

# **Prototype III and Customer Feedback**

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## **I. Introduction & Objectives**

This deliverable documents the development and evaluation of our third prototype, representing a fully functional version of our solution. The primary objectives of Prototype III are to achieve full system integration, optimize subsystem performance, and validate the solution's overall reliability. Feedback from clients and external users was gathered to inform further refinements. The results of the testing plan and feedback analysis will guide final adjustments in preparation for Design Day.

## **II. Prototype III Development**

### **Overview:**

Prototype III serves as a comprehensive iteration, integrating all subsystems into a single, functional solution. The design builds upon the improvements established in Prototype II, ensuring enhanced sampling reliability, sensor accuracy, and deployment stability.

### **Key Design Enhancements:**

- 1. Sampling Mechanism:**
  - Adjusted the blade for more effective material extraction.
- 2. Feedback & Monitoring System:**
  - Enhanced the Arduino sensor feedback system with improved real-time visualization.
  - Switched the feedback to a load sensor that gets a weight within desired range
  - Added error detection algorithms for more reliable data interpretation.
- 3. Telescoping Deployment System:**
  - Increased structural support with additional reinforcement to minimize vibrations.
- 4. Failsafe Enhancements:**
  - Strengthened safety lines and implemented a redundant securing system.

## **III. Prototyping Test Plan, Analysis, and Results**

### **Test Plan Objectives:**

The primary objectives of the Prototype III test plan are to validate full system integration, ensure consistent sampling performance, and confirm the accuracy of the sensor feedback system. Each test was designed to measure the effectiveness of the solution under real-world conditions.

#### Detailed Test Procedures & Metrics:

Test No.	Test Title	Objective	Test Description	Metrics & Target
1	System Integration	Validate full prototype functionality	Conduct operational tests with all subsystems integrated	Complete cycle with < 5% error
2	Sample Consistency	Ensure reliable and repeatable collection	Perform multiple extractions under identical conditions	Mass deviation < 5%
3	Sensor Data Accuracy	Assess real-time data feedback reliability	Compare sensor output with manual measurements	< 8% discrepancy
4	Deployment Stability	Confirm mechanical integrity	Evaluate performance under simulated operational loads	No jamming, consistent operation

#### Stopping Criteria:

Testing will conclude once each test yields consistent results over three consecutive cycles. Any major failures will prompt a reassessment and design refinement before further testing.

## IV. Customer Feedback and Analysis

#### Feedback Overview:

Following Prototype III testing, we collected feedback from both our primary client and external users, including peers and faculty members. Feedback focused on the system's reliability, usability, and overall effectiveness.

#### Key Feedback Insights:

- **Sampling Efficiency:** Users praised the improved blade design
- **Monitoring System:** The sensor feedback interface was noted for its clarity and ease of use, with minor suggestions for visual enhancement.
- **Mechanical Stability:** Positive remarks were received regarding the structural improvements of the deployment system.

## V. Updated Target Specifications and Design Modifications

Based on feedback and testing results, the following adjustments will be implemented for the final prototype:

- **Visual Enhancements:** Upgraded the sensor interface with improved graphical representations for better clarity.
- **Structural Reinforcement:** Minor improvements to the telescopic rod connections to further reduce vibration.
- **Rework Coding:** Rework aspects of code so that we can work with 2 arduinos

## VI. Conclusion

Prototype III has demonstrated strong performance in achieving the desired objectives. The feedback collected has been instrumental in identifying final refinements. With consistent sampling results, reliable feedback data, and enhanced mechanical stability, the solution is well-positioned for final adjustments and presentation on Design Day. The next step involves incorporating the final updates and preparing comprehensive documentation, including the user manual for deliverable K.