Controlling a Car using Gesture by Accelerometer with the Help of Arduino Nano

Oppiliappan T[1], Sathyanarayana M[1], Soornaraj[1] R, Jeyaselvi M[2]

[1]Computer Science and Engineering, Agni College of Technology
[2]Assistant professor, Dept. of CSE Engineering, Agni College, TamilNadu, India

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Abstract - *This project presents a low-cost human-computer interaction device represented by Arduino nano with accelerometer to control RC car. Arduino glove includes accelerometer sensor to identify the angle of the hand while the movements are identified by the adxl335. ADXL335 is a 3-axis accelerometer with signal conditioned voltage outputs. The product measures acceleration with a minimum full-scale range of ±3 g.. Moreover, this work proposes an idea to integrate a special construction of Arduino nano and ADXL335 instead of gyro sensor which are used by most of the glove projects.*

KeyWords: **ADXL335, Arduino nano, RC car**

1. INTRODUCTION

The purpose of the project is to present a low-cost human-computer interaction device the moto of this device is to provide a interaction between human being and a radio controlled car. This project proposed a glove that identify the acceleration of hand which could be used as an input for this system. As the key component we use a toy car which uses NRF24L01.However any other device such as robot arms, helicopters, quadcopter as well as other interactive device can be also used. The input of this device is controlled by the ADXL335 it is a 3-axis accelerometer with signal conditioned voltage outputs. The product measures acceleration with a minimum full-scale range of ±3 g and it calculate the acceleration of the hand and sends the signal to the Arduino. It replace the construction of potentiometers and spring for decreasing the cost of the project

The first wired connection glove named the Sayre glove was developed in 1977 by de Fanti and Sandi [1]. The base idea included is to use flexible tubes with light source and photocell that is mounted on a finger and based on the movement light intensity would vary that will cause a change in voltage in photocells. This gloves including MIT LED glove and digital entry data glove were used for research purposes and were never commercialized. However, this prototype model was used in creating a data gloves, more advanced wired connection gloves with a variety of sensors. Introducing the flex sensors has solved accuracy and comfort issues associated with earlier gloves. Flex sensors are basically they are thin films that have a carbon elements where t h e resistance varies as that thin substrate bends in the finger[2].

A device car is based on the Arduino neuron is utilizing ANN is proposed in [4]. The research proposed the learning and following method for the represented autonomous car through the neural network. In another project, a system using Arduino board, Bluetooth, and Processing was developed to allow the user to specify desired finger gestures for controlling a variety of robotic devices [5]. In a similar project, authors discuss the use of the glove to control a video game application for the rehabilitation of stroke patients [6]. In another project, It describes the sketch and implementation of an Intelligent Haptic Robot-Glove (IHRG) for the rehabilitation of the patients that have a diagnosis of a cerebrovascular accident is been discussed [7].

1.1 Hand Gestures

A hand gesture is an another way of communication (non vocals) in which the movement of the part of bodies especially a hand to express an idea or meaning. Hand Gestures differ from non-verbal communication which does not communicate some specific messages, like facial expressive displays, or displays of joint attention. Hand Gestures allow people to communicate different words and feeling, from contempt and hostility to accept and affection, often together with body language in addition to words through hand signs .The fig 1 represent the hand motion for this project.
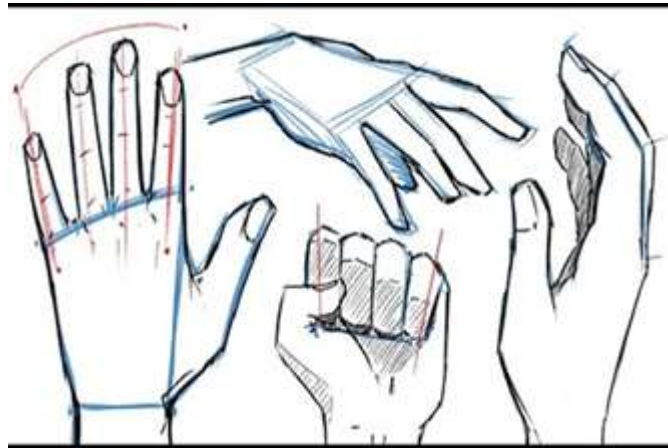

Fig-1: Various Hand Gesture Sign**s**

2. SYSTEM OVERVIEW

The System overview describes about the transmitter and receiver system and the accelerometer functionality

- · TRANSMITTER

- · RECEIVER

- · PIN DIAGRAM OF ARDUINO NANO

- · ACCELEROMETER

2.1 TRANSMITTER:

The project consist of a transmitter is shown in Fig 2, consists of Arduino Nano, NRF2401,ADXL335. ADXL335 is a 3-axis accelerometer with the signal conditioned voltage outputs. The product measures acceleration with a minimum full-scale range of ±3 the ADXL335 is place on above the wrist of the hand to measure the acceleration of the hand based on the measure value it sends the condition set the Arduino nano which makes the decision process and sends the signal RFTransmitter(NRF2401) which is required to perform wireless communication between transmitter and receiver parts of the devices.. The main disadvantage is that it cannot be operated in a network of other transceivers, however, the communication between transmitting and receiving part is required for this research without any uplink. Accelerometer module (ADXL335) which transmits command to the Arduino

1. A microcontroller (Arduino nano) to receive input from accelerometer

2. RF Transmitter module transfers data to the receiver with the help of antenna.

Fig- 2: TRANMITTER CIRCUIT

2.2. RECIEVER:

The receiver is represented by a Radio-controlled car which is controlled by the glove. The schematic diagram of the receiver circuit diagram is shown in Fig. 3. It includes four DC motors: two for forward as well as backward movements and another two for the left and right turns. The speed of the car is controlled by the hand movements and it linearly dependents to the angle of hand movement which is identified by the accelerometer. It means that if the hand is bent at a maximum angle, then the speed of the car is maximum, and if the hand is straight then the speed of the car is zero. The 2.4 GHz RF transceiver module (NRF24L01) is used to receive information from the glove.

1. The receiver receives the data through the NRF2401 and send it to the Arduino nano

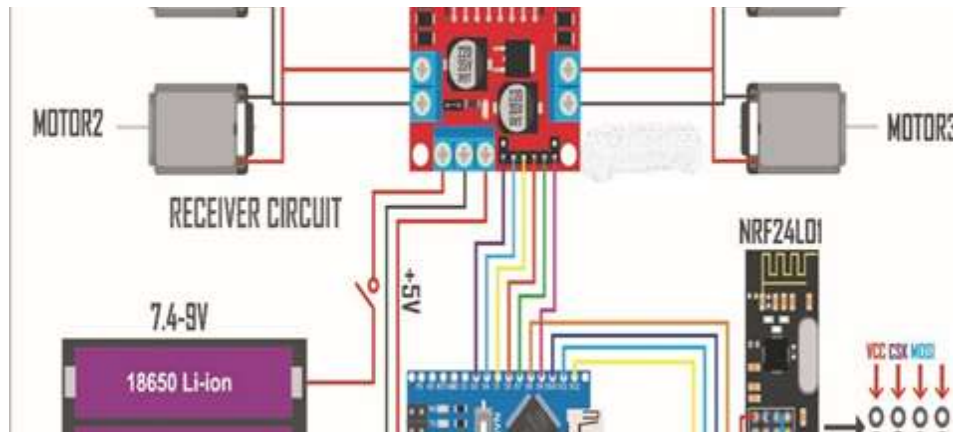2. Arduino nano commands the motor driver based on the values received

Fig-3:RECIEVER CIRCUIT

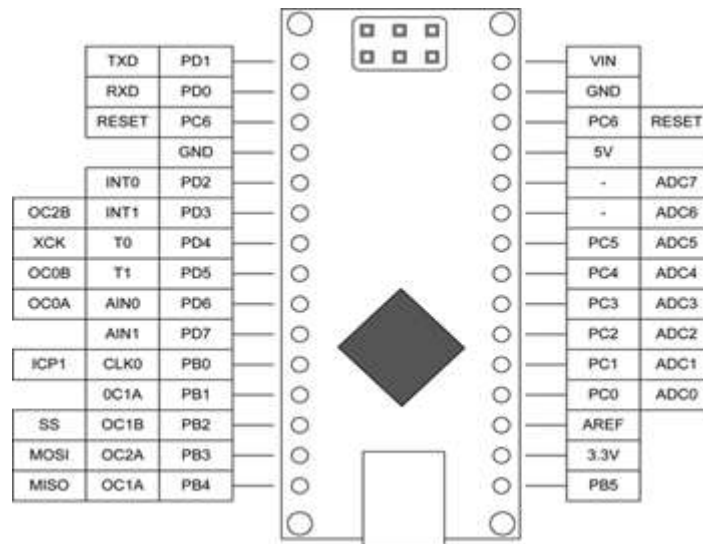## 2.3 PIN DIAGRAN OF ARDUINO NANO:

Fig-4: ARDUINO PIN CONFIG

The Arduino Nano Fig 4, is a type of microcontroller which is similar to the Arduino Uno. The difference between Uno and Nano is the number of pin present in this microcontroller .Arduino nano is used for variety of application where the microcontroller should be small and no need for more number of pins required. We use Arduino nano instead of Arduino Uno to cost cut this price difference in making this project in less cost.

2.4. ARDUINO IDE

The program is written in Arduino Integrated Development Environment (IDE) v1.8.12 as shown in figure 3.5. and connected to the Arduino hardware to upload the programs. Before uploading the program there is a need to select appropriate Microcontroller so, "Arduino Nano" from the Tool menu has been chosen and then for proper communication with computer and Arduino Nano boards there is a need to select COM port from the Tool menu

Fig-5: ARDUIINO

2.5. ACCELEROMETER

A sensor with accelerometer (ADXL335) module is used here, which senses the coordinate axis of direction of the movements of the hand, then the car starts moving according to the movement of the hand. The ADXL335 is words on the principle of Piezoelectric effect on measuring, the static acceleration amounts due to gravity, the ball of the angle tilted at with respect to the earth is determined. On sensing the dynamic acceleration amount, the way of moving the car is analyzed.
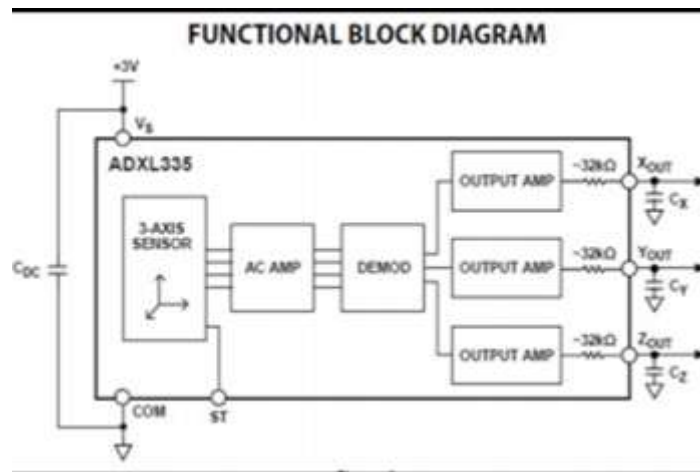

Fig- 6: Function block of accelerometer

The below fig shows how the adxl35 calculates the movement of the hand based on the acceleration due to gravity a small and low power, and thin, a complete 3-axis acceleration meter with signal conditioning output voltages.It can measure the acceleration with a minimum of full-scale range of ±3 g. It can also measure the static and dynamic due to acceleration of gravity in moving-sensing applications, and resulting from motion, shock, or vibration respectively.
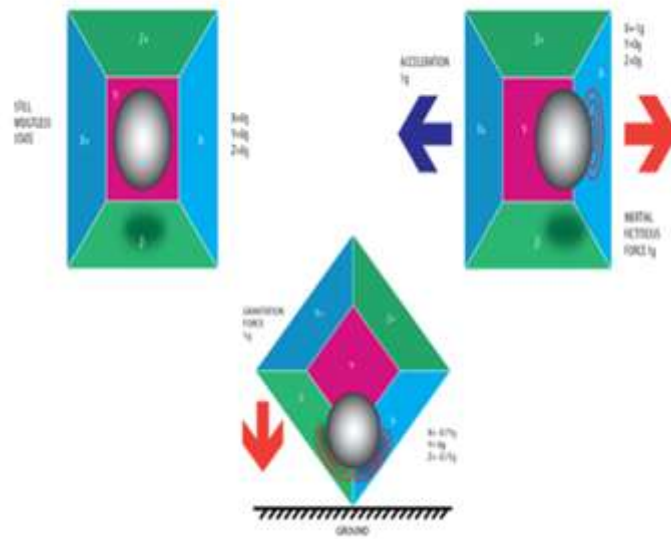
Fig-7: Accelerometer concept

3. TESTINGS AND PROCEDURES

Because of transmitter device ADXL335 wearing on hand and receiver on the car, the car starts moving according to the movement of hand gestures. In this paper, we have explained about the 5 different hand gesture or movement positions

 1. Stop condition

 2. Forward condition

 3. Backward condition

 4. Moves towards right

 5. moves towards left.

Stop condition: The car can be stopped moving the accelerometer parallel to the horizontal axis, This makes all the output pins of decoder into (13, 12, 11, 10) set to high.

 Forward condition: The car starts moving in forward direction, by making accelerometer moving to forward motion, this condition sets the two output pin of decoder (13, 11) to low and set high on the opposite two output pin of decoder (12, 10).

Backward condition: The car starts moving in forward motion, by making accelerometer tilted to forward motion (upwards), this condition sets the two output pin of decoder (13, 11) to high and set low on the opposite two output pin of decoder (12, 10).

Moves towards Right: The car starts move towards right side by tilting the accelerometer towards right, and this makes the two output pin of decoder (12, 11) low and other two output pin of decoder into (13, 10) high.

 Moves towards Left: The car starts move towards left side by tilting the accelerometer towards left, and this makes the two output pin of decoder (12, 11) high and other two output pin of decoder into (13, 10) low

Here another YOLO model has been trained to detect the character in the given plate. The model will process the give image and detect the character and return the bounding box and its coordinates decoder into (13, 10) low

4. CONCLUSION:

This project represent a low cost human-computer interaction device with the help of Arduino glove which uses ADXL 335 and nRF24L01 are proposed in this project. The ADXL335 provides the degree for RC car to move in corresponding direction, with the help of Arduino glove we can also control robot hand, helicopter and quadcopter device which can be controlled by this project. It consist of RFtransmitrer, RFreciever and Arduino nano the use of this component reduces the cost price compared to the use of Arduino uno and XBee integrated with Arduino mega board in conclusion, the overall cost of the system can further be decreased by replacing flex sensor with a ADXL335 as proposed without having any effect on the performance of the system and provide more accuracy than the existing system

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