

## Smart Industrial Robot Based on Voice and Gesture

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Article Received: 12 March 2020

Article Accepted: 11 May 2020

Article Published: 09 June 2020

### ABSTRACT

*To improve the efficiency and quality of industrial production line, robots are used in the environment. This smart robot vehicle performs the movements directed by either human voice or hand gesture technologies. The voice control is established by using an android mobile app (Voice control robot) and gesture is performed by MEMS Accelerometer sensor (ADXL345). It comprises of components like Arduino UNO, motor driver, Dc motors, Bluetooth module, and RF transmitter-receiver module. RF modules are used to enhance a wide range of transmission. This results in lifting the heavy loads without human support, and reduces the resource and time of production.*

**Keywords:** Smart Robot, Hand Gesture Command, Voice Recognition, Arduino Uno, RF Module.

### 1. Introduction

Robots are used as vehicle in industries; these may reduce the human work power. Robotics is a developing technology in today's world. Robots are usually operated or programmed with computer to control its movement by a remote. Robots nearly need to perform a specific task. It will follow the instructions which are directed from the human operator.

The hand gesture and voice command is a natural source and way of controlling the robot. This is a wireless communication meant by using RF transmitter and receiver modules which provides more efficiency than the existing method. When industry uses robotics and automation system there is increase in fertility, cost and also reduction in time.

The human voice is converted into text and gesture is processed by the MEMS accelerometer sensor and these signals are communicated to robot by using RF module. The Arduino microcontroller is used as the base platform of this smart robot vehicle. The robot is capable of performing different operations like forward, backward, left, right, start and stop. For voice control there is an android mobile application to convert voice into text message. And gesture recognition is done by accelerometer sensor. This input signals are given to the arduino Uno using Bluetooth module. RF transmitter provides the input signal to the RF receiver; this receiver gives signal to the motor driver which activates the Dc motors. The whole circuit is powered with the battery. Hence, we can control this robot vehicle in all four directions.

### 2. Existing Method

The system proposed in existing is a robotic arm. This robot functions in both voice recognition and hand gesture, The robotic arm functions in 3 degree of freedom with

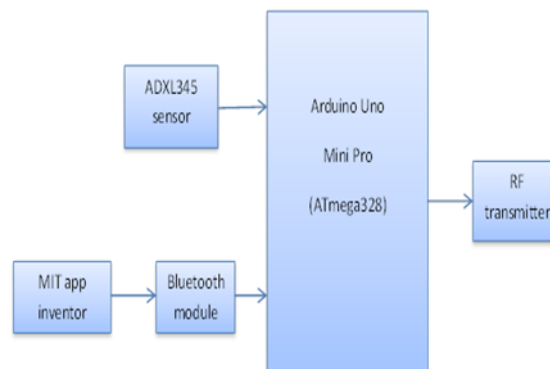
predefined program. It is based on a Bluetooth communication. This works only in a short range and also static body, which has fixed positions.

The robotic arm functions similarly as per our hand gesture works. Gesture and voice control is given as an input to operate the robot. It is capable of lifting the thing in short range. It works/ communicates through the Bluetooth module. This robotic arm in the industry reduces the human power /effort.

Whereas, the proposed system the robot functions with both gesture and voice and can also move from one place to another place and also in far distance.

### 3. Proposed Method

The project functions as a smart robotic vehicle that operates with both human voice and gesture recognition. Improves the efficiency compared to separately controlled voice or gesture robot. Consist of Arduino UNO, ADXL345 sensor, mobile application, motor driver, Bluetooth. In this work, movements of the smart Robot are controlled by voice and gesture commands. The function is of two modules, gloves (input signals) and the robot vehicle. The schematic block diagram of the gloves part is:

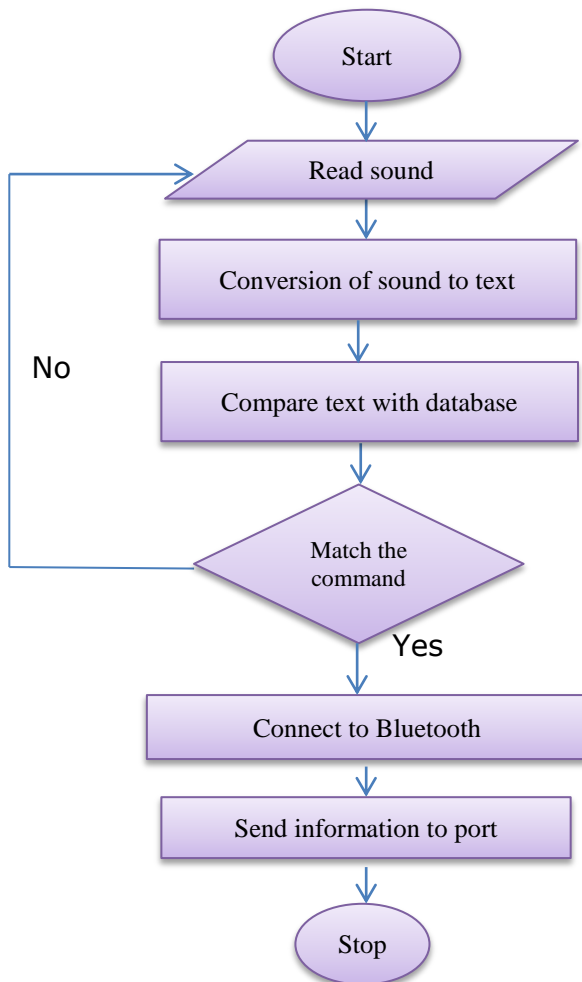


**Figure 1:** Transmitter part

These are the parameters consists of an gloves where ADXL345 sensor senses the gesture of hand movement and sends the signal to the arduino mini pro, as well as the voice is converted to text by an android application and through the Bluetooth module the signal is received to the arduino and the arduino provides the input signal to the RF transmitter. The voice control application is created by using MIT app inventor application. This application provides the various blocks and components from App Inventor Designer, App Inventor Blocks Editor. We can assemble programs visually, and fit these block pieces together.

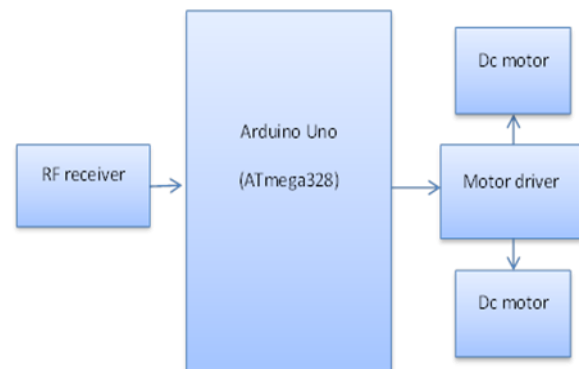
The application created by us provides a conversion of speech message into text message. This is connected to the Bluetooth module to provide input to the micro-controller. And further it processes to other blocks to operate the robot. The voice control robot application

is designed using various blocks in the MIT application can be connected through Bluetooth transceiver in the android mobile and in the gloves. The flow diagram of voice control:



**Figure 2:** Flow chart of voice control

The schematic sketch of robot part:



**Figure 3:** Robot part

In the receiver section, the RF 433 MHz receiver holds all the received parameters and sends to the arduino the programmed arduino provides the directed input to the motor driver and thus the dc motors drive the vehicle as per the conditions given.

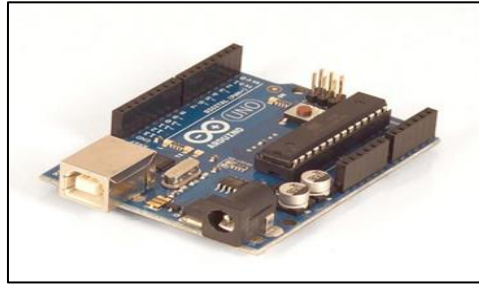
#### 4. Hardware Used

The hardware chosen for ultimate and effective use of the system include:

##### 4.1 Arduino Nano and Arduino Uno



**Figure 4:** Arduino Nano



**Figure 5:** Arduino UNO

Arduino which senses the surrounding by getting the input from different ways of sensors and also affects the environment by operating or controlling lights, motors, etc,. To perform a specific task or operation in the microcontroller, it is programmed or functioned by using an Arduino programming language.

#### **4.2 ADXL345 sensor**

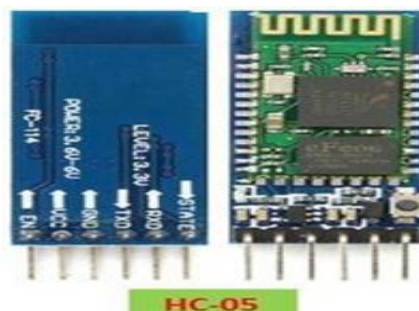
The ADXL345 sensor is based on MEMS (Micro electro mechanical system). It is small and thin 3-axis accelerometer suited for Android mobile device application as tilt recognition. It also measures the static acceleration. And used in handsets, medical instruments and industries.



**Figure 6:** ADXL345 sensor

#### **4.3 Bluetooth Module**

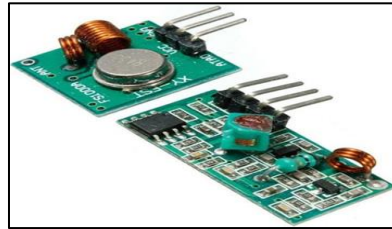
The module chosen for connecting android mobile and the arduino was an HC-05 Bluetooth 2.0 module. Using this Bluetooth module, some features can be quickly added to Arduino. HC-05 module operated in SPP (Serial Port Protocol) module, which is designed for transparent wireless connection establishment.



**Figure 7:** Bluetooth module

#### 4.4 RF transmitter and receiver

The Transmitter used in this system is 433 MHz RF Tx (transmitter). It Ranges from 20meters-200meters. Robot is operated in wireless communication. Long distance covers and more efficiency with the transmission.



**Figure 8:** RF Tx/RX

#### 5. L293D Motor Driver

L293D Motor driver Integration is a driver system which has 20 pins motor in which there are 2H Bridges. L293D, which is generally preferred motor driver to control DC motors, and the two motors, can be independently controlled in bidirectional ways. It is possible to control PWM by using enable pins. L293D within the range of 4.5 V to 36 V can be used maximum 600 mA current limit.

#### 6. Output

The output from the proposed system consists of gloves with the moving robot. The glove in figure 9 provides an input signal to the robot to function. The hand gesture is recognized by accelerometer sensor and the voice of the controller is converted into text by the android application and these inputs are transmitted through the RF transmitter which is received by RF receiver (presented in robot part) and operates as per the gesture or voice commands.



**Figure 9:** Gloves and robot hardware

The android mobile application (voice control robot) provides a voice to text message to the robot to be operated. The commands for operating or controlling the robot is like GO, STOP, LEFT, RIGHT for moving forward, in left and right directions.



**Figure 10:** Voice control robot app

Thus the robot functions with both hand gesture and voice control.

## 7. Conclusion

In our proposed system, we are using a smart industrial robot that will work according to voice command and gesture commands. The voice command is converted to text form; sensor senses the movement of hand and transmitted to the board. From there it is moved to the corresponding motors. Thus, the wheels are rotated. The Robot will perform movement operation like move right, left, forward, and backward.

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