



Part 1: Mini Lab Kickoff (Getting Hands-On Fast) ⚡🔧




- **Chapter 1: Welcome to the Lab!** 🖐️💡
 - **Topics:** Setting up Python environment, Jupyter/VS Code, installing signal libraries.
 - **Mini-Lab Twist:** “Your First Signal” — plot a sine wave and see it dance.
 - **Chapter 2: Signal Ingredients: Understanding IQ & Data** 💡📊
 - **Topics:** IQ data format, real vs imaginary parts, loading CSV/BIN files.
 - **Mini-Lab Twist:** Treat IQ data like a recipe — spot “bad ingredients” in noisy signals.
 - **Chapter 3: Visualizing Signals: Your DSP Playground** 📈🔧
 - **Topics:** Time domain, frequency domain, FFT basics.
 - **Mini-Lab Twist:** Animate a signal transformation. “See your data come alive.”
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Part 2: DSP Foundations (Understanding & Shaping Signals) 🔧📡




- **Chapter 4: Filter Fun: LPF, HPF, & Band Adventures** 🎵👩🔍
 - **Topics:** FIR/IIR filters, filter design, frequency response.
 - **Mini-Lab Twist:** “Filter Gym” — train signals through LPF/HPF and see results.
 - **Chapter 5: Frequency Response with freqz** 📊💡
 - **Topics:** Analyzing filters, magnitude & phase response, stability.
 - **Mini-Lab Twist:** Signal detective — visualize where filters fail or shine.
 - **Chapter 6: Advanced DSP: Windowing & Overlap** 💡🔗
 - **Topics:** Hanning/Hamming windows, STFT, short-time analysis.
 - **Mini-Lab Twist:** Slice signals like a pizza — observe spectral changes.
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Part 3: IQ Signal Analysis & Manipulation




- **Chapter 7: Noise Hunters: Cleaning IQ Data** 
 - **Topics:** Removing DC, filtering noise, normalization.
 - **Mini-Lab Twist:** “Noise vs Signal” game — identify hidden patterns.
 - **Chapter 8: Detect & Decode: Extracting Meaning** 
 - **Topics:** Peak detection, modulation basics (AM, FM), constellation plots.
 - **Mini-Lab Twist:** Signal as a treasure map — decode hidden info.
 - **Chapter 9: IQ Visualization & Feature Extraction** 
 - **Topics:** Spectrograms, envelope detection, feature vectors for ML.
 - **Mini-Lab Twist:** Turn raw IQ data into colorful “data art.”
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Part 4: Drone Integration

- **Chapter 10: Drone Basics & Python Setup** 
 - **Topics:** Types of drones, safety, connecting TelloPy or DroneKit.
 - **Mini-Lab Twist:** Drone “passport check” — visualize components & flight readiness.
 - **Chapter 11: Flying with Signals: Command & Control** 
 - **Topics:** Takeoff, land, move, rotate; sending IQ-based commands.
 - **Mini-Lab Twist:** Drone obeys signals from your DSP “brain.”
 - **Chapter 12: Seeing with the Drone: Camera & Vision** 
 - **Topics:** Accessing camera feed, OpenCV basics, detecting objects.
 - **Mini-Lab Twist:** “Drone sightseeing” — overlay DSP analysis onto visuals.
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Part 5: AI Meets DSP & Drone

- **Chapter 13: Object Tracking & Signal-Following Drones** 
 - **Topics:** Simple ML for tracking, integrating IQ analysis with drone flight.
 - **Mini-Lab Twist:** Drone plays “signal hide & seek” using IQ data.

- **Chapter 14: Pathfinding & Obstacle Avoidance** 🗺️🚁
 - **Topics:** Waypoints, sensor integration, SLAM basics.
 - **Mini-Lab Twist:** “Maze runner” drones guided by signal intelligence.
 - **Chapter 15: Autonomous Mission Control** 🗣️🤖
 - **Topics:** State machines, conditional flight, combining DSP & AI decisions.
 - **Mini-Lab Twist:** Drone executes multi-step missions like a smart delivery bot.
 - **Chapter 16: Project Playground: Your First Mini Lab Masterpiece** 🏠🏆
 - **Topics:** Combine DSP, IQ, AI, and drone skills in a single project.
 - **Mini-Lab Twist:** Brainstorm your own “Signal-to-Sky” project.
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Appendices & Resources 📖🔧

- Python Crash Course for DSP & Drones 📖
 - Key Libraries & Tools Reference 🔍
 - Troubleshooting Guide 🔍
 - Project Ideas & Challenges 💡🔍
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