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# A PROTOTYPE FOR VOICE/APP CONTOLLED ROVER

Prof. Smitesh Salian
B.E, M.E in Computer Engineering, Kalyan
Email: smiteshsalian@gmail.com)

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## Abstract:

The purpose of this project research is to identify the problems for human resources in form of modern threats and to eliminate them by finding out possible efficient solutions as their substitute. Thereby, in benefit of everyone concerned. This work is born in the process of solving the problem of delay in disaster relief and management through innovation by using a rover as a platform using ultrasonic sensors.

This paper provides an overview to concerned authorities with a tool to help them to gather data by reconnaissance using the rover and help them to form the strategy for the rescue operation that is cost effective, efficient, fast as well as secure for the rescue workers

The main objective of the paper is to provide a safer option in terms of rescuing, environment study and to do better inspection of the location where manual labour is not possible. The solution is to create a rover which can be controlled through IoT, to simplify the statement, the rover's significant feature is that it can be functioned with the user's voice commands through Google assistant or any relative source.

The rover has two major components: the kinetic body, and the ultrasonic sensor module. The kinetic body will function with the help of an Arduino circuit which will be programmed to function in a specific manner as per instructions provided by the user. The Arduino circuit will be programmed by C language whereas the ultrasonic sensor will be programmed by Lua language. The sensor will generate ultrasonic sound waves which will reflect upon the obstacles and surfaces and return to the rover again giving the user the approximation of the environment around the rover.

The basic idea of the rover is to do the tasks without risking the lives of laborers. The rover will be of great application in the unexpected times of disaster, to introspect highly hazardous locations and give the proper knowledge of the environment without risking any lives.

*Keywords* — **Arduino circuit, ultrasonic sensor, IoT**.

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## 1. INTRODUCTION

Saving human lives takes first priority in any situation and our rover is designed to aid the rescue workers in doing the same. Even after several decades of technological advancement few fields are still remaining where human lives are always under constant threat. The disaster-stricken area is dangerous for the rescue workers and the work is aimed at rectifying this situation. The work also aims at reducing unnecessary human resource wastage which results in the increase in work speed and cost effectiveness. Even after first phase of rescue the rover is helpful in processing the environmental harm that has been done due to the disaster and help in fast resettlement which is necessary for any economy. The rover criticizes the traditional ways of rescue works. The speeding up of data gathering after the calamity will ensure the formation of a rescue strategy which is more efficient than the traditional method. Realizing the situation beforehand with the help of the rover will invoke confidence in relief workers and hence speed up the rescue process as well.

## 2. REVIEW OF LITERATURE

## IoT SYSTEMS

Earlier there was a simple manual way of handling machines. However, with the advancement of technology, new ways are introduced for controlling the machines like automation. At the touch of a button, we can access large amount of information due to capability of computers and the Internet. Everybody wants an affordable and secure way to control their machines from any smart mobile device or Internet connection. The Internet of Things (IoT) is the network of physical objects or "things" embedded with electronics, software, sensors and connectivity to enable it to achieve greater value and service by exchanging data with the manufacturer, operator or other connected devices[1]. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure.

Internet of Things is the next big revolution of the world on digitalization of commercializing various modules/products. Everything is associated with the internet; some involves controlling and some involves monitoring the parameters from anywhere [7]. The Internet of Things is today's most trending technology that stands alongside wearables and robotics.

Arduino is an open-source programmable board. It is very easy to use and powerful single board computer that has gained considerable traction in the hobby and professional market. It consists an Integrated Development Environment (IDE) where one can write and run the programs and these programs are known as sketch in Arduino and a microcontroller [5]. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. Arduino boards are physical programmable board that are used for flexible programming, customizable signal types and easy adaptation to the existing installations can offer many benefits to world.

**Arduino UNO** is the commonly used board that is also known as classic Arduino. This board has 14-digital I/O pins, where 6- pins can be used as PWM, 6-analog inputs, a reset button, a power jack, a USB connection and more. This board can receive and send information over the internet with the help of Arduino shields [1]

## AN EVALUATION OF THE ALREADY EXISTING IMPLEMENTED SYSTEMS

Abhishek B.R. et.al [2] has presented a distance measurement of obstacle using ultrasound sensors and microcontroller P89C51RD2. Dr. Raghavendra et.al [3] has proposed a practical obstacle detection and avoidance system where the range information is obtained from stereo images by first computing and extracting points above the ground plane. S. Srinivasan et.al [4] has discussed an approach for obstacle detection and collision control of a flying unmanned quadcopter. This approach uses ultrasound sensors with simple data fusion technique. Harish K. et.al [8] has presented an obstacle detection approach using ultrasonic sensors to detect the obstacles. Akash M. et.al [9] has presented an approach to detect obstacles using rover. This approach is implemented for unmanned vehicles to detect the obstacles and avoid them. The danger zone concept will judge whether the obstacle will cause a possible collision or not.

## EXISTING IMPLEMENTATION ROVER TECHNIQUE

### CONVENTIONAL WIRELESS ROBOTICS:

A robot is a mechanical or virtual artificial agent, usually an electro-mechanical machine that is guided by a computer program or electronic circuitry in conventional robotics, the controlling and operation of robots is usually done by using RF [Radio Frequency] circuits

### BLUETOOTH:

Bluetooth is a wireless technology standard for exchanging data over short distances from fixed and mobile devices, and building personal area networks. Bluetooth technology was created by Ericsson in 1994 and is used to replace the cables in the office, in laboratories or at home as in. Bluetooth device operated in the range of 10 meters. The IEEE standardized Bluetooth as IEEE802.15.1

**HC -05 BLUETOOTH:**

The HC-05 Bluetooth Module has 6 pins – Vcc, GND, TX, RX, Key and LED. It comes pre-programmed as a slave, so there is no need to connect the key pin, unless you need it change it to master mode the major difference between master and slave modes is that, slave mode the Bluetooth module cannot initiate a connection, it can however accept incoming connections. After the connection is established the Bluetooth module can transmit and receive data regardless of the mode it is running in. If you are using upon to connect to the Bluetooth module, you can simply use it in the slave mode[3]. The default data transmission rate is 9600kbps. The range for Bluetooth communication is usually 30m or less. The module has a factory set pin off "1234" which is used while pairing the module to a phone. Frequency:2.4GHz ISM band, Power supply: +3.3VDC 50mA, Working temperature: -20 `+75 Centigrade

**SENSORS:**

A sensor is a device that measures a physical quantity and converts it into a signal which can be read by an observer or by an instrument. Sensors are used in everyday objects such as touch sensitive elevator buttons (tactile sensor) and lamps which dim or brighten by touching the base. Applications include cars, machines, aerospace, medicine, manufacturing and robotics.

## 3. PROPOSED SYSTEM

Voice/app controlled semi-autonomous prototype rover is a simple approach for obstacle detection and alerting user using ultrasonic sensor and IOT. This approach uses an ultrasonic sensor which is mounted on a rover and this rover will detect the obstacles in disaster prone areas. User can give voice-based instructions to the rover to rotate in left, right direction. Rover-bot will function as a unified entity of two autonomous circuits, i.e., the Extension and carrier body.

The Carrier body (i.e., the major chassis) consists the main body and the extension of types: -

a.) Distance sensing radar (ultrasonic)

b.) juncture arms.

c.) Night vision equipped camera.

## CONSTRUCTION

### Arduino IDE

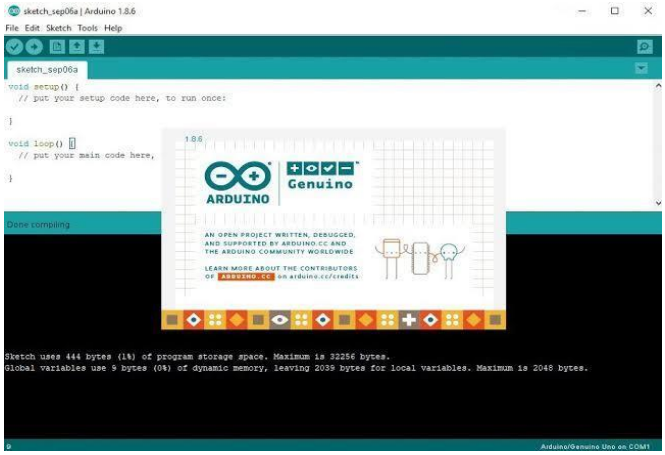


Fig 1. Arduino IDE for Coding environment and language support

The Arduino Integrated Development Environment is a cross-platform application that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of third-party cores, other vendor development boards.

### IFTTT


Fig 2. IFTTT for Google Assistant/ Blynk for creating custom command applets

**GOOGLE ASSISTANT**


Fig 3. Google Assistant for providing commands – custom tailored for rover experience


Fig 4. Arduino WEMOS D1 ESP8266 Board

Fig 5. Wheeled Motors X4

Fig 6. HC-SR04 Ultrasonic Sensor

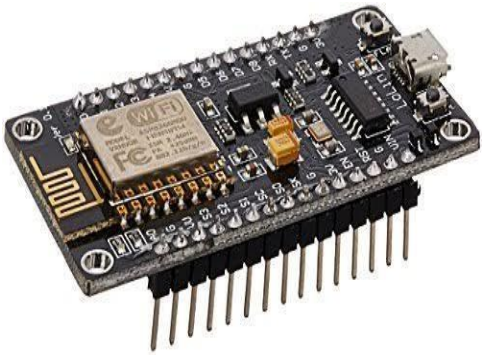

Fig 7. Nodemcu ESP8266 IoT Development Board

Fig 8. DC Servo Motor

## WORKING

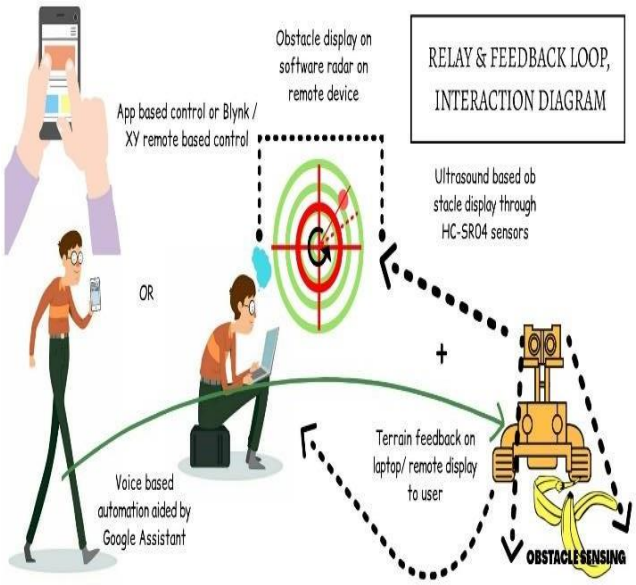


Fig 9. **Graphically representing the functioning and user-rover interaction**

The working of the rover is explained in two parts which is divided as:

a) Kinetic Body.
b) Ultrasonic Sensor Module.

A) Kinetic Body:

This is the component which does the displacement of the rover from a point to another. To make this component work, we need a Arduino circuit. The Integrated Chip (IC) acts like a microcontroller. We need to program the IDE (Integrated Development Environment) of the Arduino chip. This will enable us to give instructions to the component such as controlling the speed of rover and other functions as well. This programing is done in C language. These codes are installed in the Arduino with the help of an USB. The user will input his instructions with the help of Google assistant, these commands will be captured by the Arduino and will process the instructions and will provide the required functions.

B) Ultrasonic Sensor Module:

This has HC-SR04 ultrasonic sensor attached on sensor. The sensor generates soundwaves inaudible to human ears. These waves travels a distance and reflects back to the sensor when obstructed by any obstacle or surface. The programming in this sensor is done by using Lua language. The program plots the distance coordinates and compiles a program which provides a rotating radar that provides the proximity of the environment.

| Voice Commands through App | Output (Movement) |
|---|---|
| Forward | Vehicle moves forward |
| Back | Vehicle moves backward |
| Right | Vehicle moves rightward |
| Left | Vehicle moves leftward |
| Keep watch in all directions | Vehicle moves in all directions with some delay |
| Stop | Vehicle movements stop |

Fig 10. Sample instruction list of vocal commands

## ALGORITHM FOR ROVER CONTROL

1. Start
2. Establish Bluetooth connectivity between android application and the Bluetooth module on the robot.
3. Check whether the device is connected.
4. If connected, give the pre-defined instructions or commands to the micro-phone of the mobile handset.
5. The voice commands should be trained to the google assistant module.
6. Then the stored voice commands are represented in the form of binary numbers such as move forward - 001, move backward - 010 etc.
7. These binary values are transmitted via sensor module which is a transceiver.
8. The transmitted binary values are then received by another kinetic module which is present on the receiver side.
9. Microcontroller will take those binary values and performs action (servo motors) according to the binary values

## 4. ADVANTAGES

1. The bot will find cheap and good alternative for labour and heavy-duty.
2. Smaller size will enable greater reach to remotest areas where space is scarce.
3. The accuracy of carrying operations would be higher.
4. Nuclear and hazardous wastes could be cleaned with much accessibility and strain on public treasury will be reduced
5. Control on tasks will be greater due to lesser number of decisions be taken and lack of variance of opinions during carriage of tasks.
6. The proposed model is cheaper than the Artificial Intelligence (AI) technology used today. So it is affordable to the masses.
7. Easy to install in vehicles.
8. Easy to maintain and repair

## 5. CONCLUSION

The app/ voice-controlled rover bot prototype is successfully made and is applied to areas involving wide technological applications where extensive manual work is done and would substitute manual labour thereby not endangering human assets and carrying out tasks with reduced risks.

Certain enhancements/modifications could be done to modify the parts of the rover as per tasks and circumstances in concern.

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