AMRITA VISHWA VIDYAPEETHAM
DEEMED TO BE UNIVERSITY

19CSE213- OS CAPSTONE REPORT

Multi-Processing Fire Detection System using Raspberry Pi

1) Team Members:

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2) Problem Definition:

The problem we are trying to solve with this project is to detect fires in real-time using a Raspberry Pi-based system. Fires can cause significant damage to property and loss of life if not detected and addressed quickly. Therefore, our project aims to detect fires as quickly as possible using sensors connected to a Raspberry Pi, which will alert users through a buzzer and notification messaging using API's, allowing them to take appropriate action.

3) Methodology:

The methodology for this project involves using a Raspberry Pi and a fire sensor to detect fires in real-time.

The fire sensor will detect the presence of flames and send a signal to the Raspberry Pi.

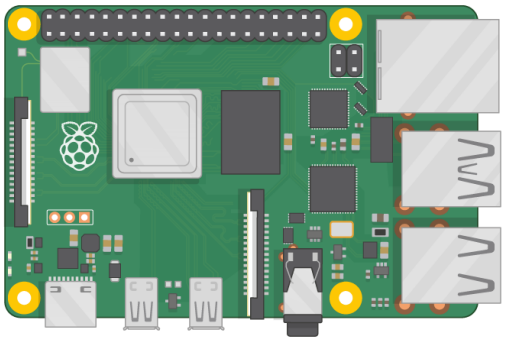
The Raspberry Pi will then process this signal and use a multi-processing approach to analyze the data and determine whether a fire is present.

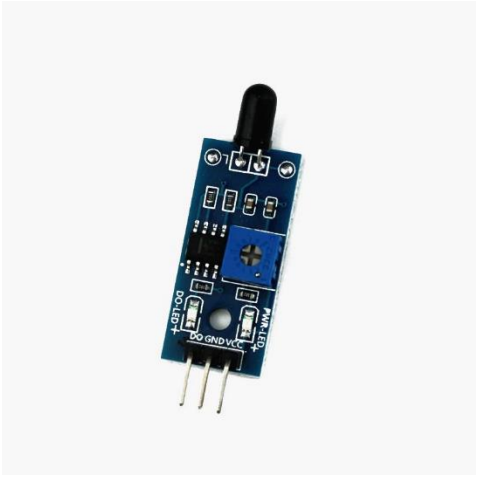
If a fire is detected, the Raspberry Pi will activate a buzzer to alert users to the danger and send a notification message to the user's devices.

In this methodology, API's will be used to connect the notification messaging system to the Raspberry Pi, which will ensure prompt delivery of notifications. This approach will enable the system to send notifications to the user's devices.

4) Components:

The components that we have used for this project are listed below:





5) Code:

The Source Code for our Multi-Processing Fire Detection System using Raspberry Pi is given below: The attachment contains Python Files executing the OS concepts.

```
import time
import RPi.GPIO as GPIO
from pushbullet import Pushbullet
from multiprocessing import Process, Value

flame_sen = 18
buzzer = 29
fire_detected = Value('i', 0)

GPIO.setmode(GPIO.BOARD)
GPIO.setwarnings(False)
GPIO.setup(flame_sen, GPIO.IN)
GPIO.setup(buzzer, GPIO.OUT)

pb = Pushbullet("o.59hrJyB39l75SDxN4tnxWh9XoYtp1GoE")
print(pb.devices)

def detect_flame(fire_detected):
    while True:
        if GPIO.input(flame_sen) == GPIO.LOW:
            print("Fire detected!")
            fire_detected.value = 1
        else:
            fire_detected.value = 0
```

```
        time.sleep(0.1)

def alert(pb):
    while True:
        if fire_detected.value == 1:
            print("Sending push notification...")
            GPIO.output(buzzer, GPIO.LOW)
            dev = pb.get_device('OPPO CPH1931')
            push = dev.push_note("Alert!!", "Fire at your place")
        else:
            GPIO.output(buzzer, GPIO.HIGH)
        time.sleep(0.1)

if __name__ == '__main__':
    p1 = Process(target=detect_flame, args=(fire_detected,))
    p2 = Process(target=alert, args=(pb,))
    p1.start()
    p2.start()
    p1.join()
    p2.join()
```

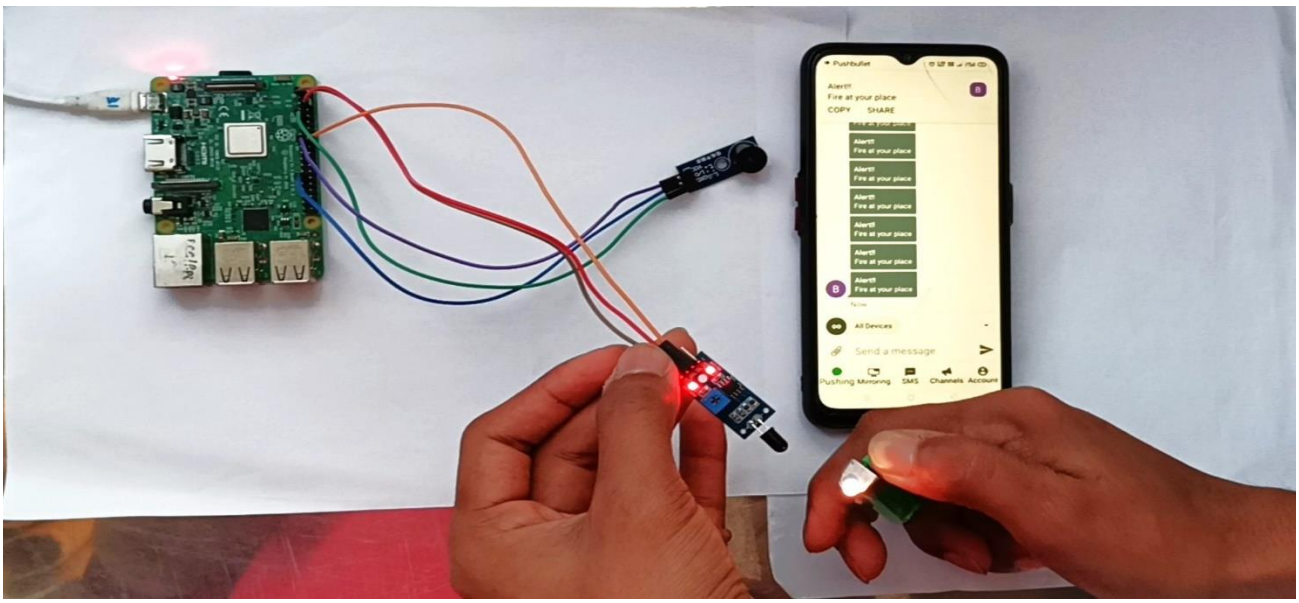
Code Explanation:

1. Importing Libraries:
    - The time library provides functions for time-related operations.
    - RPi.GPIO is a Python library used for accessing and controlling the Raspberry Pi's GPIO pins.
    - Pushbullet is a library used for sending push notifications to devices.
    - multiprocessing provides support for running multiple processes simultaneously.
2. GPIO Pin Setup:
    - Two variables, flame_sen and buzzer, are defined to represent the GPIO pin numbers.
    - The GPIO.setmode(GPIO.BOARD) sets the pin numbering mode to use the physical pin numbers on the Raspberry Pi board.
    - GPIO.setwarnings(False) disables GPIO warnings.
    - GPIO.setup(flame_sen, GPIO.IN) sets the flame sensor pin as an input pin.
    - GPIO.setup(buzzer, GPIO.OUT) sets the buzzer pin as an output pin.

3. Pushbullet Initialization:
    - The Pushbullet API key is provided to create a Pushbullet object called pb.
    - pb.devices retrieves a list of available devices associated with the Pushbullet account.
4. Flame Detection Function:
    - The detect_flame function is defined to continuously monitor the flame sensor input.
    - It runs in an infinite loop.
    - If the flame sensor input is low (flame detected), it sets the fire_detected value to 1.
    - Otherwise, it sets the fire_detected value to 0.
    - It sleeps for 0.1 seconds before repeating the loop.
5. Alert Function:
    - The alert function continuously checks the fire_detected value.
    - It runs in an infinite loop.
    - If the fire_detected value is 1, indicating a fire, it sends a push notification using Pushbullet.
    - It also sets the buzzer pin to low (active state).
    - If the fire_detected value is 0, it sets the buzzer pin to high (inactive state).
    - It sleeps for 0.1 seconds before repeating the loop.
6. Process Creation and Execution:
    - The __name__ == '__main__' condition ensures that the following code is only executed when the script is run directly, not when imported as a module.
    - Two processes, p1 and p2, are created, representing the flame detection and alert functions respectively.
    - The target parameter specifies the function to be executed by each process, and the args parameter provides the arguments for the function.
    - Both processes are started using the start() method.
    - The join() method is called on both processes to wait for them to complete before exiting the program.

6) Output

The final output for our project is given below:



7) Conclusion:

In conclusion, the project successfully addresses the problem of fire detection using Raspberry Pi. By implementing multi-processing techniques, the system achieves faster and more efficient fire detection. The integration of fire sensors, buzzer, and notification messaging through APIs enables timely alerts and notifications, allowing for quick response to fire incidents. The project demonstrates the potential of using Raspberry Pi as a cost-effective and versatile platform for fire detection applications.

THE-END