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Gesture Controlled Chair

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ABSTRACT

Today human-machine interaction is moving away from mouse and pen and is becoming pervasive and much more compatible with the physical world. With each passing day the gap between machines and humans is being reduced with the introduction of new technologies to ease the standard of living. In this paper, a rigorous analysis of different techniques of "Human-Machine Interaction" using gestures has been presented using accelerometer. Gestures can originate from any bodily motion or state but commonly originate from the face or hand. Robotics is the branch of engineering that deals with the design, construction, operation, and application of robots, as well as computer systems for their control, sensory feedback, and information processing we have implemented a system through which the user can give commands to a wireless robot using gestures. Through this method, the user can control or navigate the robot by using gestures of his/her palm, thereby interacting with the robotic system. The command signals are generated from these gestures using accelerometer sensing [1]. These signals are then passed to the robot to navigate it in the specified directions.

Keywords : *Accelerometer, ATMEGA 8 (Microcontroller), Gesture Recognition, L293D (Motor Driver IC), RF Module.*

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I. INTRODUCTION

Recently, strong efforts have been carried out to develop intelligent and natural interfaces between users and computer based systems based on human gestures. Gestures provide an intuitive interface to both human and computer. A robot is usually an electro-mechanical machine that can perform tasks automatically. Some robots require some degree of guidance, which may be done using a remote control or with a computer interface. A gesture is an action that has to be seen by someone else and has to convey some piece of information. Gesture is usually considered as a movement of part of the body, especially a hand or the head, to express an idea or meaning.

Gesture recognition technologies are much younger in the world of today. At this time there is much active research in this field and little in the way of publicly available implementations. Several approaches have been developed for sensing gestures and controlling robots. Glove based technique is a well-known means of recognizing hand gestures [2]. It utilizes a sensor attached to a glove that directly measures hand movements.

A Gesture Controlled Chair (robot) is a kind of robot which can be controlled by hand gestures and not the old fashioned way by using buttons. The user just needs to wear a small transmitting device on his hand which includes a sensor which is an accelerometer in our case. Movement of the hand in a specific direction will transmit a command to the robot which will then move in a specific direction.

The transmitting device includes a Microcontroller (ATMEGA8) for assigning proper levels to the input voltages from the accelerometer and an Encoder IC (HT12E) which is used to encode the four bit data and then it will be transmitted by an RF Transmitter module.

At the receiving end an RF Receiver module will receive the encoded data and decode it by using a Decoder IC (HT12D). This data is then processed and passed onto a motor driver IC (L293D) to rotate the motors in a special configuration to make the chair (robot) move in the same direction as that of the hand gestures i.e. forward, backward, left and right.

In this paper, a gesture based system (using Accelerometer- ADXL335) has been incorporated to control the robot by using 3-axis accelerometers. The prime aim of the design is that the chair (robot) starts the movement as soon as the operator makes a gesture or posture or any motion. The Robot is synchronized with the gestures (hand postures) of the operator.

1.1 *ANALYSIS*

The objective of this project is to use the concept of gesture recognition to control a chair (robot). The primary emphasis is laid on the mechanism of gesture recognition i.e. GR technology which is achieved by the help of accelerometer and its proposed mechanism [3]. For gesture recognition the accelerometer data is calibrated and filtered. The accelerometer can measure the magnitude and direction of gravity in addition to movement induced acceleration. In order to calibrate the accelerometer, we rotate the device's sensitive axis with respect to gravity and use the resultant signal as an absolute measurement. The four proposed movements that will be tried to achieve are: Left, Right, Stop, Forward and Backward. The flowchart for the analysis has been shown in Fig.1.

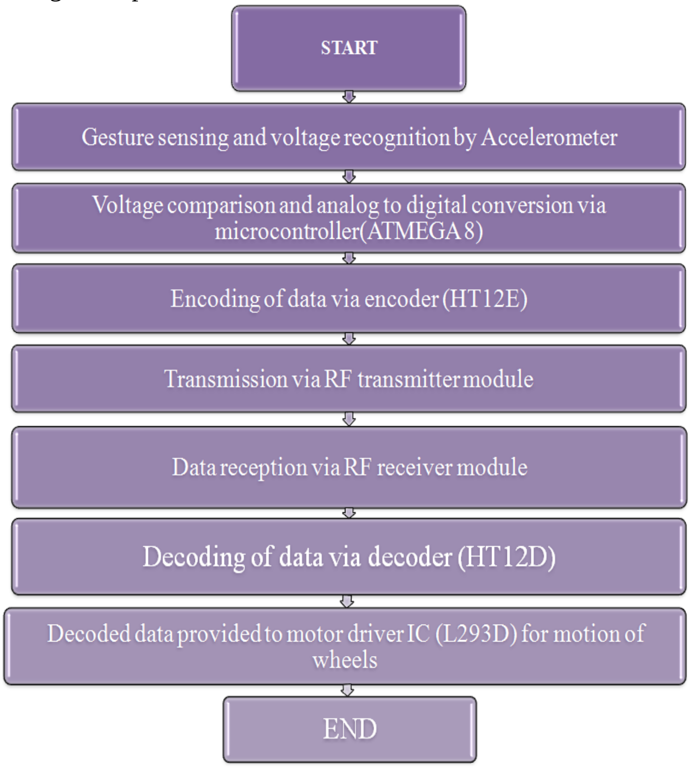


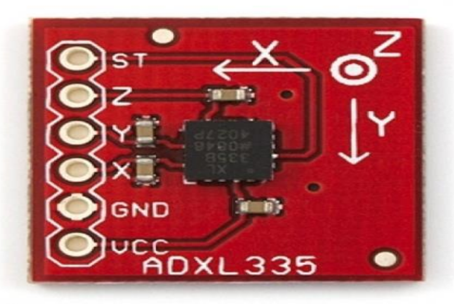
Fig. (1): Flow Chart

II. TECHNICAL REQUIREMENTS

2.1 ACCELEROMETER (ADXL335)

An Accelerometer (Fig. 2) is an electromechanical device that measures acceleration forces. It can measure the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration. It is a kind of sensor which record acceleration and gives an analog data while moving in X, Y, Z direction or may be X, Y direction only depending on the type of the sensor ADXL 335 [3]. Some of its features are as follows and also mentioned in table 1:

- 3-axis sensing.
- 10,000*g* shock survival.
- Excellent temperature stability.



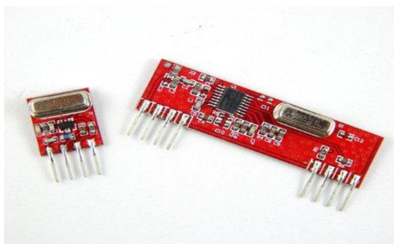


Fig. 2 Accelerometer **Fig. 3** RF Transmitter Receiver

TABLE1

PIN NO.	SYMBOL	FUNCTION
1.	ST	Sets the sensitivity of the accelerometer.
2.	X	Records analog data for X direction.
3.	Y	Records analog data for Y direction.
4.	Z	Records analog data for Z direction.
5.	GND	Connected to ground.
6.	VCC	+5 volt is applied.

2.2 RF MODULE (Rx/Tx)

Radio frequency (RF) is a rate of oscillation in the range of about 3 KHz to 300 GHz, which corresponds to the frequency of radio waves, and the alternating currents which carry radio signals.

The RF module is working on the frequency of 315 MHz and has a range of 50-80 meters. This radio frequency (RF) transmission system employs Amplitude Shift Keying (ASK) with transmitter/receiver (Tx/Rx) pair operating at 434 MHz

The transmitter module takes serial input and transmits these signals through RF. The transmitted signals are received by the receiver module placed away from the source of transmission. The transmission occurs at the rate of 1Kbps - 10Kbps.The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter. The system allows one way communication between two nodes, namely, transmission and reception.

The RF module has been used in conjunction with a set of four channel encoder/decoder ICs. Here HT12E & HT12D have been used as encoder and decoder respectively. The RF transreceiver has been shown in Fig. 3.

2.3 MICROCONTROLLER (ATMEGA 8)

Here microcontroller (shown in Fig.4) is used for processing our robot. We are using it to give decision capability to our robot.

Some of the features of this microcontroller are:

(i) 8 Kb of Flash program memory. (ii)512 Bytes of EEPROM.
(iii) 1Kbyte Internal SRAM. (iv)28 pin IC.

ATMEGA8 holds three communication devices integrated. One of them is Serial Peripheral Interface. Four pins are assigned to Atmega8 to implement this scheme of communication. A machine that converts DC power into mechanical power is known as a DC motor (shown in Fig.5).

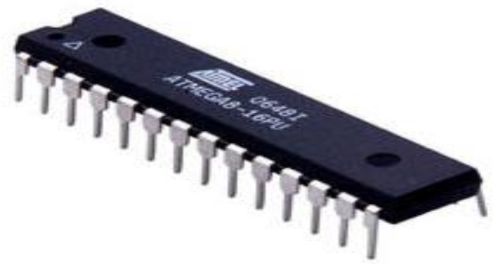


Fig. (4): Microcontroller (ATMEGA 8) **Fig. (5): DC Motor**

2.4 DC MOTORS

A machine that converts DC power into mechanical power is known as a DC motor (shown in Fig.5Its operation is based on the principle that when a current carrying conductor is placed in a magnetic field, the conductor experiences a mechanical force. This is a low cost DC motor suitable for most robotic and general applications. It has a output shaft with a hole for easy mounting of wheels or pulleys.

- Output RPM: 100 rpm
- Input Voltage: 6-12 V
- Stall Current: 500- 600 mA
- Shaft length: 2.4 cm

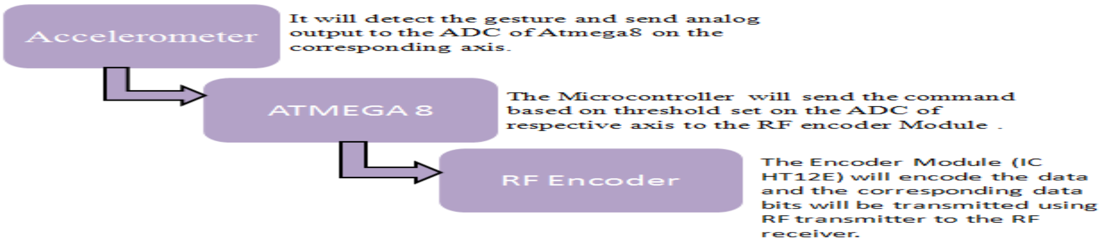
III. WORKING ALGORITHM

The accelerometer records the hand movements in X & Y directions and outputs constant analog voltage levels. These voltages are fed to the comparator of microcontroller which compares it with the reference voltages that we have set via variable resistors attached to the IC. The resulting signal is encoded and then transmitted via RF transmitter module.

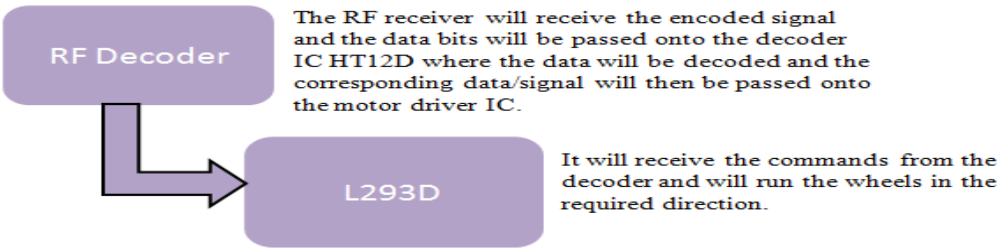
The transmitted signal is received by the RF receiver, demodulated and then passed on to the Motor driver IC for controlling the motion of wheels.

The working algorithms for the transmitter and receiver sides are given below in sections 3.1 and 3.2 respectively.

3.1 TRANSMITTER MODULE



a. RECEIVER MODULE



IV. IMPLEMENTATION

Gesture based chair is implemented as shown in Fig. 6 as per the details mentioned in the above sections. Chair is moving in 4 directions forward, reverse, left and right with the help of gesture circuit which is mounted on hand glove as shown in Fig. 7 and with the help of 4 gestures of hand moving in up, down, left and right direction respectively.

V. FUTURE WORK

Technologies developed based on gesture [5] are now really affordable and converged with familiar and popular technologies like TV, large screen. It's ubiquitous and non-intrusive as we can install a camera or remote with the TV. From this paper we can see the trends of gesture controlled communication systems. Easing of the Technology use, affordability and familiarity indicate that gesture based user interface can open new opportunity

Fig. 6 Gesture Based Chair

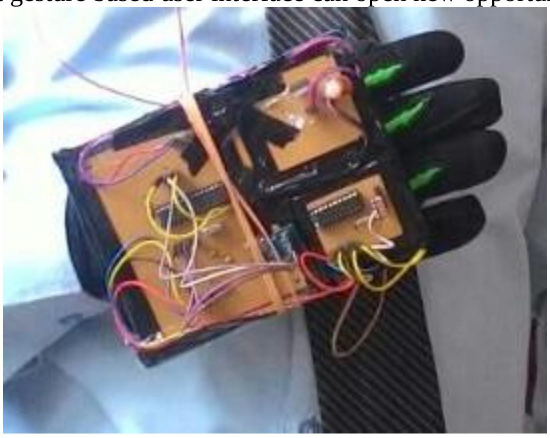


Fig. 7 Gesture Circuit Mounted on Hand Glove

for elderly and disable people. The older population (65+) numbered 36.3 million, an increase of 3.1 million or 9.3% since 1994 and it's growing over time. There will be more elderly people and fewer younger ones to care for them. So we need to invest much more heavily in Assistive Living solutions. The research 'A gesture controlled communication aid for elderly and disabled people' can be a significant task for future**.** The two important aims of the research are to identify the different gestures of elderly and disabled people for communication and to design a rich augmented-reality interface for communication via ubiquitous device [6].

VI. RESULT AND CONCLUSION

Enormous amount of work has been done on wireless gesture controlling of robots. In this paper, various methodologies have been analyzed and reviewed with their merits and demerits under various operational and functional strategies. Although recent researches in this field have made wireless gesture controlling a ubiquitous phenomenon [6], it needs to acquire more focus in relevant areas of applications like home appliances, wheelchairs, artificial nurses, table top screens etc. in a collaborative manner.

In this work Gesture Controlled Chair is built successfully as per planning which is moving in 4 directions forward, reverse, left and right according to 4 gestures of hand. In this work the task is accomplished where gesture controlled user interface for elderly and disable people has been reviewed along with the other gesture technologies and a gesture based chair with better technology is built.

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