

# **AUTOMATIC FIRE EXTINGUISHER ROBOT USING MATLAB**

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# Introduction

- Matlab Stands for Matrix Laboratory .It is the most commonly and widely used Software platform by math Works for complex mathematical computations. It makes computation very simple and easy for users and allows the user to concentrate on solving the problem rather than wasting most of the time focusing on the mathematical complexities.
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# WHY CHOOSE MATLAB FOR ROBOTICS?

Matlab has numerous applications. One such application is in Robotics. As we have discussed above that Matlab is the simplest Platform for complex mathematical computations so it becomes very easy for us to use it in Robotics may it be in Image Processing, Audio processing, Hardware Interfacing and lots more as we will be discussing it in details in later sections.

# Description:

- **Task:** To search and extinguish a fire (prototype a candle) in a dark room.
- **Procedure:** Fix a webcam on Robot to scan the room. Images shot by webcam will be processed on MATLAB and according instructions for movement were forwarded to microcontroller on robot which controlled motors and extinguishing Fan.
- **Microcontroller used:** AT89S8253
- **Sensor:** Web camera interfaced with computer via USB

- **Motor Driver:** L-293 H bridge IC
- **Power Supply:** External (regulated to 12 Volt for driving motors and 5 Volt for microcontroller circuitry)
- **Image Processing Software:** MATLAB
- **Motors:** Two DC Geared Motors controlled using PWM (Pulse Width Modulation)
- **Communication:** Using UART (Universal Asynchronous Receiver and Transmitter) of Atmega-16 we connected it to serial port of computer to communicate with MATLAB.
- **Extinguisher:** CPU Fan (just enough for a small candle!)

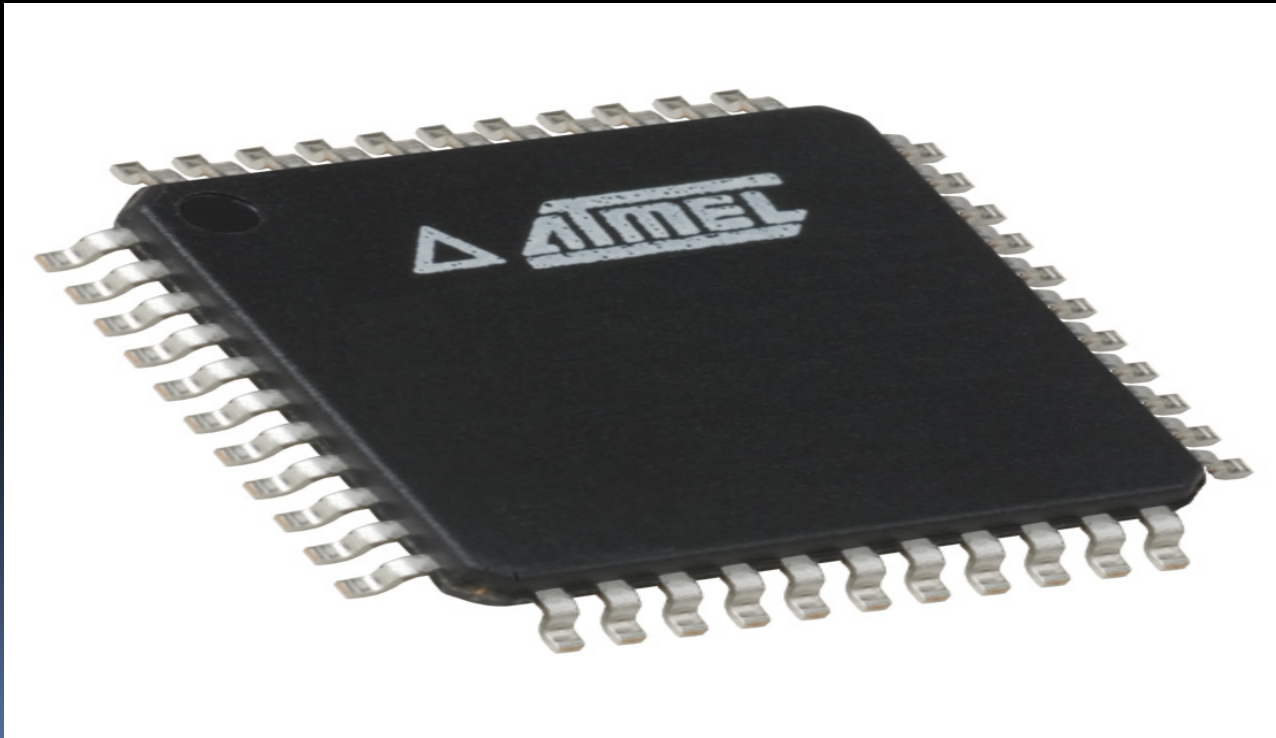


# Circuits:

- RS-232 Level converters circuit for UART communication.
- L-293 based Motor driver circuit.
- Programmer Circuit for Microcontroller

# Circuits and Components to be used:

Atmel AT89S8253



# Implementing Atmel microcontroller on Hardware





# Atmel AT89S8253:

AT89S8253 is a low power high performance CMOS 8 bit mc with 12 kb of In System Programmable flash program memory and 2 kb of EEPROM data memory. It is manufactured using Atmel high density non-volatile memory technology and is compatible with industry standard MCS-51 instruction set and pin-out. It is highly flexible and cost-effective 40 pin MC.

# RS-232 Level Converter Circuit using MAX 232 Chip:





# USB RS-232 Cables



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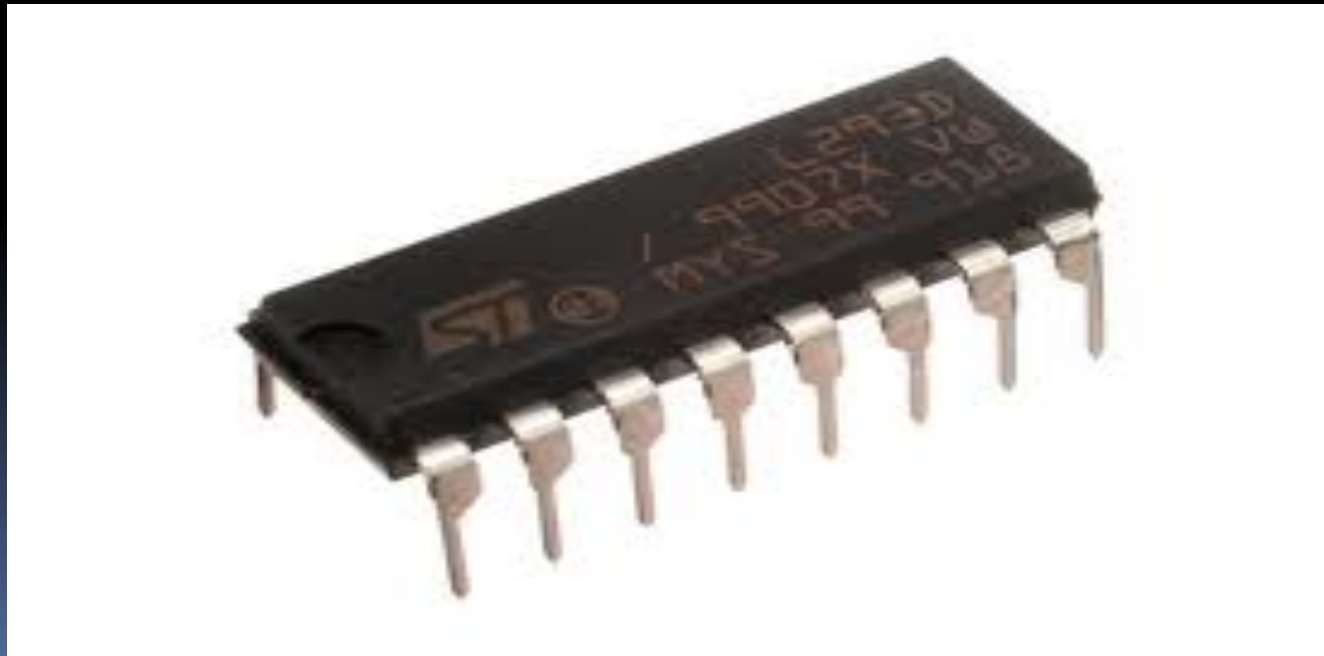
## Interfacing UART Serial Port

# RS-232 Level Converter Circuit:

It is a series of standard for serial binary serial ended data and control signals connecting b/w DTE(Data Terminal Equipment)and DCE(Data Circuit Terminating Equipment). It is used for computer serial ports.

# L-293 based Motor Driver Circuit:

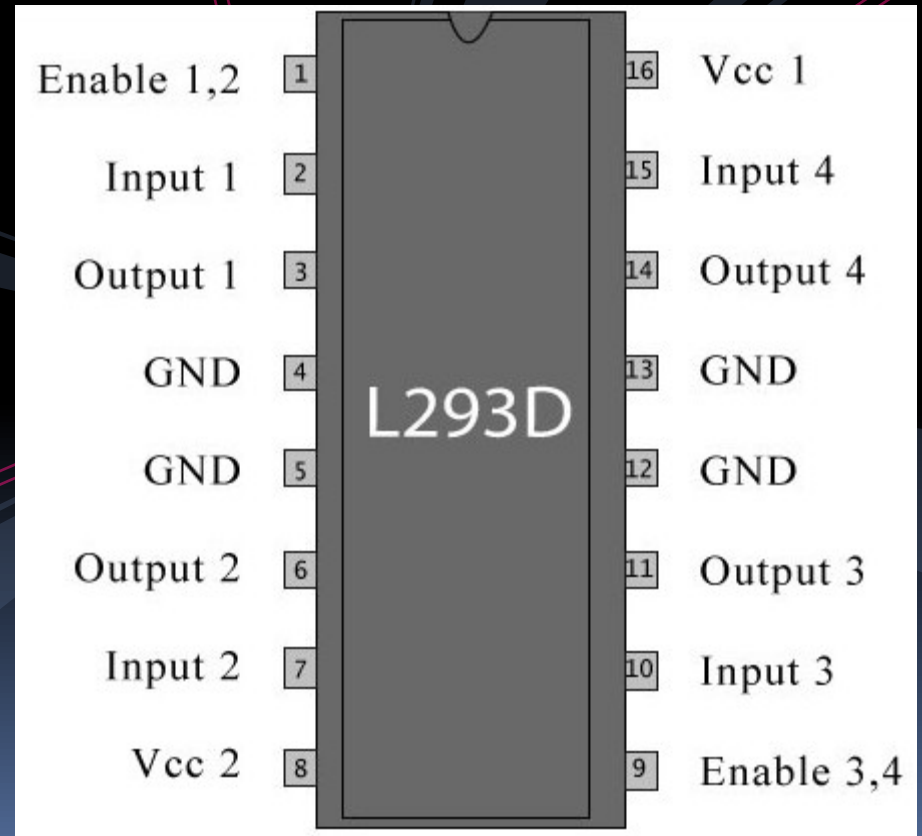
## L-293 Chip:





# L-293 Motor Driver:

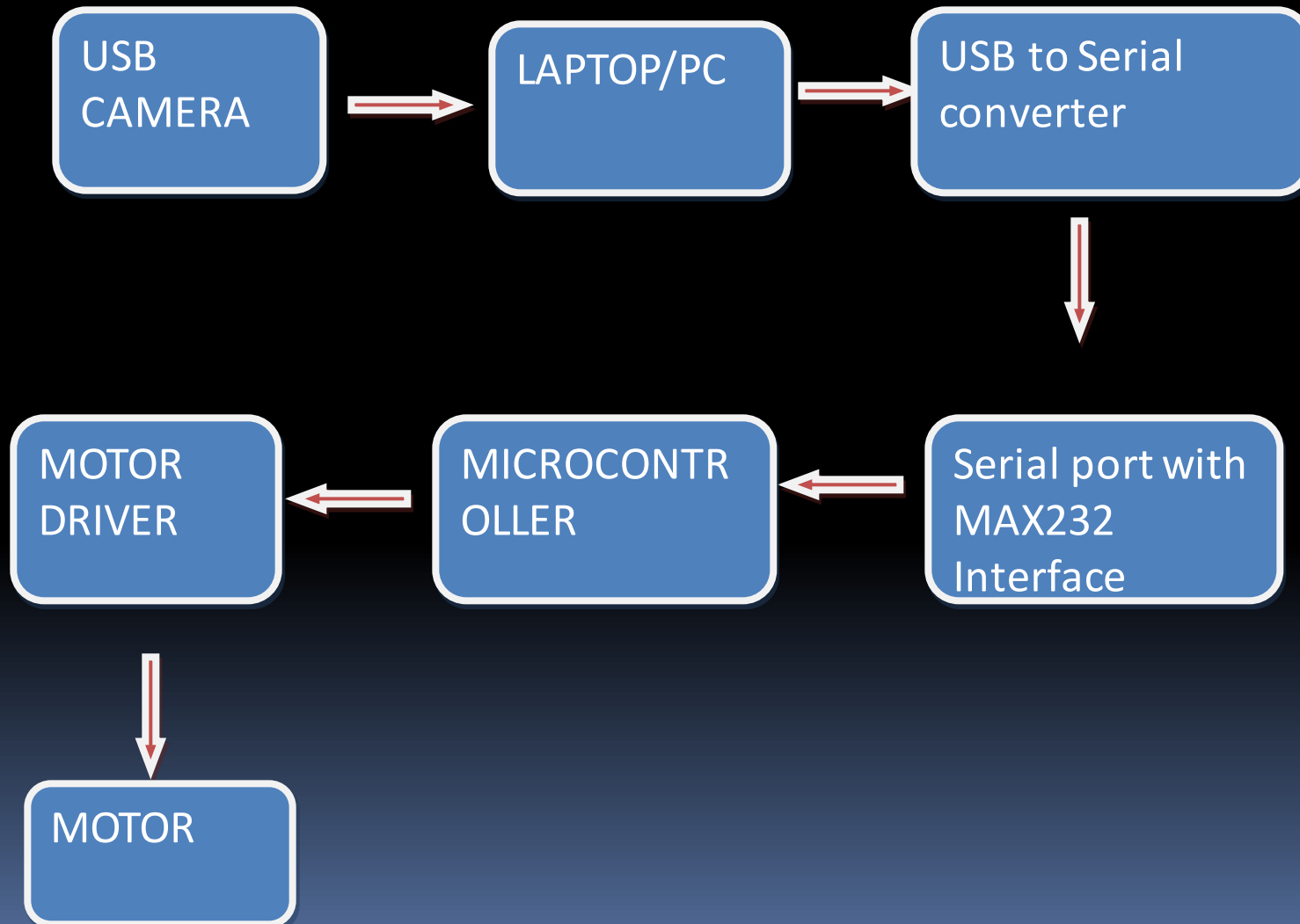
## Pin Diagram of L-293



# L-293 Motor Driver Circuit:

It is a 16-pin dual H-bridge motor driver integrated circuit. Motor Driver act as a current amplifier since they take a low-current control signal and provide a higher current signal which is used to drive a motor. It contain 2 inbuilt H-bridge driver circuit. In its common mode of operation two DC motor can be driven simultaneously in backward or forward direction.

# Block Diagram:





# BASICS OF THIS ROBOT

- This Robot was designed to automatically search a fire in a dark room and extinguish it using a fan attached.
- It was based on Image processing.
- A web camera was used for taking images which was interfaced with computer and MATLAB. We had our MATLAB code taking images, processing them and sending the control commands for the robot through serial port via UART. When candle comes very close to the body, fan se turned on by the program and the task was completed.

# How it works:

- The bot consists of an on-board webcam which is connected to the laptop. Continuous images are captured and processed in Matlab to find out the pixels of fire and its centroid. Based on whether the centroid lies to left, right or centre of the vision, characters 'A', 'B' and 'C' respectively are sent to the microcontroller (At89S8253) which then instructs the motor driver (L293D) to maneuver the bot accordingly. We are using the UART mode of communication between the computer and the microcontroller; hence IC Max 232 is used to convert the voltage levels. Finally when the robot reaches the near the fire the fan is put on to extinguish the fire.

**THANK YOU !**