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International Journal Of Engineering And Computer Science ISSN:2319-7242
Volume 3 Issue 2 February , 2014 Page No. 3877-3878

Review On: Object Detection and Tracking To Implement Human-Machine Interaction

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Abstract— In today's era of technology, evolution has occurred in every possible field. Mankind is witnessing a virtual world of internet more often since the last decade. If today's demand is transmutation from physical to virtual, so has the concept of virtual blackboard come up. Following the domain of computer vision the system makes use of an object to interact with the digital world. An object with some specifications is detected by the system through webcam, movements of the object are tracked and depending upon the color of the object, predefined functionalities are provided by the system. Main objective of developing the system is to provide all the functionalities of a physical blackboard and change the traditional approach altogether.

***Index Terms* — Virtual World, Internet, Computer Vision.**

INTRODUCTION

The domain of the system comes under Computer Vision and Image processing. Computer vision basically means study of high-dimensional data [10] and converting it into machine readable form. The proposed system works on the same principle. An object with a specific color and shape is held in front of the camera (particularly webcam) which acts as an input device. The live video which the system receives is converted into frames. These frames are individually processed in a sequence. Here the role of image processing techniques comes into picture. From each frame the interest region, i.e the object is separated from the rest background region. This separation takes place by comparing the HSV value of the object's color with the other pixels in the frame.

Once the object is detected, its motion is tracked and traced. The GUI consists of a color panel, thickness board, eraser, etc. which are considered to be some basic requirements for a black board. The object, as previously mentioned should be held in front of a specific color from the color panel so as to select it for writing (i.e. tracing). The tracing will then happen to be appearing with the same selected color. Same goes with the thickness board and eraser. The traced image can also be saved.

COMPUTER VISION

Computer Vision is transformation of data from a still or video camera to a decision or a new representation. [4] It is quite easy to fetch data from a still image. But, in case of videos, the data needs to be fetched from a dynamic frame. This is more challenging and so are the algorithms of Computer Vision. When a car is to be detected from a video, the motion or trajectory of the car along the video changes every fraction of second. Thus by converting the video into frames and processing them one by one the car is filtered from rest of the frame. Various algorithms of image processing are applied so as to enhance the efficiency of detection and tracking. The project is developed by considering the finest and most suitable algorithms of them all.

MODULES

The system is comprised of the following four modules:

Detection:

Camera is used as an input device by the system. An object of specified color and shape is held in front of the camera and detected by the system. The API's required for video and image processing are provided by a library named OpenCV. [4]

The frontend of the system is implemented using console application embedded in Visual C++.

Tracking:

CAMShift algorithm is used to track the detected object. The reason behind choosing this algorithm is its robustness to occlusions.[1] The algorithm is capable of automatically adjusting the window size as per the object throughout the process of tracking.[1]

Tracing:

This model is developed for tracing the tracked object. The traced image is saved with .png extension. As the main objective of the project is developing a paint application, the tracing can happen according to the color selected by the user from the GUI's color panel. It is an attempt to make the software more appealing to the user as well as the viewers.

Graphical User Interface:

The GUI of the software plays an important role. The interface is provided with a color panel, thickness of the line strokes, save option so as to save the image, erase option and close button. The user has to hold the object in front of the panel he desires, the system will then study the pixels of the object held at and will then recognize the function which is expected.

WORK FLOW

Following is the workflow of the system:

A. Object Capture:

The object is held in front of the camera. It is made sure that the camera is of high resolution. The HSV values of the object's color are manually set by the user. Now the object can be very well filtered from the rest background.

B. Trajectory:

Once the object is detected it is advisable to check whether the same object is getting detected along its trajectory. This is nothing but tracking. In order to detect the object from live video, the video is converted into frames.[2] Each frame is individually processed and the object is tracked.

A. User Settings:

In this phase the user selects desired options from the GUI, the system makes changes as per the function and tracing of the object advances in the same manner.

ASSUMPTIONS AND DEPENDENCIES

ASSUMPTION:

a) Maximum distance of 1.5m between camera and the object.

b) Irrespective of the dynamic background, foreground object will be detected.

c) System is capable of tracking object at different depths in the specified range.

Dependency:

a) System must have Windows Operating System.
b) .NET 3.5 Framework must be installed on the system.
c) Only specific developed object can be used.
d) Projector is required to project on surface.

FUTURE SCOPE

The system is developed considering the primary functionalities of the blackboard. In future, algorithms can be developed for making more advanced applications of paint, notepad etc. However, if text is to be processed, natural language processing techniques should be used.

CONCLUSION

The project is an attempt to develop a new way of human-machine interaction. A comparative study of different image processing algorithms has helped to gain effective results so far. The later phases of system's development will surely depend upon the foundation created through this research.

ACKNOWLEDGMENT

It is indeed a great pleasure in presenting the project under the guidance of Prof. Mrs. P. S. Kulkarni and our project coordinator Prof. S. R. Lahane. We are truly indebted and grateful to Head of the Department Prof. N. V. Alone for their valuable guidance and encouragement. We would also like to thank our College for providing the required facilities, Internet access and important books.

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