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"GESTURE BASED WHEEL CHAIRS FOR PHYSICALLY DISABELD PERSONS"

Sachin S. Patil*, Kiran N. Patil, Sanjay P. Patil

* Assistant Professor, Department of Electronics and Telecommunication, Annasaheb Dange College of Engineering and Technology, Ashta,India.

Assistant Professor, Department of Electronics and Telecommunication, Annasaheb Dange College of Engineering and Technology, Ashta,India.

ABSTRACT

The needs of many individuals with disabilities can be satisfied with traditional manual or powered wheelchairs. A segment of the disabled community finds it difficult or impossible to use wheelchairs. There is extensive research on computer-controlled chairs where sensors and intelligent control algorithms have been used to minimize the level of human intervention. This project describes a wheelchair for physically disabled people.

Our goal is to design and develop a system that allows the user to robustly interact with the wheelchair at different levels of the control and sensing. A dependent-user recognition using hand movements and infrared sensor integrated with wheelchair.

Automatic wheelchair basically works on the principle of acceleration, one acceleration sensor, provides two axis, acceleration sensors whose output varies according to acceleration applied to it. Sensor gives x-axis & y-axis o/p independently which is fed to Comparator & then µC. On chair Obstacle sensors will be installed for detection of wall/obstacle in the backward direction.

KEYWORDS: wheel chair, sensors, Gesture.

INTRODUCTION

The aim of this project is to use wheelchair automatically for moving forward, backward, Left & Right. The overall framework of this project is to restore autonomy to severely disabled people by helping them use independently a power wheelchair.

A wheelchair is an electric wheelchair fitted with acceleration sensors and obstacle sensor to help less able drivers achieve some independent mobility. By just tilting acceleration sensor wheelchair can be moved in four directions. The obstacle sensor can help the rider control the wheelchair by taking over some of the responsibility for steering and avoiding objects until he or she is able to handle the job. The amount of work that the rider chooses to do and how much control is taken by the chair is decided by the rider and his or her care.

Obstacle in the way can be determined by wheelchair and wheelchair will stop automatically. Taking advantage of technological evolution, in order to increase the quality of life for handicap people and facilitate their integration into the working world. In order to guide a wheelchair various situation can be distinguished. If the user is capable of controlling his hands, the ideal solution is the use of a sensor.

Our project handicap wheelchair basically works on the principle of acceleration, one acceleration sensor, provides two axes, acceleration sensors whose output is analogs, varies according to acceleration applied to it.

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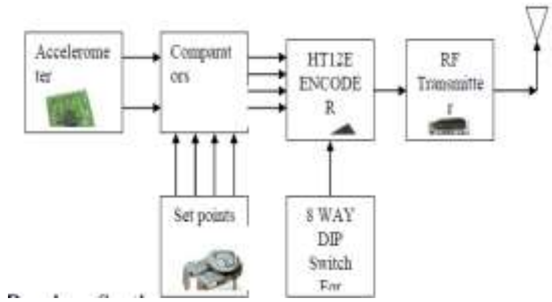
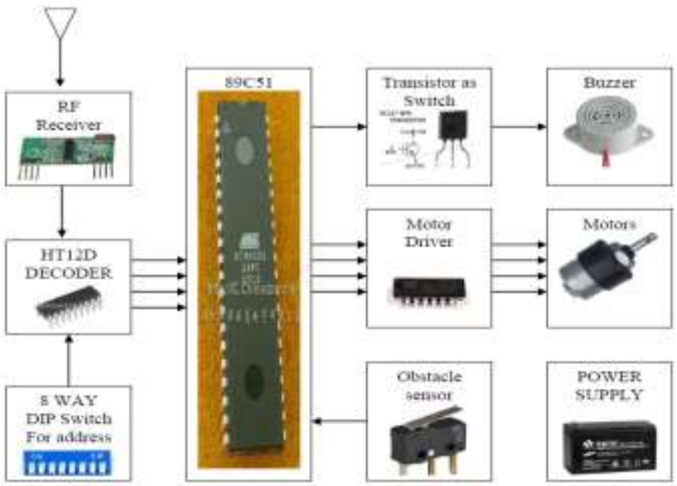
BLOCK DIAGRAM



a) Transmitter Section



b) Receiver Section

LITERATURE SURVEY

Wheelchairs are used by the people who cannot walk due to physiological or physical illness, injury or any disability. Recent development promises a wide scope in developing smart wheelchairs. The present article presents a gesture based wheelchair which controls the wheelchair using hand movements. The system is divided into two main units: Mems Sensor and wheelchair control. The Mems sensor, which is connected to hand, is an 3-axis accelerometer with digital output (I^2C) that provides hand gesture detection, converts it into the 6- bit digital values and gives it to the PIC controller. The wheelchair control unit is a wireless unit that is developed using other controller. [1]

Robots of the future should communicate with humans in a natural way. Hence, we are especially interested in hand motion based gesture interfaces. The purpose of this study was to present a reliable means for human-computer Interfacing based on hand gestures made in three dimensions, which could be interpreted and adequately used in controlling a remote robot's movement. In this paper we discuss the development of a novel architecture of an intelligent wheelchair working on wireless hand gesture control and not by the usual method of keypad for the physically handicapped people. Unlike others before it, this project also has a distress call system (GSM) to alert the concerned people or family in times of necessity for the person, by the person himself/herself from an alert switch or when there is any sudden detection of edge or staircase during backward motion, thus saving the chair from accidents. The locomotion of the wheelchair is controlled by a MCU (microcontroller). The physically handicapped people will have the option of controlling the system through hand gesture wirelessly from ranges up to several meters and will have the independence of using the wheelchair without the help of any other people. [2]

Wheelchairs are used by the people who cannot walk due to physical illness, injury or other disability. Now a day's development promises a wide scope in developing smart wheelchair. This paper is to describe an intelligent wheelchair using smart phone is develop to control the rotation of wheel chair based upon voice and gesture movement for the physically challenged persons. In build voice and gesture function are used to control the wheelchair as well as by using smart phone reading SMS, E-mail, News. The sensor used are 8 in which 2 of them are IR sensors the remaining are for temperature, smoke detection, light detection sensors. This system that allows the user to robustly interact with the wheelchair at different levels of the control and sensing. The system is divided into 3 main units Voice recognition through Android, Gesture recognition through Android, Motor control through signal conditioning. The system is based on grouping an android phone with a AVR micro-controller and sensors. [3]

This paper present the use of hand gestures for human-computer interaction, this paper presents an approach to identify hand gestures using muscle activity separated from electromyogram (EMG) using ANN. To retain a constraint-free user's environment, EMG sensing is limited to three arm muscles. EMG signals are processed to attain parameters that are related to the muscles temporal activities. The attainment of these parameters through time constructs a unique signature for each particular gesture. Experimental investigation was carried out to examine the system's reliability in recognizing 6 armgestures. The results show that the system can recognize the 4 gestures with a success rate of 97.5%. The advantage of such a system is that it is easy to train by a layer, and can easily be implemented in real time after the initial training.[4]

BLOCK DIAGRAM DESCRIPTION

Gesture based wheel chair has following blocks

1. Microcontroller
2. Gesture sensor i.e. Accelerometer
3. Comparators with set points
4. Motor driver
5. Motors
6. Obstacle sensor
7. Transistor as switch
8. Buzzer
9. Power supply
10. HT12 E Encoder
11. RF Transmitter
12. RF Receiver
13. HT12 D Decoder

Microcontroller:

It is a low-power, high-performance CMOS 8-bit microcomputer with 4K bytes of Flash Programmable and Erasable Read Only Memory (PEROM).The device is manufactured using Atmel’s high-density non-volatile memory technology and is compatible with the MCS-51™ instruction set and pin-out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional non-volatile memory programmer. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel AT89C51 is a powerful microcomputer, which provides a highly flexible and cost effective solution so many embedded control applications

Gesture Sensor i.e Accelerometer:

“It measures acceleration with a minimum full-scale range of ±3 g. It can measure the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration”
The ADXL335 has three analog outputs for XYZ axis and the output voltage corresponds to an acceleration value. That means that if you power the chip with 3V then an output of 1.5V indicates zero g acceleration.

Comparator and set point

Output of accelerometer is given to op-amp as comparator. For 0 gravity output of accelerometer is 1.5V. For positive acceleration output increases above 1.5 volts and for negative acceleration output decreases below 1.5V.Therefore the set point for comparator is above 1.5V and below 1.5V. And the output of this comparator is given to the microcontroller

Motor drivers and motors

The L293D is a quad, high-current, half-H driver designed to provide bidirectional drive currents of up to 600 mA at voltages from 4.5V to 36V. It makes it easier to drive the DC motors. The L293D consists of four drivers. Pins IN1 through IN4 and OUT1 through OUT4 are input and output pins, respectively, of driver 1 through driver 4. Drivers 1 and 2, and drivers 3 and 4 are enabled by enable pin 1 (EN1) and pin 9 (EN2), respectively. When enable input EN1 (pin 1) is high, drivers 1 and 2 are enabled and the outputs corresponding to their inputs are active. Similarly, enable input EN2 (pin 9) enables drivers 3 and 4.In our project we are using DC gear motor. These motors are connected at the output of motor driver. The direction of motor will decide the direction of the chair.

Obstacle sensor:
We are using limit switch as obstacle sensor. When we are moving the wheel chair in reverse direction, we are unable to see back side. If there is any obstacle or wall at the back site then this sensor will operate to indicate the obstacle.

Transistor as Switch:
When obstacle is detected we have to turn on the buzzer but output of micro-controller is not sufficient to drive the buzzer directly. Therefore to drive the buzzer we are using transistor as switch.

BUZZER:
This is output device. When there is obstacle detected then Buzzer turns ON. Otherwise buzzer will be turned off..

Power supply:
In our project, we require +12Vdc, and +5 Vdc supply. +5 volts is required for Micro-controller 89C51 board, sensors and signal conditioning etc. + 12 Volts are required for Buzzer, motor driver and motors. Our chair is moving so we can't use 230Vac supply. Therefore we are using 12VDC battery

Encoder HT12E
The 2^{12} encoder are a series of CMOS LSI for remote control system applications. They are capable of encoding information that consists of N address bits and 12 N data bits. Each address/data input can be set to one of the two logic states. The programmed addresses/data are transmitted together with the header bits via an RF medium upon receipt of a trigger signal. The capability to select a TE trigger on the HT12E further enhances the applications flexibility of the 2^{12} series of encoders.

TRANSMITTER MODULE
This is a 433.92Mhz ASK transmitter module with an output of up to 8mW depending on power supply voltage. The TLP transmitter is based on SAW resonator and accepts both linear and digital inputs can operate from 2 to 12 Volts-DC, and makes building RF enabled products very easy. Typical range of this product is around 100 meters (300 feet) in an open area and 30 meters (100 feet) in a built up area when used with the corresponding. The results may vary considerably depending on the surroundings, operating voltage of the transmitter and the antenna. A single piece of wire used as a ¼ wave antenna works out to be 17cm long.

RECEIVER MODULE
The size and simplicity of these units make them a professional and economical solution for many wireless applications. They have a sensitivity of 3uVRMS and operates from 4.5 to 5.5 volts-DC with both linear and digital outputs. The typical sensitivity is -103dbm and the typical current consumption is 3.5mA for 5V operation voltage.
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Decoder HT12D
These decoders are a series of CMOS LSI for remote control system applications. For proper operation, a pair of encoder/decoder with the same number of addresses and data format should be chosen. The decoders receive serial addresses and data from a programmed 212 series of encoders that are transmitted by a carrier using an RF or an IR transmission medium. They compare the serial input data three times continuously with their local addresses. If no error or unmatched codes are found, the input data codes are decoded and then transferred to the output pins. The VT pin also goes high to indicate a valid transmission. The 2^{12} series of decoders are capable of decoding information's that consist of 8 address bits and 4 data bits and are designed for use with the HT12E Encoder.

HARDWARE REQUIREMENT:-
Microcontroller 89C51
Voltage Regulator 78XX series
Capacitors

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Diodes
Light Emitting Diodes (LEDs)
Buzzer and Bleeper
Presets
Transistors
LM339
L293D
ADXL 335
Encoder HT12E
Decoder HT12D
RF Transmitter and Receiver module

L293D MOTOR DRIVER:
The L293 and L293D are quad push-pull drivers capable of delivering output currents to 1A or 600mA per channel respectively. Each channel is controlled by a TTL-compatible logic input and each pair of drivers (a full bridge) is equipped with an inhibit input which turns off all four transistors. A separate supply input is provided for the logic so that it may be run off a lower voltage to reduce dissipation. Additionally the L293D includes the output clamping diodes within the IC for complete interfacing with inductive loads. Both devices are available in 16-pin Batwing DIP packages. They are also available in Power S0IC and Hermetic DIL packages

FEATURES
Output Current 1A Per Channel (600mA or L293D)
Peak Output Current 2A Per Channel (1.2A for L293D)
Inhibit Facility
High Noise Immunity
Separate Logic Supply
Over-Temperature Protection

Accelerometer – ADXL 335:
Accelerometer sensor can measure static (earth gravity) or dynamic acceleration in all three axis. Application of the sensor is in various fields and many applications can be developed using this sensor. Accelerometer sensor measures level of acceleration where it is mounted this enable us to measure acceleration/deceleration of object like car or robot, or tilt of a platform with respected to earth axis, or vibration produced by machines. Sensor provides 0G output which detect linear free fall. Sensitivity can be adjusted in two ranges.

Acceleration is a vector force which has direction and measured in meters per second. Earth produces gravitational acceleration on all objects on earth. By monitoring the three axis acceleration one can measure the level of tilt of any platform.

Features
- Simple to use
- Analog output for each axis
- +5V operation @1ma current
- High Sensitivity (800mV/g @ 1.5g)
- Selectable Sensitivity (+- 1.5g, +- 6g)
- 0g detect for free fall detection
- Robust design, high shock survivability
- Low Cost

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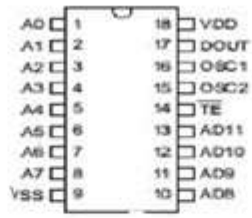
ENCODER IC HT12E
Pin diagram



18 DIP

General description:

The 2^{12} encoder are a series of CMOS LSI for remote control system applications. They are capable of encoding information that consists of N address bits and 12 N data bits. Each address/data input can be set to one of the two logic states. The programmed addresses/data are transmitted together with the header bits via an RF medium upon receipt of a trigger signal. The capability to select a TE trigger on the HT12E further enhances the applications flexibility of the 2^{12} series of encoders.

Features:

1. Low power and high noise immunity CMOS technology
2. Low standby current: 0.1uA (typ) at V_{DD} =5V
3. Minimum transmission word- One word for the HT12A

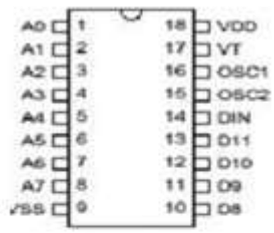
The Hol Tek encoders are a series of CMOS LSI for remote control system applications. They are capable of encoding information that consists of 8 address bits and 4 data bits. Each address/data input can be set to one of the two logic states. The programmed addresses/data are transmitted together with the header bits via an RF or an infrared transmission medium upon receipt of a trigger signal. The capability to select a TE trigger on the HT12E further enhances the application flexibility of the encoder

Pin details:

- Pin 1 to 8-------- A0 to A7:
  Address selection – input pins for address A0-A7 setting. These pins can be externally set to VSS or left open. In our circuit this pins are connected to the DIP switch.
- Pin 10 to 13------AD8-AD11
  Input pins for address/data AD8-AD11 setting. These pins can be externally set to VSS or left open
- Pin 14---------TE
  Transmission enables active low. TE is a transmission enable pin of HT12E. Transmission enable is active low, which has to be kept at VSS or left open.
- Pin 15,16----osc1, osc2
  If the HT12E is used as an encoder, a typical 3khz oscillating frequency is recommended. The decoder device can be either HT12D whose decoder oscillating frequency is typically 50 times that of encoder, viz 150 kHz. Take the following steps to find the corresponding resistor values. Resistor will be 51kohm.
- Pin 17-------DOUT
  Encoder data serial transmission output
- Pin 9 and 18
  VSS and VCC respectively

DECODER IC HT12D

Pin diagram



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These decoders are a series of CMOS LSI for remote control system applications. For proper operation, a pair of encoder/decoder with the same number of addresses and data format should be chosen.

The decoders receive serial addresses and data from a programmed 212 series of encoders that are transmitted by a carrier using an RF or an IR transmission medium. They compare the serial input data three times continuously with their local addresses. If no error or unmatched codes are found, the input data codes are decoded and then transferred to the output pins. The VT pin also goes high to indicate a valid transmission.

The 2^{12} series of decoders are capable of decoding information's that consist of 8 address bits and 4 data bits and are designed for use with the HT12E Encoder.

Features:
The HT12Ds purpose is to decode the signal, rejecting any infrared signals, which do not conform with the exact code as set on its pins A0 to A7. Therefore, it is necessary for the address pins to connect exactly the same logic levels as in the transmitter. The code is checked three times, after which the VT pin goes high, and the appropriate data pins D8 to D11 will switch to their logic levels accordingly. The data pins will normally remains at logic high, and the appropriate pin will switch to logic low when the transmitter data pin is at logic low. The OSC1 and OSC2 pins are used to set the oscillator frequency.

Application
3D Gaming: Tilt and Motion Sensing, Event Recorder
HDD MP3 Player: Freefall Detection
Laptop PC: Freefall Detection, Anti-Theft
Cell Phone: Image Stability, Text Scroll, Motion Dialing, E-Compass
Pedometer: Motion Sensing / PDA: Text Scroll
Navigation and Dead Reckoning: E-Compass Tilt Compensation
Robotics: Motion Sensing

Future Modifications:
Our project is wireless controlled robotic car. In future we can use XBee or Blue tooth technology for the car. We can change the place of sensor e.g. head, so that we can control the movement of car by changing the head.

CONCLUSION
This project is good for physical handicap. In this project by changing the hand movement we can control the chair position. If you replace the sensor, we can control the chair by head movement. From this project we understand how to program, how to erase, how to read the program from the microcontroller.

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