

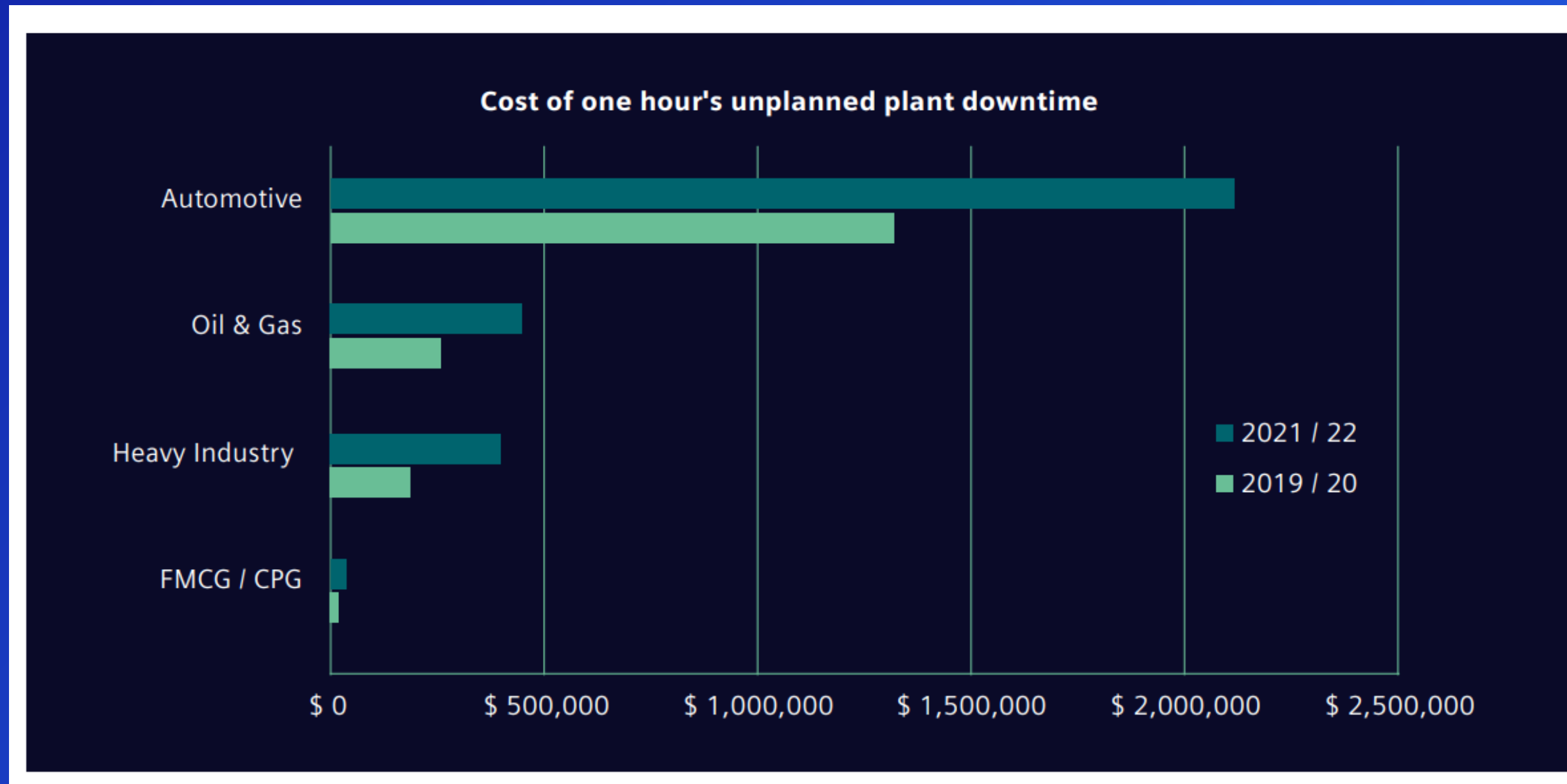


Acoustic and AI-Based Predictive Maintenance with Edge Computation

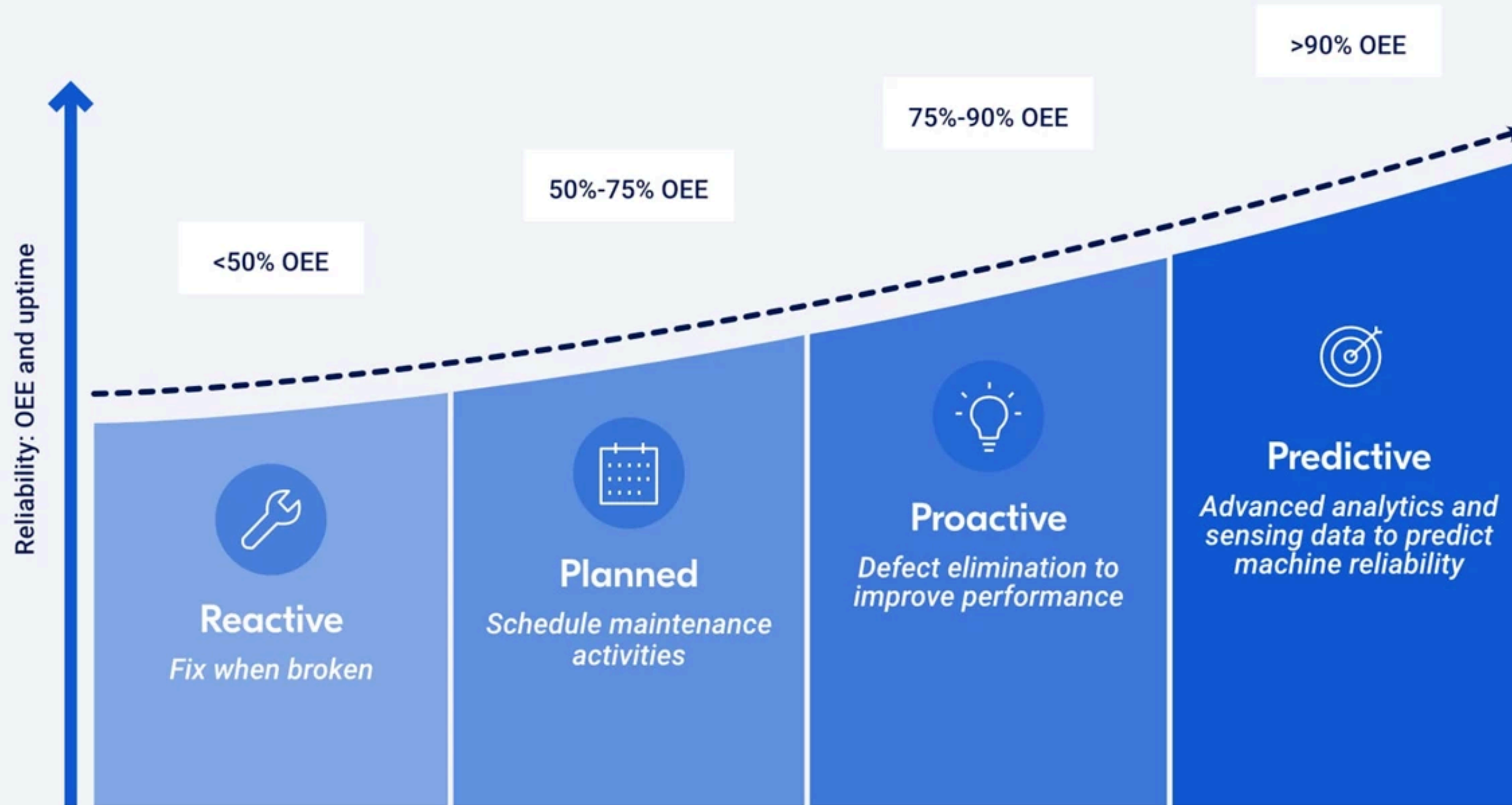
By Resonance



The True Cost of Downtime 2022



Maintenance strategies



* Original Equipment Effectiveness

QUALITY

EFFICIENCY

COST



WHY IT MATTER ?

1 **Accurate Prediction**  **300,000 \$**

One accurate prediction is worth 300,000 Baht

<https://iot-analytics.com/predictive-maintenance-market/>

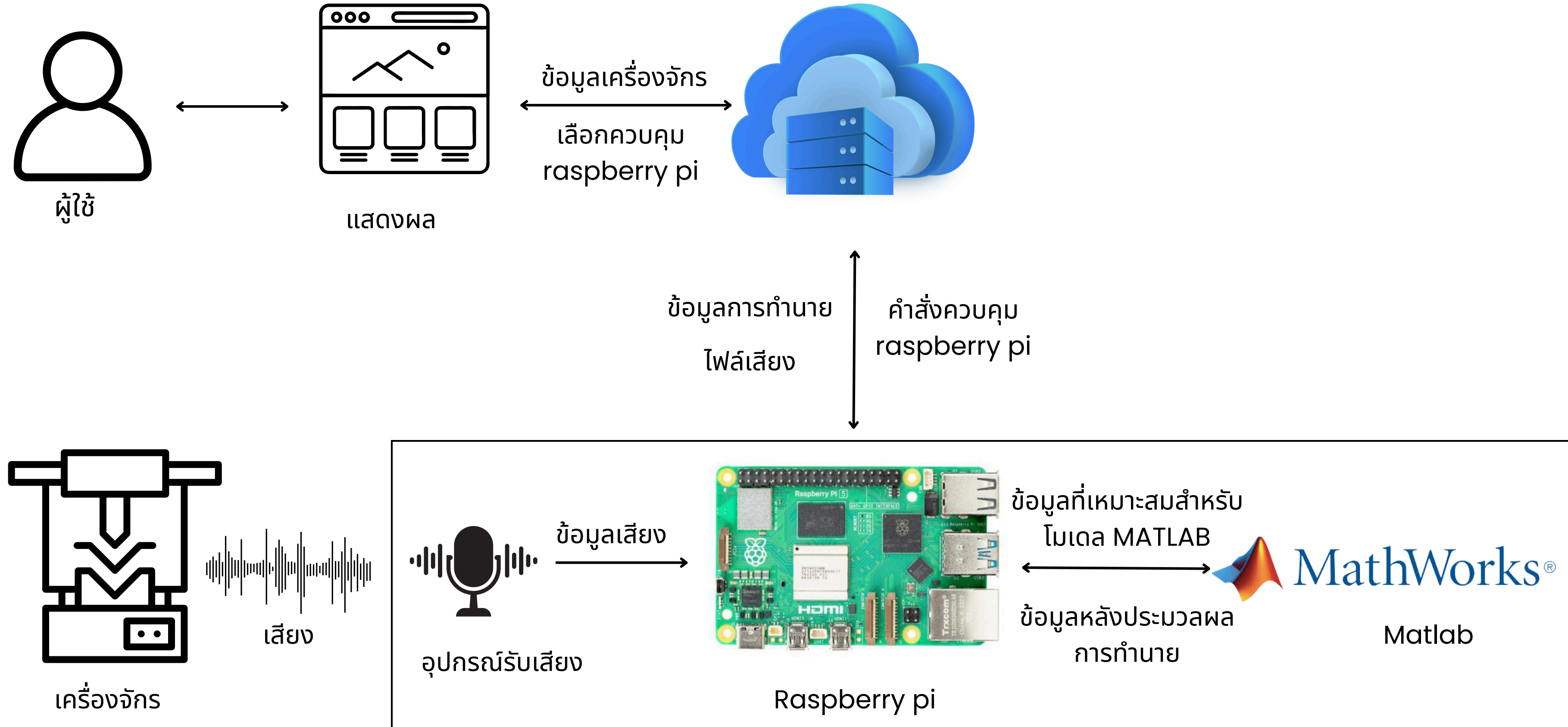
Predictive Maintenance Solution

99 %

**Detect Faulty Event*

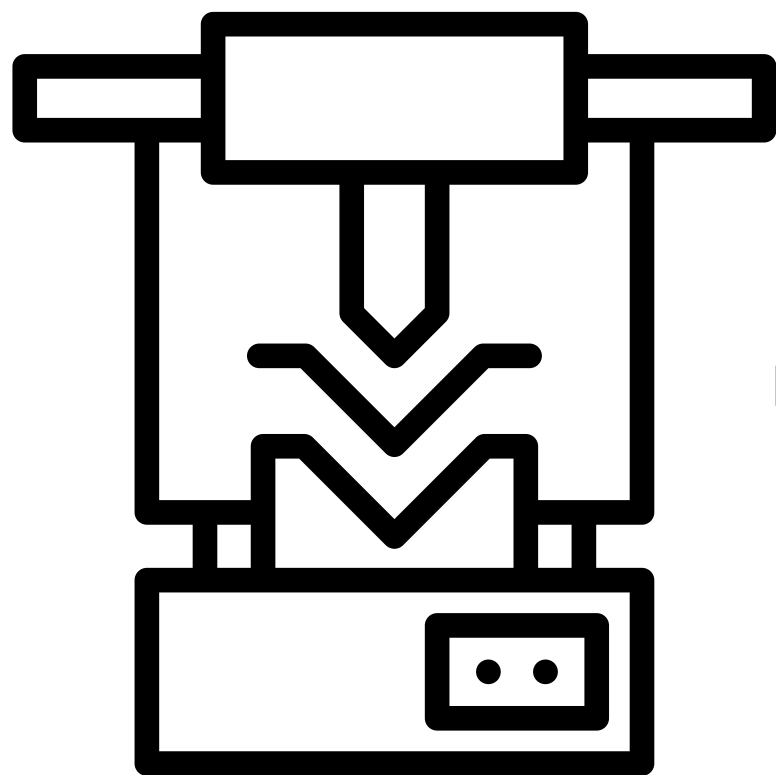


Work Flow Diagram

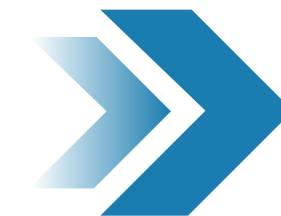


Machine Sound

1 เสียงจากเครื่องจักร



Signal

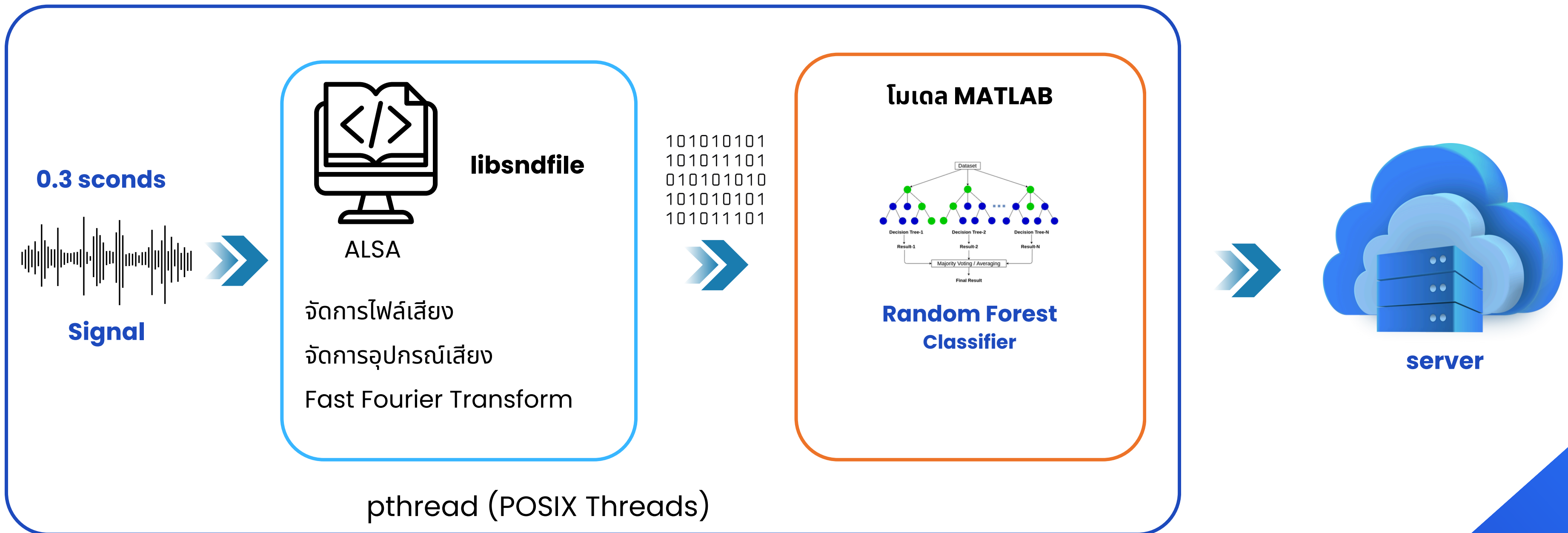


Real-time sound or .wav

Sound Detection

2 เตรียมทรัพยากรและตรวจจับเสียงเครื่องจักรที่ทำงานผิดปกติเบื้องต้น

Raspberry Pi



Delay time

~ 0.03

seconds

Confusion matrix

Model Performance:

Validation Accuracy: 97.30%

Confusion Matrix:

0.9885	0.0057	0.0057
0.3750	0.6250	0
0	0	1.0000

F1-Scores by Class:

Class X: Precision = 0.72, Recall = 0.99, F1-score = 0.84

Class N: Precision = 0.99, Recall = 0.62, F1-score = 0.77

Class F: Precision = 0.99, Recall = 1.00, F1-score = 1.00

Macro-Averaged F1-score: 0.87

***Result from matlab**

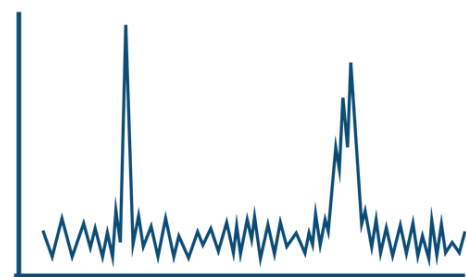
Machine Learning

3 Predictive maintenance

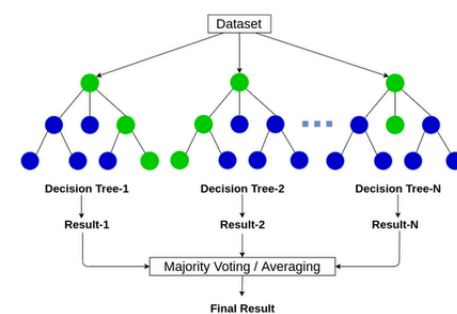
Matlab



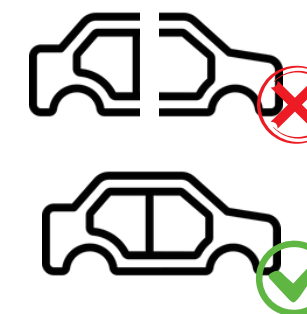
Signal



FFT Analysis
(Freq 5 - 150 Hz)



Random Forest
Classifier



Normal / Faulty

Matlab Coder
(Generate C Code For Raspberry pi)



Real-Time Data Visualization



Accuracy



Ease of Maintenance



Cost-Effective

Sound Dashboard

4 แสดงผลไฟล์เสียงที่ได้จาก Raspberry Pi



Raspberry Pi Management

5 ควบคุมการทำงาน Raspberry Pi ผ่าน Server

The screenshot displays the 'Raspberry Pi Management' web interface. On the left is a sidebar with 'Resonance' at the top, followed by 'Dashboard', 'Raspberry Pi' (highlighted), and 'Sound Dashboard'. The main content area is titled 'Raspberry Pi Management' and includes a 'Refresh' button. Below the title is a 'Control Panel' with three buttons: 'Load Code' (green), 'Upload Sound' (blue), and 'Record Sound' (red). The interface is divided into two rows of three cards each. The first row contains 'System Temperature' (45.2°C), 'CPU Usage' (32%), and 'Memory Usage' (1.2GB / 4GB). The second row contains 'Storage' (12GB / 32GB), 'Network Status' (Connected, 192.168.1.100), and 'Uptime' (5 days, 2 hours). At the bottom, there are tabs for 'MQTT Dashboard' (active) and 'MQTT Sender'. The 'MQTT Dashboard' section shows 'Status: Connected', a text input field containing 'Resonance/sensor/result', and three buttons: 'Subscribe', 'Unsubscribe', and 'Disconnect'.

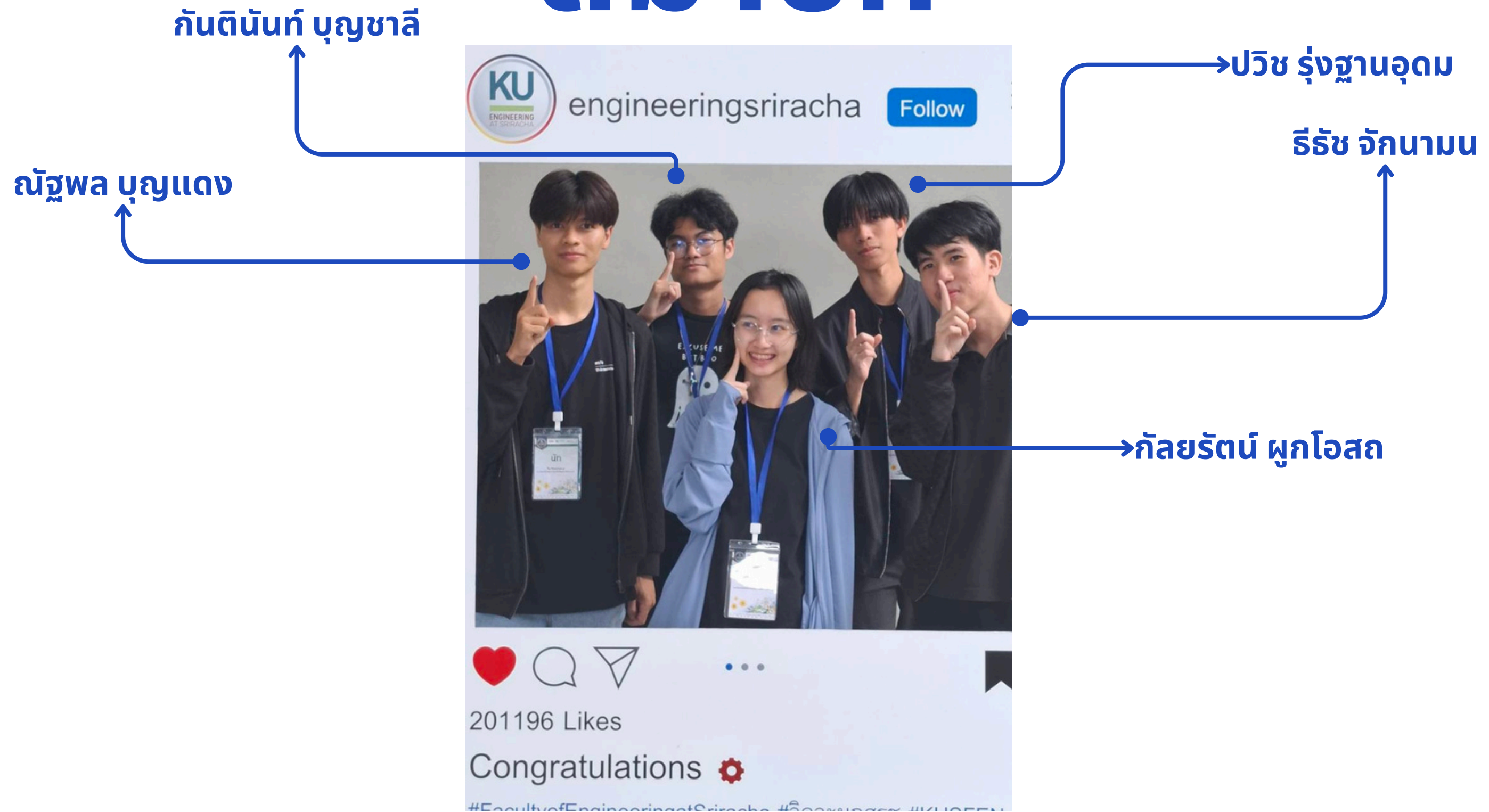
Benefits

- 1 สามารถทราบการทำงานผิดปกติของเครื่องจักรได้อย่างแม่นยำและรวดเร็ว
- 2 การควบคุมและวิเคราะห์ระยะไกลผ่านเซิร์ฟเวอร์
- 3 ต้นทุนต่ำและติดตั้งง่าย

Constraints

- 1 ทรัพยากรของ Raspberry Pi ค่อนข้างน้อย
- 2 การรองรับเสียงรบกวน

สมาชิก



Thank You

Resonance