International Journal of Modern Developments in Engineering and Science
Volume 1, Issue 6, June 2022
https://www.ijmdes.com | ISSN (Online): 2583-3138

Virtually Controlled Robot Using Kinect Sensor

H. Sandeep[1*], K. Sagar[2], S. Sandeep[3], M. R. Santhosh[4], A. C. Nirmala Devi[5]
[1,2,3,4]*Student, Department of Electronics and Communication Engineering, SJC Institute of Technology, Chikkaballapura, India*
[5]*Professor, Department of Electronics and Communication Engineering, SJC Institute of Technology, Chikkaballapura, India*

***Abstract*: Kinect is Microsoft's motion sensor is one of the Xbox 360 gamming console. The core component of Kinect is the range camera which is using an infrared projector and camera and a special microchip to track objects in 3D objects. In past, the development of human robot interaction with service robots it makes high noise and also attracted the attention of many researchers. The sensor captures the full body in 3D motion, facial recognition, and voice recognition capabilities. The movement of the human arm in 3D space is captured, processed and replicated by the robotic arm. The device provides a natural user interface that allows user to interact directly without any intermediate device such as a controller. It consists of a 3D depth sensor that creates a skeleton image of a player and a motion sensor detects their movements. The information is provided by the user and it is received by the Kinect to communicate between the user and computer and the information is received by the angle of servo motor to microcontroller. As a result, the application of Kinect control is finding its way into various aspects of life. This paper explains the mini-Robot controlling which is remotely controlled by human body motions through the Microsoft's motion sensor.**

***Keywords*: Arduino Uno, Kinect sensor, NRF module, L293D motor driver IC, Arduino IDE, Visual studio code.**

1. Introduction

With the development of technology, robots are gradually entering our life. The applications are ranging from rehabilitation, assisted living, education, housework assistance, to warfare applications. Various applications require specific control strategies and controllers. Development of a myriad of low-cost sensing devices, even nowadays, makes remote control of robotics devices a topic of interest among researchers. In particular, gesture control of robotic devices with different complexity and degrees-of- freedom is still considered as a challenging task. In this context, recently developed depth sensors, like Kinect sensor, have provided new opportunities for human-robot interaction. Kinect can recognize different gestures performed by a human operator, thus simplifying the interaction process. In this way, robots can be controlled easily and naturally. The key enabling technology is human has achieved a new level where the users directly interact with human body movements. This new form of HMI has quickly spread to various dimensions including education, medical care, entertainment, sports. Traditionally, most Kinect applications employ body movements via the Kinect sensor to control different applications body language understanding. The computer must first understand what a user is doing before it can respond.

The Main Heart of the Project is Kinect. The Microsoft Kinect sensor and its software development kit (SDK), the human machine interface of personal computers.

2. Literature Survey

KINECT Sensor Based Gesture Control Robot for Fire Fighting Nipun D. Borole. IJSRD - International Journal for Scientific Research & Development Vol. 4, Issue 02, 2019 In the proposed work, a gesture-controlled robot is implemented using Kinect based gesture recognition making it a humanized robot for firefighting. The movement of the human arm in front of the sensor is captured, processed and the according actions are followed by the robot. The human arm gestures are transmitted to the microcontroller after using Kinect sensor. Microcontroller receives the gestures and commands the robot. In testing the accuracy of control based on gestures performed by human hands was tested. This work depends on visual basic application. With this project we can extinguish the fire and save lives as there is no human intervention in actual scenario.

Controlling Servo Motor Angle by Exploiting Kinect SDK Farzin Foroughi, International Journal of Computer Applications, this paper narrates the all proceeding of designing a system for control of a servo motor angle control using by body gesture of user. Hardware structure was wholly designed and implemented for this aim. Hardware structure was designed by an interface circuit that is based on microcontroller Atmega8 for analyze the data and generate command also circumambient architecture for control movement of different angle of the servo motor. For operate the servo motor were used Kinect. Kinect is used for receive information from user and provide communication between user and computer then send information of angle of servo motor to microcontroller. For suitable interaction for controlling servo motor by user, was created Graphic User Interface in visual C [8].

Gesture Control of a Mobile Robot using Kinect Sensor Katerina Cekova, International Conference on Applied Internet and Information Technologies, 2018 This paper describes a methodology for gesture control of a custom developed mobile robot, using body gestures and Microsoft Kinect sensor. The Microsoft Kinect sensor's ability is to track joint positions has been used in order to develop software application gestures recognition and their mapping into control commands. The proposed methodology has been experimentally evaluated. The

*Corresponding author: sandeephanumeshs@gmail.com

results of the experimental evaluation, presented in the paper, showed that the proposed methodology is accurate and reliable and it could be used for mobile robot control in practical applications [9].

Design and Implementation of Human-Robot Interactive Demonstration System Based on Kinect Liying Cheng, 2012 24th Chinese Control and Decision Conference (CCDC) With the development of technology, humanoid robots gradually enter our life, not only for education, but helping people with housework and many other tasks, some of which are inevitable for human. But only few people know how to control and interact with a humanoid robot, which hinders the development of humanoid robot. So, a human-robot interactive demonstration system is designed to help non-expert users to control the humanoid robot, Aldebaran humanoid robot Nao in this case. Users just need to use the most natural body gestures to interact with the robot. Microsoft Kinect is applied in this system to recognize different body gestures and generate visual Human-Robot interaction interface, then the controlling signals of different body gesture modules are sent to Nao through wifi, which can stimulate Nao to complete tasks. This kind of system aims to enrich the interactive way between human and robots and help non-expert users to control the robot freely, making Human-Robot interaction much easier [2].

3. Methodology

A. Kinect Skeleton Tracking

A program can use the depth information from the sensor to detect and track the shape of human body. The Kinect SDK will provide programs and skeletal position information that can be used in games and many other applications. This skeletal tracking in the Kinect SDK can track 6 skeletons at the same time. which 4 of the bodies only simple location is provided but 2 will be tracked in detailed. For those 2 bodies the SDK will provide the position in 3-D space of 20 joint node positions.

B. Joint Orientation

As shown in the fig. 1, 2, a local axes representation hierarchical rotation based on a relationship defined by a bone on skeleton joint structure. This node positions are referred in terms of Cartesian coordinates by the Kinect RGB camera and this will help in framing the code for the project.

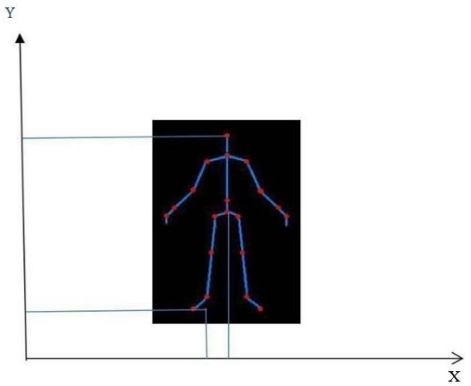

Fig. 1. Joint view

The above figure is the skeleton tracking from the Kinect and virtual motion of a robot. Kinect Deploying According to the present Project and its specifications shows below.

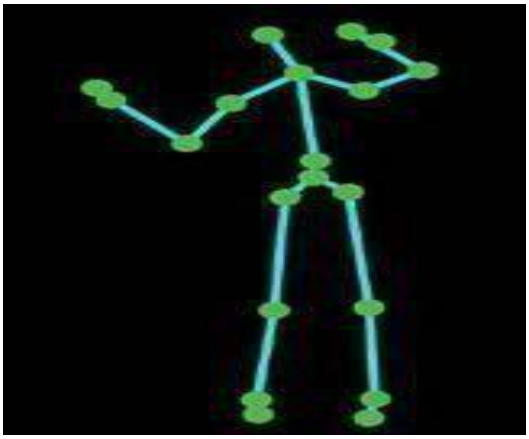

Fig. 2. Different angles of Joint view

4. Block Diagram

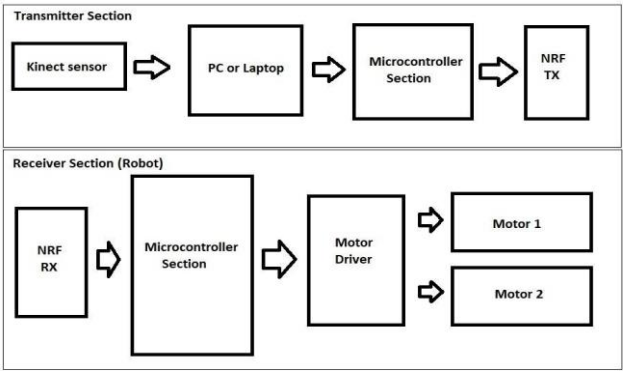

Fig. 3. Block diagram

Fig. 3 shows that the controller is fitted inside the Robot to receive the control signals from PC and to control motors through NRF Communication. To detect the human skeleton joint movement's one can remotely control the robot to take action. The Arduino controller interfaces with the NRF Module in which the transmitting and receiving pins of Arduino are connected to the SPI pins of the Module. The Communication is through the NRF USB wire with the NRF Module which provides the Data to the Arduino Board.

Whenever user will move arm, our system will track that arm and it will generate different command for different arm location. The Arduino controller is fitted inside the Robot to receive the control signals from PC and to control 2 motors through NRF Communication. The robot will go based on arm location and movement forward, backward left, right direction. This provides virtual interactions provide different command for different body action, and those we are using for control the robot movement.

5. Results

As the kinetic sensor receives the data from the gesture, it transmits the data via NRF module to the microcontroller to operate the robot motor.

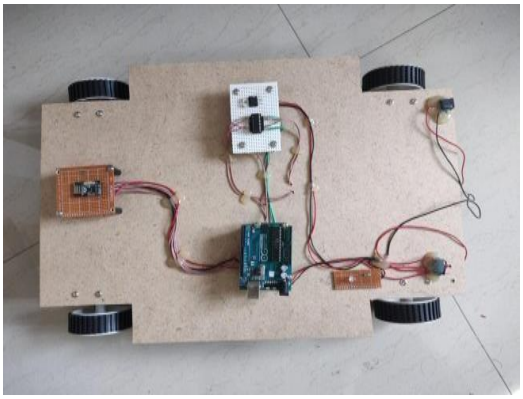

Fig. 4. Development of robot

Table 1
Gesture behavior

Body Gestures	Robot Movement
Right and left arm down	Stop
Left arm up	Forward
Right arm up	Backward
Left arm	Right
Right arm	Left

The set of gestures aimed toward robot control and their meaning are presented in Table. To keep robot in ideal user needs to keep both the arm down. If one arm is up and other is down the robot is moving right or left depending on which arm is up. To move the robot forward or backward the user must lift the right or left arm. The software application than detects the user's gesture in real time. NRF communication is used to send the commands to the microcontroller on the robot. The microcontroller controls the motor of the robot by gesture command.

6. Conclusion

This paper presented the implementation of virtually controlled robot using Kinect sensor.

References

[1] Mohammed A. Hussein, Ahmed S Ali, Elmisery, Fathy, Mostafa, and Ramadan, Motion Control of Robot by using Kinect Sensor. Research Journal of Applied Sciences, Engineering and Technology, pp. 2109-2117.

[2] Liying Cheng, Qi Sun, and Shuying Zhao, Design and implementation of human-robot interactive demonstration system based on Kinect. Proceeding of 24th Chinese Control and Decision Conference, 2019, May 23-25, pp. 971-975.

[3] Ren C. Luo, Bo-Han Shih and Tsung-Wei Lin, Real time human motion imitation of anthropomorphic dual arm robot based on Cartesian impedance control. Proceeding of IEEE International Symposium on Robotic and Sensors Environments, 2018, pp. 25-30.

[4] Michael Van den Bergh, Daniel Carton, R. de Nijs, N. Mitsou, C. Landsiedel, K. Kuehnlenz, D. Wollherr Real-time 3D hand gesture interaction with a robot for understanding directions from humans, 2019, pp. 357–362.

[5] Biao Ma, Wensheng Xu, and Songlin Wang, A robot control system based on gesture recognition using Kinect, May2020.

[6] Bhatt Meet, Joshi Hari, Vaghasiya Denil, Rohit R Parmar, Pradeep M Shah, Gesture-Based Robot Control with Kinect Sensor, International Journal of Innovative Technology and Exploring Engineering, vol. 9, no. 7S, pp. 75-78, May 2020.

[7] Farzin Foroughi, Peng Zong, Controlling Servo Motor Angle by Exploiting Kinect SDK, International Journal of Computer Applications, 2020.

[8] Katerina Cekova, Natasa Koceska, Saso Koceski, Gesture Control of a Mobile Robot using Kinect Sensor, International Conference on Applied Internet and Information Technologies, 2020.

[9] Nipun D. Borole, Gayatri M. Phade, Kinect Sensor Based Gesture Control Robot for Fire Fighting. International Journal for Scientific Research & Development, vol. 4, no. 2, 2018.