Intelligent Farm Surveillance System for Animal Detection in Image Processing using combined GMM and Optical Flow method

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***Abstract*— Intelligent farm surveillance system takes us to video level processing techniques to identify the objects from farms video. Many developed countries as well as developing countries are using intelligent farm surveillance system so that they can view the farm remotely from anywhere. In this thesis we are taking some of the videos from farm surveillance system and from that we detect animals and as the camera detects animal, alarm will ring. This can be useful to protect the farm from crop hazard by animals. In this thesis there is a brief survey of different object detection techniques as well as many background subtraction techniques like frame differencing, Kalman filter, single and mixture of Gaussian model, Optical Flow method and Combination of Gaussian mixture and Optical flow methods. Further for identifying object as animal there are different techniques like template matching, contour based technique, skeleton extraction, edge based technique, etc. But after survey of different methods and combining best feature of them, the system is proposed for animal detection. We use normalized cross correlation method for template matching to identify an object as animal. Proposed system uses the combination of Gaussian mixture model and Optical flow method for background subtraction.**

***Index Terms*— Surveillance, GMM, Optical Flow, Image Processing**

I. INTRODUCTION

Surveillance systems are widely used these days for a number of applications. Security surveillance system including CCTV is used due to increase of terrors and crimes. Surveillance systems are also used in many places for monitoring inappropriate behavior. Following are the places where surveillance systems are used:

1. Monitoring of banks, department stores, airports, museums, stations, private properties and parking lots for crime prevention and detection.
2. Patrolling of highways and railways for accident detection.
3. Detecting people, their activities, and related events such as over staying.
4. Measuring speed of vehicles.
5. Patrolling national borders.

Definition

The definition for the project is "Intelligent Farm Surveillance System for Animal Detection". The main goal of the proposed definition is to develop a prototype consisting of two cameras, placed in opposite direction, having different/overlapping FOV for real time detection and tracking the motion of animal and generate an alarm automatically when it enters any prohibited area.

Description

Video-based surveillance started with analog CCTV systems that supported black and white feeds from remote cameras connected to a central monitoring station. Human operators were entirely responsible for the processing of visual information streaming in from often multiple sources. Although there has been massive improvement in these systems, there still remains the complete dependence on human operators. Third generation surveillance systems (3GSS, 2000-) provide end-to-end digital systems. Image acquisition and processing at the sensor level, communication through mobile and fixed heterogeneous broadband networks and image storage at the central servers benefit from low cost digital infrastructure. The ultimate goal of 3GSS is to allow video data to be used for online alarm generation to assist human operators and for offline inspection effectively. To achieve this goal, 3GSS will provide smart systems that are able to generate real-time alarms defined on complex events and handle distributed storage and content-based retrieval of video data. 'Intelligent Surveillance Systems' requires fast, robust and reliable algorithms for object detection and tracking. The proposed definition aims to achieve the performance of the smart surveillance system to detect and track the motion of an animal in a prohibited area and automatically generate an alarm which will enable the human operators to take action quickly.

Scope of Work

- Cameras would be stationary.
- There will not be more than three cameras.
- Direction of motion of animal can be detected.
- System would produce results for videos taken during day time.

Need for the System

On express highways, the vehicles move at a very high speed. The boundaries of these highways are very low due to which there is a possibility of animals crossing the boundary and coming on the highway. This may result in major accident. In such a scenario the proposed framework would be helpful as it can detect the unwanted object and generate an alarm when it enters the area. Also in a huge campus like a college campus, residential area, office building or any other campus this framework will be beneficial.

II. COMPONENTS OF INTELLIGENT VIDEO SURVEILLANCE SYSTEM

Following Figure shows the working of IVS.

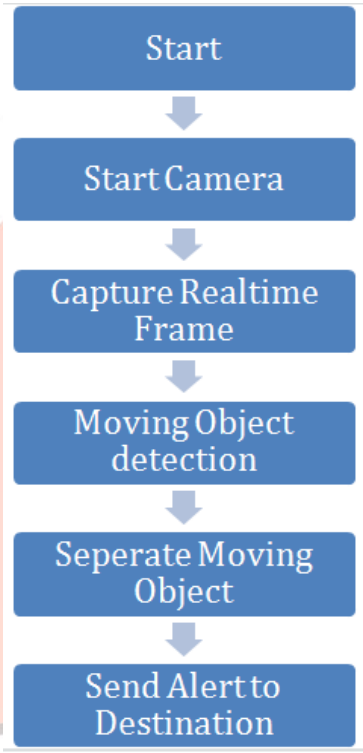


Figure 1: Working of Video Surveillance System

In IVS, there are six components. These components are listed below.

1. **Acquisition -**This component is essentially used for acquiring the images. There is a complete array of camera models so that we can meet different reviewing needs. They are analogue and digital, and can be power-operated or not. Solar cameras can also be used in many applications.
2. **Transmission -** The video captured by surveillance cameras must be sent to the recording, processing and viewing systems. We can do this transmission by cable (fiber optic or coaxial cables or copper wire) or by air (infrared signals).
3. **Compression -** Digitized video represents a huge amount of data to be transmitted and archived. So that, we must have to compress surveillance video using codec, algorithms to reduce the amount of data by deleting repetition , by image or between footage frames, as well as details that cannot be seen by a human eye.
4. **Processing -** Video management systems process video surveillance images, such as managing different video flow, and screening, recording, analyzing and searching recorded footage. There are four major types of video management systems, Digital Video Recorder (DVR), Hybrid Digital Video Recorder (HDVR), Network Video Recorder (NVR), IP video surveillance software.
5. **Archiving -** The video footage archiving time varies depending on observation needs, ranging from few days to few years. There are two types of archiving strategy, internal and attached.
6. **Display -** Video surveillance can be viewed on different devices. In small facilities, the video can be viewed directly on the recorder, as the image is to be recorded. Images are generally viewed distantly on computer or on a mobile device such as a telephone.

III. Proposed System

In the proposed system, it first fetches the current image from the stored video, then by using the background subtraction methods; the common background of farm trees are subtracted. Then from that image the object, for our purpose the animal can be detected and then animal tracking is taking place and at last alarm will be generated so that crops can be saved.

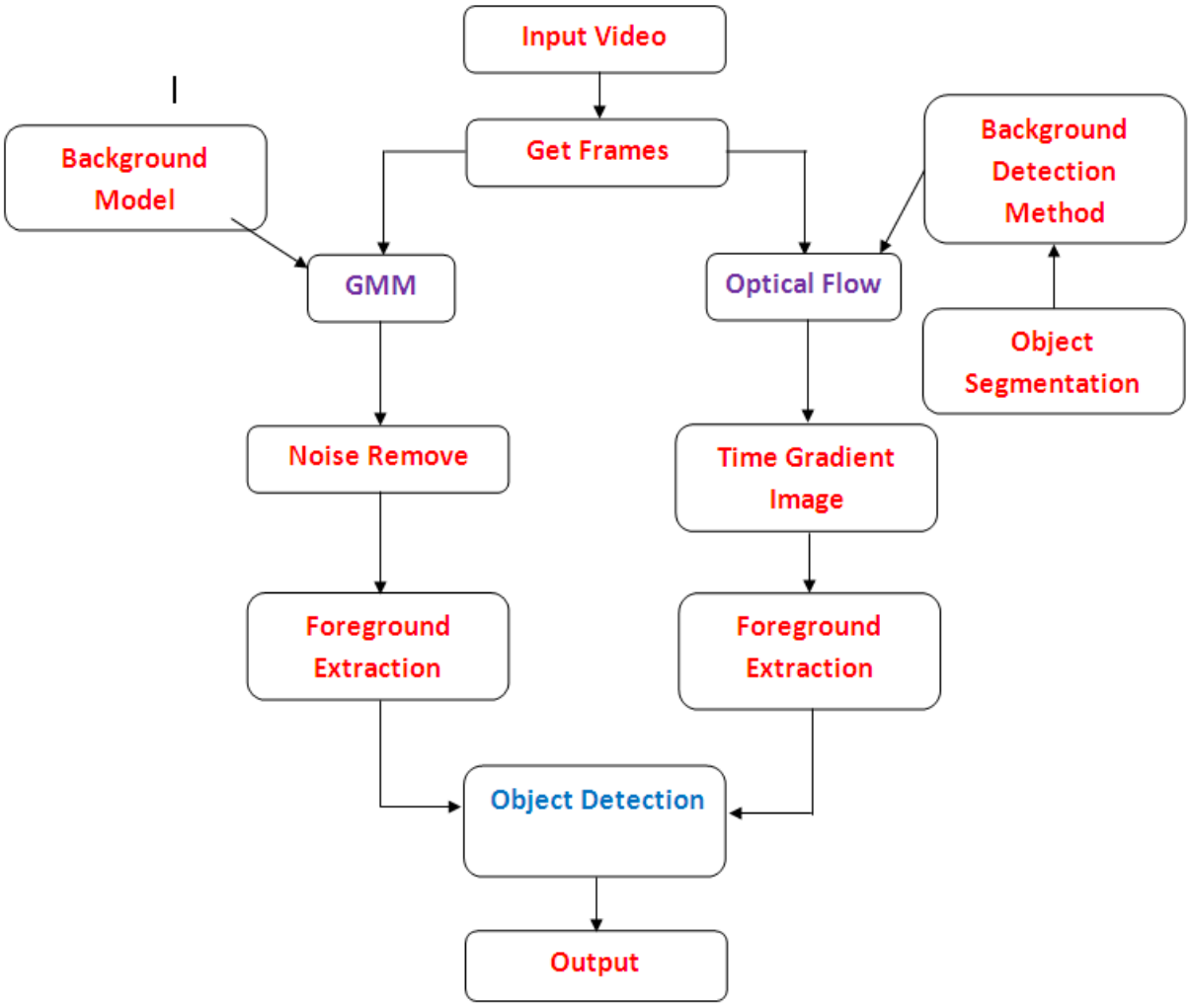


Figure 2: Block Diagram of proposed system

IV. Implementation

1st Video

Existing System Output

Proposed System Output

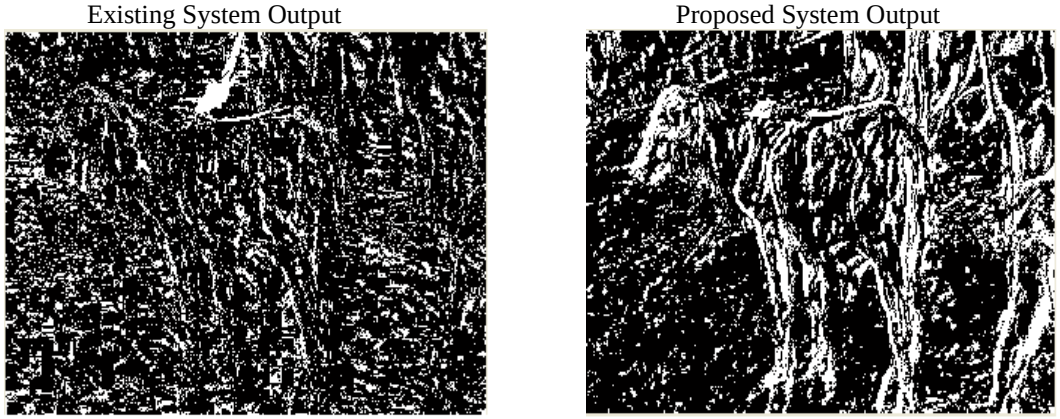
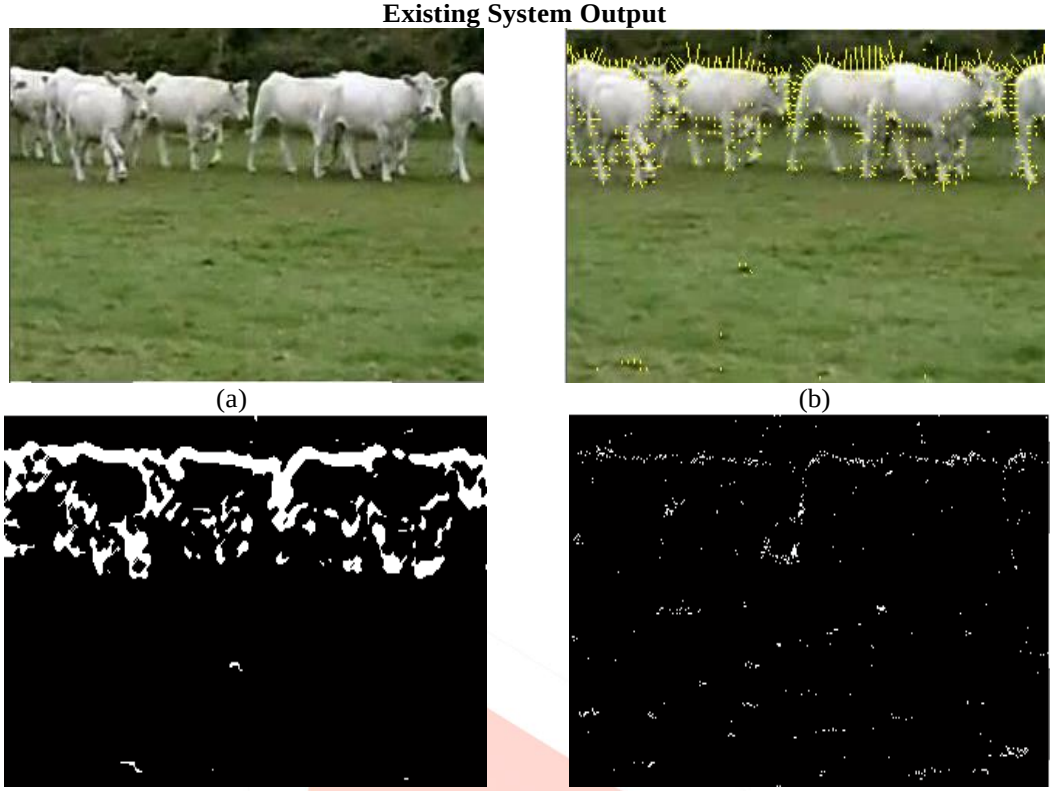


Figure 3: Comparison of output for existing and proposed system

2nd Video

Existing System Output

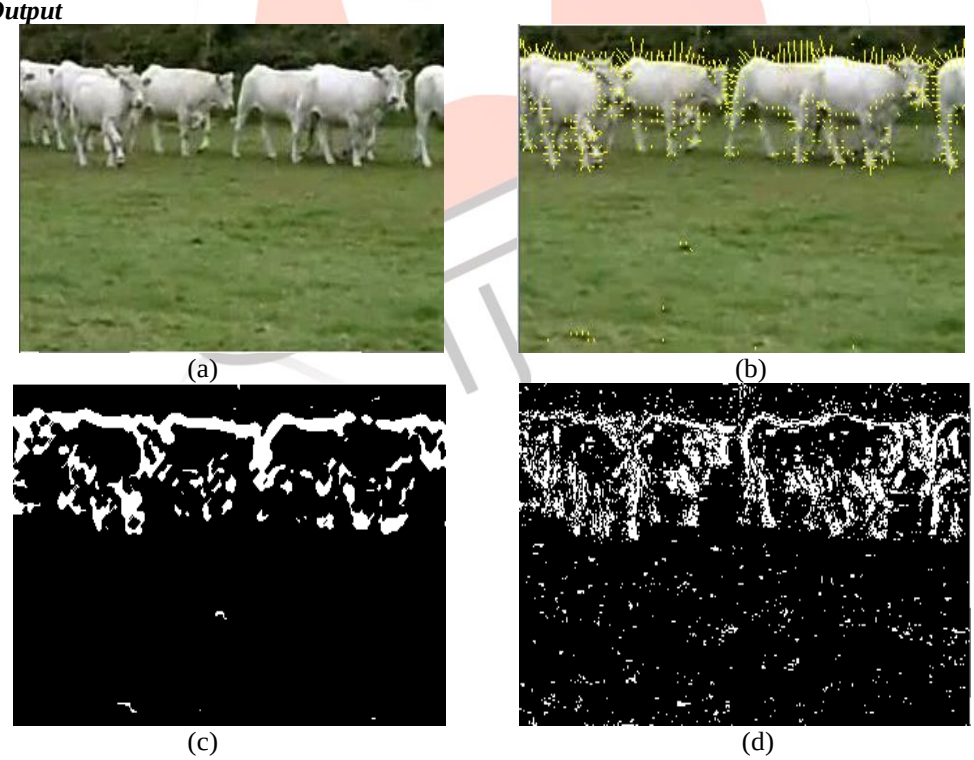


(a) (b)

(c) (d)

Figure 4: Comparison of output for existing and proposed system
(a) Original Video (b) Motion Vector (c) Threshold (d) Results

Proposed System Output



(a) (b)

(c) (d)

Figure 5: Comparison of output for existing and proposed system
(a) Original Video (b) Motion Vector (c) Threshold (d) Results

3rd Video

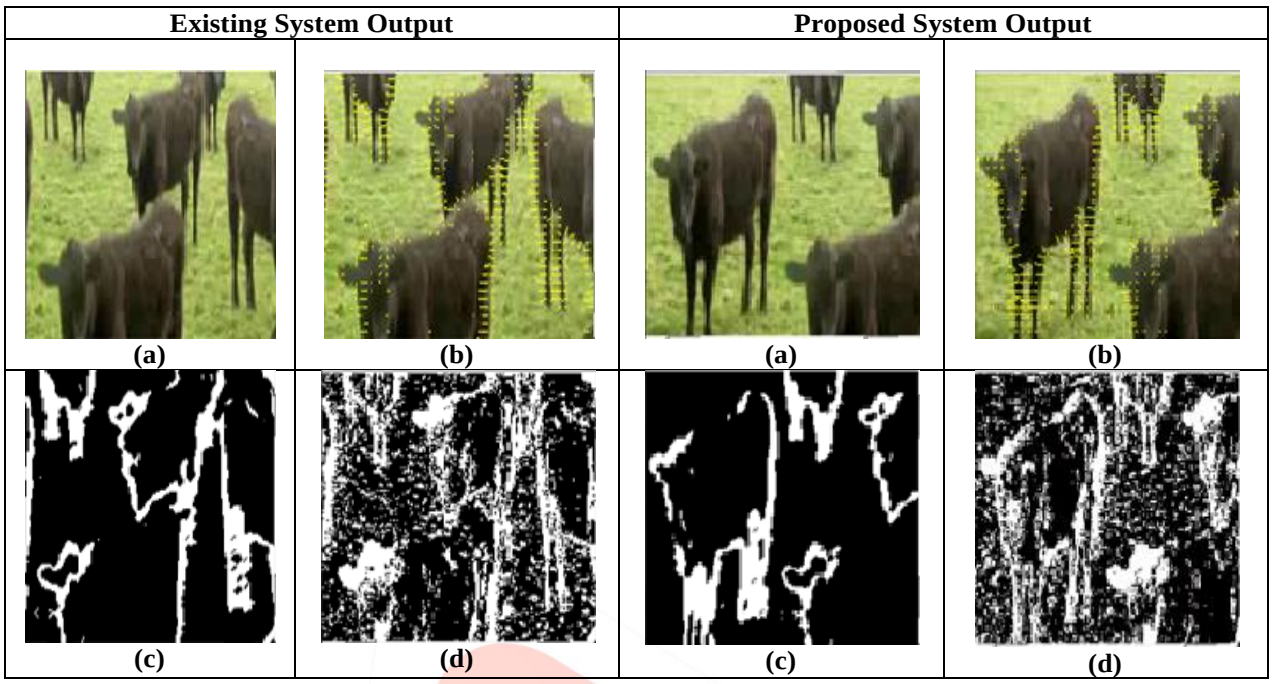


Figure 6: Comparison of output for existing and proposed system
(a) Original Video (b) Motion Vector (c) Threshold (d) Results

V. RESULT ANALYSIS

Table 1: Comparison of Proposed System frames with Main frame

Frame	Mean Square Error	Peak Signal to Noise Ratio	Average Difference
12	1.7701e+04	5.6507	58.4109
17	1.8457e+04	5.4692	64.7512
21	1.8480e+04	5.4638	83.7007
22	1.8513e+04	5.4560	102.0697
24	1.8410e+04	5.4803	75.0364
30	1.8034e+04	5.5698	47.2410
32	1.7722e+04	5.6457	65.9469
38	1.8057e+04	5.5537	57.3417
39	1.8281e+04	5.4338	101.7005
40	1.8517e+04	5.5460	84.0696

Table 2: Comparison of Existing System frames with Main frame

Frame	Mean Square Error	Peak Signal to Noise Ratio	Average Difference
12	1.8860e+04	5.3754	120.2972
17	1.8631e+04	5.4751	121.2331
21	1.8582e+04	5.4402	122.7332
22	1.8752e+04	5.3358	122.3173
24	1.8638e+04	5.1758	122.6330
30	1.8351e+04	5.5478	126.7138
32	1.8572e+04	5.4301	122.7332
38	1.7713e+04	5.3652	122.3173
39	1.7631e+04	5.3728	122.6330
40	1.8456e+04	5.2448	126.7138

Table 3: Comparison of Proposed System frames with Existing System frame

Frame	Mean Square Error	Peak Signal to Noise Ratio	Average Difference
12	1.8216e+04	5.5263	31.8862
17	5.7846e+03	10.5081	21.3404
21	6.6683e+03	9.8906	19.8842

22	6.8850e+03	9.7518	16.4168
24	2.1424e+04	4.8218	44.4921
30	6.2846e+03	5.5082	17.3408
32	6.2583e+03	7.6900	20.8241
38	6.8451e+03	7.7518	18.2148
39	3.3424e+04	7.8213	33.2921
40	7.5681e+03	8.3905	19.8842

VI. Conclusion

From all the figures and tables we can see the difference between Existing and Proposed System Outputs. We can note here that results of our proposed system are improved than in existing system. If we compare two results then directly visually we can tell that output is positive here so our proposed work is increasing the quality of an algorithm. Also if we compare table 1 and table 2 then we can see that Average Difference is less in table 1 that is for Proposed System. Also from table 3 we can check that average difference is less so it increases the quality in proposed system.

VII. Future Enhancement

Presently we are working on stored video but it is also possible to apply it on live video. We can add it to a neural network so that we can decide whether detected object is animal or not.

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