Motion Detection Using Background Subtraction

Submitted in partial fulfillment of the requirements for the award of the degree of

Bachelor of Computer Engineering

By

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Under the Guidance of

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UNIVERSITY OF MUMBAI

CERTIFICATE

This is to certify that the Mini Project 2B entitled **“Motion Detection Using Background Subtraction”** is a bonafide work of **“Meet Shah” (19102049), “Hemant Parakh” (19102048), “Vikas Kumar Sethiya” (19102028), “Aryan Agarwal” (19102037)** submitted to the University of Mumbai in partial fulfillment of the requirement for the award of the degree of **Bachelor of Engineering in Computer Engineering.**

(Prof. Brinal Colaco)
Guide

Prof. Sachin H Malave	Dr. Uttam D.Kolekar
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Project Report Approval for SE/TE

This Mini Project Report entitled **“Motion Detection Using Background Subtraction”** was Submitted by **“Meet Shah” (19102049), “Hemant Parakh” (19102048), “Vikas Kumar Sethiya” (19102028), “Aryan Agarwal” (19102037*)*** is approved for the partial fulfillment of the requirement for the award of the degree of **Bachelor of Engineering** in **Computer Engineering** from **University of Mumbai**.

External Examiner(s)

1.

2.

Place: A.P. Shah Institute of Technology, Thane
Date:

Declaration

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included, we have adequately cited and referenced the sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source of your submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

Meet Shah, 19102049

Hemant Parakh, 19102048

Vikas Kumar Sethiya, 19102028

Aryan Agarwal, 19102037

Date:

ABSTRACT:

Background subtraction is a procedure that separates stationary objects from the transferring items at the scene. It plays a significant role in computer vision applications. In this study, several background foreground segmentation algorithms are analyzed by converting their crucial parameters individually to see the sensitivity of the algorithms to some difficulties in background segmentation applications. These difficulties are illumination level, view angles of the camera, noise level, and range of the objects. This study is mainly comprised of two parts. In the first part, some well-known algorithms are explained and implemented by providing implementation details. The data set videos having different scenarios are run for each algorithm to evaluate the performances. The second part includes creating a Motion Detection with the best algorithm for background subtraction. Finally, the overall performance of the algorithm in conjunction with the premiere values of the parameters is given.

Keywords: Motion Detection, Background Subtraction, Mixture of Gaussians, CNT, GMG, KNN

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PROBLEM STATEMENT:

To examine the contemporary body through both subtracting it from a reference body or fitting it to a background model. This approach goals to categorize every of the frame's pixels as either a background or a foreground. Moving object detection has these days come to be the point of interest region of studies within-side the field of computer vision. This is mainly because of its application in tracking items, video surveillance, pedestrian detection, human counting, and self-driving cars. Background subtraction is one of the best and quickest strategies for detecting shifting items in non-stop video sequences. It evaluates the contemporary body by both subtracting it from a reference body or fitting it to a background model. This technique aims to classify each of the frame's pixels as either a background or a foreground (moving objects). This paper reviews multiple state-of-the-art background subtraction algorithms and their principle of background modeling. It additionally evaluates these algorithms by comparing their efficiency and accuracy in different environments and scenarios, to discover their strengths and weaknesses, and through the usage of the best algorithm, a Motion Detection program is created.

INTRODUCTION:

The background subtraction approach reveals moving objects and reconstructs the background from video sequences. The background subtraction has vast real-world applications. Most of the background subtraction research has been centered on increasing the accuracy whilst reducing the complexity. This study can be used in industry and academics. Also, we implemented and assessed the performance of the different types of background subtraction algorithms CNT (CouNT), GMG (Godbehere-Matsukawa-Goldberg), MOG (Mixture of Gaussian), KNN (K–Nearest Neighbor–based Background Segmentation Algorithm), MOG2 (Mixture of Gaussian version 2) and the reference algorithm of thresholding were tested. This study shows the advantages of the MOG2 algorithm. Overall, this study not only helps better understand which type of videos each method suits best but also estimates how higher-state-of-the-art strategies are in comparison to fundamental background subtraction techniques. All algorithms are available in the OpenCV library and were all coded in Python language. We analyzed seven videos, to compare the algorithms. We aim to identify how properly the algorithms perform in detection and segmentation whilst the use of the processing time to assess the effect on the computational device.

The implementation of a stand-alone system developed in python language for movement detection has been discussed. The open-source OpenCV library has been tailored for video surveillance image processing as a result of enforcing the Subtraction algorithm called the foreground subtraction algorithm. Generally, the area of interest of a body or object to hit upon is associated with specific items (people, cars, etc.) emphasized in a background. This approach is widely used for monitoring a moving object. In particular, the Background Subtraction function, find Contours, has been followed to detect the contours. After a full design of the image processing prototype, different motion tests were carried out. The results confirmed the importance to consider a few sensitivity factors to obtain higher accuracy in motion detection additionally concerning minor movements. For small objects in motion will be detected a low percentage of sensitivity factors. Experimental results prove that the setting condition is the principal feature of the typology of moving objects rather than the light conditions. The proposed prototype program is appropriate for video surveillance smart cameras in commercial structures. Background subtraction is the first and one of the most important parts of automatic vision systems used in visual surveillance, motion detection applications, human-computer interaction systems, and many more real-world use cases. The background subtraction procedure means the comparison of the current frame with the reference background model. If a pixel in the current frame is matched to the background model, it is known as background. Nonetheless, it is a foreground pixel. After this technique, the masks displaying the simplest foreground items are obtained for the object analysis process. Primitive strategies that have been now no longer capable of cowl the entire foreground pixel. However, because of the demanding situations in background subtraction which include illumination changes, webcam noise, non-static backgrounds, shadows, and climate conditions (rain, snow) arise, those strategies continue to be insufficient to deal with those varieties of difficulties.

OBJECTIVES:

The main goal of this study is to deeply understand the responses of background subtraction algorithms against their parameter changes and the different videos which contain shadows, periodic motion, camera noise, and non-static background and then use the best algorithm to create Motion Detection.

LITERATURE REVIEW:

For the detection of the foreground objects, and also the modeling of the background, background subtraction is an important method. Many research papers can be found on how the subtraction of the background plays a vital role in computer vision. Different techniques have been presented to deal with background subtraction issues [2] , [4] , [8] . Various background subtraction techniques gave different results, and those results were examined. The results were dependable with a comparison of performance which showed that the MOG2 model was durable in real-time air tracker in any changing outside environment. Although in this report, different techniques gave simultaneous results according to the performance and had distinctive superiority among them still MOG2 was detected way more accurately. Similarly, one paper proposed the Mixture of the Gaussian (MOG) method [13] . MOG has a low rate of suitability, complexity, and memory consumption to detect the object in the outdoor environment. This algorithm is way more adaptive and sturdy withinside the background subtraction method and can handle multi-modal distributions [4] . A comparative survey between these techniques is acknowledged to improve the nature and ability of every technique in extricating pixels and following the specific situation of the item. A correlation investigation of 5 techniques of foreground abstraction is received in this study to separate the moving object from the stationary ones the techniques are: MOG, MOG2, KNN, CNT, and Geometric Multigrid (G.M.G.) [2] . The results obtained from MOG2 were the best ones, the results of MOG were also satisfying, and the results gathered from GMG and KNN were not satisfying. CNT was the one with the fastest execution. On the contrary, the main advantage of the algorithms used for the background subtraction is that they are vigorous against the movement of the background, for instance, the moving branches of a tree and leaves. Without destroying the prevailing background version, objects are allowed to emerge as a part of the background. Frame difference BS has specific advantages which include: objects with uniformly distributed intensity, and its computationally reasonably-priced and quite adaptive background version. Moreover, the MOG2 method monitors multiple Gaussian distributions simultaneously. MOG2 preserves a density function for every pixel. It can cope with multi-modal background circulations. Since MOG is parametric, the model parameters can be adaptively updated without keeping a large buffer of video frames [4] . With the implementation of KNN BS, it is straightforward and smooth to use, additionally easy to understand, and may be used for classification or regression. Not subtle to outliers. Obtained outcomes confirmed that the presented test case detected the motion of an object correctly and adequately [16] .

LIMITATION OF THE CURRENT SYSTEM:

Color cameras are based on sensors like CCD or CMOS, which provide a reliable illustration of the scene with high-resolution images. Background subtraction using this kind of sensor usually ends up in a particular separation between foreground and background, even though well-known scene background modeling challenges for moving object detection should be taken into account [10] :

- Challenges in the implementation: The computation time needs to be as low as possible because most of the applications require real-time detection.
- Color Camouflage: Once videos embody foreground objects whose color is incredibly near to that of the background, it's arduous to supply an accurate segmentation primarily based on color.
- Illumination Changes: The challenge is to adapt the color background model to strong or delicate illumination changes to attain a correct foreground detection.
- Intermittent Motion: The problem is to detect foreground objects though they stop moving (abandoned or go static) or if they were initially stationary then start moving (removed objects).
- Moving Background: The challenge is to model not only the static background but also slight changes in the background that are not interesting for surveillance, such as waving trees in outdoor videos.
- Color Shadows: The challenge is to discriminate foreground objects by shadows cast on the background by foreground objects that behave as moving objects.

Even though depth facts solve a number of the previously highlighted background maintenance issues, being unbiased of scene color and illumination conditions, it suffers from numerous problems, free of which technology is used for its estimation. Indeed, as for color data, depth data suffers from bootstrapping, intermittent motion, and moving background [3] .

Table 1: Qualitative Aspects of the Video Dataset

	Night CCTV	**People**	**Car Park**
Range	*Medium*	*Short*	*Long*
Noise Level	*Medium*	*Low*	*High*
# of Highly Illuminated Regions	*Low*	*High*	*Medium*
# of Shadowed Foreground Objects	*Low*	*High*	*Medium*
# of Non-static Background objects	*High*	*Low*	*Medium*

TECHNOLOGY STACK:

- Windows 10
- Programming language: Python
- Webcam,
- Dataset: http://backgroundmodelschallenge.eu/
- Tools: Visual Studio Code Editor, Notepad++

PROPOSED SYSTEM:

In this section, a comparison of various background subtraction techniques will be performed that can be used in different domains such as object tracking and fall detection, etc.

The aforementioned techniques are:

- Frame Difference Background Subtraction
- Mixture of Gaussian (MOG & MOG2)
- GMG Background Subtraction
- KNN Background Subtraction
- CNT Background Subtraction

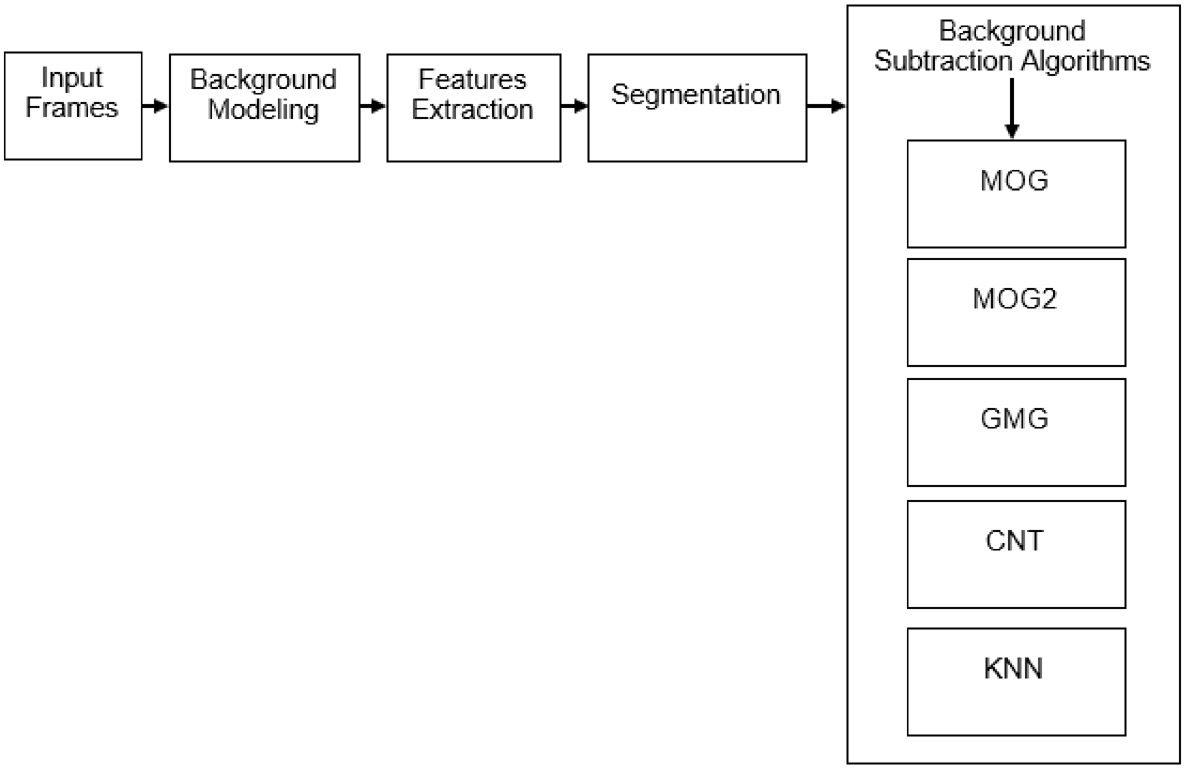


Figure 1. Proposed Methodology

A. Background Modelling: For the background subtraction algorithm, the background model is necessary. For the incoming video frames, background modeling can be used as a reference. Moreover, the background model has a significant job since video frames are ordinarily not liberated from the foreground during the starting stage. As an outcome, the model gets ruined by foreground objects away from the background model, which gives incorrect classifications.

$$D_k(x,y) = \begin{cases} 1 & \\ & if|f_k(x,y) - f_{k-1}(x,y)| > T \\ 0 & \end{cases}$$

Figure 2. Equation 1

B. Feature Extraction: The relevant information which is represented by the adequate features must be selected, so to compare the video frames with the background image. RGB and grayscale intensities are used as features by many algorithms. In a few of the cases, the intensity of pixels and some other features are joined. Moreover, it is important to select a choice feature region. Features may be extracted over the blocks, patterns, or pixels. Features that are pixel-wise mostly yield segmentation results that are noisy since they don't encode local relation, while the pattern-wise and the block-wise features are likely to be indifferent to minimum changes.

C. Segmentation: Video frames can be processed with the help of a background model. By extracting the features from corresponding pixels, background segmentation can be performed or region of the pixels of both the frames and utilizing an extension range, such as the Euclidean distance, to calculate the similarities between the pixels. With the similarity threshold and after being compared, each pixel is either labeled as foreground or background. The formation of overall background subtraction system is formed by the combination of those building blocks. The strength of the system is constantly relying on and bounded by the performance of every individual block, i.e., it cannot be expected to perform well if one module delivers poor performance. Background subtraction is a very vast field, in this way, there exist several algorithms for this purpose.

$$P(X_t) = \sum_{i=1}^{k} \omega_{i,t}.\eta(X_t, \mu_{i,t} \sum i.t)$$

Figure 3. Equation 2

D. Frame Difference: This technique is achieved by taking the difference between two pictures to decide the existence of moving objects. It can be said that it is the easiest form of background subtraction. Frame difference, otherwise called temporal difference, utilizes the video outline at time t-1 as the background model for a frame at time t. For a given video sample, take the first frame and then find the absolute difference with another frame. First, by taking the difference between the corresponding pixels of the k frame and the k-1 frame using Equation 1, a binary difference image is obtained. T represents the threshold. In the first image, foreground points are considered as one value pixels while background points are considered as zero value pixels.

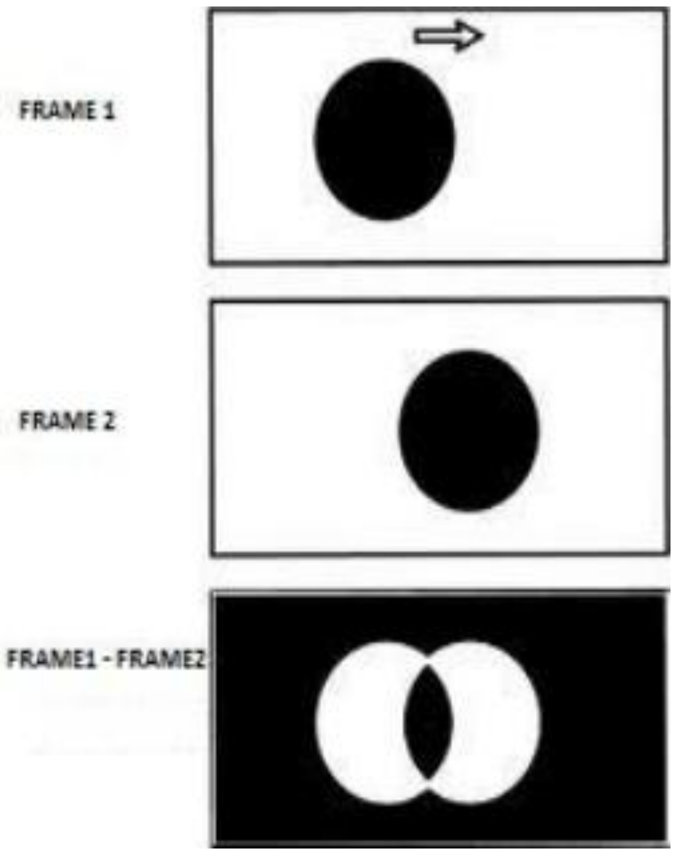


Figure 4. Frame Differencing between two consecutive frames and the result of this process

E. Image Thresholding: In this method, the pixel values of a grayscale image are assigned one of the two values representing black and white colors based on a threshold. So, if the value of a pixel is greater than a threshold value, it is assigned one value, else it is assigned the other value. It will apply image thresholding on the output image of the frame differencing. The resulting image is called a binary image as there are only two colors in it.

F. Finding Contours: The contours are used to identify the shape of an area in the image having the same color or intensity. Contours are like boundaries around areas of interest. There would be white regions that would be surrounded by grayish boundaries which are nothing but contours. We get the coordinates of these contours. This means we can get the locations of the highlighted regions. There are multiple highlighted regions and each region is encircled by a contour. The contour having the maximum area is the desired region. Hence, it is better to have as few contours as possible. The idea is to merge the nearby white regions to have fewer contours and for that, we can use another technique known as image dilation.

G. Mixture of Gaussians, or MOG: In this method, a mixture of k Gaussian distributions models each background pixel, with values fork between 3 and 5. Assuming that different distributions represent each different background and foreground colors. The weight of each one of those used distributions on the model is proportional to the amount of time each color stays on that pixel. Therefore, when the weight of a pixel distribution is low, that pixel is classified as foreground. The MOG implementation has input parameters that standardize the behavior of the MOG.

```
#code snippet
cv2.bgsegm.createBackgroundSubtractorMOG(
                                        history=300,
                                        nmixtures=10,
                                        backgroundRatio=0.9,
                                        noiseSigma=0)
```

The parameter history is responsible for the number of frames the method will use to gather weights on the model, throughout the entire processing period. Low values result in increased sensitivity to sudden changes in luminosity. The parameter mixtures indicate the method and how many Gaussian distributions it should during the whole video. Higher values extremely increase processing time. The parameter background ratio defines the threshold weight for the differentiation between foreground and background. Lower values may incur false objects. Low values create false objects.

H. MOG2: One of the most common and popular background subtraction techniques is the Gaussian Mixture Model. This algorithm is used for the segmentation of foreground/ background. Previously in a paper, proposed a scheme for the representation of background which is pixel-wise by the usage of Mixture of Gaussian (MOG) and the updating background to upgrade the variance and intensity of the mean for each pixel simultaneously. Based on the learning factor, the parameters of the model are updated. The least probable model is eliminated If no match is found and with the current pixel values are replaced by a new Gaussian. For moving background scenes having multiple background variations, the MOG-based methods are effective but they are sensitive to illumination changes and noise. By mixing Gaussian the authors modeled the background, so to find a match at a particular location, where every pixel is compared to existing models.

```
#code snippet
cv2.createBackgroundSubtractorMOG2(
                              history=300,
                              varThreshold=400,
                              detectShadows=True)
```

Given the formula of segmentation, the probability of observing the current pixel value is measured in a multidimensional case. Where K is the no. of distributions, w(i,t) weight linked to the ith Gaussian at time t having to mean u(i,t), n standard deviation, is probability density function. MOG2, a new and updated version of MOG applies the same approach as in older MOG with some added features. For each pixel, the convenient number of Gaussian distribution is selected on its own. The option of selection of shadow to be detected or not is also present. Due to changes in illumination, it gives better adaptability to different scenes. Sometimes, in the background scenery, there are often some non-static objects like branches and leaves of trees, which are showing movements due to the wind. This type of background movement shows the pixel intensity varies considerably, therefore in this type of situation, the representation of pixel intensity will not be considered by a simple Gaussian.

I. The GMG algorithm models the background with a combination of Bayesian Inference and Kalman Filters. The first stage of the method accumulates, for each pixel, weighted values depending on how long a color stays in that position. For every frame, new interpretations are added to the version, updating these values. Colors that stay static for a determined interval of time are considered background. The second stage filters pixels in the foreground to reduce noise from the first stage. The Python implementation of the GMG method has input parameters that may be modified.

```
#code snippet
cv2.bgsegm.createBackgroundSubtractorGMG(
                                initializationFrames=10,
                                decisionThreshold=0.8)
```

The parameter initialization frames indicate how many frames the algorithm is going to use to initialize the background-modeling method. During the initialization, the resultant frame is always black. The more frames used in this phase, the more stabilized the initial model is. The parameter decision threshold determines the threshold at which pixels are classified as background or foreground. In the first stage, when the algorithm collects values based on the time interval a color remains static, every pixel with a lower weighted value than the threshold is considered part of the background. Choosing high values for this parameter may result in loss of object detections.

J. KNN Background Subtraction: As the name indicates, it is a KNN-based background/ foreground segmentation algorithm. Previous papers present the density estimation method, which is also known as the KNN method and is more efficient for local density estimation. The density estimation formula approximately

$$[t]p(x|x_i) \approx \frac{1}{NV} \sum_{m=1}^{N} b^m K \left(\frac{||x_i - x||}{D} \right)$$

Figure 5. Equation 3

Here, K is the kernel function, subject to a uniform distribution. If u < 1=2, then the kernel K(u) = 1, otherwise 0. If the video sequence sample is assigned to the foreground, the value of b^m is 0. The background model only deals with samples that satisfy b^m and are classified as background. As it can be seen in Equation 4, where, if

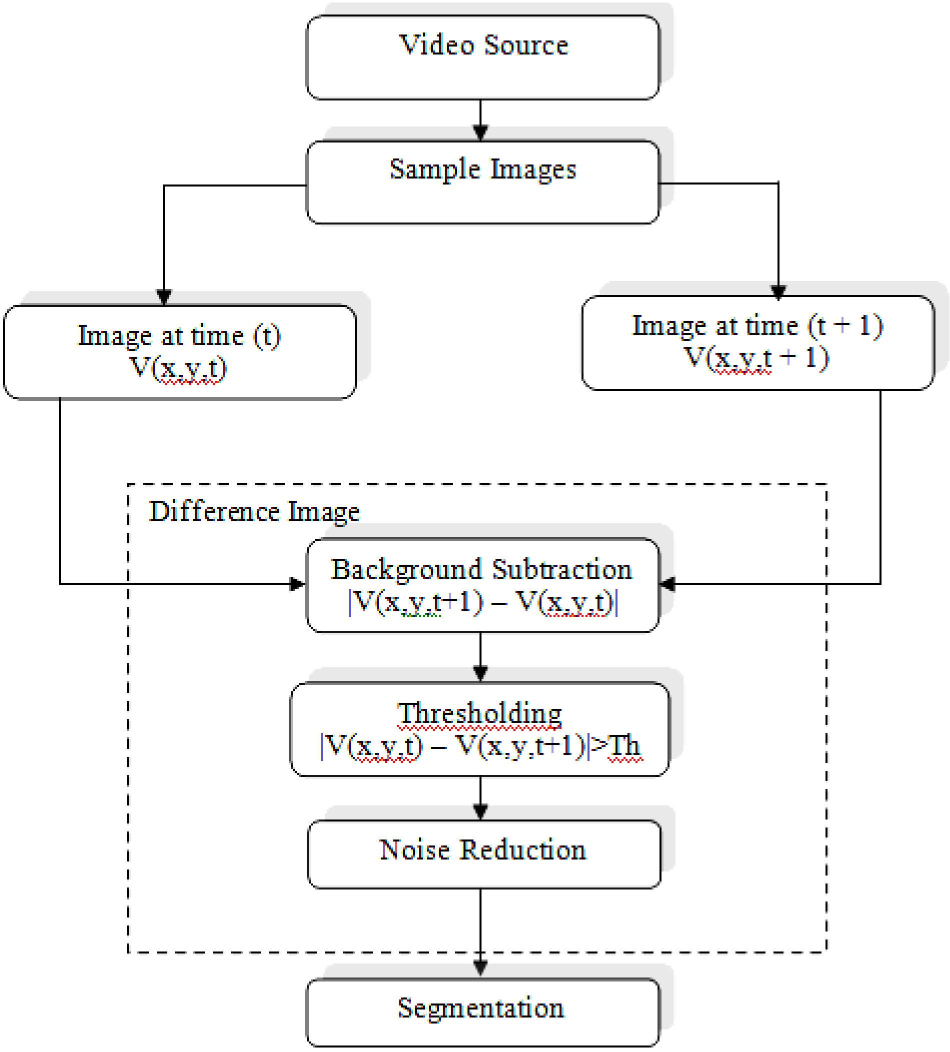
P(x|xi) is greater than a certain threshold of T, the pixel is considered the background. And the choice of T is closely related to the value of V.

```
#code snippet
cv2.createBackgroundSubtractorKNN(
                    history=300,
                    varThreshold=400,
                    detectShadows=True)
```

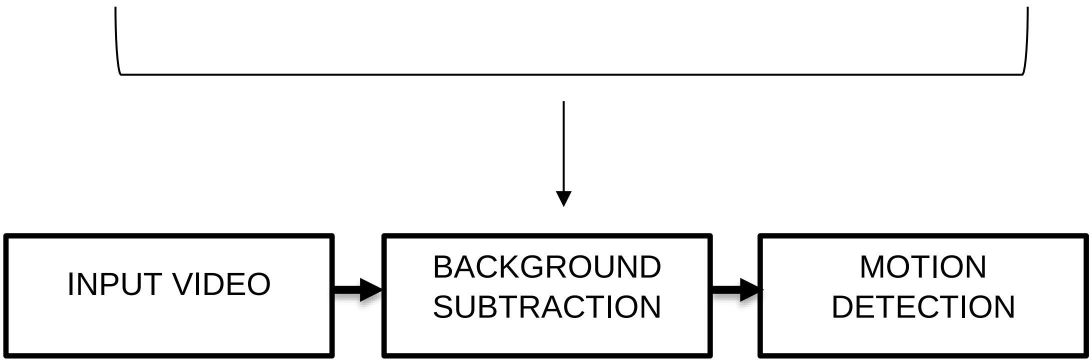
K. BackgroundSubtractorCNT is a replacement API for the background subtraction solutions supplied with OpenCV. It is much quicker than any other background subtraction solutions in OpenCV (without NVidia CUDA) on low spec hardware. It has both a C++ API and a python API. A drop-in replacement means you simply change a single line of your code to get this amazing speed development. It is using an innovative new algorithm. It is compared here to MOG2 which is the previous fastest at the time of writing.

```
#code snippet
cv2.createBackgroundSubtractorCNT(
                    pixelstability=300
                    history=True,
                    varThreshold=400,
                    detectShadows=True)
```

DATA FLOW DIAGRAMS (DFD):



FIRST PART OF THE PROJECT



SECOND PART OF THE PROJECT

Figure 6. DATAFLOW DIAGRAMS
1. BACKGROUND SUBTRACTION PART
2. MOTION DETECTION PART

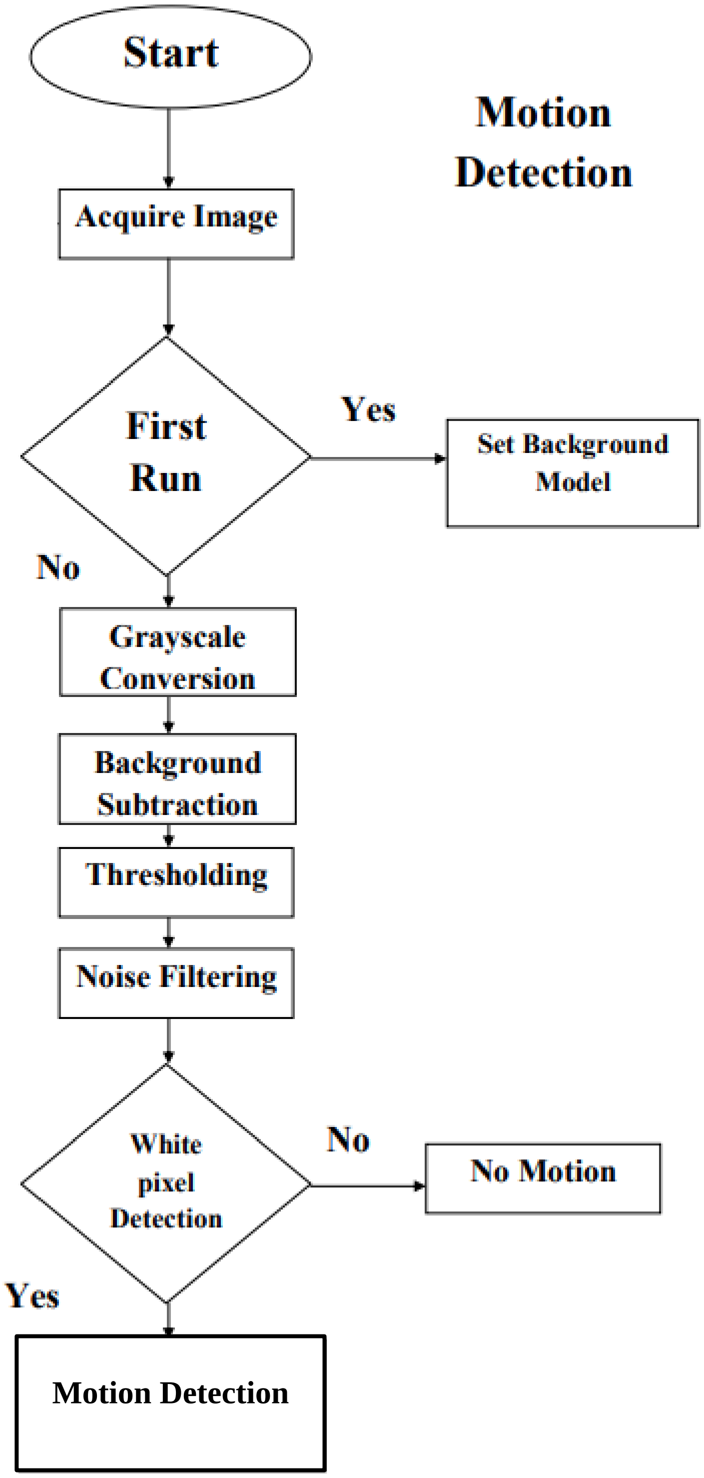


Figure 7. Flow Chart for Motion Detection

RESULTS:

This study presented the comparison and implementation of different background subtraction techniques i.e., frame difference, MOG, MOG2, GMG, KNN, and CNT background subtraction that are extensively being used in the field of computer vision. It is accomplished by methods for extraction of areas of interest in the foreground from video samples. We performed some experiments and got the performance evaluation of the aforementioned techniques. MOG2 showed good results on background subtraction tasks and achieved the best accuracy among other algorithms. KNN didn't perform well as compared to the other methods. CNT was the fastest to compute amongst others but still lacked accuracy.

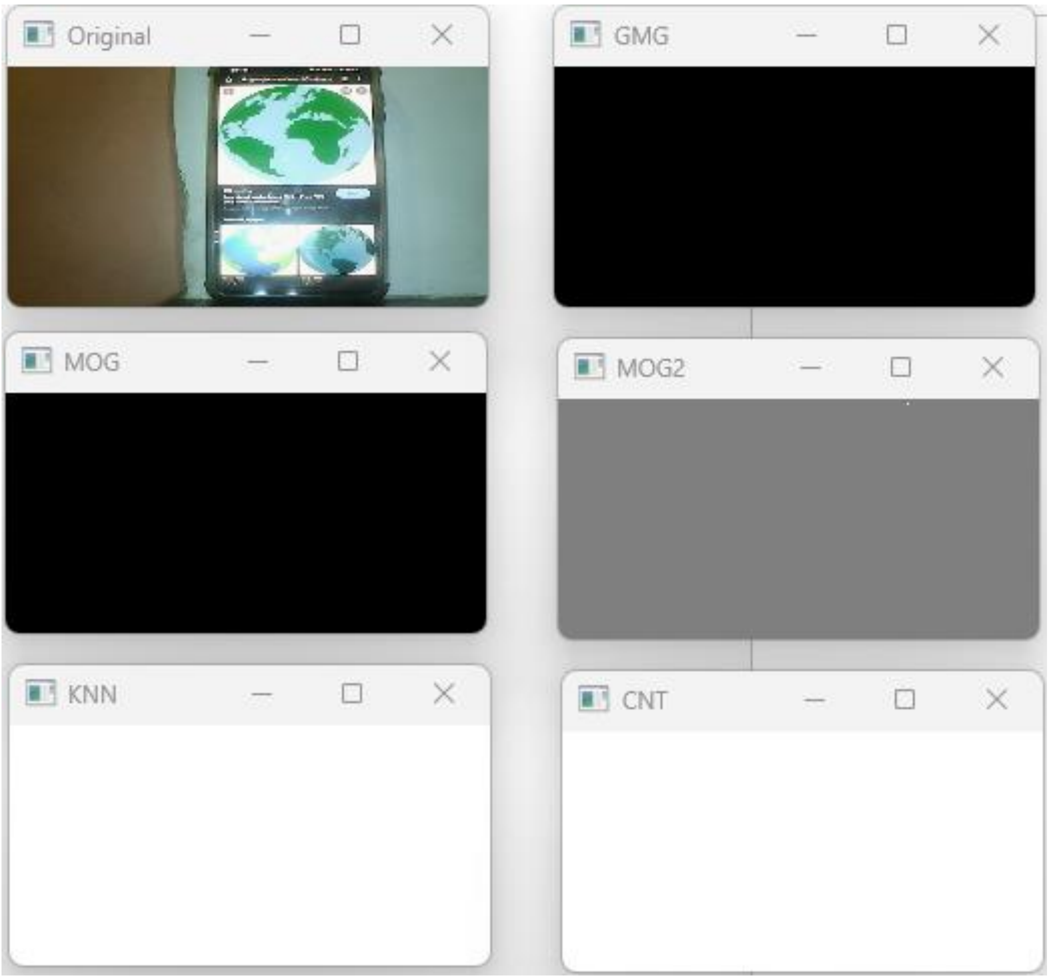


Figure 8. Initial captured Frame with other algorithms initialized

Here in the initial frame tab named "Original", an object is in a frame (a phone with a photo on display) and the other 5 tabs are the algorithm masked frame tabs. At this stage, the frame is initialized.

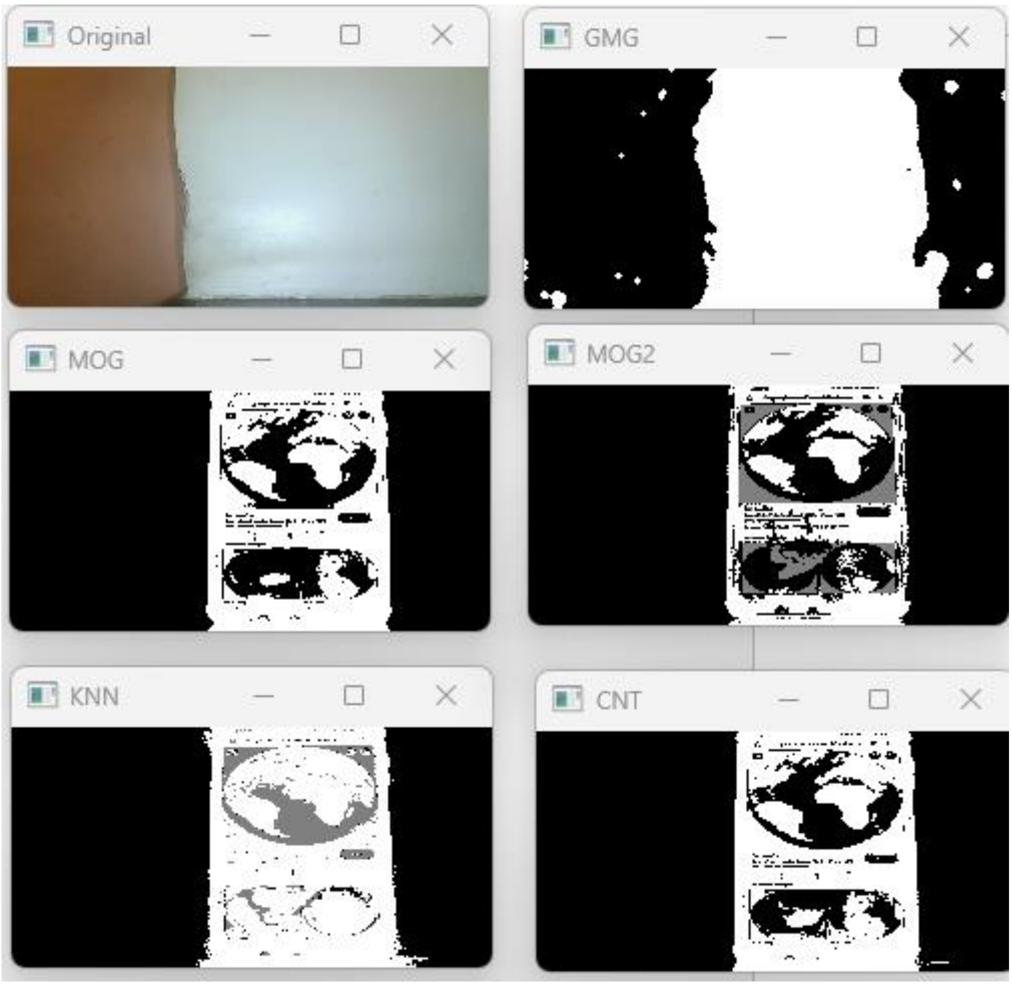


Figure 9. Frame captured after some movement and the resulting masked frames of 5 algorithms

Once a particular movement is registered, background subtraction, in general, plays its magic.

As you can see all the other tabs show masked frames after the movement and it's clear how MOG2 most accurately masks almost every detail.

Once we found MOG2 is the best algorithm for background subtraction we built a Motion Detection with MOG2 as our Background subtraction algorithm.

Figure 10. Dataset frame

Figure 11. Motion Detection on Dataset frame

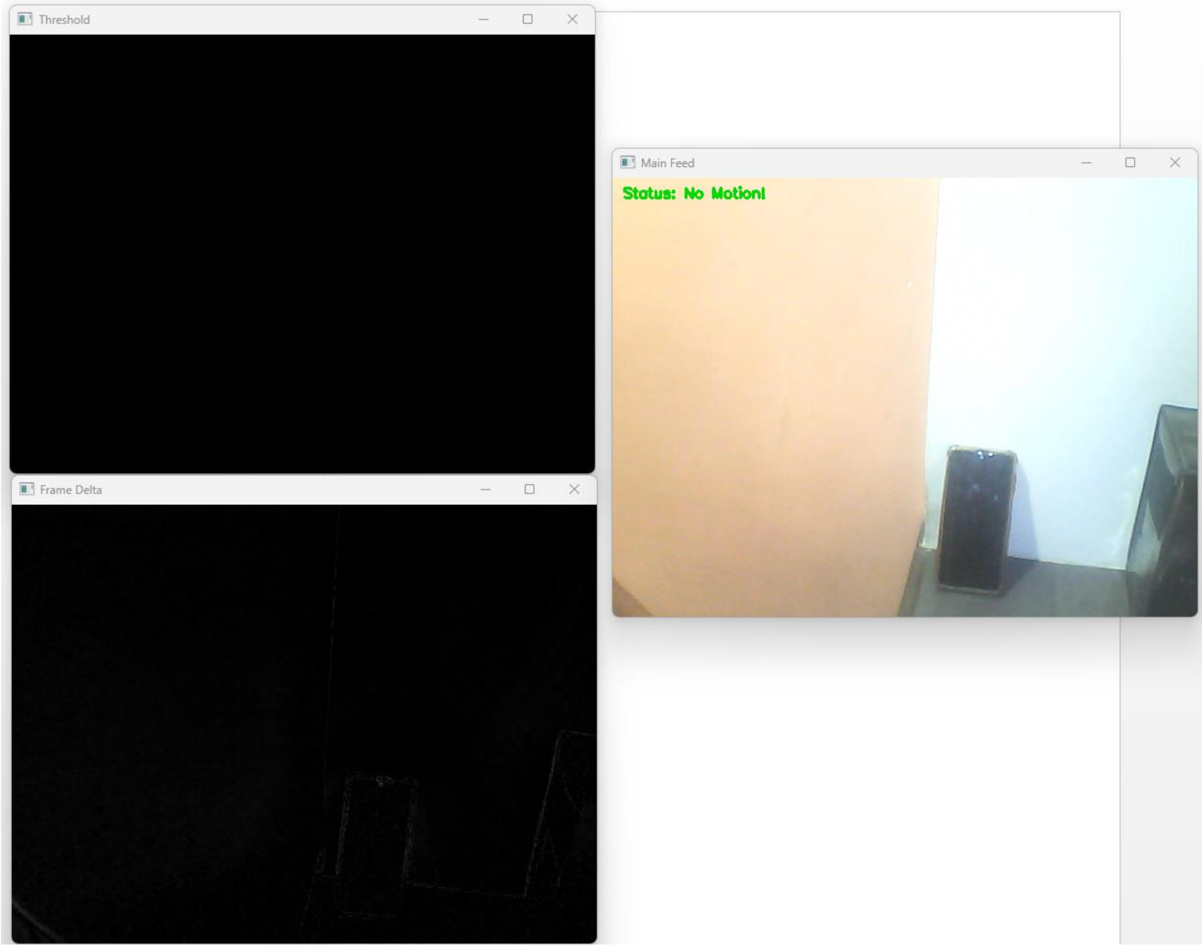


Figure 12. Motion Detection on LIVE webcam

As mentioned before according to the value of the threshold the image is converted to a binary image (white and black pixels)

The system developed in the project works well indoors. The motion detection algorithm is used to indicate the existence of motion in the. The tab shown in figure 12 is clicked to show the result of the motion detection algorithm.

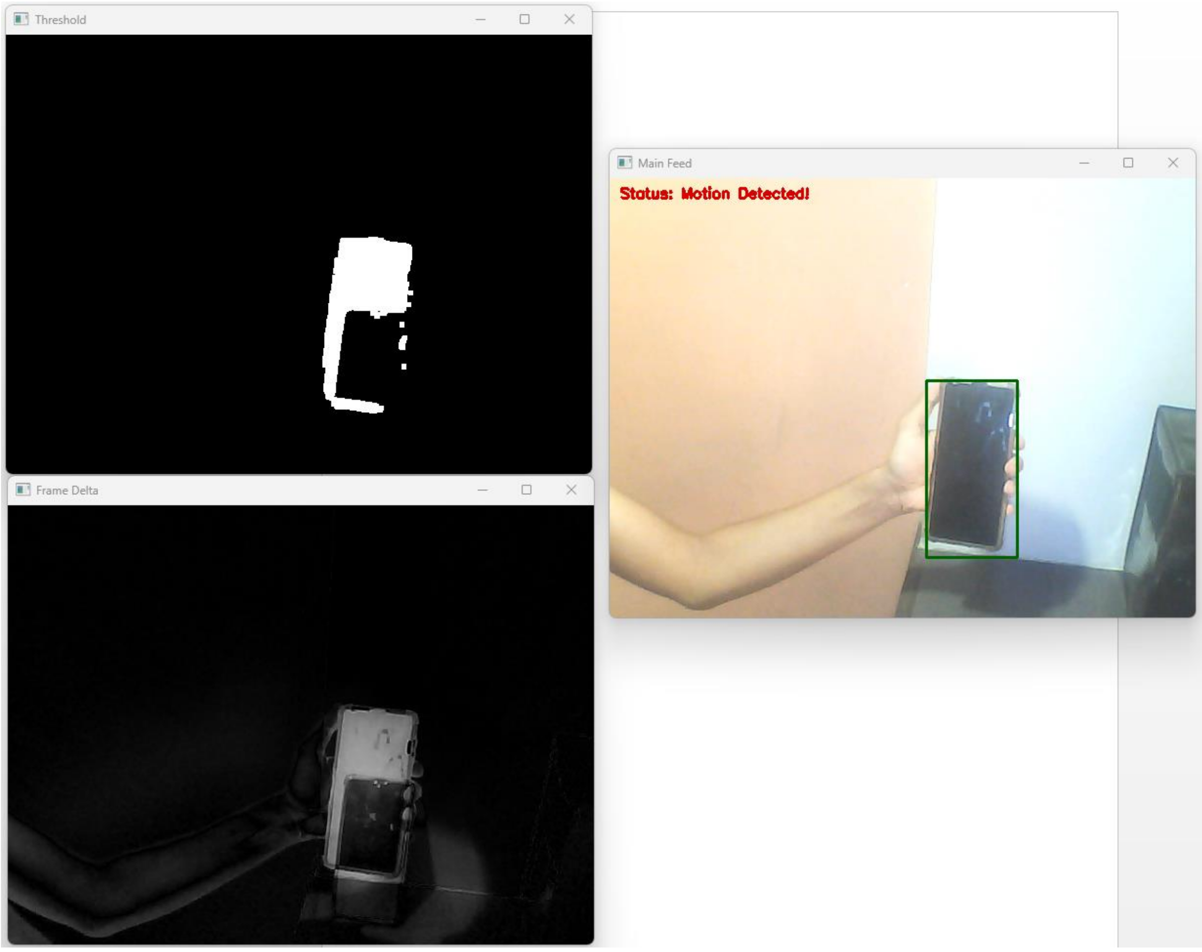


Figure 13. Motion Detection (showing detection)

If the number of white pixels (foreground) in a binary image reaches a certain value (or greater than it) the system shows a status update as Motion Detected! , Otherwise, nothing happens.

For future work, this study can also be implemented with some machine learning or deep learning algorithms for obtaining better accuracy for any large datasets.

REAL-WORLD APPLICATIONS:

Background Subtraction is primarily based on Applications Segmentation of static and transferring foreground objects from a video stream is the essential step in lots of computer vision programs for which background subtraction gives an appropriate answer which gives a very good compromise in terms of quality of detection and computation time.

- Visual Surveillance of Human Activities: The most common environments are traffic scenes for their evaluation to locate incidents along with stopped vehicles on highways or for traffic density estimation on highways which may be then categorized as empty, fluid, heavy, and jam. Background subtraction may be extensively utilized for congestion detection in city traffic surveillance, illegal parking detection, and the detection of loose parking places.

- Visual Observation of Animals and Insects Behaviors: The machine required for smart visible observation of animals and bugs need to be easy and non-invasive. Observing nature is the essential manner to gather statistics on biodiversity.

- Vision-based Hand Gesture Recognition: This application requires detection, tracking, and apprehending hand gestures for numerous applications along with the human-computer interface, behavior studies, sign language interpretation, and learning, teleconferencing, distance learning, robotics, video games selection, and item manipulation in digital environments.

- Military surveillance: Detection of transferring objects in military surveillance is regularly referred to as target detection. Most of the time, it used specific sensors like infrared cameras and Synthetic-aperture radar (SAR) imaging. In practice, the intention is to locate individuals and/or automobiles in tough environments and tough conditions.

CONCLUSION:

Classical computer vision strategies like background subtraction may be splendid additions to have in your back pocket to apply while appropriate. This paper had the objective to examine 5 of the to be had background-modeling algorithms on OpenCV, in Python, and decide which one might be better suited for our needs, primarily based totally on our videos and conditions, to section automobiles and many others. As a result, our assessments display that MOG2 has a higher overall performance equal to different examined algorithms and additionally solved the alternative tough problems confronted even as operating with such algorithms like Light conditions, Noise levels, and many others and eventually constructed a Live Motion Detection machine using MOG2 Background Subtractor.

Gantt Chart:

GANTT CHART TEMPLATE

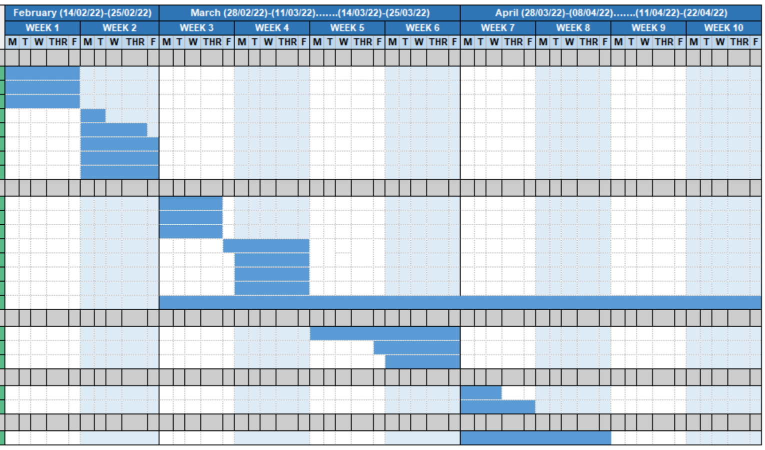
Smartsheet Tip → A Gantt chart's visual timeline allows you to see details about each task as well as project dependencies.

Motion Detection using Background Detection

PROJECT GUIDE Prof. Brinal Colaco

DATE 22/04/2021

WBS NUMBER	TASK TITLE	TASK OWNER	START DATE	DUE DATE	Working Number of days	PCT OF TASK COMPLETE
1	**Project Conception and Initiation**					
1.1	Problem search	Meet, Hemant, Aryan,	14-Feb-22	18-Feb-22	5	100%
1.1.1	Problem finalization	Meet, Hemant, Aryan,	14-Feb-22	18-Feb-22	5	100%
1.2	Project Title	Meet, Hemant, Aryan,	14-Feb-22	20-Feb-22	7	100%
1.3	Abstract	Meet	20-Feb-22	22-Feb-22	3	100%
1.4	Problem Definition	Hemant, Aryan	20-Feb-22	24-Feb-22	5	100%
1.5	Objectives	Meet, Hemant	20-Feb-22	25-Feb-22	6	100%
1.6	Technology stack	Meet, Vikas	20-Feb-22	25-Feb-22	6	100%
1.7	Benefits and Applications	Hemant	20-Feb-22	25-Feb-22	6	100%
2	**Project Design**					
2.1	Proposed System	Aryan, Vikas	28-Feb-22	3-Mar-22	4	100%
2.2	Design(Flow Of Modules)	Meet, Hemant	28-Feb-22	3-Mar-22	4	100%
2.3	Data Flow Diagram	Vikas	28-Feb-22	3-Mar-22	4	100%
2.4	Modules	Meet, Hemant, Aryan,	4-Mar-22	11-Mar-22	8	100%
2.4.1	Module-1	Meet, Hemant, Aryan	5-Mar-22	11-Mar-22	7	100%
2.4.2	Module-2	Meet, Aryan, Vikas	6-Mar-22	11-Mar-22	6	100%
2.4.3	Module-3	Meet, Hemant	7-Mar-22	11-Mar-22	5	100%
2.5	Preparation Of Report	Hemant, Aryan, Vikas	28-Mar-22	22-Apr-22	26	100%
3	**Project Implementation**					
3.1	Module-1	Meet, Vikas	14-Mar-22	25-Mar-22	12	100%
3.2	Module-2	Meet, Hemant, Vikas	18-Mar-22	25-Mar-22	8	100%
3.3	Module-3	Meet, Hemant, Aryan,	21-Mar-22	25-Mar-22	5	100%
4	**Testing**					
4.1	Design of Test Cases	Hemant, Aryan, Vikas	28-Mar-22	30-Mar-22	3	100%
4.2	Testing	Meet, Hemant, Aryan	28-Mar-22	2-Apr-22	6	100%
5	**Results and Analysis**					
5.1	Analysis Of Results	Meet, Hemant, Aryan,	28-Mar-22	8-Apr-22	12	100%



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