Interdisciplinary Congress of Renewable Energies - Industrial Maintenance - Mechatronics and Informatics

Booklets

RENIECYT Registro Nacional de Instituciones y Empresas Científicas y Tecnológicas

1702902 CONACYT

RENIECYT - LATINDEX - Research Gate - DULCINEA - CLASE - Sudoc - HISPANA - SHERPA UNIVERSIA - Google Scholar DOI - REDIB - Mendeley - DIALNET - ROAD - ORCID

Title: Prototype of natural user interface applied to a robotic arm for medical attention preventing nosocomial infections in healthcare personnel

Authors: SERRANO-RAMÍREZ, Tomás, GUTIÉRREZ-LEÓN, Diana Guadalupe, MANDUJANO-NAVA, Arturo y SÁMANO-FLORES, Yosafat Jetsemaní

Editorial label ECORFAN: 607-8695

BCIERMMI Control Number: 2020-04

BCIERMMI Classification (2020): 211020-0004

Pages: 11

RNA: 03-2010-032610115700-14

ECORFAN-México, S.C.
143 – 50 Itzopan Street
La Florida, Ecatepec Municipality
Mexico State, 55120 Zipcode
Phone: +52 1 55 6159 2296
Skype: ecorfan-mexico.s.c.
E-mail: contacto@ecorfan.org
Facebook: ECORFAN-México S. C.
Twitter: @EcorfanC

www.ecorfan.org

Holdings

Mexico, Colombia, Guatemala, Bolivia, Cameroon, Democratic Republic of Congo, Spain, El Salvador, Ecuador, Taiwan, Peru, Paraguay, Nicaragua

Introduction

In December 2019, a global crisis of health started around the world by COVID-19, a dangerous and highly transmissible virus.

Until now, it is causing thousands of deaths and growing of contagion rates around the world, involving a serious situation for healthcare personnel that works in hospitals attending infected population.

Healthcare personnel is heavily exposed to infection risk during its working sessions due to direct contact with infected people and contaminated objects including equipment, medical instruments and supplies.

Natural user interface *is a technology that can be used to control devices without establish a direct contact, specifically by gestures and human body motion that is correlated with the interface reaction*

Instant expertise

Instant expertise let the user to apply his natural abilities to control the device.

Progressive learning

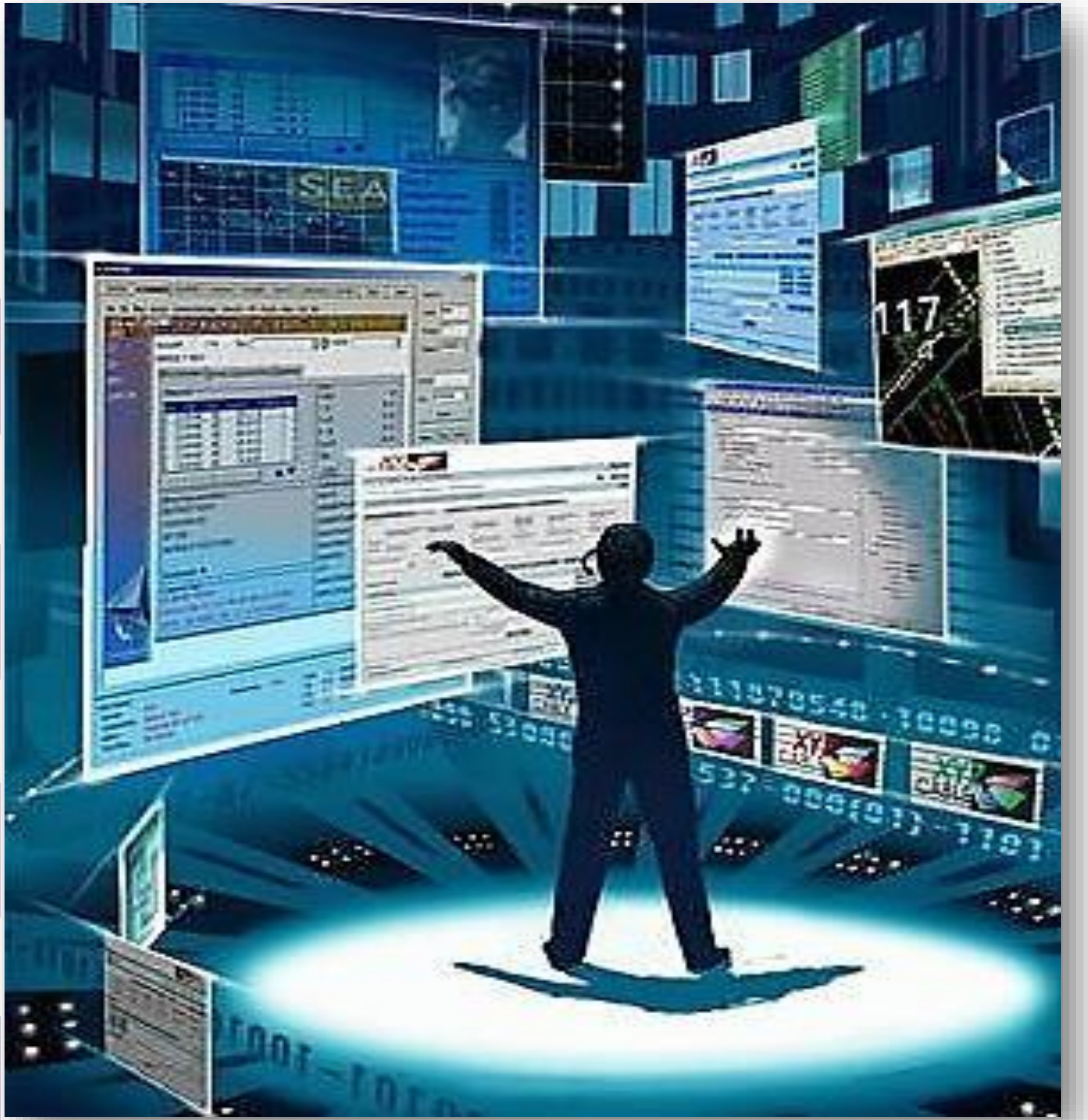
The way people learn physical skills start with basic tasks and move on to something more advanced step by step.

Direct interaction

Direct correlation between user action and the natural user interface reaction.

Low cognitive load

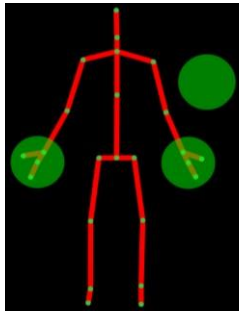
User takes advantage of his basic skills movement of body, letting him focuses on achieving the task. Minimum Mental Effort.

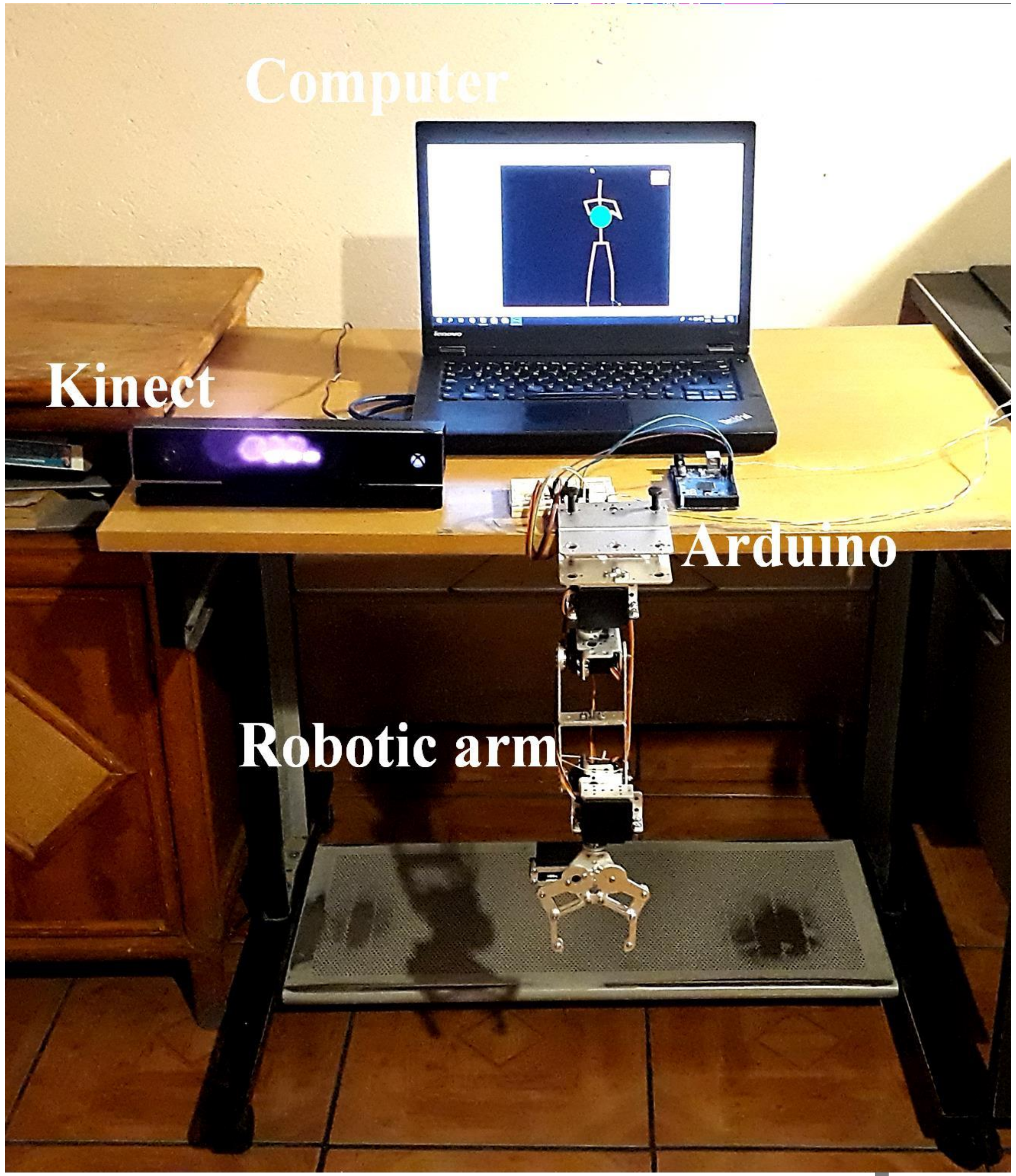


Methodology

Design and development of prototype

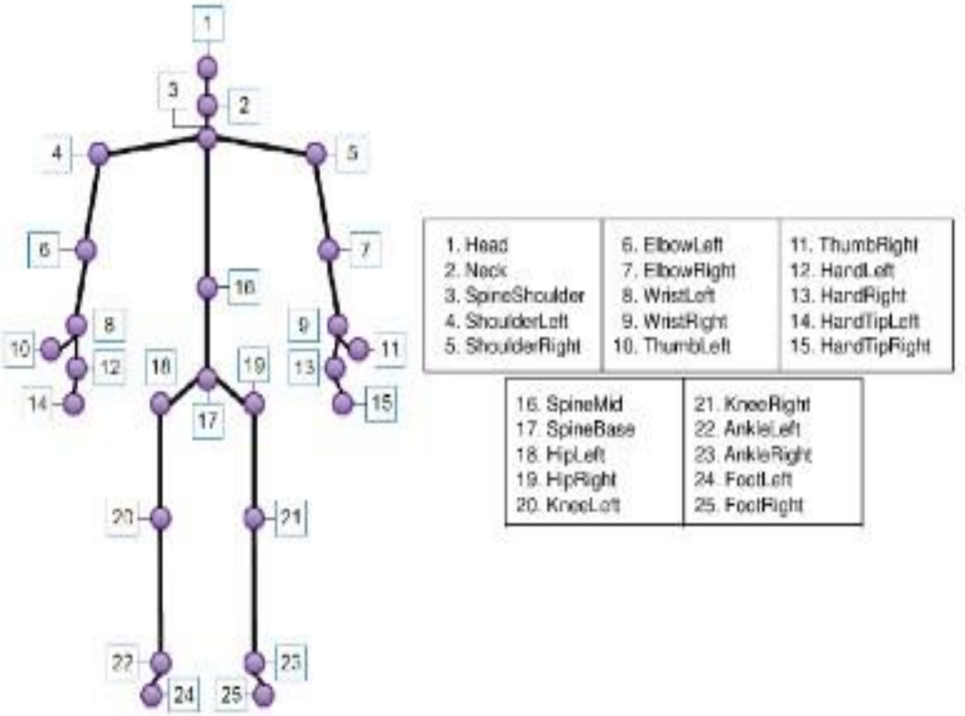
DEPTH SENSING CAMERA → COMPUTER → MICROCONTROLLER → ROBOTIC ARM





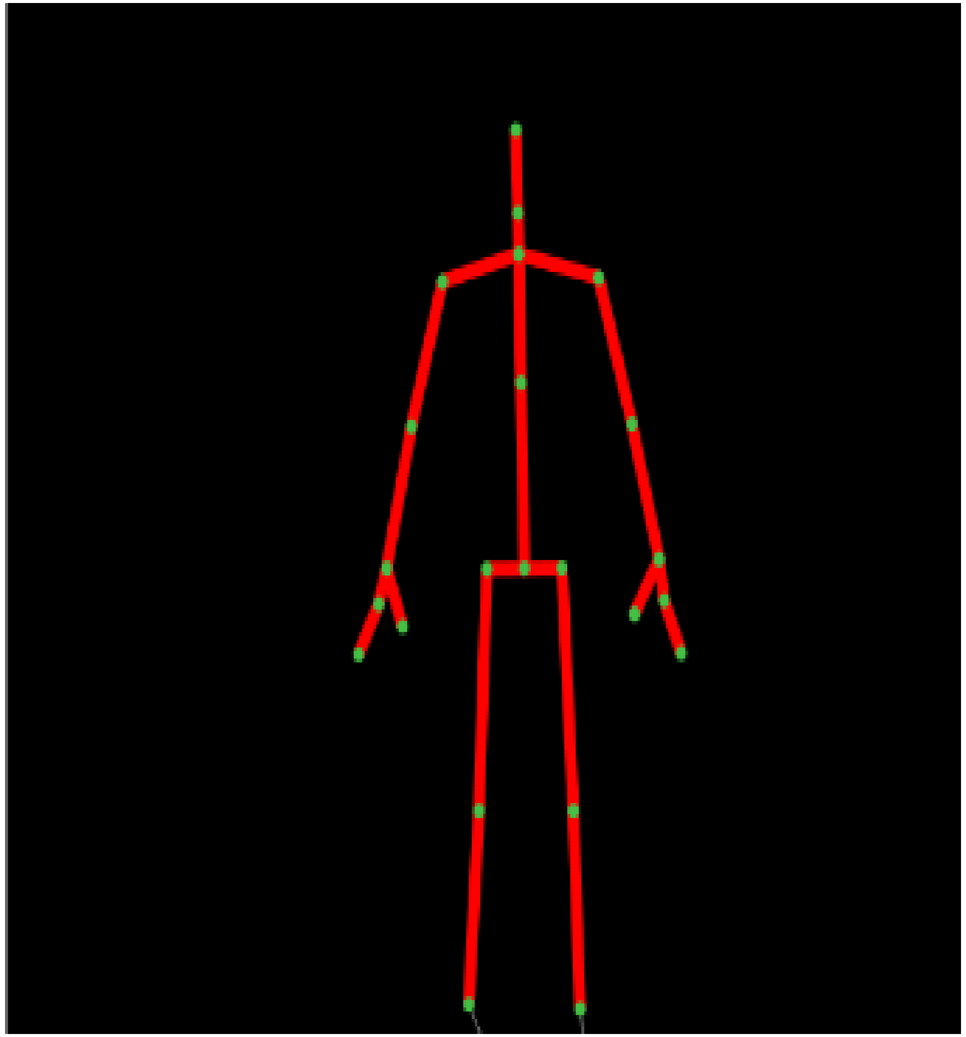
Motion sensing input device (Kinect V2)

The Kinect V2 sensor by Microsoft is used as an input device. It features an RGB camera and a depth sensor (Time of Flight) which provide full-body 3D motion capture at 30 frames per second, sen d USB 3.0.



Computer

It is notebook or a personal computer (PC) which stores and executes the designed natural user interface. The natural user interface processes the Kinect information sent via USB by artificial intelligence (Decision Forest Classifier and Mean shift), obtaining the position of the 25 specific body joints from the user at 30 fps. Natural user interface displays the user skeleton tracking and at the same time, sends via USB the respective angles and hand states to Arduino for controlling the robotic arm.

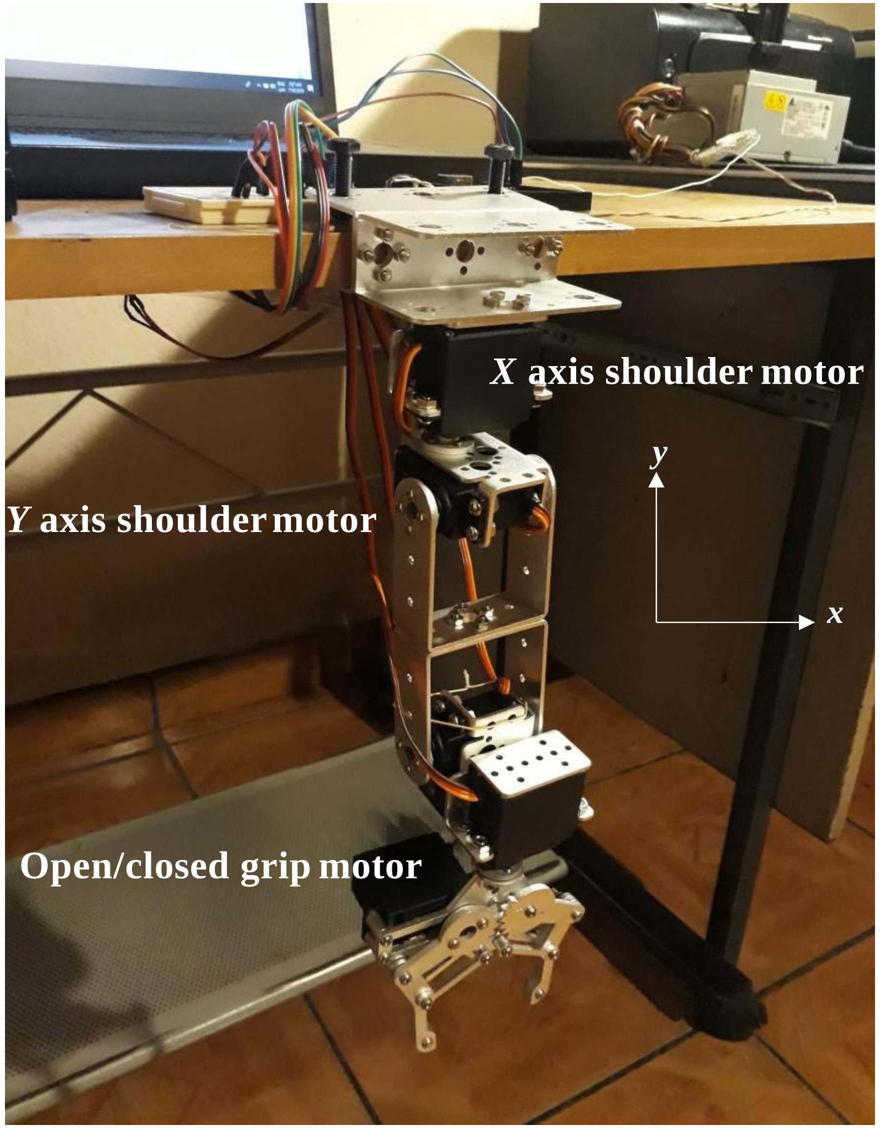


Microcontroller

Once the angles or hand states are sent from the computer using the USB port to the microcontroller board (Arduino mega 2560), it receives them, and for each one, generates a PWM signal to position the servo-motor (belonging to the robotic arm) into a specific angle. The servo-motor angle depends on the magnitude of the received angle from Kinect.

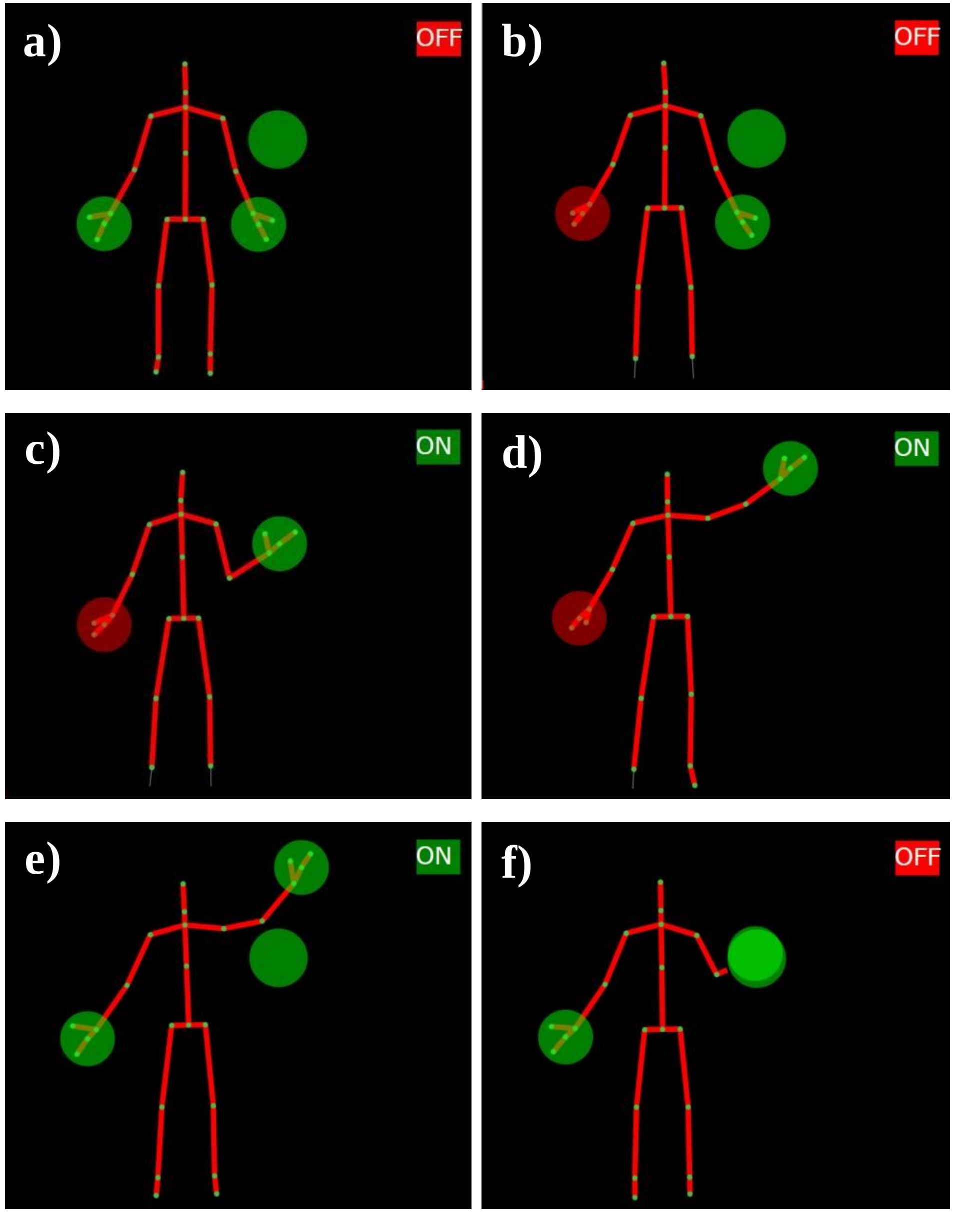
Robotic arm

The prototype is an articulated robotic arm, that tries to emulate the human arm, under the wrist and uses servo-motors to mimic the joints motion. For this prototype, the we emulate the movement from the right shoulder and the open and closed right hand state; three servo-motors mg996r are used for this purpose (0 to 180° turning radius).



Results

Interactive Functionality. At this moment, the robotic arm can be controlled by the natural user interface but it lacks of interactivity, or a dialog between the user and Computer, wasting the powerful functionality that Kinect offers in this category. For this purpose, three hand gestures detected by the improved Kinect V2 will be used in order to communicate with de computer these gestures are: open, closed and lasso as shown in Figure 8. When Kinect detects some of these gestures, it sends to the computer Boolean variables that can be read with the appropriate command in SDK 2.0.



Conclusions

According to the objectives set in this project, a natural user interface for controlling a robotic arm in real time, without the requirement of a controller or any contact device, but simply by the motion or gesture from the user's arm was successfully designed. The fast response and easy operation in the control of a robotic arm, give our natural user interface important advantages over many proposed prototypes under the same budget. Our prototype can be easily escalated to a more complex natural user interface, which would let us to control a robotic arm with more degrees of freedom, fingers control and haptics, emulating the movement of a real arm more closely. Besides that, applying a remote control using a node to node communication in an Internet of Things (IoT) application, could transform this prototype in a tool for telemedicine, in areas such as tele-operation, tele- rehabilitation, telehealth nursing, assistive and therapeutic robotic devices, which are the last tendency in medicine at this time.

ECORFAN®