PROJECTS FOR THE SESSION

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PROJECT 1: Model Rocket

Objective

To design, fabricate, and successfully launch a high-performance model rocket that demonstrates principles of aerodynamics, propulsion, payload integration, and recovery systems. The project aims to simulate real-world aerospace design workflows and ensure safe recovery of both rocket and payload using dual deployment mechanisms.

System Requirements

- Structural frame capable of withstanding aerodynamic loads
- Stabilizing fins for controlled flight
- Thrust support for secure motor mounting
- Nose cone for reduced drag
- Dual deployment system: one parachute for the rocket, another for the payload
- Payload bay with reliable locking
- Integrated altimeter for deployment control
- Mechanism for parachute ejection and secure mounting of retention hardware

Expected Output

- Stable and controlled flight
- Timely and safe payload ejection and descent
- Reliable deployment of recovery systems
- Complete data logging and post-flight analysis report
- Reusability of components after launch

Skills Required:

- CAD and mechanical design
- Structural analysis and safety verification
- Fabrication and assembly techniques
- Basic flight dynamics and propulsion theory
- Safety testing and launch operations

PROJECT 2: CANSAT

Objective

To develop a compact satellite prototype capable of environmental sensing, real-time telemetry, and safe descent under parachute. This project simulates satellite design including sensing, power systems, telemetry, and descent control.

System Requirements

- Central control system with embedded microcontroller
- Environmental sensors (temperature, pressure, humidity)
- GPS module for tracking
- Telemetry system for data transmission
- Compact and protective housing
- Power system with regulated supply
- Mechanism for controlled parachute deployment

Expected Output

- Real-time collection and transmission of sensor data
- Successful deployment during flight
- Safe descent and recovery
- Backup storage of data for post-mission analysis

Skills Required

- Embedded programming and sensor interfacing
- Data acquisition and transmission
- Power regulation and battery handling
- Mechanical integration and system testing

PROJECT 3: Flight Computer for Model Rocket/CANSAT

Objective

To design a flight computer system that manages real-time sensor input, triggers flight events like deployment, logs flight data, and transmits telemetry for both the rocket and CANSAT.

System Requirements

- Microcontroller-based architecture
- Inertial sensors and barometer for flight state estimation
- Storage interface for data logging
- Output channels for triggering devices
- Communication module for telemetry

Expected Output

- Reliable data acquisition and logging
- Automated triggering of flight events
- Stable telemetry link to ground station
- Compact and modular system design

Skills Required

- Embedded firmware development
- Real-time sensor data handling
- PCB and hardware design
- Debugging and testing protocols

PROJECT 4: Flight Software

Objective:

To develop real-time firmware for the flight computer to process data, manage deployment sequences, and ensure telemetry communication.

System Requirements:

- Drivers for onboard sensors and GPS
- State machine architecture for flight phases
- Deployment control logic
- Communication and data logging modules

Expected Output:

- Responsive and fault-tolerant software
- Accurate sensor data processing and decision making
- Modular codebase with maintainable structure

Skills Required:

- Programming in embedded C/C++
- State machine and event-driven logic
- Communication protocols
- Testing using simulations and hardware setups

PROJECT 5: Biometric Authentication Door Lock

Objective

To build a secure access control system using biometric fingerprint recognition for Satlab facilities, supporting logging and backup access.

System Requirements

- Biometric recognition module
- Microcontroller-based control logic
- Lock actuation mechanism
- Data logging capability
- Manual override and backup power

Expected Output

- Controlled access with biometric verification
- Logging of entry attempts
- Fail-safe access handling

Skills Required

- Firmware programming and biometric interfacing
- Electromechanical control
- System design for reliability and safety

PROJECT 6: Biometric Attendance System

Objective

To create an automated attendance system using fingerprint scanning, ensuring accurate time stamping and data storage.

System Requirements

- Biometric fingerprint scanner
- Real-time clock module
- Microcontroller for attendance processing
- Local/remote data storage system
- Display for user interaction

Expected Output

- Accurate attendance marking
- Real-time timestamping
- Secure and retrievable data logs

Skills Required

- Embedded systems development
- Timekeeping and data logging
- Display interfacing and user feedback

PROJECT 7: Digital Wall Clock

Objective

To develop a reliable digital wall clock that displays accurate time with good visibility and backup support.

System Requirements

- Real-time clock module
- Microcontroller for logic control
- Digital display interface
- Stable power supply

Expected Output

- Real-time display with high accuracy
- Long-term stable operation

Skills Required

- RTC and display interfacing
- Microcontroller programming
- Basic electronics and power design

PROJECT 8: Launch Pad for Model Rocket

Objective

To construct a reusable launch pad capable of securely holding the rocket, adjusting launch orientation, and triggering remote ignition safely.

System Requirements:

- Sturdy support structure
- Adjustable launch guidance system
- Remote ignition circuit
- Safety interlock mechanisms

Expected Output:

- Controlled launch initiation
- Safe and adjustable launching mechanism
- Durable structure for repeated use

Skills Required

- Structural design and fabrication
- Electronic ignition circuit design
- Safety systems and operations

PROJECT 9: Ground Control Station

Objective

To develop a control center for receiving, displaying, and analyzing telemetry data during flight operations. It may include command transmission features.

System Requirements:

- Telemetry reception hardware
- Control unit for data processing
- GUI software for data visualization
- Logging and replay system

Expected Output:

- Real-time display of telemetry data
- Storage of mission data logs
- User-friendly interface for tracking and analysis

Skills Required:

- RF communication and telemetry systems
- Programming for GUI and data handling
- Data analysis and visualization
- Hardware-software integration