**VibeNav – A Wearable Tactile Navigation and Safety System for Visually Impaired Users**

**Problem:**

Visually impaired individuals struggle to sense obstacles (especially overhead or moving ones), get lost, or face dangers (like fire, heat, or falling) without a way to alert others.

**Goal:**

Build a **wearable cap/headband** that:

* Senses obstacles and alerts user via **vibration**
* Detects **falls**, **heat/fire**, and sends **emergency SMS with GPS location**
* Is **non-auditory**, **low-cost**, **offline**, and **compact**

**Prototype Thinking:**

We'll break it down into core functionalities and map each one to the components.

| **Feature** | **Component** | **Role** |
| --- | --- | --- |
| Obstacle detection (front/side) | 2× HC-SR04 | Measure distance |
| Tactile feedback | 4× vibration motors | Vibrate based on proximity (direction-based) |
| Fall detection | MPU6050 | Detect sudden tilt/acceleration |
| Emergency alert | SIM800L | Send SMS with alert text |
| Location tracking | NEO-6M GPS | Get current latitude/longitude |
| Heat detection | DS18B20 | Warn if temperature too high |
| Fire detection | IR Flame Sensor | Detect presence of fire nearby |
| Optional control | HC-05 Bluetooth | Manual control or mobile alerts |
| Power | TP4056 + Booster | Charge + Boost battery to 5V |
| MCU | ESP32 or ESP8266 | Brain (reads data, sends alerts, controls motors) |

**Functional Thinking** – **What Each Module Does:**

**1. Ultrasonic Sensors (HC-SR04 x2)**

* Mounted **front & side**
* Detects if any object is < 1m
* Sends signal to corresponding vibration motor

**2. Vibration Motors (x4)**

* Mounted on front, back, left, right of headband
* Vibrate more strongly as the object gets closer

**3. MPU6050 Gyro + Accel**

* Continuously checks for **sudden acceleration or angle tilt**
* Triggers **fall alert**

**4. SIM800L + GPS**

* If fall is detected → gets location from GPS
* Sends **SMS** to predefined number (e.g. parent/guardian)

**5. DS18B20 + Flame Sensor**

* If **temp > 45°C** or flame detected → triggers a **vibration alert**
* Can also send SMS if configured

**6. ESP32 / ESP8266 / NodeMCU**

* Collects sensor data
* Makes decisions: when to vibrate, when to send SMS
* Stores emergency number in code (can be later updated via Bluetooth)

**7. Power System**

* TP4056 for charging 3.7V battery
* XL6009 boost converter to get 5V for motors & logic

**Development Plan**

**🛠️ Week-by-Week Breakdown (We can adjust as needed)**

| **Week** | **Task** |
| --- | --- |
| Week 1 | Setup ESP32 + test ultrasonic sensors + vibration motors |
| Week 2 | Integrate MPU6050 + simulate fall detection |
| Week 3 | Interface SIM800L → send SMS from ESP32 |
| Week 4 | Connect GPS + send SMS with location |
| Week 5 | Add temperature + flame sensor logic |
| Week 6 | Integrate everything → build prototype on cap/headband |
| Week 7 | Testing + optimization |
| Week 8 | Documentation, report |

**Prototype Sketch (Concept)**

Imagine a **cloth headband or baseball cap** with:

* **Front**: 1 ultrasonic sensor + 1 vibration motor
* **Left side**: 1 ultrasonic sensor + vibration motor
* **Back**: Vibration motor
* **Right side**: Vibration motor
* **Inside cap**: MPU6050, ESP32, flame/temp sensors
* **At the back of cap**: SIM800L + GPS
* **Power pack**: small Li-ion battery + TP4056