Hand Gesture Control in Automobiles

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Abstract: Gesture recognition is the new technology for human-machine communication, since it can make interaction between humans and machine more intuitive. The main motive of this technology is to improvise the human-machine interaction, i.e., to reduce the gap. This enables better communication between human and machines at any given situation. Vision based approaches are better preferred. A vision based real-time gesture recognition system, designed for operating in an automotive environment is still under research. It can be used within an application for retrieving traffic news and e-mails from a message storage. Image processing and matching the image with thresholds are specially adapted to the practical applications involving complex conditions, represent the systems basics. Human-Vehicle Interaction (HVI) is complicated and requires new user dimensions. Gesture control system introduces techniques which elucidated as it is capable of simplifying various interactions between the vehicle and the user or other passengers. The basic characteristics of HVI devices include stability, robustness and reliability of the entire system, beginning from the capturing of image to performing the relevant action.

Keywords: Automotive Environment, Gesture Interface, Human Vehicle Interface (HVI), Virtual Reality.

I. INTRODUCTION

Gesture recognition technology basically recognizes the gestures of a human's body like arms, legs, finger, etc. It reduces the human-machine bridge gap. As modern cars offer high end facilities, there is always a scope for better commands and interaction. In order to be controlled, two main options are usually taken: adding buttons to the already clattered dashboard or adding items in the graphic user interface. The scope of gesture recognition in automobile systems demands constant tracking of the user's gesture. In the case of the primary task – driving, the principal consequences are safety issues. The secondary tasks, which involve the control of non-driving related functions and other interactions with the dashboard, should offer better driving conditions.

Vision based gesture recognition is a popular re-search issue. Recently Pavlovic et al. [2] composed a survey of this topic. The most widespread application is sign language recognition [1][3][4], but it hasn't reached the stage of practical applicability yet. Restrictions regarding user, environment and vocabulary are still too strong. Gesture recognition can be used for robots development [5], for augmented desk interfaces [6][7] or crane control [8]. It is not surprising that only a few commercial products exist, e.g. the Siemens Virtual Touchscreen [9].

For features extraction, some methods and algorithms are required even to capture the shape of the hand as in [14][13], [14] applied Gaussian bivariate function for fitting the segmented hand which used to minimize the rotation affection [13][14]. The selection of specific algorithm for recognition depends on the application needed. In this work application areas for the gestures system are presented.

In an automotive environment, gestures can be used both as an interaction modality and for monitoring. Gesture recognition aims at collecting information about the driver's actions. In particular, such information can provide cues about the driver being on the verge of performing a gesture aimed at the dashboard. They can also assess if the driver is maintaining a sufficient level of safety – typically combined with a gaze recognition system.

II. METHODOLOGY

Input from camera is used for processing of Gesture. The gesture could be static or dynamic, so using a video input is preferable. A webcam of resolution 320x240 is preferred in this process. Digital frames are captured in the process of obtaining digital image of the gesture. After the frame is extracted, it is used for further processing of gesture recognition. The extraction should be accurate because it can affect further image processing. After this, blurring is done to spread pixels from source image and mix it with surrounding pixels which is also called as Smoothing. In graphics software it widely used effect minimize image noise. Segmentation involves spreading an image into regions with respect to objects. This is done by identifying common properties. It is natural technique to segment such regions by Threshold mechanism, the separation of light and dark regions. This technique creates binary images from grey level ones by turning all pixels below some threshold value to zero and all pixels about that threshold to one. Vector Calculation method will contain the co-ordinates points of x and y in the form of Frames while moving from one position to other position. This technique is used to calculate different positions. Vector calculation is summation of all points of x and y co-ordinate in the process of image processing. After this is one, the output is fed as input to the microprocessor. It checks for threshold gestures and matches the gesture with the existing ones and performs the required action for that gesture as an output.
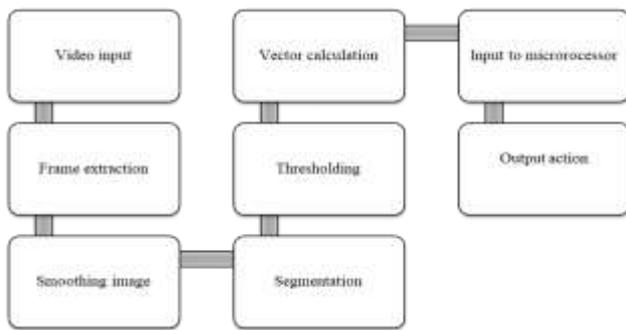
III.   IMPLEMENTATION PROCESS

Figure1. Gesture Recognition implementation in automotive systems

IV.   COMPARISION STATEMENT

We know by now that gesture is nothing but movement of a limb or a body as an expression of thought or feeling. By using gesture recognition technology we can make interface with computer using gesture of human body. In this, a camera is used which reads the movements of the human body and processes the data to a computer that uses these gestures as input to produce an output accordingly. There are two basic methods of gesture recognition.

a) Constellation Model
b) Hidden Markov Method

The constellation model is easier to implement than HMM because it includes actual samples of gestures from already existing threshold samples and it uses less mathematical approach. HMM is a good statistical model and widely used. However, this method is slower and takes lot of time for implementation. Constellation method can give high probability equations by which we can represent hidden states in a given sequence.

V.   CONCLUSION

Finally we can state, that the developed gesture recognition system provides bright usefulness of gesture control in cars. The next step towards its practical use has be a study regarding user acceptance, safety and efficiency. Then the driver and mechanical input devices can be combined to create a new multimodal input concept. The selection of specific algorithm for recognition depends on the application needed. In this work application areas for the gestures system are presented. The illustrated gesture recognition system proves to be good to the given task. Tests with an experimental vehicle yield a permanent user independent functionality in-spite of different lighting conditions like day and night or tunnel passing or even if the co-driver reaches his hand into the gesturing area. Recognition is not reliable any more if the segmentation is erroneous. Reasons can be direct sunlight or overlapping objects. Explanation of gesture recognition issues, detail discussion of recent recognition systems are given as well. The dedicated application is a high end specs car information system where each modality will be used according to its suitability.

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