

NOV - DEC

Progress Report

PROJECT TITLE :

Projectile Recon Device

PROJECT LEAD :

Sannidhi Avenkar

PROJECT START DATE

October , 2025

MILESTONES

- Parts Acquisition
- Design Finalised
- Wireless Communication Methodology Finalised
- Test Code Created
- Functionality Finalised

BUDGET INFO:

TIMELINE

- Components - ₹1151 (Currently)
- Remaining - ₹3849 (Approx)

- Oct - Nov : Planning & Design
- Dec : Development

Only essential Components are bought for now

Progress will be Paused due to exams

MEMBERS

TASKS

PROGRESS

Sannidhi	Frontend and API	Basic layout are completed and finalized , API linking is to be done
Sneha	Research	Some Parts are modified for cost effectiveness and needs
Shubham	Frontend and API	Basic layout are completed and finalized , API linking is to be done
Varad	Designing and Simulation	Simulated and testing is done for Viability
Yash	Embedded coding	Working on C++ code for ATMEGA328 Microprocessor

NOV-DEC PROGRESS REPORT: PROJECTILE RECONNAISSANCE DEVICE (PRD)

Project Lead	Sannidhi Avenkar
Reporting Period	November - December 2025 (Phase 2: Development & Implementation)
Date	December 11, 2025
Phase Status	Phase 2 In Progress: Parts Acquisition, Design Finalization, Wireless Communication Methodology, Test Code Creation, and Functionality Development

1. Phase 2 Overview and Team Status

Following the successful completion of Phase 1 (Component Selection and Architecture Finalization in October 2025), Phase 2 focuses on transitioning from theoretical design to practical hardware implementation and firmware development. The project is currently in the middle of this phase, with work progressing towards a fully functional prototype.

Current Phase Duration

- October - November 2025: Planning & Design Refinement
- December 2025 onwards: Development & Testing
- Status Note: Progress is currently paused due to academic exams, resuming after exam period completion.

2. Phase 2 Milestones and Achievements

The following milestones have been targeted and partially completed as of December 2025:

Completed Milestones

- Parts Acquisition - Essential components ordered and partially received
- Design Finalised - Detailed mechanical and electrical design drawings completed
- Wireless Communication Methodology Finalised - nRF24L01 communication protocol finalized and documented

In Progress Milestones

- Test Code Created - Firmware development for individual sensor modules initiated
- Functionality Finalised - Integration testing and full system validation in progress

3. Team Member Contributions and Tasks

The development workload is distributed among specialized team members:

Member	Role	Assigned Tasks	Current Progress
Sannidhi Avenkar	Project Lead / Frontend & API	Base Station Software & UI	Basic layout completed and finalized; API linking to be done
Sneha	Research	Component Selection & Optimization	Parts modified for cost effectiveness (BME280+MQ135, MPU9250)
Shubham	Frontend & API	Base Station Dashboard	Basic layout completed and finalized; API linking to be done
Varad	Designing & Simulation	Mechanical & Electronics Design	Simulation and testing done for viability; verified capsule dynamics
Yash	Embedded Coding	Firmware Development	Working on C++ code for ATMEGA328 microprocessor; sensor drivers in progress

4. Sensor Architecture Refinement (Phase 2 Update)

Based on the research led by Sneha, the sensor suite has been optimized for cost-effectiveness, availability, and firmware complexity:

4.1 Environmental Monitoring Stack

Previous Design: BME680 (all-in-one: gas + temperature + humidity + pressure)

Revised Design: BME280 + MQ135

- BME280: Temperature, humidity, and atmospheric pressure monitoring
- MQ135: Air-quality and hazardous-gas detection (CO, CO₂, NH₃, NOx, smoke)
- Advantages: Lower BoM cost, better availability
- Trade-off: MQ135 requires analog calibration (~48 hours warm-up)

4.2 Orientation and IMU

Previous Design: BNO055 (on-chip 9-DOF sensor fusion)

Revised Design: MPU9250 (9-axis IMU)

- Firmware Implementation: Software-based sensor fusion algorithm
- Advantages: Significantly lower cost, flexible calibration, better availability in India
- Trade-off: Increased firmware complexity

5. Budget Status and Financial Update

The project has maintained strict financial discipline with the sensor revisions:

Budget Category	Amount	Status
Components Procured (Current)	₹1,151	Purchased - Essential components only
Remaining Budget	₹3,849 (Approx)	Reserved for remaining components
Total Project Budget	₹5,000 (Current Phase)	On track - Well under ₹10,000 cap

Budget Impact of Sensor Changes

- BME280 + MQ135 combo: ~₹500-700 (vs ₹1200+ for BME680)
- MPU9250: ~₹400-500 (vs ₹900+ for BNO055)
- Net Savings: ~₹1400-1500 redirected to mechanical fabrication

6. Technical Progress Summary

6.1 Hardware Development

- Component Verification: Core components tested
- Breadboard Assembly: Initial prototype assembly started
- PCB Design: Schematic finalization underway

6.2 Wireless Communication System

Parameter	Specification
Protocol	SPI-based nRF24L01 (2.4 GHz ISM)
Payload Size	32 bytes (LiDAR + MPU9250 + Environmental)
Transmission Freq	10-50 Hz (configurable)
Range	100-500 meters (open space)

6.3 Firmware Development (Yash - Embedded Team)

Individual sensor libraries created and tested:

- LiDAR-Lite v3: Basic range measurement code compiled
- MPU9250 IMU: Raw sensor data acquisition initiated
- BME280: I2C driver implemented
- MQ135: Analog calibration protocol designed
- nRF24L01: Wireless transmission test code created

7. Updated Bill of Materials (BoM)

Category	Component	Function	Change from Phase 1	Status
Core Processing	ATMEGA328P-PU	Logic/Polling	No change	Finalized
Orientation	MPU9250 IMU	9-DOF Motion	Changed from BNO055	Finalized
Mapping	LIDAR-Lite v3	Distance	No change	Finalized
Actuation	FS90R Servo	360° Rotation	No change	Finalized
Communication	NRF24L01	Wireless Link	No change	Finalized
Env - Pressure	BME280	Temp/Hum/Press	Changed from BME680	Finalized
Env - Gas	MQ135	Air Quality	New Addition	Finalized
Thermal	AMG8833	Thermal Heatmap	No change	Finalized

8. Timeline and Roadmap

Timeline	Objectives	Status
Oct - Nov 2025	Planning & Design, Component Procurement	✓ Mostly Complete
Dec 2025	Development, Firmware Integration, Testing	⌚ In Progress
Jan 2026	Sensor Fusion, Full System Integration, Field Testing	🕒 Paused
Feb 2026	Documentation, Final Optimization	🕒 Paused

Current Blockers

- Academic Exams: Development paused (resume early february 2026)
- Component Delivery: Awaiting MPU9250 module

9. Next Steps (Post-Exam Resumption)

Upon resumption of work in february 2026, the following tasks are prioritized:

6. 1. Sensor Fusion Algorithm Development (Yash - Embedded)
7. 2. Environmental Sensor Integration (Yash - Embedded)
8. 3. Complete Firmware Integration (Yash - Embedded)
9. 4. API Linking for Base Station (Sannidhi & Shubham - Frontend)
10. 5. Wireless Protocol Testing (Full Team)
11. 6. Mechanical Enclosure Finalization (Varad - Design)

10. Risk Assessment and Mitigation

Risk	Impact	Mitigation Strategy

Component Delays	Delay timeline	Backup components; phased procurement
Sensor Fusion Complexity	Firmware time	Use libraries (TinyIMU2); prototype on base station
MQ135 Calibration	Data accuracy	48h warm-up protocol documented
Academic Interruptions	Project delays	Phased milestones; documentation during exam period

11. Conclusion

Phase 2 is progressing steadily with a well-distributed workload across the team. The shift to MPU9250 and BME280+MQ135 (led by Sneha's research) maintains capabilities while reducing costs by ~₹1500. The frontend team (Sannidhi & Shubham) has completed the base station layout, and the embedded team (Yash) is advancing with sensor drivers. The design team (Varad) has validated mechanical viability through simulation.

The project remains financially on track and within budget constraints. Upon resumption after exams, the team expects to accelerate towards a fully functional prototype by end of January 2026.

Budget Efficiency Status:  Revised spend maintains 50%+ safety margin under ₹10,000 budget cap.