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Quick Witted Security System

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***Abstract:** In the present era, safety and security are the main concerns. Due to complicated activities, homes are frequently left unattended. Closed-circuit television is typically used by people to protect their houses while they are gone. These systems are unaware of happenings in the surroundings as they just observe without any detection. It requires human interaction to work properly. We propose a Quick-Witted Security System using OpenCV. It includes features like Monitoring the theft, Detecting the noise. System also checks the visitors count and updates in and out count. This system comes with an extra feature of face recognition (Using OpenCV) where it identifies image of known and unknown faces by image processing. This technology is created to offer intelligent security in home and commercial environments.*

I. INTRODUCTION

People only want one thing these days, and that is to feel secure and safe. Closed-circuit television, or CCTV, is the most widely utilised security technology. The price to install CCTV varies according to the system's size and intended purpose. The industrial site, hospitals, banks, museums, and jails can all profit from this initiative in a variety of ways, such as reduced theft, employee protection, increased building security, remote monitoring of facilities via smartphones or tablets, and a reduction in attempts by trespassers to enter the institution. Numerous features, including facial recognition, theft monitoring, visitor counts, motion detection, and recording, were developed. We chose the Python programming language because it has a wealth of features that make it easy to create GUI applications and do machine learning and computer vision. The theft detection feature is used to identify what has been taken from the webcam-visible frame. A visitor count feature that can identify when someone enters or leaves the room. Recording feature records the frame which is similar to normal CCTV. Face detection feature detects the face which comes into the frame picture. We also have a different feature that is used to find the motion in a particular desired frame. Because of all these features, this project different from normal CCTV. The Python GUI application Quick Witted Security System employs a webcam and offers a lot of features not seen in standard CCTV. It may be used with any operating system. It includes features like monitoring the theft, detecting the noise. System also checks the visitors count and updates in and out count. This system comes with an extra feature of face recognition (Using OpenCV) where it identifies image of known and unknown faces by given data set

II. LITERATURE SURVEY

1) "A Motion Detection System in Python and Opencv," AUTHORS: S. Parveen and J. Shah,
This article presents the search software that allows us to see the movement of objects or objects. One of the most crucial security elements nowadays is motion detection software, which is generally recognised for its importance. It is used to upgrade already-installed security tools, such as the motion sensor lights in security cameras for both indoor and outdoor use. One of the most popular motion detecting systems is a security camera [1]. Now, voice recorders are indispensable for better protection.

2) "Face Detection and Recognition Using OpenCV,"
AUTHORS: M. Khan, S. Chakraborty, R. Astya and S. Khepra
Facial recognition and image or video recognition are hot topics in biometrics research. Facial recognition in a real-time environment is an exciting and rapidly growing challenge. A framework for application authentication using facial recognition. This leads to PCA (Principal Component Analysis) face recognition. Principal component analysis (PCA) is a statistical method based on multivariate analysis.

3) "Face Detection & Face Recognition Using Open Computer Vision Classifies"
AUTHOR:LAHIRU DINALANKARA
Identifying people with photographs has become popular through the mass media. However, it is less sensitive to fingerprints or retinal scans.

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In this report, the University of Plymouth's tiny face identification and recognition project for the Visual Perception and Autonomy module is discussed. It demonstrates the OpenCV library's methods and how to use Python to put them into practise. Face detection is done using Haar-Cascades, Eigenfaces, Fisherfaces, and local binary pattern histograms.

III. EXISTING SYSTEM

The surveillance systems now in use are obsolete and ineffective. The majority of them utilise similar functionality. preserving videos for 40–45 days before removing the older ones. Storage concerns are to blame for this. There isn't enough storage to accommodate storing a lot of data. But the majority of the data consists of static pictures of nothing happening. The main negative aspect is this. In typical CCTV systems, over 75% of the footage is pointless still images with nothing happening. Much database storage space might be saved if this data could be automatically found and removed. The amount of video content that can be stored can be multiplied by three. There won't be a noise detection option for the recording.

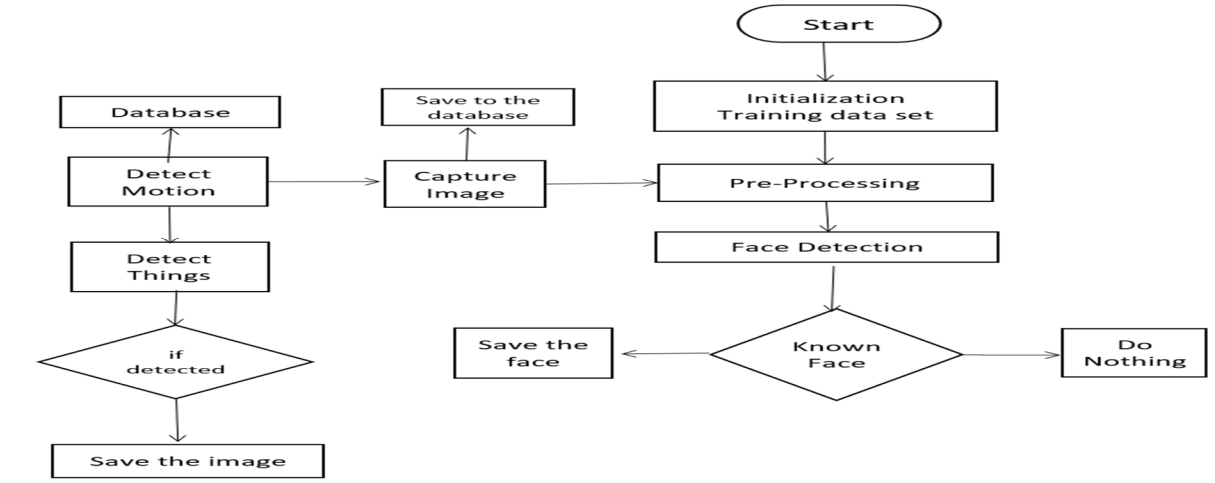
Drawbacks in Existing System

1) The surveillance systems now in use are obsolete and ineffective. The majority of them utilise similar functionality. preserving videos for 40–45 days, after which they are deleted. Storage concerns are to blame for this.
2) There isn't enough storage to accommodate a lot of data. However, the majority of the data are still images showing nothing happening. The main negative aspect is this.
3) In typical CCTV systems, over 75% of the footage is pointless still images with nothing happening. Much database storage space might be saved if this data could be automatically found and removed.
4) The amount of video content that can be stored can be multiplied by three. There won't be a noise detection option for the recording.

IV. PROPOSED SYSTEM

1) For industrial sites, hospitals, banks, museums and jails, a Quick-Witted security camera system can provide a number of advantages, such as (reduced theft, employee protection, building security, remote monitoring of facilities from smartphones or tablets, deterring trespassers from trying to enter the facility).
2) Facial recognition, theft monitoring, visitor counts, motion detection, noise detection, and recording are just a few of the features we developed.A CCTV camera or surveillance system has the drawback of being expensive due to the utilisation of numerous components, including a computer, camera, and cables. To preserve the video, we require a hard disc with a larger storage space. More room is needed for ongoing recording, and more personnel is needed to spot unauthorised activity.
3) However, our system will be far less expensive and have excellent resolution and low power consumption advantages when compared to the Raspberry Pi.
4) Many of the cost-related difficulties that would deter consumers from purchasing remote monitoring technology could be resolved by it.

V. SYSTEM ARCHITECTURE



Below are the different features which can performed by using this minor project:

a) *Monitor Feature:* This feature is used to determine what was taken from the webcam's captured frames. It keeps track of the cargo and determines which item or things were taken from it by the criminal. SSIM is used to assess how similar two provided photos are to one another. Since SSIM has been a part of technology since 2004, there are a lot of documents that explain its basic principles, but few of them delve into great detail because SSIM is frequently used as a fallback and is thus well suited for gradient applications.

The Structural Similarity Index (SSIM) metric extracts 3 key *features* from an image:

- *Luminance, Contrast, Structure*

These three features are used as the basis for comparing the two photos.The Structural Similarity Index, which ranges in value from -1 to +1, is calculated using this system between two provided images. A number of +1 denotes that the two photographs are identical or extremely similar, whereas a value of -1 denotes that the two images are highly dissimilar. These numbers are frequently changed to fall between [0, 1], where the extremes have the same meaning.

Luminance: Averaging across all of the pixel data yields the luminance value. Its symbol is (Mu), and the formula is shown below.

Structure: A condensed formula is used to perform the structural comparison (more on that later), but in essentially, we divide the input signal by its standard deviation to produce a result with a unit standard deviation, allowing for a more reliable comparison.

Fortunately, we don't need to duplicate all of these mathematical calculations in Python because the skimage package in Python includes built-in functionality that takes care of all of these duties for us.Just two of the previous frames or images that we took need to be fed into the system, so we just feed them in and its gives us out the masked image with score

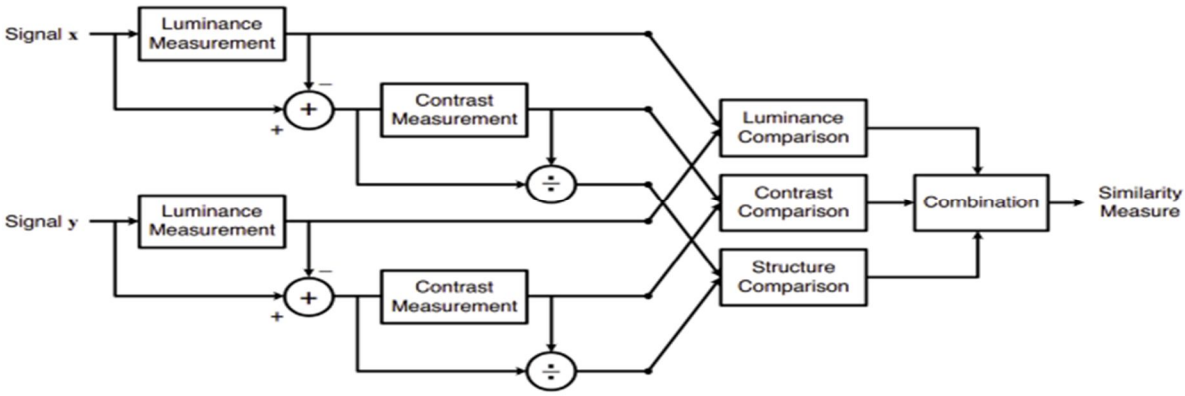
$$\mu_x = \frac{1}{N}\sum_{i=1}^{N} x_i. \qquad (2)$$

The luminance comparison function $l(\mathbf{x}, \mathbf{y})$ is then a function of μ_x and μ_y.

$$(\mathbf{x} - \mu_x)/\sigma_x$$

$$\sigma_x = \left(\frac{1}{N-1}\sum_{i=1}^{N}(x_i - \mu_x)^2\right)^{\frac{1}{2}}. \qquad (4)$$

The contrast comparison $c(\mathbf{x}, \mathbf{y})$ is then the comparison of σ_x and σ_y.

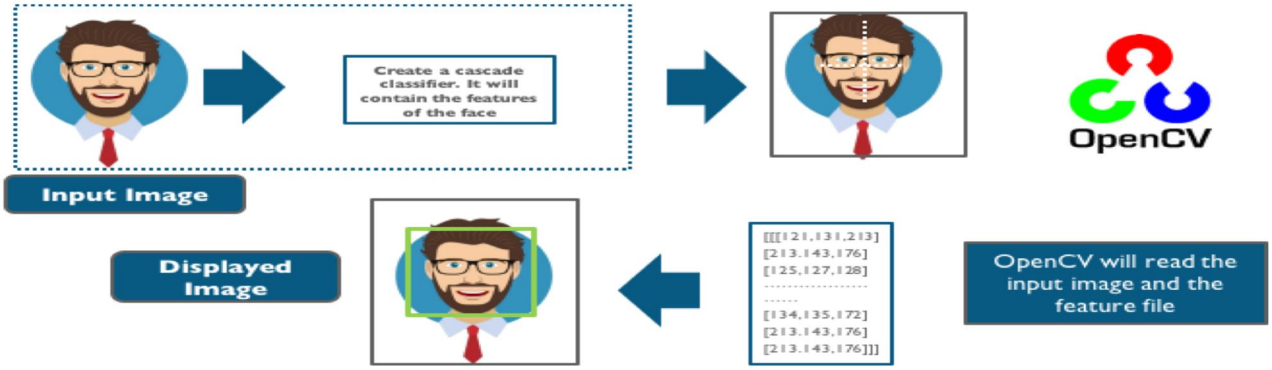


b) *Identify the Face feature*

The purpose of this function in our small project is to determine whether the individual in the frame is well-known or not. This process takes two steps:

- Recognise the faces in the pictures.
- Using the LBPH face recognizer technique, use the trained model to predict who the individual is.

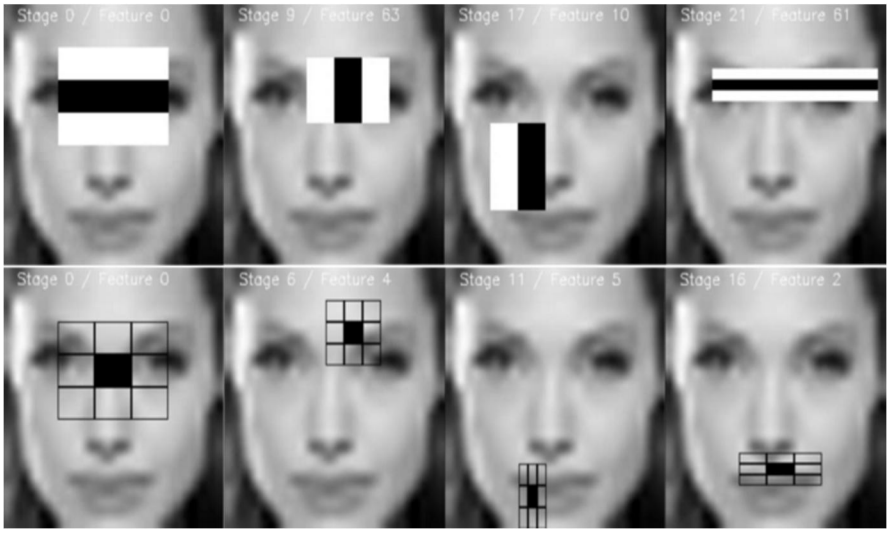
Let's categorise this into the following groups:
Detecting faces in the frames
This is done with Haarcascade classifiers reimplemented in python's openCV module.



Graded classifiers are part of a subset of powered classifiers known as reinforcement learning that use haar-like features. The Adaboost classifier is typically its foundation (as well as additional models like Real Adaboost, Gentle Adaboost, or Logitboost). Hundreds of example photos, both those with and without the objects we want to recognise, are used to train the cascading classifier. Some facets of the human face are visible:

- A slight bridge in the nose compared to the eyes; • Dark eyes compared to the upper jaw area
- The two eyes, mouth, and nose in various locations...

These characteristics are known as Haar features. The method for extracting videos will resemble this:
To identify their presence in the image, Haar features resemble convolution kernels.
To accomplish all of this, we use the cascadeclassifier function that is a built-in feature of the openCV module in Python**.**



c) Visitors In Room Detection

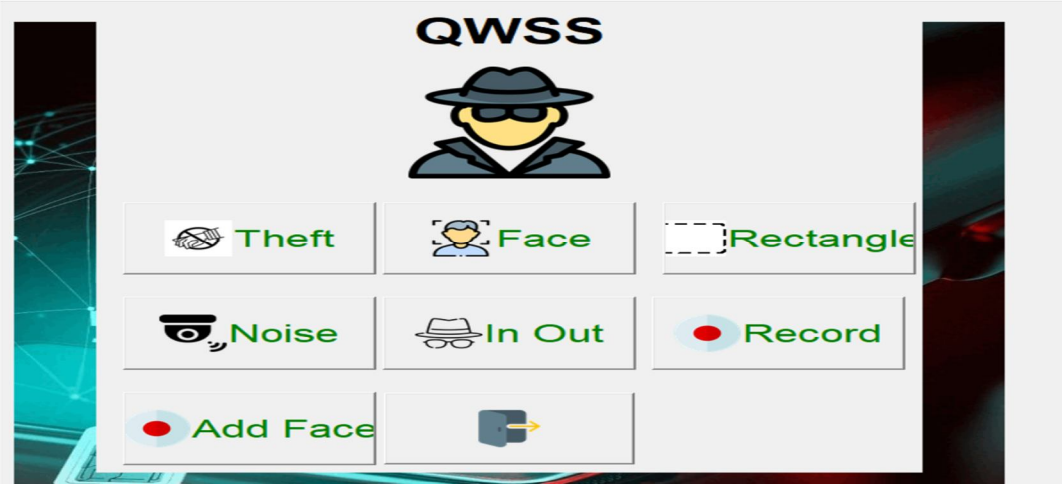
This feature has the power to regulate who is allowed to enter and exit the space. In order to make it function, take these steps:

- noticed the noise in the frame in step one.
- If a movement occurs later, it is seen on the left or right side.
- Lastly, it is tested to determine if it passes from left to right or vice versa since it will enter the frame and show that it has caught.

So there is no arithmetic in this particular function. By first seeing the motion, then drawing a rectangle over the sound, and finally checking the controls, it is simple to determine which side the motion is coming from. If the content is on the left, it is categorised as such. movement.

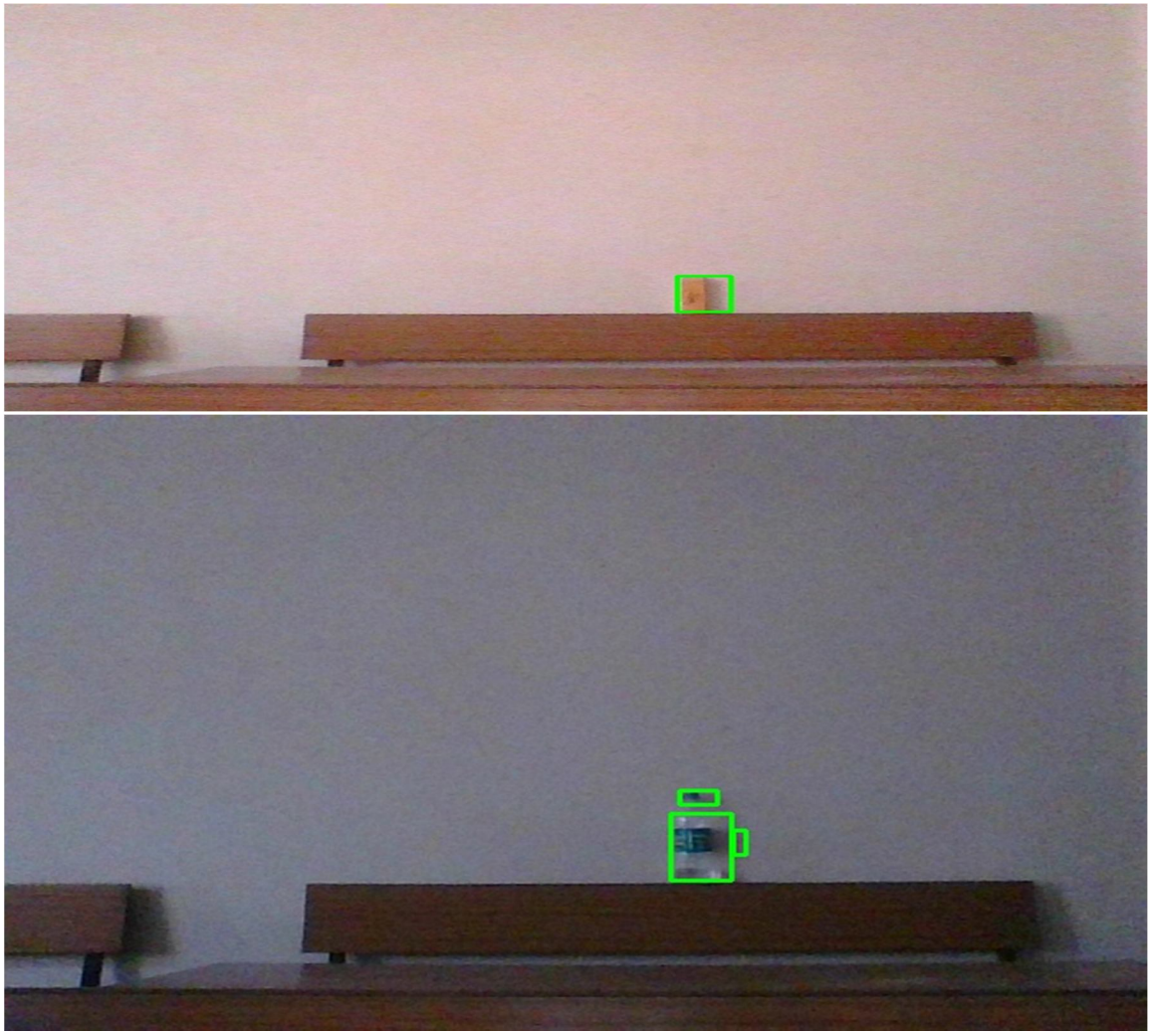
VI. RESULTS AND CONCLUSION

GUI

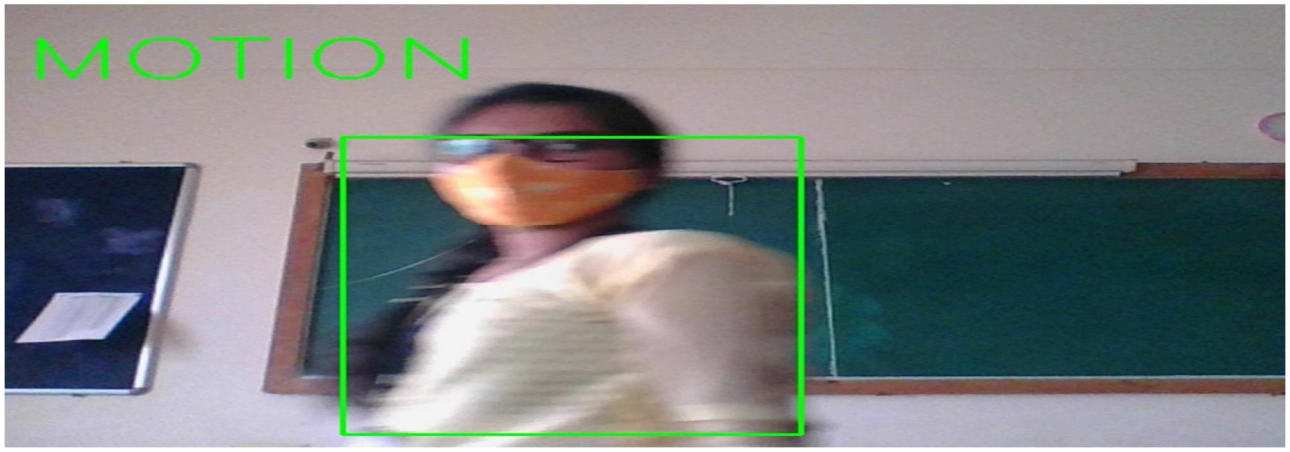


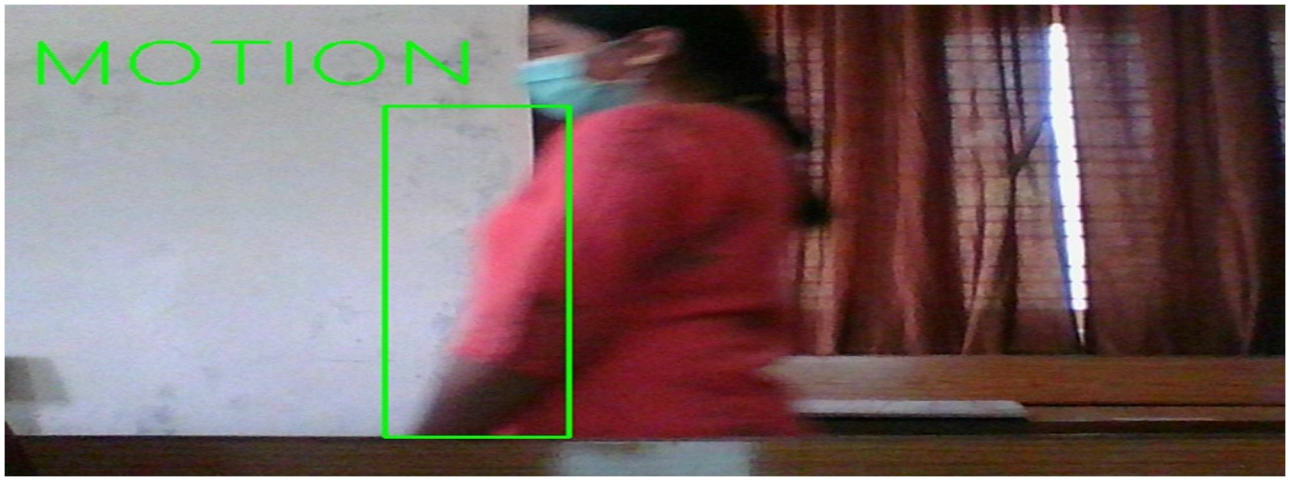
VII. FEATURES

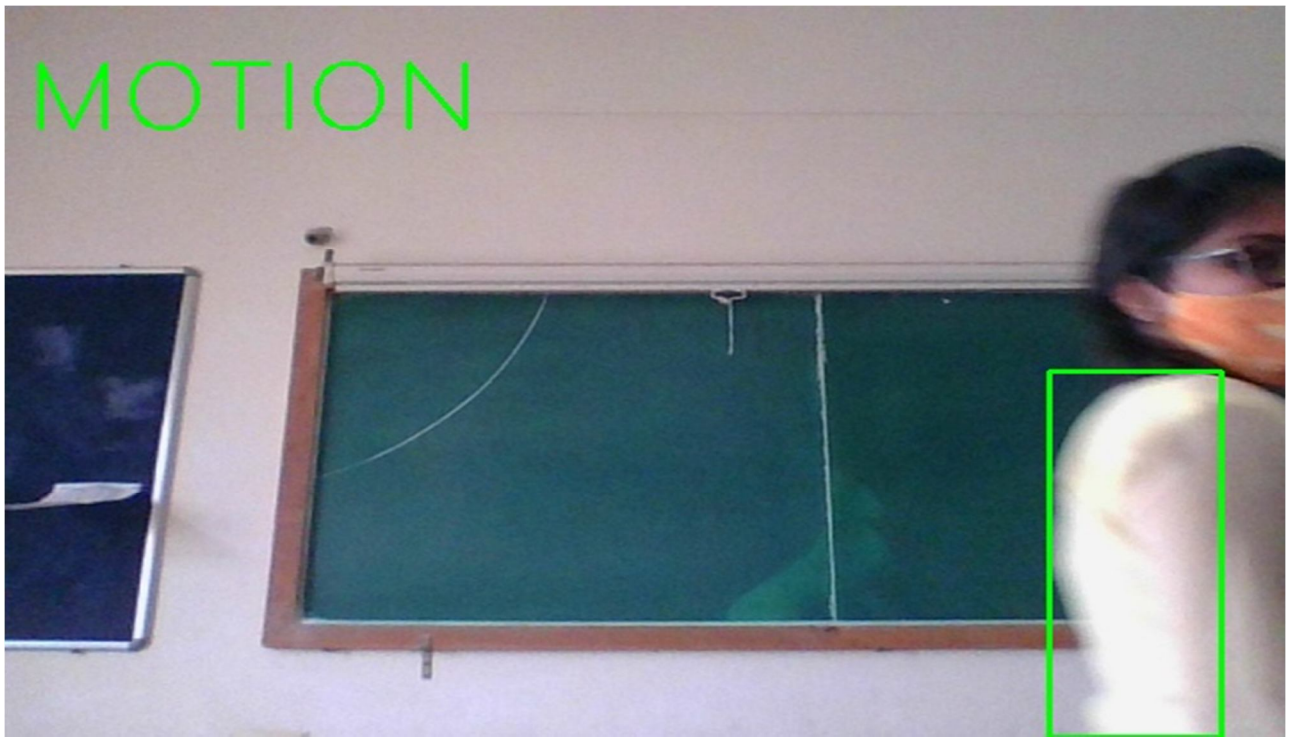
A. Theft Detection



B. Motion







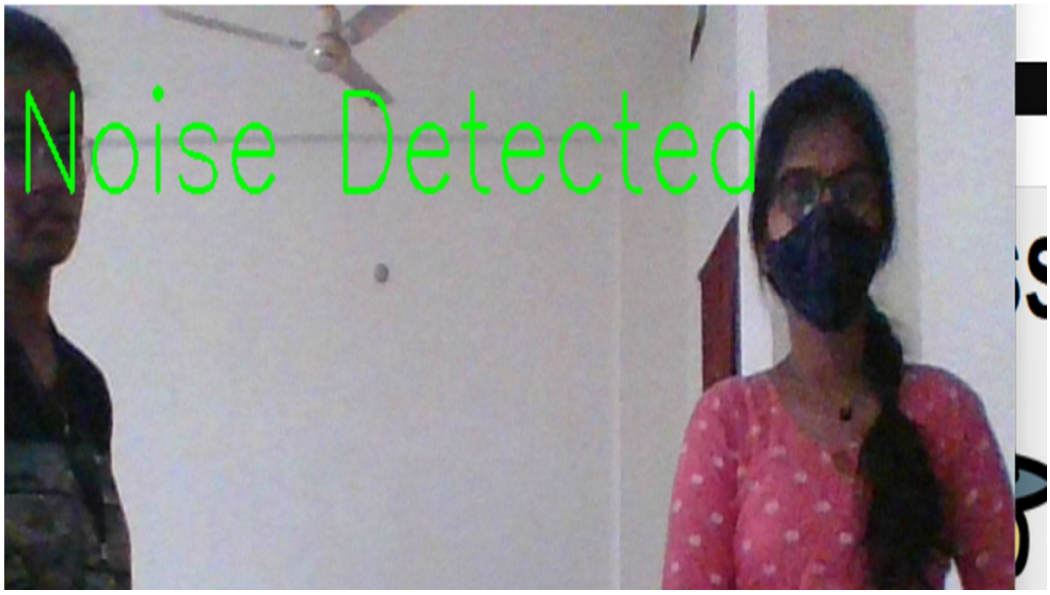
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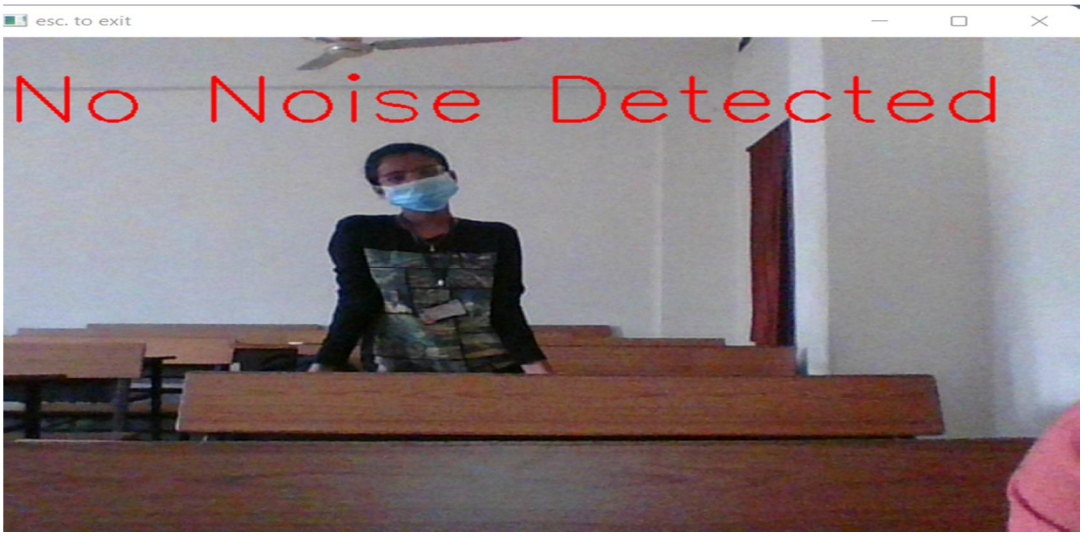
C. Motion In Frame



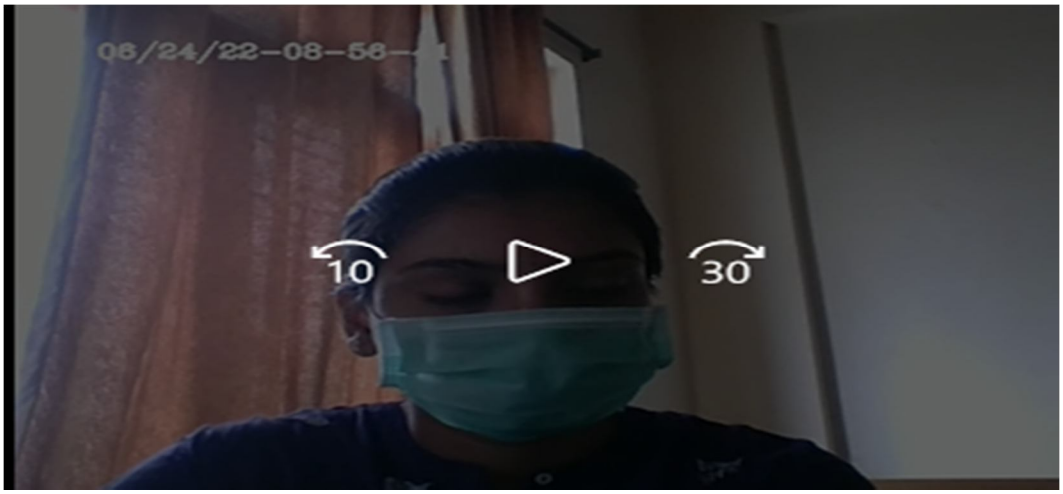
D. Noise Detection



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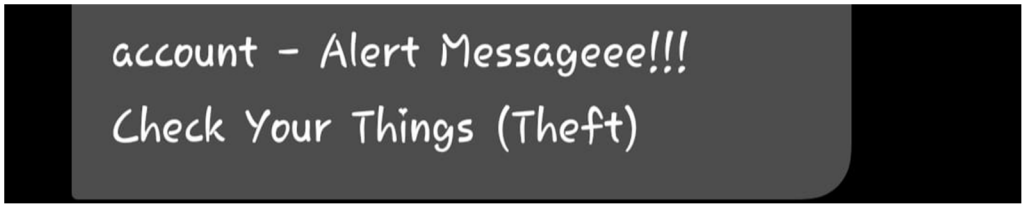


E. Recording





F. Message Alert



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VIII. FUTURE SCOPE

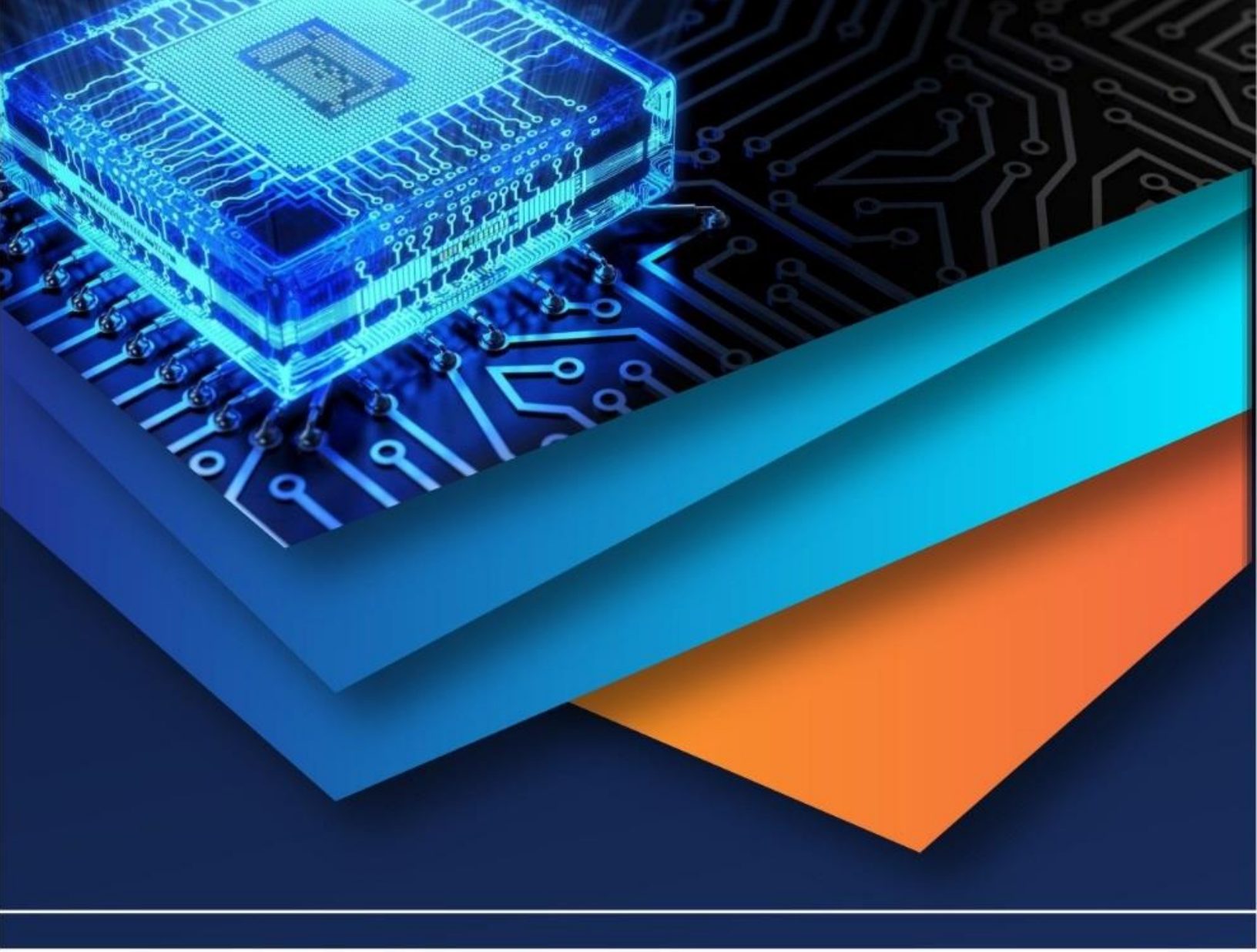
Based on technological advancements, such as the capacity to combine tiny size and high processing power, this project has a wide range of applications. The project's future exercises are listed below.

1) Building mobile CCTV.
2) Including built-in night vision.
3) Including deep learning if you have a powerful device.
4) Additional features, such as the ability to detect deadly weapons, accidents, fires, and standalone devices.

The project would have a considerably wider scope if DL support were included because we would be able to incorporate much more functionality.

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