



EMBEDDED SYSTEMS

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TRAFFIC ACCIDENT DETECTION AND IOT ALERT SYSTEM

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THE CHALLENGE

UNSTABLE REAL-TIME ACCIDENT DETECTION

- Traffic accidents must be detected in real time
- Video-based AI predictions fluctuate frame by frame
- Naïve systems react to single frames → **false alarms**
- False alarms lead to:
 - Unnecessary interventions
 - Loss of trust in the system
 - Operational inefficiency



IMPACT OF UNSTABLE DETECTION

False Positives

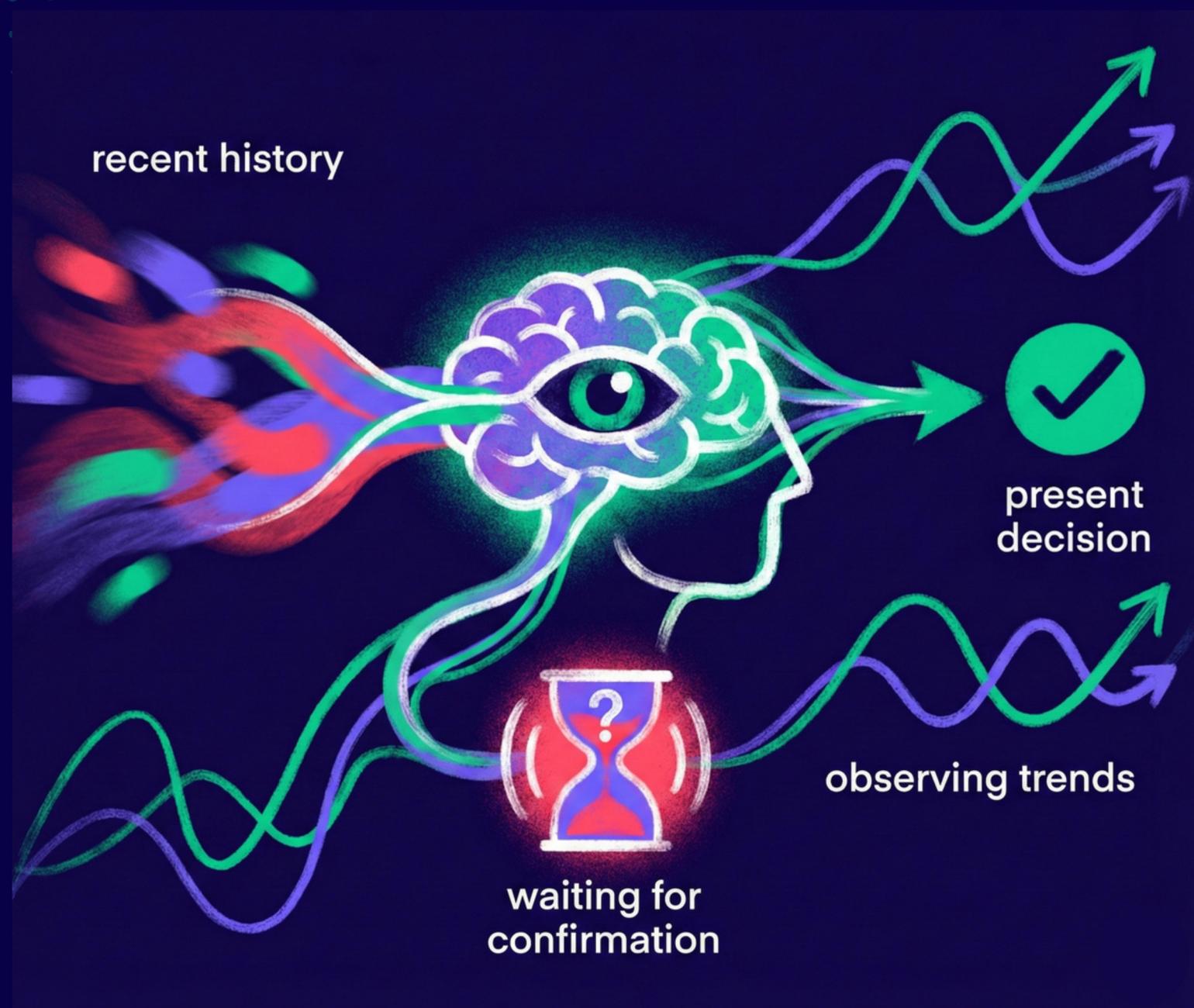
False Negatives

WORST SCENARIO
missed critical events

Higher operational costs

Reduced confidence from operators and clients





DECISIONS MUST BE TEMPORAL, NOT INSTANTANEOUS

| Video is a temporal signal, not independent images

| Human operators implicitly:

- Observe trends
- Wait for confirmation
- Act decisively once confident

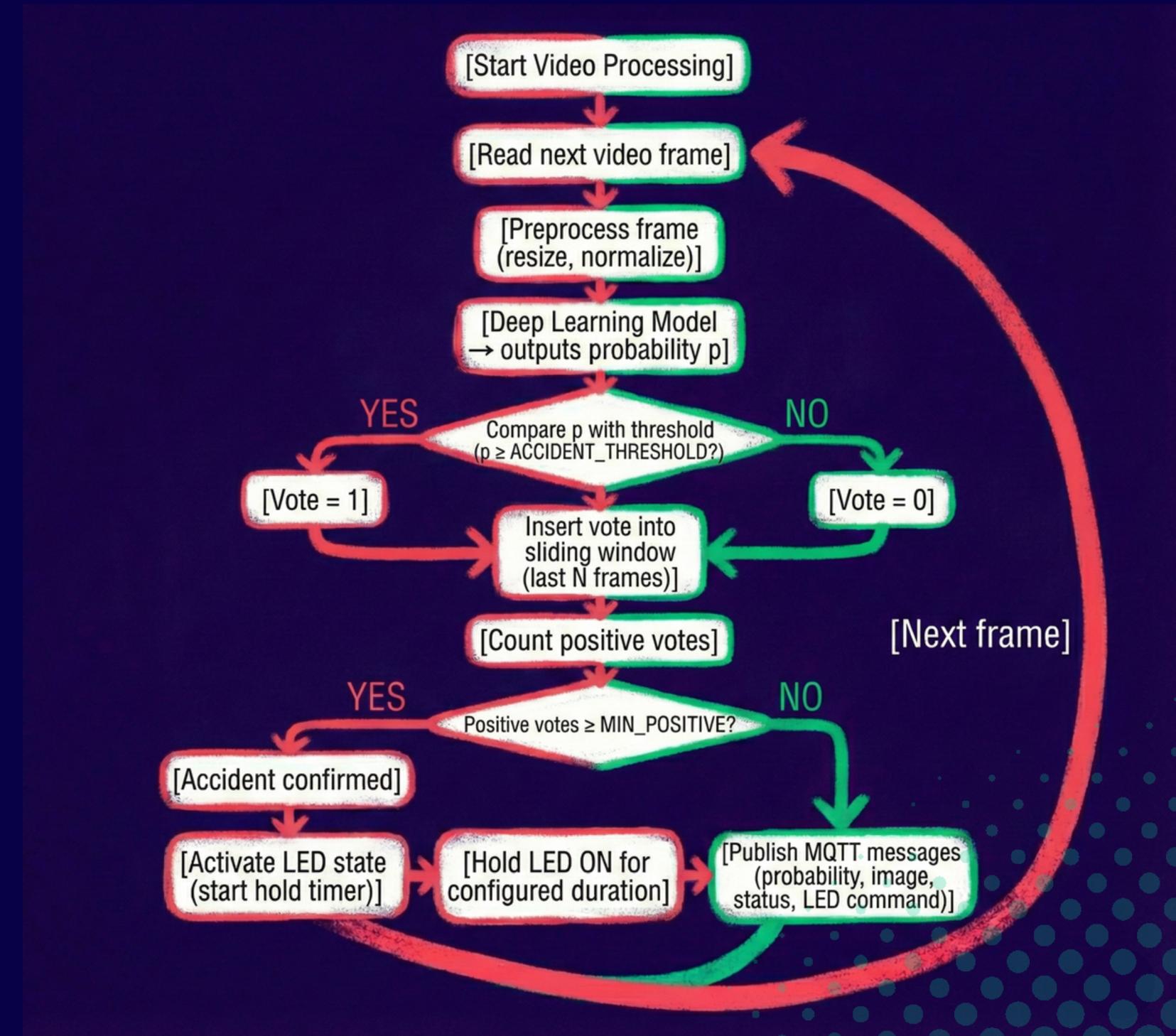
Our system tries to mimic this behavior



SOLUTION

Temporal Stabilization with Voting Logic

- Sliding window of the last N frames
- Each frame votes:
 - Accident detected
 - No accident
- Accident is confirmed only if:
→ A minimum number of positive votes is reached





Embedded Systems Project

System State Video

2012/04/25 18:21:50

Accident probability 0.999

Status Accident detected



VISUAL ALERTS

Physical Alert (LED)

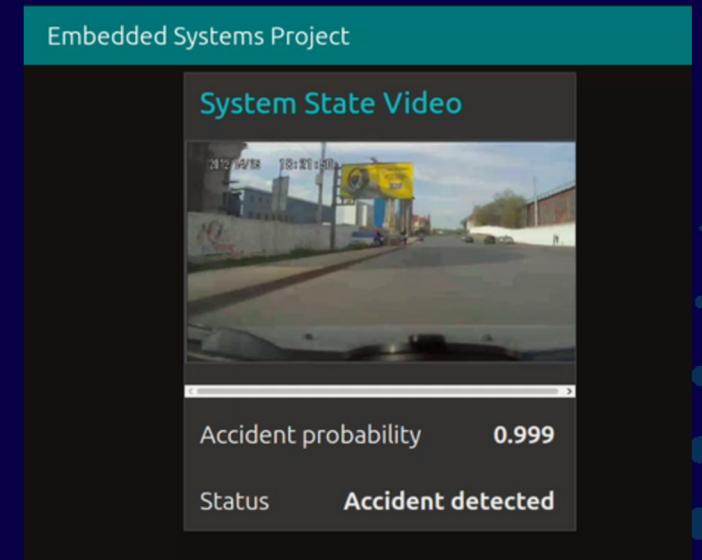
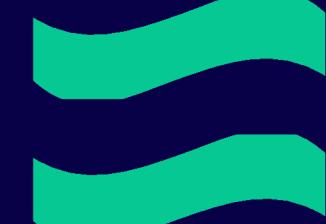
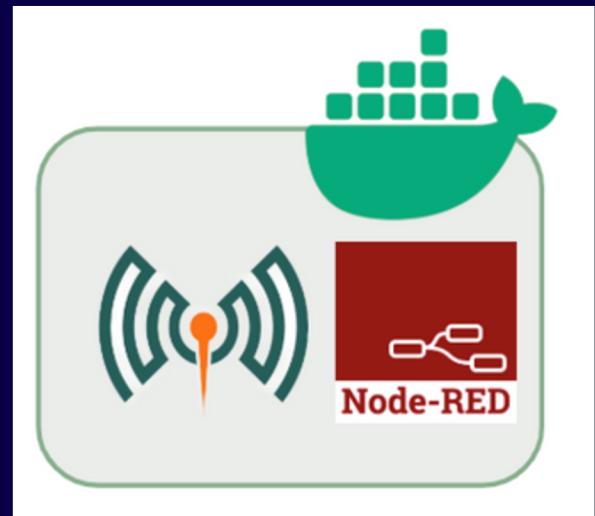
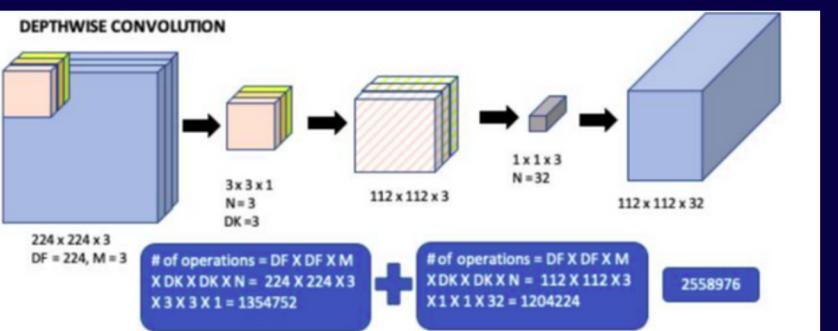
- LED turns ON when accident is confirmed
- LED remains ON for a minimum hold time
- No rapid ON/OFF flickering

Node-RED Dashboard

- Clear accident / no-accident state
- Synchronized with physical LED
- Stable display for human operators



SYSTEM ARCHITECTURE OVERVIEW





PHASE 3

DEMO

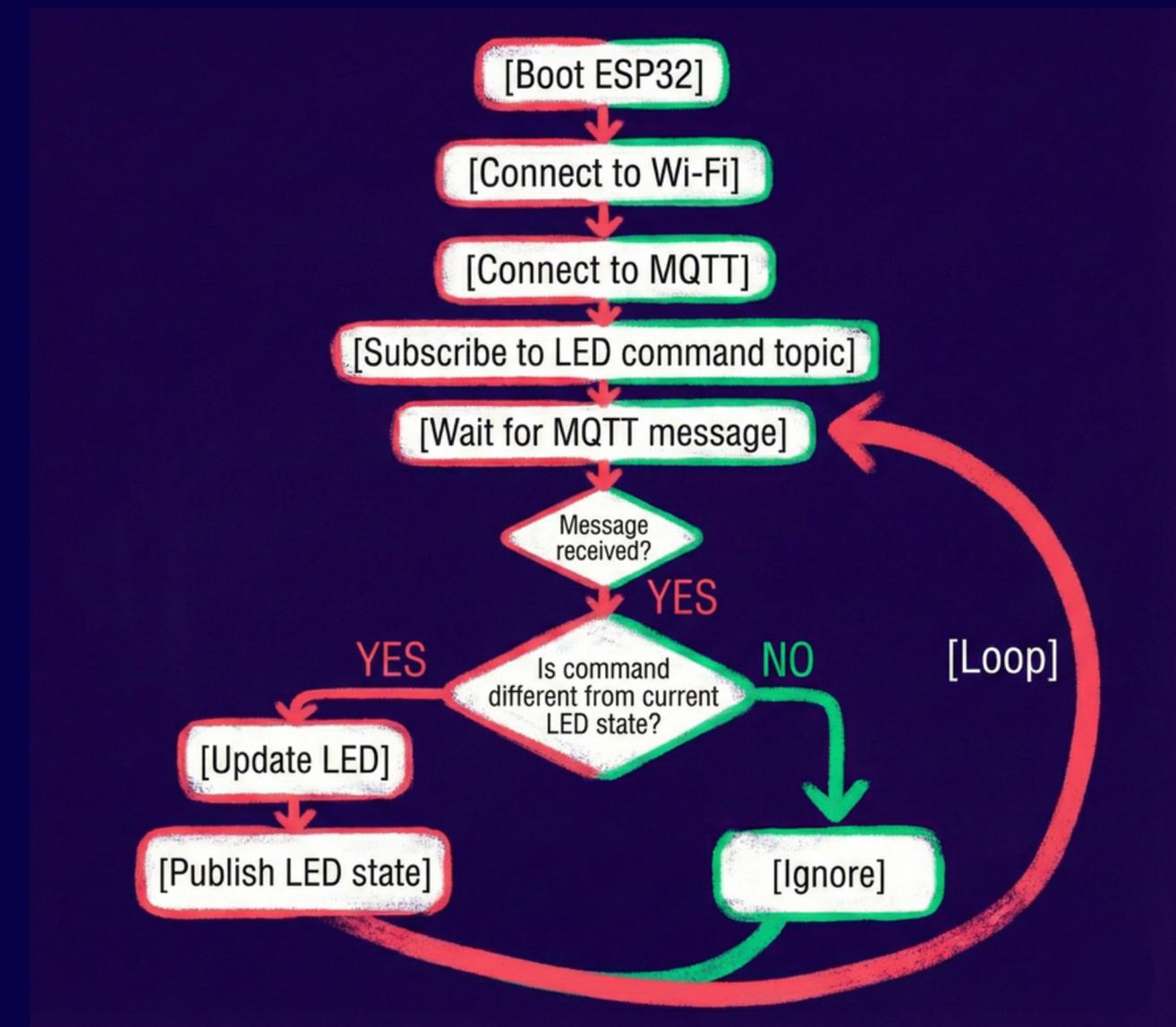
johcue/
IoT_crash_detection



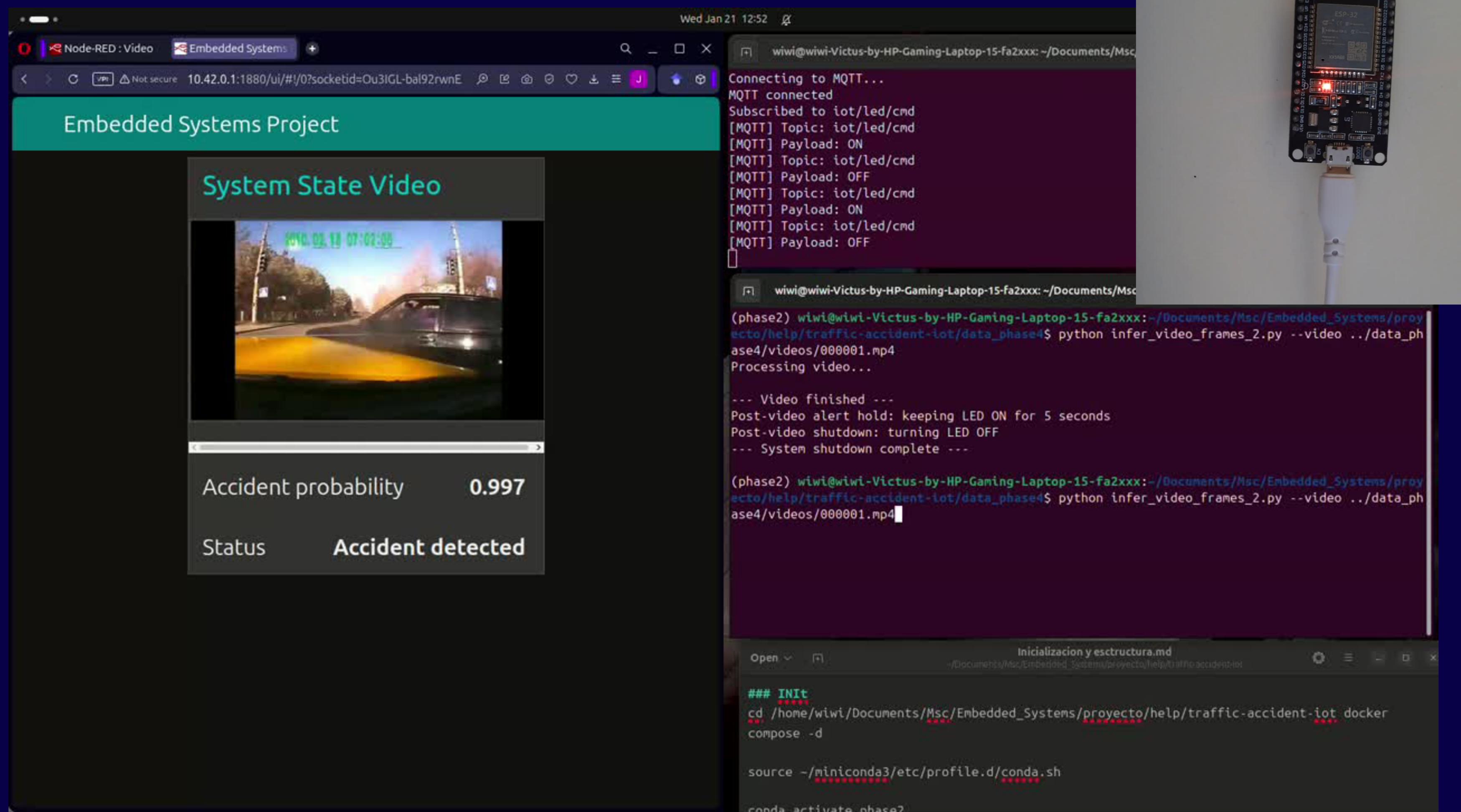
1 Contributor 0 Issues 0 Stars 0 Forks

johcue/IoT_crash_detection
Contribute to johcue/IoT_crash_detection development by creating an account on GitHub.

[GitHub](#)



Firmware Flowchart of ESP32





Questions?

THANK YOU FOR
ATTENTION

See You Next →