Software Strategy: Local vs. Cloud vs. Blynk

Since your hardware setup is identical, you can switch between these modes simply by uploading different code to your ESP32.

Option A: Local Web Server (The "Offline" Approach)

The ESP32 hosts a website itself.

- **Best for:** Privacy, areas with no internet, simple setups.
- **Pros:** Free, Fast, No Internet needed.
- **Cons:** No remote access, no history graph, ugly UI (basic HTML).

Option B: Cloud/Firebase (The "Pro/Custom" Approach)

The ESP32 sends data to Google; you view it on a custom website we built.

- **Best for:** Engineers who want full control, custom styling, and free unlimited data.
- **Pros:** Professional look, completely customizable, free tier is generous.
- **Cons:** Requires setting up Google Firebase (can be intimidating).

Option C: Blynk IoT (The "Drag-and-Drop" Approach)

You use the "Blynk" app from the Play Store. You drag a "Gauge" widget onto the screen, and it connects to your ESP32 automatically.

- **Best for:** Beginners who want a mobile app *fast* without writing any App code.
- **Pros:** Easiest App setup (Drag & Drop widgets), Push Notifications are easy.
- **Cons:** The "Free Tier" is limited (you have "Energy" limits for widgets), you cannot customize the look as much as Option B.

Comparison Table

Feature	Option A: Local	Option B: Firebase	Option C: Blynk
Internet Required?	No	Yes	Yes
Remote Access?	No	Yes	Yes
App Building	HTML (Hard to style)	React (Custom Code)	**Drag & Drop (Easy)**
Setup Difficulty	Easy	Medium	**Easy-Medium**
Cost	₹0	₹0	₹0 (Free Tier limits)

Alerts	No	Yes (Code needed)	**Yes (Built-in Widget)**

Detailed Instructions for Option C (Blynk)

This option requires three distinct stages of setup.

Stage 1: The Cloud Setup (Blynk Console)

Where: Computer Browser

1. Go to blynk.cloud and create a free account.
2. Click **New Template** -> Name: "Water Monitor", Hardware: "ESP32", Conn: "WiFi".
3. Go to the **Datastreams** tab -> Click **New Datastream** -> **Virtual Pin**.
   - Name: `Water Level`
   - Pin: `V0`
   - Data Type: `Integer`
   - Min: `0`, Max: `100`
   - Click **Create**.
4. Go to the **Web Dashboard** tab -> Drag a **Gauge** widget. Set its datastream to `Water Level (V0)`.
5. Click **Save**.
6. Click the **Search/Magnifying Glass** icon (Devices) -> **New Device** -> **From Template** -> Choose "Water Monitor".
7. **IMPORTANT:** A box will pop up with `BLYNK_TEMPLATE_ID`, `BLYNK_DEVICE_NAME`, and `BLYNK_AUTH_TOKEN`. **Copy these.** You need them for the code.

Stage 2: The Mobile App Setup

Where: Smartphone

1. Install **Blynk IoT** app from Play Store / App Store.
2. Log in with the same account.
3. Tap on the "Water Monitor" device you created in Stage 1.
4. Tap the **Wrench Icon** (Developer Mode) to edit.
5. Tap `+` to add widgets.
   - Add a **Level H** (Horizontal Level) or **Gauge**.
   - Tap the widget, select Datastream: `Water Level (V0)`.
   - Add a **Notification** widget for alerts.
6. Exit Developer Mode. The app is now ready to receive data.

Stage 3: The Hardware Code

Where: Arduino IDE on Computer

1. Open Arduino IDE.
2. Go to **Sketch** -> **Include Library** -> **Manage Libraries**.
3. Search for **"Blynk"** (by Volodymyr Shymanskyy) and install it.
4. Open the file `main_blynk.cpp` provided here.
5. Paste the **Template ID**, **Device Name**, and **Auth Token** (from Stage 1) into the top of the code.
6. Enter your Wi-Fi name and password.
7. Upload to the ESP32