Introduction:

This design project aims to combat the education and use of autonomous weapon systems through a subversive antiwar message delivered via a 90-second video featuring the RoboMaster S1. The video will be accompanied by a one-page manifesto written from the RoboMaster S1's perspective, stating its objection to being used for the education of autonomous weapon systems. The video and manifesto will collectively question the ethical ramifications of delegating military decisions to machines, urging audiences to consider the broader consequences of such advancements.

Our current plan for this design project is to program the RoboMaster S1 to create an art piece in defiance of the use of autonomous weapons systems. The art piece can be created through installing a temporary paintbrush attachment and programming the RoboMaster to follow a specific trajectory. The design seeks to show an alternative use of the RoboMaster S1 which does not promote the use of autonomous weapon systems, and which does not glorify or promote violence.

This purpose of this document is to define a list of prioritized design criteria, conduct technical benchmarking, and determine target specifications that will serve as a guide to the development of the final product. By establishing a clear design criterion to adhere to, it can be ensured that the RoboMaster S1 video will effectively convey an antiwar message while remaining feasible given the constraints.

Technical Benchmarking:

To ensure the development of a well-informed and effective solution, we have conducted technical benchmarking by researching existing products that address the clients interpreted needs. This will help us the industry standards and potential gaps in public awareness that our project can address. User benchmarking will be updated to incorporate insights from public perceptions and experiences with similar content. We are also conducting user benchmarking with respect to the RoboMaster S1. By analyzing both technical and user benchmarks, we will be able to refine the design criteria, ensuring that the final video and manifesto not only align with technical feasibility but also resonate with audiences and effectively communicate the project's ethical stance.

Category	Specification
Camera	FOV: 120°, Photo: 2560×1440, Video: 1080/30fps
Infrared Units	Narrow Range: 6m, Wide Range: 3m, Wide Width: 360°

Hit Detector	Detection: Gel diameter ≥6mm, speed ≥20m/s
Chassis	Weight: 3.3 kg, Speed: 0-3.5 m/s (forward)
Motor (M3508I Brushless)	Max Speed: 1000 rpm, Max Power: 19 W
Blaster	Launch Speed: 26 m/s, Frequency: 1-8/s
Gimbal	Pitch: -20° to +35°, Yaw: ±250°, Max Speed: 540°
Controller	Latency: 80-120ms, Live View: 720p/30fps
Battery	Capacity: 2400 mAh, Life: 35 mins (active), 100 mins (standby)
Charging	Input: 100-240V, Output: 12.6V, Max Power: 29 W
Gel Bead	Diameter: 5.9-6.8 mm, Weight: 0.12-0.17 g
App	RoboMaster, iOS 10.0.2 or later, Android 5.0+
Router	Recommended: TP-Link TL-WDR8600, Archer C7, NETGEAR X6S
microSD Card	Supported Capacity: Up to 64 GB

User Benchmarking

User benchmarking was performed to gather real world feedback and insights from actual users of a product. This helps identify areas of improvement, gauge satisfaction, and understand how well thew product meets user needs. Below is the summarized pros and cons of the Robomaster S1.

Several sources were used to gauge the community opinion on the Robomaster S1. Many of the sources rated the Robomaster highly, praising it for being highly educational and fun for those looking to start learning coding and robotics. Many of the users are younger children, in grade school. The build quality was commented as superb, as well as having a “robust design”. Reviewers enjoyed the fact that the S1 supports both scratch and python language models, saying it caters to users of all skill levels. The camera of the S1 was well enjoyed, with reviewers saying the object recognition and autonomous functions being very accurate, and enjoyable.

Some reviews stated that the S1 was very expensive, especially for an education toy. Although having both scratch and python some users found performance in python to be glitchy. The battery life was said to be insufficient, lasting around 35 minutes of continuous use. Some users found the setup and app navigation difficult. while being designed well for clean, indoor spaces, the Robomaster S1 was said to not perform outdoors, especially in less clean conditions.

Other examples of robots or creations that were originally created for military use is the internet and drones. The internet is being used daily for many people for work or projects such as this. Drones now a days are used to monitor crops or drop off supplies during disaster events such as tsunamis or tornados. The general public's reviews on these are generally positive.

Target Specifications:

Paintbrush attachment length - should not exceed 10 cm beyond the body of the robot to maintain balance and stability when drawing with the brush.

Paintbrush attachment up and down movement - there should be a system implemented so that the brush can lift at least 1-2 cm when moving to different parts of the drawing design.

Brush angle – marker should be on an angle less than 90 degrees to the ground to prevent marker skipping.

Surface roughness – must be a smooth surface that the marker can draw on easily.

Ink drying – the paint should dry quickly to avoid smudging if the wheels of the RoboMaster roll over the drawing.

Speed:

The RoboMaster's maximum speeds:

Forward speed: 3.5 m/s (12.6 km/h)

Backward speed of 2.5 m/s (9 km/h)

Sideward speed of 2.8 m/s (10.1 km/h)

For the goal to create a drawing through movements on the robot via marker attachment, a specific speed must be set to ensure accuracy and smooth lines/ curves when drawing the desired design. This speed should not exceed 0.5 m/s (ideally 0.05-0.3 m/s) otherwise it

may cause jagged lines or skipping, especially when drawing curved lines. For acceleration control, the robot should accelerate/decelerate smoothly at a max of 0.2 m/s^2.

Dimensions:

RoboMaster is 32cm ×24cm ×27cm (length x width x height). With the addition of the paintbrush attachment the RoboMaster might be a few centimetres greater in length and other accessories such as a wig, the robot might be a few centimetres greater in height.

Cost:

Spendings on this design should not exceed $100 since RoboMaster is already provided. The paintbrush attachment and brush will be low cost as well as accessories that will give the RoboMaster character (i.e. wig, glasses, eyes, lights, etc).

Weight:

The RoboMaster's weight is approximately 7.3lbs. Again, with the addition of accessories the RoboMaster might reach close to 8lbs.

Other important specifications:

Gripper grip strength: 5 N

Battery life: 35 minutes

Operating temperature range: -10 to 40 °C

These specifications will aid in evaluating potential solution ideas and provide measurable design goals.

Design Criteria Table:

Need	**Design Criteria**
1. Displays a use that promotes the idea of alternative uses for autonomous weapons systems	-Uses no firing/shooting/launching mechanisms (programming)
2. Move in all directions, with adequate speed and accuracy	-Adequate programming -Proper setup -Weight -speed

3. Has the ability to be used creatively and artistically	-Robot dimensions -Speed -Accuracy
4. Maintain RoboMaster S1 in its original form	-No permanent modifications
5. Video must appeal to a broad audience	-Inclusive and widely understandable visuals/messaging (video)

Client Meeting Reflection:

A client meeting was conducted on January 20, 2025. During the client meeting, we received important information regarding the structure of the project. We are to create a 90 second video and an accompanying one-page manifesto. The client emphasized the project should not depict any sort of violence, shooting, or endangering life in any way. Instead, the project should be more appropriate for a wider audience including children, political leaders, and policy makers. The tone should be clear and engaging, making it easy to understand the message of the video within a 90 second timeframe.

The client highlighted the importance of linking the manifesto to the video to strengthen the video's message and reinforcing the idea that even small changes in robotics can be the difference between life and death. Another one of the main ideas discussed in the meeting was DJI's intentions of using the Robomaster S1 to teach children how to program autonomous weapons. Our task is to reject the idea of teaching kids to program autonomous weapons.

Following the client meeting, we adjusted the importance of our design criteria to prioritize clarity, emotional impact, and symbolic representation. Creative storytelling and avoiding violence became important to ensuring the message works for a wide audience. Compared to deliverable B, which focused more on the Robomaster's technical features, we updated our criteria to highlight the connection between the video and manifesto. This change helps us deliver a clear anti AI war message while keeping the design practical and feasible.

Conclusion:

The finalized design criteria and specifications outlined in this document ensure that the RoboMaster S1 remains unmodified except for the paintbrush attachment which can be easily removed, operates within its programming capabilities, and produces a final

product that symbolically resists the concept of autonomous warfare. Additionally, audience engagement considerations have shaped the approach to storytelling, making the video and manifesto accessible, thought-provoking, and emotionally resonant.