Mathematical Statistician and Engineering Applications
ISSN: 2094-0343
2326-9865

Gesture Controlling Robotic Car with Hand by Using Flex Sensors

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Article Info
Page Number: 9399 - 9407
Publication Issue:
Vol 71 No. 4 (2022)

Article History
Article Received: *15 September 2022*
Revised: *25 October 2022*
Accepted: *14 November 2022*
Publication: *21 December 2022*

Abstract

The main theme and aims of the work are to originate a very simple usable and self-intellect design for a car that is implemented in versatile areas. Truly we propose a real-time hand gesture that will reduce the scattering in driving mode. In our daily life, we are gettingattached more to machines and their communication system as it is confirmed that more proficiency and interaction is perfect. We represent our research on an automated smart car for physically unfit people in this paper. So, keeping all the facts and issues in mind, proposed and designed in that way a hand gesture robotic car, controlled by two flex sensors with six commands, which is more efficient, accurate and cost-effective than before. In addition, even an individual person could operate with two fingers and real-time hand gesture recognition. The most attractive and finest part of the work is to assemble a lot of devices in them: a 3-axis accelerometer (MPU6050), flexible flex sensor with ATmega328P microcontroller. Furthermore, a little bit of AI technology has been added by sound waves.

Keyword- GY521(MPU 6050); Flex Sensors; Arduino Uno; HC-SR04 Ultrasonic Sensor; RF Sender/Receiver; Servomotor and Motor shield drive.

I. Introduction

In the entire world where we live, about two billion physically unfit people belong, which is as a percentage 37.5% of the total earth population. A disabled person is someone who is physically unfit in terms of body function, shape, and lack of activity to do any work, even depend on other assistance according to the world health organization (WHO). Humans are now in such an era where they want all the sectors in automated procedures to be called digitalization and automation [1-5]. Similar things are implemented in ourproposed work. As it is concerned that day by day, we are getting more connected with mechanization. That day is not too far away when from morning to night there is no way to avoid AI technology. Some related works in recent years are very similar and close. In the field of real time hand gestures [6]. It is an imperative part of human-computer

interaction. Normally people who are handicapped, not able to move without the assistance of others. The work is accumulated in this paper for those individuals, in case of being involved in an accident and mutilated and want feedback into normal life except the help of others. The movement of the human hands[7-8] is perceived by the robot through an accelerometer.

In this paper, the command is controlled by the two flex sensors [9]. Two modes are achieved in this car in the driving mode and reverse mode. Until the flex sensor is in active mode, there is no chance to work any gestures [10] of hand as well as the car will not move at all. In addition, the two-flex sensor gives an extra smooth driving of the car. Hand gestures (hand globes) and cars communicate throughout the RF and receiver. If the vehicle finds any obstacle in front of this it reduces the speed and active stop mode by the help of ultrasonic sensors. To rotate the sonar sensor at 180 degrees angle, attach the same angle base servo motor. And finally, the car can run in six directions by the flex sensor and accelerometer.

II. Theoretical Explanation

A. Object detection by Sound wave:

A burst of short, high-frequency sound waves that progress cone shape onto the object is radiated by ultrasonic sensors. And when these sound waves are interrupted by any target, the receiver part receives an echo or reflected signal which is generated by this particular object. The time span is then computed between emitting the signal and receiving the echo. The distance of the object is excused from the time span value. The distance is calculated by this equation: if sound waves travel t seconds in the distance of d meter and the velocity is v meter/second then the equation goes like:

$V = d \times tor$, $d = v/s$.

The destination of the distance is only the time of flight, where the intensity of sound can be neglected.

B. Unction of Gyroscope and Accelerometer

Gyroscope and accelerometer are made of electrical detecting component, which in general are called MEMS (Microelectromechanical framework), mechanical elements and a simple low powered micro-controller for information handling. These flexare also known as inertia measurement units (IMU) and altitude of any object can be calculated by these sensors in three dimensions. HereMPU-6050 is utilized as our IMU sensors which include both accelerometer, gyroscope magnetometer, and altimeter. Typically, 6 degrees of freedom (DOM)or 3 axis IMU sensors.6 DOF implies that3 values are yielded from the accelerometer and 3 values output from the gyroscope [12]. In the second law of motion, Newton explains that acceleration of an object is directly proportional to its mass. That means two things depend on the acceleration of an object: mass and force. The force-detection instrument really measures a drive of an accelerometer that's made by acceleration and is connected on one of the accelerometer's axes. A normal mechanism of detecting is altering the capacitance of a moving mass with the altar of increasing acceleration. Let's make it clear to understand by a good instant of piezoelectric effect. It's very simple to know that piezoelectric crystal converts pressure energy to crystal energy. A cuboidal box with walls made of piezoelectric crystals and exists a ball inside of it. Due to gravity, the box is forced to move in that direction of inclination while the box is tilted. The collision creates very low piezoelectric currents between walls and the ball. The magnitude and direction can be determined by inclination form calculation of piezoelectric currents. Same way a gyroscope works at which the principle of Coriolis acceleration is

formed [13]. Imagine a fork is keptin back-and-forth motion inside a piezoelectric structure.

Now if placement is tilted due to inertia a force along the direction of inclination is experienced and yielded apiezoelectric current.

III. Proposed Development and Design

A. Firmware Development

The platform of the proposed smart car for people has been developed on Arduino. Three kinds of code files are recordedin general- .ino file. These three-program run at the same time and interface with each other.

B. Hardware Development

The whole system of the work is accomplished in two stages. These two individual parts are respectively the transmitter and receiver section. Here the flex sensor and two fingers are parallelly positioned where the sensor is pointed on the gloves and then sent as a signal to the Auridon nano. An MPU- 6050(gyroscope module) accelerometer is utilized for motion detection whereas along with this a gyroscope is used which is easy to interface with Arduino Uno. On the other hand, Arduino uno is interfaced Arduino nano and encoder. The encoder interface with RF transmitter. There is a radio frequency sender and receivers. Radio frequency sender or transmitter and encoder attached with a hand glove. The wireless transmission is made possible by the RF transmitter that operates at 433.9MHz. It was a good choice since the cost of it is low when compared to the others and also, it will makegood.

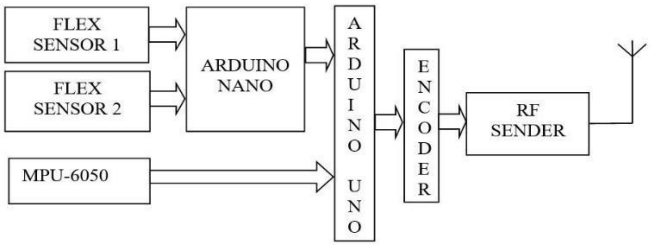

Figure -1: Block diagram of Transmitter Section

A rover consists of two wheels of which are controlled by two 12V DC motors. Wheels are well equipped with grip for almost all non-structured movement. A 12V 3.9mA power supply is able to recharge the whole system, and is used to power the mechanisms, controllers, ultrasonic sensor and servo meter. Voltage regulator LM2596(buck module) controlling the voltage from 12v to 9v for proper powering. The signal received by the receiver which is transmitted through the RF receiver, is transmitted through the RF transmitter. RF receiver interface with decoder. The main programmable controller use here, is an Arduino uno which is consisted of ATmega328P microcontroller [14]. The microcontroller also interfaces with decoder, motor driver shield [16], ultrasonic sensor and with two motors.

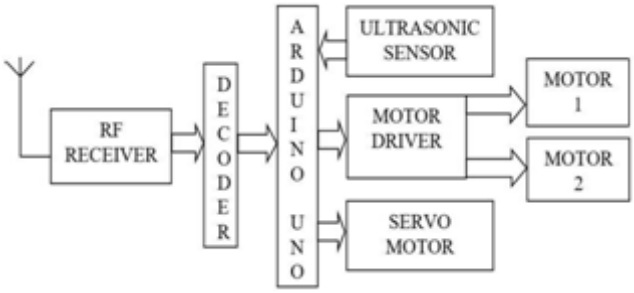

Figure -2: Block diagram of Receiver Section

C. Design Consideration

The procedure of gesture control is achieved by the accelerometer and flex sensor in the MEMS technology is used by accelerometer. According to the movement of the west along with two fingers the car is governed. The active driving and reverse mode are commanded by two flex sensors. In absence of finger fold, the car will not go reverse or forward by the movement of the hand until the fingers are folded. To remain in the active mode is possible only by folding the index finger, otherwise disable mode will on. To drive the car in reverse, you need to fold the middle finger. Arduino nano sends signal to Arduino uno depending on the finger sensor base of the outputs of Arduino nano as well as the position of accelerometer Arduino uno sends data to the IC. The accelerometer data is taken from I2C BUS. IC 4-bit parallel data is then converted to serial data by encoder and transmitter to RF transmitter. 8-bit address and 4-bit data are on encoder IC serial data, which is sent to the RF receiver by

433.9 MHz radio frequency.

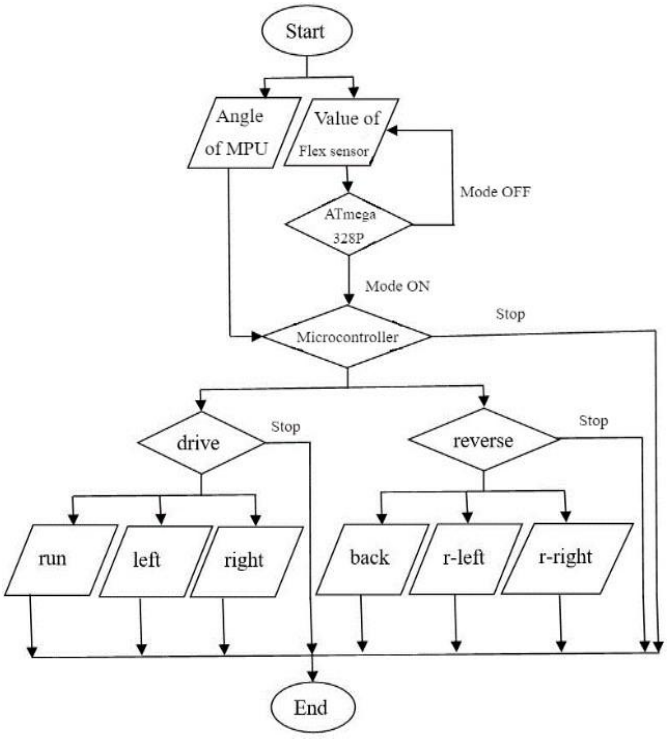

Figure -4: Block Diagram of Transmitter and Receiver Module

RF receiver does not convert serial data to parallel, If the data does not match or send data from RF transmitter through address bit, but serial data is received by RF receiver. The similar serial data then parallelly comes to the main controller of Arduino uno of the car is after the command to the motor driver that in which direction to move. Our car can move in six directions, Infront of left and right, in reverse left of reverse mode (left wheel will not rotate but right one will) in reverse right (right wheel will rotate but left one will not).

If any finger is not folded the car will stop. Figure-3a represents the car movement stop. When the Index finger is folded and the time X-axis value is negative Y and Z axis are positive the car goes forward shown in Figure- 3b. Figure-3c Present the index finger fold Y-axis negative, X and Z axis must be positive for turning left the car otherwise it doesn't turn left. Figure-3d represents the car turning right when Z- axis is negative and the X, Z-axis is positive.

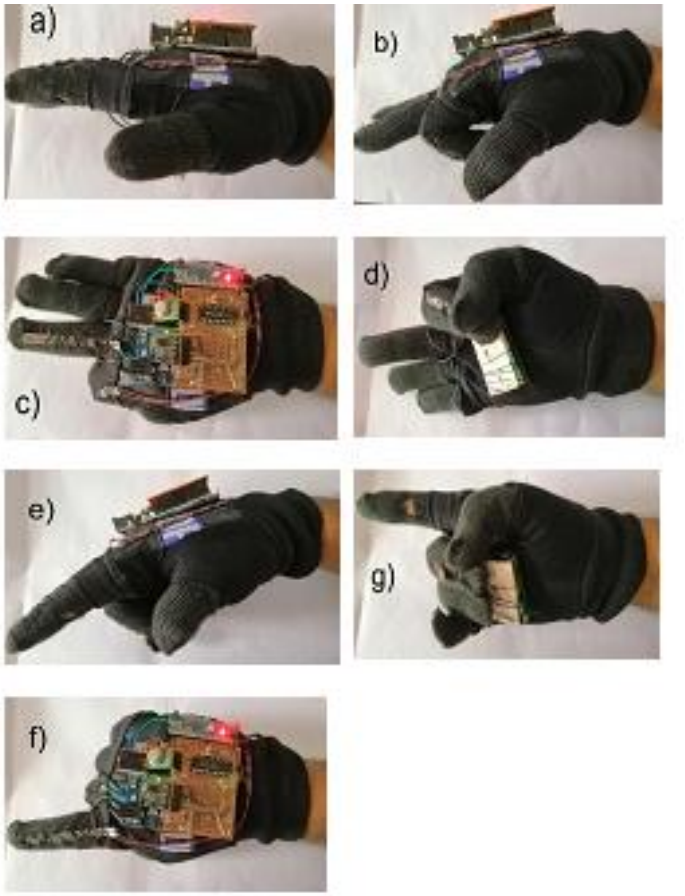

Figure -3: The theme of Gesture recognition

Reverse gear is the active fold of the middle finger. Figure-3e the car goes in the Backward direction. Figure-3f reverse left command is active. When the car follows reverse right for which hand position it shows in Figure-3g.

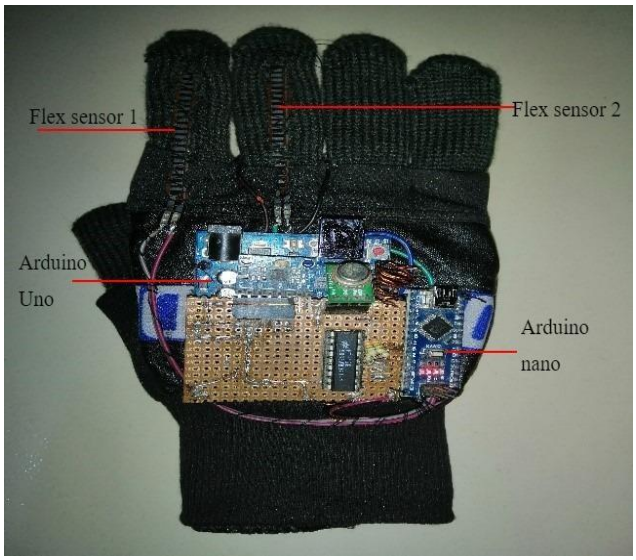

Figure-5: Top view of Hand Glove

Detection for object and obstacle in driving mode two ultrasonic sensors are used for safety, and will automatically stop after finding any curb. Those two sensors are rotated by a servo. The most interesting thing is that in the detection range of distance between 50cm to 250cm, within this immediate speed can be reduced. Totally the car is stopped while it comes closer to the distance of 25cm,until the obstacle has been removed, does not follow any command. When turn left or right then sensor rotates left or right.

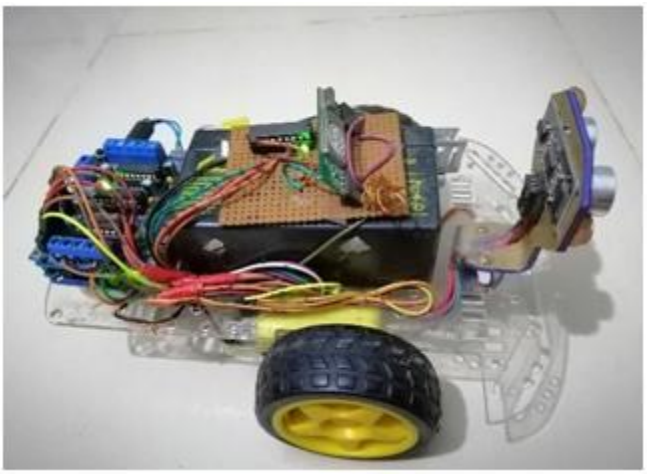

Figure-6: Side view of gesture Car

The car is in high speed and it takes a turn (subconscious turn)then it slows down automatically using PID (proportional integral derivative) control and overcomes the bump. If the driver is unaware, his finger will not be folded. Nd since the finger is not folded, the car will not have any command active.

IV. Result

In this paper a hand gesture-controlled navigation robotic carhas been introduced, a person who has only one hand and twofingers could operate by hand gesture. The result of the handglove is shown in the curve. The blue, red and green colors represent X, Y and Z. The adjustment in the value of

the X, Y and Z axis coordinate made the robotic car move to the desired direction. The route between the robot and the hand module transmitter circulate was made for the module.

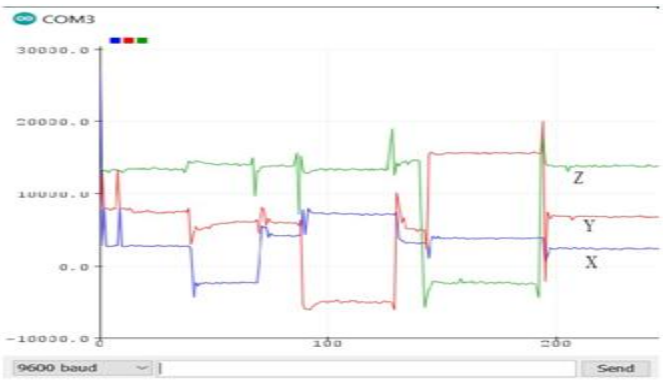

Figure -7: Output of Accelerometer

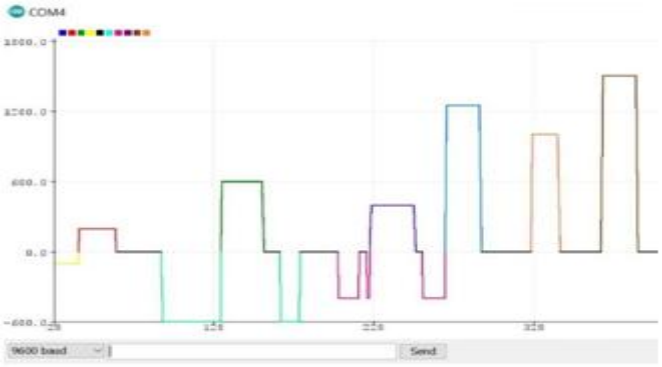

Figure -8: Output of the Project

In figure 8 is simulated, when the commands come from the transmitter side (hand glove) and how the robotic car reacts to this. Here 10 individual colors represent specific criteria black, yellow, red, cyan, dark green, pink, purple, blue, orange and soil color respectively demonstrate for stop (black), going forward (yellow), found any obstacles (red), move to left (cyan), getting obstacles while turning to left (dark green), move to right (pink), getting obstacles while moving to right (purple), for reverse left (blue), for reverse right (orange) and going backward (soil).

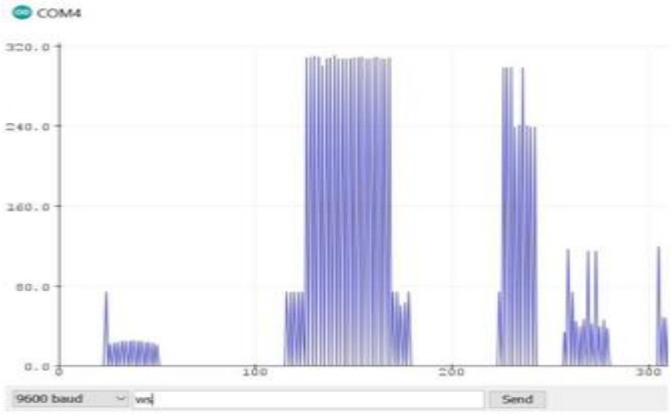

Figure-9: Accuracy Rate of Ultrasonic Sensor.

We used ultrasonic sensors in our project to detect obstacles in front of the car. Immediately the car will stop near a close distance of 25 cm. Maximum range 320cm. According to figure-8 shows the sensitivity of this car sensor when it's run.

V. Conclusion

To conclude this paper appeared with some authentic and constructive, way for those people who fall in accident or bybirth abnormal and neglected or ignored in society because oftheir unusualness in terms of body function or shape. This vehicle based on "Human Gesture Recognition" could operate by folding fingers without any complication. Two flex sensors made the project smoother, flexible as well as economical. As usual this work was done previously but haveextended it more by six positions of the accelerometer. This implementation will make it much more self-reliant. Eventually the motive of this work was not to stage as a burden to the society for movement.

VI. Future Scope

In the long run, gesture-controlled technology will be much more dominant than any others. From ground to space in all areas gesture could be implemented. It's true that they still are not capable of making a safer world of handicapped people. To make them easier and comfortable life. this Technology could contribute a huge role.

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