PULSE

The Compass That Connects

The Problem

On a high-pressure campus, the smartphone has become a barrier rather than a bridge. Students at CMU currently face the following challenges:

1. Current **social coordination relies on smartphones**, which introduce a high degree of digital friction and cognitive distractions
2. There is a **lack of a low-pressure way to signal availability** or interest in a spontaneous encounter.
3. Venturing to a new part of campus feels **socially isolating** if the student doesn't have a guaranteed connection at the destination.

There is a gap between physical proximity and social connectivity. The digital baggage of current tools makes connecting that gap feel like a high-effort endeavor.

The Newtro Revolution

Newtro (New Retro) is driven by a desire to reclaim attention and presence.

The Dumbphone -Sales of basic flip phones rose by 16% in North America in 2024 as students adopt them for weekends and social outings to escape notification fatigue.

The Camera Revival -Sales of point-and-shoot digital cameras surged by 127% in 2025, as Gen Z users seek to capture moments without the temptation to immediately share them.

Tactile Retro-Handhelds -The resurgence of Tamagotchis reflects a preference for singular, high-quality interaction.

PULSE: The Ultimate Newtro Tool

Pulse is a dedicated, single-purpose handheld device designed to facilitate spontaneous human connection without the digital baggage of the smartphone. Pulse is engineered to solve the three primary friction points of campus life:

1. **Eliminating Digital Friction & Distraction**
2. **A Low-Pressure Signal of Availability**
3. **Connecting the Gap Between Proximity and Connectivity**

Image/ Inspo from TERRA Device found here

User Segment & Functional Use Cases

First-Year Students

· actively building a network
· navigating new physical spaces

Pulse provides a low-stakes signal of availability, allowing these students to broadcast their location in common areas and facilitate organic meetups that build community.

Upper-Year Students

· established circles
· seek a Digital Detox

Pulse acts as a dedicated social tether, providing the essential utility of a smartphone without the cognitive load of unrelated notifications.

Graduate Students

· fragmented schedules with limited gap hours
· move between different parts of campus

Pulse enables high-efficiency navigation; a glance at the device provides a real-time vector to a friend nearby, making a 10-minute spontaneous encounter viable.

Social & Mental Health — **Global/Cultural**

User Walk Through

1. The Connection

You are studying on campus. You notice your friend's status is active in the same building or area. You tap your device to send an invitation.

2. The Acceptance

Your friend receives the pulse on their device and accepts.

3. The Navigation

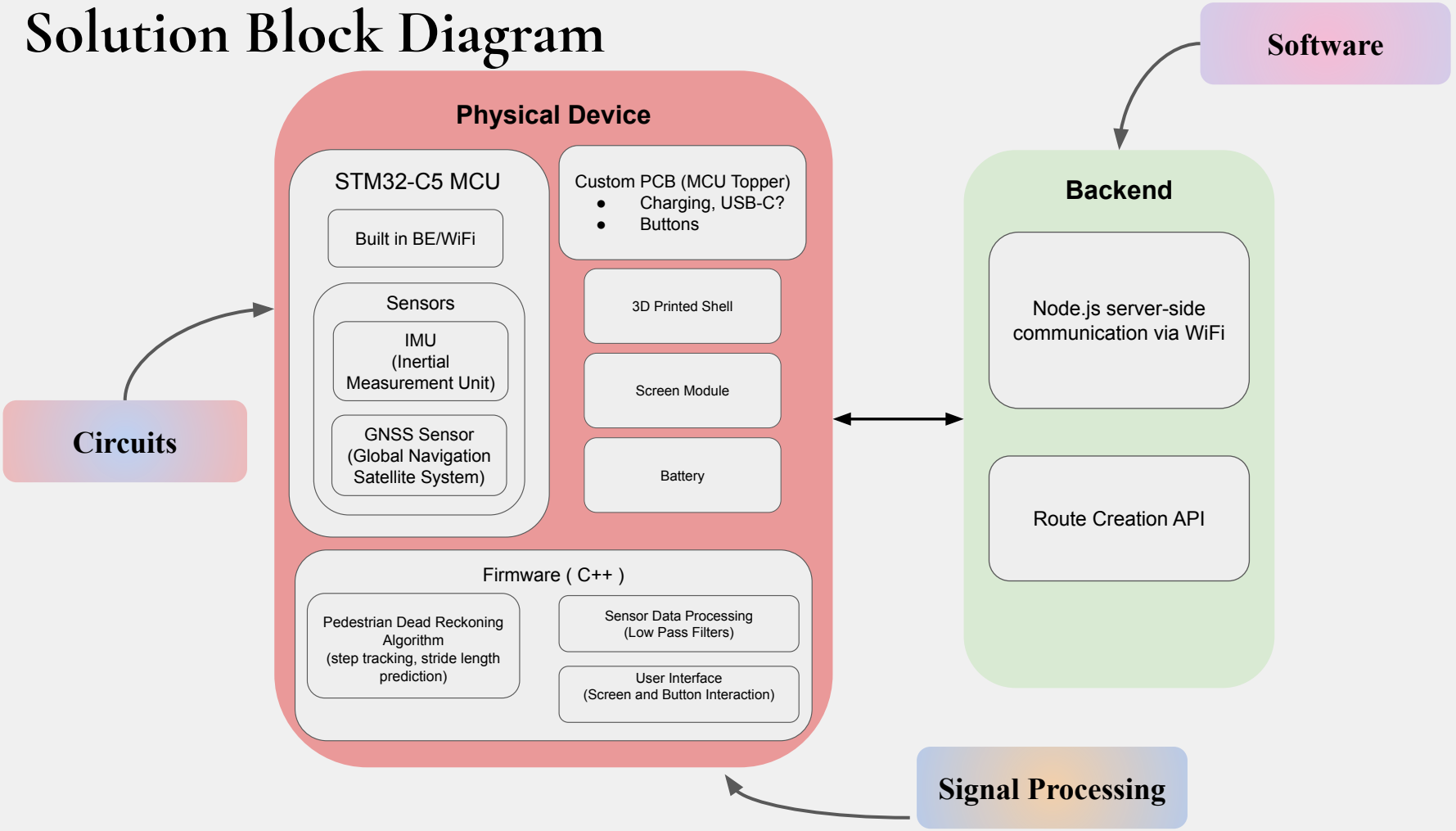
You begin walking toward your friend. The arrow on the display glides smoothly as you turn corners or walk through doors.

4. The Arrival

You approach a doorway or a corner and get close. As you cross the ≤7 meter threshold, the arrow dissolves or changes to a success state.

Image/ Inspo from TERRA Device found here

Solution Block Diagram



Potential Choices

Hardware

Microcontroller:

- ESP32
- Other MCU with a WiFi Module

IMU -> 9 Degrees of Freedom:

- BNO055 breakout boards

GNSS:

- Sparkfun's GNSS breakouts
- Less reputable sellers' GNSS modules….

PCB (Before Spring Break) :

- JLCPCB

Will be using I2C for sensor communication

Software / Firmware

Route Creation API:

- Google Maps API
  - Free -> 10,000 transactions
    - $5.00 for 90,000 transactions
- HERE Route API
  - Free -> 30,000 transactions
    - ~$0.75 per 1,000 transactions after

Pedestrian Dead Reckoning Algorithms

- Step Length -> Weinberg Algorithm
- Stride Length -> "SL+θ" Algorithm

Use Cases Requirements

Metric	Requirement	User -Centered Justification
UI Vector Refresh	≥ 5 Hz	A 5 Hz refresh ensures the directional arrow remains stable and responsive during active movement
Positional Precision	≤ 7 Meters	The device mission is complete when it brings users into this range. 7m is the average distance at which a person can identify a friend's face/silhouette in a crowd.
Operational Endurance	≥ 6 Hours	This ensures the device is a reliable for a full campus day without needing a mid-day charge.
Spontaneity & Interaction Frequency	70% of users report increase in in-person meetups	The product's ultimate goal is to increase physical interactions. We measure success through User Testing and surveys.
Social Friction Reduction	≤2 Tactile Interactions	To reduce the social anxiety of reaching out, initiating a meetup must be faster and lower-effort than unlocking a phone and typing a text.

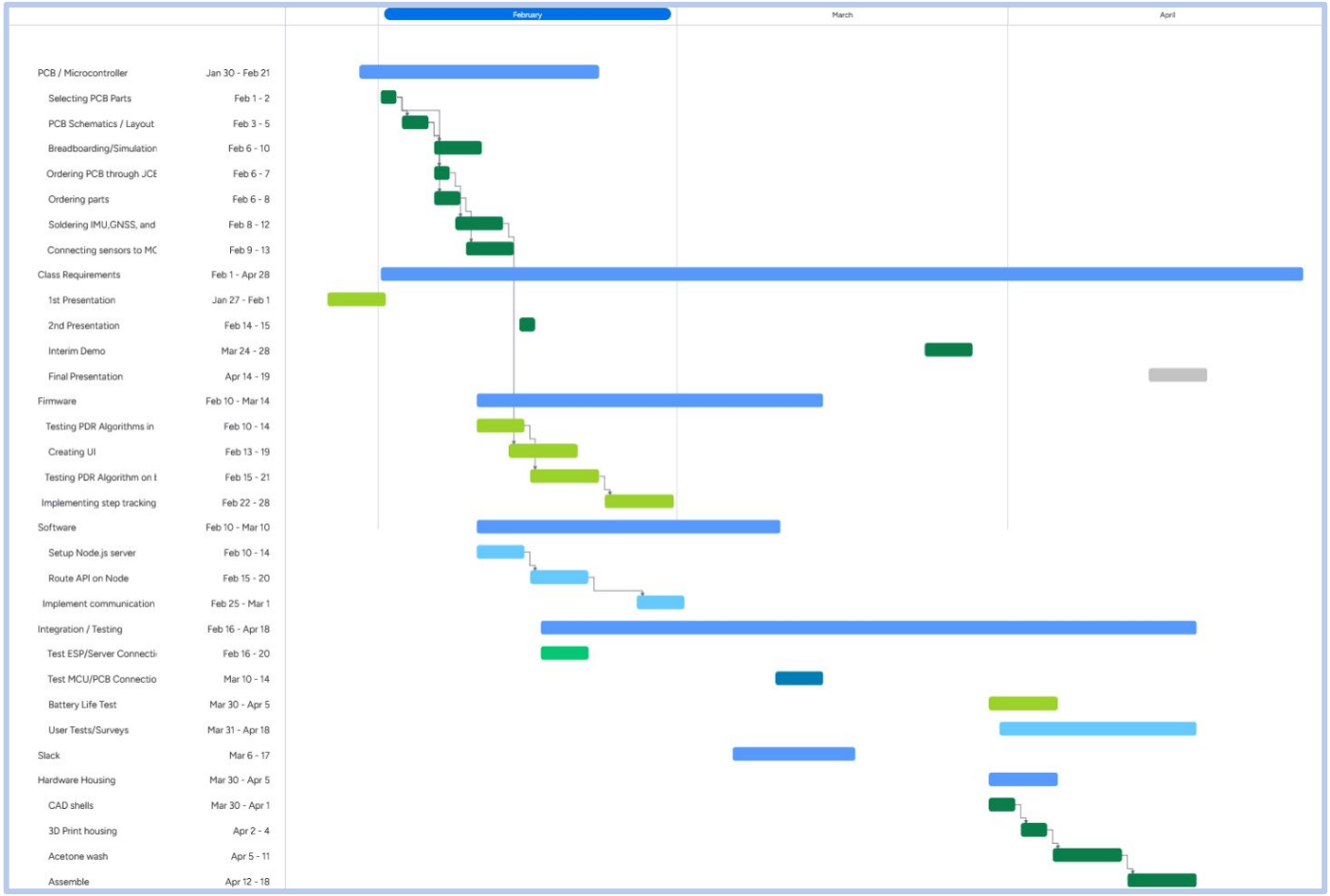
Key Technical Challenges and Mitigations

Key Technical Challenges	Why Is This a Challenge?	How We'll Mitigate These Challenges
6 Hour Battery Life	Real Time Tracking Drains Battery rapidly	Introducing a sleep state or using a larger battery
Positional Precision of ≤ 7 meters	GPS degrades indoors and near urban areas Maintaining connection between the devices so that they can detect each other	Combining GPS + Wi-Fi or utilizing PDR as a way to decrease lag and increase precision
UI Vector Refresh of ≥ 5 Hz	Combining GPS and accelerometer so that it updates fast enough at 5Hz	Using filters and PDR alongside GPS/GNSS to create smooth direction updates without adding lag and drift.

Testing, Verification and Metrics

Metric/Requirements	Validation	Verification
UI Vector Refresh ≥ 5 Hz	Users will rate how smooth the vectors update on a scale of 1–5 Pass Criteria: ≥ ⅘ avg perceived smoothness	Get a log of of the UI updates with timestamps while the user is walking/using device Pass Criteria: ≥ 5 updates/second avg
Positional Precision ≥ 7 m	Two participants attempt to find each track % of successful meetup within the 7m range Pass Criteria: ≥ 70% correct detection rate	Compare device-reported position vs known distance from maps and self measurement Pass Criteria: ≤ 7 m average error
Operational Endurance ≥ 6 Hours	Use the device during a full campus day for 2-3 weeks and track battery life Pass Criteria: ≥ 80% of users completing day without recharge	Run device continuously under normal usage conditions and track total hours Pass Criteria: ≥ 6 hours before battery depletion
Spontaneity & Interaction 70% of users report increase in in-person meetup	Users complete a survey and rate how likely they are to use this device to send a ping to meet up in person vs a phone Pass Criteria: ≥ 70% will use device vs phone	Log accepted meetups and actual meetups, and calculate rate of in person meetup Pass Criteria: ≥70% accepted meetups resulted in an person meetup

Schedule / Responsibilities



Katherine
| Software & Interface
Frontend coding, server-side logic, and Wi-Fi data handling. A/B testing and distribute the Surveys.

Brandon | Hardware & Power
PCB Design & Integration, Power Management, Physical Assembly, Stress & Endurance Testing

Lata | Signal & Systems
PDR algorithm development, sensor fusion (IMU + GNSS), and digital filtering. Accuracy Validation Testing.