

CapSure Design Review Presentation

A Device to Capture Moments You Missed

Team Members: Jayden Lin | Ankita Kundu | Clarence Choy

Use Case / Application

Goal: Capture unexpected moments after they happen

Use Case Requirement	Quantitative Requirement
Incident Recognizability	Identify a person $\geq 10\text{m}$; coherent conversation $\geq 2\text{m}$
Retrospective Capture	Capture previous 60s
Clip Transfer	Transfer a clip within <60s at 3m
Wearability & Runtime	$\geq 5\text{h}$ of continuous use while adding $\leq 100\text{g}$ of total mass
Recording Awareness	People 2m in front will recognize when audiovisual capture is active
Comfort & Safety	Remain comfortably and safely wearable $\geq 5\text{h}$

Technical Design Requirements

Design Requirement	Quantitative Requirement	Justification
Video & Audio Capture	640×480 @ 15 FPS; 16 kHz, 16-bit mono; A/V sync +45/-125 ms	Incident Recognizability: Visual detail and speech legibility, matches ITU's detectability threshold
Circular Buffer & Storage	Retain ≥60 s pre-trigger footage; SD write rate ≥2× peak A/V bitrate (~2 MB/s)	Retrospective Capture: Margin for SD write stalls or spikes
Trigger & Preservation	Trigger response ≤100 ms; clip preservation ≥99% success	Retrospective Capture: Protects buffered footage

Technical Design Requirements

Design Requirement	Quantitative Requirement	Justification
Wireless Transfer	Complete transfer to phone within <60s at 3m	Clip Playback
Power & Mass	2000mAh battery; <100g total	Wearability & Runtime
Recording Indicator	LED indicator on during 100% of capture , visible at 2m	Recording Awareness: Similar to Meta's LED
Thermal Management	Contact surfaces <40°C after 5h @ 25°C ambient	Comfort & Safety: IEC guidance for prolonged skin-contact safety is <43°C

Solution Approach

Wearable Cap System

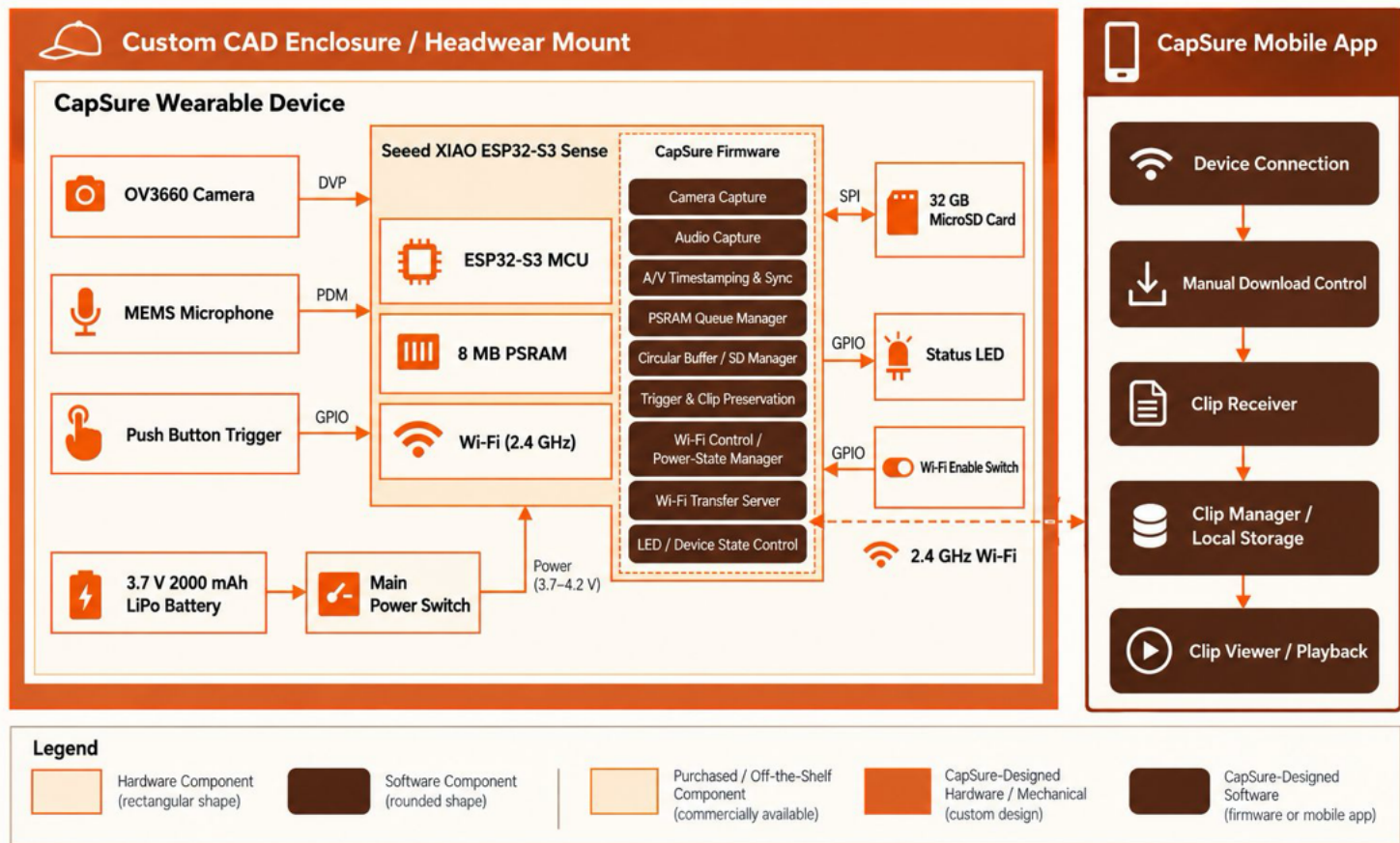
- Electronics integrated onto standard baseball cap
- Custom enclosures for **protection**
- Placement optimized for **comfort, visibility, and weight**

Social, Safety & Welfare

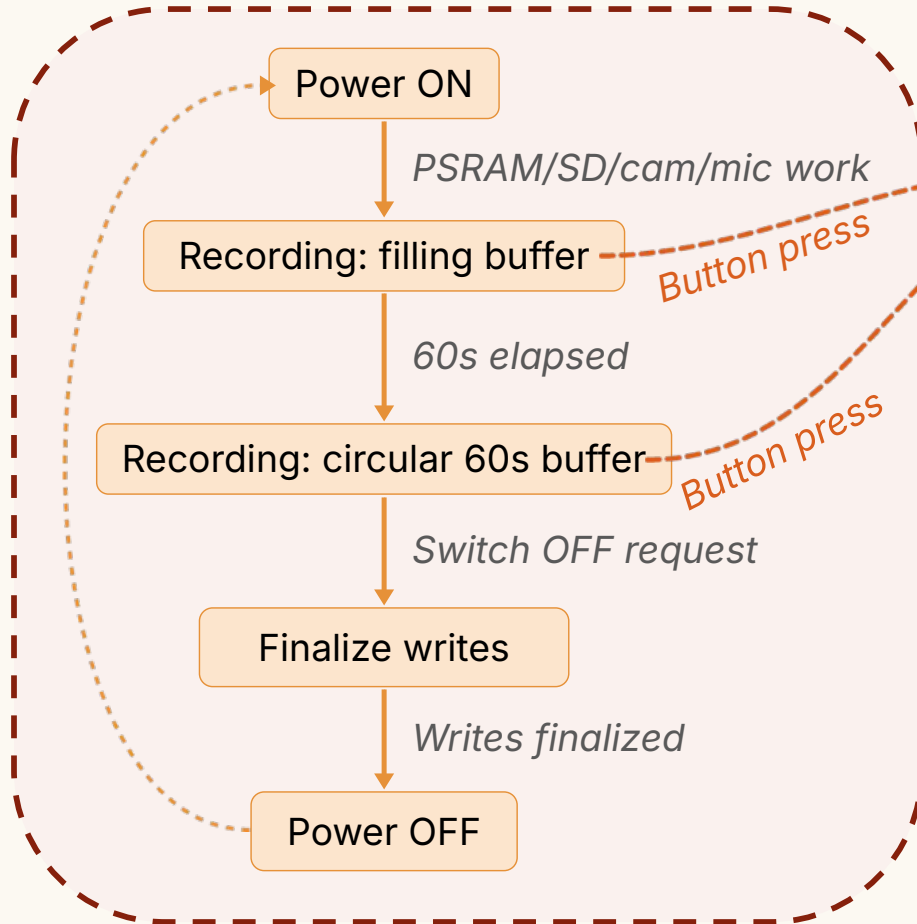
- **Intentionally visible** + LED indicator
- Only last 60s stored
- **Explicit user action** to trigger save
- Local storage + easy footage deletion
- Contact surfaces below 40°C



System Specification / Block Diagram

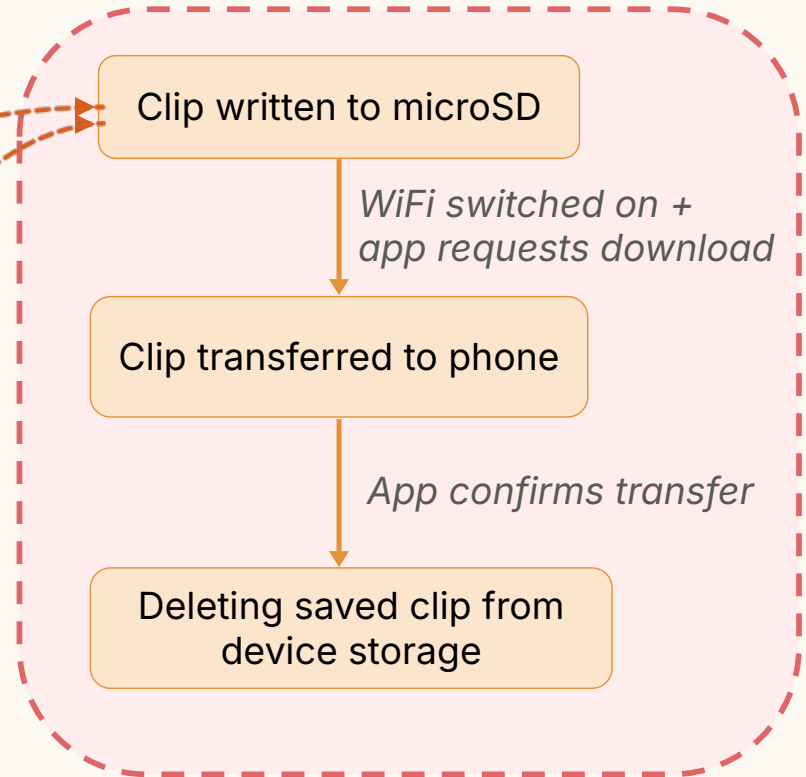


Main Loop



Saving & Transferring Loop:

runs concurrently w/ main loop



Design Choices



ESP32-S3

- **System integration** (camera, mic, WiFi)
- Designed for wearable IoT
- RPi has more compute than necessary



2000mAh
Battery

- $\sim 400\text{mA} \Rightarrow 5 \text{ hrs}$
- **Balances runtime and mass**



MicroSD

- **Write-intensive, continuous recording**
- 32 GB matches ESP docs



2.4 GHz
Wi-Fi

- **Higher throughput** than Bluetooth
- Power on/off extend battery and lower thermal



CapSure
Mobile App

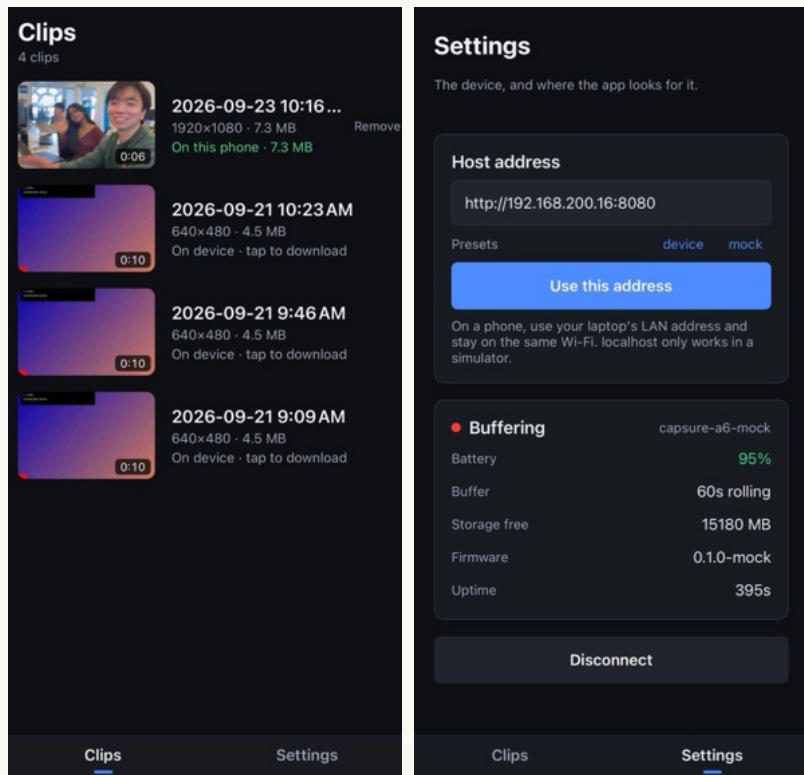
- Avoids removing internal MicroSD
- Enables **file management + clip access**

Testing, Verification, Metrics

Test Area	Test Inputs	Passing Criteria	Risk Factors
Usable & Synced Footage (video & audio)	Person + speech, clapperboard → measure FPS and A/V offset	Sync offset: +45/-125ms 640×480 @ 15 fps	Frame drops or drifts → Refine timestamps & buffering
Reliable Button Presses (buffer + trigger)	100+ randomized presses	> 99% preservation Uncorrupted 60s clips	SD stalls / overwritten footage → Tune queues & segment protection
Wearable User Limits (power + thermal + transfer)	5-hour recording + clip transfer, logging battery & surface temp	5 hour runtime < 60s transfer < 40°C temp	V/I instability, interference, heat → Adjust power, WiFi & enclosure

Current Progress

Software Mockup & Mobile Interface



Wireless Clip Transfer

Wireless transfer of clips across devices to device

Clip Management

View, share and delete clips stored to the phone

Device Status & Telemetry

See status of device including battery and storage

Project Schedule

Hardware, Software, Firmware & Integration Timeline

Week	9/21	9/28	10/5	10/12	10/19	10/26	11/2	11/9	11/16	11/23	11/30
Hardware: Clarence											
Power & electronics											
3D design & CAD											
Thermal & system testing											
Software: Jayden											
App architecture											
Clip transfer & media											
App polish & testing											
Firmware: Ankita											
System setup											
A/V capture & sync											
Buffer management											
Firmware hardening											
Integration: All											
Hardware integration							Clarence & Ankita	Clarence & Ankita	Clarence & Ankita		
App / device integration					Jayden & Ankita	Jayden & Ankita	Jayden & Ankita				
End-to-end testing								All	All	All	
Documentation	All	All	All	All	All	All	All	All	All	All	All
Checkpoint				Camera + basic app			Button -> phone	Suitable Mount		Slack	Demo

Slides Citation: Gemini was used to help improve theme and formatting