Predictive Maintenance Of Rotating Components

Sensors : Tinkercad Model

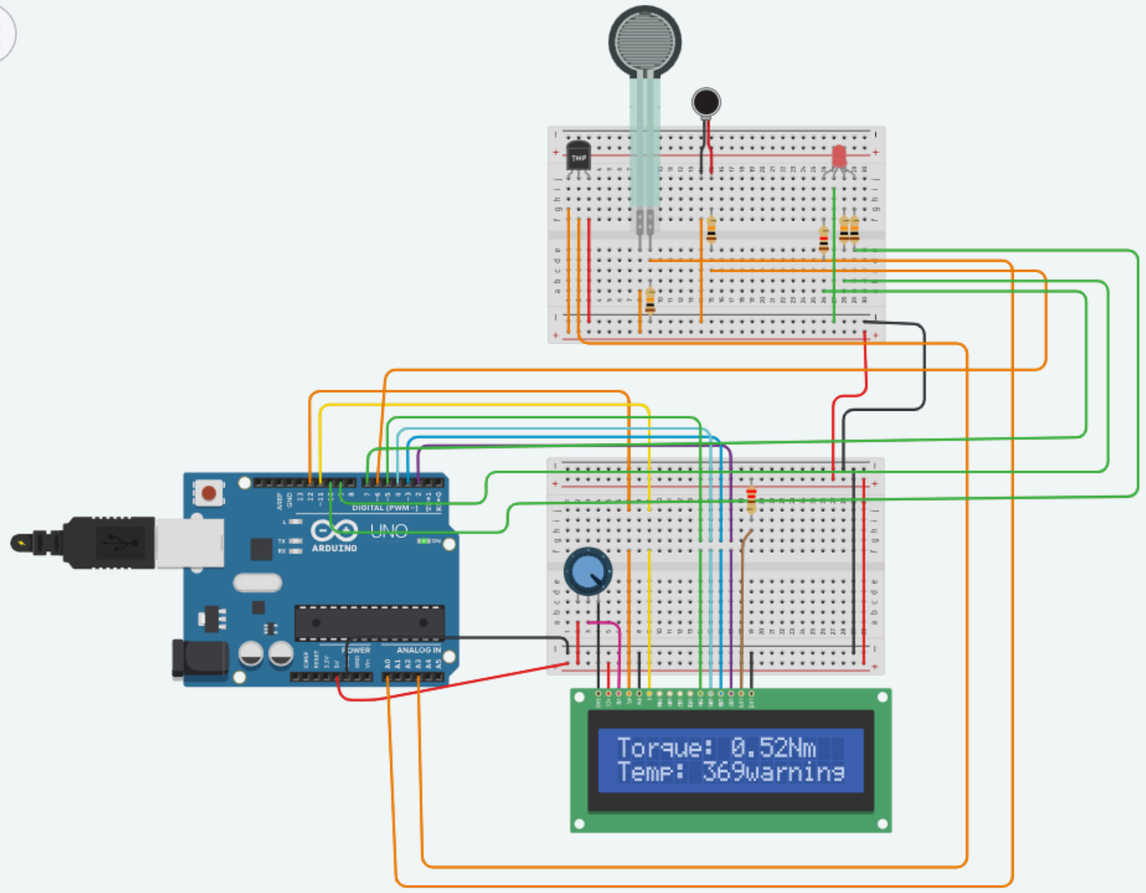
AUTODESK® TINKERCAD®

Copy of Vibration Motor Control with Button

All changes saved

Simulator time: 00:03:40

Code | Stop Simulation | Send To



1 (Arduino Uno R3)

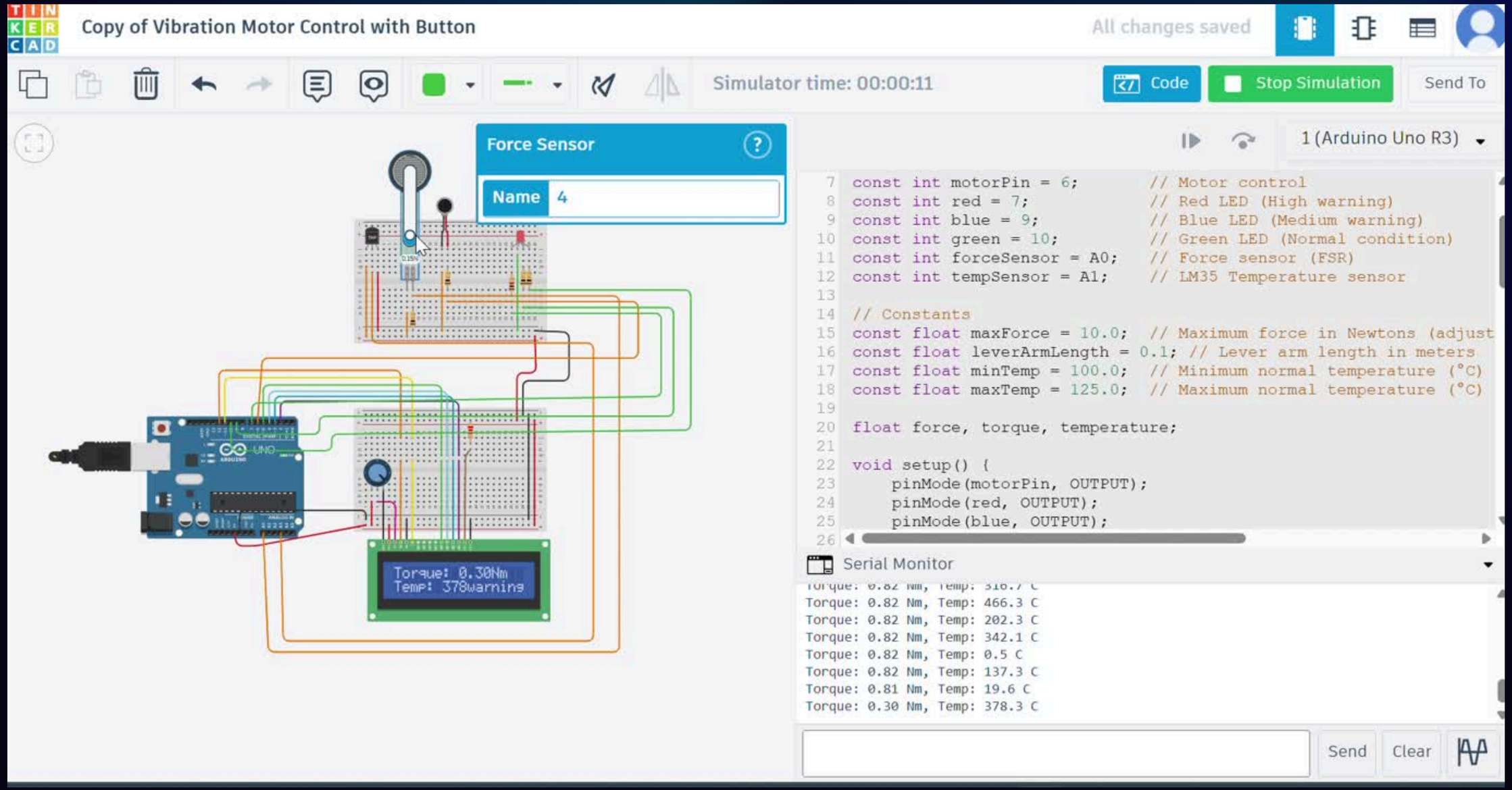
```
7  const int motorPin = 6;        // Motor control
8  const int red = 7;             // Red LED (High warning)
9  const int blue = 9;            // Blue LED (Medium warning)
10 const int green = 10;          // Green LED (Normal condition)
11 const int forceSensor = A0;    // Force sensor (FSR)
12 const int tempSensor = A1;     // LM35 Temperature sensor
13
14 // Constants
15 const float maxForce = 10.0;  // Maximum force in Newtons (adjust
16 const float leverArmLength = 0.1; // Lever arm length in meters
17 const float minTemp = 100.0;  // Minimum normal temperature (°C)
18 const float maxTemp = 125.0;  // Maximum normal temperature (°C)
19
20 float force, torque, temperature;
21
22 void setup() {
23     pinMode(motorPin, OUTPUT);
24     pinMode(red, OUTPUT);
25     pinMode(blue, OUTPUT);
26
```

Serial Monitor

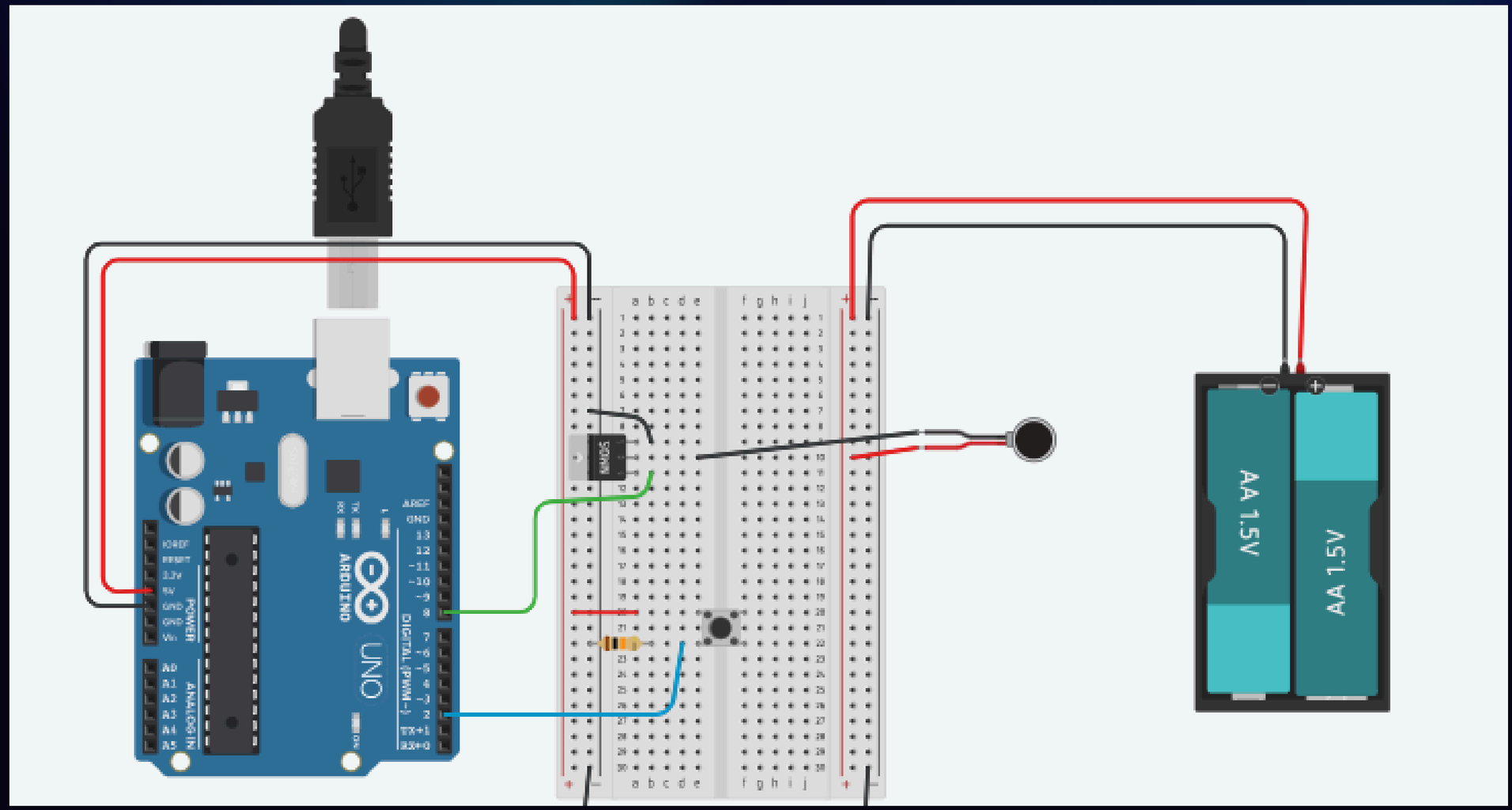
```
Torque: 0.52 Nm, Temp: 332.8 C
Torque: 0.52 Nm, Temp: 3.4 C
Torque: 0.52 Nm, Temp: 483.4 C
Torque: 0.52 Nm, Temp: 455.5 C
Torque: 0.52 Nm, Temp: 169.6 C
Torque: 0.52 Nm, Temp: 183.8 C
Torque: 0.52 Nm, Temp: 369.5 C
```

Send | Clear

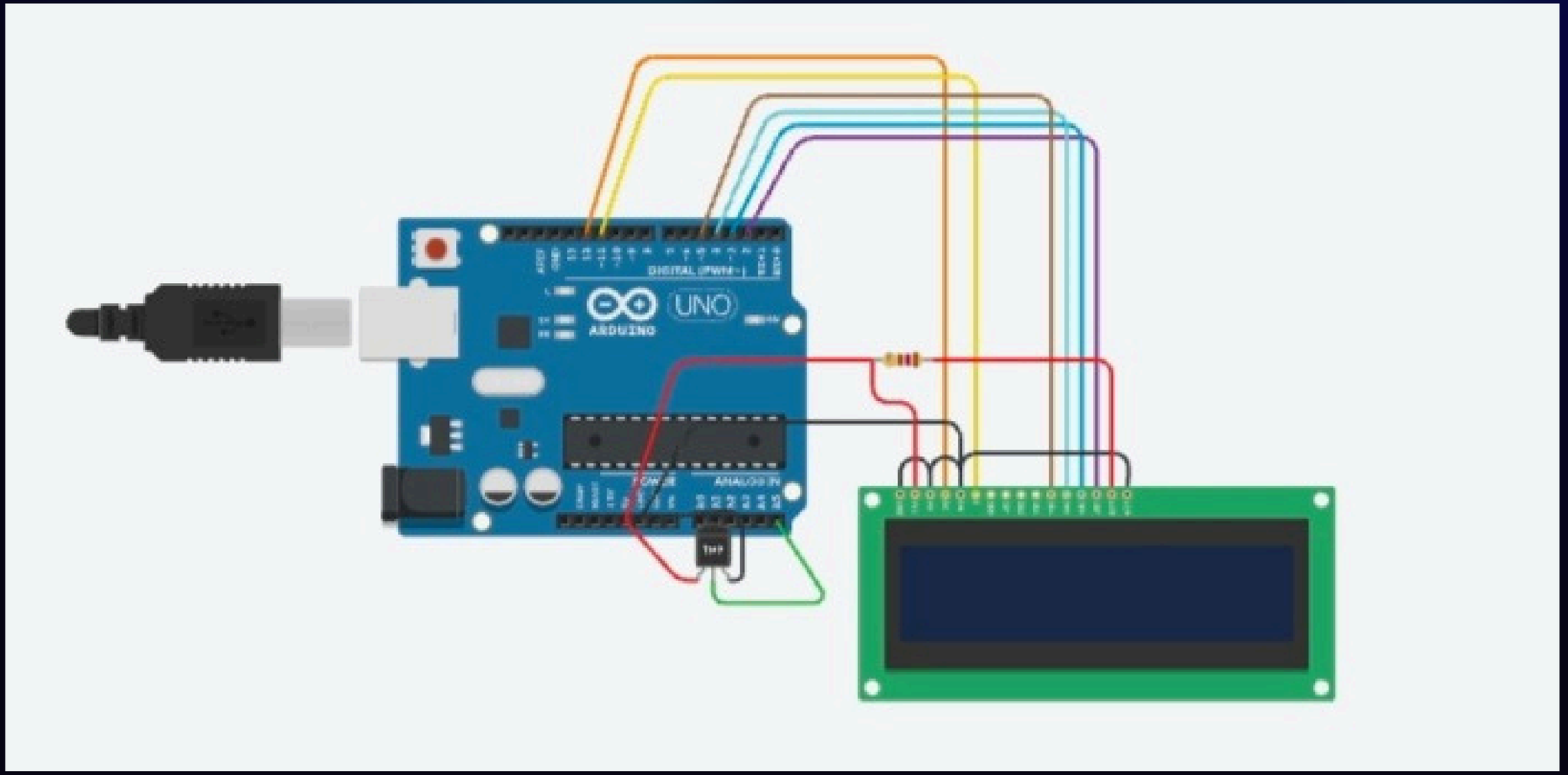
TINKER CAD SIMULATION



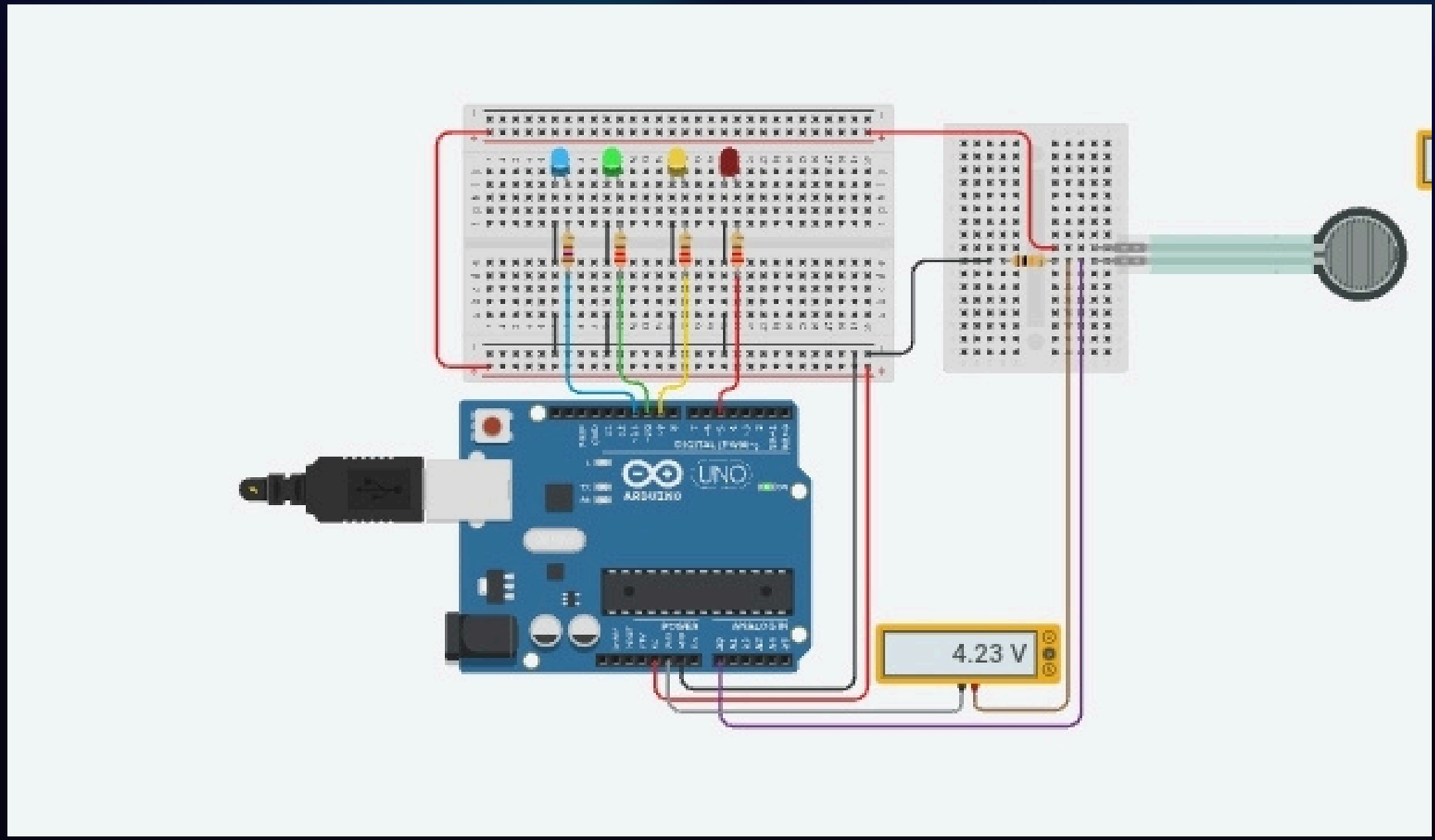
Vibration motor

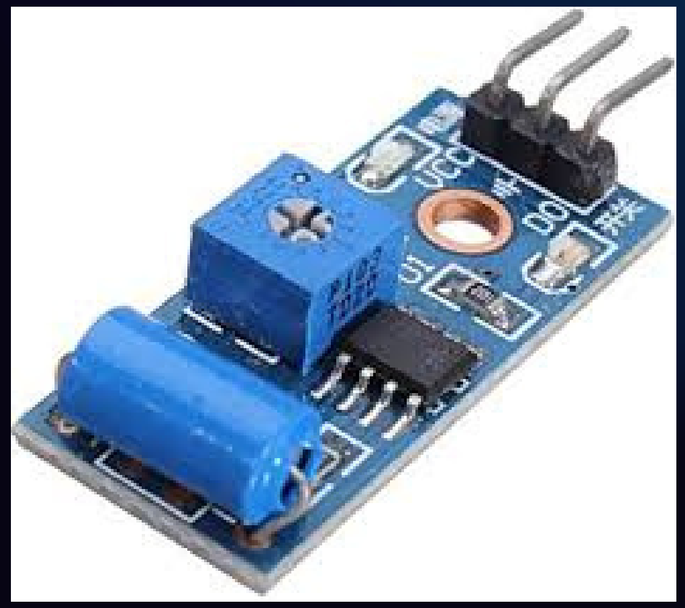


Temperature sensor



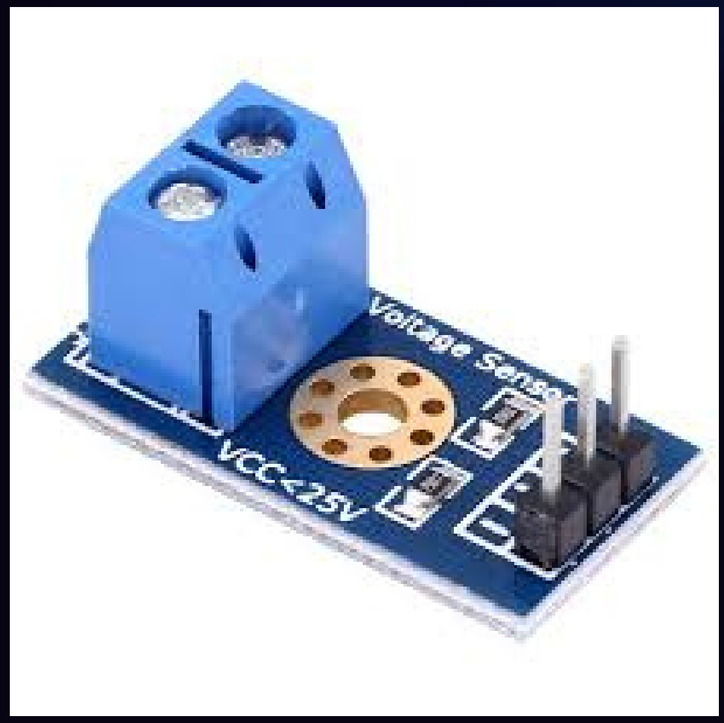
Force Sensor

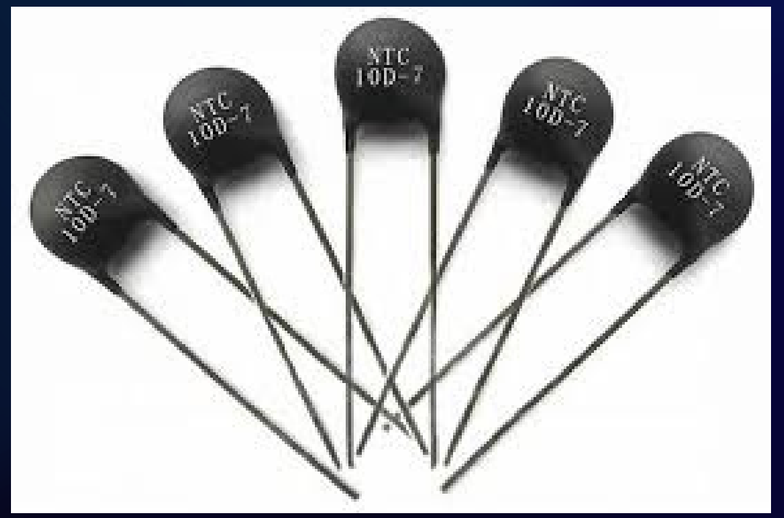




Vibration
SW420

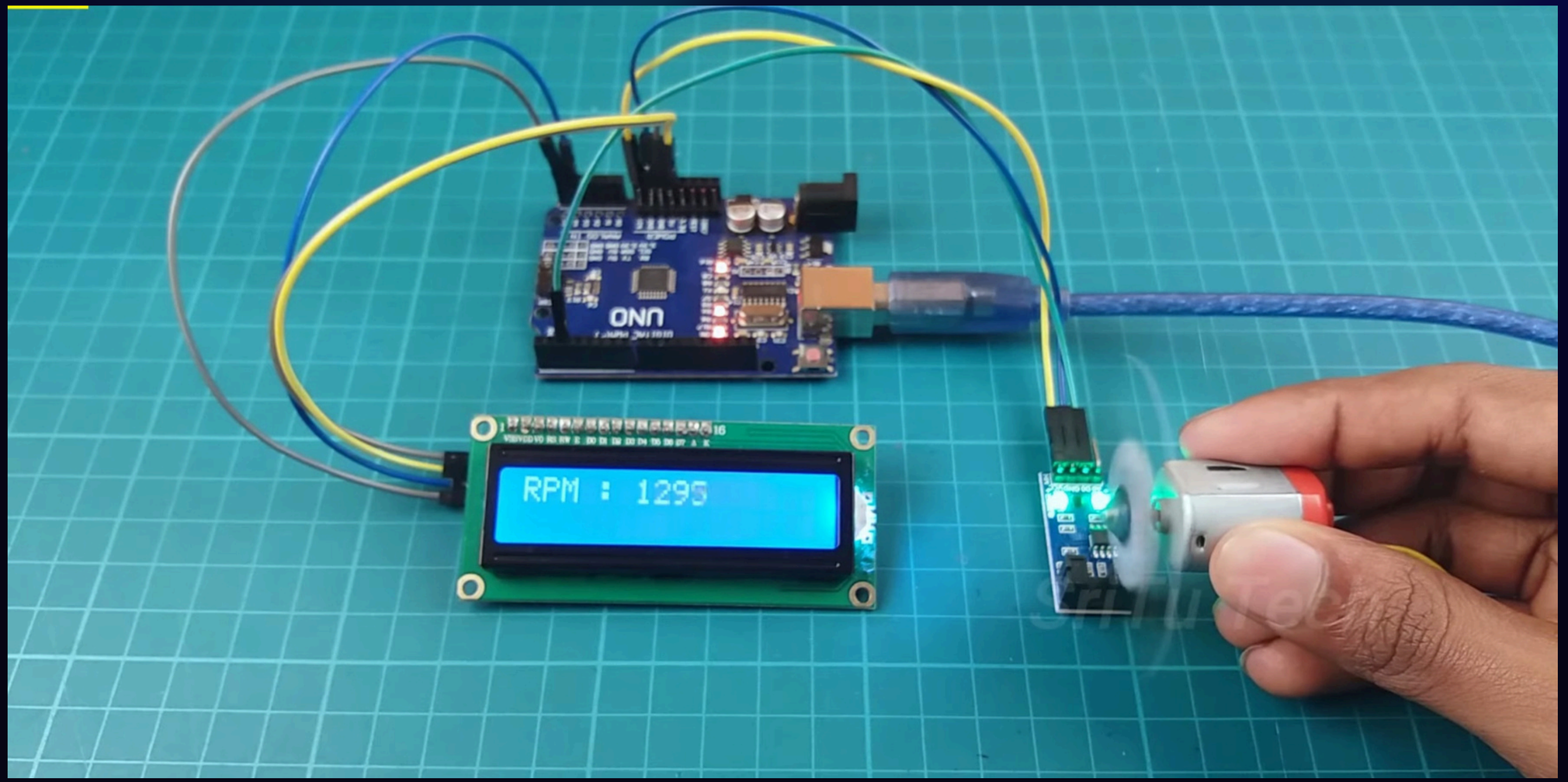
Voltage sensor





Thermistor

Speed Sensor



DATA COLLECTION

Data Preprocessing

Noise Reduction: Use filters (e.g., Butterworth, Kalman) to remove unwanted signals.

Feature Extraction: Extract meaningful indicators like RMS, kurtosis, and spectral analysis features.

Data Normalization: Scale data for machine learning model compatibility.

Real-Time Analysis & Machine Learning

Machine Learning Techniques

Classification Models: Categorize motor health (e.g., healthy, degraded, failure-prone).

Regression Models: Predict the Remaining Useful Life (RUL) of components.

Anomaly Detection: Identify unusual patterns using clustering (K-means, DBSCAN) or autoencoders.

Pipeline Setup

Data is ingested in real-time from sensors.

Stored in a time-series database (e.g., InfluxDB, TimescaleDB).

Machine learning models analyze incoming data.

Alerts are generated when anomalies or failure risks are detected.

Deployment & Real-Time Monitoring

Implement Edge Computing for real-time decision-making at the device level.

Use Cloud Dashboards (Grafana, Power BI) for remote monitoring.

Integrate predictive maintenance with SCADA systems for automated responses.