1. Introduction

- **Project Title**: RoboMaster S1 Ethical Awareness Demonstration – Conceptual Design
- **Objective of the Deliverable**: Present possible conceptual design ideas based off the pre-established problem statement and design criteria.
- **Overview of Design Criteria:** The RoboMaster S1 must display a use that promotes the idea of alternative uses for autonomous weapons systems, while remaining unmodified. The Robot should be used creatively and artistically while appealing to a broad audience.

2. Subsystems Overview

- Define the subsystems your project will include (minimum 3 required).
    - **Subsystem 1 Name:** RoboMaster S1 Physical components
    - **Subsystem 2 Name:** Mobility
    - **Subsystem 3 Name:** Code
    - **Subsystem 4 Name:** Appearance

3. Conceptual Designs for Subsystems

- **Subsystem 1:** Involves any physical attachments or modifications, such as an arm for drawing or a mechanism for planting symbolic objects.
- **Subsystem 2:** Focuses on controlling the robot's precise movement and ensuring it navigates correctly to execute visual tasks.
- **Subsystem 3:** Handles the software programming, integrating Scratch or Python to control the RoboMaster's movements, interactions, and functions.
- **Subsystem 4:** Considers visual design and symbolic elements that enhance the anti-war message, such as colors, stickers, or projections.

Subsystem 1: Physical Components (arm for drawing, cannon that implants seeds)

- **Concept 1: Marker attachment for peace symbol drawing**

  Sketch:

  Description: A lightweight attachment mounted on the robot's turret to drag a marker behind to draw symbol.

  Benefits: Simple, direct representation of peace.

  Drawbacks: Limited to surfaces that allow the marker for drawings.

- **Concept 2: Seed-planting mechanisms**
  Sketch or diagram:

Description: A mechanism that would be able to drop seeds.

Benefits: visually engaging, strong meaning behind the message.

Drawbacks: Hard to apply.

Subsystem 2: Mobility

Concept 1: Marker Attachment tilt axis/movement

Sketch/diagram:

Description of the concept: A removable marker attachment could be attached to the head/turret area of the robot for a wide range of motion with the marker. Tilting the head of the robot would change the angle of the marker against the drawing surface.

Benefits and drawbacks: The axis of rotation is limited to whatever section of the robot the marker attachment is placed on, for example the head/turret section. The tilting motion of the gyroscopic headpiece will allow for an optimal angle for drawing.

Concept 2: Seed Planter tilt/rotation and general movement

Description of the concept: Like the marker attachment, the seed planter would rely on the tilt and rotation of the turret mechanism where the attachment would be added. This concept also relies on the speed of the robot, as it should slow down while seeds are being

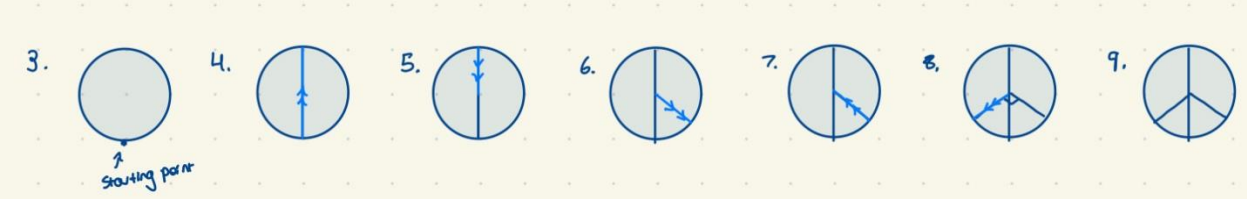
planted and increase speed while moving to the next location where seeds should be planted.

Benefits and drawbacks: The mechanism controlling the dropping of seeds could be challenging to implement mechanically, and without proper testing. The tilting motion of the gyroscopic headpiece could allow control of the dispersal of the seeds.

Subsystem 3: Code

Concept 1 (Draw peace symbol with robot movements):
Sketch or diagram (flow chart):

1. **Start**
2. **Move to the starting position**
3. **Draw a circle** (outer boundary of the peace symbol)
4. **Move straight from one end of circle to the other**
5. **Turn 360 degrees and go straight to centre of circle (radius length)**
6. **Turn 45 degrees left (to draw first angled line)**
7. **Turn 360 degrees and move back to centre of circle**
8. **Turn 90 degrees left (to draw second angled line)**
9. **Stop**



Description of the concept:
Code is built to move the robot in the path of a peace symbol that will allow the marker to draw a peace symbol. This will include functions such as turn a certain number of degrees, move forward in circular path, move forward in straight line, etc.

Benefits and drawbacks:

- Simple drawing, not much room for error
- Might not meet each line smoothly to create a “crisp” design/ drawing

Concept 2 (Launch or drop seed):

Sketch or diagram (flow chart):

1. *Start*
2. *Turret launch aimed for pot of soil*
3. *Turn 45 degrees*
4. *Turret launch #2 aimed for second pot of soil*
5. *Stop*

OR (if turret use is not permitted)

1. *Start*
2. *Stop at (x,y) location for seed drop #1*
3. *Translate forward (180 degrees) and stop for seed drop #2*
4. *Stop*

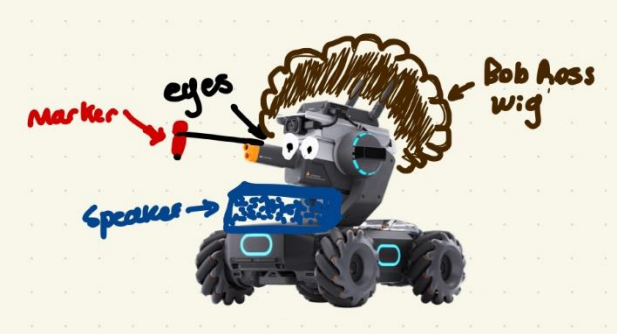
Description of the concept:
Code is built to project or drop a plant seed to symbolize life and growth rather than canons being used to for war and violence.

Benefits and drawbacks:

- Use of turret might create conflict with anti-war intentions
- Projection of seed distance may be unknown

Subsystem 4: Appearance/ Aesthetic

Concept 1: Draw peace symbol with marker



4. Combining Subsystems into Global Solutions

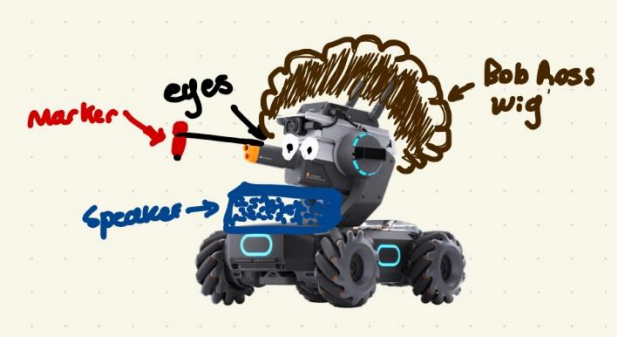
Global Solution 1: Marker Drawing a Peace Symbol

This idea attaches a lightweight marker holder to the RoboMaster S1's turret and uses simple movement code to draw a peace symbol on a smooth surface. It prioritizes ease of implementation, maintains the original structure of the robot, and clearly conveys an anti-war message through a familiar symbol. However, it requires a suitable drawing surface and precise coding to achieve crisp lines.

Global Solution 2: Seed Planting Mechanism

Here, the robot uses a small attachment or hopper that drops seeds when the turret tilts. By programming specific waypoints, the RoboMaster S1 would stop to release seeds, symbolizing growth and renewal instead of violence. While this is visually compelling and delivers a strong message, it may need more modifications to the robot's turret and could be harder to execute accurately.

Global Solution 3: Fun, Artistic Robot



In this concept, the RoboMaster S1 is outfitted with playful accessories like a wig, googly eyes, a marker to draw a peace symbol and a small speaker playing cheerful music to give it a friendly, lighthearted appearance. A marker is attached to the turret so the robot can move in planned patterns and draw a peace sign on the floor. By combining these humorous elements with a simple artistic action, the design presents the robot as a creative, positive force rather than a tool for conflict.

5. Selection Matrix and Evaluation (Ben)

Design Criteria	Weight	Solution 1: Marker Drawing	Solution 2: Seed Planting
Alternative use for autonomous weapons systems	5	10 (50)	7 (35)
Movement accuracy & speed	4	8 (32)	7 (28)
Creativity & artistic potential	3	9 (27)	9 (27)
Maintains RoboMaster S1 in its original form	5	10 (50)	6 (30)
Appeal to a broad audience	4	9 (36)	8 (32)

Design Criteria	Weight	Solution 1: Marker Drawing	Solution 2: Seed Planting
Total Score	—	195	152

Analysis

- Solution 1 (Marker Drawing) scored 195 points, making it the best choice based on the design criteria.
- It excels in maintaining the RoboMaster S1's original form (no permanent modifications) and avoiding any firing or launching mechanisms, which aligns with the project's core ethical message.
- Solution 2 (Seed Planting) scored lower (152 points) due to the difficulty of implementation, potential misalignment with the anti-weapon concept (turret use), and modifications required to add a planting mechanism.

Justification of Final Choice

- Final Choice: Solution 1 – Marker Drawing a Peace Symbol
- Why it was chosen:
    - Best alignment with anti-weapon messaging (no firing/launching).
    - Simple and effective—easy to implement without modifying the robot
    - Higher feasibility—movement programming for drawing is more precise and reliable than seed dropping.
    - Broad audience appeal—a peace symbol is universally understood and non-controversial.
- Why Solution 2 was rejected or modified:
    - Modifying the RoboMaster S1 to drop seeds may require physical alterations, which conflicts with the design criteria.
    - The use of the turret may be misinterpreted, even if the intention is peaceful.
    - Less control over results—planting effectiveness depends on terrain, seed distribution, and movement precision.

5. Final Concept Description

The RoboMaster S1 Ethical Awareness Demonstration integrates multiple subsystems to symbolize alternative uses for autonomous weapon systems. The physical components include a marker attachment that enables the robot to draw peace symbols, reinforcing the anti-war message while keeping the turret unmodified. Mobility is programmed to ensure precise navigation for creating artistic symbols. The code guides the robot's path to draw a peace symbol through programmed instructions. The appearance is enhanced with non-permanent stickers and colors that emphasize peace and sustainability.

Benefits of the Final Design

- Strong Symbolism: Promotes peaceful robotic applications.
- Creative & Engaging: Captures public attention through artistic expression.
- Non-Permanent Modifications: Preserves the RoboMaster S1's original form.
- Broad Appeal: Simple and accessible for diverse audiences.
- Accurate Execution: Ensures precise drawings through calibrated movement.

Potential Limitations

- Surface Dependency: Drawing is limited to suitable surfaces.
- Movement Precision: Small errors may affect accuracy.
- Time Constraints: Larger symbols require optimization for efficiency.

7. Task Plan Update (Rob)

- Summary updates made to the Trello board:
    - For each deliverable, there are subtasks in Trello given to each member of the group to complete.
    - End dates have been updated and added to all upcoming deliverables and group assignments.
    - Each member now has specific tasks attached to every deliverable.
- Ensure tasks are clearly categorized:
    - **Completed tasks: All of the past deliverables have been completed as well as the peer evaluation survey for assignment 2.1.**

- **Issues:** There are currently no tasks or assignments that have been put on hold. Everything is up to schedule.