Mock Anti-Sleep Glasses Data Pipeline (Arduino)

Below is a ready-to-run Arduino sketch to simulate a **TCRT5000 blink sensor** and an **MPU6050 accelerometer/gyroscope**, and log CSVs for use in AI model development. Use this sketch to build your data pipeline before hardware is available.

Arduino Emulator (Mock Sensor Generator)

Purpose

Simulate **blink duration** and **head tilt angles** similar to what your Arduino hardware would produce, including automatic **ALERT** and **DROWSY** modes.

Requirements

- Arduino Uno/Nano (or compatible board)
- Arduino IDE or PlatformIO
- Serial connection to PC

Usage

1. Upload the Arduino sketch to your board.
2. Open the Serial Monitor (baud: **115200**).
3. The sketch prints CSV-formatted data to the console.
4. Use the CSV output for AI model training, feature engineering, data cleaning, and simulating live streaming.

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arduino_emulator.ino

```
const uint32_t BAUD = 115200;

const uint16_t SAMPLE_MS = 50; // 20 Hz


enum Mode { ALERT, DROWSY };

Mode mode = ALERT;


unsigned long blinkEndMs = 0;

unsigned long blinkDuration = 0;
```

```
unsigned long nextBlinkMs = 0;

const float TILT_THRESHOLD = 25.0;
const int MIN_BLINK_MS = 100;
const int MAX_BLINK_MS = 400;

long randBetween(long a, long b) { return a + random(b - a + 1); }

void scheduleNextBlink(unsigned long now) {
  unsigned long interval = (mode == ALERT) ? randBetween(2500, 6000) : randBetween(1000, 2500);
  nextBlinkMs = now + interval;
}

void setup() {
  Serial.begin(BAUD);
  randomSeed(analogRead(A3));
  scheduleNextBlink(millis());
  Serial.println("timestamp,blinkDuration,ax,ay,az,pitch,roll,mode");
}

void loop() {
  static unsigned long lastSample = 0;
  unsigned long now = millis();
  if (now - lastSample < SAMPLE_MS) return;
  lastSample = now;

  if (now >= nextBlinkMs && blinkEndMs == 0) {
    blinkDuration = (mode == ALERT) ? randBetween(80, 150) : randBetween(200, 400);
    blinkEndMs = now + blinkDuration;
  }
```

```
 if (blinkEndMs > 0 && now >= blinkEndMs) {
  blinkEndMs = 0;
  scheduleNextBlink(now);
 }

 float axf = randBetween(-2000, 2000);
 float ayf = randBetween(-2000, 2000);
 float azf = 16384 + randBetween(-500, 500);

 float pitch = atan2(axf, sqrt(ayf * ayf + azf * azf)) * 180.0 / PI;
 float roll  = atan2(ayf, sqrt(axf * axf + azf * azf)) * 180.0 / PI;

 if (abs(pitch) > TILT_THRESHOLD || abs(roll) > TILT_THRESHOLD) mode = DROWSY;
 else mode = ALERT;

 Serial.print(now); Serial.print(',');
 Serial.print(blinkDuration); Serial.print(',');
 Serial.print((int16_t)axf); Serial.print(',');
 Serial.print((int16_t)ayf); Serial.print(',');
 Serial.print((int16_t)azf); Serial.print(',');
 Serial.print(pitch, 1); Serial.print(',');
 Serial.print(roll, 1); Serial.print(',');
 Serial.println(mode == ALERT ? "alert" : "drowsy");
}
```

Example CSV Output

```
timestamp,blinkDuration,ax,ay,az,pitch,roll,mode
12345,120,500,600,16500,5.3,7.1,alert
12400,320,1500,-800,14000,28.5,3.2,drowsy
```

Notes

- **Blink Duration Threshold**:
    - Normal blink = **80–150 ms** → ALERT
    - Long blink = **200–400 ms** → DROWSY
- **Head Tilt Threshold**:
    - Normal within **±10°**
    - Drowsy if beyond **25°**
- **Accelerometer Values**:
    - az ≈ 16384 represents gravity
    - Drowsy mode shows **larger sway** and **forward nod dips**
- **Sampling Frequency**: Default = **20 Hz** (interval 50 ms).

This Arduino emulator replaces the **TCRT5000 + MPU6050** for software development, letting your team iterate on data processing, AI model training, and alert pipeline before the hardware is ready.
