system becomes. For testing purposing, a black sheet was put up behind the subject to eliminate this problem. For testing, rapid head movement was not allowed. This may be acceptable, since it can be equivalent to simulating a tired driver. For small head movements, the system rarely loses track of the eyes. When the head is turned too much sideways there were some false alarms. The system has problems when the person is wearing eyeglasses. Localizing the eyes is not a problem, but determining whether the eyes are opened or closed is.

**5.4 Applications:**

1. This implementation will be very useful for drivers of each vehicles.
2. Drowsy and fatigue alerts can be intimated to the vehicle user.
3. Insurance schemes can be implemented based on the driving behavior.
4. Comparing earlier implementations, this is a low cost method which is practically feasible.

**5.5 Future Scope:**

Currently there is not adjustment in zoom or direction of the camera during operation. Future work may be to automatically zoom in on the eyes once they are localized. This would avoid the trade-off between having a wide field of view in order to locate the eyes, and a narrow view in order to detect fatigue. This system only looks at the number of consecutive frames where the eyes are closed. At

that point it may be too late to issue the warning. By studying eye movement patterns, it is possible to find a method to generate the warning sooner. Using 3D images is another possibility in finding the eyes. The eyes are the deepest part of a 3D image, and this maybe a more robust way of localizing the eyes. Adaptive binarization is an addition that can help make the system more robust. This may also eliminate the need for the noise removal function, cutting down the computations needed to find the eyes. This will also allow adaptability to changes in ambient light. The system does not work for dark skinned individuals. This can be corrected by having an adaptive light source. The adaptive light source would measure the amount of light being reflected back. If little light is being reflected, the intensity of the light is increased. Darker skinned individual need much more light, so that when the binary image is constructed, the face is white, and the background is black.