**SafeTusk: AI-Powered Elephant Protection Network**

This working prototype demonstrates a scaled-down, low-cost version of the Migratory Corridor Emergency Response System. The prototype uses **motion detection**, a deployable **miniature bridge panel**, and **sound playback** to simulate a real-world elephant-safe crossing deployment.

## Working Principle:

1. **Detection Phase**:  
- A Passive Infrared (PIR) motion sensor continuously monitors the surrounding area for movement. In the hackathon demo, a person or object is used to simulate an approaching elephant.  
  
2. **Trigger Decision**:  
- Once motion is detected, the ESP32 microcontroller processes the input signal and initiates the deployment sequence.  
  
3. **Deployment Phase**:  
- The ESP32 sends control signals to a micro servo (SG90), which rotates and physically unfolds a lightweight demo panel, representing the deployable bridge in real life.  
  
4. **Audio Playback Phase**:  
- Simultaneously, the ESP32 communicates with the DFPlayer Mini MP3 module over UART to play a preloaded sound file. For elephants, this could be an infrasound rumble or a bee-swarm deterrent sound. The sound is output through an 8Ω 3W speaker.  
  
5. **Active State Indication**:  
- An LED indicator is turned on during the deployment to represent a 'Crossing Active' signal in real-world scenarios.  
  
6. **Retraction Phase**:  
- After a short delay (e.g., 5–10 seconds), the ESP32 commands the servo to retract the demo panel and turns off the LED. The system then returns to the idle monitoring state.

## Functional Schema:

The prototype's workflow can be described as the following sequence:  
  
PIR Motion Detection → ESP32 Processing → Servo Activation (Deploy Panel) + DFPlayer Audio Playback → LED Active Indicator → Delay → Servo Retraction → LED Off → Return to Idle

**Hardware Schema**:

- PIR Sensor → Digital input pin on ESP32  
- Micro Servo → PWM output pin on ESP32  
- DFPlayer Mini MP3 Module → UART (TX/RX) pins on ESP32  
- Speaker → Connected to DFPlayer Mini audio output  
- LED Indicator → Digital output pin on ESP32  
- Pushbutton (optional) → Manual override input to ESP32  
- Power Source → 5V power bank supplying ESP32, DFPlayer Mini, and servo

**CIRCUIT DIAGRAM:**

