# 📄 Dynamic QR Code Display via Bluetooth on LilyGo TTGO T-Display V1.1

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## 📌 Project Overview

This project enables the **LilyGo TTGO T-Display V1.1** to dynamically generate and display a **QR Code** based on user input received over **Bluetooth**. Users can send text or URLs via Bluetooth, and the device will display the corresponding QR Code on its **240x240 TFT screen**.

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## ⚙️ Hardware Components

1. **LilyGo TTGO T-Display V1.1**
   - Microcontroller with **240x240 TFT Display**
   - Built-in **Bluetooth Communication**
2. **Power Supply:** USB or battery power via the onboard connector.

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## 🛠️ Pin Configuration

| Component | Pin on TTGO | Description |
|---|---|---|
| **TFT RST** | GPIO23 | TFT Reset |
| **TFT CS** | GPIO5 | TFT Chip Select |
| **TFT DC** | GPIO16 | TFT Data/Command |
| **TFT Backlight** | GPIO4 | TFT Backlight |
| **TFT MOSI** | GPIO19 | SPI MOSI |
| **TFT SCLK** | GPIO18 | SPI Clock |

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## 📚 Libraries Used

1. **Adafruit_GFX:** Graphics library for displays.
2. **Adafruit_ST7789:** Specific driver for the ST7789 TFT display.
3. **qrcode_st7789:** QR Code rendering library for ST7789 displays.
4. **BluetoothSerial:** Bluetooth communication library for ESP32.

**Installation Steps:**

- Open **Arduino IDE → Sketch → Include Library → Manage Libraries.**
- Search and install:
  - **Adafruit GFX Library**
  - **Adafruit ST7789 Library**
  - **qrcode_st7789 Library**
  - **BluetoothSerial Library**

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## 🚀 Setup Instructions

### 1. Hardware Setup

- Connect the LilyGo TTGO T-Display V1.1 to your computer via USB.

### 2. Upload the Code

- Open the provided code in **Arduino IDE**.
- Select **Board:** ESP32 Dev Module.
- Upload the code to the LilyGo TTGO T-Display.

### 3. Bluetooth Pairing

- Enable Bluetooth on your device (mobile or PC).
- Search for **"TTGO_QR_Display"** in the Bluetooth device list.
- Pair and open a Bluetooth serial app.

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## 📝 Code Explanation

### 1. Initialization (`setup()`)

- **Serial Communication:** 115200 baud rate for debugging.
- **TFT Display Initialization:** Configure SPI pins and backlight.
- **Bluetooth Initialization:** Start Bluetooth with the name **"TTGO_QR_Display"**.
- Display an initial QR code message: **"Waiting for Bluetooth Input..."**.

cpp
Copy code
displayQRCode("Waiting for Bluetooth Input...");

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### 2. Bluetooth Data Handling (`loop()`)

- **Listen for Bluetooth Input:** Read characters sent via Bluetooth.
- **End of Input (`\n` or `\r`):** When an Enter key is detected, generate the QR code with the received string.
- **QR Code Display:** Render the QR code on the TFT screen.

```
cpp
Copy code
if (SerialBT.available()) {
   char receivedChar = SerialBT.read();
   if (receivedChar == '\n' || receivedChar == '\r') {
      if (bluetoothInput.length() > 0) {
         displayQRCode(bluetoothInput);
         bluetoothInput = ""; // Clear buffer
      }
   } else {
      bluetoothInput += receivedChar;
   }
}
```

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### 3. QR Code Display Function (`displayQRCode`)

- Clears the TFT display with a white background.
- Generates and displays the QR code dynamically based on the received data.

```
cpp
Copy code
void displayQRCode(const String &data) {
   display.fillScreen(ST77XX_WHITE);
   qrcode.init();
   qrcode.create(data.c_str());
}
```

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## How to Use the System

1. **Power On the TTGO T-Display.**
2. **Pair Bluetooth Device:** Look for **"TTGO_QR_Display"** and connect.
3. **Open a Bluetooth Serial App:** Send text or a URL (e.g., https://example.com).
4. **View the QR Code:** The corresponding QR code will be displayed on the screen.
5. **Repeat Input:** Send new text to refresh the QR code dynamically.

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## 📊 Expected Behavior

| User Input (Bluetooth) | Displayed QR Code |
|---|---|
| https://akijresource.com | QR Code for the URL |
| Hello World | QR Code for the text |
| 12345 | QR Code for numeric string |

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## ⚠️ Troubleshooting

1. **Bluetooth Not Connecting:**
   - Restart the device and try pairing again.
   - Ensure Bluetooth is enabled on your mobile/PC.
2. **Blank Screen or No QR Code:**
   - Verify TFT connections and backlight.
   - Ensure the input is valid and not empty.
3. **Partial QR Code Display:**
   - Ensure input length does not exceed the QR code library's capacity.

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## 📡 Bluetooth Serial Example Input/Output

**Input:**

Copy code
Hello World

**Serial Monitor Output:**

less
Copy code
Bluetooth Input Received: Hello World
QR Code displayed successfully!

**Display:**

- QR code for "Hello World" is shown on the TFT screen.

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## 🔄 Future Improvements

- Add error correction for invalid QR code data.
- Display additional information (e.g., timestamp) alongside QR code.
- Enable QR code scanning feedback via Bluetooth.

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## 📚 References

- Adafruit GFX Library Documentation
- Adafruit ST7789 Library Documentation
- BluetoothSerial ESP32 Documentation
- QR Code ST7789 Library Documentation

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## 📝 Credits

- **Developed by:** AKIJ Agro Tech Development Team
- **Date:** 2024
- **Technologies Used:** ESP32, Bluetooth, TFT Display, QR Code