Project Brief: Creating a Gimbal-Based Camera Controlled via Bluetoot

---

Introduction:

The objective of this project is to develop a gimbal-based camera system that can be controlled wirelessly via Bluetooth using an Android phone. The system utilizes the phone's gyroscope data to adjust the orientation of the camera mounted on a Raspberry Pi-controlled gimbal. Additionally, live video streaming from the camera to the phone is implemented.

Project Components:

1. **Bluetooth Connection:**
   - Establish a Bluetooth connection between the Android phone and the Raspberry Pi.
   - Utilize Bluetooth APIs on both devices for seamless data transmission.

2. **Phone Gyroscope Data:**
   - Develop an Android app to read gyroscope data from the phone's sensors.
   - Transmit the gyroscope data to the Raspberry Pi over the Bluetooth connection.

3. **Raspberry Pi Control:**
   - Write a Python script to run on the Raspberry Pi to receive gyroscope data.
   - Interpret the gyroscope data to control two servo motors attached to the gimbal.
   - Utilize GPIO pins to interface with the servo motors for precise control.

4. **Camera Attachment:**
   - Mount a camera module onto the Raspberry Pi for capturing live video.
   - Ensure the camera is securely attached and capable of capturing a clear field of view.

5. **Live Video Streaming:**
   - Use the PiCamera library to capture live video frames.
   - Stream the video frames from the Raspberry Pi to the Android app over the Bluetooth connection.

6. **Gimbal Fabrication:**
   - Design and fabricate a gimbal system using two servo motors.
   - Attach the camera to the gimbal to enable pan and tilt movements based on gyroscope data.

Code Implementation:

1. **Android App (Java):**
   ```java
   // Code to read gyroscope data from Android phone and send it over Bluetooth
   ```

2. **Raspberry Pi Script (Python):**
   ```python
   # Code to receive gyroscope data from Bluetooth and control servo motors

   import bluetooth
   import RPi.GPIO as GPIO
   ```

```
import time

# Set up GPIO pins for servo motor control
GPIO.setmode(GPIO.BCM)
GPIO.setup(18, GPIO.OUT)
GPIO.setup(19, GPIO.OUT)

# Define function to control servo motors based on gyroscope data
def control_gimbal(gyro_data):
    # Parse gyroscope data and adjust servo motor positions accordingly
    # Example code:
    servo1_pwm = GPIO.PWM(18, 50)  # GPIO 18 for controlling servo 1
    servo2_pwm = GPIO.PWM(19, 50)  # GPIO 19 for controlling servo 2
    servo1_pwm.start(0)
    servo2_pwm.start(0)
    # Adjust servo motor positions based on gyroscope data
    servo1_pwm.ChangeDutyCycle(50)  # Example duty cycle
    servo2_pwm.ChangeDutyCycle(50)  # Example duty cycle
    time.sleep(0.5)  # Adjust sleep time as needed

# Bluetooth setup
server_socket = bluetooth.BluetoothSocket(bluetooth.RFCOMM)
port = 1
server_socket.bind(("", port))
server_socket.listen(1)

# Accept incoming Bluetooth connections
client_socket, address = server_socket.accept()
print("Accepted connection from", address)

# Receive and process gyroscope data
while True:
    try:
        data = client_socket.recv(1024)
        if not data:
            break
        gyro_data = data.decode("utf-8")  # Convert received data to gyroscope readings
        control_gimbal(gyro_data)
    except KeyboardInterrupt:
        break

# Clean up GPIO
GPIO.cleanup()
```

Conclusion:

This project demonstrates the successful implementation of a gimbal-based camera system controlled via Bluetooth. By integrating gyroscope data from an Android phone with servo motor control on a Raspberry Pi, the camera's orientation can be adjusted in real-time. Live video streaming further enhances the functionality, allowing users to view the camera feed directly on their mobile device. This project lays the foundation for various applications such as remote surveillance, drone control, and more.