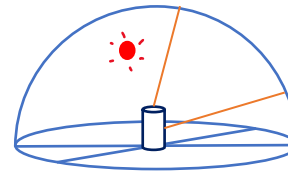
Motion to search and detection of the target

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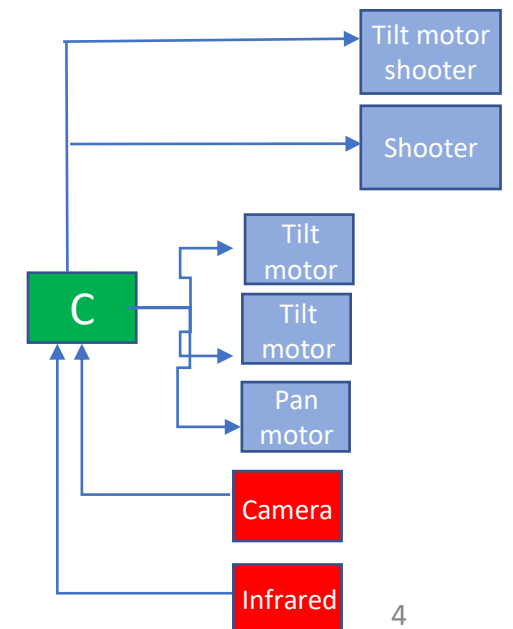
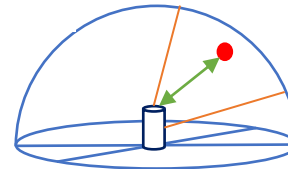# Bronze level : Main concept

3 key features :

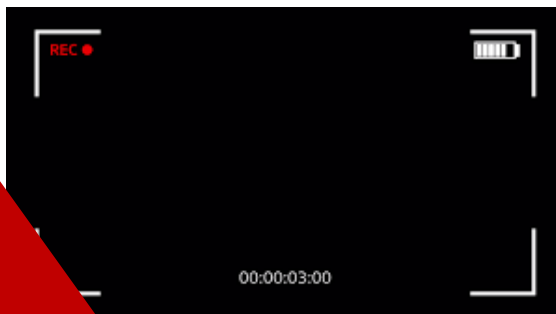1) Rotate on both axis to point at any location in the semi circle

2) Detect the drone (no, yes, aligned)

3) Be able to measure the distance to the drone

NO   YES   ALIGNED

New
progress
Slide

Bronze : Hardware design

Camera

Shooter

Tilt motor 1

Tilt motor 2

Pan motor
With turntable

EV3 computer

Solid base

z

x

y

7
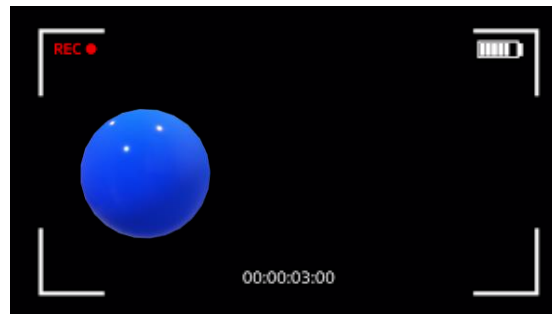
Bronze : Hardware solution

Pan axis on a 60:24 gear ratio for higher torque

Two tilt motors to hold a wide sensor platform

This is our drone !
Its 10 cm wide and completely green

Camera

Z

X

Tilt motor 1

Tilt motor 2

Pan motor

Rotation support (60/24)

Bronze : Software solution

Sequence Diagram for Bronze function

New progress Slide
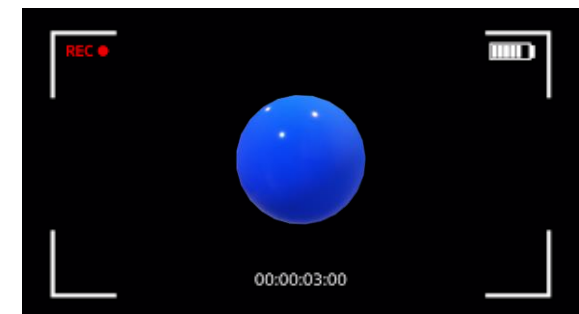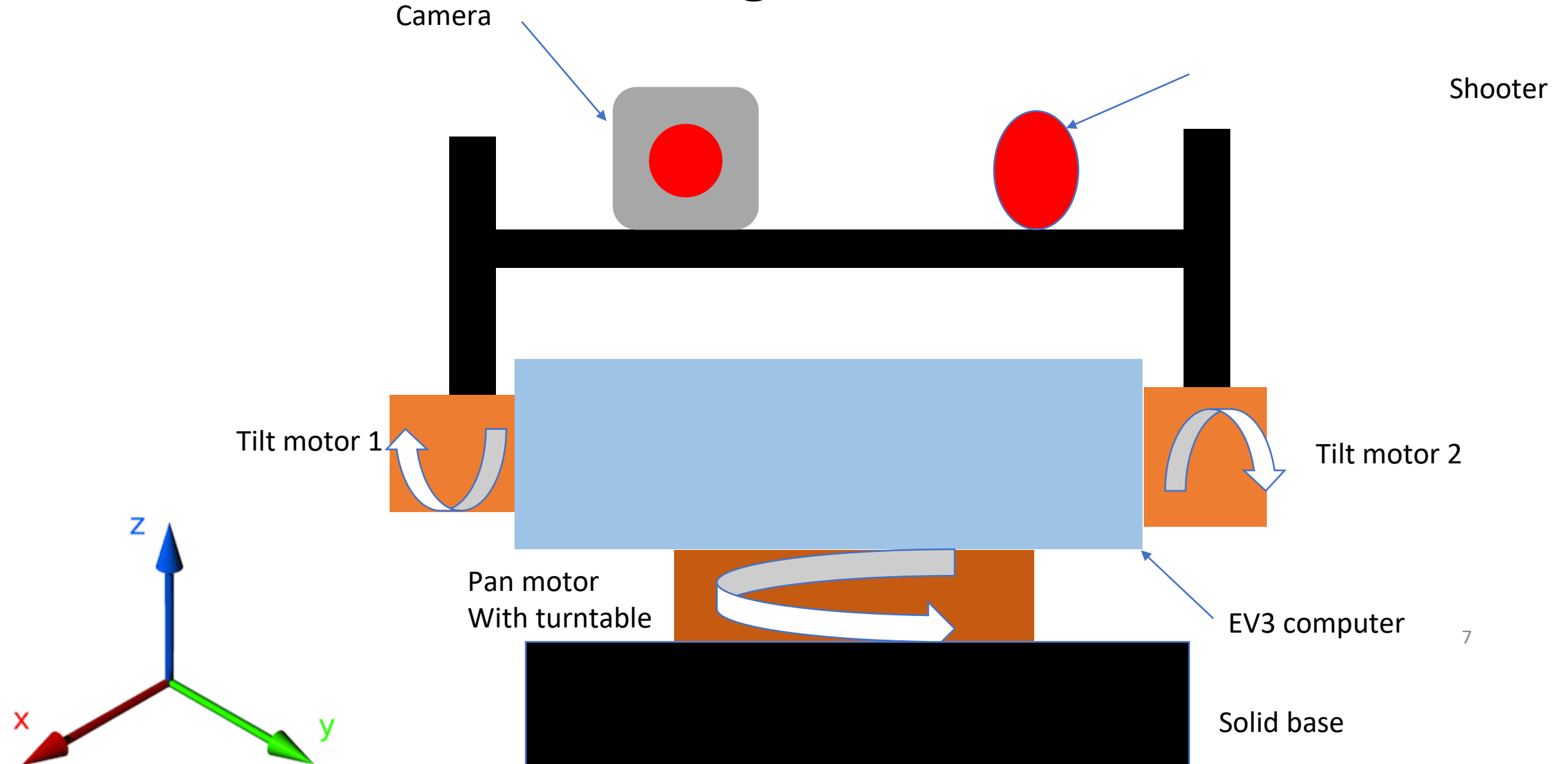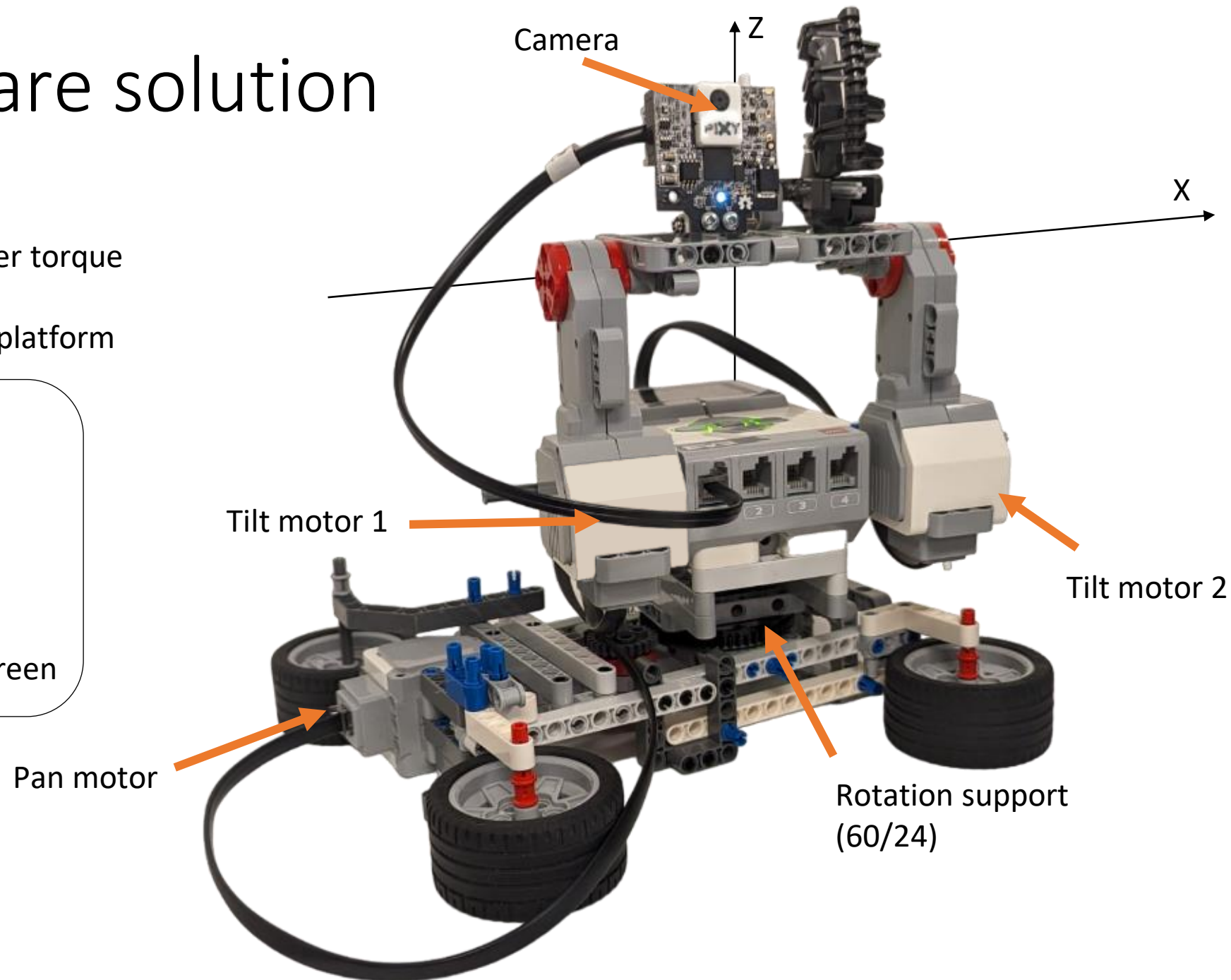
User

Lego mindstorm

Camera

Pan motor

Tilt motors

Initialization
- GO : Search and destroy
- Audio : "Robot ready"
- Initialize to angle 0° pan
- Initialize to angle 0° Tilt motors

Search the target
Scan the all environment

Loop
Until target no detected
- Audio : "Starting search"
- Go again
- Is target detected ?
- Camera active Significant green color detected
- NO
- Audio : Target detected
- YES + coordinates

Align with the target
- Compute command to both motors to align
- Angle needed to align on Z axe with target
- Angle needed to align on X axe with target
- Audio : "Target aligned"

Compute most reliable distance
- Green LED power on
- Do 10 times
- Asking for distance
- Camera active Compute coordinates & size
- Coordinates + Size
- Compute average distance with raw size data
- Audio : "Distance acquired"
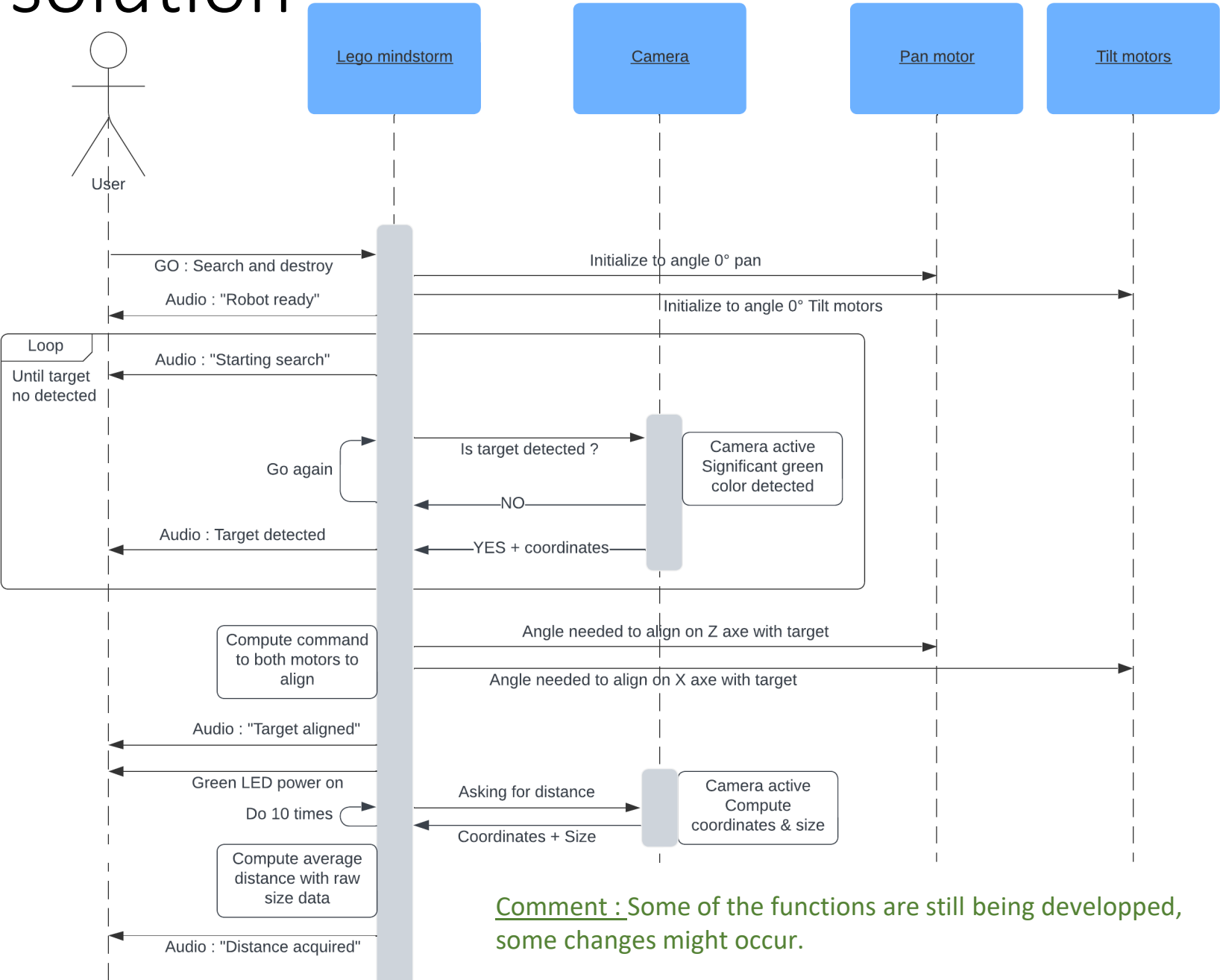
Comment : Some of the functions are still being developed, some changes might occur.

Bronze : Test specification

Condition of test:

- Robot on ground, facing 1.5m semi-circle.
- Static robot.
- Scans sky, detects target in 1.5m range.
- Uses moving sensor with pattern scanning,
- Evaluates target distance (object size on camera).
- Target: Green ball

Verification:

- Setup.
- Robot Activation: The robot starts with a cue indicating readiness. (Flashing lights)(audio)
- Target Presentation: 1 to 8 targets are presented within 1.5 meters of the robot.
- Target Detection: The robot detects the target and signals it via text to speech.
- Distance Measurement: The distance between the target and robot is measured using a tape measure or equivalent tool.
- Robot Calculation: The robot calculates the distance and must be within 10% accuracy of the measured distance.

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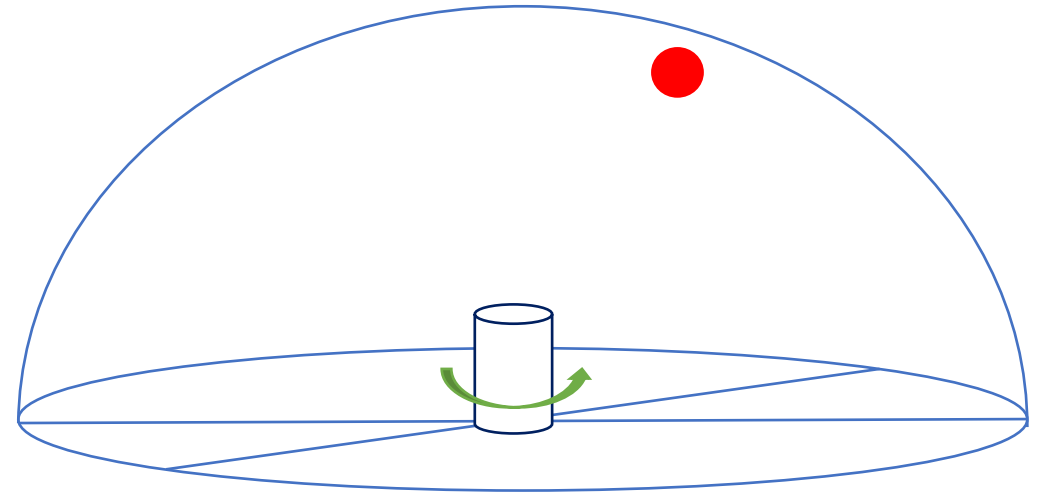
Bronze : Validation
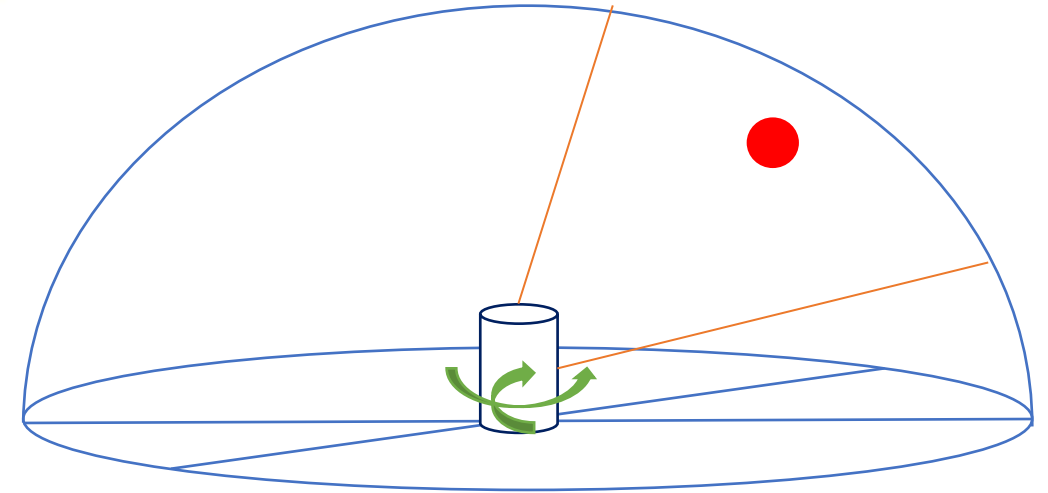
Test 1 : Target Detection

Condition of tests :
- Target (green ball) within 1.5m range.
- Robot equipped with camera Pixy 2.
- Robot can be either static or in motion with camera active.

Actions :
- Present 1 target (at different distances and angles) to the robot.
- Move the target.
- Ensure the camera is active and set to capture and process images in real-time.

Verification :
- Computer can get the information about the target.
- Robot can change direction to scan the entire area if the target is not detected within its current field of view.
- Robot can detect each target and emits cue.

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Bronze : Validation

Test 2 : Distance Evaluation

Condition of tests :
•Targets (green ball) within 1.5m range.
•Robot equipped with camera.
•Robot can be either static or in motion with sensors active.

Actions :
• Present 1 target (at different distances and angles) to the robot.
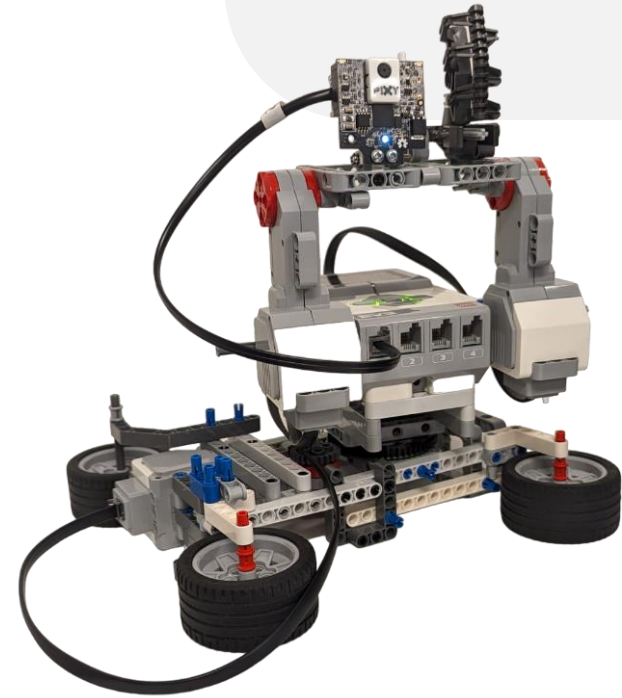• After a target is detected by the camera, measure the distance to the target.

Verification :
• Measure the actual distance with a tape measure.
• Compare the robot's calculated distance to the actual.
• Distances measured by the robot are within 10 per cent of error.

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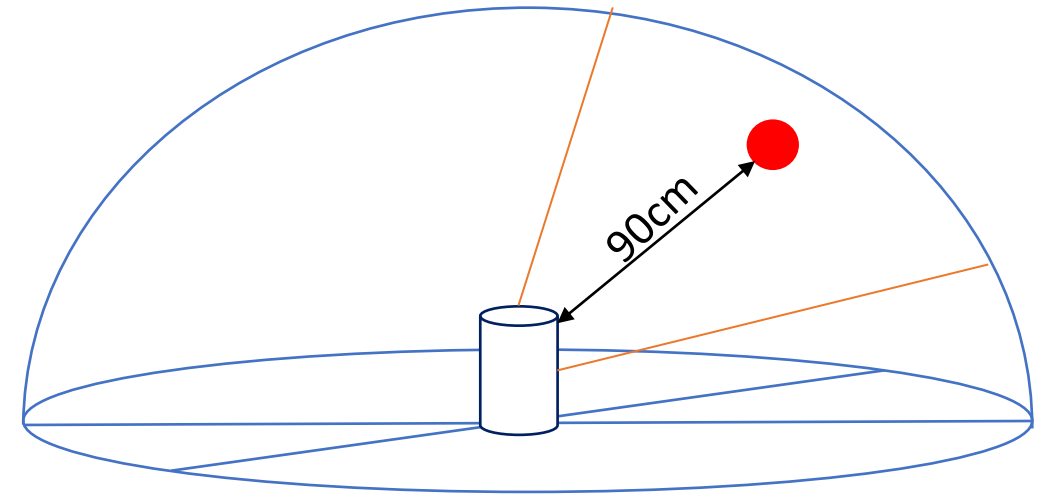
Bronze Level

Motion to search and detection of the target

Shortcoming/To work on :
- Motion :
The motion is not very smooth ➔ We could reduce the speed

- Detection :
Our detection is based on color ➔ It needs more setup to be sure it detects everytime

- Distance : We still don't compute the distance this week ➔ It will be ready for the next presentation

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