Deployment and Operations

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1. Deployment Process

1.1 Hardware Setup

- ESP32-C3 microcontroller connected with ADXL345 accelerometer via I²C pins (SDA = GPIO4, SCL = GPIO5).
- Power supplied using a 3.7V Li-ion battery.
- Onboard Wi-Fi enabled for device-to-network connection.

1.2 Firmware Flash

- Firmware written in C/C++ using Arduino IDE.
- Code uploaded to ESP32 via USB to TTL.

1.3 DNS and Network Integration

- Users on the same Wi-Fi can access the system by typing http://newtonia.local
- instead of a numeric IP.
- Tested on laptops, Android phones, and iOS devices: DNS resolved consistently without errors.

2.4 Dashboard Deployment

- ESP32 serves the HTML/CSS/JavaScript dashboard directly.
- Control buttons (pause, reset) and force calculator included.
- Accessible on Chrome, Firefox, and Safari.

2. Operation

1. Teacher powers ESP32 device.
2. Students connect their devices (laptops/phones) to the same Wi-Fi.
3. Students open browser → enter http://newtonia.local.
4. Dashboard loads instantly and displays live acceleration graph.
5. Students or teacher can move the toy car and observe:
    - Real-time motion data.
    - Calculated force values.
    - Multiple clients (up to 5 tested) receive synchronized data simultaneously.

3. Monitoring

3.1 Hardware Monitoring

- Periodic battery level check.
- Sensor wiring inspected before use (loose wires cause errors).

3.2 Software Monitoring

- Verify that the Wi-Fi is connected by LED blinking in Newtonia Device.
- Dashboard graphs visually confirm correct data flow.

4. Maintenance Plan

- Recharge Li-ion battery after each session.
- Store ESP32 and sensor in protective case.
- Replace worn cables or loose connectors.
- Backup firmware stored in GitHub repository