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Rakshak - A Rescue Bot

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Abstract: Robotics is the field of designing and innovation that assumes a vital part in making our lives simpler to perform different undertakings. The primary point of the venture is to outline and build up, a sensor based mechanical arm which is controlled by human hand. The venture manages controlling a servo mechanical arm with the assistance of movement detecting innovation by Flex sensor and 3-hub accelerometer. The pick and place operation of the mechanical arm can be controlled utilizing Arduino. This framework can be utilized as a part of enterprises, dangerous conditions, biomedical surgeries and different applications.

Keywords: *Robotic Arm; Data Glove; Flex sensors; Arduino UNO; Accelerometer; Servo motor; DOF(Degree of Freedom)*

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I. INTRODUCTION

Robotics is one of the trending technology.The research in Robotics today is mainly focusing on developing systems that exhibit modularity, flexibility, redundancy, fault-tolerance, a general and extensible software environment and seamless connectivity to other machines, some researchers focus on completely automating a manufacturing process or a task, by providing sensor based intelligence to the robot arm.

As we know that the robotic system can be controlled through physical devices, nowadaysrecent method of gesture control has become very popular. The main purpose of using gestures is that it provides a more natural way of controlling and provides a rich and intuitive form of interaction with the robotic system. These days many types of robots are being developed and are put to many variety of applications and uses. Human hand gestures are natural and it is easier to interact with the robot in a friendly way.

The robot moves depending on the gesture made by the hand from a distance.These robots are currently used in many fields such as inmilitary, hospitals, dangerous environment and agriculture. Sometimes it might be difficult for humans to do some dangerous tasks like picking up explosive chemicals or to pick and place the bomband other tasks. Therefore robots can replace humans to perform various tasks.

II. LITERATURE SURVEY

There are various ways in which a robotic arm may be controlled. In the past, there have been many researchers working to control robotic arm through computer terminals, Joysticks, even interfacing them with the internet so they can be controlled from anywhere in the world. Among the research papers, paper [1], paper [2], and paper [3] are most valuable towards the development of this project.

The paper [1], deals with robotic arm using flex sensors.Robotic applications demand sensors with high degrees of repeatability, precision, and reliability. Flex sensor is a device, which accomplishes the above task with great degree of accuracy. The pick and place operation of the robotic arm can be efficiently controlledusing micro controller programming. In the paper [2], researchers have presented a model to control robotic arm through human gestures using accelerometer. A three axis accelerometer is mounted on human hand in order to perform the action of robotic arm according to the action of human hand. Accelerometer is connected to the Atmega 16 Microcontroller which is programmed to take analog readings from accelerometer. Movements of the robotic arm are achieved through Servo-Motors. The arm is also equipped with a gripper to facilitate the pick and drop facility.In the paper [3] it describes the design and implementation of pick and place arm Robot and its movement Control by realization of the mobile application for the Android operating system which is focused on using wireless Bluetooth technology. Prototype of a mobile robot is necessary for the development of the application.

III. PROBLEM DEFINITION

Many variants of these robots/robotics are available such as Keypad Control, Voice Control, Gesture Control, etc. However, most of the industrial robots are programmed using the typical teaching process which is still a time-consuming task that requires technical expertise. Therefore, there is a need for new and easier ways for programming the robots. The prime aim of the design is that the robot and platform starts the movement as soon as the operator makes a gesture or posture or any motion. The Robotic arm is

synchronized with the gestures (hand postures) of the operator. The goal of this paper is to develop methodologies that help users to control and program a robot, with a high-level of abstraction from the robot specific language.

WORKING PRINCIPLE

The Gesture controlled Robotic arm is composed of 3 major sophisticated systems, a wearable Data Glove controller, a processing unit and theservo controlled Robotic Arm. The basic block diagram of the project is shown in below figure 1:

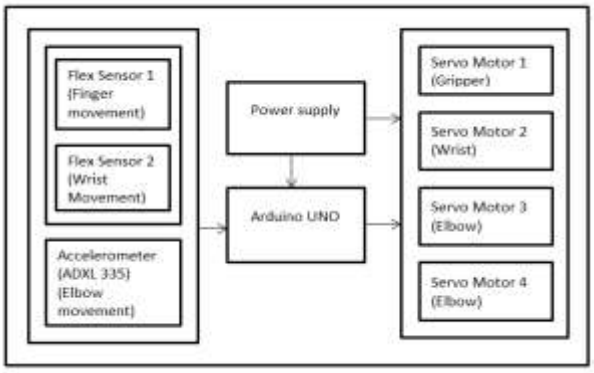
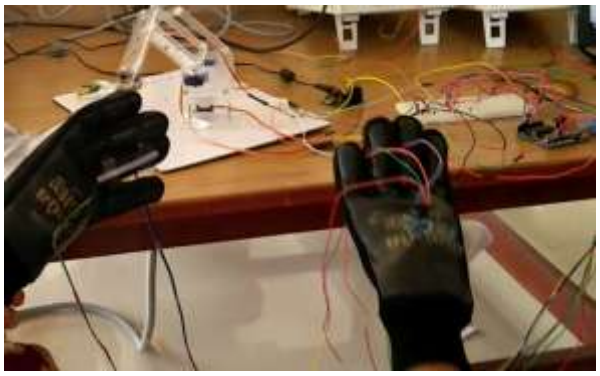


Figure 1 Basic Block Diagram

For the implementation of the Data Glove controller, one flex sensor has been placed between the index finger and thumb & another on the wrist of the data glove. These sensors are variable resistors. A 3-axis accelerometer is mounted on forearm which gives analog voltage signals when tilted in X, Y and Z directions so far we have used only X and Y tilts.Based on the digital value corresponding to specific analog voltage outputs from the sensors, the microcontroller can be programmed to control the speed and planar rotational position of the servo motor linking the gripping fingers of the robot. Since our structure allows movement in all three dimensions we have used 4 servo motors. The step by step operation can be explained as follows

1. At first, the rotation of user's forearm results in the variation of values of accelerometer, which controls the servo motor at the right side of robotic arm resulting in forward, backward, right and left movements of whole structure.
2. Now the bend in user's wrist results in the variation of flex sensor resistance placed on the wrist, which controls the servomotor at the left side of robotic arm and this corresponds the wrist movement of robotic arm resulting in upward and downward movements.
3. While the flex sensor placed in between the index finger and thumb controls the servo motor on top of robotic arm and allows for gripping of objects.



Experimental setup

DESCRIPTION IN DETAIL

The following are the hardware and software components required :

ARDUINO UNO: Arduino is an open source electronics prototyping platform based on flexible, easy to use hardware and software. The Arduino can sense the environment by receiving input from a variety of sensor and can affect its surroundings by controlling lights, motors, and other actuators.We can control the board functions by sending a set of instructions to themicrocontroller on the board via Arduino IDE.

FLEX SENSORS: Flex sensors are passive resistive devices that can be used to detect bending or flexing.A simple flex sensor is 4.5" in length. As the sensor is bent, the resistance across the sensor increases. They are often used in gloves to sense finger movement. Flex sensors are simple in construction. They convert the change in bend to electrical resistance the more the bend, the more the resistance value. They are usually in the form of thin strip1-5 long that varies in resistance.

ACCELEROMETER: Acceleration is a measure of how quickly speed changes. The ADXL335 is a small, thin, low power, complete 3-axis accelerometer with signal conditioned voltage outputs. The product measures acceleration with a minimum full-scale range of ±3 *g*. It can measure the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration.

SERVO MOTOR: Servo refers to an error sensing feedback control which is used to correct the performance of a system. A servo motor consists of three major part : a motor,

control board and potentiometer (variable resistor) connected to output shaft.Servo or RC Servo Motors are DC motors equipped with a servo mechanism for precise control of angular position. The RC servo motors usually have a rotation limit from 90° to 180°. But servos do not rotate continually. Their rotation is restricted in between the fixed angles.

THE GLOVE: Gloves offer for superior data input potential since they provide multiple degrees of freedom for each finger and the hand as a whole. By taking orientation of fingers and relative position of hand, glove devices can track an enormous variety of gestures each of which corresponds to a different type of data entry.

ARDUINO IDE: The board functions can be controlled by sending a set of instructions to the micro controller on the board via Arduino IDE. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program.

IV. APPLICATIONS

Automotive industry: In the industries the robots are used to manipulate very heavy loads and are also used in welding purpose.

Assembly: The robots can monitor the quality assembly line with adapted enhance sensor technologies.

Medicine: Robotic systems now start to be developed to assist surgeons in high precision manipulation of devices.

Nuclear energy:The robotic systems are used for the replacement of radioactive fuel tubes.

Agriculture: Robots have also found application in agriculture field.

V. CONCLUSION & FUTURE SCOPE

The robotic arm has been produced effectively. This robotic arm control technique is relied upon to defeat the issue, for example, picking or setting the protest that is far from the client. Be that as it may, we are pleased as a gathering to have accomplished an ease Data glove controlled automated arm. For the future execution of this venture, the accompanying changes can be made, for example, it is conceivable to manufacture a WIRELESS ROBOTIC ARM for upgraded applications. By using LAN and different remote procedures it is conceivable to fabricate a robotic arm which is controlled from a remote area. The robot can be fitted with haggles sensors to make development conceivable. The robot can be given included knowledge with the goal that it can detect impediments react fittingly.

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