International Journal of Electrical Engineering and Technology.
ISSN 2249-3085 Volume 12, Number 1 (2022), pp. 73-80

http://www.ripublication.com

Fire Detection Using Raspberry Pi

S.Bhuvaneswari [1,a]

[1]*Assistant Professor, EEE Department, Bannari Amman Institute of Technology, Tamil nadu-638 401, India.*

ABSTRACT

Video fire detection is an essential requirement of any video surveillance alarm interface since it can avoid huge catastrophic fires at an early stage. Conventional fire sensors can detect fire in a narrow range especially in closed environments. In the last decade, video fire detection has been contributed by many researchers. Most of them use high-frequency motion of fire in different methods. In the Existing System, the Air ventilation framework is skilled to vacuum oxygen (O2) and other inflammable gases in room which is the principle factor to keep away from the fire. The objective of research work is for high-frequency pattern detection, image features such as colour, motion, flickering edges, probabilistic turbulence models, trained dynamic textures and sharp corners are put into spatio-temporal analysis to detect fire in video sequences. In this research paper, image processing framework method by Convolution Neural Network is introduced and analysing the fire Detection

Keywords: fire detection, pattern detection, Neural Network, high-frequency motion

I. INTRODUCTION

Asok & Hossain (2012) it is a combinational digital circuit which can perform an alarm by the voice signal. In this project detects smoke using Light Dependent Resistor & Light Emitting Diode [1]. This project used voice alert instead of traditional buzzer. This project. has certain limitations like it has a complex circuit and more number of transistors. Muheden (2016)[2] this paper shows how to increase wireless sensor network (WSN) techniques by composing new design methods and improved a low-cost industrial and home safety systems. So as to guarantee and present accurate solutions to the system, not only temperature and humidity sensors but also flame and gas sensors were used in this study with a the notification alarm message to the mobile users.S. Bayoumi (2013) this project was done by using computer vision and image ocessing techniques to detect fire flames based on studying the fire properties beside s an alarm notification system[3]. Molla Shahadat Hossain Lipu (2010) the project entails the design

and engineering of a wireless smoke detector unit and network. The premise of the wireless network isto alert and to set off all of the smoke detectors in the network if one smoke detector is set off[4]. Ibrahim Furkanince (2014) The basic idea is fire has a highly varying texture and waits at the same location for long consecutive periods.[5] Since the pixel- wise framework has a high algorithmic cost, a patch-wise periodical analysis of fire- colour moving pixels in terms of consecutive re-occurrence in a given duration is presented. Instead of analyzing the fire motion frame by frame, the motion ratio of each patch is evaluated at the end of each period to attain true turbulence of fire. Experiments with a large number of fire and non-fire video sequences give promising results. Zhen Yang (2018) Research on video analysis and processing of fire and smoke detection has gradually become a popular topic in computer vision. It is also a challenging task to detect smoke in videos due to the non-rigid characteristics and the large variance of smoke color, texture, shape, density, and lighting, causing most of the existing video-based smoke detection algorithms with high false detection rates. In this paper, we combine Gaussian Mixture Model (GMM) and HSV color model with the deep convolution model for detecting video-based smoke, which aims at filtering out no-smoke blocks to further reduce false detection rate and improve the detection accuracy. We evaluate our approach on many smoke video clips and demonstrate a reduction of false detection rate and the improvement of precision.

II. PROPOSED METHODOLOGY

The fig 1 shows the program flow chart for the project. Here when fire is detected it first collects the image then apply the RGB colour model and converts it into HSV. Now collects the results from both sobel edge detection and RGB colour model and combines it and applies segmentation method to produce final result and sends it to raspberry pi.

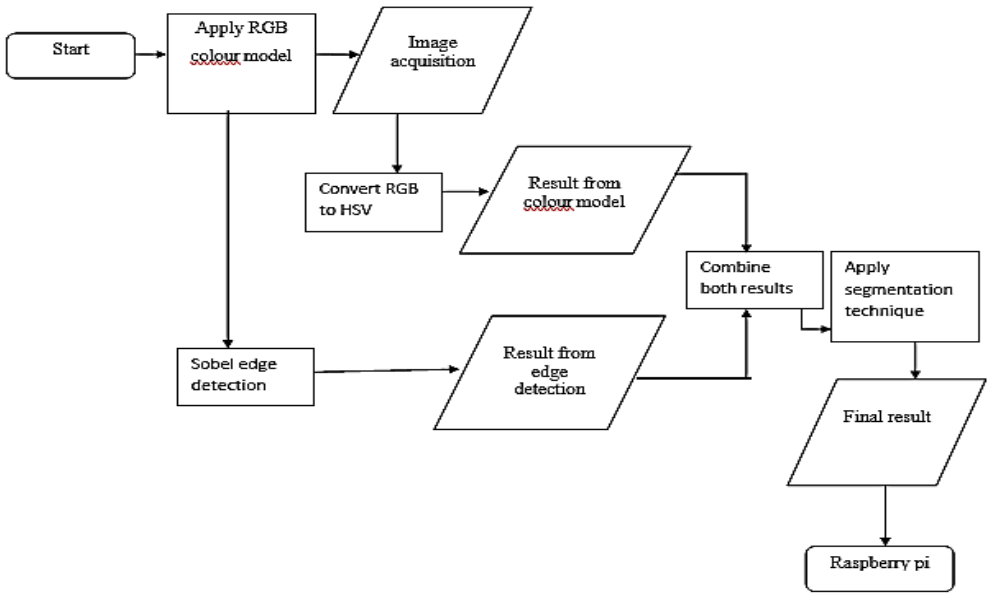

Figure 1 Block Diagram of MPPT

III. CONVOLUTION NEURAL NET

These convolution neural networks are very similar to the neural networks present in our brains. It has multiple layers and depths. And also have different areas to process different information. The below image shows a very basic Convent.[6]

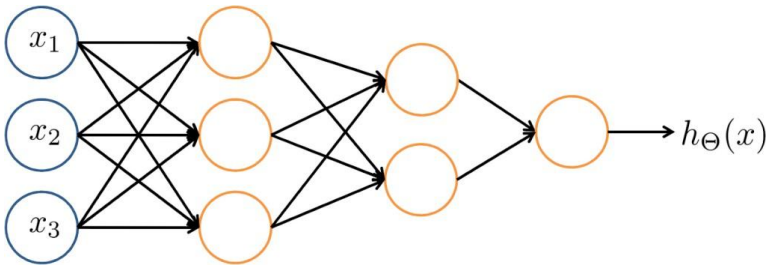

Figure 2. Layer neural network

The above fig 2 only has three layers, an input layer and two deep layers and an output layer. This neural network just computes the function h(x) which is our prediction, with the 3 inputs. The accuracy and the probability of the output being correct increases with the increase in the number of layers and neurons in it.

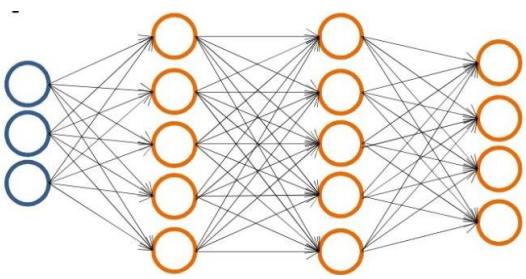

Figure 3. Multi-classifications Neural Network

The fig 3 shows the Multi-Classifications Neural Network which looks very similar to our model in this project.

IV. BLOCK DIAGRAM

The fig 4 shows the block diagram of our project. First we have power supply unit which has a Step down Transformer that converts 230v AC to 12v AC, then a bridge rectifier and a filter circuit at last a Voltage Regulator (IC 7805) and now the raspberry pi and the other components is powered. The raspberry pi servers as main controller which has several peripherals connected to it namely a pi camera to capture images of fire, a temperature sensor to sense temperature, a fire sensor to sense flame, a buzzer to sound the alarm. A water motor is connected to spray the water on the affected area [7]. A GSM and GPS module to send a SMS on latitude and longitude location to nearby

fire station.

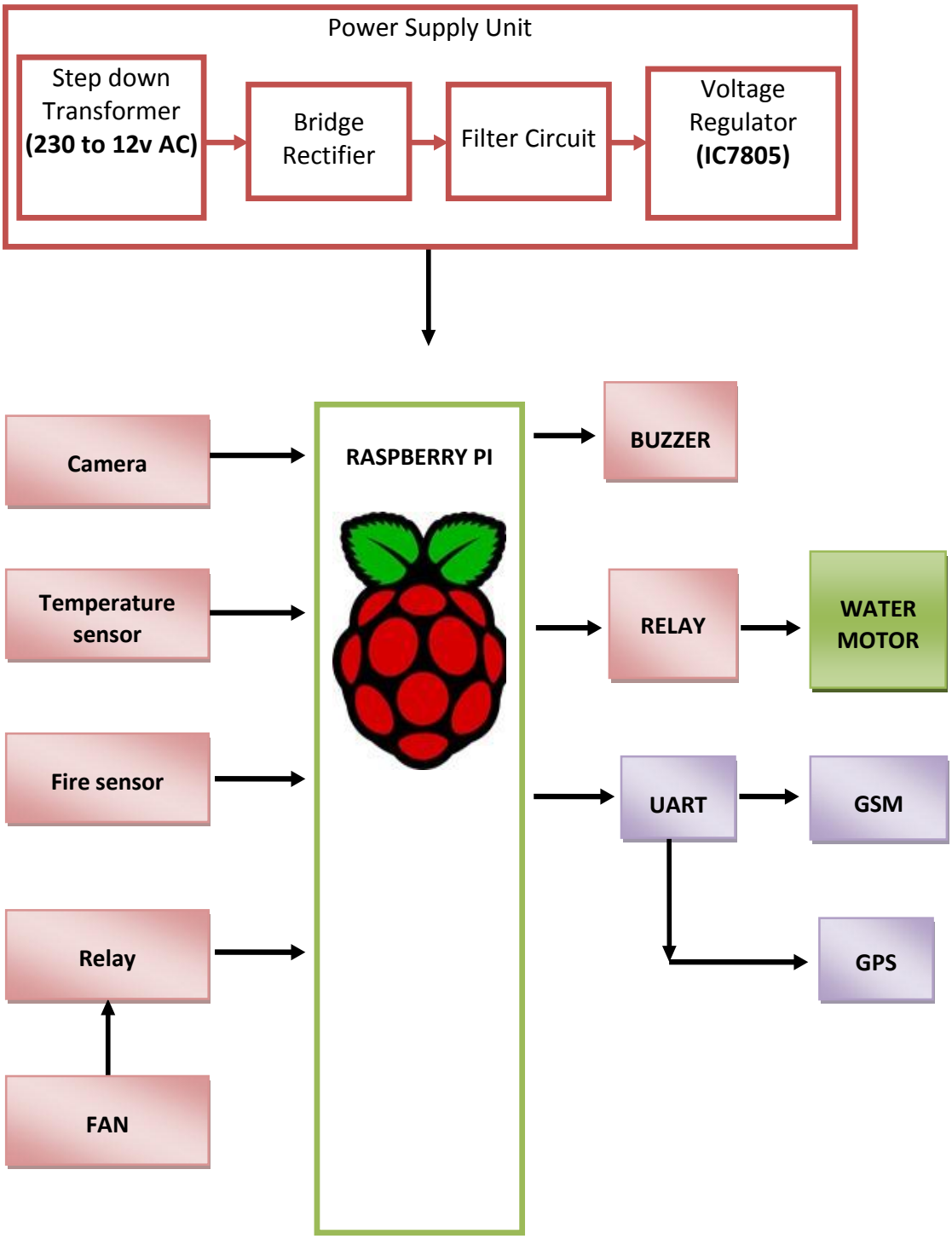

Figure 4. Block diagram of the project

V. RESULT AND CONCLUSION

5.1 RESULT

Our objective of the project is to design and develop a lightweight and high accuracy fire detection system which can fire at staring level. To accomplish this lightweight fire detection system, we needed to develop a high accuracy and scalable neural network which can detect the images without a huge dataset and training process. Generally, humans identify fire based on their visually seeing them or by the temperature. It is the primal criteria for identification of fire. In this project we used CNN or usually called Convents, which is a neural network which performs extraordinarily well, when it comes to image detection and image classification. Theseare very high performance and reliable. When it comes to Convents, they are forward net and trained [8]. After identifying the image and comparing the data from the temperature sensor and fire sensor, the buzzer will have turned on and water motor will begin to spray and ventilator fan will be switched on alongside a audio alert will be played.

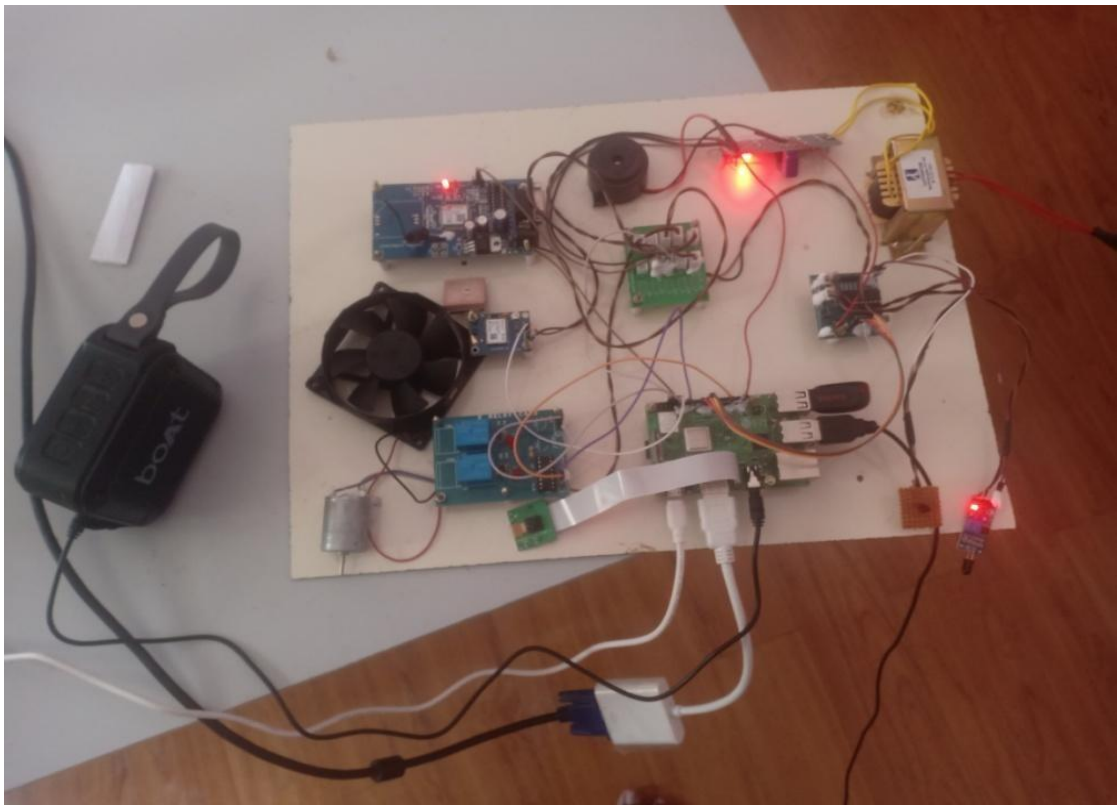

Figure 5. Hardware Connection Final Output

The fig 5 shows the final connection of hardware of fire alarm using raspberry pi. The connections are briefly discussed under chapter 4 of sub heading block diagram.[9]

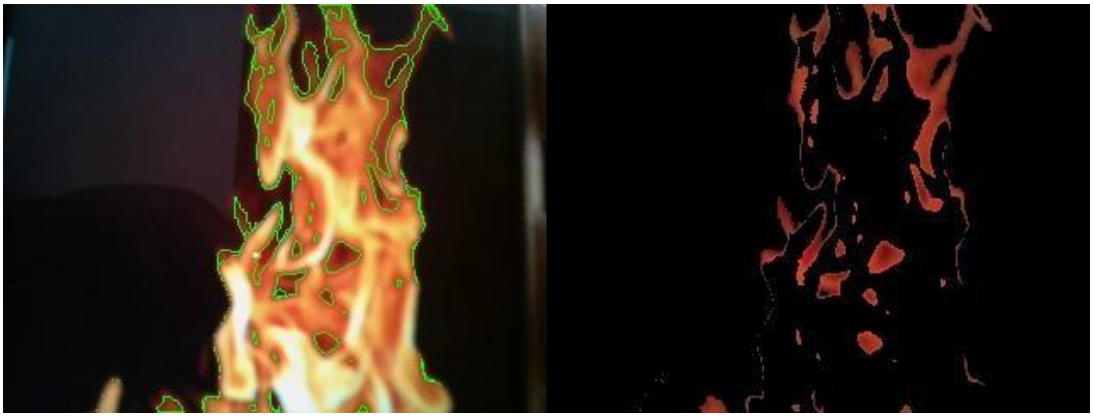

Figure 6. Output image

The fig 6 shows the output of image analysed by the system. On the left we have the original image with tracing of edges and spots. On the right we have the traced image of edges and spots to identify whether it is fire or not.[10]

VI. CONCLUSION

In this project, we have done a Method of Fire Detection and Prevention using Water Pump Motor. The algorithm uses a deep learning approach based on a convolutional neural network (CNN). The system is highly useful and effective because there is no background effect to recognize a fire. It can recognize a fire irrespective of the environment and background changes. And it works sufficiently in different luminous levels[11]. Fire recognition systems are currently incorporated in many top technological companies and industries, agricultural land. The utilization of python programming and Open CV makes it a simpler and helpful instrument or framework which can be made by anybody as per their necessity. The proposed framework examined in this venture will be useful for some as it is an easy to understand and cost efficient framework. Consequently, by the utilization of python and Open CV the fire acknowledgment framework can be intended for different purposes. In future work, we hope to improve the strategy by utilizing a 3D convolutional neural organization. In fact, CNN is presently restricted to deal with 2D information sources which lead us to handle the video input just edge by outline. Contrariwise, 3DCNN concentrates highlight from both spatial and fleeting measurements by performing 3D convolutions [12]. Accordingly, the movement data of fire and smoke could be encoded, which makes it conceivable to diminish significantly the time cost.

REFERENCES

[1]. A Arefín, Utsho & Bala, Asok & Hossain, Md. (2012). Design & Implementation of Fire Alarm Circuit. 10.13140/2.1.1126.9440.

[2]. J. Feng, Y. Feng, L. Ningzhao and W. Benxiang, "Design and experimental research of video detection system for ship fire," *2019 2nd International Conference on Safety Produce Informatization (IICSPI)*, 2019, pp. 367-370, doi: 10.1109/IICSPI48186.2019.9095929.

[3] S. Jamadagni, P. Sankpal, S. Patil, N. Chougule and S. Gurav, "Gas Leakage and Fire Detection using Raspberry Pi," *2019 3rd International Conference on Computing Methodologies and Communication (ICCMC)*, 2019, pp. 495-497, doi: 10.1109/ICCMC.2019.8819678.

[4]. M. Sheth, A. Trivedi, K. Suchak, K. Parmar and D. Jetpariya, "Inventive Fire Detection utilizing Raspberry Pi for New Age Home of Smart Cities," *2020 Third International Conference on Smart Systems and Inventive Technology (ICSSIT)*, 2020, pp. 724-728, doi: 10.1109/ICSSIT48917.2020.9214108.

[4] H. Mahamudul, M. Islam, A. Shameem, J. Rana and H. Metselaar, "Modelling of PV module with incremental conductance MPPT controlled buck-boost converter," 2013 2nd International Conference on Advances in Electrical Engineering (ICAEE), 2013, pp. 197-202

[5] Noorinder, J. Singh and E. Sidhu, "Raspberry pi based smart fire management system employing sensor based automatic water sprinkler," *2017 International Conference on Power and Embedded Drive Control (ICPEDC)*, 2017, pp. 102-106, doi: 10.1109/ICPEDC.2017.8081068

[6] G. Sathyakala, V. Kirthika and B. Aishwarya, "Computer Vision Based Fire Detection with a Video Alert System," *2018 International Conference on Communication and Signal Processing (ICCSP)*, 2018, pp. 0725-0727, doi: 10.1109/ICCSP.2018.8524216.

[7] M. S. Bin Bahrudin, R. A. Kassim and N. Buniyamin, "Development of Fire alarm system using Raspberry Pi and Arduino Uno," *2013 International Conference on Electrical, Electronics and System Engineering (ICEESE)*, 2013, pp. 43-48, doi: 10.1109/ICEESE.2013.6895040.

[8] H. Takahashi *et al*., "Improvement of automatic fire extinguisher system for residential use," *2015 International Conference on Informatics, Electronics & Vision (ICIEV)*, 2015, pp. 1-4, doi: 10.1109/ICIEV.2015.7333992.

[9] K. B. Swain, S. Dash and S. S. Gouda, "Raspberry PI based Integrated Autonomous Vehicle using LabVIEW," *2017 Third International Conference on Sensing, Signal Processing and Security (ICSSS)*, 2017, pp. 69-73, doi: 10.1109/SSPS.2017.8071567.

[10] R. Sarath Kumar, J. Hariharan, R. S. Revanth, K. R. Prasanth and J. Lokesh, "Automatic Fire Fighting Robot using RPI," *2021 2nd International Conference on Smart Electronics and Communication (ICOSEC)*, 2021, pp. 136-139, doi: 10.1109/ICOSEC51865.2021.959168

[11] H. Jan, H. Yar, J. Iqbal, H. Farman, Z. Khan and A. Koubaa, "Raspberry Pi Assisted Safety System for Elderly People: An Application of Smart Home," *2020*

First International Conference of Smart Systems and Emerging Technologies (SMARTTECH), 2020, pp. 155-160, doi: 10.1109/SMART-TECH49988.2020.00046.

[12] M. N. A. Khan, T. Tanveer, K. Khurshid, H. Zaki and S. S. I. Zaidi, "Fire Detection System using Raspberry Pi," *2019 International Conference on Information Science and Communication Technology (ICISCT)*, 2019, pp. 1-6, doi: 10.1109/CISCT.2019.8777414.