

Haptic gloves controlled robotic arm using MEMS accelerometer

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ABSTRACT

Robots of the current generation have been used in fields isolated from the human society. The definitions of robotics are numerous and varied, ultimately they all deal with a labour-saving machine that with increasing technological capabilities gets closer and closer to human mechanical and mental capabilities. 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 project 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.

Keyword - Haptic, MEMS, accelerometer, robot, arm.

INTRODUCTION

The introduction section of this report illustrates the original industrial robot arm unimate from 1961- which doesn't look much like a human arm- compared with the 2012 Baxter which is basically a combination of two robot arms on a central body processing centre with a humanoid faced on video display for a head and the wheeled mobile base. The paper focuses on design and implements a robotic arm and controlled it using a human arm by means of HAPTICS technology. A robot consists of sensors, processors, actuators and power sources. Sensors are the marvel of the 21st century robotics ranging from laser range finding to MEMS on a chip like gyroscopes, accelerometer. Haptics is the science of applying touch sensation and controlled for interaction with virtual or physical applications.

HAPTICS is mainly classified in three areas

1. Human Haptics
2. Machine Haptics
3. Computer Haptics

On the other hand, Sensors on the haptic device work transducers which convert hand motions into electrical signals. This hand movement can be replicated using robotic arm.

Our project is basically divided into two modules namely,

- **Transmitter side (Haptics Glove)**
- **Receiver side (Robot Side)**

- I/O and Packages
- 32 Programmable I/O Lines
- 40-pin PDIP, 44-lead TQFP, and 44-pad MFL
- Operating Voltage is 4.5V-5.5V for ATmega16.
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RF transceiver modules

The CC2500 is a very low cost true single chip 2.4GHz transceiver which is used to designed for very low power wireless applications. So it acts as transmitter module. Its carrier freq. is 2.4GHz. Therefore data received at Din pins of cc2500 from TXD (PD1) pins of microcontroller is modulated by ASK technique for long distance wireless transmission. Without antenna transmitting range of the transmitter is 25 to 30m (radius). For the transmission antenna should be connected over this distance. Hence this modulated data is send via antenna to robotic arm (receiver). CC2500 RF Module is a transceiver module which provides easy to use RF communication at 2.4 Ghz. It can be used to transmit and receive data at 9600 baud rates from any standard CMOS/TTL Source. This module is a direct line in replacement for your serial communication it requires no Extra hardware and no extra coding toIt works in Half Duplex mode i.e. it provides communication in both directions, but only one direction at same time.

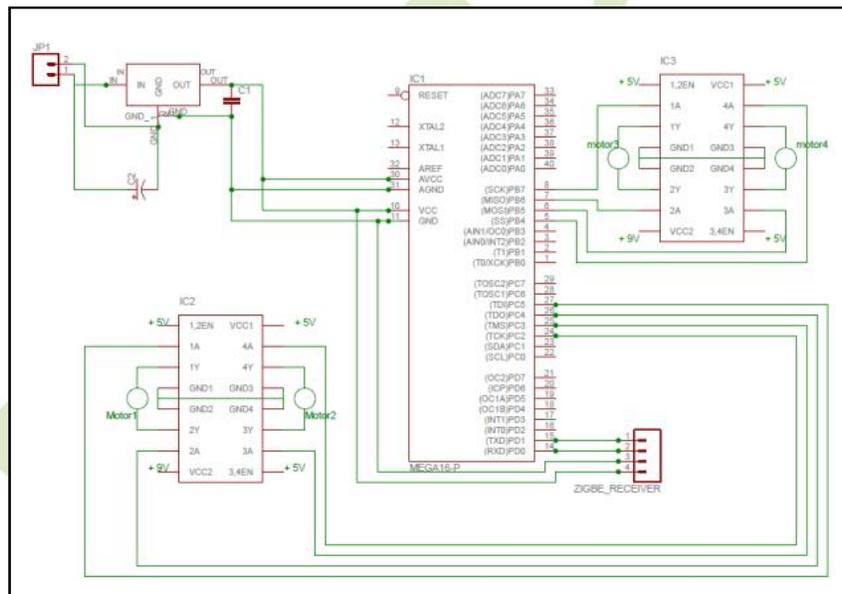


Fig 2: Circuit diagram of receiver

RECEIVER

RF transceiver module-CC2500:

CC2500 acts as a receiver module. It demodulates the received data. This data is then send serially to microcontroller pin on PD0 (RXD).

Voltage regulator (7805)

7805 is a voltage regulator integrated circuit. It is a member of 78xx series of fixed linear voltage regulator ICs. The voltage source in a circuit may have fluctuations and would not give the fixed voltage output. The voltage regulator IC maintains the output voltage at a constant value. The xx in 78xx indicates the fixed output voltage it is designed to provide. 7805 provides +5V regulated power supply. Capacitors of suitable values can be connected at input and output pins depending upon the respective voltage levels.

Motor Driver (L293D)

L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors. L293D contains two inbuilt H-bridge driver circuits. In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction. The motor operations of two motors can be controlled by input logic at pins 2 & 7 and 10 & 15. Input logic 00 or 11 will stop the corresponding motor. Logic 01 and 10 will rotate it in clockwise and anticlockwise directions, respectively.

Atmega 8 Microcontroller:

The Atmel AVR ATmega8 is a low-power CMOS 8-bit microcontroller based on the AVR RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega8 achieves Throughputs approaching 1MIPS per MHz, allowing the system designer to optimize power consumption versus processing speed. Enable pins 1 and 9 (corresponding to the two motors) must be high for motors to start operating. When an enable input is high, the associated driver gets enabled. As a result, the outputs become active and work in phase with their inputs. Similarly, when the enable input is low, that driver is disabled, and their outputs are off and in the high-impedance state.

Accelerometer Sensor

Accelerometers are sensors or transducers that measure acceleration. Accelerometers generally measure acceleration forces applied to a body by being mounted directly onto a surface of the accelerated body. Accelerometers are useful in detecting motion in objects. An accelerometer measures force exerted by a body as a result of a change in the velocity of the body. A moving body possesses an inertia which tends to resist change in velocity. It is this resistance to change in velocity that is the source of the force exerted by the moving body. This force is directly proportional to the acceleration component in the direction of movement when the moving body is accelerated. The motion is detected in a sensitive portion of the accelerometer. This motion is indicative of motion in the larger object or application in which the accelerometer is mounted. Thus, a sensitive accelerometer can quickly detect motion in the application.

ADVANTAGES

Advantages: -

- It allows interactivity in real-time with virtual objects
- Machines don't get tired. They don't close their eyes.
- Can be applied in remote rural areas so as to carry out operations.
- Can be used in military areas where highly skilled doctors may not be present.
- In application like bomb disposal the human life is not at risk.
- It allows interactivity in real-time with virtual objects.
- Less cutting of skin due to use of advance technology camera and tools.
- Precise control of tools during operation.
- Reduction of no. of peoples needed in operation room.
- Be unaffected by anger, revenge, hunger, fear, fatigue, or stress.

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