I J C T A, 9(34) 2016, pp. 639-642

User Hand Gesture Recognition in Robotics

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ABSTRACT

In computing, a natural user interface, or NUI, or Natural Interface is the common parlance used by designers and developers of human-machine interfaces to refer to a user interface that is effectively invisible, or becomes invisible with successive learned interactions, to its users, and is based on nature or natural elements. Existing systems to control robot include use of GUI graphical user interfaces that are systems built in high level programming languages which have buttons and other user built controls to control the robot. And also some use hardwares like joysticks and user built hardwares to control. And in advance scenarios people make use of touch screens a form of NUI to control robots making use of tablets and other form factors to control the robots. Users hands can be used as a tool to interface to control the robot. So to achieve this some contrasting color are used over the hand to identify the hand. Then an algorithm to track the movement of hand i.e., the gestures can be captured using any web cam even the low resolution or the integrated web cam for this purpose .This is translated using some functions to the actual commands to control the robot and is sent to the robot through a wireless module connected to serial port .

Keywords: NUI, Gesture, User Hand

I. INTRODUCTION

The word natural is used because most computer interfaces use artificial control devices whose operation has to be learned. A NUI relies on a user being able to quickly transition from novice to expert. While the interface requires learning, that learning is eased through design which gives the user the feeling that they are instantly and continuously successful. A NUI may be operated in a number of different ways, depending on the purpose and user requirements. Some NUIs rely on intermediary devices for interaction but more advanced NUIs are either invisible to the user or so unobtrusive that they quickly seem invisible.

Touch screen interfaces let users interact with controls and applications more intuitively than a cursor-based interface because it is more direct – instead of moving a cursor to select a file and clicking to open it, for example, the user touches a graphic representation of the file to open it. Smartphones and tablets typically enable touch input. Touch is being adapted for non-screen applications as well. For example, Microsoft is working on a touch interface called “skin put” that allows users to interact by tapping their own skin.

Gesture recognition systems track user motions and translate those movements to instructions. Nintendo Wii and PlayStation Move motion gaming systems work through controller-based accelerometers and gyroscopes to sense tilting, rotation and acceleration. A more intuitive type of NUI is outfitted with a camera and software in the device that recognizes specific gestures and translates them to actions. Microsoft’s Kinect, for example, is a motion sensor for the Xbox 360 gaming console that allows users to interact through body motions, gestures and spoken commands.

Speech recognition allows users to interact with a system through spoken commands. The system identifies spoken words and phrases and converts them to a machine-readable format for interaction. Speech recognition applications include call routing, speech-to-text and hands-free computer and mobile phone operation. Speech recognition is also sometimes used to interact with embedded systems.

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Gaze-tracking interfaces allow users to guide a system through eye movements. In March 2011, Lenovo announced that they had produced the first eye-controlled laptop. The Lenovo system combines an infrared light source with a camera to catch reflective glints from the user's eyes. Software calculates the area of the screen being looked at and uses that information for input.

In this paper we learn To track hand gestures using a web cam, to convert the gestures into action, to control the direction of a robot and to control the speed of the robot.

II. GESTURE RECOGONITION

Gesture recognition is a topic in computer science and language technology with the goal of interpreting human gestures via mathematical algorithms. Gestures can originate from any bodily motion or state but commonly originate from the face or hand. Current focuses in the field include emotion recognition from the face and hand gesture recognition. Many approaches have been made using cameras and computer vision algorithms to interpret sign language. However, the identification and recognition of posture, gait, proxemics, and human behaviors is also the subject of gesture recognition techniques.

Gesture recognition can be seen as a way for computers to begin to understand human body language, thus building a richer bridge between machines and humans than primitive text user interfaces or even GUIs (graphical user interfaces), which still limit the majority of input to keyboard and mouse.

Gesture recognition enables humans to interface with the machine (HMI) and interact naturally without any mechanical devices. Using the concept of gesture recognition, it is possible to point a finger at the computer screen so that the cursor will move accordingly. This could potentially make conventional input devices such as mouse, keyboards and even touch-screens redundant.

III. NUI OVER GUI

Using Natural User Interfaces (NUI's), more specifically using gestures or movements on a multi-touch device, can be a good alternative to overcome these difficulties. The resulting classification enables us to recognize research opportunities on Natural User Interfaces, and namely multi-touch interfaces for elderly. With the escalating role of computers in educational system, human computer interaction is becoming gradually more important part of it. The general believe is that with the progress in computing speed, communication technologies, and display techniques the existing HCI techniques may become a constraint in the effectualutilization of the existing information flow. The development of user interfaces influences the changes in the Human-Computer Interaction (HCI). Human hand gestures have been a mode of non-verbal interaction widely used. The vocabulary of hand gesture communication has many variations. It ranges from simple action of using our finger to point at and using hands to move objects around for more complex expressions for the feelings and communicating with others. Also the hand gestures play a prominent role in teaching considering the explanations and exemplifications being highly dependent on hand gestures. Naturalistic and intuitiveness of the hand gesture has been an immense motivating aspect for the researchers in the field of Human Computer Interaction to put their efforts to research and develop the more promising means of interaction involving human and computers.

The pursuance for the Human Computer Interaction research is moved by the central dogma of removing the complex and cumbersome interaction devices and replacing them with more obvious and expressive means of interaction which easily comes to the users with least cognitive burden like hand gestures. This paper designs a simple, natural system for gestural interaction between the user and computer for providing a dynamic user interface. The gesture recognition system uses image processing techniques for detection, segmentation, tracking and recognition of hand gestures for converting it to a meaningful command. This hand gesture recognition system has been proposed, designed and developed with the intensions to make it a substitute for mouse while making dynamic user interface between h- man and machine. Hence instead of

making effort to develop a new vocabulary of hand gesture we have matched control instruction set of mouse to subset of most discriminating hand gestures, so that we get a robust interface. The interface being proposed here can be substantially applied towards different applications like image browser, games etc."

IV. OBSERVATION

A NUI may be operated in a number of different ways, depending on the purpose and user requirements. Some NUIs rely on intermediary devices for interaction but more advanced NUIs are either invisible to the user or so unobtrusive that they quickly seem invisible. I make use of the users hands to be used as a tool to interface to control the robot. So to achieve this I use some contrasting color over my hand to identify my hand. Then an algorithm to track the movement of hand i.e., the gestures for which I make use of a web cam any web cam can be used even the low resolution or the integrated web cam for this purpose. Then this is translated using some functions to the actual commands to control the robot and is sent to the robot through a wireless module connected to serial port .Some advantages of my system are there is no need to buy costly hardware like touch screens and joy sticks to control the robot just a web cam one integrated with the pcs is enough to control the robot .And gestures are easier learn and use by the end users of the system.

Add Marker

It is used to add a tracking mechanism called marker to track the object. Image from webcam servers as the input to this module. A contrasting color is clustered out from the background. A marker which is tracked as it moves on the vision of camera is obtained.

Purpose: To add a tracking mechanism called marker to track the object.

Input: Image from webcam.

Processing: A contrasting color is clustered out from the background.

Output: A marker which is tracked as it moves on the vision of camera is obtained.

Identify Gesture

It observes to get valid actions that must be translated. The values of marker as they move servers as the input to this module. Valid gestures are found by comparing with the gesture base. Gesture type is identified.

Purpose: To get valid actions that must be translated.

Input: The values of marker as they move.

Processing: Valid gestures are found by comparing with the gesture base.

Output: Gesture type is identified

Translate Gesture

It converts user gesture to action. Identified Gesture servers as the input to this module. The gesture is then converted to an action that must be done. Action is identified as the output.

Purpose: To convert user gesture to action

Input: Identified Gesture.

Processing: The gesture is then converted to an action that must be done.

Output: Action is identified

Create Packet

The identified action serves as the input. Action is identified and a packet to be sent is created. Packet to be sent is the output.

Purpose: To send the identified action

Input: The identified action

Processing: Action is identified and a packet to be sent is created

Output: Packet to be sent

Send Packet

It helps to send the created packet .Packet to be sent servers as the input to this module. The serial port is opened and the packet is converted to stream of bytes and sent. The stream of bytes is sent to the serial buffer.

Purpose: To send the created packet

Input: Packet to be sent.

Processing: The serial port is opened and the packet is converted to stream of bytes and sent

Output: The stream of bytes is sent to the serial buffer.

V. CONCLUSION

A natural user interface to control the direction and the speed of a 4wd robot which works with a ATMEGA 16 microcontroller is successfully implemented. The gestures for the movement of the bot in the directions right left, forward and backward are formulated to give high level of accuracy. A gesture for speed control is devised for 4 levels of speed. A mechanism to track and movement is implemented using the touchlesssdk which works by image processing to find contrasting color region and present the relative position of the region.

Appropriate design guidelines for usage were devised based on the above devised gestures. Gesture is continuously read and the gestures are translated continuously and translated. The thus got speed and the direction were successfully converted to packets that the microcontroller can interpret and is sent through the serial port to the wireless module and thus it executed in the microcontroller in the bot. This type of natural user interfaces makes it easy and cheaper to implement and easy to learn and use. Thus making it a reliable and cheaper alternative to the traditionally used hardware based or GUI based controls.

VI. FUTURE WORK

This system is built using a limited gesture base to control limited functionalities of the bot future work can include formulating a bigger gesture base. It can also include some mechanism to track hand effectively without making use of some marker to track hand .It can also be to improve the speed and accuracy of the tracking mechanism. The method used here is not good in terms of accuracy. With help of depth sensors and other hardware the accuracy can be improved.

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