Junior Jay

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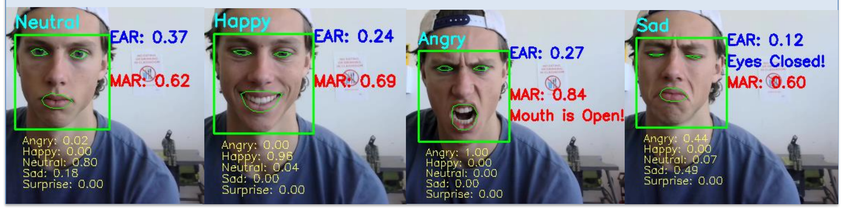
Project Goal

Develop a Jayhawk mascot animatronic with dynamic facial expressions for better live audience interaction, controlled by the wearer's facial movements.

Facial Detection Software

- Python script captures video frames, detects faces, predicts facial expression, and sends signal to adjust servo angles to mimic detected expression.
- Custom machine learning model trained on the FER 2013 dataset for emotion recognition. Eye/mouth aspect ratio calculated to determine if open/closed.
- Difficulties detecting face in dark, close-up environment inside the head—even with low light, wide angle camera.



Electrical System

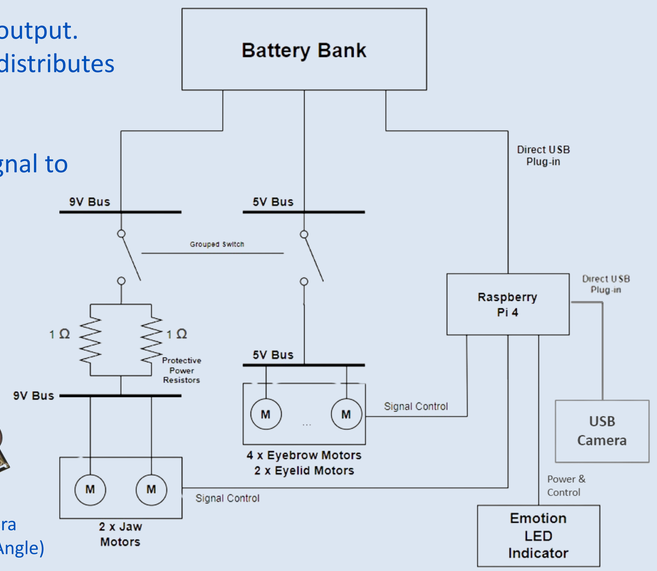
- 50,000mAh battery pack chosen for 2hr. lifetime, 5-20V output.
- HUSB238 draws 5V, 9V from battery, custom power bus distributes 9V power to two beak servos, 5V to other six servos.
- Power resistors protect system by limiting current flow.
- Raspberry Pi runs facial detection software and sends signal to servos over GPIO pins.
- Optional LED panel installed in head indicates detected emotion to wearer.

Raspberry Pi 4

HUSB238 Power Delivery Breakout

Custom 5V/9V Power Bus w/ Power Resistors

Arducam USB Camera (Low Light, 160° Wide Angle)



Mechanical Mechanisms

Beak:

- Goal: Open/close to simulate smile, shock.
- Two high-torque servo motors running on 9V move lightweight Al frame fixed to beak.
- Servo choice driven by requirement to counter beak weight of 1.5 lbs. with center of gravity centered 9 in. away (13.5 lbs·in).

Eyebrows:

- Goal: Rotate to display nuanced emotions.
- 3-bar linkage consisting of fixed arm, slider arm, and eyebrow, uses servo rotation to pivot eyebrow.
- Servos mounted neatly on eyelid frame inside head, with shafts protruding through forehead that spin links.

Eyelids:

- Goal: Open/close to simulate blinking.
- Custom thermoformed plastic coated with one-way mirror film ensures internal components cannot be seen from outside.
- Belt-driven mechanism spins stitched-on fabric (eyelid) by continuous rotation servo.
- Fabric spools at top so wearer's vision is not obscured when in open position.
- Limit switches tripped by belt send signal to shut off servo when eyelid is fully open/closed.

Special thanks to KU Athletics for making this project possible by donating a retired Baby Jay head.