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Virtually Controlled Robot Using Kinect Sensor

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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.

I. 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, likeKinect 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

II. METHODOLOGY 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 andmany other applications. This skeletal tracking in the Kinect SDK can track 6 skeletons at the same time.For 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.

JOINT ORIENTATION

As shown in the fig 1, 2 a local axes representation hierarchical rotation based on a relationshipdefined 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.

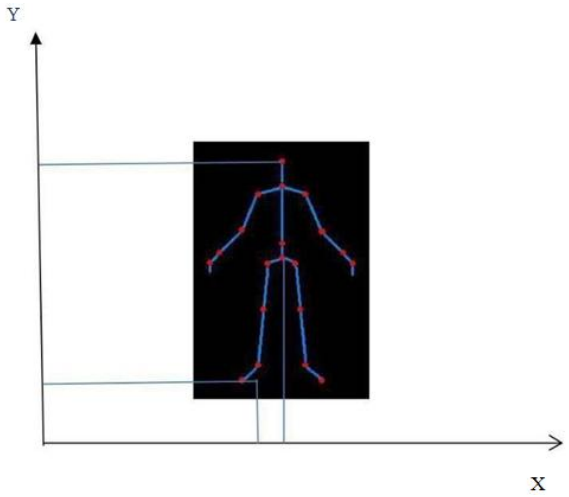

Fig 1. Joint view

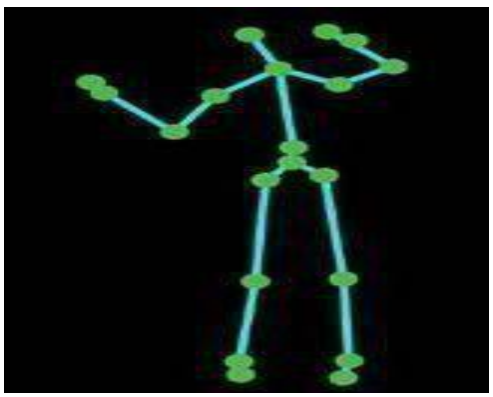

Fig 2. Different angles of Joint view

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

III. Block diagram

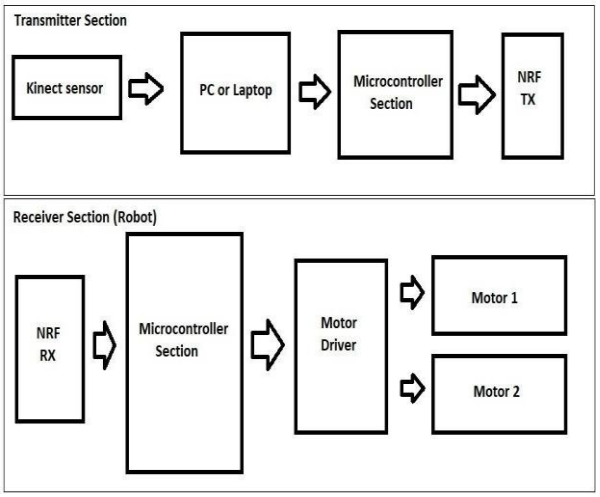

Fig. 3. Block diagram

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.

IV. Hardware and software specifications

A. Kinect sensor

Microsoft Kinect is a set of sensors developed as an Interactive Console the Xbox 360 & Xbox one too. Kinect has an RGB camera and a dual infrared depth sensor with a projector and CMOS IR Receiver (Sensor). The RGB camera has a resolution of 640X480 pixels and coming to the Infrared Camera, It is the basic Cause of Depth

Imaging and Skeleton Building.

B. Arduino UNO microcontroller

Arduino Uno is a microcontroller based on 8-bit ATmega328P microcontroller. It also consists of other components such as crystal oscillator, serial communication, voltage regulator, etc. to support the microcontroller. Arduino Uno has 6 analog input pins, 14 digital input/output pins, a USB connection, A Power barrel jack, an ICSP header and a reset button.

C. Transceiver module (NRF24L01)

NRF24L01 is a wireless communication module that uses a 2.4GHz RF frequency and both the transmitter and receiver are integrated on the same IC. There is a special feature called Multi Ceiver in nRF24L01 IC. This enables each RF Channel with a set of 6 unique addressed data pipes so that each module can communicate with 6 other modules in the same RF Channel.

D. L293D motor driver IC

L293D is a typical motor driver or IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of 2 DC motors simultaneously in any direction. A single L293D IC can control two DC motor.

E. DC motors

DC motor shows very easy to use and available in standard size. Nut and threads on shaft to easily connect and internal threaded shaft for easily connecting it to wheel.

F. Arduino IDE

Arduino IDE is an opensource software that is mainly used for compiling the code into the Arduino Module. It is an Arduino software that make's code compilation too easy with no prior technical knowledge. It is easily available for operating systems like MAC, Windows, and Linux that comes with inbuilt functions and commands that play a vital role for debugging, editing and compiling the code in the environment

G. Visual studio code

Visual Studio Code (famously known as VS Code) is a free opensource text editor by Microsoft. VS Code is available for Windows, Linux, and macOS. Although the editor is relatively lightweight, it includes some powerful features that have made VS Code one of the most popular development environment tools in recent time

V. APPLICATIONS

- We can use this system in Offices, Smart cities, etc.
- This system is most useful in chemical industry area because it extinguishes the fire.
- Virtually control robots used for military safe and high-end operations.
- The system could be applied in control of various robotic devices (such as robotic wheel chairs) that are aimed at disabled persons having functional upper limbs.

VI. ADVANTAGES

- The main advantages of Kinect sensor, there is no require of any kind of remote or any other interface.
- Here we can increase functionality of any application without hardware change.
- This provides virtual interactions directly with machines without any intermediate devices which results in human machine interface.
- In this project directly we are passing information from human action only.

VII. 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.

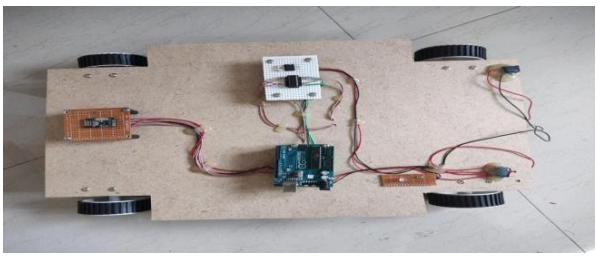

Fig: Development of robot

Table of gesture behavior:

BODY GESTUERS	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.

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