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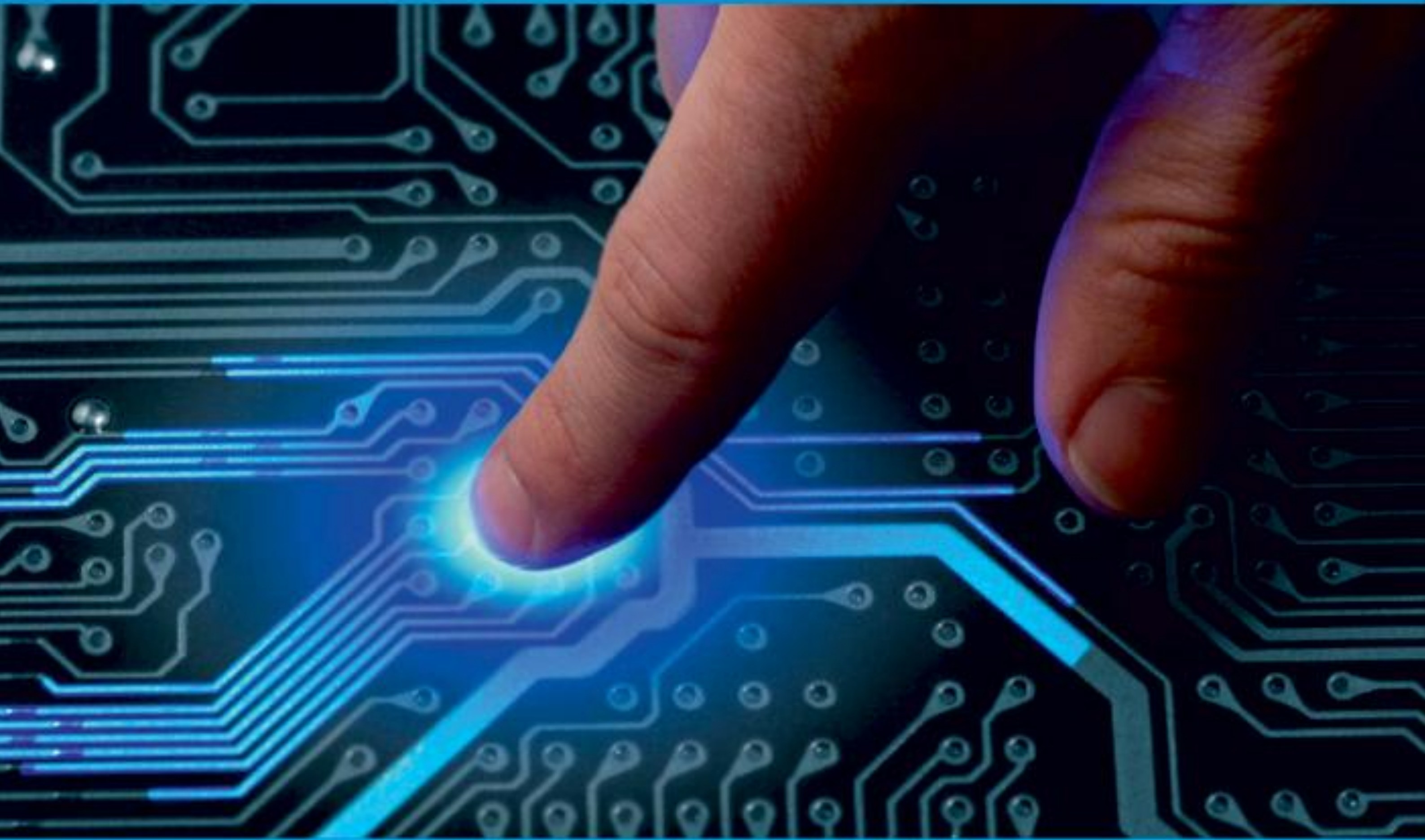

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Smart CCTV Camera using Machine Learning

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ABSTRACT: In today's world, safety and security are key issues. People use security devices to protect their property, whether it is their home or their business. Perimeter of Smart cctv cameras are security systems that uses camera sensors for motion detection and video surveillance. This initiative attempts to provide one such solution for ensuring property safety and security. We propose a smart CCTV system with intrusion detection and many more features in this study. For streaming and monitoring, Cameras have been mounted in various locations. The feature of our surveillance system is Theft protection, Identity watch-out, Motion detection into a rectangle zone, Noise detection, In-Out intruder image capturing, Face mask detection, Video recording feature list saving image into their respective folders for review purpose using Machine Learning algorithms.

KEYWORDS: COVID-19, Learning Face Mask Detection, masked facial recognition, Smart CCTV, CCTV, Camera based security systems, Face Detection using Machine Learning, Camera Based Security Systems, Security Devices, Video surveillance.

I. INTRODUCTION

The goal of the project Smart CCTV camera surveillance system is to improve the CCTV camera-based security systems that are currently in use in various locations. Wireless technology was used to design the project security system using CCTV cameras. The deployment of an image detection and video surveillance system is becoming increasingly crucial. An embedded surveillance system is commonly employed in the house, workplace, or factory for image processing and traffic monitoring, but this design necessitates a high-performance core, which negates some of the benefits of embedded systems, such as low power consumption and low cost. Using machine learning algorithms, the theft and face identification is most prior to the surveillance system.

II. RELATED METHODOLOGY

The training data consists of 1300 data points, and the validation set consists of few hundred data points, both produced experimentally from testing. For each experimental point, these data set is sent to a CCN computational model for further processing of the image datasets provided, after which the output frame is displayed on the screen Between the tests it is important to let the test environment stabilize to minimize noise and unwarranted external factors. This waiting takes several minutes due to the size of datasets and the points translate to several days of testing. Before creating a machine learning model, the usefulness of the data must be evaluated.

Relevant?

Can we assume that the input data cause any impact to the output? In this case it is safe to make this assumption. That the eccentricity of the system to identify an image intuitive. An example of irrelevant data for the machine learning model would be time stamp of each experiment since the condition were made identical between each run.

Accurate?

It is harder to evaluate the accuracy of the data since no measurement error is provided. The input data is assumed accurate since they are chosen and display little deviation

Size of Data?

Do we have enough data points to train a reliable and accurate databased model? This depends on the complexity of the system's behavior, if we have a perfectly linear single-input-single-output case, fewer data points could be enough.

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III. PROPOSED ALGORITHM & ANALYSIS

1. Monitor Feature:

This feature is used to find what is the thing which is stolen from the frame which is visible to webcam. Meaning It constantly monitors the frames and checks which object or thing from the frame has been taken away by the thief.This uses Structural Similarity to find the differences in the two frames. The two frames are captured first when noise was not happened and second when noise stopped happening in the frame.

SSIM is used as a metric to measure the similarity between two given images. The Structural Similarity Index (SSIM) metric extracts 3 key features from an image:

1. Luminance
2. Contrast
3. Structure

The comparison between the two images is performed on the basis of these 3 features.

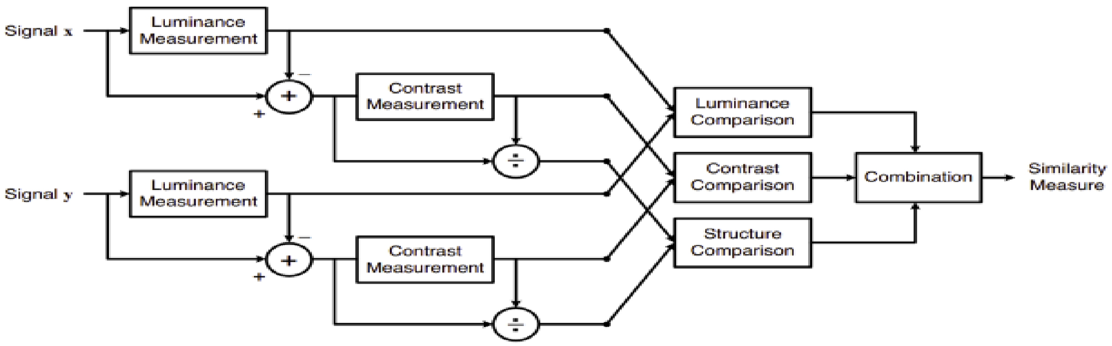


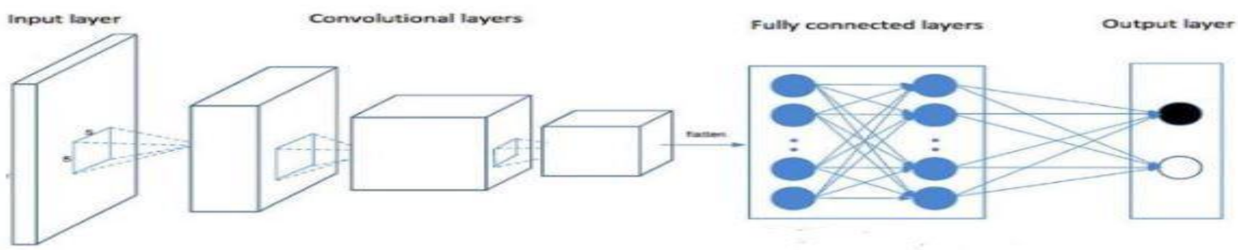
Figure 1: Structural similarity Luminance model.

2. Face Mask Identification Feature:

This feature is methodology consists of two significant parts which binded together performs as expected.

1. Find the faces into the frame.
2. Use CNN algorithm to predict the person facemask from trained ML model.

An image of a person is fed to the Model, to identify whether the person is masked or unmasked. The pixels of the image are provided to the CNN neural network's input layer in the form of arrays (multi-layer networks used to classify things). By conducting various calculations and manipulations, the hidden layers retrieve features. The convolution layer, the ReLU layer, and the pooling layer are all hidden layers that extract features from the image. A ConvNet is another name for it. Finally, there's a completely connected layer that recognises the in the image and displays Realtime data as objective notation on the screen. On the training set, the CNN achieves a precision of 98.2 percent, and on the test set, it achieves a precision of 97.3 percent. The CNN's stored weights are then utilised to classify whether the object image is with mask or not with mask .



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3. Noise Detection Feature:

This feature is used to locate frame noises. All frames are evaluated and noise-checked on a constant basis. In the next frames, noise was checked. We do absolute difference between two frames and in this way the difference of two images isanalysed and Contours(boundaries of the motion are detected) and if there are no boundaries then no motion and if there is any there is motion.All images are just integer or float values of pixels which tells the brightness of pixel and similarly every pixel has that values of brightness.

frame1

10	90	16	16
0	11	11	11
18	30	33	33
18	18	18	18

frame2

10	90	16	16
0	13	17	11
18	34	31	33
18	17	19	18

frame2 - frame1

0	0	0	0
0	2	6	0
0	4	-2	0
0	-1	1	0

abs (frame2 - frame1)

0	0	0	0
0	2	6	0
0	4	2	0
0	1	1	0

4. Visitor In-Out Feature:

This feature detects whether someone has entered or exited the room. This feature's processing sigma is divided into three steps:

1. It first detects for noises in the frame.
2. Then if any motion happens thenprogram searches the side where the motion took place either in left or right direction of the frame
3. It checks if motion from left ended to right then it will detect it as entered and capture the frame or vise-versa objectively.

5. Video Recording Feature:

Using python OpenCV, we connect to a webcam or video camera connected to our computer and then once connected, we can later do things such as open the video-recording device and record and save video. Once the escape button is pressed the video capturing stops and the video file is saved into the directory.

IV. Results and Discussions

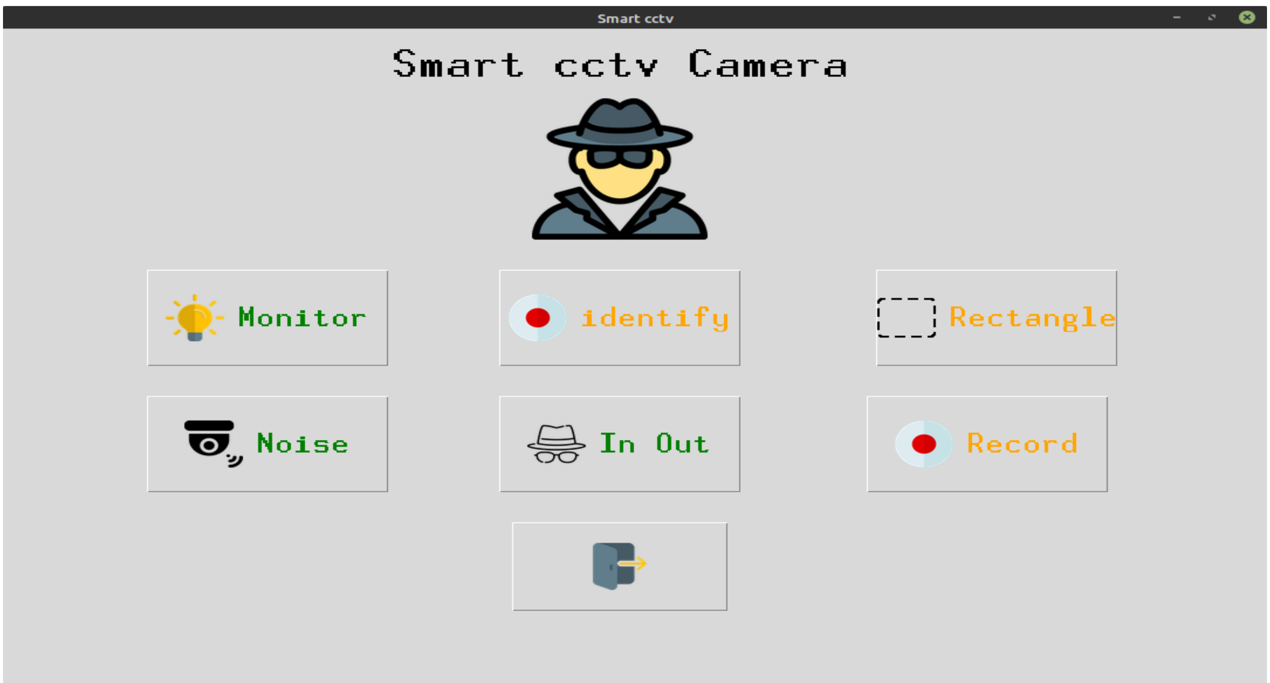

Figure 1. Main User Interface listing features.

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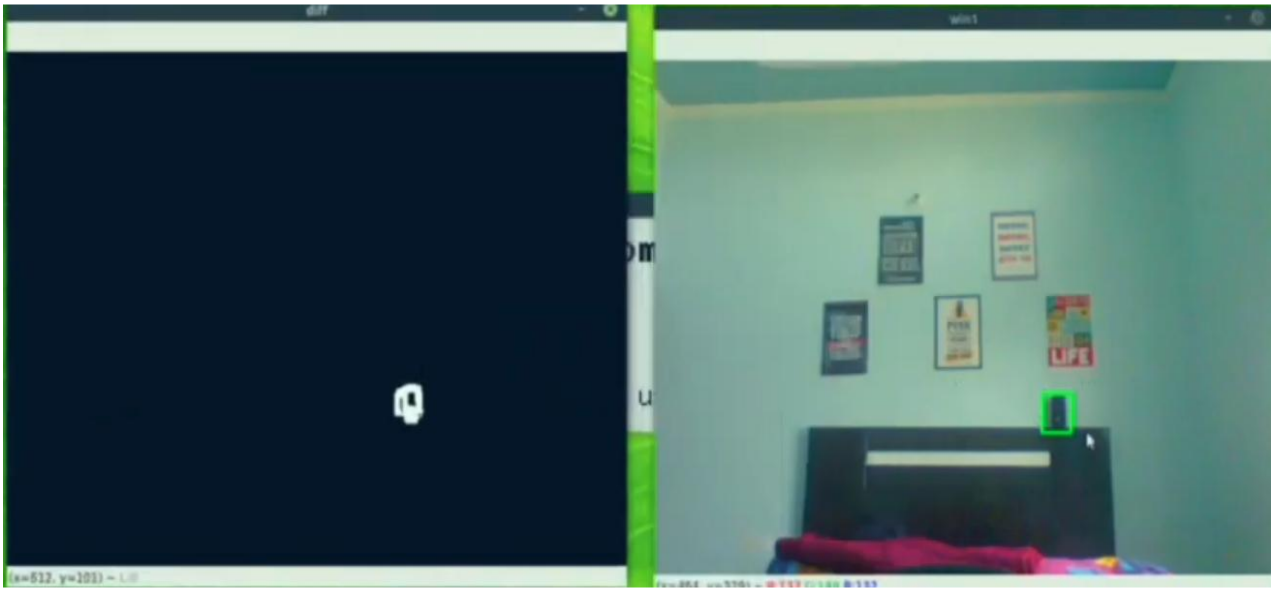

Figure 2. Output of Monitor Feature where a speaker is stolen.

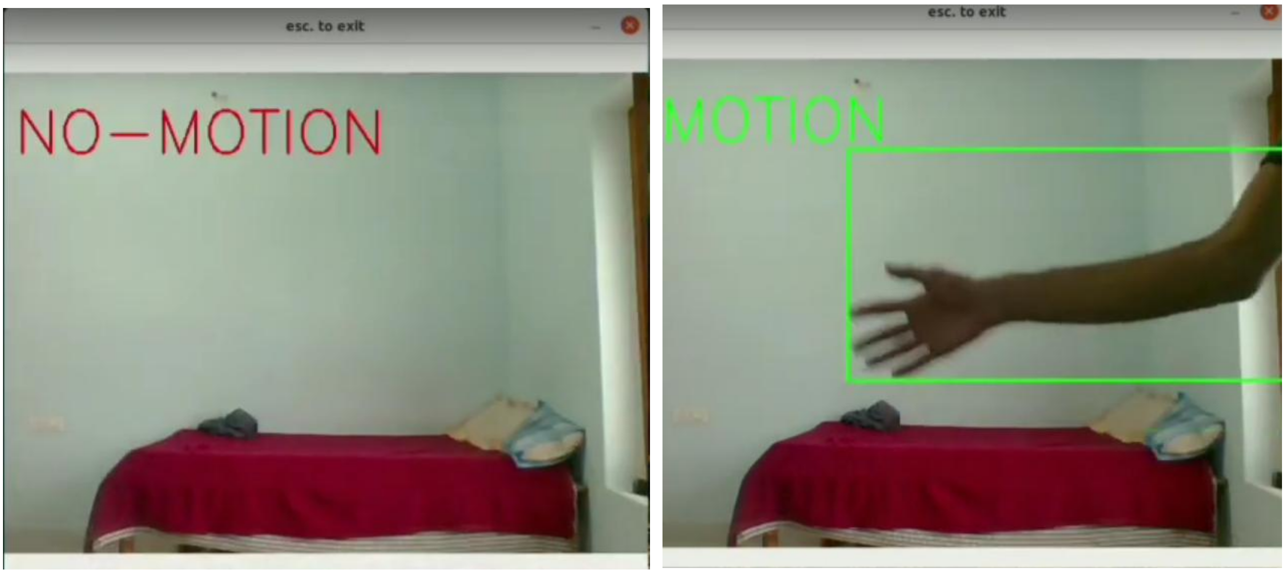

Figure 3. Output of Noise Feature where motion is detected

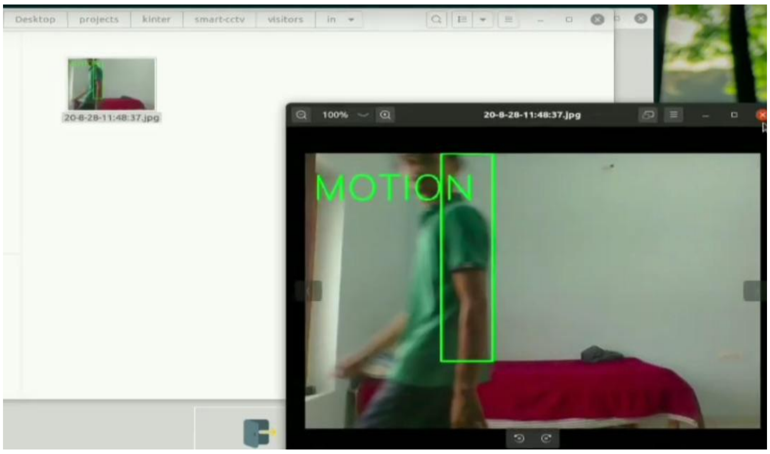

Figure 4. Output of In-Out Feature where motion is detected

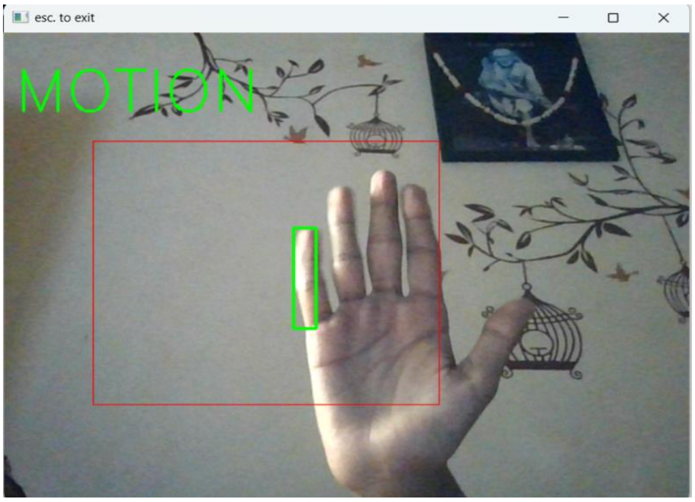

Figure 5. output of Rectangular Frame motion detection feature.

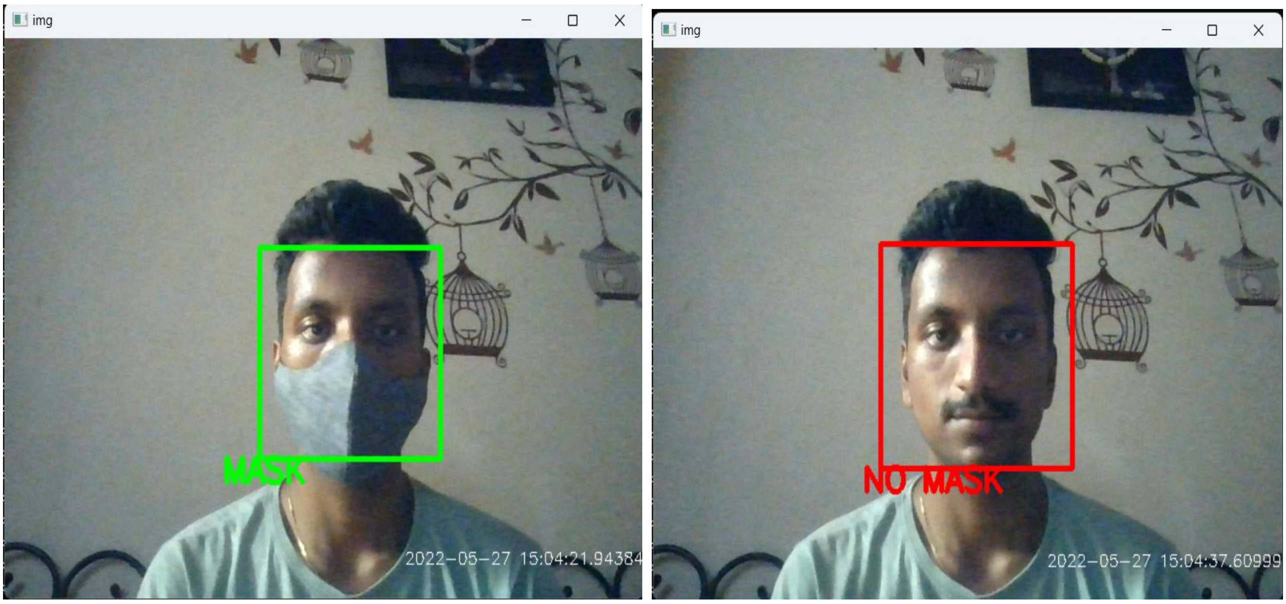

Figure 6. output of Mask – No mask Identification feature

V. CONCLUSION AND FUTURE WORK

The Project Smart CCTV camera Surveillance system is built using the most up-to-date opensource technology and a wired communication structure. The project's major goal is to provide advanced and feature-rich security in a variety of settings, including the military, banks and companies, colleges and malls, and to reduce the amount of power and memory required for CCTV and CCTV footage.

VI. ACKNOWLEDGMENTS

All of the authors listed have contributed a significant, direct, and intellectual contribution to the development of the features and have given their approval for publishing.

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