



INJURY PREVENTION



FPGA & CV

95% angle
identification
accuracy

1 second latency

**30s post process
per min video**

24 FPS playback

WebApp

10 min initial
calibration

**Users find each
feature \leq 3
seconds**

Setup & Takedown

**System fits in
tote bag**

5 min setup &
takedown

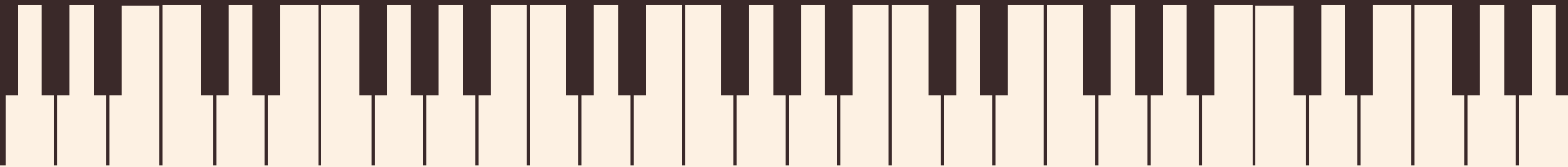
Solution Approach

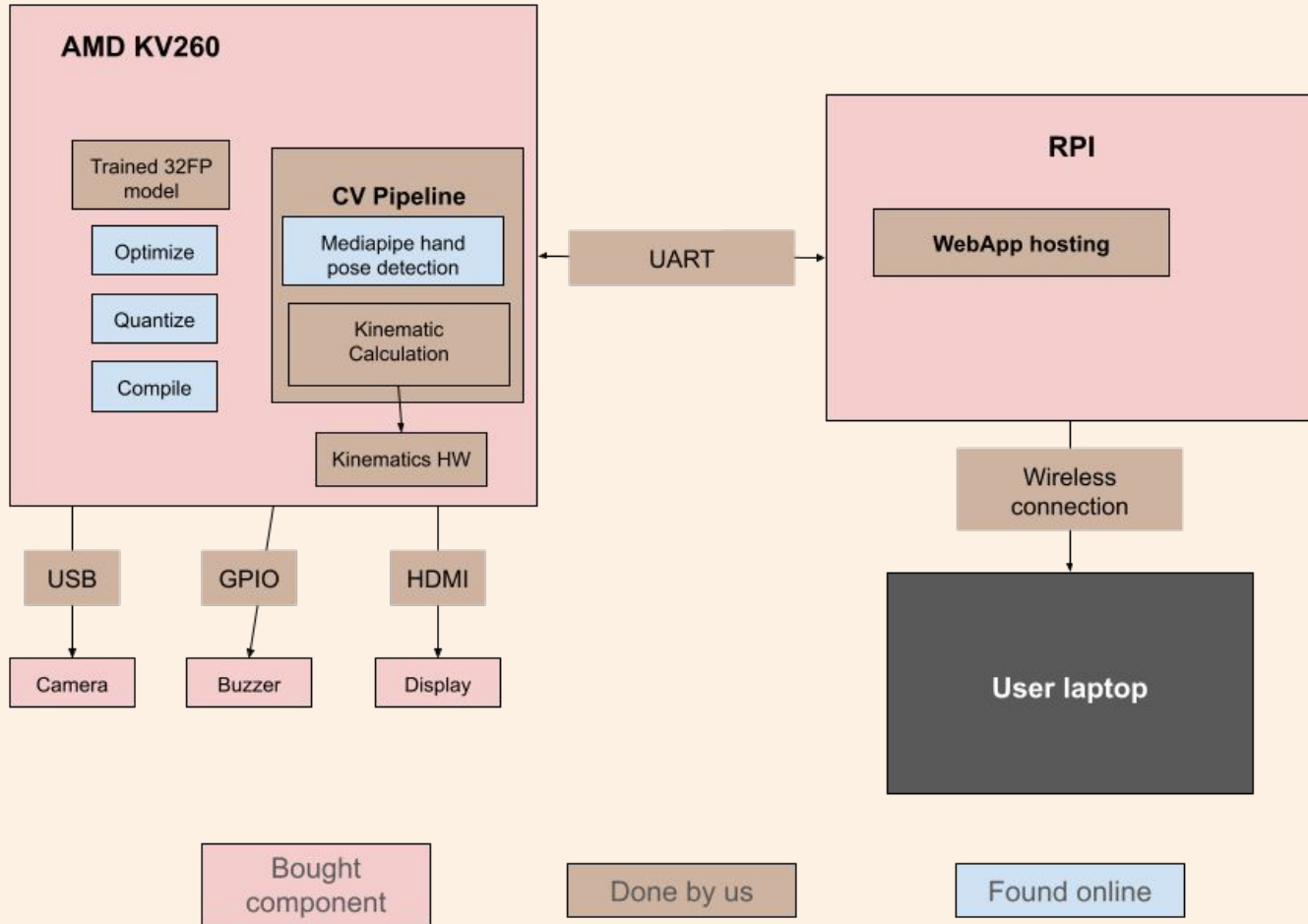


**Track hand posture
while playing**

**Provide live
feedback**

**WebApp to access
post processed
feedback**





Implementation:

Setup

IN POSSESSION:

Logitech C920e / C920
HD Webcam, Full HD
1080p



TO BUY:

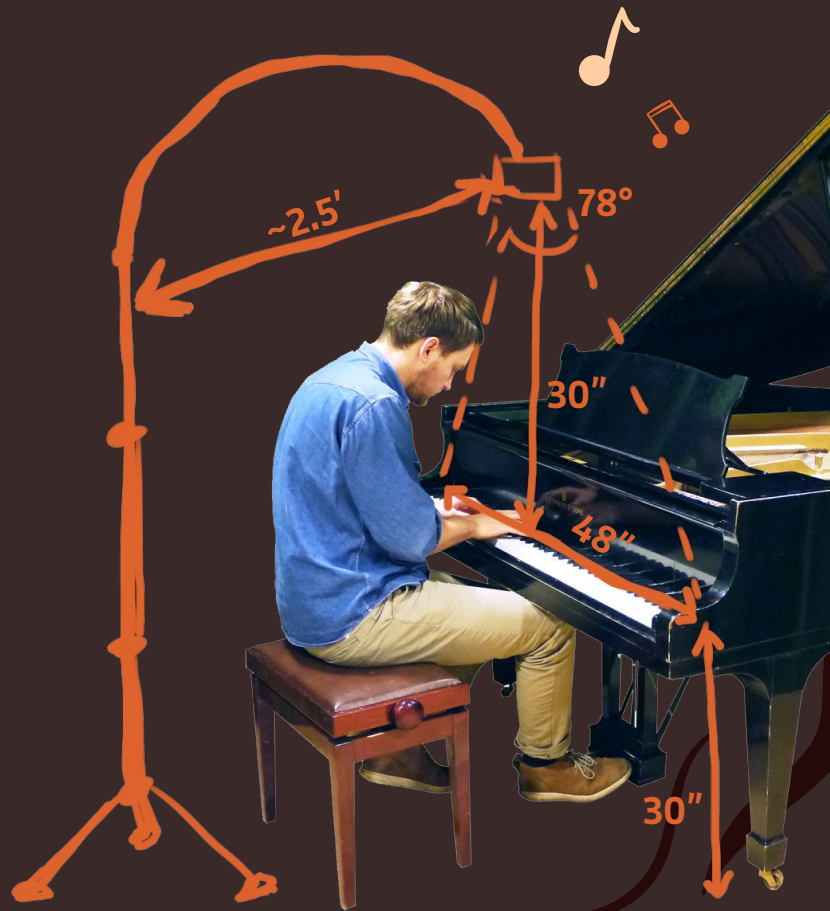
Tripod or mic stand
gooseneck

*

*

TO BUILD:

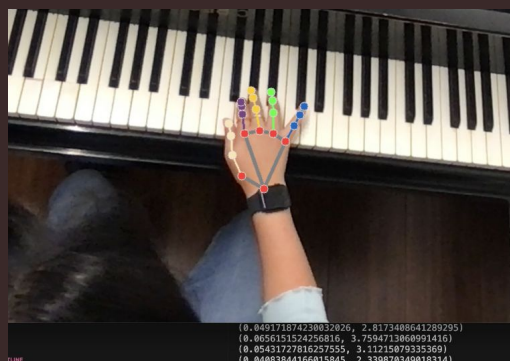
* Webcam holder
laser cut or 3d print



Implementation: CV Workflow & FPGA

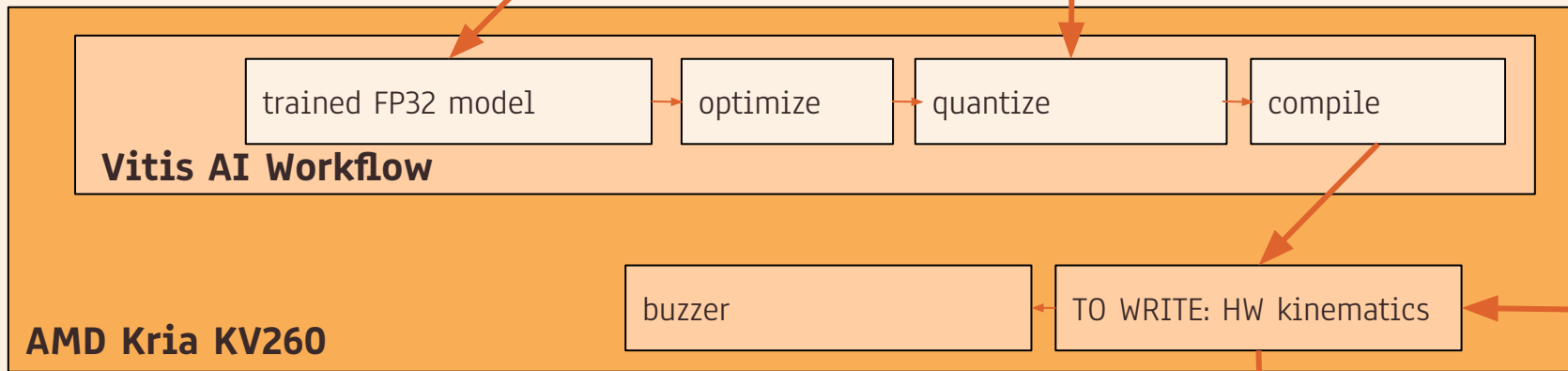
WRITTEN: python
kinematics

USING: existing
MediaPipe Pose
Detection Model



TO WRITE: format
conversion script

TO WRITE: data sample
generation script

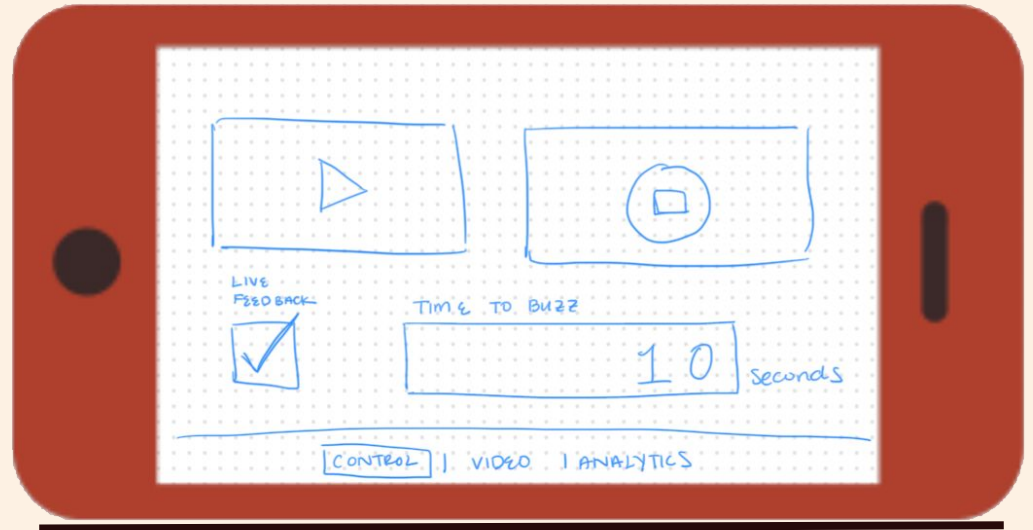


frames
from
Webcam

UART to RPi

Implementation: WebApp

- * Hosted on RPi
- * Communicate with FPGA (UART)
- * Store videos on dedicated hard drive



Testing: Setup



Test new user and experienced users:

- * Set up time
- * Set up + calibration time
- * Take down time

Testing: CV

Select key frames:

- * Compare system angle output to manually measured angles
 - * System angle = measured angle \pm 0.5°
 - * 95% accuracy
- * Position classification match ground truth



Testing: UI

1. Ask users for their initial impressions
2. Give new users a task list
 - a. Click start record button \Rightarrow 3 seconds
 - b. Click stop record button \Rightarrow 3 seconds
 - c. Locate bad playing position in video \Rightarrow 5 seconds
 - d. Find analytics \Rightarrow 3 seconds
3. Ask users for final impression and feedback

Passing test: 75% of users able to complete tasks within the threshold time



Testing: Integrated System



Live feedback:

- * Record buzz times
 - * Compare to marked video section
 - * Confirm live feedback 1 second latency

Risks/ mitigations:

- * Low framerate \Rightarrow untimely feedback
- * Cut buzzer feature



Testing: Integrated System

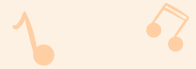


Post-processed video:

- * Framerate timer to confirm requirement
- * Test multiple sessions to check processing time

Risks/ mitigations:

- * Only post processes bad posture
- 



TASK TITLE	TASK OWNER	START DATE	DUE DATE	DURATION	PCT OF TASK COMPLETE	Proposal/ research												Design/ integration												Integration											
						Week of 9/16				Week of 9/23				Week of 9/30				10/7			10/14			10/21			10/28				11/4										
						M	T	W	R	F	M	T	W	R	F	M	T	W	R	F	M	T	W	R	F	M	T	W	R	F	M	T	W	R	F	M	T	W	R	F	
Logistics																																									
Proposal slides	All	9/9/24	9/15/24	6	100%																																				
Proposal presentation	Jessie	9/16/24	9/18/24	2	100%																																				
Design Slides	All	9/23/24	9/29/24	6	100%																																				
Design presentation	Danny	9/30/24	10/2/24	2	50%																																				
Design document	All	10/1/2024	10/11/24	10	25%																																				
Final poster	All	12/8/24	12/15/24	7	0%																																				
Final slides	All	11/25/24	12/1/24	6	0%																																				
Final presentaiton	Shaye	12/1/24	12/4/24	3	0%																																				
Computer Vision																																									
CV pipeline on laptop	Shaye	9/15/24	9/25/24	10	100%																																				
Pipeline porting	Shaye	9/25/24	10/9/24	14	0%																																				
External camera/ tripod integration	Shaye	9/25/24	10/2/24	7	50%																																				
slack time	Shaye	10/2/24	10/9/24	7	0%																																				
FPGA/CV Integration	Shaye/ Jessie	10/9/24	10/30/24	21	0%																																				
FPGA																																									
FPGA/CV Integration	Shaye/ Jessie	10/9/24	10/30/24	21	0%																																				
slack time	Jessie	10/2/24	10/9/24	7	0%																																				
FPGA Setup	Jessie	9/15/24	10/2/24	17	10%																																				
Webapp																																									
Learn webapp basics	Danny	9/15/24	9/25/24	10	25%																																				
Survey for features	Danny	9/15/24	9/25/24	10	100%																																				
Webapp Feature implementation	Danny	9/25/24	10/14/24	19	0%																																				
Webapp feature finalization	Danny	10/14/24	10/30/24	16	0%																																				
Final integration																																									
Full system integratoin	ALL	10/30/24	11/18/24	18	0%																																				
Slack time	ALL	11/18/24	11/25/24	7	0%																																				
Verification & testing	ALL	11/25/24	12/15/24	20	0%																																				

[link to chart](#)