Third Prototype Development Plan

1. Objective of the Third Prototype (Why?)

The third prototype aims to achieve the following objectives:

- **Full System Integration:** This prototype will integrate all the refined components and subsystems from the second prototype, ensuring that the RoboMaster S1 can effectively draw a peace symbol with precision and stability.
- **Validation of Usability Improvements:** The prototype will test the usability of the system, including the user interface, ease of operation, and overall user experience.
- **Performance Benchmarking:** The prototype will be tested under real-world conditions to ensure that the system performs reliably and meets the target specifications.
- **Durability Testing:** The prototype will undergo stress tests to evaluate the wear and tear resistance of the materials and components, ensuring long-term functionality.

2. Prototype Scope (What?)

The third prototype will focus on:

- **Structural Integrity:** The 3D-printed arm will be refined to provide adequate stability and structural integrity
- **User Interface:** The code being used will be refined to instruct the Robomaster to effectively draw a peace symbol
- **Cosmetic Enhancements:** The wig and other cosmetic elements will be securely attached without interfering with the functionality of the robot.
- **Drawing Precision:** The prototype will be tested to ensure that the RoboMaster can draw smooth, precise lines and curves, with the marker maintaining consistent contact with the paper.

3. Timeline (When?)

The third prototype will be developed and tested over the next **two weeks**, with the following milestones:

- **Week 1:** Finalize the design and 3D print the arm system. Assemble the prototype and conduct initial tests.
- **Week 2:** Perform usability and durability tests. Gather user feedback and make final adjustments.

Prototyping Test Plan

1. Test Objectives

- **Stability:** Ensure the RoboMaster moves without wobbling or instability while drawing.
- **Drawing Precision:** Assess the accuracy of the lines and curves drawn by the RoboMaster.
- **Durability:** Test the wear and tear resistance of the 3D-printed arm
- **Usability:** Evaluate the ease of programming and operating the RoboMaster.

2. Test Procedures

- **Stability Test:** Observe the RoboMaster's movement while drawing. Check for any wobbling or instability in the arm.
- **Drawing Precision Test:** Run the RoboMaster on a predefined path and assess the accuracy of the lines and curves. Adjust the parameters in scratch when/if necessary
- **Durability Test:** Conduct repeated drawing sessions to test for wear and tear on the 3D-printed components.
- **Usability Test:** Have users program the RoboMaster to draw the peace symbol and provide feedback on the ease of use.

3. Metrics for Success

- **Stability:** The RoboMaster should move smoothly without any wobbling or instability.
- **Drawing Precision:** The lines and curves should be smooth and accurate, with the marker maintaining consistent contact with the paper.
- **Durability:** The 3D-printed components should show minimal wear and tear after repeated use.
- **Usability:** Users should find the programming interface intuitive and easy to use.

4. Data Collection & Analysis

- **Recording Methods:**
    - Video analysis of the RoboMaster's movement and drawing precision.
- **Analysis Techniques:**
    - Qualitative analysis of user feedback to identify areas for improvement.

Client Feedback

Topic	Client Feedback	Action Taken
Turret Capabilities	Can hold moderate weight but limited rotation (200°).	Kept the arm lightweight and designed movements within the turret's range.
Mobility	Robot can move each wheel independently (diagonal, straight, rotational).	Used independent wheel control for smoother drawing.
Attachment Limitations	Attachments are allowed but must not damage the robot.	3D print filament was used to reduce weight and avoid stressing the turret.
Aesthetics	"Bob Ross" appearance is acceptable.	A wig was purchased and will be attached without blocking sensors or affecting movement
Coding Limits	Python is possible, but avoid complexity. Stick to basic functions and math.	Continued using Scratch to keep the system simple and functional.
Video Expectations	Show the robot performing tasks clearly. Demonstrate drawing and the concept's purpose.	Planned the final video to highlight the drawing ability and align with the project's creative theme.

Potential Client/User Feedback:

The group conducted a brief design review in our lab session with another team working on a similar project, who agreed that our video would convey a clear anti-autonomous weapons message, highlighting the key themes outlined by the client. Group members have also shared ideas relating to the video to friends and students, who agree that it accurately portrays the themes of digital dehumanization, impacts on our relationship to technology, and loss of meaningful human control

Updates to Detailed Design and BOM

1. Updated Design Changes

- **Arm system:** The 3D-printed arm will be changed according to the results of the tests performed
- **User Interface:** The programming interface will be optimized based on the robots accuracy, and user feedback
- **Cosmetic Enhancements:** The wig and other cosmetic elements will be securely attached without interfering with the functionality of the robot.

2. Updated Bill of Materials (BOM)

Item	**Cost ($)**
3D filament	1
A4 paper (4 pieces)	0.02
Sharpie fine point marker	3.5
RoboMaster S1	0
Cosmetics (Wig)	15
RoboMaster app	0
Total	**20.48**

Justification for the Third Prototype

The third prototype builds on the results of the previous prototypes:

- **First Prototype:** The initial prototype demonstrated that the RoboMaster could control a marker's movement, but the arm design and marker-holding mechanism needed refinement.
- **Second Prototype:** The second prototype introduced a 3D-printed arm and clamp system, improving stability and durability. However, further testing revealed the need for better drawing precision and usability.
- **Third Prototype:** The third prototype integrates all the improvements from the previous iterations, focusing on full system integration, usability, and durability. This prototype will serve as a comprehensive version of the final solution, ready for real-world testing and user feedback.

Next Steps

- **Finalize the Third Prototype:** Complete the assembly and testing of the third prototype.
- **Gather User Feedback:** Collect feedback from potential users and the client to identify any final adjustments needed.