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# Hand Gesture Recognition Based Auto Navigation System for Leg Impaired Persons

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**ABSTRACT**: In this paper we used MEMS technology to control the movement of car which is used by the physically challenged people or person who meet the accident. Driving a car in domestic environments is a difficult task for people with arm or hands impairments. In this project the car is developed to overcome the problem faced by the physically challenged people or paralysed person to perform safe movements and accomplish some daily life important task. The system is divided into two main units they are MEMS Sensor and Microcontroller unit. The MEMS sensor unit , which is connected to hand, is an 3-axis MEMS accelerometer with analog output voltage that provides hand gesture detection, the AURDUINO UNO is the microcontroller which controls the overall performance of the system and it converts the analog voltage given by the accelerometer sensor into the digital output and the H-BRIDGE driver IC which drives the DC motor in the desired direction i.e in left,right,forward and backward directions.

**KEY WORDS**: MEMS sensor, AURDUINO UNO.

## I. INTRODUCTION

In the past decades many works had been done for the movement of wheel chair in that they used various methodologies. In order to overcome the difficulty and complexity in the previous works the automatic hand gesture based movement is introduced.

In recent times joystick is used to control the wheel chair and this is not compatible so we went for various other techniques [1] some used voice signals to control the wheel chair [2]. The eye tracking application are not used by all its complex to use [3]. To overcome the eye tracking technique hand gesture based wheel were introduced[4]. In the motion control based application motion technique is used this is not reliable [5]. This paper proposes an embedded approach to real time detection and direction recognition of hand gestures for the intelligent car using Micro Electrical-Mechanical sensor (MEMS) [6]. The MEMS accelerometers can be used to effectively translate hand and finger gestures into computer understandable signals. For hand gesture recognition, the accelerometer data is calibrated and filtered. The gesture based car is suitable for the elderly people and the physically challenged people who have lost ability in their limbs due to paralysis or by birth or by old age. Head cue information is tracked by using the IR sensor for the wheel chair movement [7].

Our proposed system makes use of a car that can be used by elderly or physically challenged to move without any external aid. The physically challenged people find difficult to move the car without help from others [8]. The aim of the proposed system is to control a car using the MEMS technology. MEMS ACCELEROMETER SENSOR is highly sensitive and capable of detecting the tilt [9]. This sensor finds the tilt and makes use of the accelerometer to change the direction of the car depending on tilt. For example if the tilt is to the right side then the car moves in right direction or if the tilt is to the left side then the car moves in left direction [10].

The movement of the Car can be controlled by hand gestures in Forward, Reverse, Left and Right direction. The technologies which had greater developments are the MEMS technology. These had greater importance than any other technologies due its user friendly nature. MEMS Accelerometer Sensor based devices can be easily reachable to the common man due to its simpler operation [11].

## II. MEMS SENSOR

In the proposed system the MEMS Accelerometer sensor we are using is ADXL335. The ADXL335 is a small, thin, low power, complete 3-axis accelerometer with signal conditioned voltage outputs. The product measures a acceleration with a minimum full-scale range of ±3 g. It can measure the static acceleration of gravity in tilt-sensing

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applications as well as dynamic acceleration resulting from motion, shock or vibration. The user selects the bandwidth of the accelerometer using CX, CY and CZ capacitors at XOUT, YOUT and ZOUT pins. Bandwidths can be selected to suit the application, with a range of 0.5 Hz to 1600 Hz for the X and Y axes, and a range of 0.5 Hz to 550 Hz for the Z axis.

The ADXL335 is available in a small, low profile, 4 mm × 4 mm × 1.45 mm, 16-lead; plastic lead frame chip scale package. Fig 1 shows the MEMS accelerometer sensor. In the proposed system ADXl335 accelerometer sensor is used it will detect the hand gestures in 3 axis and detect the tilt and tilt angle is noted and analog voltage is taken as output.

## III. HARDWARE REQUIREMENTS OF PROPOSED SYSTEM

The components used in the proposed system are:

1. MEMS accelerometer sensor.
2. ARDUINO UNO board.
3. Driver IC L293D.

DC motors.

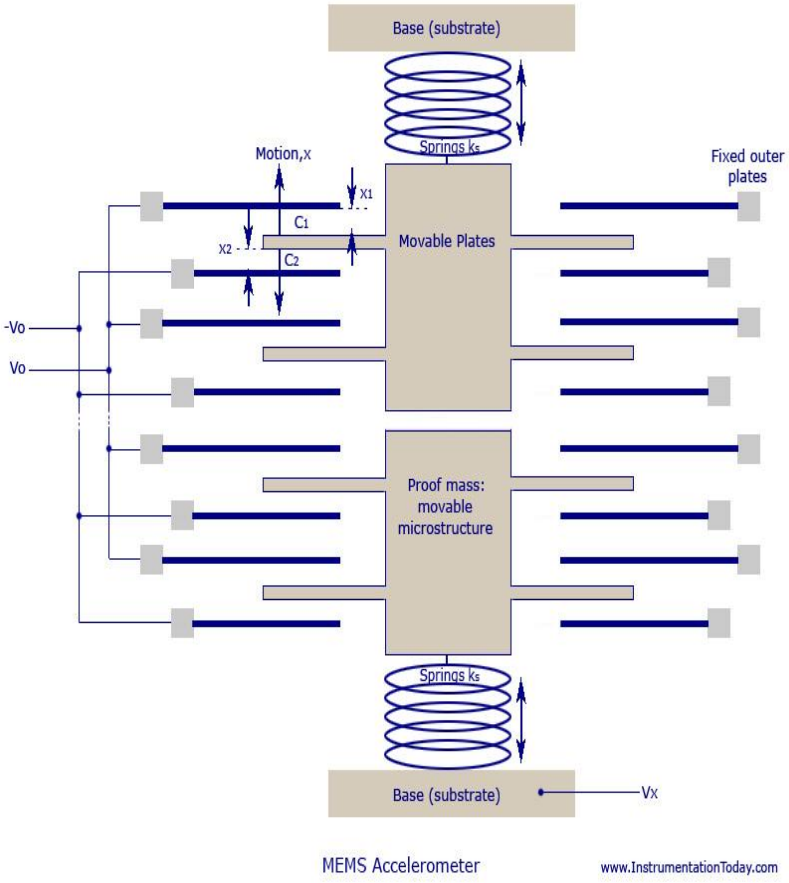


Fig 1. MEMS accelerometer sensor

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## IV. BLOCK DIAGRAM

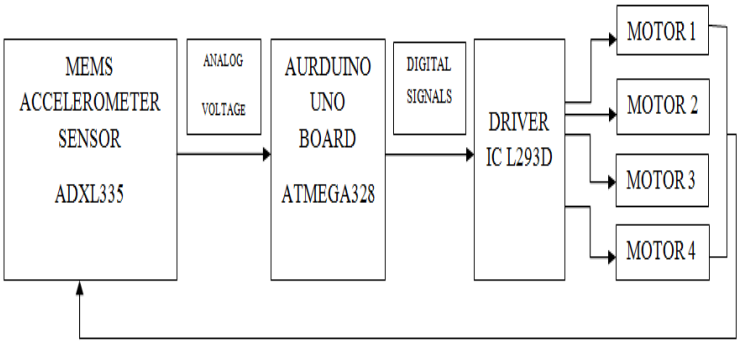


Fig 2. Block diagram of the proposed system.

Fig 2 shows the block diagram of the proposed system. In this proposed system we have used Accelerometer sensor which detects the tilt angle of the hand movements. The accelerometer sensor will produce analog voltage signal. This analog signal is given to the ARDUINO UNO board which has an inbuilt ATmega328 microcontroller and it will convert the analog voltage signals to digital signals. The DC motors are not directly connected to the ARDUINO UNO board because it affects the back emf of the DC motor so driver IC is used. The digital voltage signal is given to the Driver IC is an interfacing IC which used for driving the dc motor which moves according to our hand movements.

## V. THE ARDUINO BOARD

Arduino is an open source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board. The Arduino platform has become quite popular with people just starting out with electronics, and for good reason.Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board – you can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the microcontroller into a more accessible package.
L293D is a typical motor driver IC which allows DC motor to drive on either direction. It is a 16-pin IC which can control a set of two DC motors simultaneously in two directions. Fig 3 shows the model of DRIVER IC L293D.

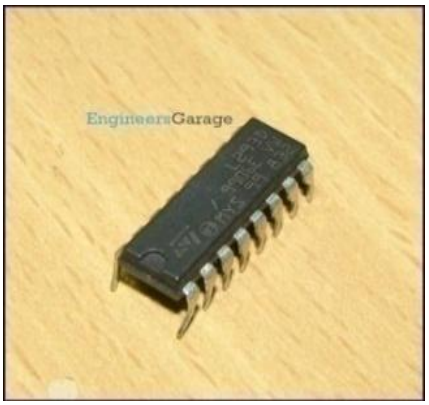


Fig 3. Driver IC L293D.

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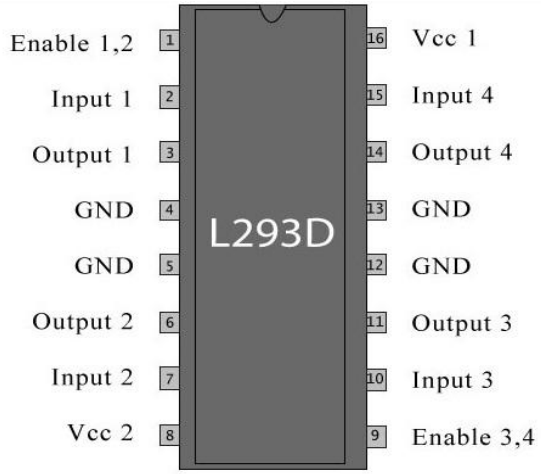


Fig 4 Pin diagram of L293D.

It works on the concept of H-bridge. H-bridge is a circuit which allows the voltage to be flown in either direction. Voltage need to change its direction for being able to rotate the motor in clockwise or anticlockwise direction, hence h-bridge IC are ideal for driving a dc motor. Fig 4 shows the pin diagram of driver IC. Left input pins will regulate the rotation of motor connected across the left side and right input for motor on the right hand side.

## VI. PROGRAMMING TOOL

ARDUINO IDE tool is used for programming.This open source arduino software makes it easy to write and upload it to the board. Fig 5 shows the programming tool of AURDUINO IDE. It runs on Windows, MAC OSX and Linux. The environment is written in JAVA and based on processing and other open-source software. In this paper I have used AURDUINO IDE as the software tool because it is simple to write the program and also easy to execute. The overall performance of the system will also be good.


Fig 5. Arduino IDE.

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## VII. FLOW CHART

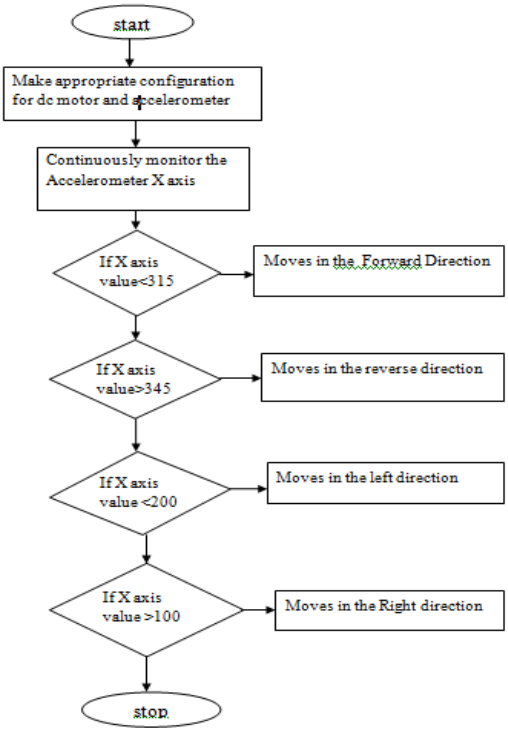


Fig 6: Flow Chart of proposed system.

Fig 6 shows the flow chart representation of proposed sytem.when you start the microcontroller it make appropriate pin configuration for dc motor and accelerometer and the it monitor the x-axis ,according to the desired value the motor runs in the forward,backward ,left and right direction.

## VIII. RESULT AND DISCUSSION

The controller programming is implemented using embedded c program is written and compiled in AURDUINO IDE and then uploaded to the AURDUINO UNO board. AURDUINO IDE and the prototype model of the proposed system are shown in Fig 7 and Fig 8. The DC motor will move according to the hand movements which are given by the accelerometer sensor. The car will move in the forward, backward, left and right movement. Table 1 show the Experimental values taken from Accelerometer sensor. The values are taken from the by tilting the Accelerometer sensor in right, left, forward and backward direction.

Table 1 Experimental values

| Position | voltage |
|---|---|
| Forward | <315 |
| Reverse | >345 |
| Left | <200 |
| Right | >100 |

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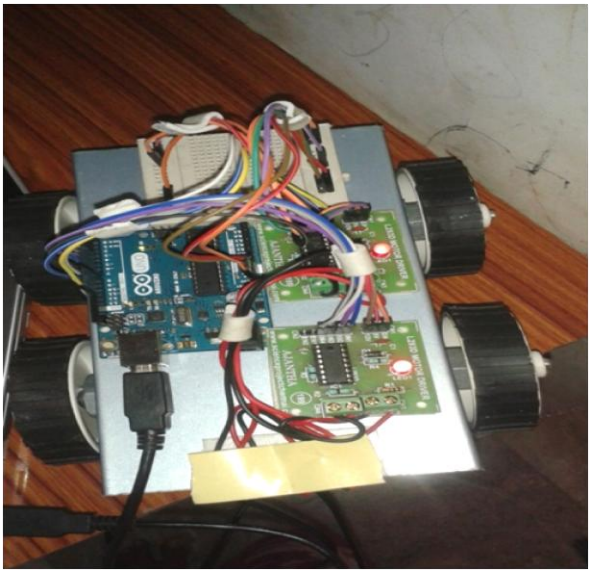

Fig 7. Prototype model of proposed system.

Fig 8. Prototype connected to AURDUINO IDE.

## IX. CONCLUSION

In the proposed system hand gesture is used to control the car using MEMS accelerometer sensor which is fixed to the finger tip and the car moves according to the hand gestures .With their hand movements they can move car right, left, front, and back directions with 3-axis accelerometer (MEMS SENSOR) which is a highly sensitive sensor and capable of detecting the tilt. The input and algorithm used in this project is very simple. The future scope of the project can be extended using wireless technology, and additional hand gestures can be added. The complete system can be controlled by the internet and also the system is designed to move in different terrains.

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