



VISUAL FIRE DETECTION AND PEOPLE DENSITY MONITORING SYSTEM

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AGENDA

- *Problem Statement*
- *Survey*
- *Abstract*
- *Literature Review*
- *Proposed Features to be incorporated in the final Prototype*
- *Block Diagram*
- *Flowchart*
- *Components and Budget Estimation*
- *Architecture*
- *Key Milestones*
- *Conclusion*
- *References*

PROBLEM STATEMENT

Fire incidents have a huge damaging impact on human life as well as property in residential and industrial areas. On the other hand, the risk of fires is growing in conjunction with the growth of urban buildings due to increase in population and lack of ventilation. Traditional fire detection equipment's have a chance of failure and also have a high possibility of giving false alarm moreover they cannot give dynamic attributes like number of people trapped in fire and the intensity of fire. One of the major problems among fire fighters is to find the number of trapped people in the building among all the smoke generated in fire



SURVEY

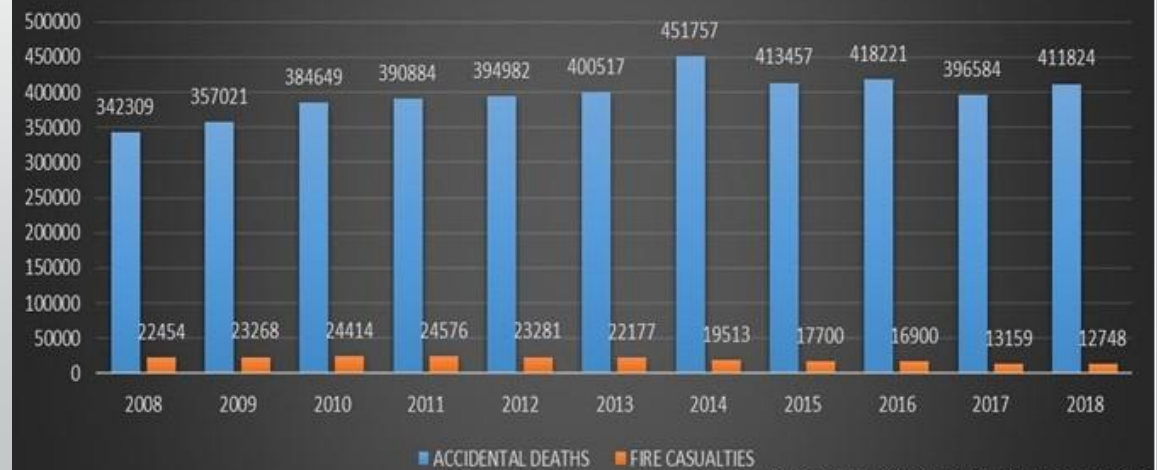
- *As per the National Crime Records Bureau, about over 60 people die every day in India due to fire. Every year, about 25,000 persons die due to fires and related causes, in India. Women account for about 66% of those killed in fire accidents. Fire accounts for about 6% of the total deaths reported due to natural and unnatural causes.*
- *Bulk of the cases reported every year are under the other causes category. Between 2001 and 2018, a total of 3.16 lakh fire accident cases were reported in the country. More than 20000 cases were reported in 12 of the 14 years. The highest number of cases were reported in 2011 (26343). The number of cases reported witnessed a mixed trend in the last 14 years. The number of cases saw a decline from 2001 to 2004 only to increase continuously from 2004. This increasing trend continued till 2011 only to be followed by a decreasing trend till 2014.*

FIRES IN INDIA

	Fire accidents		Deaths	Injuries
2016	16,695		16,900	998
2017	13,397		13,159	348
2018	13,099		12,748	777
2019	11,037		10,915	441
2020	9,329		9,110	468

Source: ADSI report by NCRB, 2020

YEAR 2008 - 2018 : FIRE CASUALTIES IN INDIA



Referred source by Firepedia : NCRB Annual Reports

ABSTRACT

In this project, we propose an architecture using raspberry pi and a camera to provide an accurate number of people trapped in the building and moreover, find the location of trapped people and detect fire using, deep neural network (DNN) models, i.e., MobileNet SSD and ResNet101 which are embedded in the vision node which is the camera and raspberry pi. We also use FOMO algorithm to find out the estimated number of people trapped inside the whole building. A web application is developed and integrated with the vision node through a local server for visualizing the real-time events in the building related to the fire and getting the count of people. In this proposed system concentration on sensors are omitted with the usage of HSV algorithm, which identifies the fire with the help of the Hue, Saturation and the value of the color obtained from the live video .In the proposed system, a webcam is used instead of a surveillance camera for convenience .

LITERATURE REVIEW

S.No	Title of Papers and Authors	Year	Existing Work
1	Fire detection using smoke and gas sensors Chen, S. J., Hovde, D. C., Peterson, K. A., & Marshall, A. W[IEEE]	2007	Fire detection can be delayed due to smoke generation and detection time, leading to damage before prevention measures can be taken.
2	Novel method of real time fire detection and video alerting system using open-cv techniques M. Karthikeyen, N. Ramya, M. Sai Priya and C. Yuvalakshmi[MDPI]	2021	Fire detection and giving alerts using mailing system which is a very traditional way and it is not sustainable
3	Fire Detection Using Deep Learning And Opencv Vinaya Gawali, Saloni Pawar, Muskan Chhangani, Arsh Shrivastava, K.A. Kalokhe []	2022	The system uses advanced Deep learning and Convolutional Neural Networks technology to detect the fire and OpenCV technology to capture the images

Proposed Features to be incorporated in the Final Prototype

➤ *Accurate detection of fire*

This system uses HSV algorithm, which identifies the fire with the help of the Hue, Saturation and the value of the colour obtained from the live video .In the proposed system, a camera is used .The process involved in proposed system.

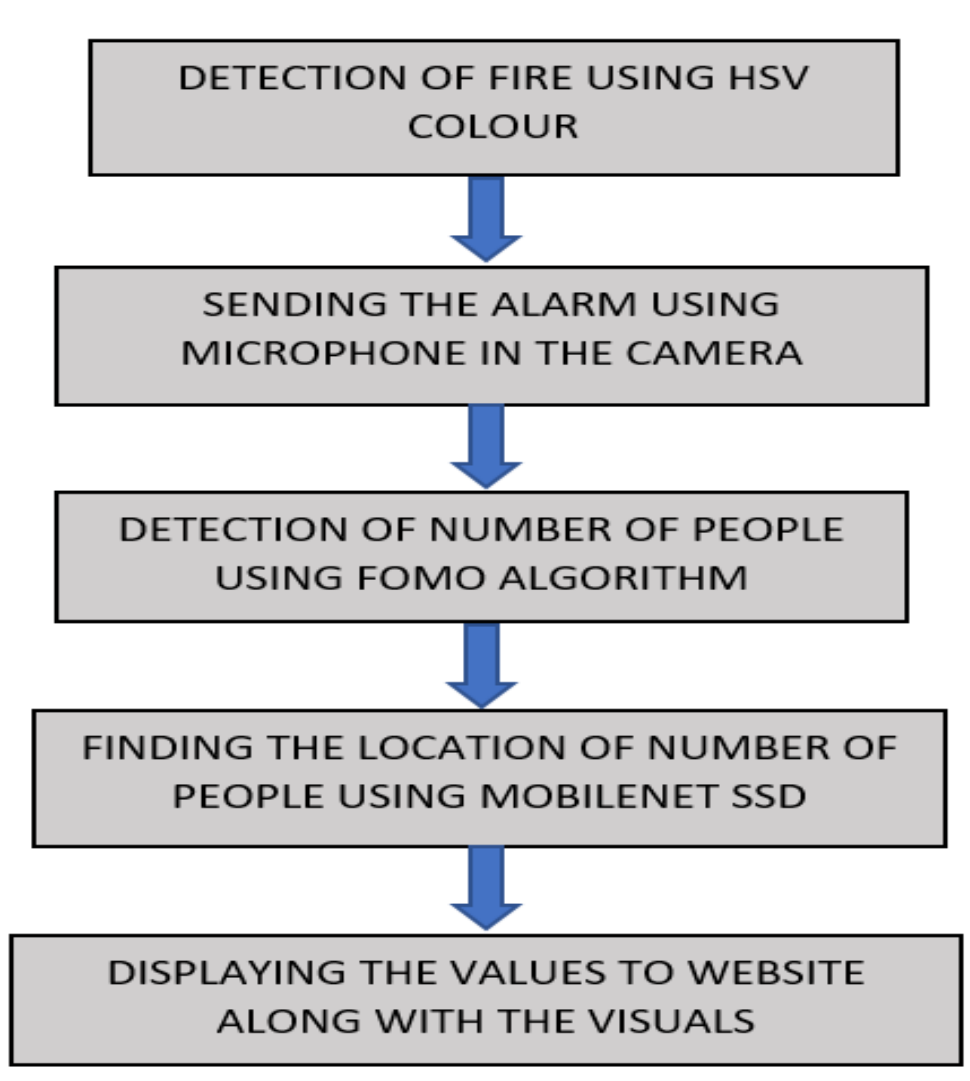
➤ *Counting of people*

To get the estimated number of people in the building we will use the FOMO algorithm with the MobileNet SSD algorithm which allows us to calculate the number of people exiting the area through the exit. The number of people trapped can be found out by subtracting the people who enter the building by the people who are exiting the building

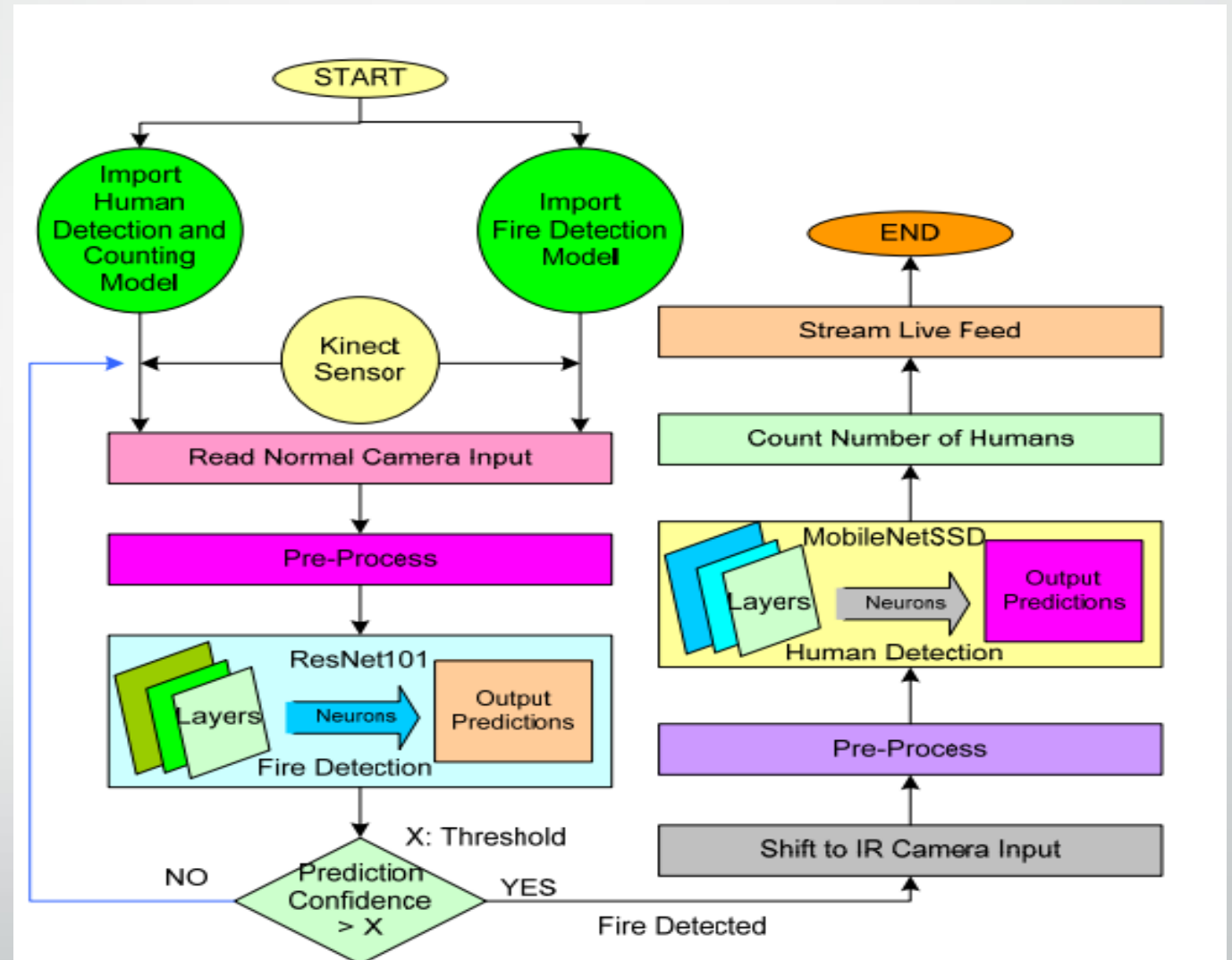
➤ *Web Application*

It then streams the real-time output and the live feed to a network, which is then parsed by an application listening to the stream port. This feed can then be used by the concerned authorities to plan out further steps and evacuation procedures.

BLOCK DIAGRAM



FLOWCHART OF PROPOSED ARCHITECTURE



COMPONENTS AND BUDGET ESTIMATION

1) Raspberry Pi 4 Model B

A series of single board computers

CPU: Broadcom BCM2711, quad-core Cortex-A72 (ARM v8) 64-bit SoC @ 1.5GHz

RAM: 2GB, 4GB, or 8GB LPDDR4-3200 SDRAM (depending on model)

Networking: Gigabit Ethernet, 2.4GHz and 5GHz 802.11b/g/n/ac wireless, Bluetooth 5.0, BLE, Gigabit Ethernet, 2 USB 3.0 ports, 2 USB 2.0 ports, 2 micro-HDMI ports (up to 4kp60 supported), 3.5mm audio jack, and 40-pin GPIO header.

Storage: microSD card slot for loading operating system and data storage

Operating System: Supports multiple operating systems including Raspberry Pi OS, Ubuntu, and Windows 10 IoT Core.

2) Kinect Sensor

The **Kinect sensor** is a motion-sensing device developed by Microsoft for the Xbox 360 and later for Windows-based computers. Here are the specifications for the original Xbox 360 version of the Kinect sensor:

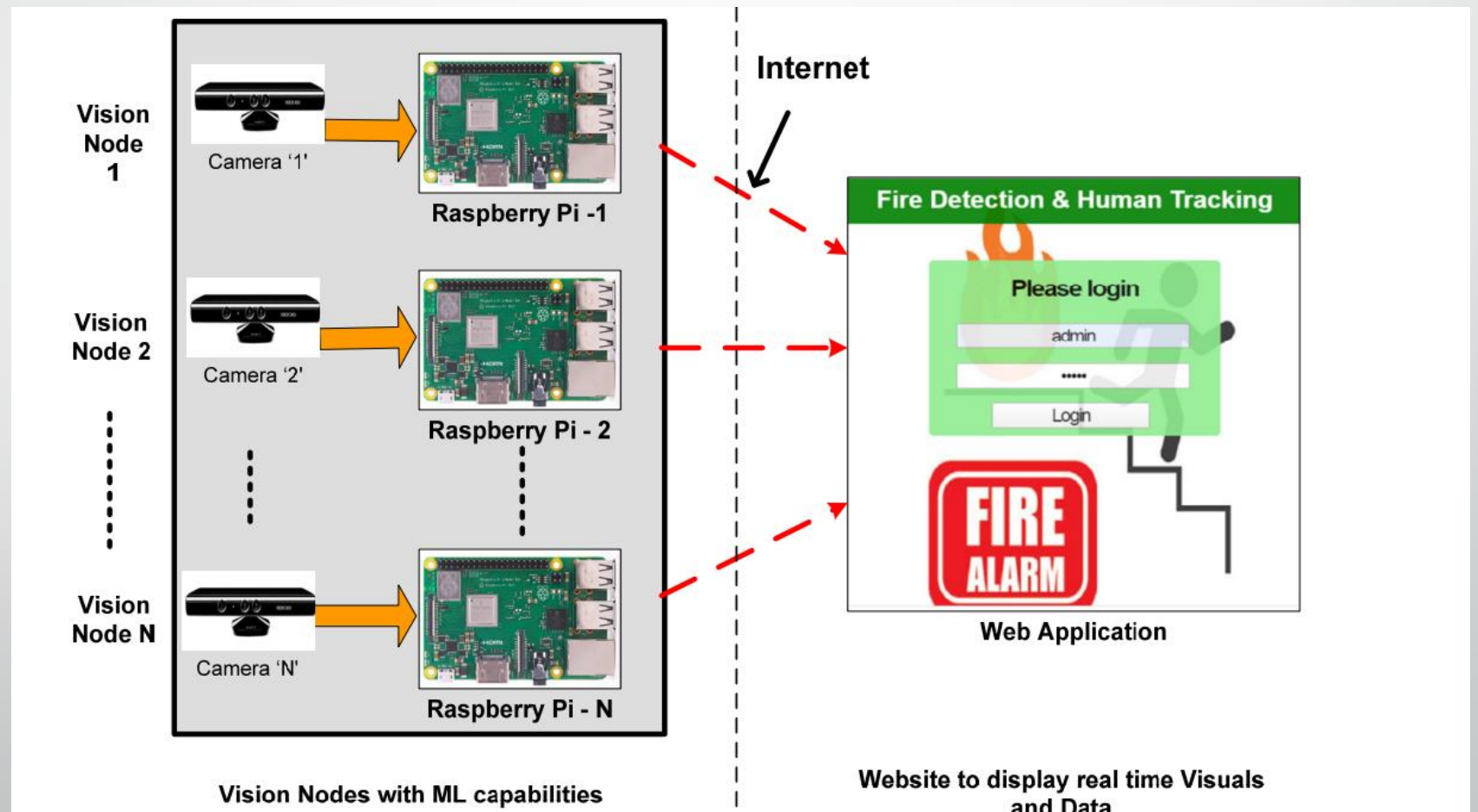
Video camera: 640x480 pixel resolution, 30 frames per second

Depth sensor: 320x240 pixel resolution, 30 frames per second

Connectivity: USB 2.0

S. NO.	Name Of Component	No of Pieces	Price Estimation
1.	Raspberry Pi 4 Model B	1	Rs. 8000/-
2.	Kinect Sensor	1	Rs. 4000/-
			Total = 12,000/-

ARCHITECTURE OF THE SYSTEM



KEY MILESTONES

Milestone 1

Project Proposal
07 - 02 - 2023

0

Identifying Problem
Statement, Formulating
the system and Budget
Estimation

Milestone 2

1st Review
11 - 02 - 2023



01

Final Prototype

Milestone 3

2nd Review
12 - 03 - 2023

02

Suggestions and Final
Touches

Milestone 4

3rd Review
09 - 04 - 2023

03

03

Oth

1st

2nd

3rd

2023

CONCLUSION

Fire detection and people estimation are very crucial during a fire accident. Early fire detection enables suggesting a safe exit path from the building for the people inside the building. Moreover, it is important to find the number of people stuck inside the building during a fire accident. Thus, in order to detect fires and to estimate the number of people in real time, we require a real-time visual capturing system. In this project, we have implemented a vision node based on Raspberry Pi with machine learning capabilities for detecting fire and estimating people count accurately in real time. Along with the vision node, we have designed a web interface that is capable of triggering all connected vision nodes by authorized signing in to the portal. Here, the vision node interfaces with the web portal through a local server hosted on Raspberry Pi. As the vision node is switched on, it starts capturing the real-time frame. Moreover, a machine learning-based pre-trained model processes real-time frames and sends the estimated result on web portals such as the status of fire detection and count of people

REFERENCES

- <https://www.financialexpress.com/money/fire-safety-are-commercial-and-residential-spaces-in-india-safe-enough/2637244/>
- <https://ieeexplore.ieee.org/abstract/document/341064>
- <http://www.ijeea.in/wp-content/uploads/2021/04/Volume-9-Issue-1-Paper-6.pdf>
- <https://www.mdpi.com/1302514>