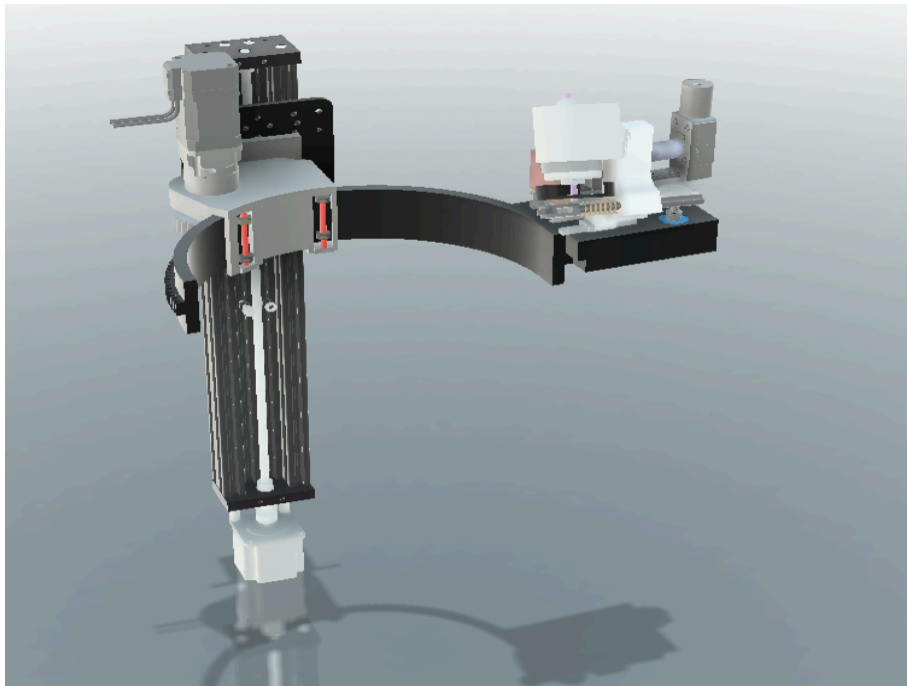


# Project Progress & Next Steps

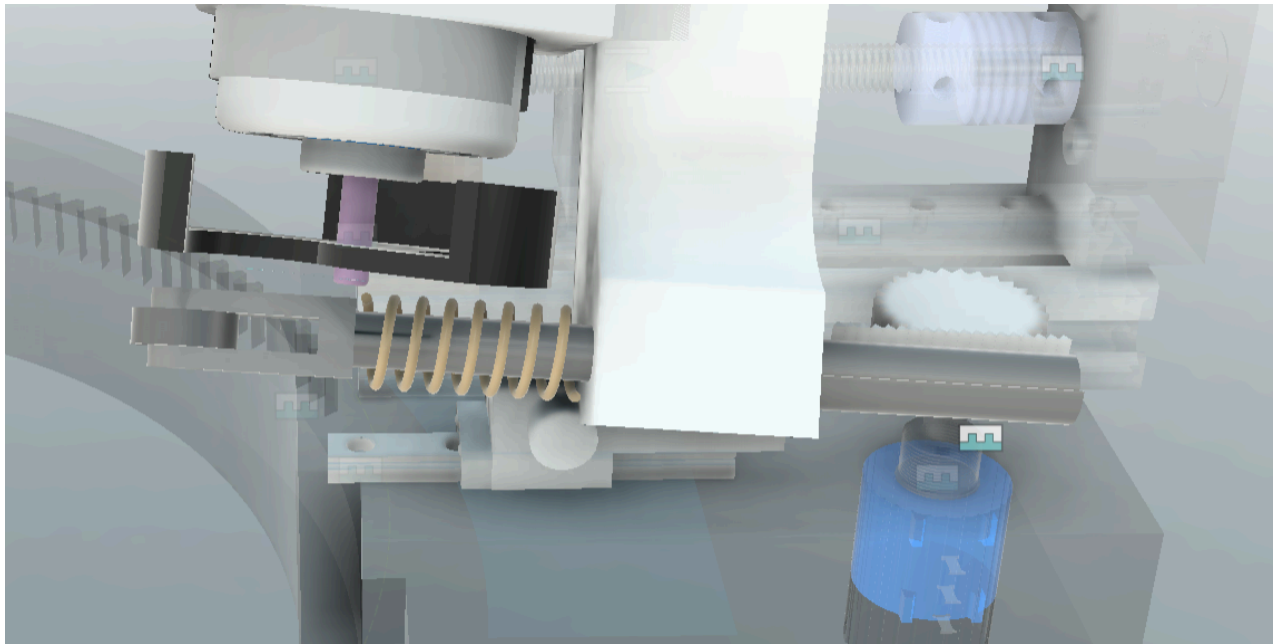
## 1. Cutting Unit Design Details

Feature	Description
Movement Modes	- Circular cutting path around tree
	- Vertical movement for helical incision
Feedback System	- Spring mechanism connected to a roller
	- Roller follows bark unevenness, spring transmits motion to potentiometer
	- Cutting blade position automatically adjusts with tree surface
Actuation Upgrade	- Original: Stepper motor (caused vibration due to weight/length)
	- New: Worm gear DC motor (compact, high torque, vibration-reducing)
Cutting path	- Revolution restricted to 90° for simplicity and effective result



## 2. Feedback Mechanism

Component	Function
Spring-Attached Roller	Senses tree bark unevenness
Spring Mechanism	Transmits roller position change to blade
Blade Adjustment	Blade moves in/out as roller compresses/extends spring



### 3. Design & Manufacturing Updates

Task/Component	Status	Remarks
Motors (Worm gear DC motor, rotary motor)	<b>Procured</b>	All motor units received and validated for design requirements
Springs (feedback mechanism)	<b>Procured</b>	Spring components received; matches design specs for force and endurance
Design (circular & vertical parts)	<b>Finalized</b>	All dimensions, specs, and drawings completed; ready for fabrication
Feedback Mechanism (spring roller system)	<b>Finalized</b>	Design tested and confirmed, ready for manufacturing
3 Face Cutting Blade	<b>Manufacturing Pending</b>	-
Rover Platform	<b>90% Complete</b>	Manufacturing done; minor modifications for gearbox replacement (due to previous complaint).
Gearbox Replacement (Rover)	<b>In Progress</b>	Need to purchase a new gearbox from China.
Robotic Arm Mounting Structure	<b>Manufacturing Pending</b>	-
Robotic Arm - Lower Arm	<b>Designed, Manufacturing Pending</b>	CAD design complete; ready for fabrication.
Robotic Arm - Upper Arm	<b>Designed, Manufacturing Pending</b>	Design finalized; fabrication next step

### 3. Circuit & Control System Updates

Task/Component	Status	Remarks
Rover	<b>95% Complete</b>	Functionally done; pending final optimization
Communication Protocol	<b>Implemented</b>	Rover receives commands from STM32 Black Pill
Robotic Arm Controller	<b>80% Complete</b>	Direct joint angle control working.
Inverse Kinematics (IK)	<b>Pending</b>	Convert X, Y, Z coordinates to joint angles
Cutting Mechanism	<b>85% Complete</b>	Hardware built; automatic cutting cycle ready
Force Sensor Feedback	<b>Integrated</b>	-
PID Control (Cutting Head)	<b>In Progress</b>	Kp, Ki, Kd optimized for smooth cutting response
Limit Switches	<b>Installed</b>	-
System Integration(Rover + Robotic arm + Cutting System)	<b>In Progress</b>	Testing communication and operation together
RF Remote Purchase	<b>Completed</b>	8 channel rf remote
RF Remote Channel Mapping	<b>Completed</b>	-
BLDC Controller Purchase	<b>Pending</b>	25A controllers need to be purchased to avoid current overload issues.
Low level controller purchase	<b>Completed</b>	Replaced damaged boards.

- CNC manufacturing of critical mechanical assemblies is yet to begin, including fabrication of the robotic arm segments, cutting system parts and any remaining structural parts.
- Procurement of key components, specifically the gearbox for the rover platform and the motor controllers (25A BLDC controllers), is pending.

After completing manufacturing, the next phase will be focused on testing the cutting unit integrated with the robotic arm on actual rubber trees.