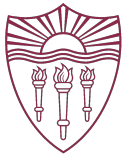


SortSmart

At-Home Trash Sorting System

Emily London, Russell Tan, Sam Guzik

USC Viterbi
School of Engineering

Purpose

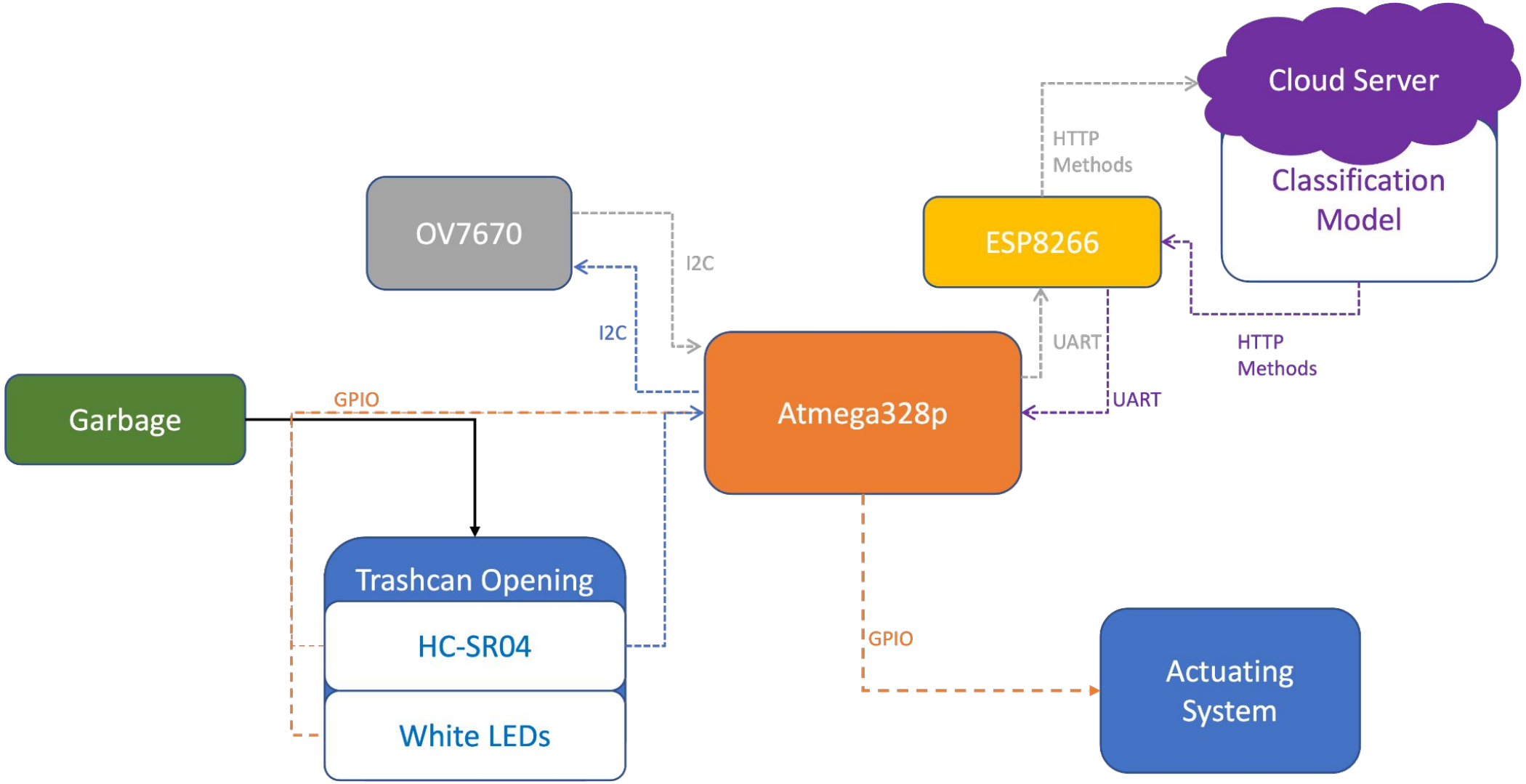
User Problem:

- Disposal guidelines for commercial use can be confusing
- Easy to forget in the home during daily activity
- More than 50% of all waste ends up in landfills

Our Solution:

- Automatically sorts garbage to correct category
- Requires little intervention from the user
- Integrates seamlessly into preexisting user habits
- Dramatically reduces the amount of landfill waste

High Level System



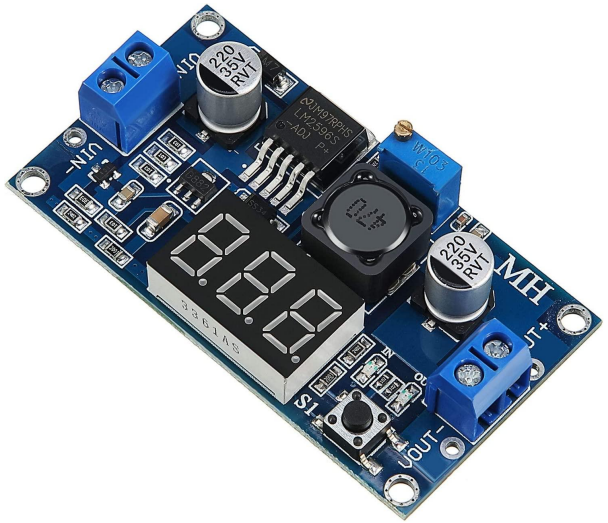
Hardware Breakdown

Object Detection System

- Ultrasonic Distance Ranger (HC-SRO4)
  - Used to identify when trash has been inserted
  - Uses GPIO to connect with Atmega328p
  - Measures distance from objects placed in range
- OV7670 Camera
  - Captures 640x460 8-bit images
  - Sends data to Atmega328p via I2C
- ESP8266 WiFi Module
  - Communicates with Atmega via UART
  - Provides WiFi capabilities to Atmega
  - Sends image data to cloud server and model

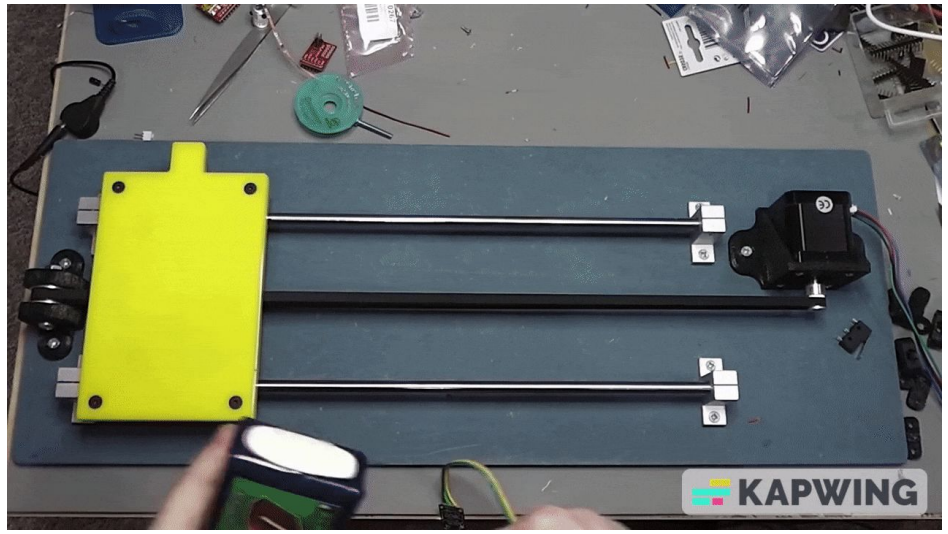
Power Supply

- Universal 45W 5-15V Power Adapter
  - Stationary system
  - Can be installed near home outlets
  - Power supply is adjustable
  - Utilize a buck converter to step down voltage



Mechanical Actuation System

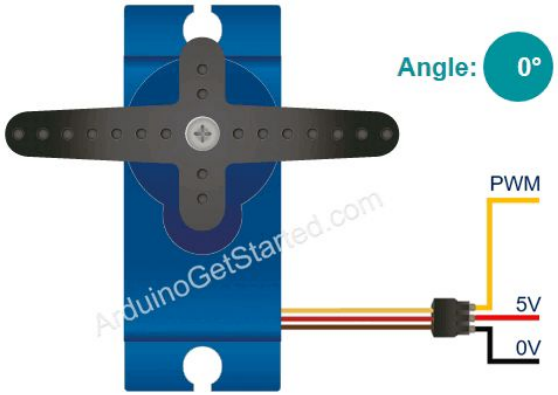
- Not a MechE capstone project…
- Our idea is to use a simple rail system built into the back end of the cabinet that we can use to guide the linear motion of the motor
- The motor will be a nema 17 stepper motor, controlled by an A4988 motor controller

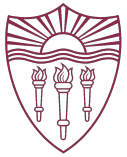


Trash Deposition System

- Attached to the linear moving yellow plastic in the previous slide will be a tray that holds the object that the user deposited

- Once this tray is over the correct bin, a servo will tilt it downward so the object falls off into the desired bin



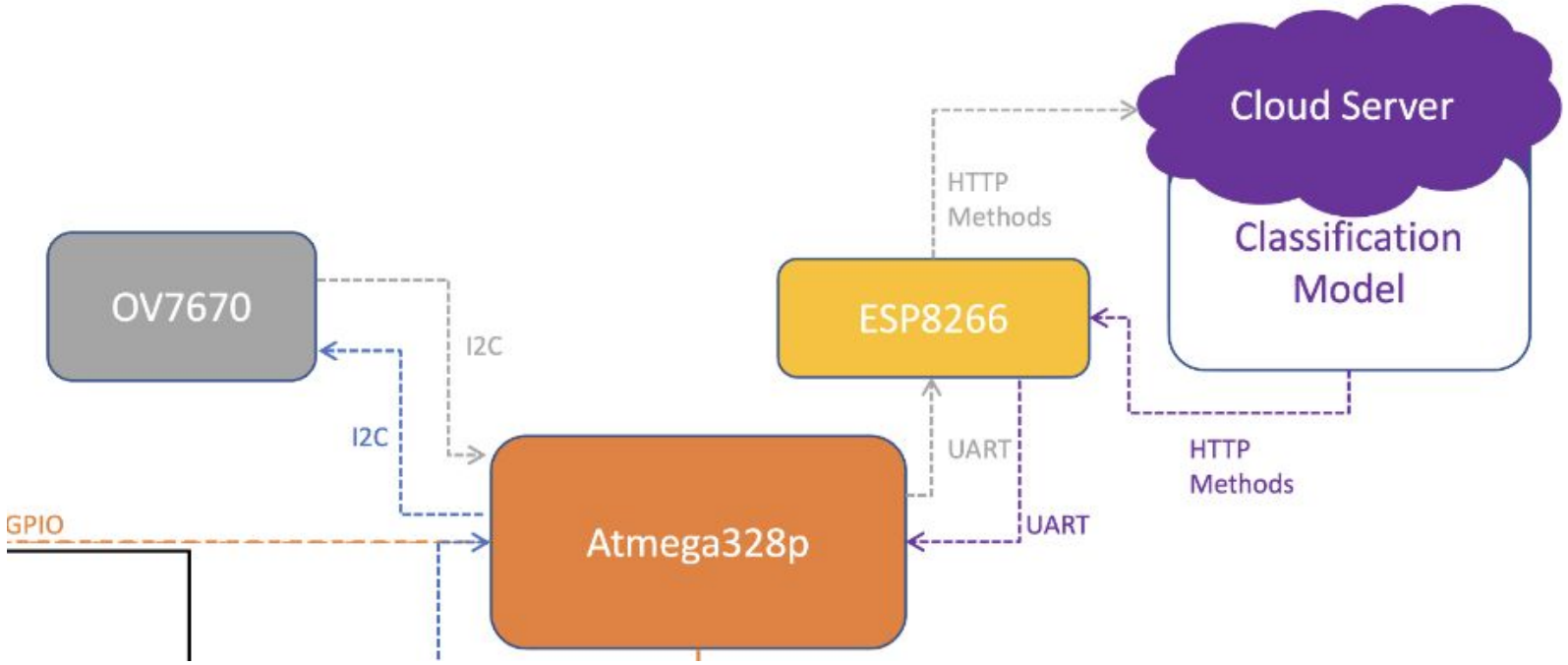


Software Breakdown

Object Classification System

OV7670 (Camera) -> Atmega328p (processor)-> ESP8266 (Wifi Module)

- Camera will take a photo and will convert it into bits (base64 encoding)
- We will use various communication protocols such as I2C, UART, and HTTP (via REST API) to communicate photo information between hardware devices and the server.



Object Classification System

Google Cloud Hugging Face

Garbage classification API

- We can communicate with server API's with garbage classification. Examples:
  - Hugging face -> example on the left
    - Has an interface API for certain models in their marketplace "spaces"
  - Google's Cloud vision API

Future goal

- Use our own convolutional neural network for garbage classification

The prediction class is:

plastic

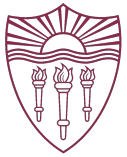
Credits to: Spaces: yangy50/garbage-image-classification

Manual Override Mode

- An additional feature we plan to add if we have time is the “Manual Override Mode”
- If the user is already certain of the correct bin that the object should be placed in, they can turn on manual override mode which will bypass the automated system and allow the user to directly select what bin the object should be deposited into
- At the front of the SortSmart there will be a switch and 3 push buttons:
  - Override switch will toggle “Manual Override Mode” on and off
  - Button 1 will move the tray to “Trash”
  - Button 2 will move the tray to “Recycle”
  - Button 3 will move the tray to “Compost”

Estimated Costs

Part Name	Link	Description	Price
Cabinet	FB Marketplace	Cabinet to house bins and electronics	$2
600 mm Linear rail w/ Ball Bearing	Amazon	Linear rails to move the plate to the correct corresponding trash can	$37
Nema 17 Stepper Motor	Amazon	Motor required to do linear motion of tray	$12
A4988 Motor Controller	Amazon	Used to control the stepper motor	$10
OV7670	Amazon	Camera module	$9
HC-SR04	N/A	typical UDR	
VCNL4010	N/A	small range proximity sensor	
ESP8266	Amazon	wifi module	$9
BIQU-3D0142	Amazon	end stops/limit switches	$9
		TOTAL:	$88



Thank you!

Questions?