IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319 5940

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 5, Issue 6, June 2016

Implementation of Hand Gesture Recognition for Controlling In-Car Devices

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Abstract: When the system is integrated with facility of the recognizing real time gesture then system can be used for interfacing HCI (Human computer Interface). This work presents a technique for a human computer interface through hand gesture recognition that can recognize most of English alphabet from the American Sign Language hand alphabet. Gesture control is techniques which are to be explored as it can tremendously simplify numerous interactions between the car and the driver and/or other passengers. Distracted driving is one of the main causes of vehicle collisions. To provide support at times of danger and critical situation networking are used that transmit the gestures to the respective Industry along with whereabouts of the user of asset. Alert about traffic in rout is provided using sound sensor, obstacle sensor and vibrator. An internet based SMS (Short Message Service) application issued for where there is emergency which will message the real time location of asset and its speed and location name to the user's mobile. The GPS receiver system uses a hardware GPS receiver provided with a USB (Universal Serial Bus connector) so that the receiver is compatible and can be easily connected to a user computer. A GPS antenna is connected to the GPS receiver to acquire the signals. There should not be obstacle between the antenna and the satellite to achieve stronger signal. The software used for system is developed in VB.NET (visual basic.NET) programming language. VB.NET is an application oriented computer programming language.

Keywords: GPS, GSM, Image Processing, MATAB.

I. INTRODUCTION

In today's world employee security has become a major concern especially employee's that are working in call centres who have to do a night shifts and return home at late night hours. For such employees their safety is a major worry for all companies. We read many attacks on such call centre cabs in recent times; moreover, there is no efficient way to in-form the company or the police so that any immediate action can be taken. To resolve above mentioned problems we have come up with the solution of GSM and GPS based employee tracking and security. Here we are making a Cab unit which has GPS and GSM for tracking the current position of cab. The µC will send the current coordinates to the Server Unit with the help of GSM. The SMS will have the current coordinates of cab which will be displayed on the Google MAP of server The Cab unit is also interfaced with a Fingerprint sensor which will identify the person / Employees getting and out of cab. The µC will send this data to the server unit with the employee information as well as the GPS co-ordinates to pin point the location of pick up and drop of company employees. We have also interfaced MATLAB based hand gesture information system. Here the camera fitted inside the cab will continuously take snaps inside of car. Then it will try and identify any special hand gesture made by the users. Here we have 2 categories of hand gestures. One is for car automation which is used for controlling functions inside of car such as volume up volume down, Child lock on/off; etc. The second one is for the emergency condition. When the employee senses any danger to life he/ she have to make specialized gesture which is picked up by camera. Once it is processed the gesture is recognized and appropriate action and GPS locations is send to Company and the nearest police station.

II. LITERATURE SURVEY

Attempts to automatically recognize sign language began to appear in the 1990's. Re-search on hand gestures can be classified into two categories: First category relies on electromechanically devices that are used to measure different gesture parameters such as hand's position, angle, and the location of the fingertips. Systems that use such devices are called glove-based systems. The second category uses machine vision and image processing techniques to create visual based hand gesture recognition systems. The second technique is not flexible to users and is expensive. Reference [1] and [2] discuss the gesture recognition for human robot interaction and human robot symbiosis. Reference [3] discusses different categories for gesture recognition. Markov models are used for gesture recognition in reference [4] and [5]. A comprehensive framework is presented that ad-dresses two important problems in gesture recognition systems in [6]. An augmented reality tool for vision based hand gesture recognition in a camera projector system is described in reference [7]. A methodology using a neighborhood-search algorithm for tuning system parameters for gesture recognition is addressed in [8]. A novel method is introduced to recognize and estimate the scale of time-varying human gestures in [9]. In the past decade, much

IJARCCE

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works have been done in the field of speech recognition and speech synthesis for communication. One promising study [10] at California State University at Northridge explored the performance of learning disabled college students using voice recognition technology to complete the university's written proficiency exam. With the use of this in-novation, the learning disabled students achieved the same distribution of scores on the exam as their non-disabled peers. Another exploratory study [11] focused on a single subject-a sixth grade student with learning disabilities. The authors describe four methods for the persons who are blind or visually impaired use to access information: enhanced image, Braille, synthetic speech and optical character recognition. These devices can be used separately or in combination to access consumer products, personal computers and printed information. Marshall H. Raskind, a learning disabilities researcher at the Frosting Center in Pasadena, Calif., found that voice recognition software could make a significant difference for many people with dyslexia. It is concluded that speech recognition not only allows dyslexics to communicate more efficiently, but may even help them overcome their condition. The proposed system using the data glove technique, Data glove especially made up of electronic glove worn by the user. It consists of flex sensors that used to detect finger gestures and transmit the information to a PIC microcontroller. Microcontroller processes the gesture of the user and plays the audio file corresponding gesture. Embedded voice-box aid [EVB]for deaf and dumb persons that can translate their phenotype language to understandable language of a normal person and thereby enabling them to get better understanding of normally spoken words [10].

III. METHODOLOGIES

A. Implemented methodologies

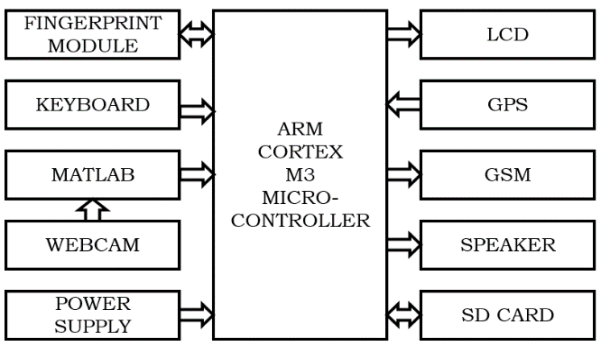
In 2008, it was demonstrated in [4] that, by using a special 3D IR camera, gestures based on hand and finger movements can be robustly understood by computers. This allowed users to play games and interact with computer applications in natural and immersive ways that improve the user experience. In 2010, Microsoft's Kinect used Prime Sense's technology based on projecting a structured light pattern on the object in order to build and track the skeleton of the user's body to control electronic games. Similar techniques have been shown in [5] for 3D object reconstruction. As cameras providing depth information are limited in the number of principles used, 3 basic techniques i) stereo or triangulation based techniques, also known as stereo-vision; ii) structured light techniques, where depth images are obtained by projecting a known pattern of light and recording the de-formations of the pattern relative to a reference image which contains the pattern projected on a planar surface; iii) LIDAR and time-of-flight based imagers, which obtain a depth map through measuring the time or the phase taken or shifted, respectively, for a series of generated pulses of light that return to the camera[8][9][10]. A camera which operates using an image sensor such that its output contains depth information has been a key element in obtaining the well-known six degrees of freedom in user interaction [11].

B. Proposed methodologies

The proposed work focus on the hardware, gesture set, and image processing software for real-time car device control. The real-time aspect is extremely important: the whole process from image acquisition to gesture control has to be finished in 33.333ms, the time of producing one frame by a regular camera. It should be noted that a delay longer than the above time interval may produce de-synchronization between the user and the processing unit, which finally are so large that the control process becomes unusable. A new system for real-time measurements of depth is proposed for car device control. The Gesture Control of car devices has to be based on depth images obtained in near infrared spectrum from short distances (30cm-1m ranges) as the lighting conditions in the care are varying at a degree which makes the basics of the image processing algorithm completely unreliable. The camera's physical dimensions have to be small enough to mount it on a place in the car which can easily be accessible for gesture observation. One of the most important features of the depth camera is the ability to change the parameters of the depth measurements on an as-needed basis. It can therefore be adjusted to process nearby hand gestures, distant full-body movements, or both, as required by the application. Depth data, including finger details, are visible even at distances of 4 meters away from the camera. The selection of a gesture set for controlling a computer based system is a very important step before the building. Gesture meant for controlling a car device function shall be unique. The set of gestures for car control has to be designed like any computer language and analyzed in details. The anatomy and the physics of hand and fingers movement has also to be taken into account. Also the gesture set has to be very simple and natural such that the user doesn't need to make a remembering effort for producing the proper gesture for the command needed. Every device which can be controlled by gesture such as the radio, car-phone, GPS, the display unit and others has to respond to a set of gestures specifically designed for their control. A unique gesture has to be selected to activate the gesture control for each device.

IV.SYSTEM DESIGN

A. Block Diagram



DOI 10.17148/IJARCCE.2016.5664

IJARCCE
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Finger Print Module:
If the presence of the authenticated user proposed system can work efficiently for that this is the good option to add in this system so that authenticate user only can access the system. This module is used to identify the finger prints of human being. The finger print module uses a sensor which identifies the human finger and stores the data in the form of 32-bit data frame. Figure print module is interfaced with the microcontroller via rs232 standard.

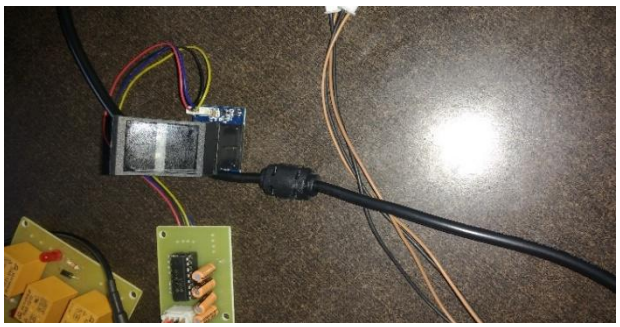


Fig1. Used R305 Fingerprint module

The biometric fingerprint module can be controlled using 2-way serial communication microcontroller using its general commands. Using these standard figure print module commands we can register the user, check (compare) and delete the user from this module.

GSM Modem:
GSM is just the network to connect the unlimited user on one network using simple services like SMS, Telephonic conversation, GPRS. In proposed system SMS service is mainly used for the alerting the user about his hereabout of his belonging so he can look after that. Accident or misfortune can be avoided. This SMS service has no range limit because there is no place where GSM has not reached. So that it ultimate solution for the system development for logging issue.

Liquid Crystal Display:
LCD is just a visual output of the system that can show the ongoing process in the system so that interaction with the designed system could be very easier to give input by user to system. Simple LCD architecture of the 16x2 can be enough to handle the visual output of proposed system.

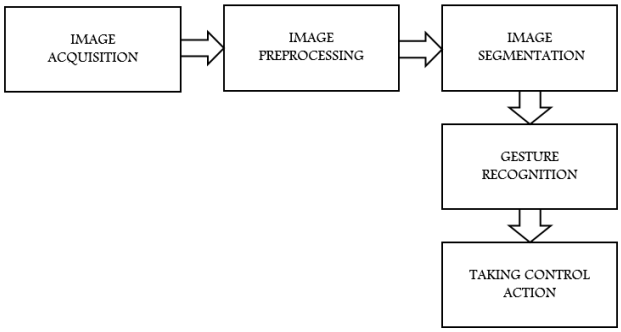
SD CARD:
SD card is basically being used as a storage device which will required to store the required data. SD card has the functionality of storing the different type of data format in on architecture that helps user to store or log the data that might helpful for user to accomplish his task of system design. here we store the require data in the .wav file and play whenever the command or interrupt is given to the SD card using SPI Protocol.

GPS:
A GPS essentially contains GPS module to receive the GPS signal and calculate the coordinates on the earth surface it uses the triangulation method to find out exact location on the surface. In this system it is used to get the coordination of the user asset in case of emergency situation so that asset can find out easily.

Key Board:
Keyboards are the widely used input device that can interface with any of the controller, and the basic understanding of them is essential. Their matrix connection and algorithm to find out which key is pressed is the key feature that keyboard help in system development with allocation of minimum pins on controller. In this system it is used for the giving to the microcontroller.

Fig2. Final system of proposed project

B. Block Diagram for Image Processing



Block Diagram Description:

Image Acquisition:
Image Acquisition block is requiring to the take real time input from the camera and convert it into supported format for the MATLAB software so that MATLAB can perform algorithm on it. You can access the camera with help of the standard command from the MATLAB. In acquiring image, it results in background and synchronizes various multimodal devices.

Image Pre-processing:
Image preprocessing is required to convert the real time capture image into the proper format where by changing its basic properties like histogram equalization, quality of image to better one to apply the algorithm reliably and takes its output robustly. In our project we are removing Paper and Salt Noise. Median Filter can be used for removing noise.

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Image Segmentation:
This process is quite easy while this process just used to tell the algorithm which parameter or entity of image should be taken into account. And then just compare that value with the test recognized value and provided the match gesture to the output.

Gesture Recognition:
Gesture recognition is basically a term used for determining human gestures with mathematical algorithms. gestures can originate from bodily motion or state but commonly originates from the hand. It reduces or say connect both the gap between machine and humans with primitive text also called as GUI (graphical user interfaces).it also has demerits with input to keyboard as well as mouse. Gesture recognition provides a way for humans to communicate with the machine and interact naturally.

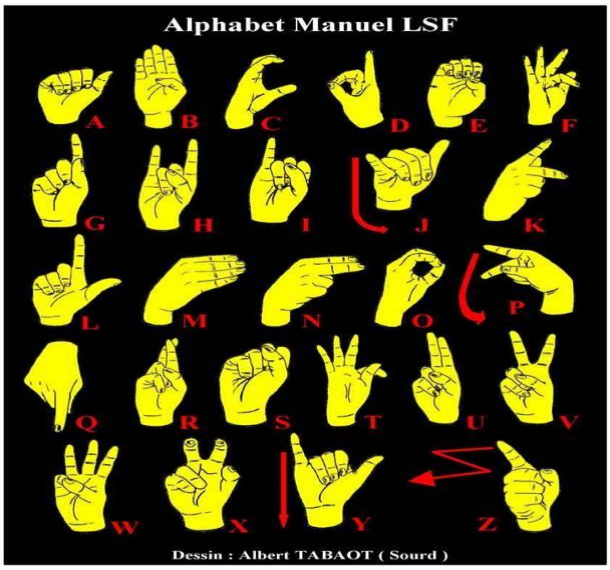

Fig4. Hand Gestures for the different letter

ALGORITHM
1. Start
2. Image Acquisition.
3. Image Pre-processing. (E.g. Noise Reduction, Histogram Adjustment, Exposure Adjustment)
4. Thresholding based Hand segmentation.
5. Gesture Recognition
6. Hamming distance calculation for Database and Testing Gestures.
7. Controlling based on recognized gesture. (E.g. Steer Right, Steer Left, Accelerate, Break)
8. Repeating steps 2 to 6 till exit.
9. Stop.

V. CONCLUSION

The system consisting of hardware module as well as software module provides positioning and navigational information in terms of number of parameters. Also information regarding the satellites which are being tracked by the system is also displayed. The developing system will be compact, low cost and reliable. Using the same system internet based applications and mobile based messaging applications are to be developed. Since this system provides global coverage, this system can be used anywhere on the planet provided that decent signals from at least four satellites are received.
Because of this system we can ensure safety of the women and track down and solve the ongoing emergency or critical situation efficiently and reliably

ACKNOWLEDGEMENTS

I take opportunity to gratefully acknowledge the inspiration, encouragement, guidance, help and valuable suggestions received from all our well-wishers. I would like to thank my Project guide **Prof. R.S. Nipanikar** who have helped me and made available much useful information to complete this seminar report. I am also thankful to our M.E. Coordinator **Prof. V. M. Joshi** and Project Coordinator **Prof. S. I. Nipanikar** for their valuable guidance. Also our respected HOD **Prof. S. D. Joshi** for her support and guidance. I owe my thanks to our respected principal **Dr. K.N. Barbole** for his valuable guidance. Without their complete support willing co-operation, this would not have been possible. We are forever obliged to our parents and friends for their encouragement to us and faith in our ability to succeed.

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