



# Drone Design & Development Program

By : TuxAcademy

An Educational & Research Division of Linux Mantra IT Services

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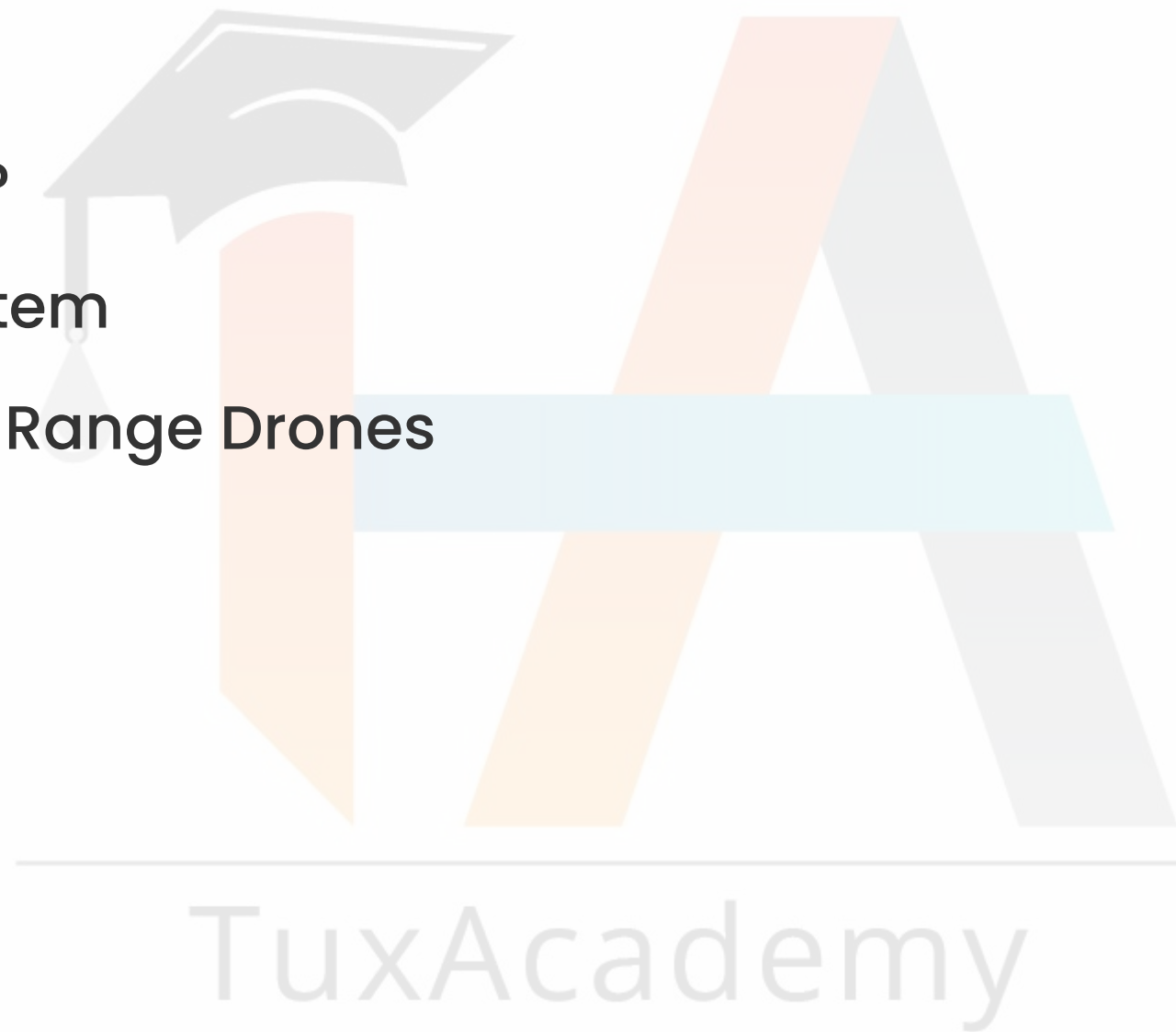
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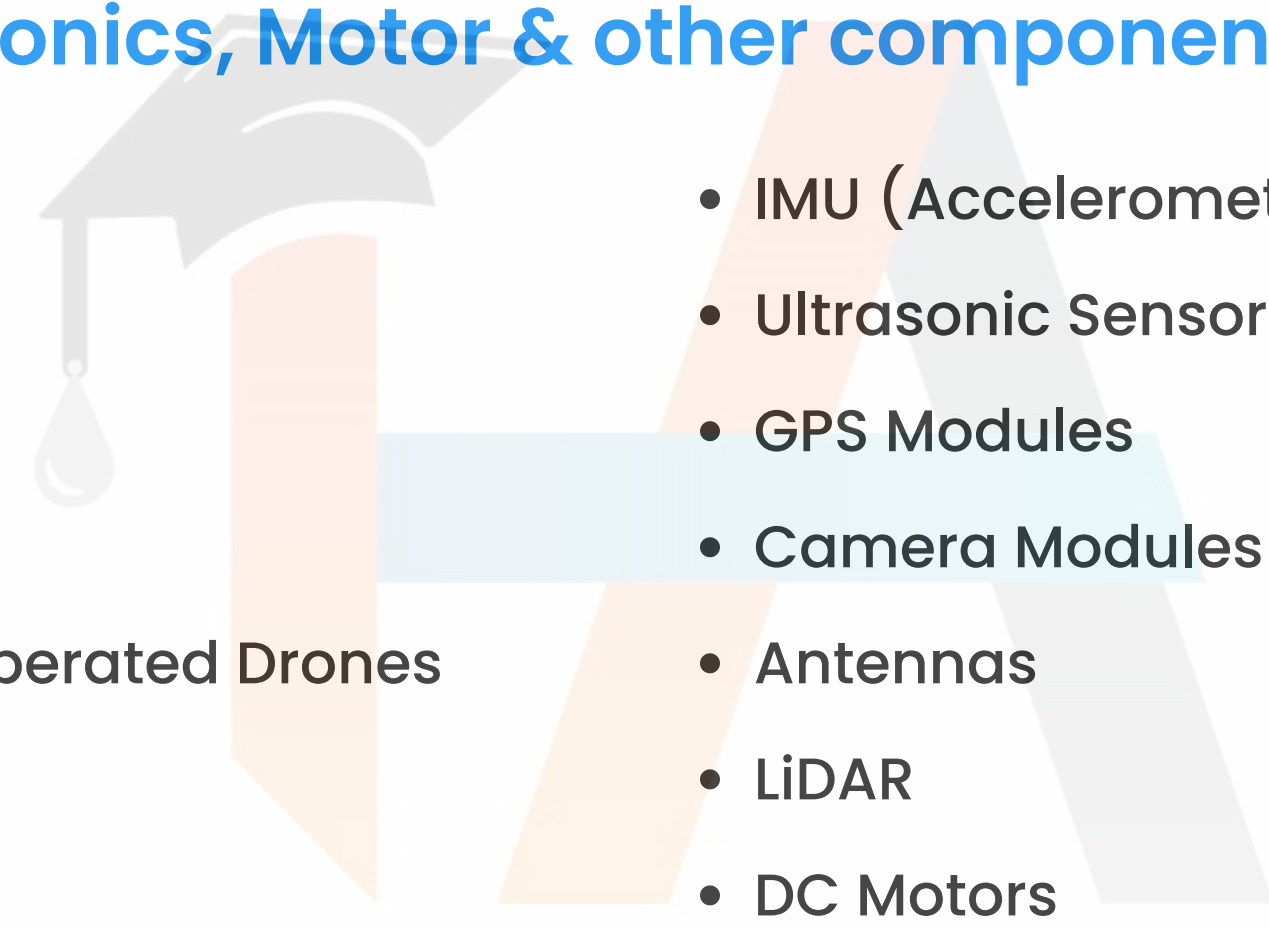
Projects

## 1.1 Introduction to Drones

- What are Drones and UAVs?
- Drone Development Ecosystem
- Racing, Freestyle and Long-Range Drones
- FPV vs Camera Drones
- Drones in Modern Warfare
- Drones in Industry 4.0
- Drones in Agriculture
- Drones for Surveillance



## 1.2 Fundamentals of Electronics, Motor & other components

- Digital and Analog Signals
  - Voltage, Current, Resistance
  - PCB Basics
  - Designing Power Systems
  - Batteries Operated and Solar Operated Drones
  - Battery Types and Comparison
  - Sensors & Actuators
  - Digital and Analog Sensors
  - Connectivity to Sensors
  - Temperature Sensors
  - Humidity Sensors
  - IMU (Accelerometer & Gyroscope)
  - Ultrasonic Sensors
  - GPS Modules
  - Camera Modules
  - Antennas
  - LiDAR
  - DC Motors
  - Servo Motors
  - Stepper Motors
  - ESCs for Drones
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## 1.3 System-on-Chip (Brain of the Drone)

- Arduino
- ESP32
- STM
- ARM Processors
- Developing Custom Chips
- Evaluating SoC from Technical Perspective
- Understanding Circuit Design of SoC
- Understanding Peripherals of SoC
- Customized SoC for Drones

## 1.4 Power Systems

- LiPo Batteries
- Cell Configurations
- Battery Safety
- Power Distribution Boards
- Voltage Regulators

## 1.5 Communication & Networking

- UART
- SPI
- I2C
- CAN Bus
- RF spectrum analysis
- MQTT
- HTTP/HTTPS
- LoRaWAN
- Bluetooth BLE
- Wi-Fi
- Zigbee
- Securing Communication
- TCP and TLS
- UDP
- Ciphers and Encryption in Communication



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## 2.1 Aerodynamics

- Lift
- Drag
- Thrust
- Stability

## 2.3 Navigation

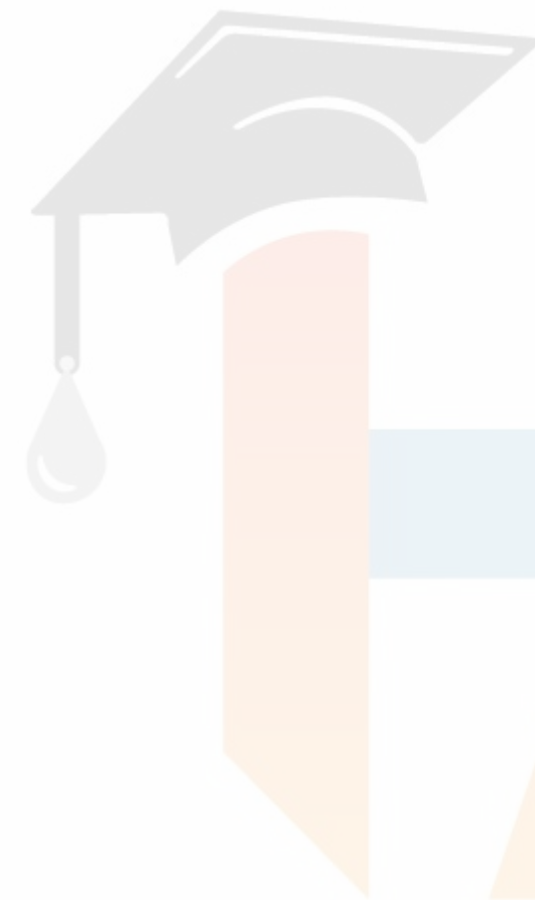
- GPS Navigation
- Waypoint Missions
- Return-to-Home

## 2.2 Flight Control Systems

- PID Controllers
- Sensor Fusion
- IMU Processing

## 2.4 Autonomous Flight

- Obstacle Avoidance
- Follow-Me Systems
- Autonomous Navigation



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## 2.5 Computer Vision

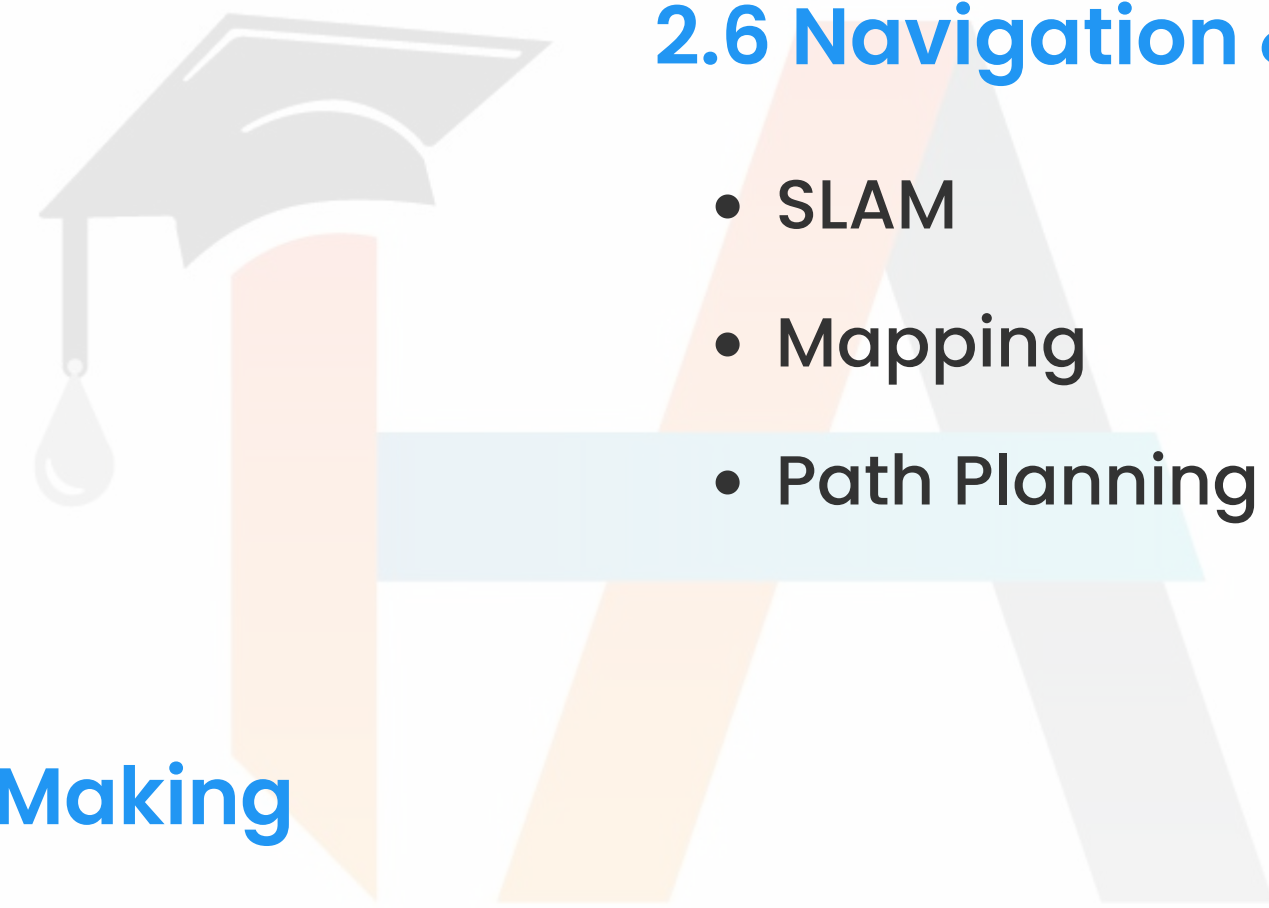
- OpenCV
- Image Processing
- Object Detection
- Face Recognition

## 2.6 Navigation & Localization

- SLAM
- Mapping
- Path Planning

## 2.7 Autonomous Decision Making

- State Machines
- Behavior Trees
- Reinforcement Learning Introduction



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### 3.1 Drone Hardware Architecture

- Frame Design (Carbon Framing)
- Motors
- ESCs
- Flight Controllers
- Propellers

### 3.2 Flight Mechanics

- Aerodynamics
- Stability
- Control Systems



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### 3.3 Design & Development of Drone Motherboard

- Designing Circuit for Drone Motherboard
- Develop Circuit Design Files for Mass Production
- Component Placement
- Testing Developed Board



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## 4.1 Programming Fundamentals

- Python
- C/C++
- Compiling Code to Generate Firmware
- Uploading Firmware
- OTA (Over-the-Air) Firmware Updates
- ArduPilot and PX4 overview
- ExpressLRS firmware customization

## 4.2 Data Management

- Data Caching
  - Local Databases
  - SQL and NoSQL Databases
  - Time-Series Data
  - Sensor Data Processing
  - Data Visualization
  - Creating Reports
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## 4.3 Drone Programming

- Flight Modes
- Autonomous Missions
- Geofencing
- Obstacle Avoidance
- Telemetry Systems Programming
- MAVLink Protocol
- Mission Planning
- Ground Control Station Integration
- Autonomous Flight

## 4.4 AI for Robotics & Autonomous Drones

- Machine Learning Basics
- Deep Learning Overview
- Edge AI
- TinyML
- Predictive Maintenance



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## 4.5 Cloud for Robotics & IoT

- MQTT Brokers
- Device Shadow
- Digital Twins
- AWS IoT
- Cloud IoT



## 5.1 Drone Building

- Frame Assembly
- Soldering Techniques
- Wiring Standards
- Component Integration

## 5.3 Radio Systems

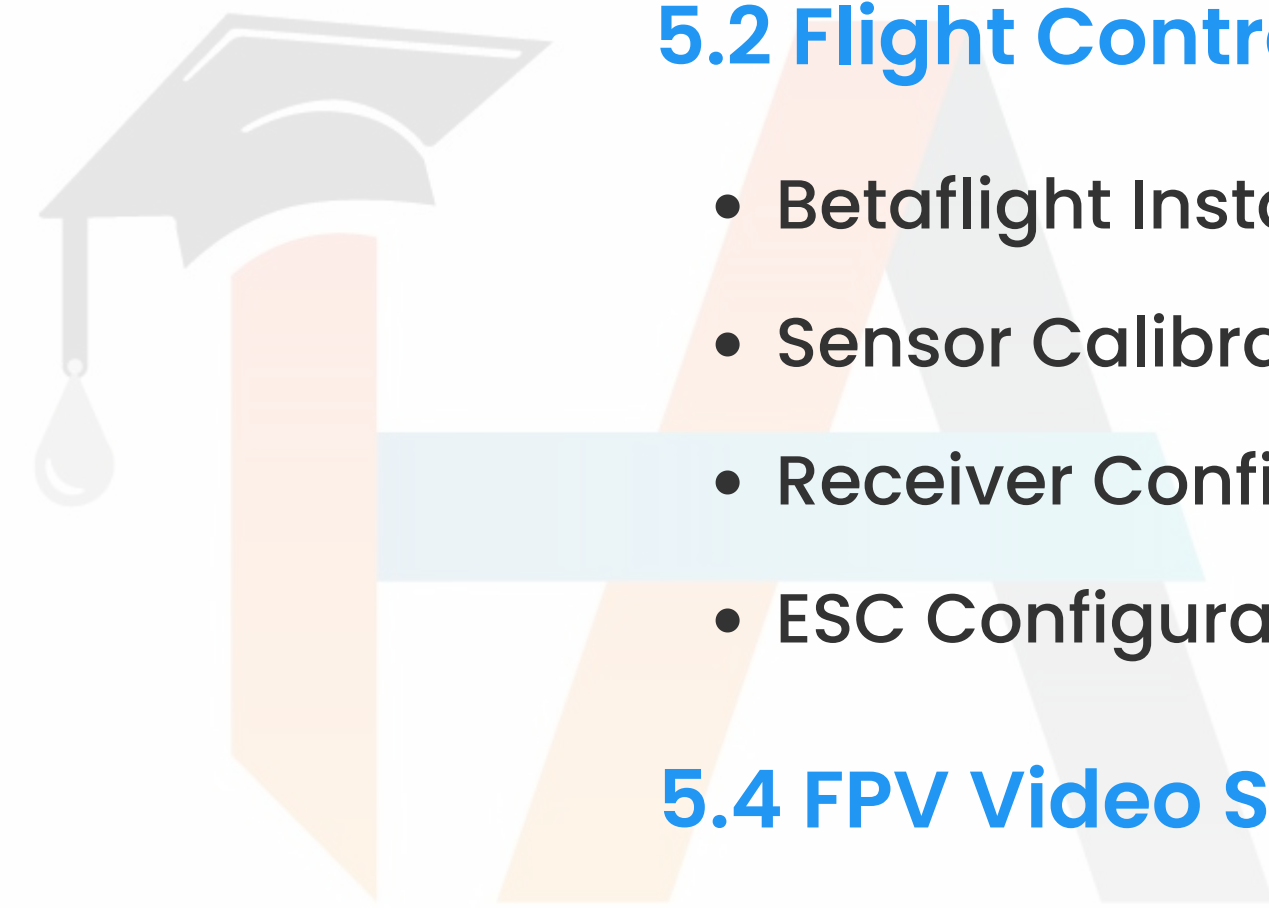
- ELRS (ExpressLRS)
- Crossfire
- Radio Binding
- Telemetry

## 5.2 Flight Controller Setup

- Betaflight Installation
- Sensor Calibration
- Receiver Configuration
- ESC Configuration

## 5.4 FPV Video Systems

- Analog FPV
- Digital FPV
- Video Link Optimization
- Antenna Selection



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## 5.5 Drone Assembly & Testing

- Wiring
- Calibration
- Flight Testing
- Troubleshooting



## 6.1 Long-Range FPV

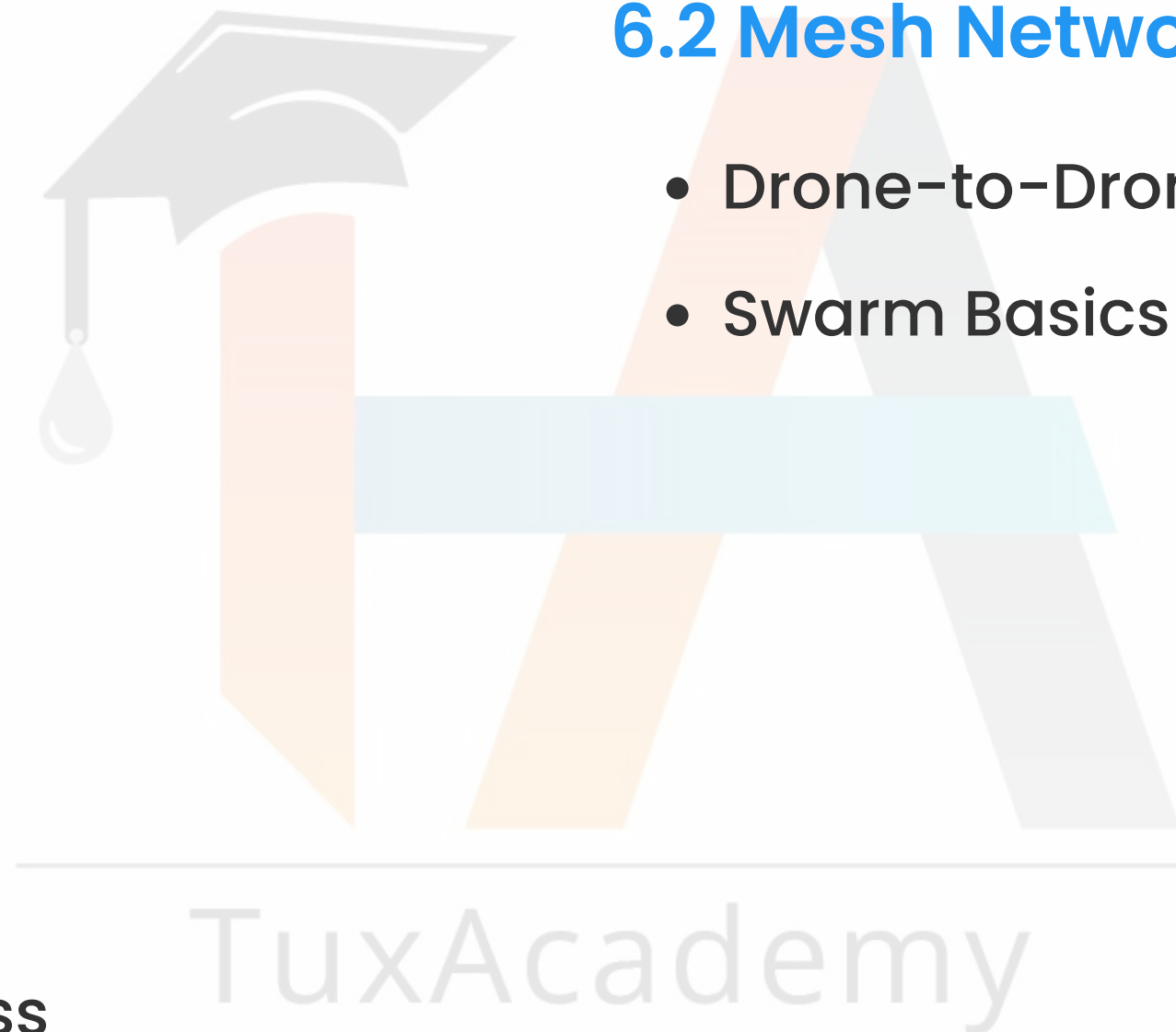
- RF Fundamentals
- ELRS Optimization
- Antenna Design

## 6.2 Mesh Networking & Swarm Systems

- Drone-to-Drone Communication
- Swarm Basics

## 6.3 Drone Security

- Secure Telemetry
- Signal Jamming Awareness
- Communication Security



## 7.1 CAD Design

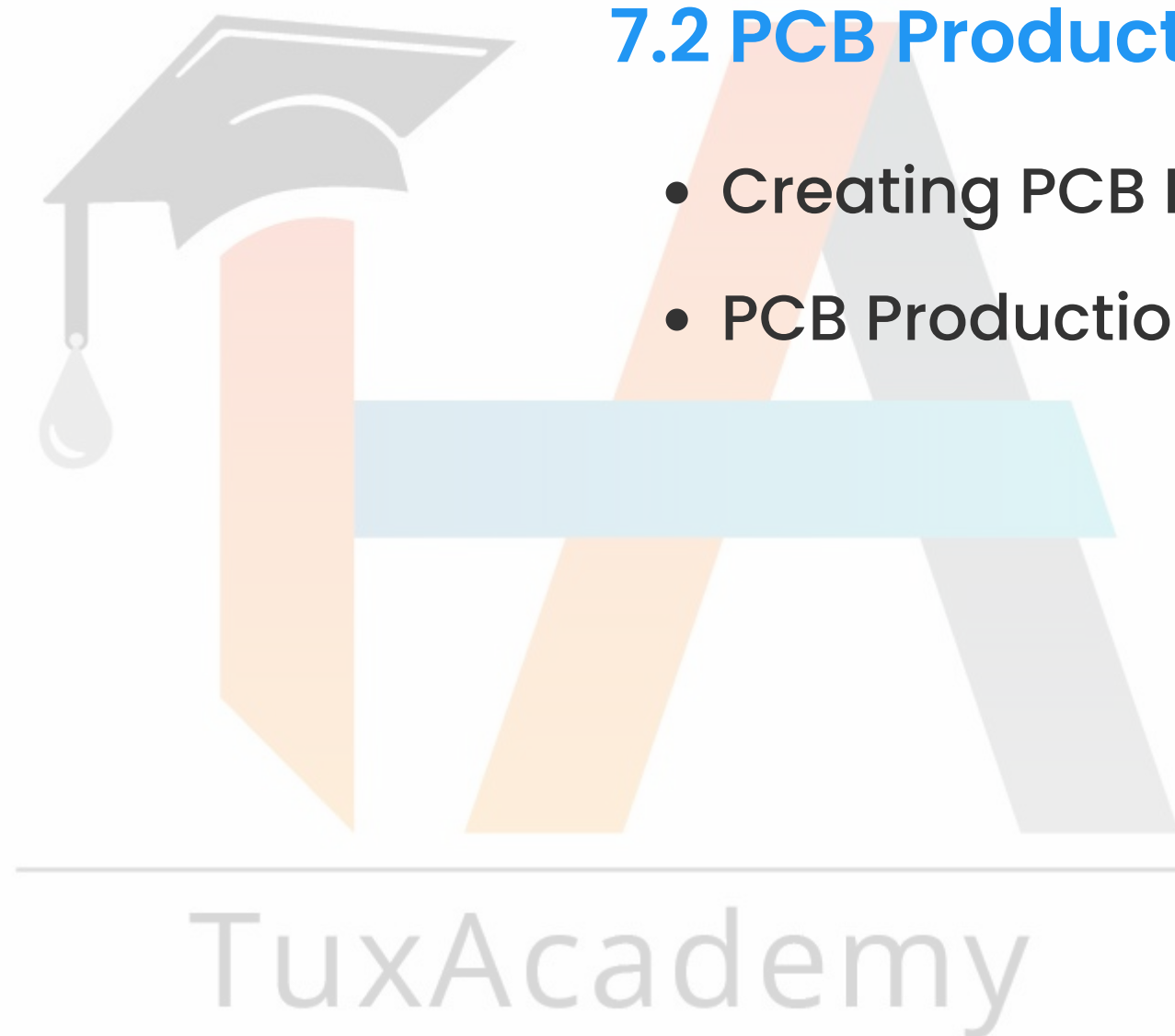
- Frame Design
- 3D Printing

## 7.2 PCB Production

- Creating PCB Design Files for Mass Production
- PCB Production and Vendor Selection

## 7.3 Product Development

- Prototype to Product
- Testing & Certification



## Industry Projects

- AI-Based Surveillance Drone
- Warehouse Monitoring System
- FPV Drone Design and Development as per candidate concept



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