

# DEVELOPING A NOTIFICATION SYSTEM FOR AN ELECTRIC KETTLE

CEE 5440 - S2021 PROJECT PRESENTATION

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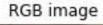


### MOTIVATION

- Kettle does not turn off after reaching desired temperature
- How can we add "Smart" features to it?

# (COLOR) LIGHT DETECTION

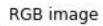




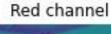


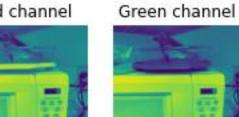
#### RGB image



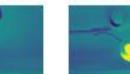




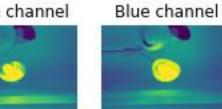


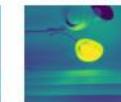


### Red channel



### Green channel





Blue channel

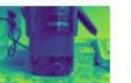
## **RGB IMAGES**

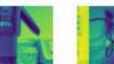
- **Red-Green-Blue** representation mixes color with light
- How can I distinguish a red object from a red light?

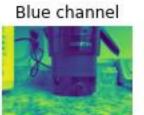
02 DETECTION

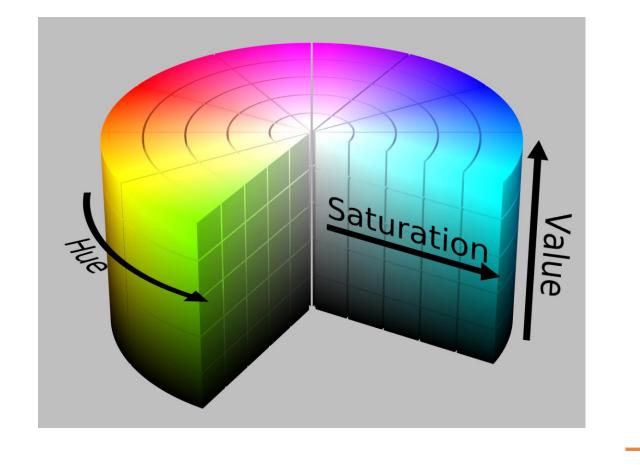


### Green channel



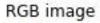






### HSV TRANSFORMATION

- How humans
  "interpret" color
  and brightness
- Distinguish
  between Hue
  (color), Saturation
  and Value (light)



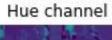


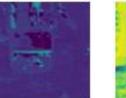
### RGB image



### RGB image







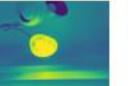
#### Hue channel

Hue channel

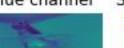


### Value channel

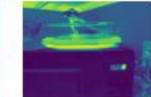
Value channel







#### Saturation channel Value channel



Saturation channel

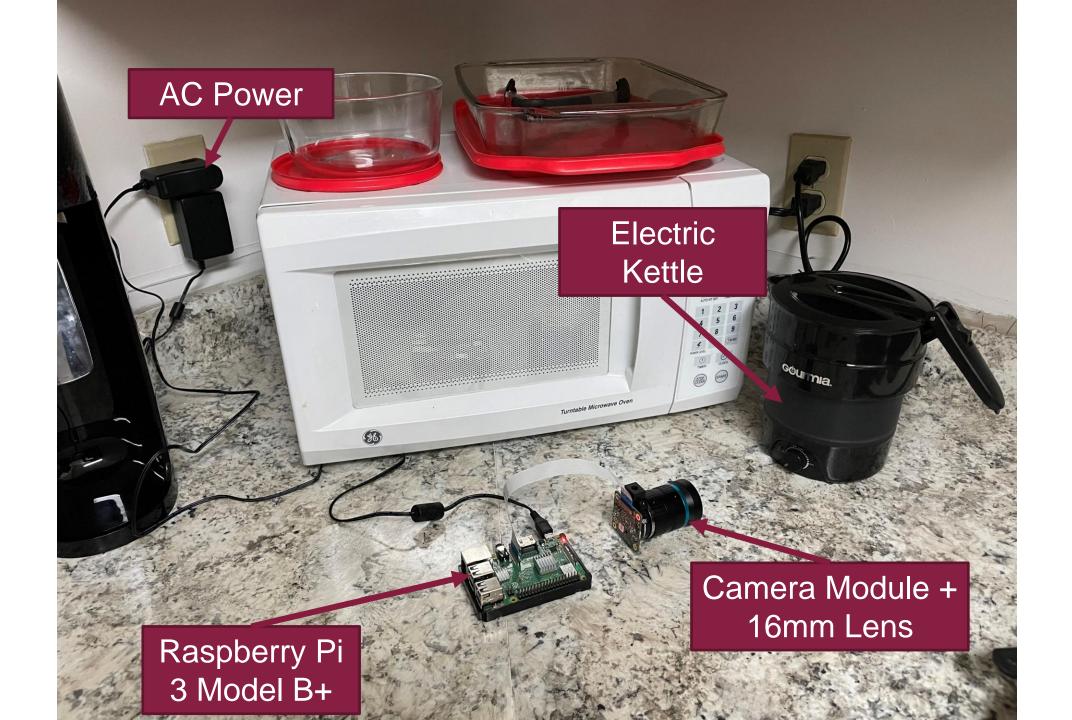
Saturation channel

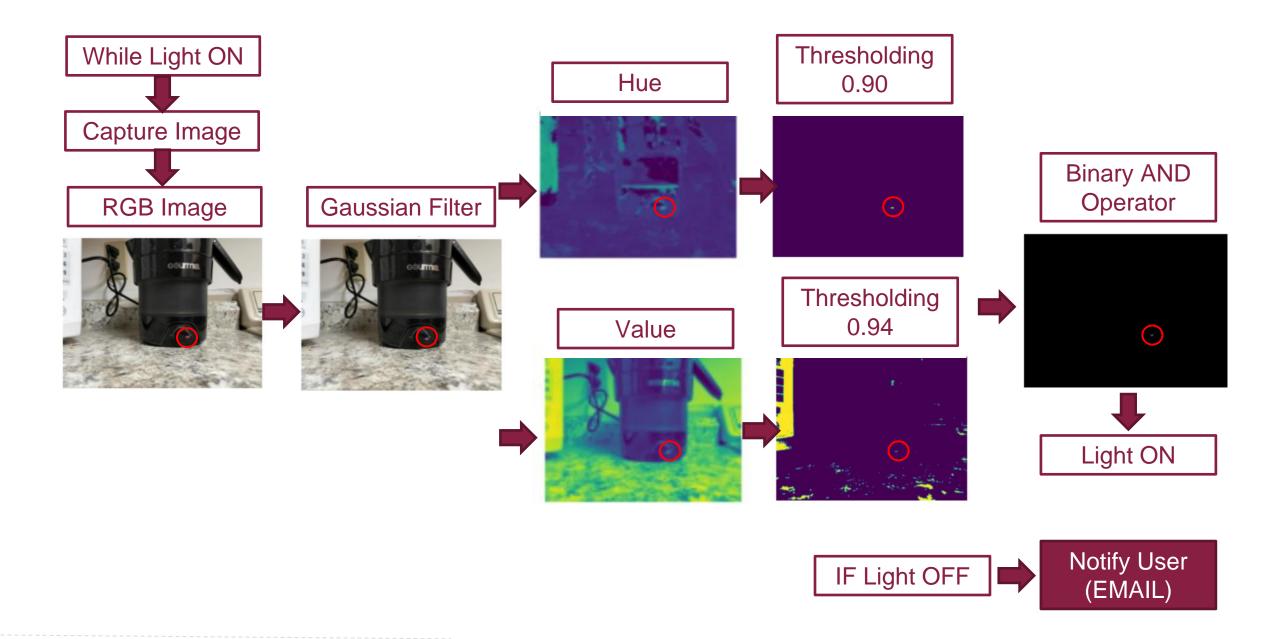
## **HSV TRANSFORMATION**

- How humans "interpret" color and brightness
- Distinguish between Hue (color), Saturation and Value (light)

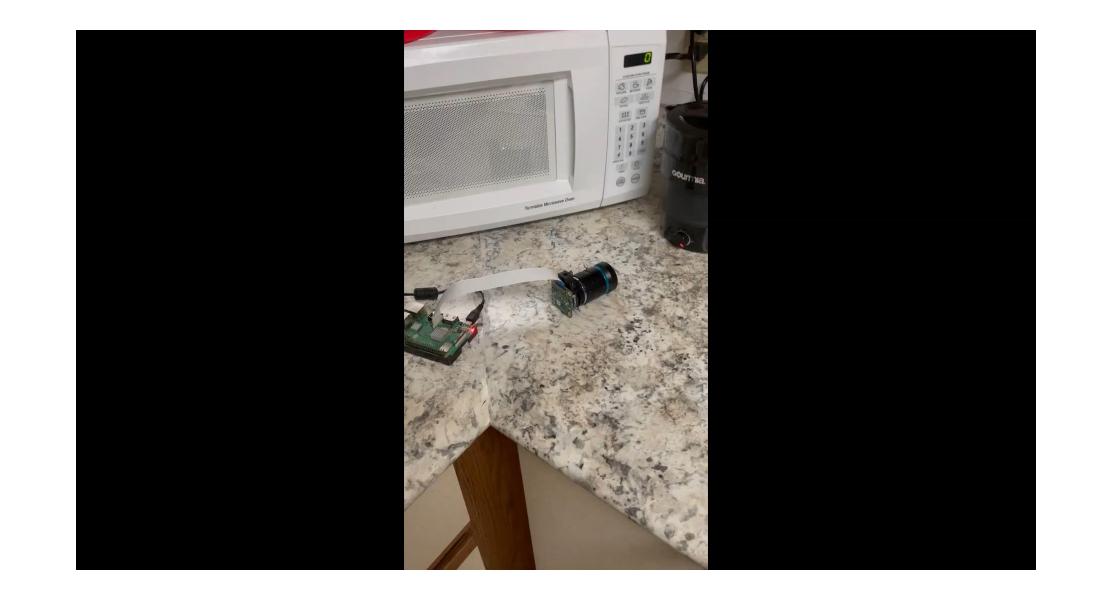
# TEST SETUP + ALGORITHM







### VIRGINIA TECH...



### VIRGINIA TECH.

	Boiling Water? You've got it! > Inbox ×	\$	•
	berteroraspi@gmail.com Your kettle's done! Here are the receipts	C 1:53 PM (4 hours ago)	☆
3	<b>berteroraspi@gmail.com</b> Your kettle's done! Here are the receipts	2:19 PM (3 hours ago)	\$
•	berteroraspi@gmail.com to me ▼ ····	) 2:28 PM (3 hours ago) 📩 🕤	:
	and and a second s		

🖌 Reply

→ Forward

### NOTES

- Up to 10s delay (5s wait time for focus + processing time + emailing)
- 100% success rate (so far) under different lighting conditions in the kitchen

## FINAL THOUGHTS

- Avoid idle time for faster
  response time: Camera and
  processing in parallel; Don't
  refocus each time
- Highly flexible method can be adapted to other problems (e.g.: traffic lights in self-driving car)
  - Any ideas for your own use?