COMPONENTS

	Component	Quantity	Notes / Role
Controllers			
U1	**Arduino Uno Rev3**	×1	Κεντρικός Ελεγκτής, Συλλογή Local Data.
U2	**ESP8266 Dev Board**	×1	Gateway / MQTT Publisher / Aggregator (3.3V Logic).
Sensors / Modules			
U3	**Garmin eTrex PCB** (or NEO-6M Module)	×1	Εντοπισμός Θέσης / Ταχύτητα (Χρησιμοποιείται το TX Pin).
S1	**MFRC522 RFID Sensor**	×1	Έλεγχος Ταυτότητας Μαθητών (SPI Protocol).
S2	**ADXL343 Accelerometer**	×1	Ανίχνευση Επιτάχυνσης (I2C Protocol).
S3	**DHT22 Sensor**	×1	Θερμοκρασία / Υγρασία Καμπίνας.
S4	**HC-SR04 Sensor**	×1	Υπερηχητικό Αισθητήριο Απόστασης.
Interface / I/O			
IC1	**Logic Level Shifter** (4-ch Bi-directional)	×1	Μετατροπή Τάσης $5 \text{V} \leftrightarrow 3.3 \text{V}$ (Serial Data Path Uno $\rightarrow$ ESP).
S5	**Pushbutton**	×1	Τοπική είσοδος (Local I/O).
S6	**Buzzer**	×1	Ηχητική Ειδοποίηση.
D1	**LED** (Red or Green)	×1	Οπτική Ένδειξη Κατάστασης.
C1	**Jumper Wires**	—	Καλώδια Σύνδεσης (διάφοροι τύποι).

LIBRARIES

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// A. Libraries Required for Both Uno and ESP8266

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// 1. PubSubClient: MQTT client for publishing data to the Broker.

PubSubClient

// 2. ArduinoJson: Used by ESP8266 for parsing JSON data from Uno

// and creating the final payload for MQTT.

ArduinoJson

// 3. SoftwareSerial: Used by ESP8266 for GPS communication (D8/D7 pins)

// and by Uno for legacy communication (removed in final version, but good practice).

SoftwareSerial

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// B. Libraries Required for ESP8266 (Gateway/Aggregator)

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// 4. TinyGPSPlus: Essential for parsing the NMEA sentences received from the Garmin GPS.

TinyGPSPlus

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// C. Libraries Required for Arduino Uno (Local Sensor Acquisition)

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// 5. DHT sensor library (by Adafruit): For reading data from the DHT22 temperature/humidity sensor.

DHT sensor library (by Adafruit)

// 6. Adafruit Unified Sensor: Dependency for the DHT and ADXL343 sensor libraries.

Adafruit Unified Sensor

// 7. Adafruit ADXL343: For communication and data acquisition from the I2C accelerometer.

Adafruit ADXL343

// 8. MFRC522: For handling the SPI communication and data read from the RFID reader.

MFRC522

// 9. Wire: Standard library for I2C communication (used by ADXL343).

Wire

// 10. SPI: Standard library for SPI communication (used by MFRC522).

SPI