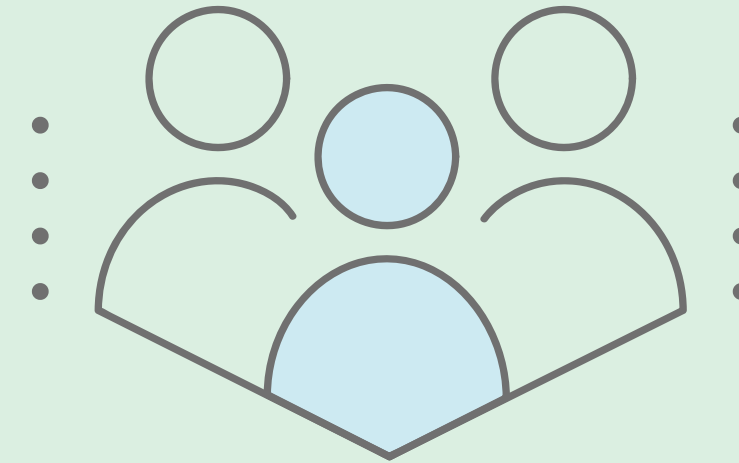# Development of A.S.O (Automatic Smoke Observer), a Micro-Computer (Raspberry Pi) – Operated Early Fire Detection Surveillance Device

A.A.B. Acasio. P.L.S. Gealon, K.Z. Rollo, R.S. Ybanez

INTRODUCTION

Cause over 75 percent
of all deaths from fires and
burns

Lack smoke and fire detection
system

64,100 annual average
of wildfires in the past
10 years

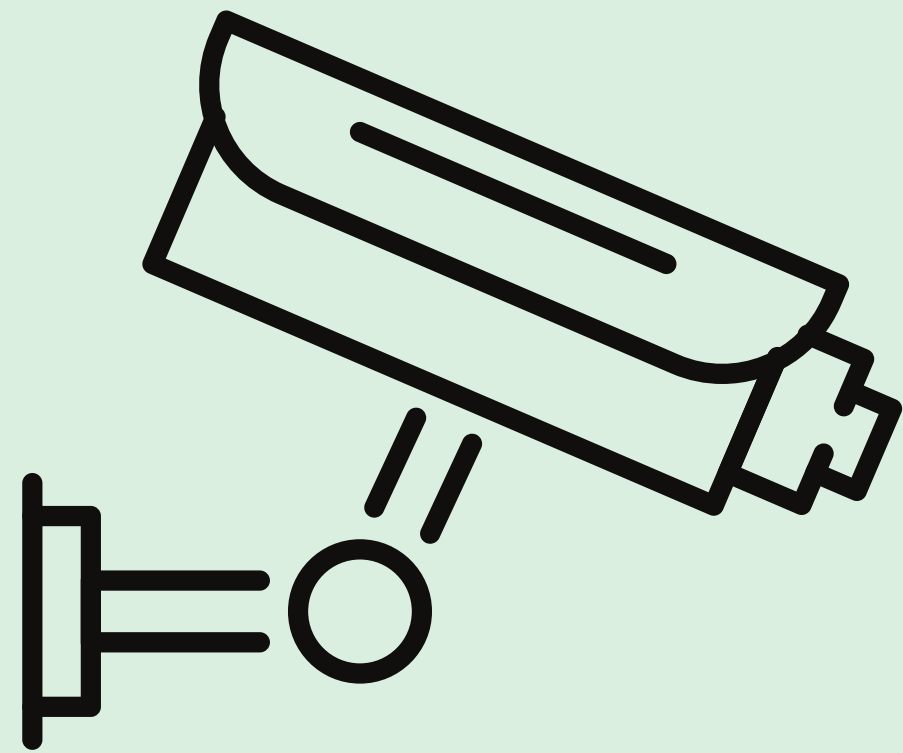Not connected to
fire stations

OBJECTIVES

Main:

Aims to make a device that alerts the community and nearby officials immediately upon detecting fire.

Specific:

- Calibrate the sensors of the device
- Notify the fire station immediately upon detection of flame and smoke through a text message

SIGNIFICANCE

The device can be useful in addressing the problem by actively surveying the surrounding area especially in remote locations for any fire or smoke instances and alerting the community and the Fire Department immediately upon confirmed detection

METHODOLOGY

Device Prototyping

- Product Designing

Rendered image of 3D model

Device Training and Calibrations

- AI Trained using YOLO framework and Google Colaboratory

Device Testing

- AI was tested for its predictions on 100 images of smoke and fire

App Development
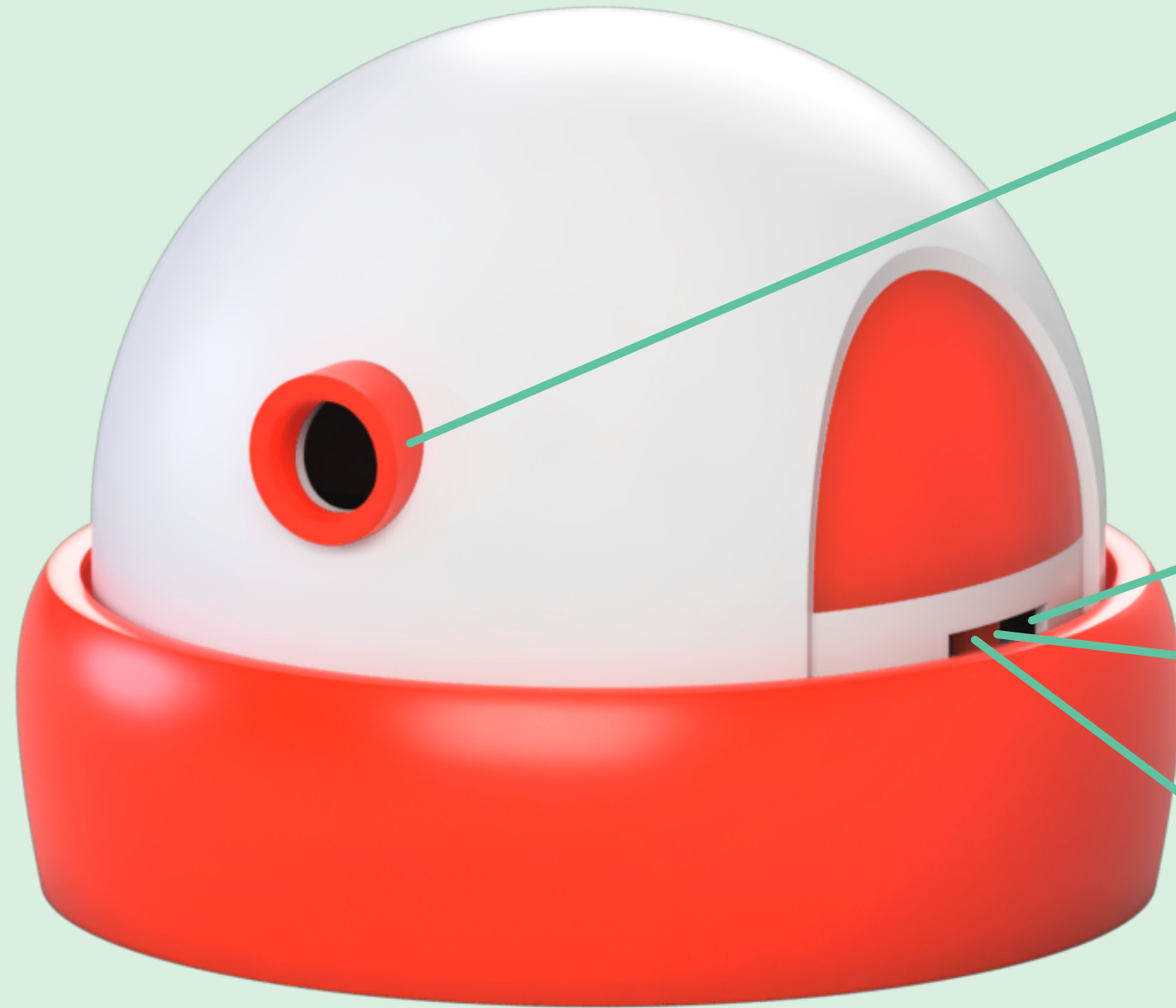
- App developed using Android Studio IDE

Data Analysis

- Performance metrics on test set was analyzed
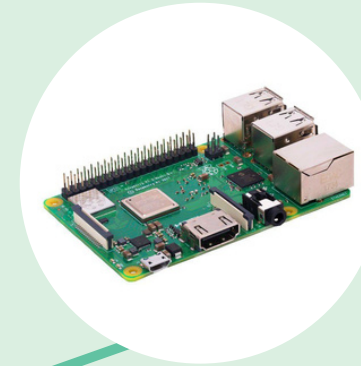- User Satisfaction Survey

Marketability Test
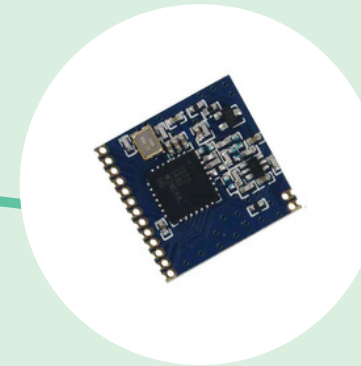
- User Satisfaction survey
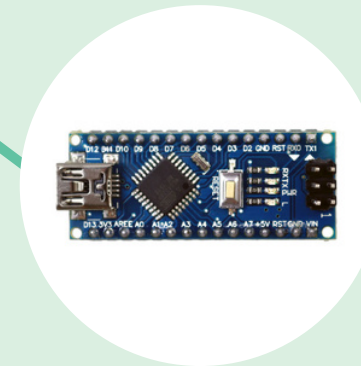
Device Components

Raspberry Pi Camera
Used for the input images

Raspberry Pi
Used as the computing power for the machine learning model

LoRa Sx-1272
Used to transmit data over long distances

Arduino Nano
Used to operate the LoRa module

Results and Discussion

What is Precision?

Of all those that the model detected as fire/smoke, which among them is actually fire/smoke?

What is Recall?

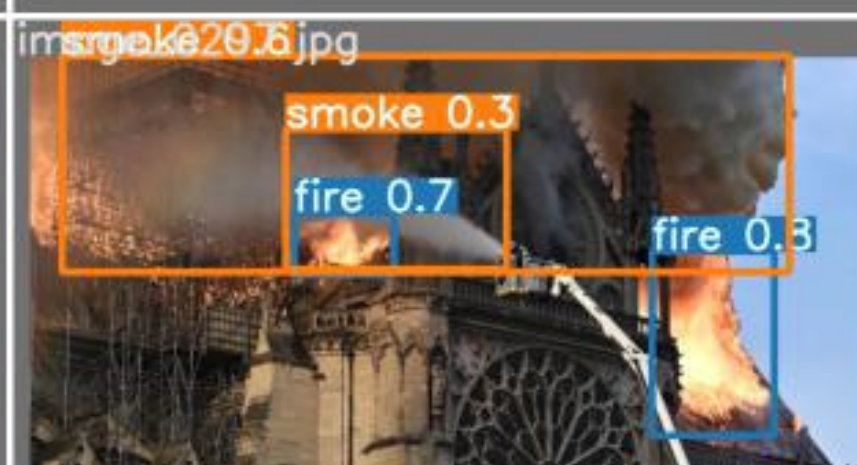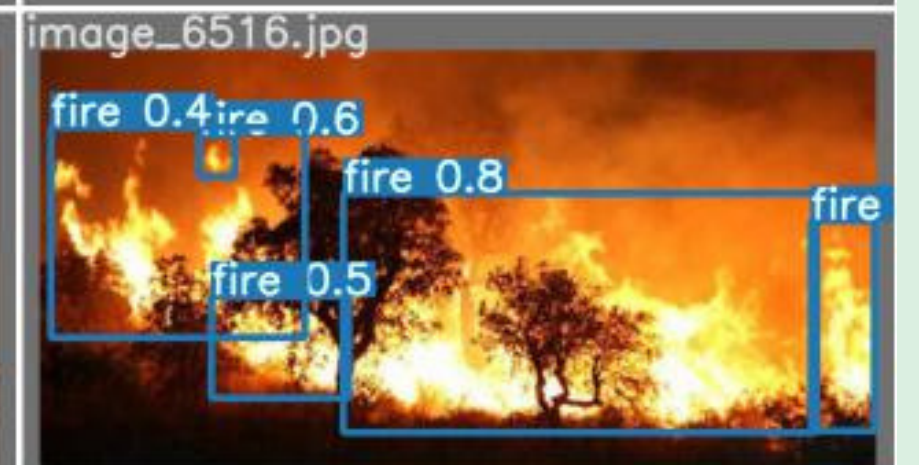**Of all those that are actually fire/smoke which among them did the model detect?**

Results and Discussion

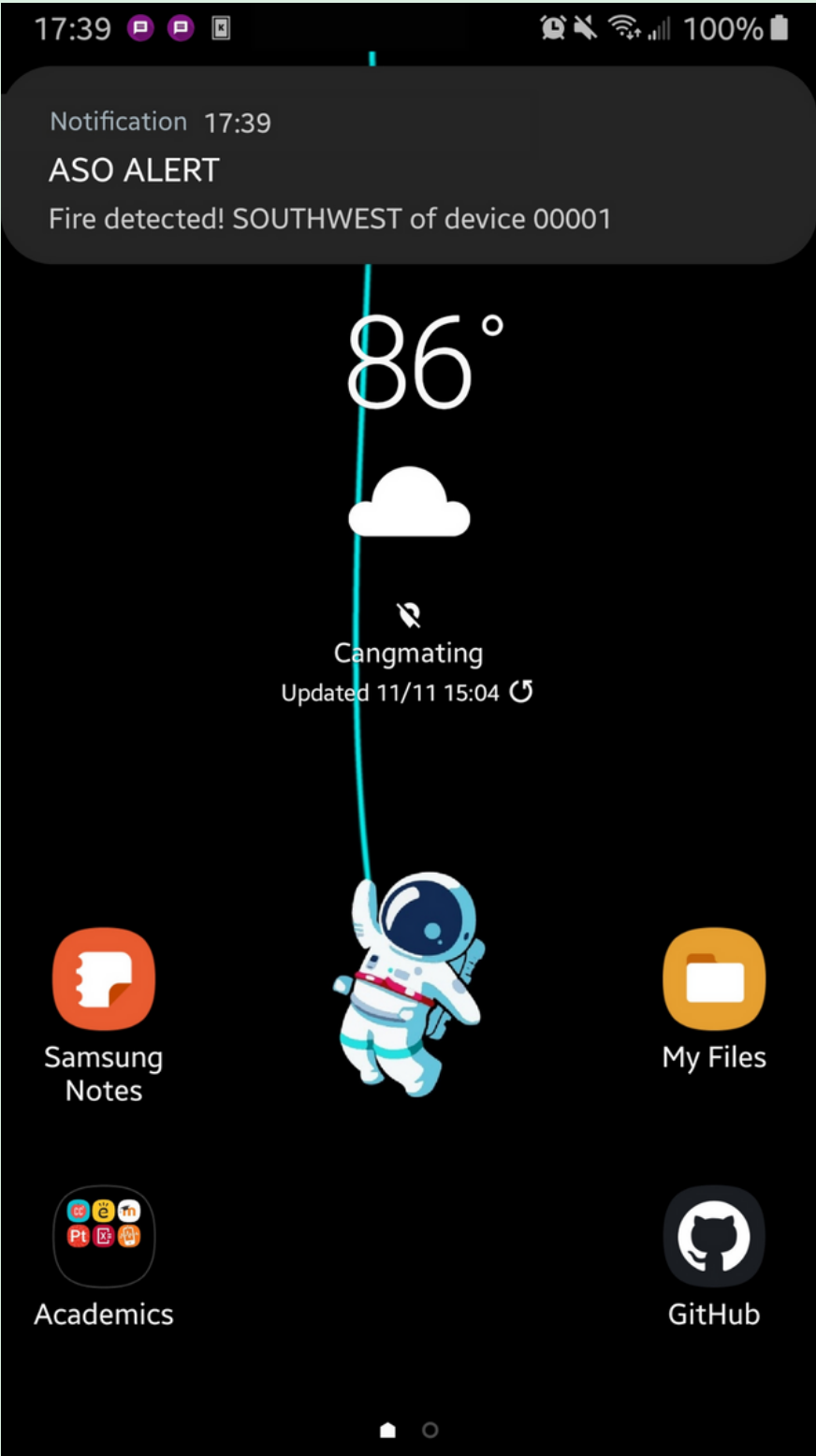| PERFORMANCE ON TEST SET	
Sample Size: 500	
Precision	91.25%
Recall	89.22%
F1 Score	90.22%

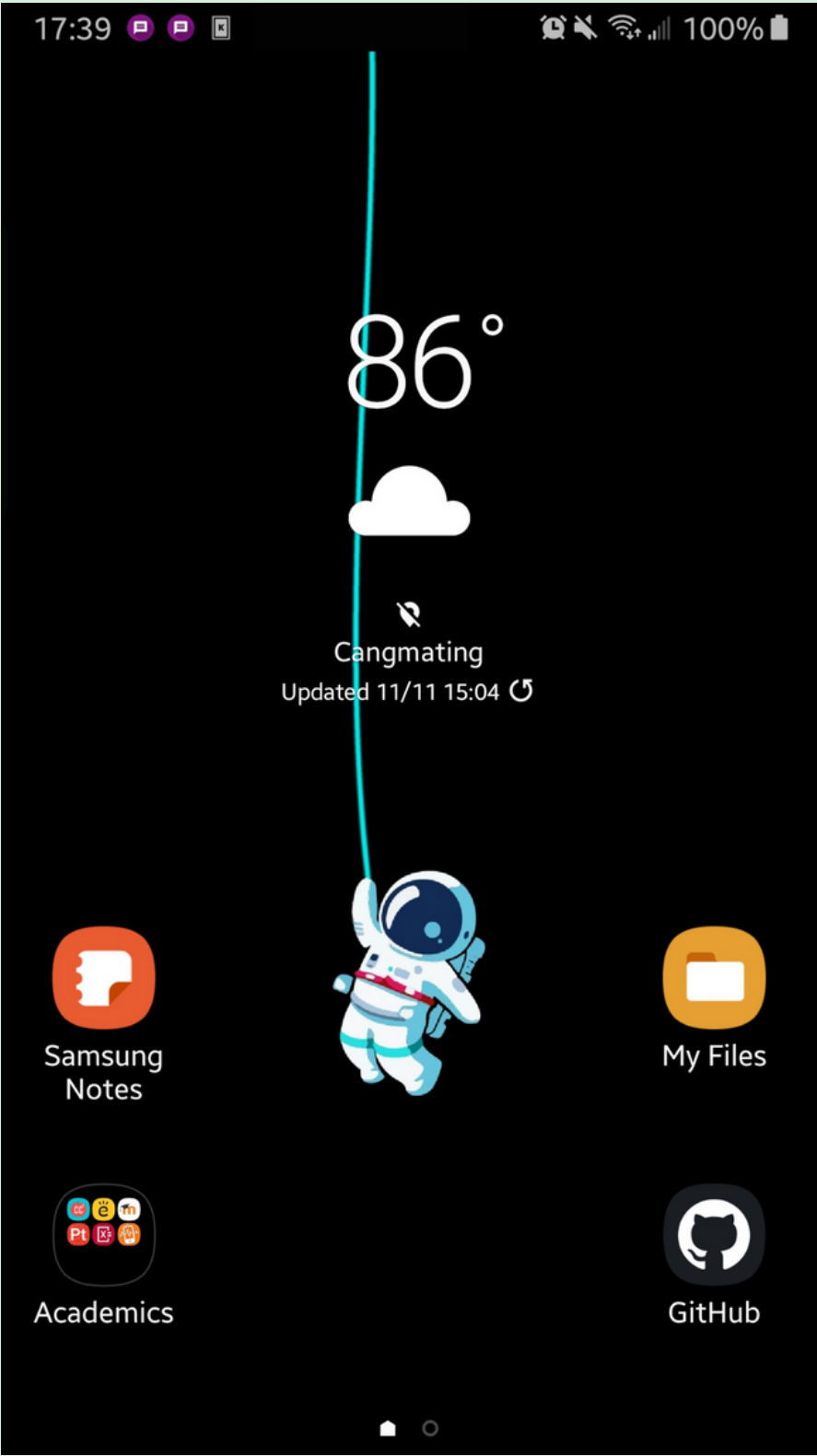# RESULTS AND DISCUSSION

RESULTS AND DISCUSSION

RESULTS AND DISCUSSION

USER SATISFACTION SURVEY

$$CSAT\ Score\ (\%) = \frac{Sum\ of\ All\ Scores}{Sum\ of\ the\ Maximum\ Possible\ Scores} \times 100$$

Category	CSAT Score
Branding	96%
Usability	97%
Functionality	96%

COST ANALYSIS

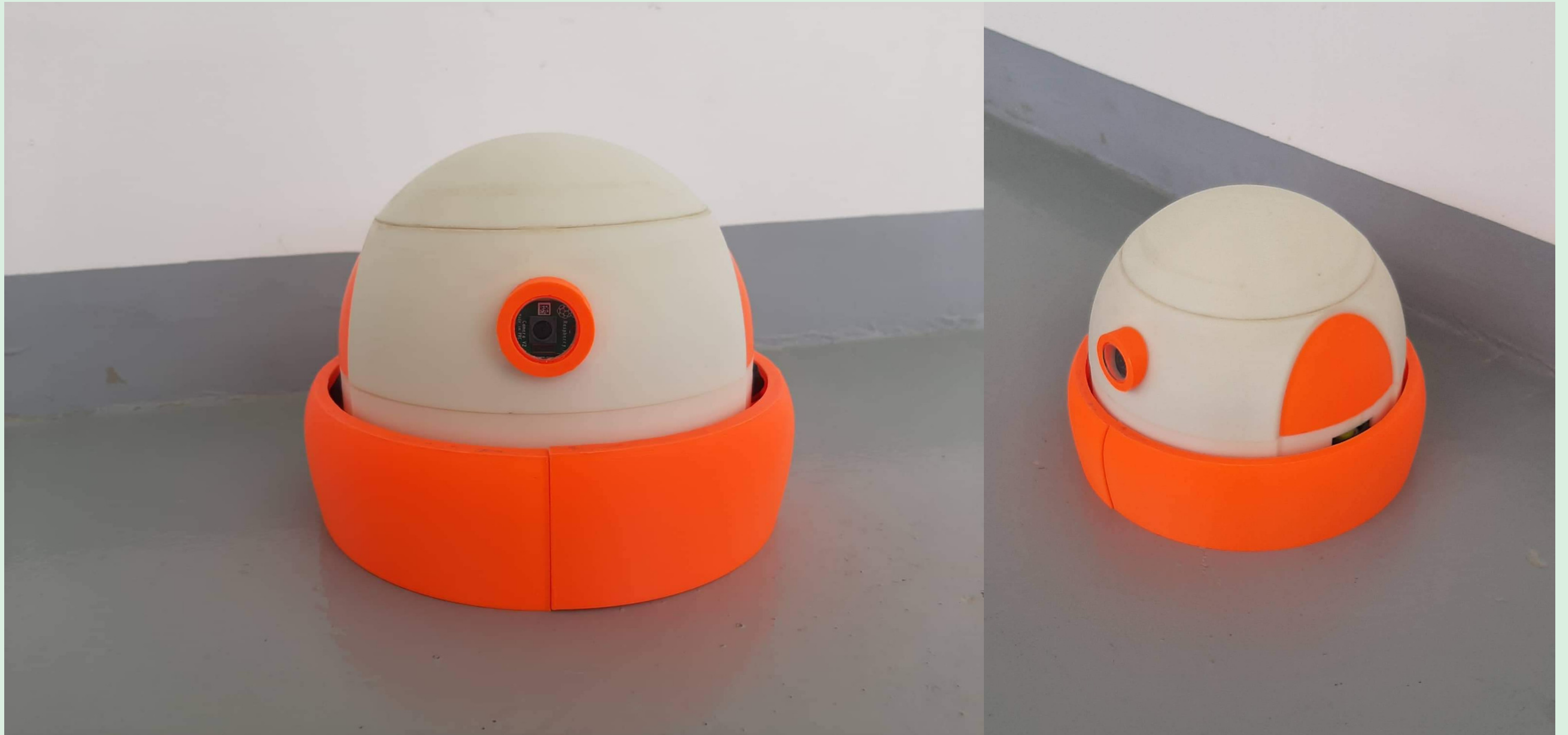|	
Raspberry pi 3 model b+	$35
Raspberry pi Camera	$24
Arduino Nano	$4
2 LoRa Sx1272	$8
Circuit	$2
Total	**$73**

Available Fire detection and Alarm System $165

*estimated

PRODUCT IMAGES

References:

Mallonee, S., Istre, G. R., Rosenberg, M., Reddish-Douglas, M., Jordan, F., Silverstein, P., & Tunell, W. (1996). Surveillance and Prevention of Residential-Fire Injuries. New England Journal of Medicine, 335(1), 27–31. doi: 10.1056/nejm199607043350106