Haptic Based Tele-picking Robotic Arm

Avi Kumar R
Department of TCE
GSSSIETW, Mysuru

Papiya Mandal
Department of TCE
GSSSIETW, Mysuru

Preethi K S
Department of TCE
GSSSIETW, Mysuru

Ranjitha N
Department of TCE
GSSSIETW, Mysuru

Nishkala U
Department of TCE
GSSSIETW, Mysuru

Abstract— Robots of the current generation have been used in fields isolated from the human society. They suffer major shortcomings because of their limited abilities for manipulation and interaction with humans. In order to represent the robotic technology in the field of human-machine interaction and wireless communication for allows interactivity in real-time with virtual objects it is very necessary to develop some or the other technology that makes the maximum use of robot to help people do their work in an efficient way in their day to day life. The main objective of the paper is to design and develop the Robot that is used to move using wireless system by recognizing hand motion that is controlled by haptics technology for virtual environment & human-machine systems capable of haptic interaction. Without risking human life or limb, this research has applications in many areas, including robot assisted surgery, simulation and training, rehabilitation, exploration of hazardous or remote environments, enabling technologies, manufacturing, design, mobile computing, and education.

Keywords—Haptics, human-machine interaction system, robotic arm control, robot, transceiver module.

I. INTRODUCTION

Robotics is a special engineering science which deals with designing, modeling, controlling and robot's utilization. Nowadays robots accompany people in everyday life and take over their daily routine procedures. As the research progressed, robots were recognized not only as simple action performer but as a machine that have diverse and variety of purposes and usages. The paper focuses on design and implement a robotic arm and control it using a human arm by means of haptics technology. Haptics is the science of applying touch sensation and control for interaction with virtual or physical applications. Haptics is one of thegrowing areas in human computer collaboration which deals with sensory interaction with computers. The word haptic is derived from the Greek word *haptikos* which means pertaining to the sense of touch. Haptic is used in engineering systems to create virtual environment. It is a tactile feedback technology which takes advantage of sense of touch by applying motions, vibrations or forces to the user.

Haptics can be divided into three areas**:**

1. *Human haptics* - the study of human sensing and its control through touch.
2. *Machine haptics*- the design, construction, and the use of machines to replace or augment human touch.
3. *Computer haptics* - algorithms and software associated with generating the touch and feel of virtual objects.

The basic idea is the sensors on the haptic device work as transducers and converts hand motions into electrical signals. These hand movements can be replicated using a robotic arm. Our research is devoted to developing the principles and tools needed to realize advanced robotic and human-machine systems capable of haptic interaction. The project is divided into two modules namely, Haptic glove (Transmitter) & Robot side (Receiver).

II. LITERATURE SURVEY

Some of the relevant literary works in this field are briefed below: The study relatedhow the autonomous robots would benefit from improvements in haptic intelligence and overview of tele-robotics systems. In the real world, the developed robots to help to perform tasks in the remote environment.This paper aims to design and construct a robotic arm through in cooperation of haptic feedback.They have studied human-machine interaction and works in a similar way as the body goes in specific direction or manner and shows sensation at the same time. The haptic robotic arm was successfully designed and implemented and lifting of an object was attained successfully. This paper helped us understand modelling haptic glove [8].

The research work performed by AnkitPurohit and MakarandKakatkardescribes Tele-operation system using haptic technology, an operator controls the movements of a robot which is located at some distance. Different types of force sensors, angel sensors and gyro sensors are used to take the input and these inputs are given to microcontroller. The motors in robot arm respond to control signal from controller board [10].

In this paper Tele-operation system using haptic technology, an operator controls the movements of a robot which is located at some distance. Different types of force sensors, angel sensors and gyro sensors are used to take the input and these inputs are given to microcontroller. The motors in robot arm respond to control signal from controller board.Although the human wrist is thought to have three degrees of freedom the Pronation-Supination mainly interests the distal radioulnar joint which is a pivot joint located between the bones of the forearm, the radius and ulna: this part is called extrinsic wrist and the muscles concurring in such kind of DoF are located in the middle part of the forearm [6].

These Papers fit the objective(s) of the system being proposed were studied with respect to the type of sensors to sense the movement, driver circuit to drive the actuators.

III. PROPOSED METHODOLOGY

This paper is devoted to developing the principles and tools needed to realize advanced robotic and human-machine systems capable of haptic interaction. The below block diagram is divided into two modules namely, Haptic glove (Transmitter) & Robotic arm side (Receiver).

a. Haptic Glove Side:

This device fits over the user's entire hand like an exoskeleton has potentiometers on finger, wrist & picks up change in resistance with hand movement.

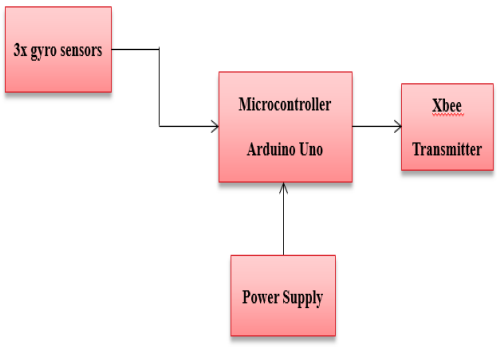

Figure 1: Haptic Glove side

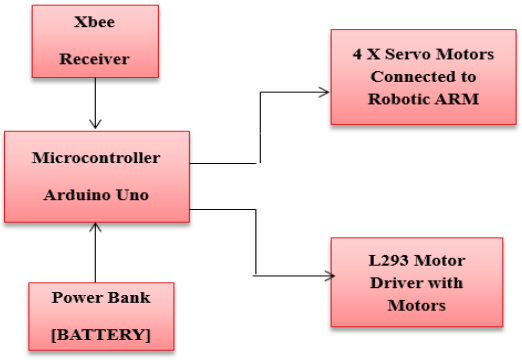

Figure 2: Robotic Arm Side

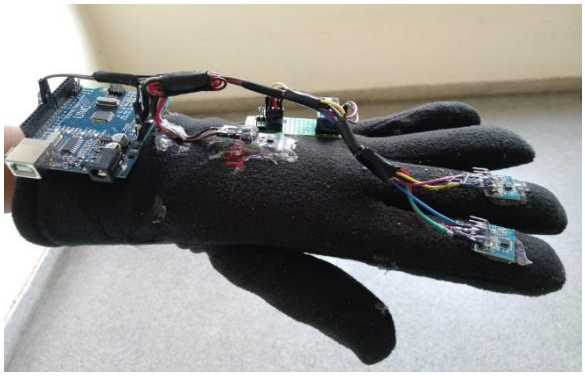

Figure 3: Glove Side

b. Robotic Arm Side:

A robotic manipulator is a device capable of moving in different directions (base, shoulders, elbow, yaw, pitch, roll directions) relative to base and controlled by Haptics, Its base is actuated by a D.C motor mounted beneath it. The degrees of freedom, or DOF, are a very important term to understand. Each degree of freedom is a joint on the arm, a place where it can bend or rotate or translate.

The user in order to move the robot should make a hand movement. This different movement is sensed by gyro sensor attached to haptic glove. Gyroscope sensors used in haptic glovefor position feedback of wrist, index and middle finger. It gives the feedback in the form of voltage.The output of this sensors are in digital form, therefore they are connected to ports of microcontroller.

Zigbeetransceiver modules is used for transmitting, hence data received at pins of microcontroller is modulated for long distance wireless transmission.The transmitting range of the transmitter is 25 to 30m (radius) without antenna.

According to the program in the microcontroller, the robot starts and moves the Robotic Arm.We have implemented robotic arm in our robot. The arm is able to pick any light weight item. We can operate arm from user haptic glove. Like when we move wrist up/down and arm will move up and down respectively and so on. These functions will be

done using microcontroller, motor driver IC and servo motor.

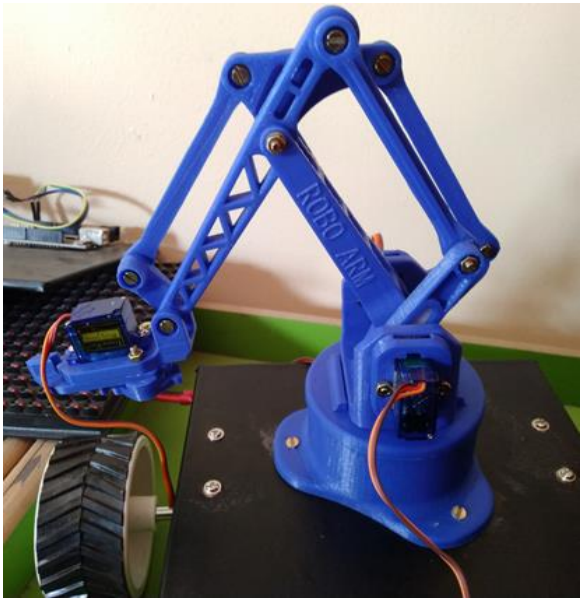

Figure 4: Robotic Arm Side

IV. APPLICATIONS

a. Industry:

It is used for material handling of heavy cartages. It is also used in controlling humanoids by placing sensors in every joint carry data to the microcontroller for analysis and processing.

b. Military:

Military training is extremely expensive. Then training procedures are dangerous and harmfull at many times in the real world. It is more convenient to send telerobots than putting soldiers into vehicles and dangerous areas for disposal of bombs.

V. RESULTS AND CONCLUSION

We have developed a four wheel robot which can work based on the gesture signal from the haptic glove. The glove also contains Gyro sensor array which will provide gesture to the robotic arm movements.

We have studied Human-Machine interaction which works in similar manner as Hand gesture. The Haptic Robotic Arm successfully designed and implemented and lifting of an object was attained successfully. A high level of precision was observed in the movement of the Robotic Arm due to the generation of accurate signal for the Servo Motors.

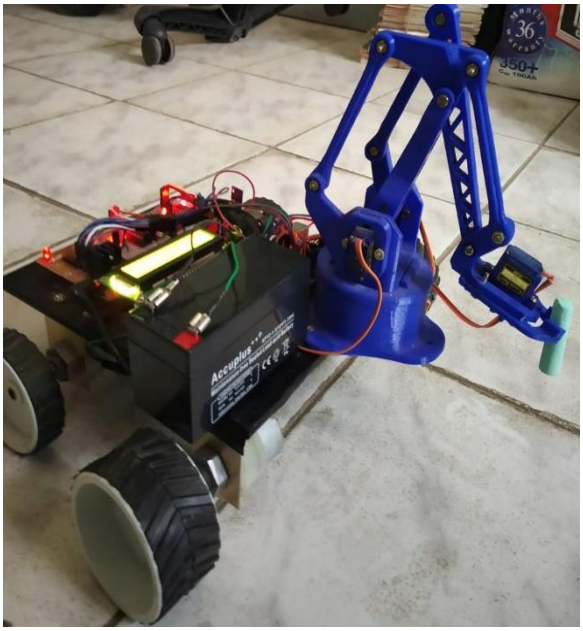

Fig 5: Picking Operation

VI. FUTURE WORK

We need to think beyond the gyro sensors to achieve more accuracy in the movement of the arm. In the case of designing of anrobotic arm, more Degrees of Freedom can be implemented instead of four. The Robotic Arm side can be upgraded by implementing a technique required for tracking the position of the objects. Future advancements may result in more realistic and flexible industrial applications.

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