Carnegie Mellon

POKERCAM

Electrical & Computer ENGINEERING

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Product Pitch

Currently, professional card game analysis is not automated. Instead of having to tag cards in advance or rely on human labor to manually review game footage, our product images cards as they are dealt through a self-contained automated cardshoe, classifies the cards, and automatically updates a web app with the game state. This allows spectators, commentators, and stakeholders to observe the game state in real-time without the overhead of current solutions.

Our most critical requirements were achieving at least 98% classification accuracy and less than 2 seconds in latency between the card trigger and web app update. We achieved 97.87% test accuracy and 0.17 second average latency. With these metrics, *PokerCam* effectively updates the game state with a high accuracy.

System Architecture
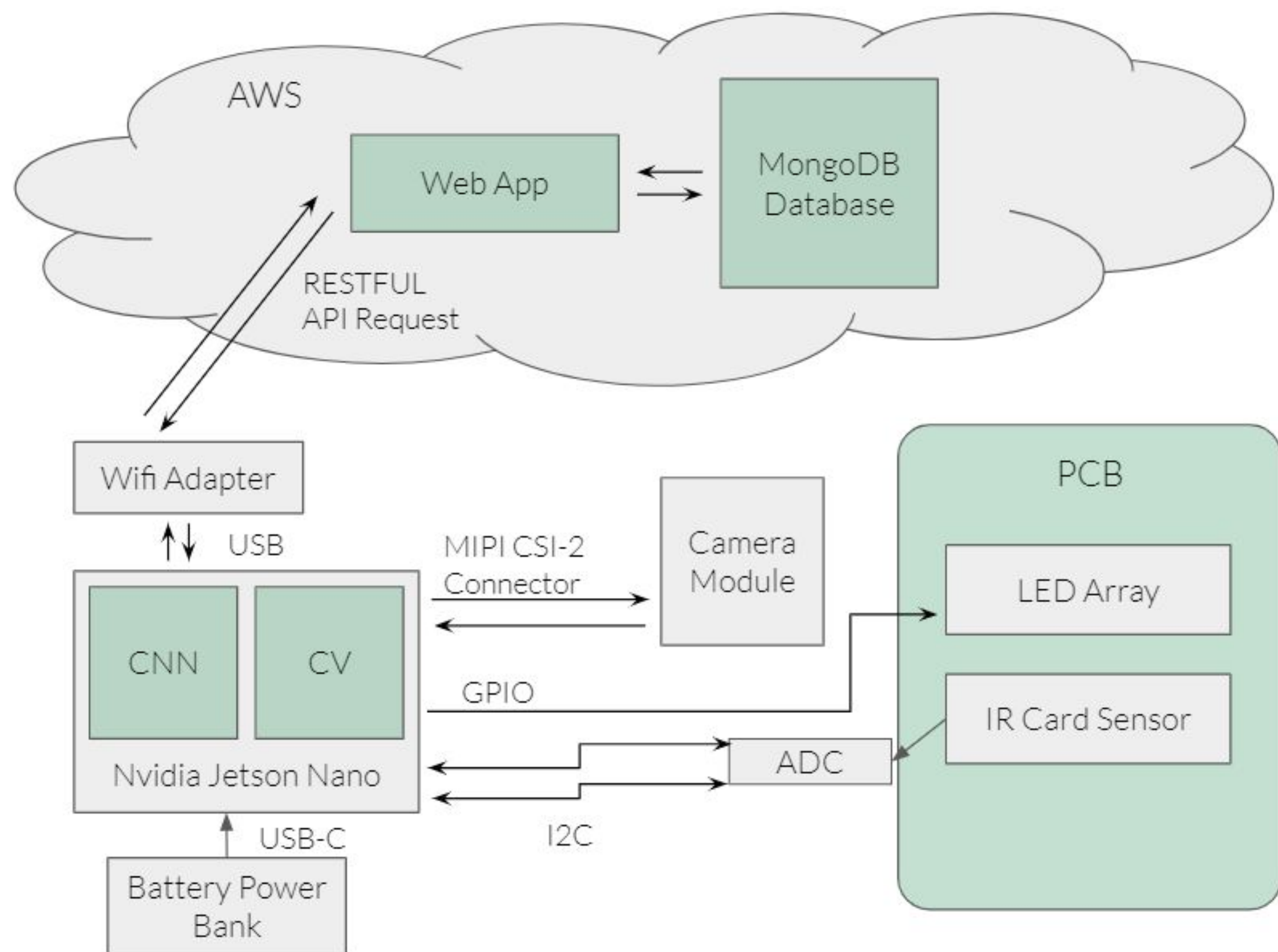
System Description

The Nvidia Jetson Nano controls the camera system, performs image processing, and sends the results to the web app. The Jetson Nano is battery-powered and can last hours without having to recharge. It connects wirelessly to the internet, so it requires no extra cables on the casino table.

PokerCam employs infrared reflectometry to accurately identify when cards are being dealt. LEDs below illuminate the face of the card and ensure quality images are captured. This then triggers our camera system, which takes a picture of the card as it slides out of the shoe.

Once *PokerCam* images a card, it runs the image through a convolutional neural network to classify the card's rank and suit. The Jetson Nano wirelessly sends this classification result to the web app, which immediately updates the game state for the viewers. *PokerCam* performs this entire process in less than a fifth of a second to provide viewers with up-to-date game state.

Finished product with laser cut enclosure

Custom PCB
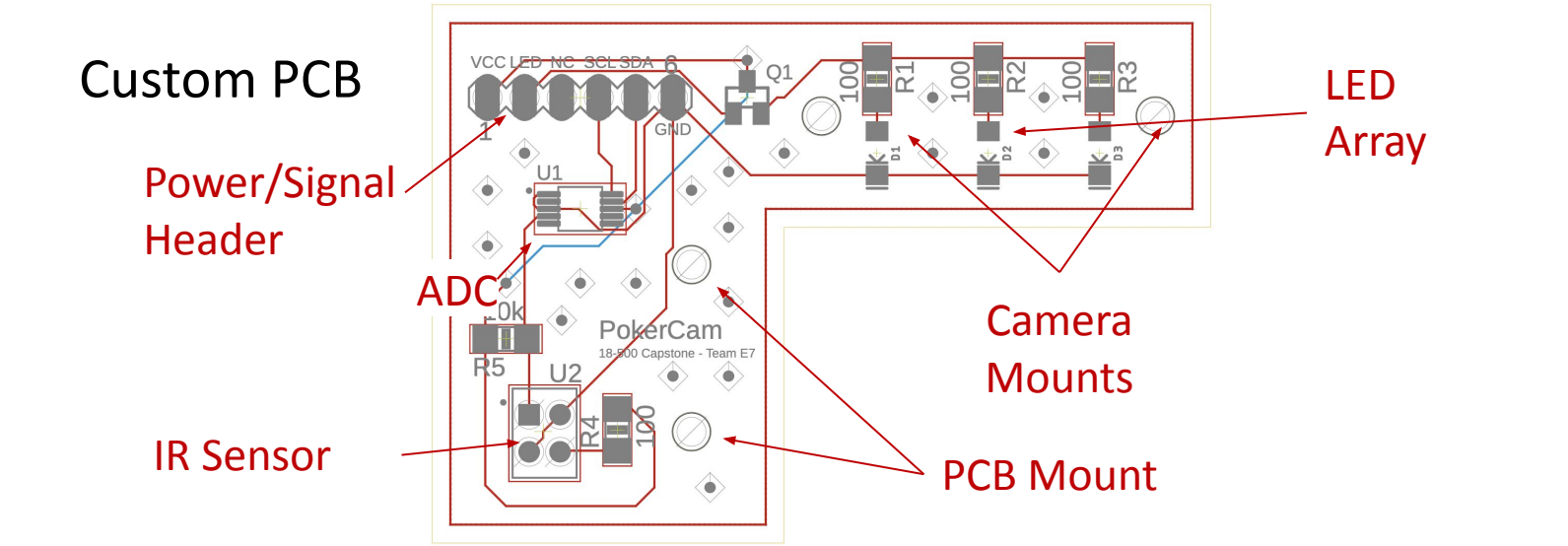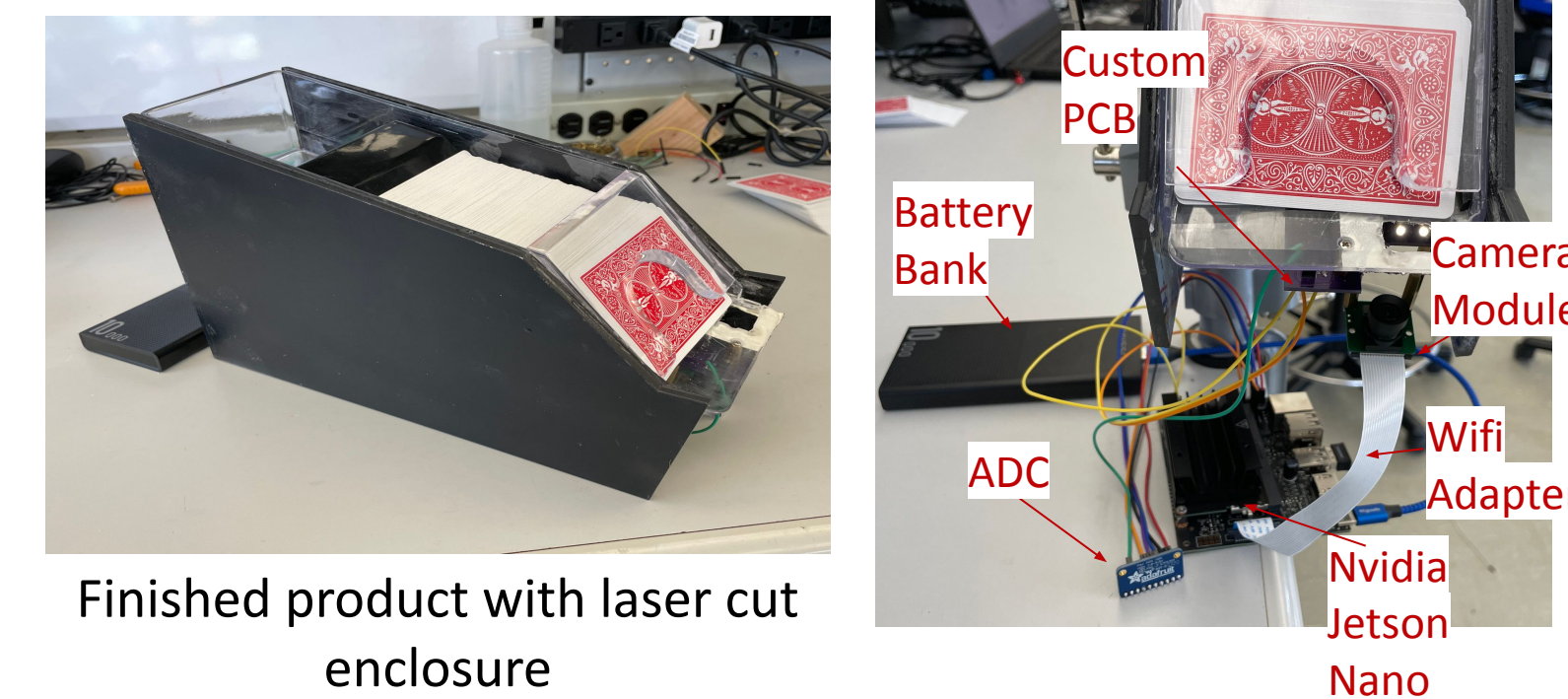
System Evaluation

We evaluated *PokerCam's* image classifier on a fixed test dataset of 987 captures taken over multiple days. The convolutional neural network classified both the rank and suit correctly with 97.87% test accuracy.

We continuously dealt 432 playing cards (8 decks) from unopened Bicycle Standard Card decks to measure classification latency and false triggers. We flipped the ceiling lights on and off to simulate the varying casino lighting this product will operate in. *PokerCam* achieved an average latency of 0.17 seconds with zero false triggers over the 432 card swipes. Furthermore, *PokerCam* is robust to accidental hand gestures above the trigger and did not produce any false triggers.

PokerCam's battery lasts at least 3 hours dealing 10 decks, enough power to last multiple games.

Requirements	Desired Results	Actual Results
Classification Accuracy	≥ 98%	Test Accuracy: **97.87%**
Classification Latency	≤ 2s for web app to update	Average: **0.17s** Maximum: **0.19s**
Battery Life	≥ 2 hours	**≥ 3 hours** (dealing 10 decks)
Continuous Classification Latency	Classify entire card deck in ≤104 seconds	Classified entire card deck in **54 seconds**
False Triggers	0 False Triggers	**0 False Triggers**