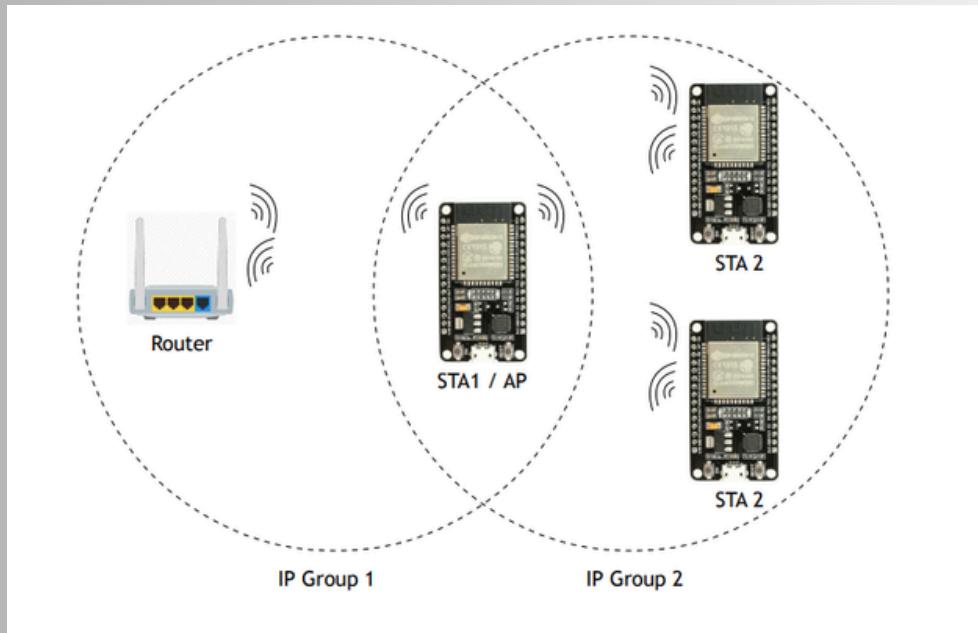


# Industrial Machine State Monitoring System

The Industrial Machine State Monitoring System is designed to track and analyze **real-time** machine parameters such as temperature, pressure, current, and voltage.

It enables continuous monitoring of machine health and operational status using IoT-based sensors and communication. The system helps detect abnormalities early, supports predictive maintenance, and reduces downtime. It plays a vital role in achieving efficient and smart industrial automation.

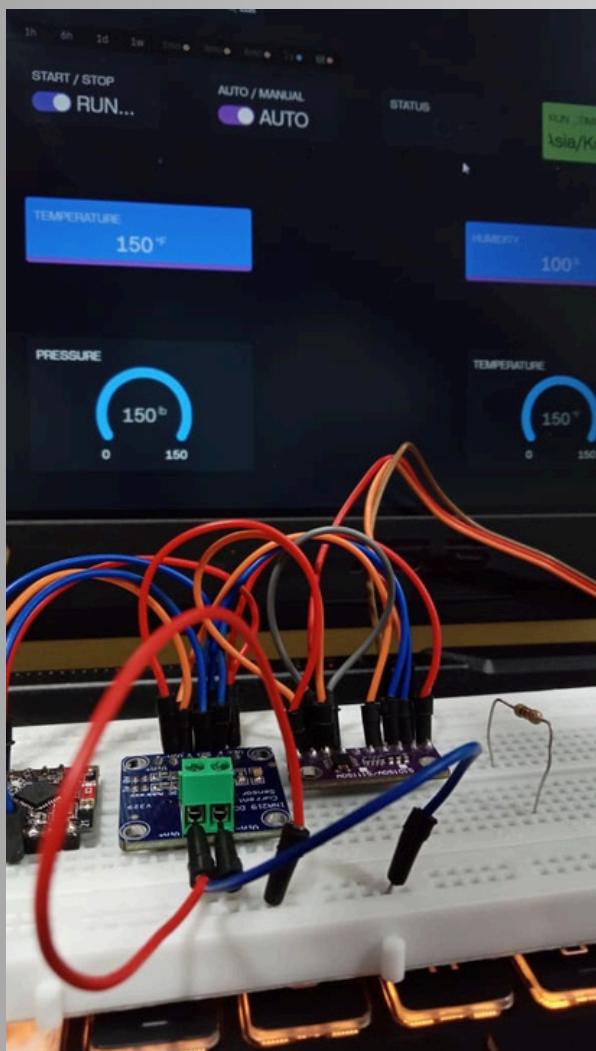


In this **Extended Service Set (ESS)** setup, you can have multiple ESP32 boards acting as Access Points with the same SSID and password and function in Dual mode **Access Point (AP)** and **Station (STA)**, each covering different areas of a factory or building.

As an ESP32 (station) device moves around, it automatically connects to the nearest AP with the strongest signal, maintaining continuous data transmission.

# Hardware Architecture

- **ESP32-C3** – Core controller handling data processing, Wi-Fi communication, and IoT connectivity.
- **ADS1115 ADC** – Reads analog signals from pressure, temperature, and flow sensors with high precision.
- **Sensors** – Measure voltage, temperature, humidity, pressure, Flowrate and current for machine power monitoring.
- **Control Unit** – Includes Start, Auto/Manual, and Status controls for remote operation via Blynk.
- **Power Supply** – Provides stable 5V/3.3V to ESP32 and sensor modules for reliable operation.



```
Machine_monitoring.ino
1 // --- Function to read sensor data ---
2 void readadc(int8_t channel) {
3     int16_t adc_value = ads1115.readADC_SingleEnded(channel);
4     float voltage = (adc_value * 4.096) / 32767.0;
5     float current = (voltage * 1000) / 10000.0;
6     float pressure = (adc_value * 4.096) / 32767.0;
7     float temp = (adc_value * 4.096) / 32767.0;
8
9     // Convert to voltage (ADS1115: 16-bit, 4.096V range)
10    float voltage_flow = (adc_value * 4.096) / 32767.0;
11    float voltage_pressure = (adc_value * 4.096) / 32767.0;
12    float voltage_temp = (adc_value * 4.096) / 32767.0;
13
14    // Example conversion formulas (adjust for your sensor calibration)
15 }
```

```
Serial Monitor
Message (B to send message to 'ESP32C3 Dev Module' on 'COM7')
Flow: 52.91 L/W | Pressure: 30.61 psi | Temp: 49.45 °C | Voltage: 0.01 V | Current: 0.000 A
Flow: 60.33 L/W | Pressure: 24.11 psi | Temp: 59.94 °C | Voltage: 0.02 V | Current: 0.000 A
Flow: 68.75 L/W | Pressure: 18.61 psi | Temp: 69.43 °C | Voltage: 0.03 V | Current: 0.000 A
Flow: 77.17 L/W | Pressure: 13.11 psi | Temp: 78.92 °C | Voltage: 0.04 V | Current: 0.000 A
Flow: 85.59 L/W | Pressure: 8.61 psi | Temp: 88.41 °C | Voltage: 0.05 V | Current: 0.000 A
Flow: 93.01 L/W | Pressure: 4.11 psi | Temp: 97.89 °C | Voltage: 0.06 V | Current: 0.000 A
Flow: 101.43 L/W | Pressure: 0.61 psi | Temp: 107.37 °C | Voltage: 0.07 V | Current: 0.000 A
Flow: 109.85 L/W | Pressure: 28.59 psi | Temp: 59.43 °C | Voltage: 0.01 V | Current: 0.000 A
Flow: 118.27 L/W | Pressure: 28.62 psi | Temp: 50.63 °C | Voltage: 0.04 V | Current: 0.000 A
Flow: 126.69 L/W | Pressure: 28.65 psi | Temp: 57.48 °C | Voltage: 0.02 V | Current: -0.000 A
```

```
19:39:06.724 -> ets Jul 29 2019 12:21:46
19:39:06.724 ->
19:39:06.724 -> rst:0x1 (POWERON_RESET),boot:0x13 (SPI_FAST_FLASH_BOOT)
19:39:06.739 -> configSip: 0, SPIWP:0xee
19:39:06.739 -> clk_drv:0x00,q_drv:0x00,d_drv:0x00,cs0_drv:0x00,hd_drv:0x00,wp_drv:0x00
19:39:06.739 -> mode:DIO, clock div:1
19:39:06.739 -> load:0x3fff0030,len:1344
19:39:06.739 -> load:0x40078000,len:13964
19:39:06.739 -> load:0x40080400,len:3600
19:39:06.739 -> entry 0x400805f0
19:39:07.088 -> Connecting to WiFi...
19:39:07.609 -> ....
19:39:09.088 -> Connected to router!
19:39:09.088 -> Station IP: 10.21.219.37
19:39:09.135 -> Access Point started!
19:39:09.135 -> AP IP: 192.168.4.1
```

## Blynk Web Dashboard

ESP32 updates Blynk every few seconds, syncing both web and mobile dashboards in real time.

- Provides a real-time visualization of machine parameters such as pressure, temperature, current, voltage, and flow rate.
- Features interactive controls (Start/Stop and Auto/Manual buttons) for remote machine operation.
- Displays live sensor data using widgets like gauges, graphs, and indicators.
- Allows cloud-based monitoring accessible from both web and mobile applications.
- Supports data logging and history view, helping in performance tracking and predictive maintenance.

This screenshot shows the Blynk Web Dashboard interface. At the top, there's a header bar with various links. Below it is a sidebar with navigation options like 'Get Started', 'Dashboards', 'Developer Zone', 'Devices', 'Automations', 'Users', 'Organizations', 'Locations', 'Fleet Management', and 'In-App Messaging'. The main content area displays a 'MACHINE STATE' section with a green status indicator. It includes a 'START / STOP' button set to 'RUNNING', an 'AUTO / MANUAL' button set to 'AUTO', and a 'STATUS' button. A 'RUN TIME' badge shows '1Asia/Kolkata5.'. Below this are four circular gauge widgets: 'TEMPERATURE' at 150°F, 'HUMIDITY' at 100%, 'PRESSURE' at 150, and 'CURRENT' at 150. At the bottom, there are 'VOLTAGE' and 'CURRENT' sections.

This screenshot shows the Blynk mobile application interface. It has a yellow header with three icons: a key, a bell, and a refresh. Below the header, it says 'MACHINE STATE' with a green 'Online' status. There are two tabs: 'Tab 1' and 'Tab 2', with 'Tab 1' selected. Under 'Tab 1', there are two large green buttons: 'ON/OFF' set to 'ON' and 'AUTO / MAN' set to 'AUTO'. Below these are 'Status' (a grey circle), 'Run Time' (Fri), 'Temperature' (150°F), 'Humidity' (100%), 'Voltage' (0v), 'Current' (0mA), 'Water Flow' (0 gal), and 'Pressure' (150). At the bottom, there's a green circular icon with a dot and the word 'Efficiency'.

This screenshot shows the 'Datastreams' configuration table in the Blynk Web Dashboard. The table has columns for ID, Name, Pin, Color, Data Type, Unit, In Rate, Min, Max, Decimals, Default Value, Automation Type, Condition, and Action. The rows list various sensors and actuators: PRESSURE\_SENSOR (Pin V0, Integer, 0-150), TEMPERATURE\_SENSOR (Pin V1, Integer, 0-150), HUMIDITY\_SENSOR (Pin V2, Integer, 0-100), CURRENT\_SENSOR (Pin V3, Integer, 0-120), START\_STOP (Pin V5, Integer, 0-1), VOLTAGE (Pin V6, Integer, 0-250), FLOWMETER (Pin V7, Integer, 0-200), Timer (Pin V8, String, 0-0000), AUTO\_MAN (Pin V9, Integer, 0-1), and STATUS (Pin V4, Integer, 0-1).

ID	Name	Pin	Color	Data Type	Unit	In Rate	Min	Max	Decimals	Default Value	Automation Type	Condition	Action
1	PRESSURE_SENSOR	V0	Yellow	Integer	0	false	0	150	-	0	Switch		
2	TEMPERATURE_SENSOR	V1	Grey	Integer	°F	false	0	150	-	0	Switch		
3	HUMIDITY_SENSOR	V2	Pink	Integer	%	false	0	100	-	0	Switch		
4	CURRENT_SENSOR	V3	Blue	Integer	mA	false	0	120	-	0	Switch		
6	START_STOP	V5	Purple	Integer		false	0	1	-	0	Switch		
7	VOLTAGE	V6	Yellow	Integer	V	false	0	250	-	0	Switch		
8	FLOWMETER	V7	Cyan	Integer	gal	false	0	200	-	0	Switch		
10	Timer	V8	Pink	String		false	-	-	0	0000	Sensor	On	On
11	AUTO_MAN	V9	Grey	Integer		false	0	1	-	0	Switch		
12	STATUS	V4	Black	Integer		false	0	1	-	0	Switch		

THANK  
you