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# Robotic Arm Control through Internet/LAN for Patient Operation

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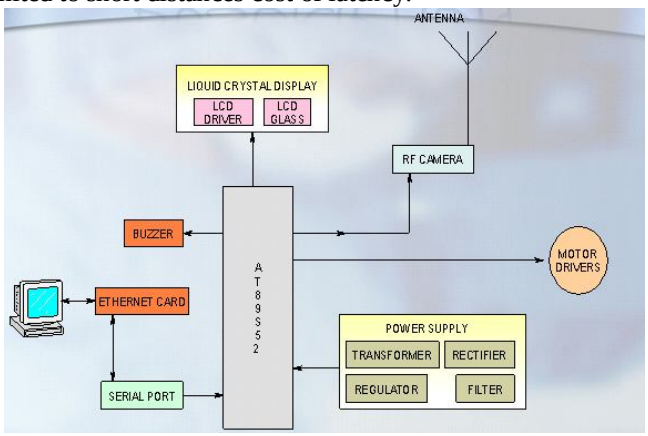
**ABSTRACT :** To design a robotic arm controlled through the internet/LAN used for patient operation and interface the robotic arm and the other components like LCD, DC motor and RF video camera with the microcontroller. Here we propose to build a robotic arm controlled by natural human arm movements whose data is acquired through the use of accelerometers. For proper control mechanism and to reduce the amount of noise coming in from the sensors, proper averaging algorithm is used for smoothening the output of the accelerometer.

## I. INTRODUCTION

One of the hurdles it has overcome is medical field. There is lack of basic medical facilities in cities as well as small towns. The problems faced by patients are the lack of good facilities and also absence of skilled surgeons. Incorporation of the robotic arm tackles these problems. The plus point is the robotic arm is controlled by LAN. By this method the doctors sitting in any place of the world can perform the surgery on patients and also can know the recovery status. The choice of using the robots is b'coz they can perform variety of functions in more flexible environment and at lower production costs. The word robot originated from the Czech word "ROBOTA" meaning "work". Generally a robot is a re-programmable multi-functional manipulator designed to move materials.

The idea behind the development of the robotic mechanism was the hospital visit where the problem faced was the absence of the surgeon. As we all know that surgery is a common thing these days' even a small tumor removal needs surgery. Suppose that the surgeon is in a foreign country to ask him to come over for the surgery is impractical in cases of emergency. These problems are tackled by our Robotic arm which is fully automated. Microcontroller provides a helping hand in making a system automatic. Microcontroller AT89s52 was chosen for a simple reason that it is advanced and more flexible version of microcontroller 8051.

The first robotic surgery was performed in 1992-93 called as the RoboDoc system. Later the AESOP systems were developed that were used in general surgery. After commercialization the systems were used in neuro surgery. After the redesigning process the Da Vinci surgical system was developed. First robotic surgery was performed in 1997. The surgery using robotics was limited to short distances cost of latency.




Block diagram of System

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Working Principle:

The front end application will send the controlling data to the particular computer by sending corresponding IP address. After sending the commands the Ethernet adapter which is already configured with that particular IP address; will receive the data. And the Ethernet adapter will send the received data to microcontroller through serial port. After receiving the command the microcontroller will control the robotic arm by sending appropriate signals to geared motor.

The microcontroller part which is connected in robot side, is doing all the operations of motor control. The Ethernet card is a medium, which is used to convert LAN signal in to RS232 form.

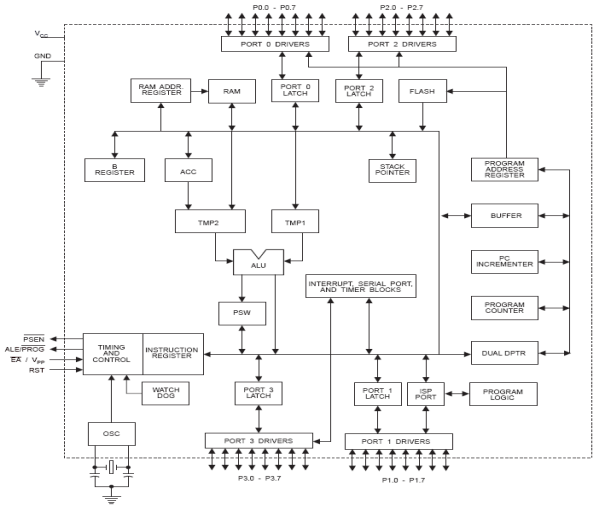
According to the command received the microcontroller will control the robotic arm step movements. We use the RF camera's to view the patient status and transmit it to the PC. In this project we are using the arm only to cut the skin of the patient using the high-speed blades.

Micro controller-AT89S52

- The AT89S52 is a low-power, high-performance CMOS.
- Features:
  - Compatible with MCS-51 products
  - 8K bytes of in-system programmable (ISP) flash memory
  - Endurance: 1000 write/erase cycles
  - 4.0V to 5.5V operating range
  - Fully static operation: 0 Hz to 33Hz
  - Three-level program memory lock
  - 256 x 8-bit internal RAM

    32 programmable I/O lines
- Three 16-bit timer/counters
- Eight interrupt sources
- Full duplex UART serial channel
- Low-power idle and power-down mode
- Interrupt recovery from power-down mode
- Watchdog timer
- Dual data pointer
- Power-off flag

## II. BLOCK DIAGRAM OF AT89s52



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### III. PIN DESCRIPTION

Vcc-supply voltage.
Gnd-ground.
Port 0

- It s an 8-bit open drain bi-directional I/O register port.
- When 1's are written to port 0 the pins can be used as high impedance inputs.

Port 1

- It s an 8-bit bi-directional I/O port with internal pull up's.
- When 1's are written to Port 1 they are pulled to high by internal pull up's and can be used as inputs.
  - P1.0 and P1.1 can be configured as timer/counter

Port 2 and Port 3

- Have the same features as the Port 1 except that the Port 3 serves functions of various special features

Rst

- Is the reset pin. A high on this pin for two machine cycle while the oscillator is running resets the device

ALE/PROG

- Address Latch Enable is an output pulse for latching the low byte of address during the external memory access.
- It acts as an Program Pulse Input during Flash Programming.

PSEN

- Program Store Enable is the read strobe to external program memory.

EA/Vpp

- External Access Enable must be strapped to the Gnd in order to fetch the code from external memory.

XTAL 1

- Input to the inverting oscillator amplifier and input to the internal clock operating circuit.

XTAL 2

- Output from the inverting oscillator amplifier.

Special Function Registers(SFR's)
Timer 2 Registers

- Control and status bits are contained in registers T2CON and T2MOD for timer 2.
- The register pair (RCAP2H, RCAP2L)are the capture/reload registers for timer 2 in 16-bit capture mode or 16-bit auto-reload mode.

Interrupt Registers

- The individual interrupt enable bits are in the IE register. Two priorities can be set for each of the six interrupt sources in the IP register.

L293D IC (DC MOTOR DRIVER)

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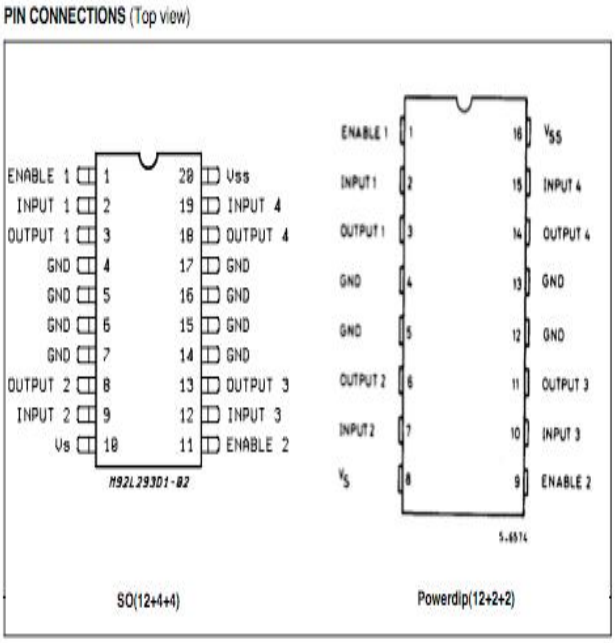
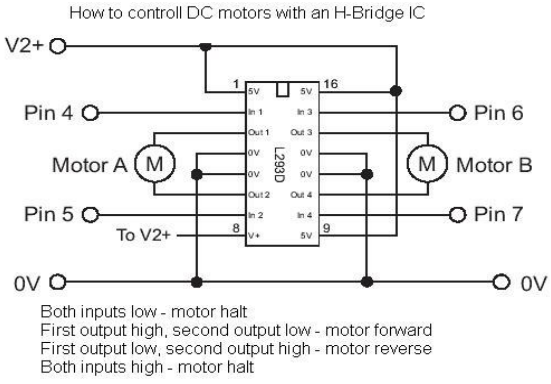



FIGURE: L293 & L293D Driver ICs

The L293 and L293D are quadruple high-current half-H drivers. The L293 is designed to provide bidirectional drive currents of up to 1 A at voltages from 4.5 V to 36 V. The L293D is designed to provide bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V. Both devices are designed to drive inductive loads such as relays, solenoids, dc and bipolar stepping motors, as well as other high-current/high-voltage loads in positive-supply applications. All inputs are TTL compatible. Each output is a complete totem-pole drive circuit, with a Darlington transistor sink and a pseudo-Darlington source. Drivers are enabled in pairs, with drivers 1 and 2 enabled by 1,2EN and drivers 3 and 4 enabled by 3,4EN.

When an enable input is high, the associated drivers are enabled and their outputs are active and in phase with their inputs. When the enable input is low, those drivers are disabled and their outputs are off and in the high-impedance state. With the proper data inputs, each pair of drivers forms a full-H (or bridge) reversible drive suitable for solenoid or motor applications. On the L293, external high-speed output clamp diodes should be used for inductive transient suppression. A VCC1 terminal, separate from VCC2, is provided for the logic inputs to minimize device power dissipation. The L293and L293D are characterized for operation from 0°C to 70°C.



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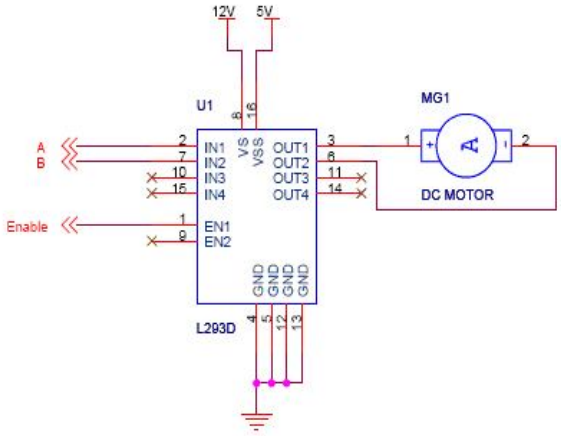


**Truth Table**

| A | B | Description |
|---|---|---|
| 0 | 0 | Motor stops or Breaks |
| 0 | 1 | Motor Runs Anti-Cloclwise |
| 1 | 0 | Motor Runs Clockwise |
| 1 | 1 | Motor Stops or Breaks |

For above truth table, the Enable has to be Set (1). Motor Power is mentioned 12V, but you can connect power according to your motors.

**LCD (LIQUID CRYSTAL DISPLAY)**

- LCD's provides an useful interface for the user and for debugging an application
- The most common type of LCD controller is the Hitachi 44780 which provides a relatively simple interface between a processor and an LCD.
- LCD has single line display, two-line display, four line display. Every line has 16 characters

**ETHERNET ADAPTER:**

- EAD is a device that converts RS-232 protocol into TCP/IP protocol.
- In other words, EAD is a protocol converter.
- EAD also supports UDP protocol for broadcast kind of application.
- The EAD allows to network-enable a variety of serial devices that were not originally designed to be networked.
- The EAD is the most cost effective single port serial-Ethernet communication device.
- The EAD supports RS232 serial communication.

**BUZZER**

- The buzzer subsystem produces a 2 kHz audible tone when powered.
- The buzzer will sound when the signal coming into the driver is high.
- The buzzer is connected between the supply rail (+v) and the input signal.
- This acts as load on the driver.
- When the input signal coming into the buzzer subsystem is low, a potential difference across the buzzer causes current to flow.

It is this flow of current that causes the buzzer to sound

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**RS232**

- The main role of the RS232 chip is to convert the data coming from the 12-volt logic to 5 volt logic and vice versa.
- In this project, card is recharged in the office through PC.
- Therefore to make the computer serial port compatible with microcontroller serial port we are using the RS 232 converter.

**POWER SUPPLY**

- The microcontroller and other devices get power supply from AC to DC adapter through 7805, 5 volts regulator.
- The adapter output voltage will be 12V DC non regulated.
- The 7805 will convert the 12v to 5v DC.

**RF Camera**

- It consists of a receiver and transmitter.
- Transmitter captures the status of the patient and sends it.
- Receiver receives and displays it on the monitor so that the surgeon can view the patient status.
- Wireless transmission and reception is done.
- Low power consumption.
- High sensitivity.
- Easy installation and operation.
- Light weight.
- Small size.

**Software tools**

- The intelligence of smart devices reside in embedded system.
- It performs single well defined tasks, tightly constrained and reactive.
- Embedded hardware.
- Embedded software.
- Application areas of embedded systems.
- The Keil complier is used because it allows the user to take advantage of the 8051's architecture.
- The Keil C has all the standard data types plus a couple of specific data types that maximizes the use of 8051's architecture.
- It provides a header file that defines all the SFR's and their bits.
- Memory types
    - Data segment
    - Bdata segment
    - Idata segment
    - Pdata and xdata segments
    - Code segments

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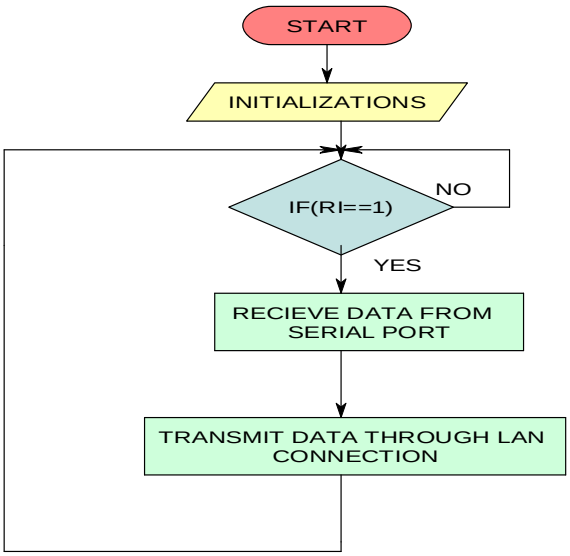
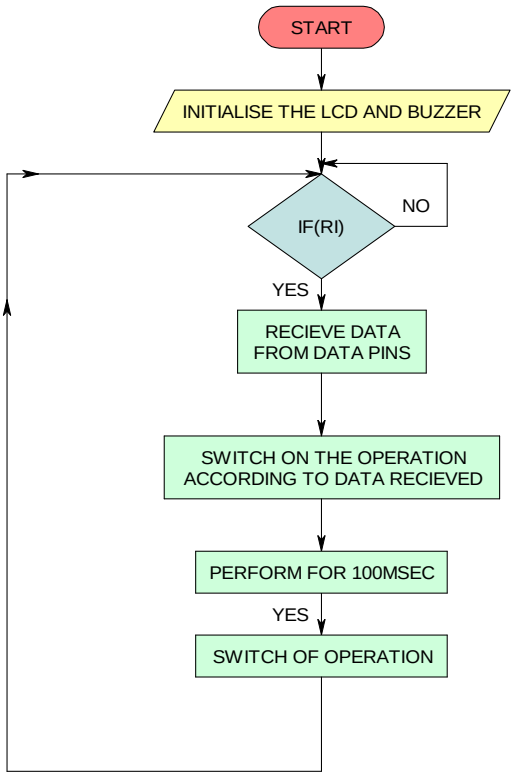
ROBOT TRANSMITTER FLOW CHART




ROBOT RECIEVER FLOW CHART



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## ADVANTAGES

- Computer-assisted robots provide exact motion and trajectories to minimize the side-effects of surgical intervention.
- Surgeon-guided robotics allow the surgeon to access patient anatomy with smaller incisions.
- Faster recovery.

## IV. CONCLUSION

The use of robotic arm will help save patient's life in cases of emergency. It will speed up the process of operation. If this is used efficiently and in a proper way will be a boon to medical field.

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