HAND GESTURES TO CONTROL AUTOMOTIVE INTERFACES AND INFOTAINMENT EQUIPMENTS IN CAR

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ABSTRACT

Controlling multiple devices while driving steals drivers' attention from the road and is becoming the cause of accidents in 1 out of 3 cases. Many research efforts are being dedicated to design, manufacture and test Human-Machine Interfaces that allow operating car devices without distracting the drivers' attention. The integration of more and more functionality into the human machine interface (HMI) of vehicles increases the complexity of device handling. Thus optimal use of different human sensory channels is an approach to simplify the interaction with in-car devices. This way the user convenience increases as much as distraction may decrease. A complete system for controlling the infotainment equipment through hand gestures is explained in this paper. This paper describes effective operation of a variety of automotive interfaces and infotainment devices using static as well as dynamic hand gestures.

Keywords: Human Machine Interface, Hand Gesture Recognition, Driver Assistance Systems, Infotainment Devices,Visible Infrared Camera.

I. INTRODUCTION

An increasing number of new functionalities that enhance safety and driving performance or increase the level of comfort are included in modern cars. While first passive safety systems like airbags were integrated, later systems, that directly affect the driving process, like active cruise control were added. Additionally more and more information systems have become of general interest, for example: media player, navigation systems, restaurants guides or telephone systems. In the beginning of the 80s, the integration of new infotainment systems, like radio or media player, which were developed by different suppliers, results in an unmanageable amount of displays and control elements. This development requires invention of other strategies, to enable handling in spite of increasing functional range.

Driver distraction is one of the principal causes of car accidents. Driver attention is affected by a lack of concentration, a talk to passengers, outside events, the use of infotainment devices and others causes. According to a study released by the National Highway Traffic Safety Administration (NHTSA), 80 percent of automobile accidents and 65 percent of near-accidents involve at least some form of driver distraction within three seconds of the crash or near-miss. Some of the main actions that cause distracted driving are changing the radio station, adjusting CD or Mp3 player settings by reaching to the infotainment system, etc.

Fig.1 Effect of Driver Distraction

The interaction with other infotainment devices like mobile phones, GPS, radio, and, recently, the use of tablets to view web pages, watch videos or look at maps, is one of the causes with increasing prevalence. Since infotainment devices are increasing their presence in the new car models, there is also an increasing interest to develop safer user interfaces that allow drivers to keep their eyes on the road. In the last few years, many systems were developed to provide the user with a natural way to interact with the infotainment.

1.1 Literature survey

To provide solution to the problems due to increasing accidents while operating the devices in cars is to develop means or user interfaces which will enable handling of devices in spite of increasing functional range and allow drivers to keep their eyes on the road. In the last few years, many systems were developed to provide the user with a natural way to interact with the infotainment. These systems lie in four principal categories: haptic devices (buttons, knobs, tablets or other touching devices), electronic sensors, voice controls or vision based systems detecting features like eye gaze, head pose or hand gestures.

All these systems have their pros and cons. Voice-based interaction is maybe the most natural, but, even when this technology is commercially available in many models, it only works accurately in acoustically clean environments provoking some degree of stress for the user, otherwise. Touching-based devices are comfortable when they are located in reachable ergonomic places and the user has memorized the location associated to every function, but as the ergonomy decreases and functionality increases, the necessity to glance at the device to search for the desired function, also increases.

II. OBJECTIVE

To developed smart car infotainment access by using smart hand gestures to access them which would not steal driver's attention from driving and will ultimately increase driver safety thus providing interactive and easy infotainment access. The design of the system was guided by the necessity of an easy to use, intuitive, robust and non-intrusive interface, so we resorted to an interface based on hand gesture recognition that allowed the accessing of devices easier without letting the driver to get distracted from his primary aim i.e. driving.

Gesture-based devices are midway between touching the knobs and speaking to the system, so it inherited some of the pros and cons of both worlds. Gesture input has specific advantages that it can be used in noisy environments and, gesture control is faster and more efficient for small commands, like "next menu point" or "mute audio". On the one hand, drivers are accustomed to using a hand to access car parts, like the shift-stick or the controls of the front panel, so, gesturing is just an evolution of those actions.

Such implementation of system would allow user to control several functions of the infotainment service, like moving forward and backward the songs while operating media player, selecting options, increasing/decreasing the volume or other continuous parameters also operating devices present in cars like windows, wiper, headlights etc. which are frequently accessed by the user. The user would have to perform the predefined set of static and dynamic hand gestures in an ergonomic predefined area. The functionality had to be the same with daylight and infrared light. When the system is ON the predefined area should be continuously monitored. This prototype is composed by a set of static gestures and another set of dynamic gestures. Static gestures are the numbers from one to five and the set of dynamic gestures comprises hand raising (third row, right), down, left and right movement; left-right shaking, XY mouse-like movement and left-right twist of the wrist.

In short, implementation a hand-gesture-based interface system using a visible-infrared camera mounted on the screen and reading gestures performed in the shift-stick area by the driver or the passenger. The biggest effort of the project was aimed to end up with a robust, reliable, easy-to use and responsive system. It works in real-time so it is fast enough for the task. It works quite independently on the lighting conditions, so it is robust. Thus automatic recognition of gestures in an automotive environment can increase both the usability of complex driver information systems and driving safety since the eyes can be kept on the road.

III. BLOCK DIAGRAM

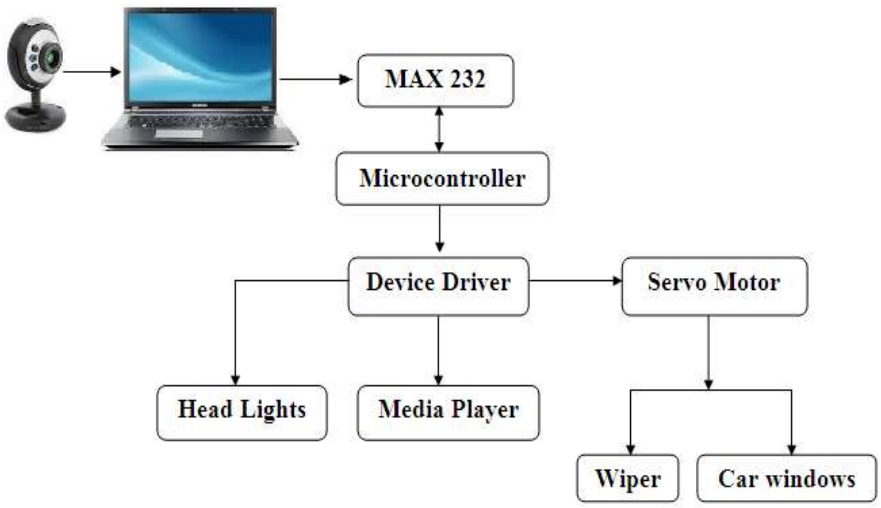


Fig.2 Block diagram

Power supply is used to provide 5V supply for whole system For processing the data firstly it has to be captured, here the information to detect hand gesture is used by taking camera which records video, video is frame of images, these images contain the required hand gesture which has to be detected, to detect this data it is forwarded to processing in MATLAB.

The captured images are filtered and required frames containing information about gesture are processed and hand gesture is detected, these detected signals are sent to microcontroller through MAX232 using serial communication. Same method is used for detection of both static and dynamic gesture.

Now image processing part is done hand gesture is detected and unique signal to activate particular equipment is sent to microcontroller, microcontroller activates particular equipment by activating there drivers to run them, equipment activated are viper, windows, headlights

3.1 Gesture Detection

In the gesture detection technique two types of gestures are used i.e. Static and Dynamic gesture. Hand localization is done to identify which type of gesture is detected either static or dynamic. Due to hand localization we can easily identify the gesture for further processing. If the gesture is dynamic then it is important to trace the path of gesture so that it is easy to identify the gesture. Using center of gravity detection we can trace the path of hand movement and select particular action. The selected blob is converted into vectors means the dynamic array used to perform some operations on selected blob.

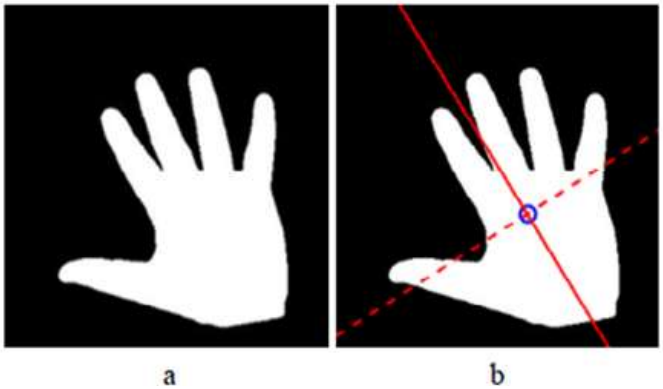


Fig.3 Center of Gravity

After all processing steps the gesture is recognized. All image processing activities are done on the particular image frame like RBG blurring, RGB to HSV conversion, Median filtering, Blob detection, etc. The image after all these processing techniques is in position to match with database which is already stored in system. The selected processed image is then compare with database and send for post processing.

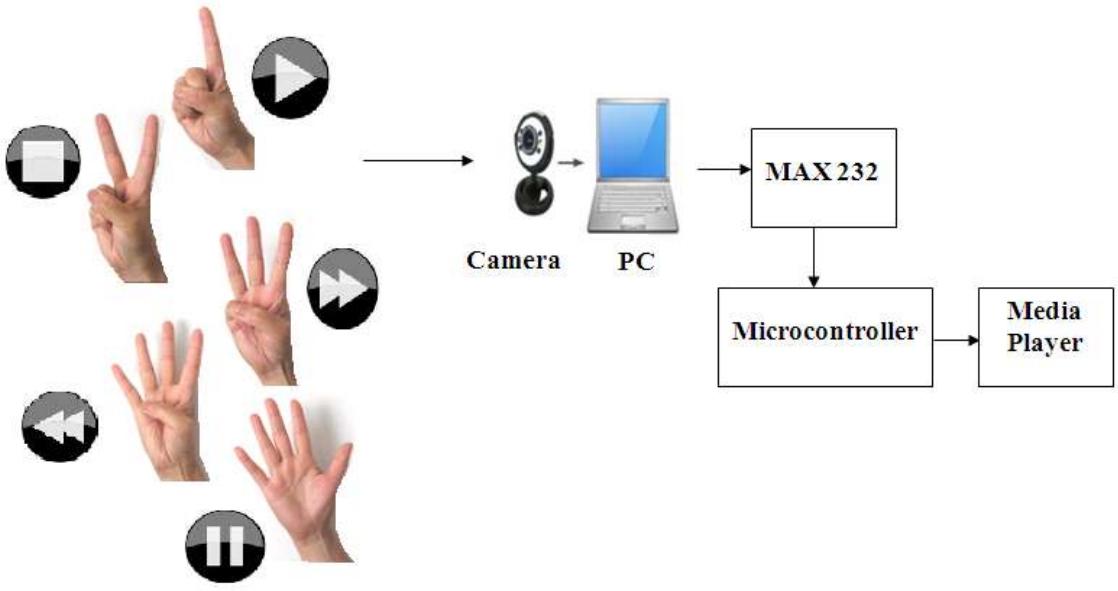


Fig.5 Block diagram description for media player operation

Static gestures as shown above are used for operating various menus in media player of the car like one indicates play, two indicates stop, three indicates forward, four indicates backward, five indicates pause, the image is captured by camera and then processed in the computer using MATLAB software as it has very well defined GUI, the static gesture detected has an unique binary code that would be sent to microcontroller after the detection of the respective gesture. For detection of the gesture the image processing is carried out using MATLAB and then the processed image will be compared with the image in the database and the respective

code will be sent to the controller. As soon as microcontroller receives the code it sends corresponding signal to the media player and corresponding action will be carried out.

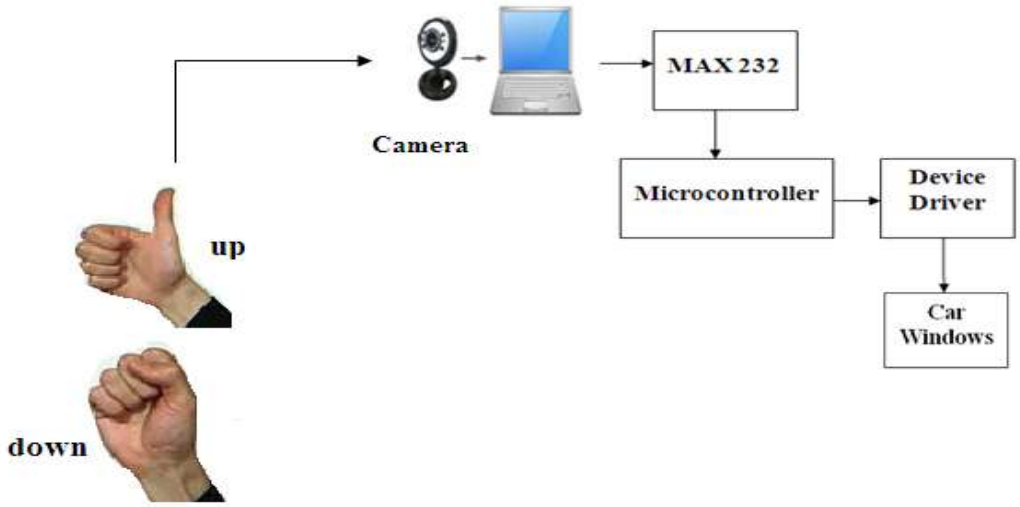


Fig.4 Block Diagram Description for Car Windows Operation

Similarly Static gestures as shown above are used for controlling windows in the car like first hand gesture will indicate moving window upwards and second towards down, the image is captured by camera and then processed in the computer using MATLAB software. Only difference is when microcontroller receives the code it sends a high signal of 5V to IC L293D which is used to control motor, this motor controls window action.

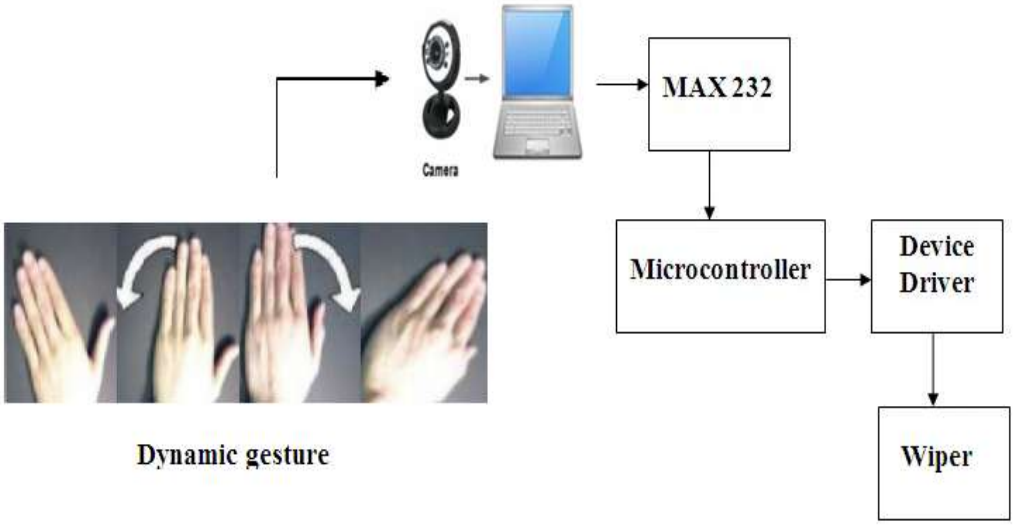


Fig.6 Block diagram description of wiper operation

Dynamic gesture as shown above is used for controlling wiper in the car, the image processing part remains the same as earlier only difference is more no of frames are required to detect dynamic gesture. The dynamic gesture detected also has an unique binary code which would be then sent to microcontroller ,as soon as microcontroller receives the code it sends an high signal of 5V to IC L293D which is used to control motor ,this motor is then activated so to switch on viper. According to signal specific hardware is activated to provide the required operation.

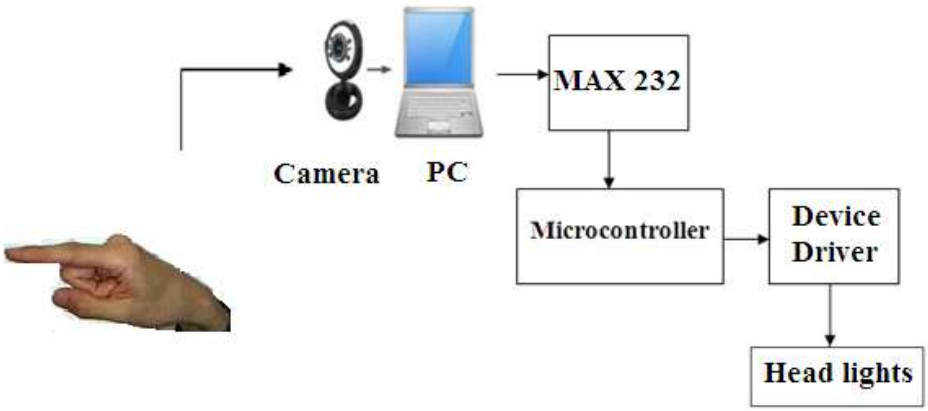
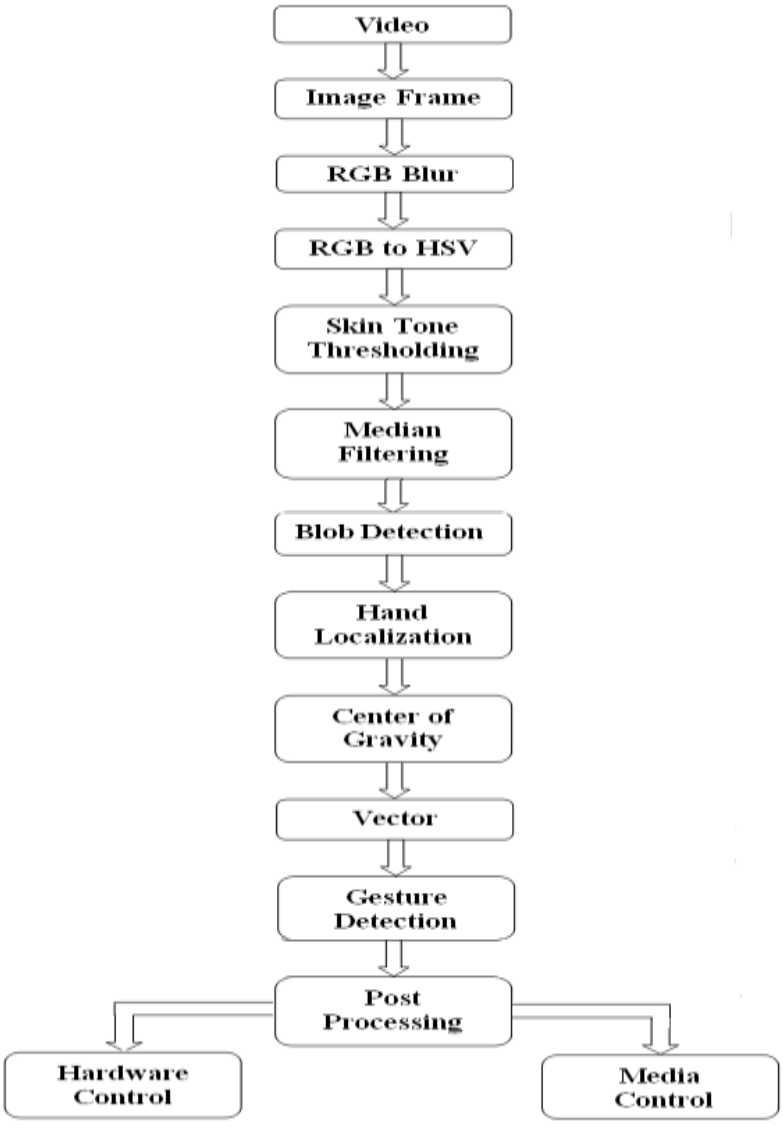


Fig.7 Block diagram description of headlight operation

IV. FLOWCHART



V. RESULT

The aim of the project is to develop a prototype of automotive gesture detection system .The focus will be placed on designing a system which would be more interactive easy to use so that driver does not need to compromise his attention from driving .Our team is dedicated to provide luxury quality reliable technology affordable and simple in use. This model is for safety of all human beings .The model prevents the accident from happening and thus saves a lot of money and reduces the risk.

VI. CONCLUSION

Saves lives through accidents, design highly innovative and interactive easy to use gesture detection system to control car infotainment equipment's, utilizing best sensors available with proven results on road. Increase public awareness for such interactive gesture detection system. Develop affordable pricing packages provide professional and friendly installation service .Participate in ongoing battle to reduce car accidents and the resulting fatalities, injuries.

VII. ACKNOWLEDGMENT

We take this opportunity to thank all our teachers and senior authorities whose constant encouragement made it possible for us to take up challenge of doing this project .we express our deepest thanks to Head of Department of Electronics and Telecommunication.

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