SYSTEM DESIGN

Sixth sense is a wearable gestural interface that augments the physical world around us with digital information and lets us use our natural hand gestures to interact with that information.

Our main aim is to capture the image enclosed in the frame formed by the colour caps at the fingers of the users. Swiping, zoom in, zoom out, rotating and other additional features are implemented based on the position of colour caps in the input video Stream. For doing that we need some components such as PC camera/webcam, colour markers, laptop/PC.

COMPONENTS:

1. **Camera:** Camera is used to capture the object which is in the range and follow the users hand gestures. It grabs the motion of the coloured markers worn on the fingertips and tracks the users hand gestures. The camera recognizes individuals, images, gestures that user makes with his hand and then sends this data to the laptop or PC for processing. The camera performs a basic interface device between laptop and the physical world. It acts as a digital eye connecting the user to the digital world.

2. **Coloured Marker:** These coloured markers placed at the fingertips of the users. Making the user's fingers with red, yellow, green and blue coloured tape helps the webcam to recognize the hand gestures. The movements and arrangements of these markers are grasped as gestures that act as an interaction or projected application interfaces.

3. **Laptop or Personal Computer:** A laptop with web enabled services is used as the processing device that processes the input video data send by the camera. It is also used for running or implementing the code written on the MATLAB tools for executing the concept of image processing. The various gestures done by the colour marker are tracked by the camera and hence given to the laptop for further processing of the various applications involved.

4. **Projector:** the information through the laptop or phone can be projected into any surface. The projector projects the visual information enabling surfaces and physical objects to be used as interfaces.

CONSTRUCTION AND WORKING

The methodology shown below in the algorithm used is based on the Sixth Sense Technology where user has to make several gestures using the finger worn colour markers and perform real time actions whose images are preloaded in the program.

Our aim is to move mouse cursor as the user moves his/her fingers, zooming of images, capturing of photos, etc.

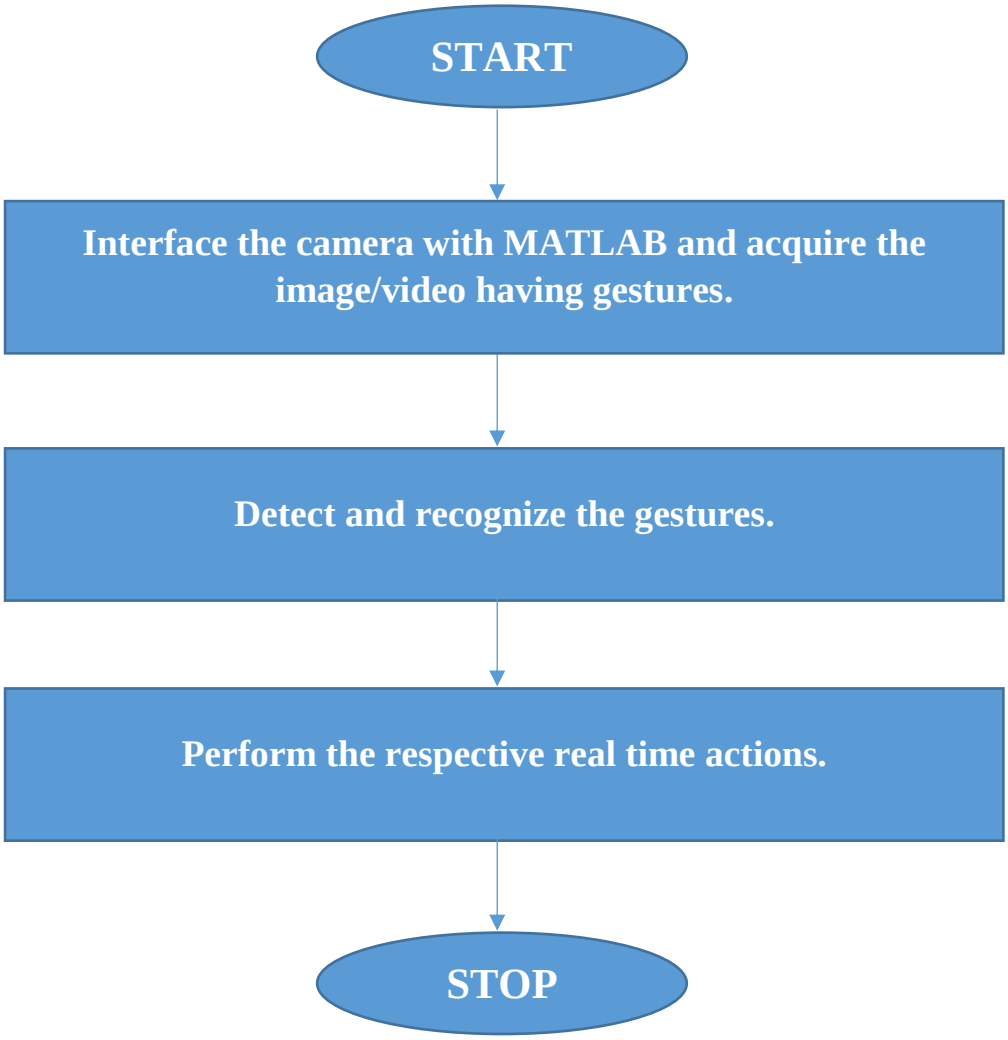


Fig1: Algorithm of Working

The approach works in a continuous manner where camera takes the live video, sending to the laptop and MATLAB installed in laptop processes the input and recognizes the colours at the fingertips of the users.

Camera takes the video and starts recording the live video and in continuation of recording it sends the live video to MATLAB which is installed in the laptop which is further connected with the camera. In MATLAB, code is prepared which convert the incoming live video from camera into frames of images or slicing of video is done in the form of images. These images that are obtained from the slicing of video are the processed for **colour recognition process**. The output of the colour recognition process are the images that contains those colours of which colour caps are present at the fingertips of the user.

RGB values of the colour caps are set to prior in the code so that no other colour will be detected in the image after colour recognition except the caps colours. The output images are displayed in continuation and at the same speed as the speed at which slicing of video is done, so that it looks like a continuous move in which the input is physical world and the output is only those colours which are present at the fingertips of user. The colour is then associated with the mouse cursor in code so that whenever the colour moves in the output image from one position to another, the mouse cursor gets attached at the same position where the colour is now displayed. In the same manner the combination of yellow, green and blue, red is detected and hence by the action performed we can click the images. Neither fingers of the user are not shown in the output images nor are any background colours are there in the output images from the colour recognition process. Each time a feature is implemented, its result is shown in a separate figure in MATLAB environment to clearly differentiate between the features.

The process can be as follows:

- Capture every single frame from the video.
- Process each frame obtained.
- Get the green channels from the frame by setting threshold.
- Subtract the gray scale image from the channel.
- Convert the subtracted image to binary image.
- Find bounding box of definite height and definite distance from each other.

Fig2: Background subtraction of a square green marker

AN EXAMPLE APPLICATION:

All though there are numerous applications of sixth sense technology which are discussed briefly in the application section of this report but one application is discussed in detail in this section as **Controlling movement of a Robot using Sixth Sense Technology**.

ADDITIONAL HARDWARE USED:

1. Microcontroller
2. DC motor
3. Motor Driver IC
4. Wi-Fi module

WORKING

A Microcontroller which has enabled serial communication is used to program the robot as per the requirement. The overall movement of a robot is controlled by the motors used. These motors are attached to the wheels of the robot and are programmed for moving forward, backward, turning left and turning right by giving a certain command.

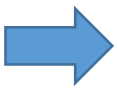
These commands are send to the microcontroller by serial data communication which is fed to the motor driver IC L293D which further drives the motor as per the requirements.

Now the above working is interfaced using Sixth sense technology. The marker in fig2 act as a command to drive the robot in the forward, backward, turning left and turning right. Initially a command from the keyboard is send by serial data communication to drive the motor but now these colour markers act as a virtual keyboard and are used to send the command to the robot.

If there are two markers the fingers, that will behave as two object in the output screen of MATLAB. So using multiple colour we can make multiple object in the output screen. So now with the help of these multiple markers we can control the movement of our robot because now these markers will act as different commands which are sent by serial communication to drive the motor.

The logic for driving a motor and controlling it by the marker is as shown:

RB0	RB1	MOTOR STATUS
Low	Low	Stops
Low	High	Anti-Clockwise
High	Low	Clockwise
High	High	Stops



OBJECT USED	MOTOR STATUS
No Object	Stops
One Object	Anti-Clockwise
Two Object	Clockwise