

NiT Sparkathon: Problem Statements

Instructions

Welcome, innovators! These instructions are your guide to a successful and impactful hackathon experience.

1. **Your Core Mission:** Build & Present a Solution

Your primary goal is to solve a real-world problem by creating a compelling physical prototype. Over these two intensive days, every decision should lead towards a working, demonstrable hardware solution.

2. **Choose Your Challenge** Select a path that ignites your passion:

- **Option A:** Pick one of the 10 problem statements provided in this document as your project's foundation.
- **Option B:** Forge your own path by defining a unique real-world problem statement that resonates with you.

2. **Interpret with Innovation:**

The provided problem statements are a launchpad, not a rigid blueprint. Embrace creative interpretation. The "Problem" sets the context, and the "Challenge" offers a direction. Your unique, artistic, and unconventional approach is highly valued.

3. **Leverage "Key Features" for Depth:**

The "Key Features" are designed to spark ideas and highlight potential avenues for development. While not a strict checklist, they illustrate what a sophisticated solution might encompass. Use them to inspire depth and functionality in your prototype.

4. **Collaborate, Create, Conquer**

Your team is your greatest asset. Organizers have intentionally formed diverse teams to blend technical expertise, design thinking, and business acumen. Maximize this synergy to overcome challenges and innovate faster.

5. **Prototype is Paramount & Presentation is Key:**

This is a physical prototype hackathon. Your ultimate deliverable is a functional, tangible hardware solution that tells a clear story.

- **Prioritize the Prototype:** Focus on bringing your core idea to life physically. A working demonstration is paramount.
- **Master the Presentation:** Be prepared to powerfully articulate the problem you're solving, how your prototype works, and the impact it creates during your live demo. A brilliant prototype deserves a brilliant presentation.

Good luck, and we eagerly anticipate the innovative solutions you will build and present!

1. The "Emotional Mirror"

- **Problem:** We often don't recognize our own emotional state in the moment. A device could offer a private, abstract reflection of our expressed emotion.
- **Challenge:** Use the microphone and camera to gauge the user's emotional tone (from voice) and expression (from face) via on-device AI. The device must then reflect this *abstractly*—not with words, but by generating a unique, corresponding colour and haptic pattern.
- **Key Features:**
 - Real-time, multi-modal emotional analysis (voice tone + facial expression).
 - Fusion of multiple AI model outputs into a single, cohesive response.
 - An abstract, non-literal feedback system using light and touch.

2. The "Shared Vibe"

- **Problem:** Two people can be in the same room but feel emotionally distant. A shared object could create a subtle, non-verbal connection.
- **Challenge:** A two-device challenge. Each device uses its IMU to sense the individual's "energy level" (e.g., fidgeting, movement). They then wirelessly share this data, and each device glows with a colour representing the *average* energy of both users, creating a single, shared "aura."
- **Key Features:**
 - Real-time device-to-device communication (Bluetooth or ESP-NOW).
 - An algorithm to quantify an "energy level" from IMU data.
 - Data synchronization and averaging between two nodes.

3. The "Colour of Your Day"

- **Problem:** Our memory of a day is often a feeling, not a perfect record. A device could create an artistic summary of our visual journey.
- **Challenge:** The device's camera must periodically capture the dominant color palette of the user's environment. At the end of the day, the user can prompt the device to play back their day as a 60-second, seamless light show, transitioning through the colours it has recorded.
- **Key Features:**
 - Automated, time-based, periodic image capture.
 - An efficient, on-device colour extraction algorithm.
 - Data logging and retrieval from an SD card.

4. The "Focus Anchor"

- **Problem:** In a world of digital distractions, our focus is fleeting. A physical object could serve as a tangible anchor to the present moment.
- **Challenge:** Create a device that helps maintain focus through tactile feedback. The user "sets" their focus by letting it learn their current state of stillness via the IMU. If the user begins to fidget or move erratically, the device provides a long, slow, calming haptic pulse as a gentle reminder.
- **Key Features:**
 - High-precision IMU stillness detection and user calibration.
 - An algorithm to distinguish subconscious fidgeting from intentional movement.
 - A subtle, non-disruptive haptic feedback loop.

5. The "Silent Conversation"

- **Problem:** How can a device listen and respond to a story without using words?
- **Challenge:** The user speaks a short story to the device. The microphone listens while an on-device AI performs real-time sentiment analysis. As the story progresses, the device uses its haptic motor and a single coloured light to "react" silently—a soft pulse during calm parts, a sharp buzz at an excited moment.
- **Key Features:**
 - Real-time, on-device voice sentiment analysis.
 - Dynamic mapping of sentiment data to light and haptic patterns.
 - A privacy-centric design where audio is processed and immediately discarded.

6. The "Human Detector"

- **Problem:** A wearable device should understand its social context. Is the user alone or with people?
- **Challenge:** Create a highly power-efficient system using the camera and a face-detection model to determine if the user is alone, with one other person, or in a group. This state should fundamentally change the device's behaviour (e.g., it only communicates via haptics when others are present).
- **Key Features:**
 - Power-efficient, always-on (or periodically waking) face detection.
 - Ability to count detected faces and classify the social context.
 - A state machine that alters device behaviour based on the context.

7. The "Memory Weaver"

- **Problem:** Our digital photos are literal records. A more artistic way to remember an event would be to capture its sensory essence.
- **Challenge:** The user points the camera at a scene and presses a button. The device captures one image and 3 seconds of ambient audio. It then "weaves" these inputs into a single, unique haptic pattern that represents that moment, which can be saved and "played back" later as a purely tactile memory.
- **Key Features:**
 - Multi-modal data capture (image + audio).
 - A generative algorithm to create a unique haptic pattern from sensor data.
 - A system to save and replay haptic patterns.

8. The "Environmental Echo"

- **Problem:** We become numb to the subtle sounds of our environment. A device could help us appreciate the unique soundscape of the places we inhabit.
- **Challenge:** The device must periodically listen to ambient sound and, using an on-device model, identify a single, interesting, non-speech sound (e.g., a bird, a bell, rain). It saves a "sonic postcard" of this sound and can quietly play it back later.
- **Key Features:**
 - On-device sound classification to identify "interesting" ambient sounds.
 - A system for curating and saving short audio snippets.
 - A gentle and non-disruptive audio playback system.

9. The "Subconscious Journal"

- **Problem:** Journaling requires conscious effort. A device could passively capture the subconscious "texture" of our day through our speech patterns.
- **Challenge:** Throughout the day, the device passively listens to the user's speech (without understanding content) and runs an AI model to analyse vocal features: pitch, pace, and volume. It logs this abstract data, presenting a summary at the end of the day: "Today your voice was mostly fast-paced and high-pitched."
- **Key Features:**
 - On-device analysis of vocal prosody (pitch, pace, etc.).
 - Privacy-first design that logs abstract features, not raw audio or text.
 - A simple interface to display the final summary.

10. The "Physical Heartbeat"

- **Problem:** In a remote world, we lack a sense of presence with our loved ones.
- **Challenge:** A two-device challenge. A user can tap their device, sending a signal over the internet to a paired device. The receiving device responds with a single, gentle haptic pulse, a silent, one-bit message that says, "I'm thinking of you." The physical DND switch must pause incoming pulses.
- **Key Features:**
 - Ultra-low latency internet communication (MQTT or WebSocket's).
 - Integration of the physical DND switch to control connectivity.
 - A distinct, single-pulse haptic output.