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Gesture Based Automation of a Robot Car

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ABSTRACT

Lot of small robotic cars are controlled by remote controller or by using a mobile interface for controlling its movement by using Raspberry Pie. This paper is about how car is controlled by recognizing different gestures of a person's body generally hand movements. This will help a person to easily control the automated car to move in different direction as per requirement of the user.

Keywords : Gesture, Automation, Microcontroller, Transceiver, Accelerometer

I. INTRODUCTION

In recent months, automation in robots has increased on a large scale. Different types of technology are upcoming, modified in different categories in automation world. Generally, all these robots are controlled by using some hardware equipment. So, a robot car controlled by a person's body gestures is new technology upcoming in today's world. All the movements of this automated car are controlled by different activities that a user performs, car's movement can be easily controlled. As human actions are involved in controlling movement, this car can be easily controlled. Sensors are used to detect the gestures of hand .and to transmit the data transmitter and receiver module is used. The exact movements are interpreted by Arduino Lilypad. For robot to turn efficiently, motors are connected in cross connection pattern to increase the turning efficiency of the automated car. Two different circuits namely Transmitter Circuit and Receiver Circuit are required to establish a proper and secured wireless connection between a person and automated car. [1]

II. INNOVATION AND HIGHLIGHTS OF PROJECT

As the name itself suggests that, this is automated car controlled by hand gestures of person. For simple movements of car, if a person's hand is tilted down then car moves in forward direction, if tilted above then car moves in backward direction, if tilted to left then car turns in left direction and if tilted to right then car turns in right direction. First, accelerometer (gyroscope) is used (ADXL335). This sensor has 3 axis X, Y, Z which detects position of a person's hand and gives an output in range of serials. This data is received by Arduino Lilypad. Microcontroller of Arduino (ATMEGA328P) then computes and forwards data about direction to which car should move. This data is then sent to an encoder IC (HT12E). This IC encodes the data to ensure the safety. Then this data is forwarded to transmitter module. At a frequency of 433 MHz this data is sent in air in encoded format. Now at Receiver end, this encoded data is captured by receiver module and then data is sent to decoder IC (HT12D). This decoded data is about which pin to set high so that motor of the

automated car can run accordingly. A motor driver IC Board (L298D) is used which runs the motor in desired direction given by User's Hand Gestures. All this process is given in block diagram below.

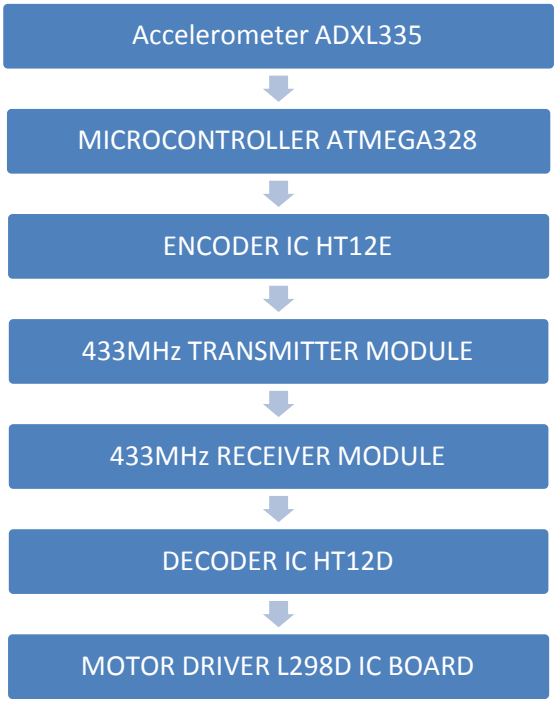


Fig. 1 Block Diagram of the proposed work

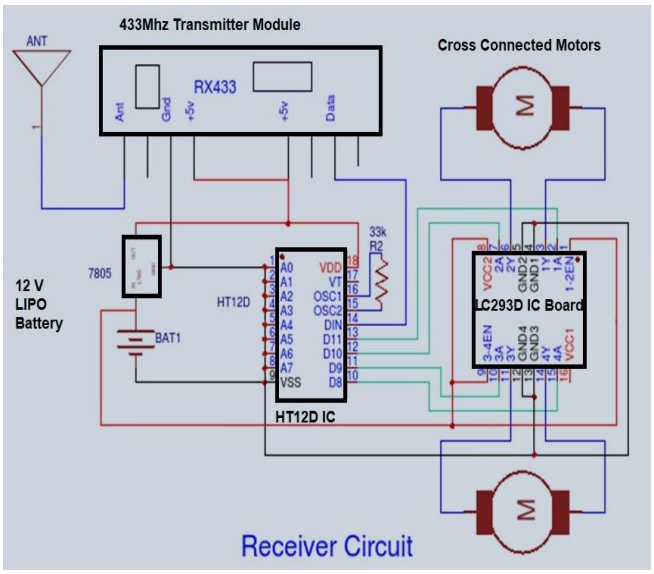


Fig. 3 Receiver Circuit

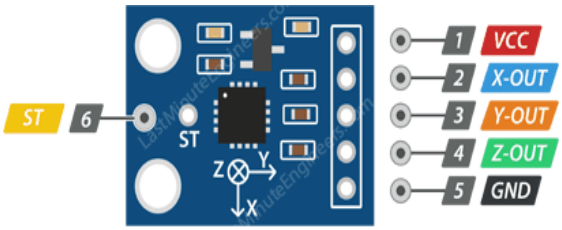


Fig. 4 Pin diagram – accelerometer

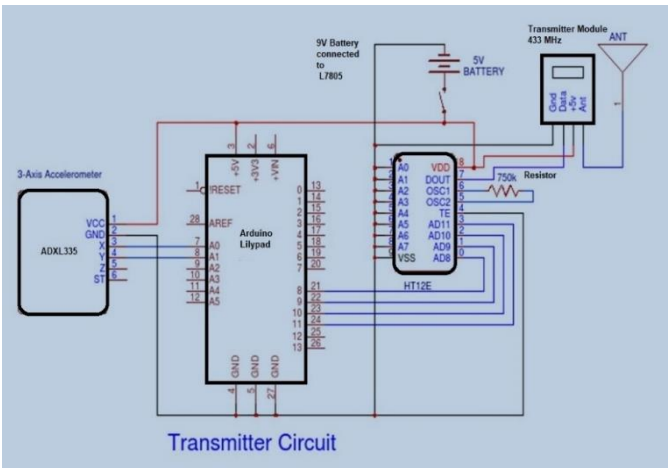


Fig. 2 Transmitter Circuit

The sensor works on power between 1.8V to 3.6VDC (3.3V optimal), and typically consumes just 350µA of current which becomes perfectly compatible for Arduino. It has 3 analog outputs for X, Y and Z axis measurements, 2 supply pins and self-test pin. The analog outputs are Ratiometric, meaning 0g measurement output is generally equal to half of the 3.3V supply voltage i.e. 1.65V, -3g is at 0v and 3g is at 3.3V with full scaling in between.

Arduino Lilypad

The LilyPad Arduino 328 Main Board is an Arduino-programmed microcontroller designed to be easily integrated into e-textiles and wearable projects. It offers the same functionality you find in other Arduino boards, in a lightweight, round package designed to minimize the size and profile, with wide tabs that can be sewn down and connected with conductive thread. The LilyPad Arduino consists of an ATmega328 with the Arduino bootloader. This

board will run from 2V to 5V and offers large pin-out holes that make it easy to sew and connect. Each of these pins, with the exception of (+) and (-), can control an attached input or output device like a light, motor, or switch. It has same voltage properties like od Arduino Uno. It has 9 digital IN/OUT pins and 4 Analog pins.

HT12E and HT12D

The IC HT12E can be used only with its pair HT12d. These two ICs together form an Encoder and Decoder pair. They are 12-bit Encoders/Decoders. That is, they can transmit 12-bit a data among them. An Encoder and Decoder IC pair will share a common Address which is an 8-bit data for communication only in between these two ICs. So out of the 12-bits 8-bits will be used to set address and the remaining 4-bit will be used to transmit data. With 4-bit data we can create 16 types of combinations. These IC's are commonly used with RF pairs or IR pairs.

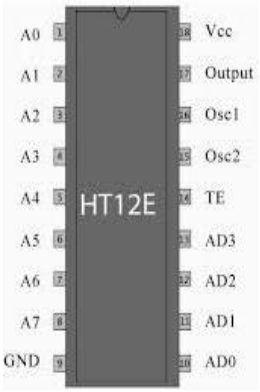


Fig. 5 HT12E - Encoder

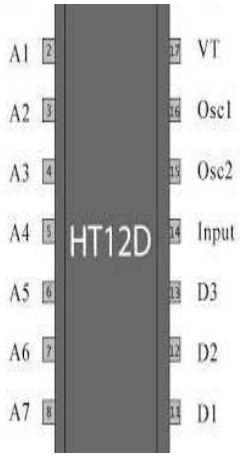


Fig. 6 HT12D Decoder

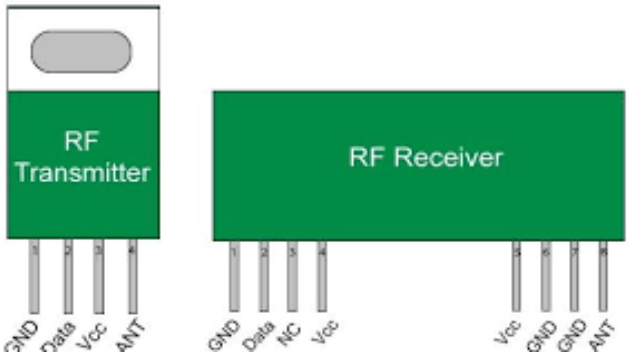


Fig. 7 Transmitter and Receiver Module

RF modules are 433 MHz RF transmitter and receiver modules. They are used to transmit and receive the infrared waves. RF transmitter consists of three pins. ATAD pin - Signal pin used to send data for the receiver, VCC pin- for providing voltage and Ground pin - for grounding the module. Its operating voltage is 3V-12V and consumes 12V power. It can transmit up to 90m in open area. RF Receiver module consists of four pins. VCC pin - for providing Voltage, two DATA pins for receiving data sent by transmitter module and Ground pin - for grounding the module. Its working voltage is generally 5V DC.

L298D IC Board

The L293D is quadruple high-current half-H drivers. These are used to control the direction and speed of up to four direct current (DC) motors. It has an individual 8-bit speed selection simultaneously of up to 0.6A each. It is designed to provide bidirectional drive currents.IT gives output of up to 600-mA at voltages from 4.5 to 36V. It has eight output pins for connecting four DC motors or two Stepper motors, one reset button, six pins for connecting two servo motors, one +M pin for providing external motor power, five Analog input pins, thirteen digital input pins for connecting with Arduino and ground pins for grounding.

III. WORKING AND IMPLEMENTATION

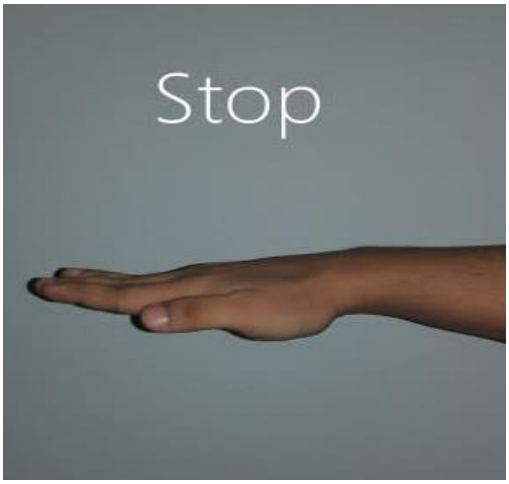
Working process is divided into two main parts, Transmitter Circuit and Receiver Circuit implementation. In transmission circuit, first step is to

recognize and detect the movements of hand. This is done by using Accelerometer ADXL335. Position of hand is identified by using X and Y scale. This data is supplied to Arduino Lilypad. Arduino has a micro controller ATMEGA 328 which can be programmed using Arduino IDE Software.

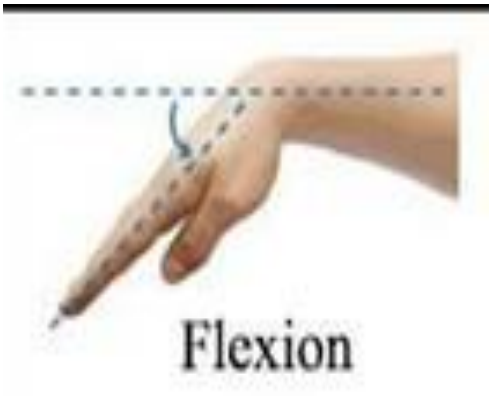
Following Algorithm is used to detect and analyse the gestures and in which direction automated robot should move.

For Car to Stop its movement:

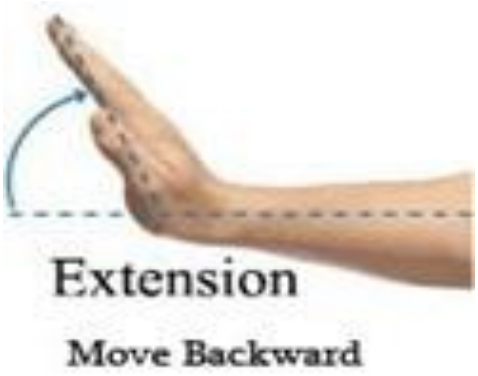
If x axis values and y axis values lie between 294 and 340 then car will stop its movement.



For car to move in forward direction:
If X value lies between 340 and 380 and Y Value lies between 294 and 340 then car moves forward.



For Car to move in backward Direction:
If X value lies between 250 to 320 and y value lies between 294 to 340 then car will move in backward direction.



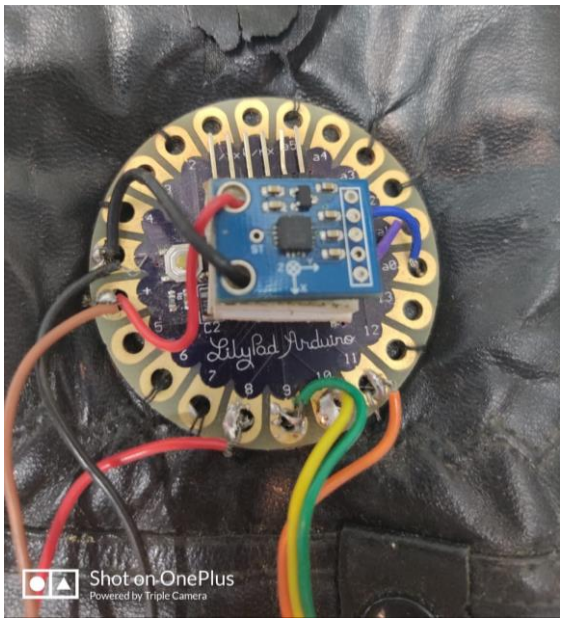
For Car to turn Left:
If X value lies between 294 and 340 and y value lies between 340 and 400 then car will turn left.

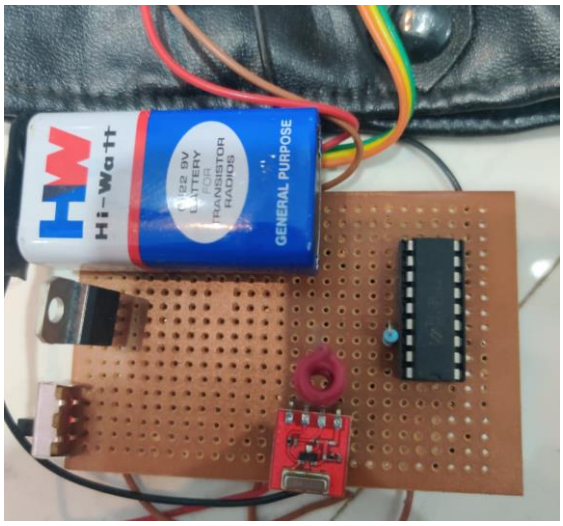
For Car to turn right:
If X value lies between 294 and 340 and y value lies between 140 and 300 then car turns right.

Please note that these values are output of accelerometer and are subject to change for another individual depending on their input fir gestures.

According to these values Arduino gives output for which motor pins to set output High or Low. This data is encoded by encoder IC HT12E and then further the data is transmitted in air at frequency of 433 MHz by transmitter module. All this functioning till now is part of transmitter circuit. Below is the implementation of this.

Transmitter circuit where Arduino lilypad is attached to the glove and accelerometer on top of this while transmitter module and HT12E IC is attached to PCB which can be tucked inside the glove along with battery. [3,4]





Transmitter Circuit

This transmitted data in air is captured by receiver circuit. Receiver Module captures data and sends to decoder IC HT12D. This IC decodes the data and sends 4 pin output of High or Low Digital Signal to L298D Motor Driver Board Module. This board then runs the automated car in desired direction according to the gesture of the User's hand. Given below is actual implementation of transmitter circuit. [3]

Actual implementation of Transmitter Circuit

IV. CONCLUSION

Any robot can be controlled wirelessly by using human gestures. The robot is very easy to control as it is based on human actions. It also can be used for military surveillance activities, in medical applications like surgery and can be used for entertainment purpose as well. It is easy to implement. Proximity Sensor can be installed to detect any obstacle and stop for better durability and risk of damage to automated car parts. As the installed Transmitter and Receiver Module has less range of operations. Hence, a high range transmission module can also be used. Even High End Global Positioning

System (GPS) can be used for detecting location and control the car accordingly. A Small but powerful High End Camera can be installed for any surveillance operations. Even some features like Night vision and Thermal Imaging can be added for better use for surveillance activities.

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