Methodology

The four stages are as follows:

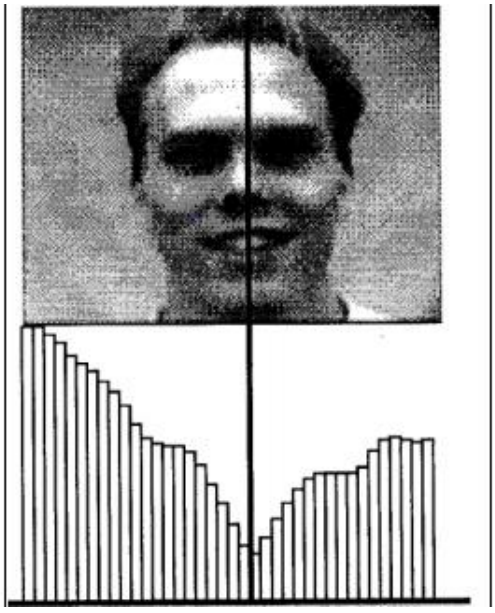
. • Localization of Face

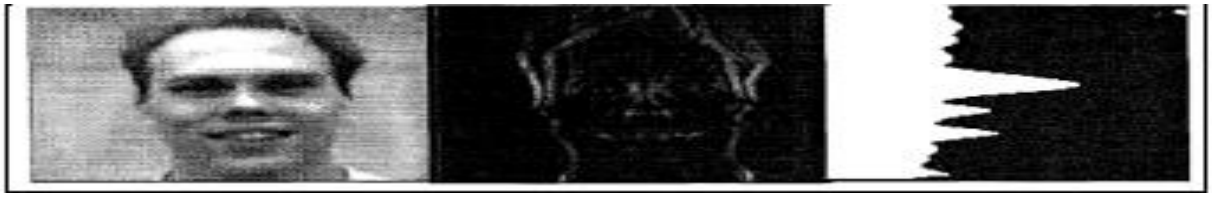
• Localization of the Eyes

• Tracking the eyes in the subsequent frames.

• Detection of failure in tracking.

Localization of Face: Since the Face is symmetric, we use a symmetry-based approach. We found that it is enough to use a sub sampled, gray-scale version of the image. A symmetry-value is then computed for every pixel-column in the reduced image.





Location of Eyes: A raster scan algorithm is used for the exact location of the eyes and extracts that vertical location of eyes. Tracking of the eyes: We track the eye by looking for the darkest pixel in the predicted region. In order to recover from tracking errors, we make sure that none of

the geometrical constraints are violated. If they are, we relocalize the eyes in the next frame. To find the best match for the eye template, we initially center it at the darkest pixel, and then perform a gradient descent in order to find a local minimum.

Detection of Drowsiness: As the driver becomes more fatigued, we expect the eye-blinks to last longer. We count the number of consecutive frames that the eyes are closed in order to decide the condition of the driver. For this, we need a robust way to determine if the eyes are open or closed; so we used a method that looks at the horizontal histogram across the pupil.

Fig 3: detection of eyes.

The final system consists of a camera pointing at the driver. The camera is to be mounted on the dashboard inside the vehicle. For the system we are developing, the camera is stationary and will not adjust its position or zoom during operation. For experimentation, we are using a webcam. The grabbed frames are represented in RGB-space with 8-bit pixels (256 colors). We will not be using any specialized hardware for image processing. Given below is the block diagram.

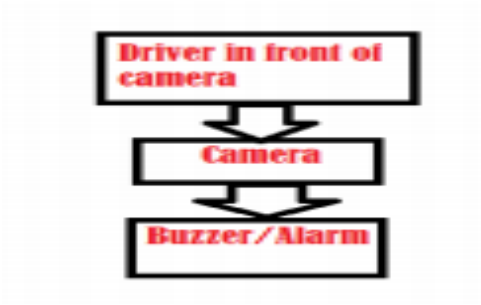


Fig4: block diagram.

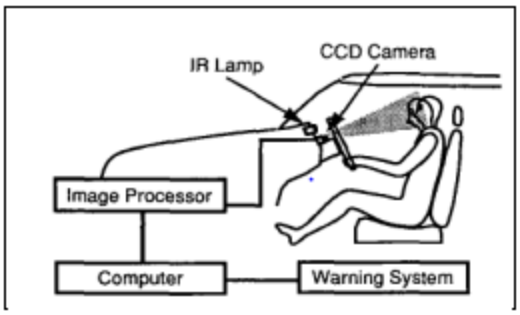


Fig 5: system configuration