Created by Author

Zero-Visibility Autonomous Landing System (Z-VALS)

Matthew Calim, Asaf Iron-Jobles, Connor Klies, Sam Mansouri, Reshmi Nilus

Problem

UAVs cannot reliably land in **smoke/fog/low-visibility** environments

Cameras and GPS fail indoors or under obscurants

Emergency response + logistics demand robust landing capability

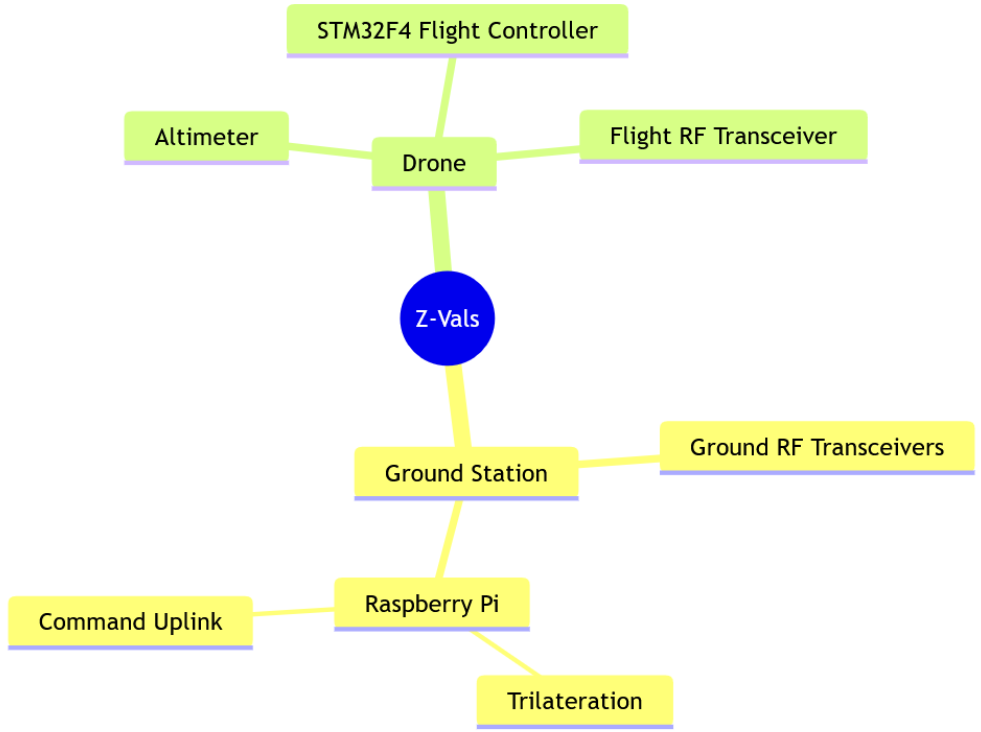
Solution: Zero-Visibility Autonomous Landing System (Z-VALS)

RF-based pseudo-ILS

Indoor, GPS-denied, no vision

Manual → Autoland transition

High Level Architecture



Creativity

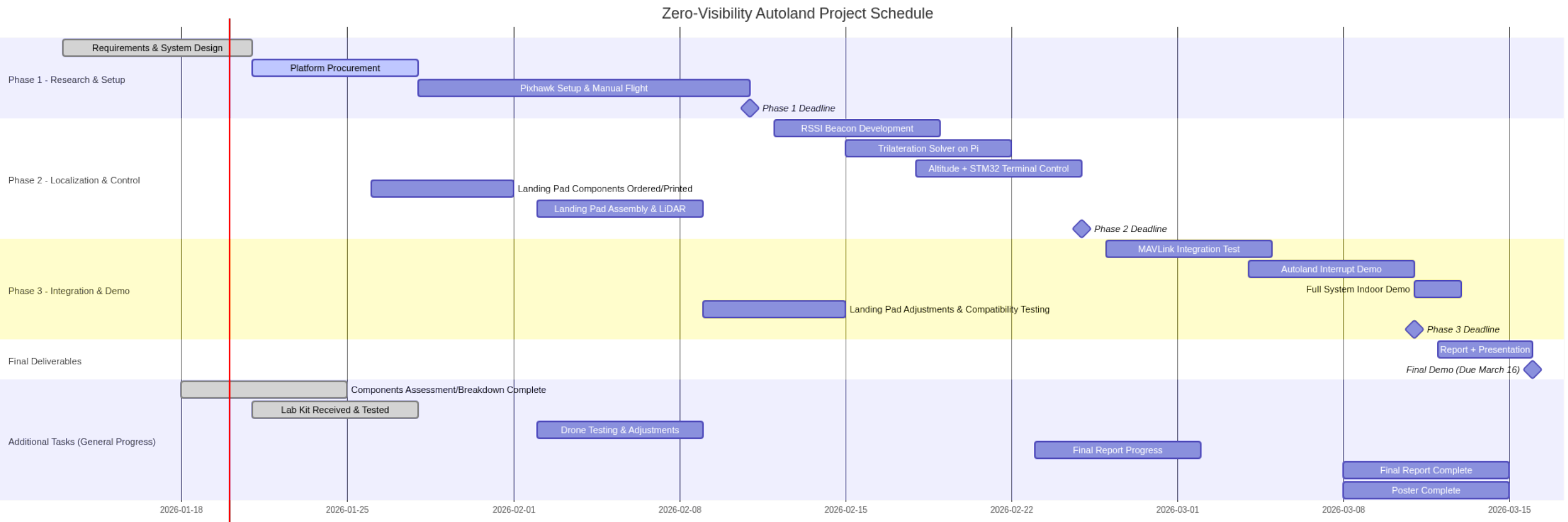
- Current autonomous landing is **vision-based or vision-assisted**
- Z-VALS is a novel effort to implement a landing system that:
  - Is **low-cost**
  - Operates on truly **zero visibility**
  - Has applications in the **drone/autonomous aircraft** space

Source: [1] 'Prime Air: Amazon Drone Delivery and FAA Safety,' *About Amazon*. [Online]. Available: https://www.aboutamazon.com/news/transportation/prime-air-amazon-drone-delivery-faa-safety. [Accessed: Jan. 19, 2026].

Feasibility: Schedule

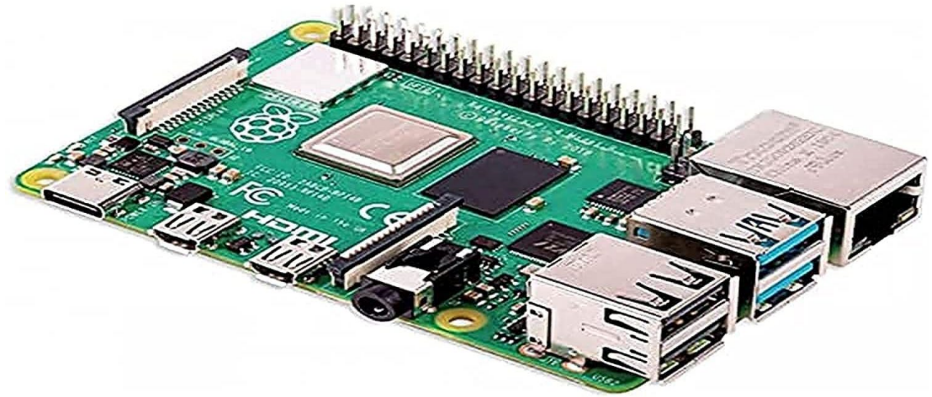
This project is divided into three attainable intermediate milestones:

- **Manual flight** setup
- **Localization** via RSSI trilateration and onboard altimeter
- **Autonomous control** touchdown



Cost-effectiveness

- Estimated total cost $300, self-funded
- Raspberry Pi 4 and STM32F4 provided at no cost
- RF Modules, Altimeter (~$100)
- Drone platform (~$110)
- 3D-printed parts ($15)
- Power system (~$50)
- Additional circuit components sourced from student inventory
- Replacement of broken or faulty parts ($25)
- **Significantly more simple than other autonomous systems (e.g. MIT MiFly, Prime Air VTOL)**



Source: [2] 'Raspberry Pi 4 Model B 8GB, Cortex-A72,' *Amazon India*. [Online]. Available: https://www.amazon.in/Raspberry-Pi-Cortex-A72-Computer-RPI4-MODBP-8GB/dp/B0899VXM8F. [Accessed: Jan. 19, 2026].

Source: [3] 'Pixhawk PX4 PRO 32-Bit Flight Controller Autopilot,' *Shopee Malaysia*. [Online]. Available: https://shopee.com.my/Pixhawk-PX4-PRO-PIX-32-Bit-Flight-Controller-Autopilot-with-4G-SD-RC-Quadcopter-Ardupilot-ArduPlane-ArduRover-i.756673533.22950536047. [Accessed: Jan. 19, 2026].

Feasibility: Risk Analysis

Failures in flight test can damage parts	• Design tests with product safety in mind
Purchase/fabrication of new parts is expensive	• 3D printing these parts can be more cost effective
Novel drone design may be prohibitive to design and deploy	• Modifying an open-source drone platforms could save time and money

Z-VALS in Summary

A **zero-visibility** autonomous **drone landing** system

RF-to-ground and an onboard **altimeter** to localize

Novel localization system, which is **cost-effective**

Will serve **emergency response and logistics** use cases