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Robot in Telemanipulation Using Android and Bluetooth

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Abstract: *Robots are used for the purpose of picking the object and placing it into another place. This robot runs with human guidance and communicates through blue tooth. The robot setup is controlled by the android mobile which is having the blue-control application. Tele-manipulation allows human to perform operations in a remote environment. This system provides human operators with the ability to see, touch, and feel objects from a remote location. Using Tele-manipulation technique, the robot is controlled by the remote. Haptic shared control is a promising approach to improve tele-manipulated task execution, by making safe and effective control actions tangible through guidance forces. The tele-manipulator serves as a tool to transfer movements from a human operator on a local station (the master) to a remote station (the slave), through a controller. Haptic shared control gives the visual information about the position, external and environmental forces acting on the robot to the human operator. There are many applications based on haptic shared control definition. Tele operation is used for the purpose of assembly in wireless manner controlled by human guidance.*
Keywords: *android, haptic shared, Robots, tele-manipulation*

I. Introduction

In telemanipulation, a remote robot is controlled by a human and interacts with an environment while relaying information back to the human, providing access to environments which may be hostile, hazardous, or difficult to access. Shared control has the potential to overcome some of the limitations imposed by traditional telemanipulation architectures. Problems such as time delays and limitations in the fidelity of the master interface become less detrimental because commands from the operator are supplemented by local control.

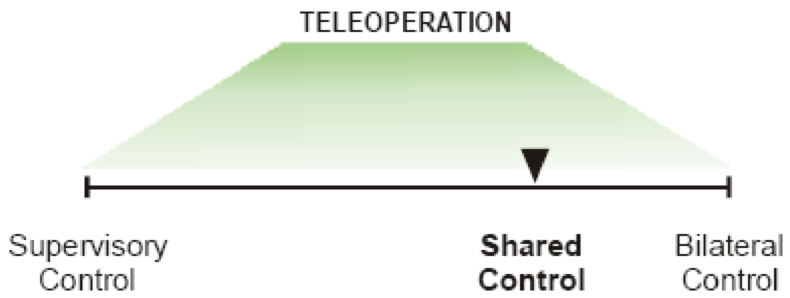

Fig 1.1- Haptic shared control

Shared control falls between supervisory control and bilateral control in that the human has the ability to control, and receive feedback from, the remote robot at a low level while maintaining the ability to supply high level commands Under this control scheme, the human operator can intervene in an autonomous task executed by the robot and the robot can augment the direct commands generated by the operator. In current research, these guidance forces are most often generated based on pre-generated, errorless models of the remote environment. Such guidance forces are exempt from the inaccuracies that can be expected in practical implementations.

The current research adopts the definition of haptic shared control, which “allows both the human and the [guidance] system to exert forces on a control interface, of which its output (its position) remains the direct input to the controlled system” Guidance forces are based on a task model, which contains information about both the remote environment and the systems goal.

II. Literature Survey

H. Boessenkool et.al[1] the methodology used is assisted by forces applied at master device. It is hypothesized that continuous intuitive interaction between operator and support system will improve required time and accuracy with less control effort, even for imperfect transparency.

N. Stefanov et.al[2] - here the methodology is a computer-assisted tele operation system. The work uses a computer-assisted teleoperation system, where the control over the teleoperator is shared between a human operator and computer assistance in order to improve the overall task performance. Two units, action recognition and an assistance unit are introduced to provide context specific assistance. The action recognition unit can evaluate haptic data, handle high sampling rates, and deal with human behaviour changes caused by the active haptic assistance. Repairing of a broken hard drive is selected as scenario and three different task specific assistance functions are designed.

Ningbo Yu et.al[3] - the methodology used is Autonomous as well as teleoperated robots and wide applications in various environments. Their capability to accomplish complex and dynamic operations can be significantly improved by fusing human intelligence with autonomous algorithms. Through the admittance and impedance models, the haptic shared controller smoothly puts together human operator inputs with robot autonomy. Further, the level of autonomy is fully determined by the operator with the grasp motion.

J. Wildenbeest et.al[4] –here the haptic feedback allows the human operator to touch the remote environment. This work presents human factors in which teleoperated task performance and control effort are assessed for a typical(dis)assembly task in a hard-to-hard environment, well known to the operator. Subjects are provided with four levels of haptic feedback quality: no haptic feedback, low-frequency haptic feedback, combined low- and high-frequency haptic feedback, and the best possible—a natural spectrum of haptic feedback in a direct-controlled equivalent of the task.

Franck Mars et.al[5] - This study investigated human-machine cooperation when driving with different degrees of a shared control system. By means of a direct intervention on the steering wheel, shared control systems partially correct the vehicle’s trajectory and, at the same time, provide continuous haptic guidance to the driver.

Henri Boessenkool ea.tl[6] - The experimental results provided evidence for the hypotheses, showing that the tested telemanipulation task benefits from haptic shared control, for three different levels of transparency. Essentially, the presence of haptic shared control allows for a worse transparency without compromising required time, and can even improve required time during perfect transparency.

Mark Mulder et.al[7] - Haptic feedback on the steering wheel is reported in literature as a promising way to support drivers during steering tasks. Haptic support allows drivers to remain in the direct manual control loop, avoiding known human factors issues with automation. The results indicated that continuous haptic guidance is a promising way to support drivers in actively producing (more) optimal steering actions during curve negotiation.

Paul Griffiths et.al[8] – Here a paradigm for shared control is described in which a machine’s manual control interface is motorized to allow a human and an automatic controller to simultaneously exert control. These results indicate that the haptic assist through the steering wheel improves lane keeping by at least 30% reduces visual demand by 29% ($p<0.0001$) and improves reaction time by 18 ms ($p=0.0009$).

Haiying Hu et.al[9] - This describes a master-slave teleoperation system which is developed to evaluate the effectiveness of teleopresence in telerobotics applications.

Kenneth J. Waldron et.al[10] - A set of experiments was designed to evaluate the efficacy of shared control for dexterous telemanipulation and to determine what combinations of force, visual and audio feedback provide the best performance and operator sense of presence.

III. Block Diagram And Requirements

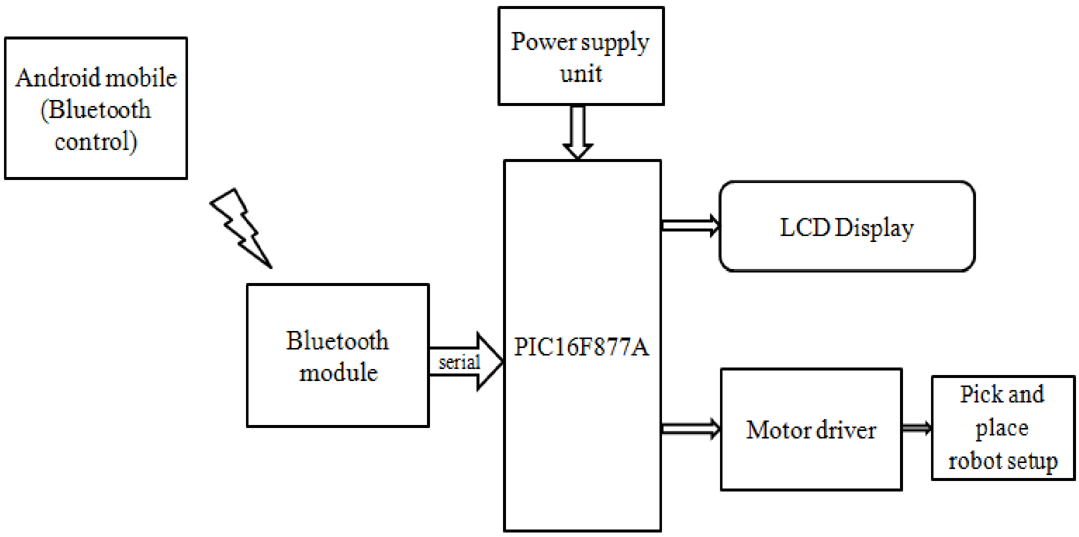

Fig.3.1 Block diagram of tele manipulated robot.

We are implementing a wireless connection between remote and arm robot for picking and placing of objects. Robot setup is controlled by the android mobile which is having the blue-control application.

In this setup the main components used are android app, blue tooth module, PIC controller, power supply, LCD display, motor driver circuit, robot setup. The android mobile is paired to the setup. Blue tooth module is serially communicated to the PIC controller. The blue tooth module HC05 is used to receive the data from the android mobile which contains blue control application. The power supply unit is used to convert the 230 ac to 5v dc. The microcontroller has 5v power supply and the motor has 12v power supply. The drive circuit is used to provide 12v power supply to the motor. The 16×2 LCD is used to display the command which is given by the human operator. Five motors are used for the commands-- forward, reverse, left, right, up, down, pick and place. Two motors are connected in parallel for forward and reverse commands; rest three motors are connected to other commands respectively.

IV. Operation And Performance

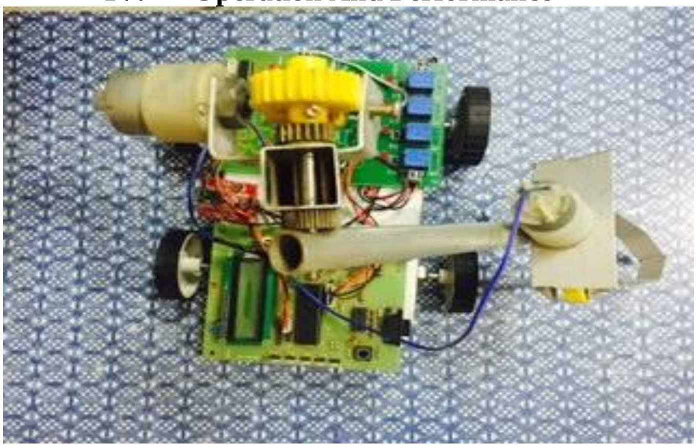

Fig.4.1 Top view of robot

Robots can be classified into different categories depending on their function and the market needs they are designed for. We identify two major classes of robots, industrial robots and service robots. According to the Robotic Industries Association, an industrial robot is an automatically controlled, e programmable, multipurpose manipulator programmable in three or more axes which may be either fixed in place or mobile for use in industrial automation applications.

INITIAL ON STATE

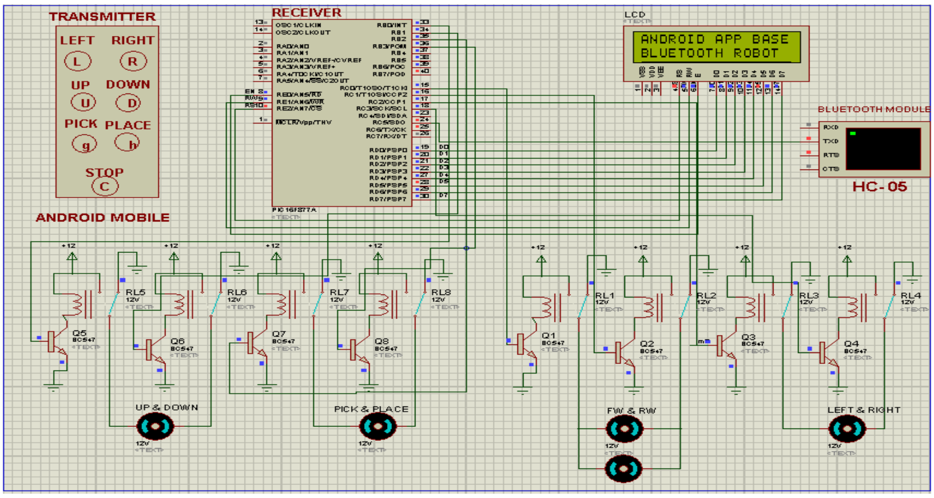

Fig.4.1 Initial on State

The simulation is performed by proteus software. The software simulation is done to check the result and then it is implemented in the hardware. The first diagram shows the on-state position of the robot. To ensure that the robot is in on state, the simulation displays “ANDROID APP BASE BLUETOOTH ROBOT “ after some particular delay followed by displaying “enter your choice”.

FORWARD MOVING OF ROBOT

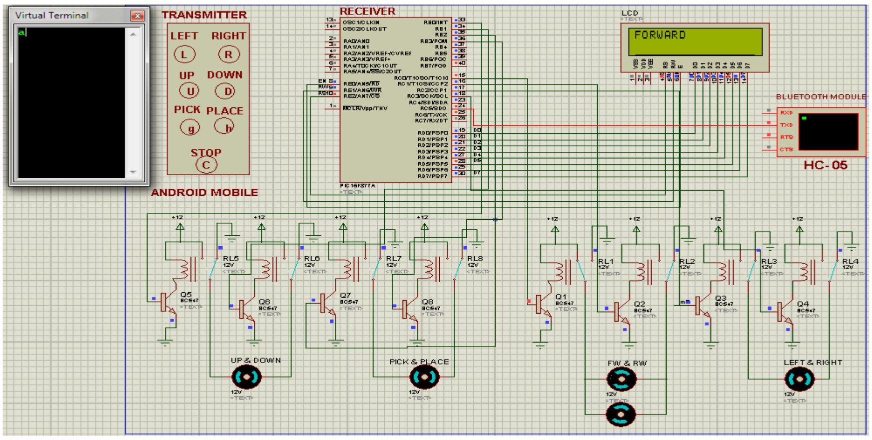

Fig.4.2 Forward Moving of Robot

The button “a” which is given in the virtual terminal describes the forward command where the motor rotates in the forward direction. Forward and reverse motor are connected in parallel manner.

LEFT ROTATION

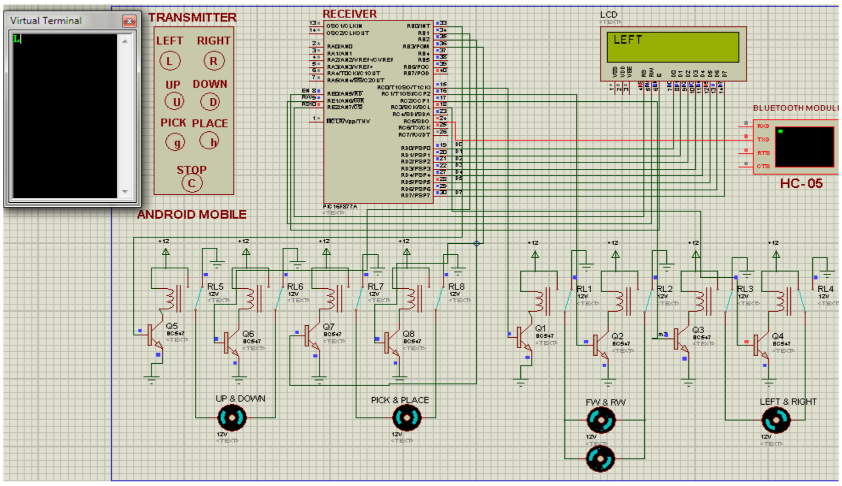

Fig.4.1 Left Rotation

The button “L” which is given in the virtual terminal describes the left command where the motor rotates in the left direction**.**

UPWARD MOVING

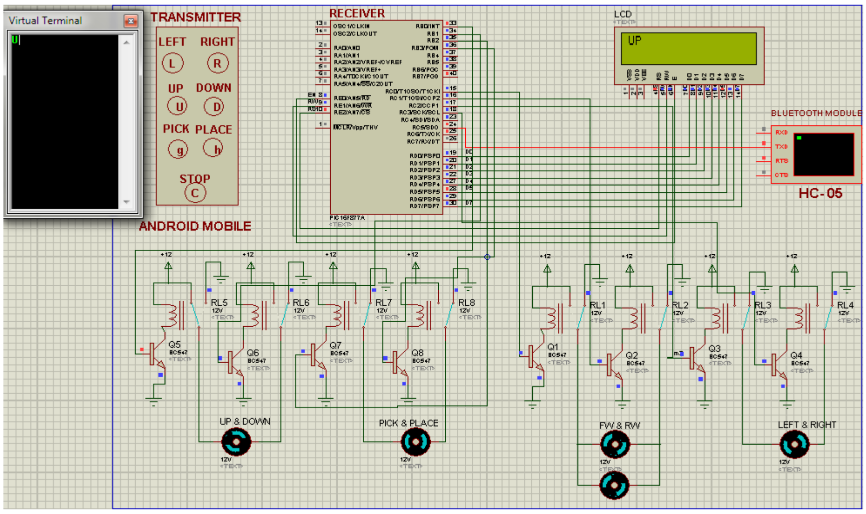

Fig.4.1 Upward moving

The button "U" which is given in the virtual terminal describes the up command where the motor moves in the up direction. To summarize forward moving

a- forward moving,
l- left rotation
b- r- left rotation
c- u- upward moving
d- d- downward moving

V. Conclusion

This robot setup reduces the complexity because of wireless connection. The human operator uses android app, so it is easy to access for everyone. This is implemented only for the short distance communication. In future, Wi-Fi is used widely for long distance communication. The execution time is reduced in this project.The merits are it can be more effective to control on the slave setup and it is easy to access. The complexity is also reduced as we are implementing on wireless communication. The cost is also less as compared to others. There are many unsolved problems and fundamental challenges for robotics. At a very high level manipulation and physical interaction with the real world is hard to implement. We need concerted modeling and control efforts together with the development of good hardware to make arms and hands that can perform anything but the simplest of pick-and-place operations that are prevalent in industry. As we are using android based control, the applications broadens to both the domestic and industrial use.

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