Prototypically Functioning Device For Gesture Control In Automobiles

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Abstract- *Gesture interfaces are gaining relevance for human-machine communication, since it is expected that they make interaction more intuitive. Majority of the industrial robots are autonomous and are required to operate with high accuracy and speed. Some applications are required to be semi-autonomous or human controlled robots. Human gestures constitute a variety of motion expressed by the body which includes facial expressions and hand movements. This paper describes a developing a human machine interface used for controlling car and to make the device simple as well as cheap so that it can be produced and used for number of purposes. In this case study of Gesture control, components required for prototype has been bought and prototype for rough dimensions has been made and finally testing for errors and reworks has been made for several times.Hence we prototypically developed device can perform various tasks because of Arduino Nano which is implanted on the Transmitter section. A major advantage of the system is that it provides real time palm gesture recognition, leading to an effective and natural way of controlling vehicle. The present application though seems to be feasible and more user friendly in comparison to the traditional input modes but is somewhat less robust in recognition phase. So in future the work can be done on improving each of the technology and functionality of the chosen application new ideas.*

I. INTRODUCTION

Ever since electronics was discovered, it has become an integral part of our life. Over the year's control of electronic devices such as smart phones and robots have seen groundbreaking research. Nowadays, we a removing towards automation where electronic devices can think on their individual. Gesture control is used with technical applications, like in human-robot interaction, for augmented desk interfaces or crane control. Although the common motivation of such work is to yield more natural and intuitive and thereby more efficient interfaces, the actual usefulness in practice is not always obvious. In today's globe robots have been a large progression in the knowledge fashioned by us. They are the foremost motive owing to which the effort which cannot be complete by human being is effortlessly performed by robots. These can be categorized in two traditions: 1). Autonomous robots, which are guarded by themselves and they do not require any external source to make it work and 2) Semi-autonomous robots, which necessitate an exterior source for their operational. In the midst of all the assortment of gestures, hand gesture is the generally communicative and the on the whole regularly used and establishes an outstanding means for the physically immobilized individuals too. One such kind of semi-autonomous robot is vehicle guarded by the association of Hand gestures. Gesture credit is an extremely adaptive line among the robots and customers. It let the actions of multifaceted machines by means of hand association there by eliminating bodily contact. The Gesture controlled robots offers a chance to incorporate immobilized individuals into their usual functioning life as well as to increase the independence in deeds of daily livelihood. This sort of organize could tender a realistic way to give immobilized individuals more autonomy. They can even assist to convene confront pretences by military, defence manoeuvres and can also be used in surgical operations.

Hand gestures are the simplest and the accepted means to organize robots. These robots are industrial with the intention of assist mankind to they are attain places which are idealistic and perilous to them. They have a transmitting side and a receiving side. The transmitter is mounted on the hand, while the receiver is mounted on the robot itself. This is an easy, user-friendly method to interact with robotic system and robots. An accelerometer is implemented for detecting the tilting position of your hand, and a microcontroller initiates different analogy values and generates command signals necessary to control and move the robot. A component called Accelerometer is used for the working of this device. This component defines an axis for the movement of our device in the 3D axis. The plan of the scheme is to extend a person mechanism line used for domineering car and to construct the machine straight forward in addition to economical so that it can be fashioned and used for numeral of rationale. The purpose of this scheme is to make a car that can be inhibited by gesture all the way through wireless and ultimately to construct it user sociable so that user can organize motions of the car by tiring controller glove and performing predefined gestures.

II. METHODOLGOY

The case study of Gesture control is done based on literature survey for types of gestures and different hand gestures studies (1-7).Components required for the prototype such as Arduino Nano and other encoders and decoders has been selected. Coding for the prototype i.e., similar commands like forward, backward, stop, left and right is done using Arduino software. Circuit diagrams for Transmitter and Receiver has been done.3D CAD Model for prototype will be prepared based on rough dimensions. Components required for prototype has been bought and prototype for rough dimensions has been made and finally testing for errors and reworks has been made for several times.

2.1. Components Selection (Figure.1)

a. **Accelerometer:** Accelerometer sensors are used to measure the tilt in x and y planes and converts it into analog signals. The ADXL335 is a small, thin, low power, complete 3-axis accelerometer with signal conditioned voltage outputs. It has 6 pins. First pin for power supply (VCC), second pin for ground (GND) and the last one for self-test (ST). Remaining 3 pins are for X, Y, Z axis.X and Y axis pins are connected to A0 and A1 pin of Arduino Uno board respectively. X and Y axis pins are connected to A0 and A1 pin of Arduino Uno board respectively. The low cost and small size of 3-axis accelerometer can measure the static acceleration of gravity from tilt-sensing applications as well as dynamic acceleration resulting from motion, shock or vibration and gives corresponding analog values through X, Y, Z axis pins.

b. **Arduino Nano:** Arduino board designs use a variety of microprocessors and controllers. The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328P; offers the same connectivity and specs of the UNO board in a smaller form factor. The Arduino Nano is programmed using the Arduino Software (IDE), our Integrated Development Environment common to all our boards and running both online and offline.

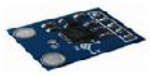
c. **Zigbee:** Zigbee is an IEEE 802.15.4-based specification for a suite of high-level communication protocols used to create personal area networks with small, low-power digital radios, such as for home automation, medical device data collection, and other low-power low-bandwidth needs, designed for small scale projects which need wireless connection. Its low power consumption limits transmission distances to 10–100 meters line-of-sight, depending on power output and environmental characteristics. Zigbee devices can transmit data over long distances by passing data through a mesh network of intermediate devices to reach more distant ones. Zigbee is typically used in low data rate applications that require long battery life and secure networking (Zigbee networks are secured by 128 bit symmetric encryption keys.) Zigbee has a defined rate of 250 kbit/s, best suited for intermittent data transmissions from a sensor or input device.

d. **L293DNE**: The L293 and L293D devices are quadruple high-current half-H drivers. The L293D is designed to provide bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V. The L293 is designed to provide bidirectional drive currents of up to 1 A at voltages from 4.5 V to 36 V

e. **L293 Motor Driver:** The L293 is an integrated circuit motor driver that can be used for simultaneous, bi-directional control of two small motors.The L293 is limited to 600 mA, but in Reality can only handle much small currents unless you have done some serious heat sinking to keep the case temperature down. The L293 is simplest and inexpensive for low current motors, for high current motors, it is less expensive to build your own H-bridge from scratch.

f. **12-Volt Battery:** A battery is a device consisting of one or more electrochemical cells with external connections. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that will flow through an external electric circuit to the positive terminal. When a battery is connected to an external electric load, a redox reaction converts high-energy reactants to lower-energy products, and the free-energy difference is delivered to the external circuit as electrical energy.

g. **Electric Motor:** An electric motor is an electrical machine that converts electrical energy into mechanical energy. Electric motors can be powered by direct current (DC) sources, such as from batteries, motor vehicles or rectifiers, or by alternating current (AC) sources, such as a power grid, inverters or electrical generators. Most electric motors operate through the interaction between the motor's magnetic field and electric current in a wire winding to generate force in the form of rotation of a shaft.

		
Accelerometer	Nano	Zigbee
		
L293 Motor Driver	12 v Battery	Electric Motor

2.2. Coding

a) Hand

```
#include <SoftwareSerial.h>
SoftwareSerial mySerial(5,4);
int x=A0;
int y=A1;
int z=A2;

void setup()
{
  Serial.begin(9600);
  mySerial.begin(9600);
  pinMode (x,INPUT);
  pinMode (y,INPUT);
  pinMode (z,INPUT);

}
void loop()
{
int X_value =analogRead(x);
int Y_value =analogRead(y);
int Z_value =analogRead(z);
Serial.print("\n");
delay(200);
if(Y_value>390)
{
  mySerial.write('l');
  }
  if(Y_value<330)
{
  mySerial.write('r');
  }
  if(X_value>360)
{
  mySerial.write('f');
  }
    if(X_value<300)
{
  mySerial.write('b');
  }
}
```

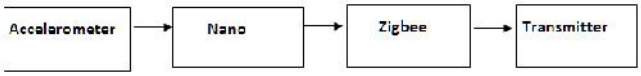
b) Robot

```
#include <SoftwareSerial.h>
SoftwareSerial mySerial(3,4);
int in1=8;
int in2=7;
int in3=9;
int in4=10;

void setup()
{
  Serial.begin(9600);
  mySerial.begin(9600);
  pinMode(in1,OUTPUT);
 pinMode(in2,OUTPUT);
  pinMode(in3,OUTPUT);
   pinMode(in4,OUTPUT);

}
void loop()
{

while(mySerial.available()>0)
{
  char ch = mySerial.read();
  if(ch == 'l')
  left();
     if(ch == 'r')
   right();
     if(ch == 'f')
   forward();
     if(ch == 'b')
   backward();
  }

}
void forward()
{
  digitalWrite(in1 , HIGH);
  digitalWrite(in2 , LOW);
  digitalWrite(in3 , HIGH);
  digitalWrite(in4 , LOW);
    delay(200);
   dc_stop();
}
void backward()
{
  digitalWrite(in1 , LOW);
  digitalWrite(in2 , HIGH);
  digitalWrite(in3 , LOW);
```

```
  digitalWrite(in4 , HIGH);
  delay(200);
   dc_stop();
}
void right()
{
  digitalWrite(in1 , LOW);
  digitalWrite(in2 , HIGH);
  digitalWrite(in3 , HIGH);
  digitalWrite(in4 , LOW);
  delay(200);
   dc_stop();
}
void left()
{
  digitalWrite(in1 , HIGH);
  digitalWrite(in2 , LOW);
  digitalWrite(in3 , LOW);
  digitalWrite(in4 , HIGH);
  delay(200);
   dc_stop();
}
void dc_stop()
{
  digitalWrite(in1 , HIGH);
  digitalWrite(in2 , HIGH);
  digitalWrite(in3 , HIGH);
  digitalWrite(in4 , HIGH);
}
```

2.3. Circuit Connections

a)Transmitter Circuit



The basic block diagram of the transmitter section of vehicle controlled by hand gesture is shown in the above diagram.

ATmega328: Microcontroller that we are implementing is a single-chip microcontroller from series Atmel and belongs to the mega AVR series. It is a highly efficient and cost effective type of microcontroller. It's an AVR RISC that stands for reduced instruction set. It is a 8 bit system.

ADXL335:Component is a necessary complete three-axis acceleration measurements system. An accelerometer is a type of sensor that gives an analog data while moving in the direction of X, Y and Z axis. These provided directions depend on the type of sensors that is implemented.

b)Receiver Circuit:

At the receiver section we used RF receiver to receive the data and then transfers it to HT12D decoder. Then further the decoder convert the Received serial data to parallel data and then with the data is read by using Arduino software, if data is an predefined process then it instructs the motor driver to proceed further.

RF Receiver: RF Receiver of this project will receive the data which is particularly transferred by the transmitter and then on the reception of the received data it transfers it to the decoder.

Zigbee: Zigbee receives the signal via wireless and transmits to the L293 Motor Driver for the further process of the robot.

L293: This is a DIP package 16-pin motor driver IC which has four input pins and four output pins. All the four i/p pins are connected to o/p pins of the decoder IC and the four output pins are connected to DC motors of the robot. The motor driver is a device which is required for initiating appropriate functionality.

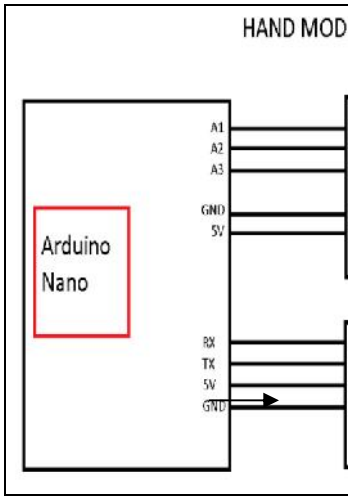


Figure. 2. Transmitter Circuit Diagram

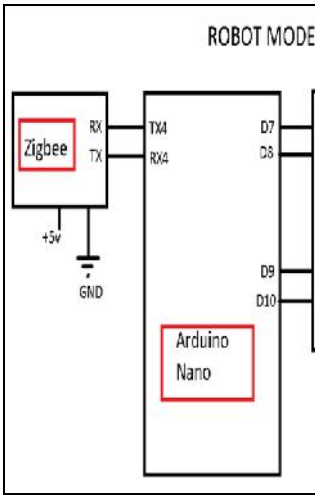
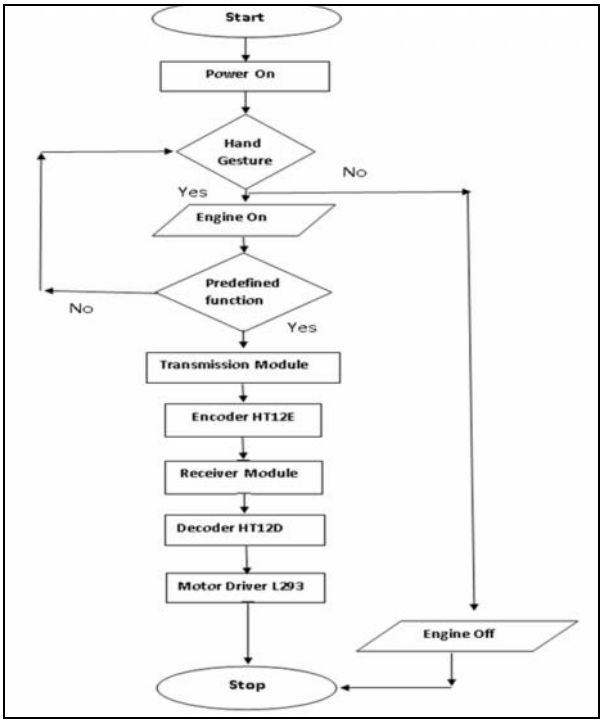


Figure. 3. Receiver Circuit Diagram

c)Flow Chart:

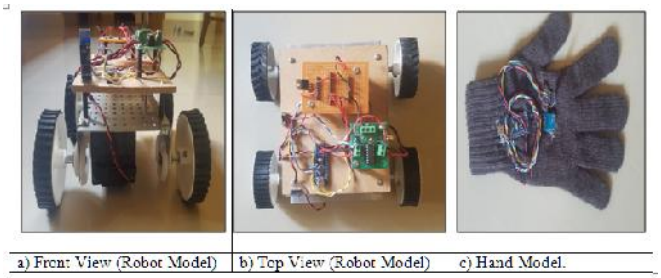


III. RESULTS

Transmission through Zigbee is better than RF(Radio frequency),IR (infrared) because of many reasons some of them are: First, signals through Zigbee can travel through larger distances while making it suitable for long range applications, while, IR mostly operate in the line of sight mode.Second, Zigbee and RF signals can travel even when there is an obstruction between transmitter & receiver.Third, Zigbee transmission is more Strong and Reliable than RF and IR transmission. RF communication uses a specific freq. unlike IR signals which are affected by other IR emitting sources.

The transmitter and receiver pair operates at a particular freq. A Zigbee receives serial data that is transmitted wirelessly through Zigbee transmitter. Here the experimental setup will be first done for transmission unit and it is separately tested with connecting it to the laptop/pc and observing the outputs and the transmitting time of the hand gesture.Then the Receiver Unit will be done and can be tested to know about the response time or the time to Decode the information received from Transmission unit and sending it to the Motor Drivers.

Prototype (Fig.4a-c)



a) Front View (Robot Model) b) Top View (Robot Model) c) Hand Model.

IV. DISCUSSION AND CONCLUSION

The described recognition system proves to be well suited to the given task. Tests with an experimental vehicle yield a permanent user independent functionality despite to varying conditions. The interaction with the system is rated as intuitive by the subjects. This originates from combining the chosen features that are robust against intense variations of gesture performance, with the immediate system reaction as a result of the high processing speed. Recognition of dynamic gestures instead of static hand postures would even increase the impression of naturalness. This device can perform various tasks because of Arduino Nano which is implanted on the Transmitter section.A major advantage of the system is that it provides real time palm gesture recognition, leading to an effective and natural way of controlling vehicle. Vehicle can be upgraded to detect humans buried in earthquake and landslides by implementing the sensor accordingly. GPS system can be added to the vehicle by which its location can be tracked. The device can also be used for military purposes to monitor those areas of battlefield where human presence cannot be found. All these evolving techniques from Glove based approach to the use of range camera for moving 3D recognition have proved to be of great use to humans and are finding great applications not only in theories and labs but also commercially.

The present application though seems to be feasible and more user friendly in comparison to the traditional input modes but is somewhat less robust in recognition phase. So in future the work can be done on improving each of the technology and new ideas can be discovered to make the methods easy. The system can be made faster and accurate, different search algorithm techniques can be used and also can design the library software to auto-generate a folder for most used hand gesture by the user and discarding the least used one. This would make the search process faster and better for the user. Herewith we can state, that the developed gesture recognition system convincingly documents the usefulness of gesture control in cars. The next step towards practical use is going to be a study regarding user acceptance and efficiency. Then the gesture recogniser will be combined with a speech recogniser and mechanical input devices to create a novel

multimodal input concept. The dedicated application is a multimedia car information system where each modality will be used according to its suitability. Future work includes not only improvement of the designed strategy but also taking into account more challenges such as dynamic gestures involving both hands and/or multiple cameras. The final objective involves gestures with a high degree of freedom; which may require detection of fingers and articulated hands. In this work, we use a sensor-based motion tracking system to capture 3D hand and finger motions. To detect and recognize hand gestures, we proposed a novel method, which is directly applied to real-time 3D motion data streamed by the sensor-based system. Our approach is capable of recognizing both static and dynamic gestures in real-time. We assess the recognition accuracy and execution performance with two interactive applications that require gesture input to interact with the virtual environment.

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