

FIRE SENSING VOICE CONTROLLED ROBOT

Vanita Israni¹, Eeshita Sai P², Himabindu Reddy B.³

¹ Student, Electronics and Telecommunication, Thadomal Shahani Engineering College, Maharashtra, India

² Student, Electronics and Telecommunication, Thadomal Shahani Engineering College, Maharashtra, India

³ Student, Electronics and Telecommunication, Thadomal Shahani Engineering College, Maharashtra, India

Abstract - The main purpose of this project is to control a robot using voice and to monitor environmental conditions in case of fire emergencies and gas leaks. Voice controlled robot system is a movable robot which is supervised or controlled using voice commands given by the user. The robot performs tasks based on the voice commands given. The voice controlled robot uses a built-in speech recognition application in a Smartphone to convert voice commands to text. Using Bluetooth technology these text commands are sent to robot. A Bluetooth device placed on the robot receives commands. The commands are analyzed by a Microcontroller (in this project Arduino Uno Board) and control the robot using motor driver circuits. A Voice controlled robot system is also used for monitoring the gas present in the surrounding places such as nuclear power plants and industrial areas where there is a high risk of fire accidents and it is hazardous and risky for humans. These parameters are monitored using sensors which are connected to the Arduino. The data collected by the sensors are sent to the smart phone via serial communication. The sensed data is then used to activate the pump connected to the robot and thereby extinguishes the fire.

Key Words: Arduino Uno, Sensors, Android Application, Speech Recognition, Bluetooth.

1. INTRODUCTION

In today's world the use of robots has increased in all fields of life. The robots becomes essential in applications involving monitoring of environmental conditions and surveillance in places like chemical plants, nuclear plants, war zones, very hot or sub- zero temperature environments, disaster affected areas, places which are highly hazardous and dangerous for human intervention and also in farms etc.

In this project we are going to control a robot using voice. A voice controlled robot is a semi-autonomous robot. The Voice controlled robot system makes use of speech recognition. The speech recognition algorithm used in voice controlled robot is Forward or Viterbi Algorithm [7]. In this project an android speech recognition application is being created and used.

The wireless technology used in this project is Bluetooth. By using Bluetooth technology, the Arduino Uno receives commands from the user.

Due to technological advancements Robots can be used in places where humans cannot enter. This is possible due to the use of sensors which have been placed on the robot,

which continuously monitor the conditions of the place where the robot has been sent to or deployed. By using sensors such as gas sensor, it would be helpful to check whether there has been any fire. And by interfacing a water pump to the robot it helps to douse the detected fire.

2. BLOCK DIAGRAM

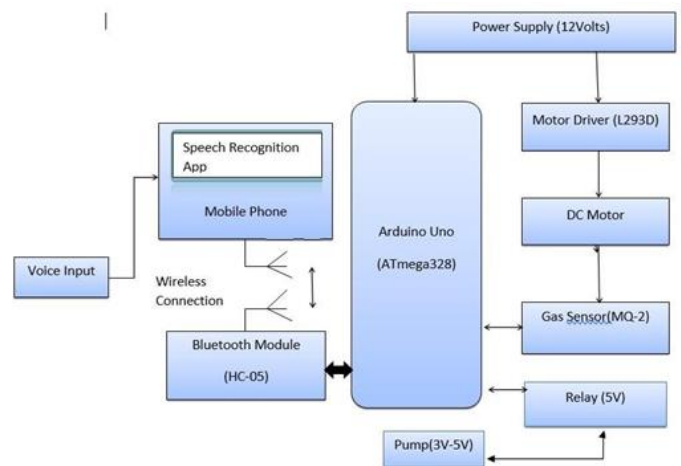


Fig-1: Descriptive Block Diagram

3. CONSTRUCTION DETAILS OF ROBOT

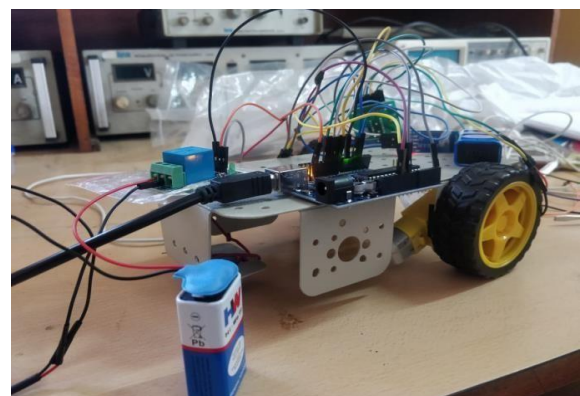


Fig-2: Construction of Voice Controlled Robot

1. Voice Input: Voice input consists of voice commands like move forward, move backward, turn right, turn left for the robot which are given using an Android phone.

- Speech Recognition App: This app is made using a software MIT app Inventor 2 tool. This tool consists of designer section and Block section.

Designer Section: This section consists of front End page of the app in which there are:

Image Label: In this slot there is an image which represents the symbol front view as the app opens up.

Button (Press to Speak): This button is used as a button to input voice commands from the user to the robot.

Button (Pump Switch): This button is ON whenever the smoke value is generated.

Text Label (Value): The text label value shows the value of smoke in ppm units as the user finds the value of smoke the pump is on.

Bluetooth Button: This button checks the Bluetooth connection if not on pops the message in the App if on then connects it to Arduino.

Text Field (Word Spoken): This field shows the text which is converted from the user input/voice

- Bluetooth module (HC-05): Bluetooth serial Bluetooth Protocol used for wireless communication with Bluetooth enabled devices (like smartphone) When it gets connected to any other Bluetooth device, its blinking slows down after two seconds. The connection can be point-to-point or multi-point where the maximum range is 10 meters. The transfer rate is data is 1Mbps. In order to increase the range of the Bluetooth we can use Bluetooth range Extenders which can increase the range up to 150 ft in open air, and between 15-17 ft indoors.

- Arduino Uno (AT-mega328): The AT-mega328 is a single-chip microcontroller created by Atmel in the mega AVR family (late microchip technology acquired Atmel in 2016). The Arduino is connected to mobile phone through Bluetooth module. Bluetooth module communicates with microcontrollers using serial communication (USART). AT mega 328 has 1KB Electrically Erasable Programmable Read Only Memory (EEPROM).

- Driver Circuit: The commands are analyzed by the Arduino, which then controls the motor drivers. These motor drivers are controlled by driver circuits.

- DC motor: A DC motor is of a class of rotary electrical machines that converts direct current DC motors are interfaced in Arduino.

4. HARDWARE USED

Arduino: Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller. The recommended input voltage for an Arduino Uno is 7-12V [8].

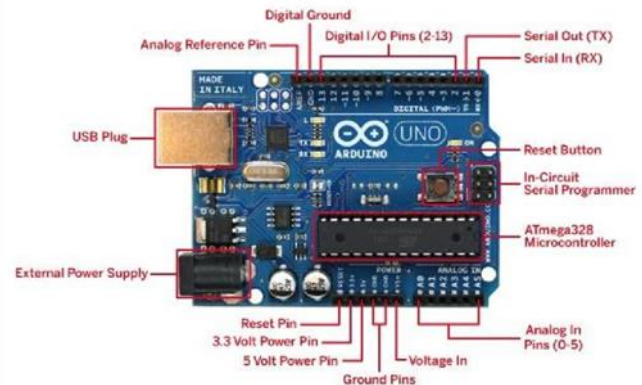


Fig -3: Arduino Uno

Motor Driver: The L293D motor driver can be used to run two DC motors with the same IC. The motor driver can be used control speed and direction. The L293D IC receives signals from the Arduino and transmits the relative signal to the motors. It has two voltage pins, one of which is used to draw current for the working of the L293D and the other is used to apply voltage to the motors. The L293D switches its output signal according to the input received from the microprocessor. The L293D is a 16 pin IC, with eight pins, on each side, dedicated to the controlling of a motor. There are 2 INPUT pins, 2 OUTPUT pins and 1 ENABLE pin for each motor [9].

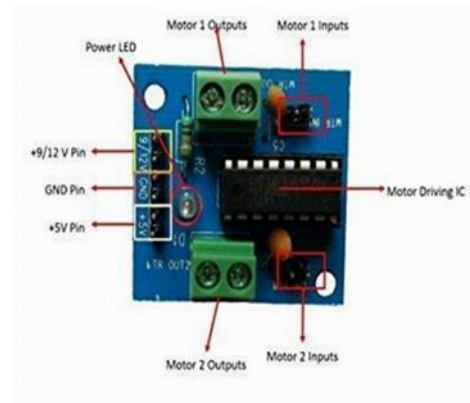


Fig -4: L293D Motor Driver

Bluetooth Module: HC-05 is a serial Bluetooth protocol of Bluetooth serial interface module and Bluetooth adapter. Bluetooth serial module is used for converting serial port to Bluetooth. This device is capable of establishing connection with any bluetooth device and can connect to any

microcontroller for the exchange of serial data. The HC-05 Bluetooth Module has 6 pins Vcc, GND, TX, RX, Key, and LED [13].

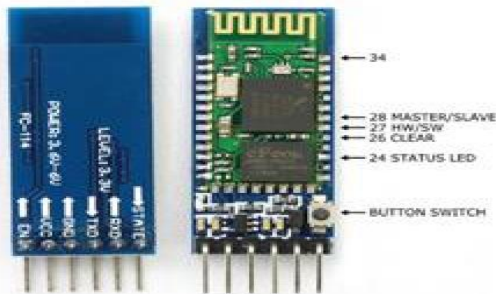


Fig -5: HC-05 Bluetooth Module

DC Motors: DC Motor runs on DC power or AC line voltage with a rectifier. DC Motor has a high starting torque. It has low no-load speed. The dc motors are connected to the wheels of the car through the dc motors only possible to change the car directions. 9V batteries provide charge to motors [13].



Fig -6: DC Motor

Gas Sensor: MQ2 is one of the commonly used gas sensors in MQ sensor series. Using a simple voltage divider network, concentrations of gas can be detected. MQ2 Gas sensor works on 5V DC. MQ2 can detect LPG, Smoke, Alcohol, Propane, Hydrogen, Methane and Carbon Monoxide. The operating voltage is 5V [14].

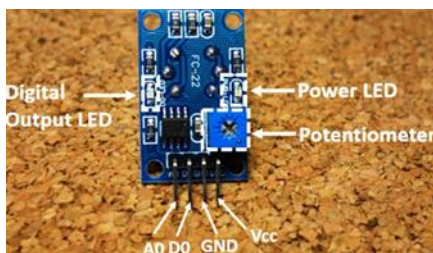


Fig -7: MQ2 Gas Sensor

Mini Submersible water pump: The DC Voltage required for the pump is 3-5V. The pump generates low noise. The made is made of plastic and has a continuous working life of 500 hours. The driving mode for the pump is brushless dc design and magnetic driving [11] [16].



Fig -8: Mini Submersible Water pump 3-5V

5V Relay: The SRD-05VDC-SL-C relay has three high voltage terminals (NC, C, and NO) which has to be connected to the device to be controlled. The other side has three low voltage pins (Ground, Vcc and Signal) which connect to the Arduino [15] [17].

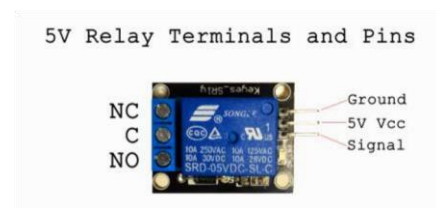


Fig -9: 5V Relay

5. WORKING

In this Robot Human voice is taken as an input and converted to text using Speech Recognition App which is an android based application. The robot will perform action on the commands based on the user Input. In this we have used Bluetooth module (HC-05) which is wireless module and is used to transfer commands to Arduino. The Arduino the analysis the Commands that are received by Bluetooth. Arduino AT mega 328 is used in which programs can be directly loaded to the device. Motor driver L293D allows DC to drive in any direction. It controls two motors simultaneously. This robot also consists of gas sensor which detects the amount of gas and displays the amount of gas in the Mobile App. This sensor displays the amount of smoke in ppm units. The relay is connected Arduino which is nothing but an electrically operated switch. It consists of set of input terminals for a single of multimode signal. The pump is connected to relay the signal of the gas sensor is send to the App and then based on the value of smoke the pump is functioned ON and OFF.

6. APPLICATION

The Android application has been designed using MIT App Inventor 2. MIT App Inventor is a web application integrated development environment originally provided by Google, and now maintained by the Massachusetts Institute of Technology (MIT) [19]. App Inventor is a blocks programming language. MIT App Inventor uses Graphical User Interface (GUI). Working of MIT APP Inventor App Inventor involves three aspects: (i) App inventor designer, (ii) App Inventor Blocks editor, and (iii) An emulator or Android Phone.

(i) App inventor designer: The App inventor designer block is used to design the user interface of the mobile application. Using the Layout tools and User Interface tools the User Interface has been designed. In this project it has 2 user interface screens [18].

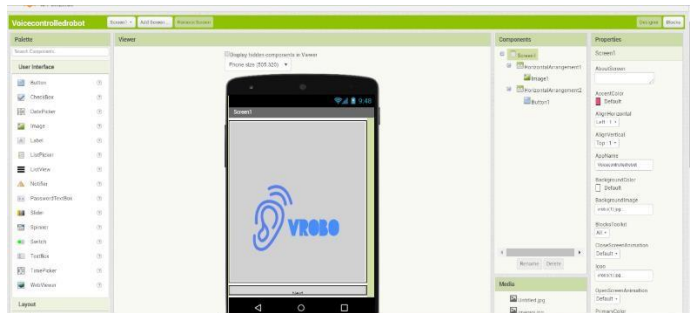


Fig -10: User Interface Screen 1

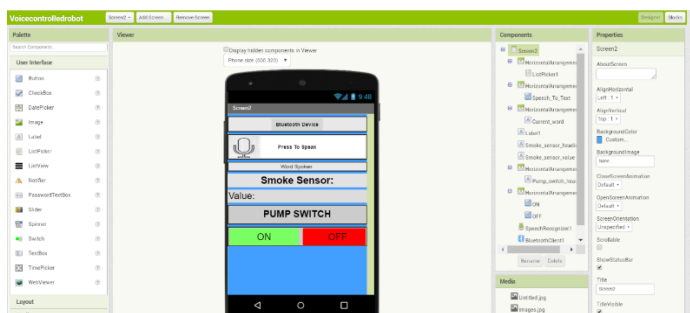


Fig -11: User Interface Screen 2

The second screen has a button called Bluetooth device for selecting a Bluetooth device to be connected to. The Press to speak button is a speech to text converter which records the command and converts it to text. Words spoken now is used for displaying the command that has been given. The reading of the Smoke Sensor is displayed in the Value textbox. If the output of the sensor is high this indicates the presence of fire in the environment in which the robot has been deployed in. The fire can be doused using a spraying water. The water pump is controlled using the ON/OFF switch present on the application.

7. FUTURE SCOPE

We can modify the robot as per our need. In order to improve the sensing capability of the robot we can add additional sensors such as wireless cameras and proximity sensors. To improve the availability of robot an Application can be created which can also be used on iOS platform. Further to make the robot environment friendly we can use solar batteries by implementing solar panels. We can also improve the security of the robot by using security algorithms to train the robot, so that it will only be accessible to authenticated users.

8. CONCLUSION

This project designs a robot which is controlled using voice commands. Commands by the users Control the motion of the robot. The robot continuously senses the conditions around it and provides the recorded data visible to the user via the mobile application installed in the user's mobile phone. This mobile application is also a medium for the user to send the voice commands to the robot. The data sent to user's application is collected by the sensors attached to the robot. In case of a fire accident or a gas leak and accordingly he can activate the water, pump which is connected to the robot via a button provided in the mobile application. Therefore, the robot can detect any fire and continuously senses the surrounding conditions and notifies the user in cases any fire accident and helps the user extinguish without the user going there remotely.

ACKNOWLEDGEMENT

I bow in Gratitude to Prof. Sharmila Barve for giving us courage and wisdom to reach this point of completion. We place on record and warmly acknowledge the continuous encouragement, invaluable supervision, timely suggestions, and inspired guidance offered by our Project Guide, Prof. Sharmila Barve, in bringing this report to a successful completion. We also thank her for showing keen interest and for providing all the facilities as and when we needed them. It gives us immense pleasure to express our deepest sense of gratitude and sincere thanks to our esteemed Head of the Department Dr. Ashwini Kunte and respected Principal, Mr. G. T. Thampi for their revered guidance throughout our dissertation work, which made this task a pleasant job. It was a real delight to work under their guidance.

REFERENCES

- [1] Anurag Mishra, PoojaMakula, Akshay Kumar, Krit Karan and V. K. Mittal "A VoiceControlled Personal Assistant " Indian Institute of Information Technology, Chittoor, Sri City, A.P., India, 2015 International Conference on Industrial Instrumentation and Control (ICIC) College of Engineering Pune, India. May 28-30, 2015.
- [2] Garcia, E., Jimenez, M. A., De Santos, P. G., & Armada, M. (2007). The evolution of robotics research. IEEE Robotics & Automation Magazine, 14(1), 90-103. doi:10.1109/mra.2007.339608.
- [3] YeongChe Fai, Shamsudin H.M. Amin, NorsheilabtFisal, J. Abu Baka, "Bluetooth Enabled Mobile Robot", Bluetooth enabled mobile robot. 2002 IEEE International onference on Industrial Technology, 2002. IEEE ICIT '02. doi:10.1109/icit.2002.1189288.
- [4] SagarPramanik, HarendraKerketta, Dibas Ghosh, Jivesh Kumar Jha, "Bluetooth Controlled Robot", International Journal of Scientific & Engineering Research, Volume 7, Issue 4, April-2016 204 ISSN 2229-5518.

- [5] P.NarendralayaPallavan, S.Harish, C.Dhachinamoorthi, "Voice Controlled Robot with real time barrier detection and averting", International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 06 Issue: 1 Jan 2019 -ISSN: 2395-0072
- [6] Sagar Pinjarkar, Siddhi Khadpe2, Anuja Tavte, Riddhi Karpe, "Voice Controlled Robot Through Android Application", International Research Journal of Engineering and Technology (IRJET) eISSN: 2395 - 0056Volume: 04 Issue: 04 | Apr -2017 p-ISSN: 2395-0072
- [7] <http://gekkoquant.com/2014/05/26/hidden-markov-models-forward-viterbi-algorithm-part-2-of-4/>
- [8] <https://www.controlvoltage.net/arduino-arduouno-r3-development-board.html>
- [9] <http://www.hobbytronics.co.uk/arduino-uno-r3>
- [10] <https://www.instructables.com/id/How-to-Use-the-L293D-Motor-Driver-With-Arduino/>
- [11] <https://lastminuteengineers.com/mq2-gas-senser-arduino-tutorial>
- [12] <https://www.electricaleasy.com/2014/07/characteristics-of-dc-motors.html>
- [13] https://www.rhydolabz.com/wireless-bluetooth-ble-c-130_132/hc05-bluetooth-module-masterslave-p-1169
- [14] <https://create.arduino.cc/projecthub/Aritro/smoke-detection-using-mq-2-gas-sensor-79c54a>
- [15] <https://www.google.com/url?sa=i&url=https%3A%2F%2Fpotentiallabs.com%2Fcart%2FBuy-micro-dc-3-6v-submersible-pump-mini-water-pump-online-Hyderabad-india&psig=AOvVaw21mgdjHlVviW2XGZiYcQe&ust=1587367741135000&source=images&cd=vfe&ved=0CAIQjRxqFwoTCLCr5OT78gCFQAAAAAdAAAAABE>
- [16] <https://www.makerlab-electronics.com/product/mini-submersible-pump-3-5v/>
- [17] <https://www.circuitbasics.com/setting-up-a-5v-relay-on-the-arduino/>
- [18] https://link.springer.com/chapter/10.1007/978-981-13-6528-7_3
- [19] https://en.wikipedia.org/wiki/App_Inventor_for_Android

BIOGRAPHIES



Vanita Israni Student, Electronics and Telecommunication, Thadomal Shahani Engineering College, Maharashtra India.



Eeshita Sai Pittala Student, Electronics and Telecommunication, Thadomal Shahani Engineering College, Maharashtra, India



Himabindu Reddy Bollavaram, Student, Electronics and Telecommunication, Thadomal Shahani Engineering College, Maharashtra India.