"Obstacle Avoidance Robotic Vehicle Using Ultrasonic Sensor, Android And Bluetooth For Obstacle Detection"

Vaghela Ankit[1], Patel Jigar[2], Vaghela Savan[3]

[1]Vaghela Ankit, Dept. Of E&C Engineering, Sigma Institute & technology, Gujarat, India
[2]Patel Jigar, Dept. Of E&C Engineering, Sigma Institute & technology, Gujarat, India
[3]Vaghela Savan, Dept. Of E&C Engineering, Sigma Institute & technology, Gujarat, India

Abstract - *Now day's many industries are using robots due to their high level of performance and reliability and which is a great help for human beings. The obstacle avoidance robotics is used for detecting obstacle and avoiding the collision. This is an autonomous robot. The design of obstacle avoidance robot requires the integration of many sensors according to their task. The obstacle detection is primary requirement of this autonomous robot. The robot gets the information from surrounding area through mounted sensors on the robot. Some sensing devices used for obstacle detection like bump sensor, infrared sensor, ultrasonic sensor etc. Ultrasonic sensor is most suitable for obstacle detection and it is of low cost and has high ranging capability. Arduino robot that can be controlled by an android mobile or tablet, with the help of an android app that can be downloaded from Google Play store. The android application gets connected to the Bluetooth module and sends desired commands. This app controlled robot is capable to move in any direction. Though there are lots of similar apps out there, we have programmed this project to be used with ANDROID app.*

Keyword: Ardiuno controller, Android OS, Smart phone, Bluetooth,

1. INTRODUCTION

1.1 BASIC INTRODUCTION

The project is designed to build an obstacle avoidance robotic vehicle using ultrasonic sensors for its movement. An Arduino uno is used to achieve the desired operation. A robot is a machine that can perform task automatically or with guidance. Robotics is generally a combination of computational intelligence and physical machines (motors). Computational intelligence involves the programmed instructions. The project proposes robotic vehicle that has an intelligence built in it such

that it guides itself whenever an obstacle comes ahead of it. This robotic vehicle is built, using an Arduino uno. An ultrasonic sensor is used to detect any obstacle ahead of it and sends a command to the Arduino.

Fig-1: Sensor based robot

In today's world ROBOTICS is a fast growing and interesting field. ROBOT has sufficient intelligence to cover the maximum area of provided space. Autonomous Intelligent Robots are robots that can perform desired tasks in unstructured environments without continuous human guidance. The obstacle detection is primary requirement of this autonomous robot. The robot gets the information from surrounding area through mounted sensors on the robot.

1.2 WORK WITH SMART PHONE:

Fig-2: Android phone controlled robot

The present invention relates to mobile robotic device, and more particularly, to obstacle detectable mobile robotic device. We have developed on application for mobile device which run on android OS. This application provides or controls the robot using wireless technology. The robot based on Arduino board. The robot is programmed to be controlled using the android application

2. LITERATURE SURVEY

2.1 PRELIMINARY STUDY

I. PAPER 1: AUGUST 1997

Adaptive Navigation of Mobile Robots with Obstacle Avoidance

Robot navigation problems can be generally classified as global or local, depending upon the environment surrounding the robot. In global navigation, the environment surrounding the robot is known and a path which avoids the obstacles is selected. In one example of the global navigation techniques, graphical maps which contain information about the obstacles are used to determine a desirable path. In local navigation, the environment surrounding the robot is unknown, or only partially known, and sensors have to be used to detect the obstacles and a collision avoidance system must be incorporated into the robot to avoid the obstacles. The artificial potential field approach is one of the well-known techniques which has been developed for this purpose. Krogh, for example, used a generalized potential field approach to obstacle avoidance. Kilm and Khosla used instead harmonic potential functions for obstacle avoidance. On the other hand, Krogh and Fang used the dynamic generation of sub goals using local feedback information.

II. PAPER 2: APRIL 1991

Potential Field Methods and Their Inherent Limitations for Mobile Robot

During the past few years, potential field methods (PFM) for obstacle avoidance have gained increased popularity among researchers in the field of robots and mobile robots. The idea of imaginary forces acting on a robot has been suggested by Andrews and Hogan and Khatib.

In these approaches obstacles exert repulsive forces onto the robot, while the target applies an attractive force to the robot. The sum of all forces, the resultant force R, determines the subsequent direction and speed of travel. One of the reasons for the popularity of this method is its simplicity and elegance.

III. PAPER 3: NOVEMBER 1991

Histogramic in-motion mapping for mobile robot obstacle avoidance

This paper introduces histogram in-motion mapping (HIMM), a new method for real-time map building with a mobile robot in motion. HIMM represents data in a two-dimensional array, called a histogram grid, that is updated through rapid in-motion sampling of onboard range sensors. Rapid in-motion sampling results in a map representation that is well-suited to modeling inaccurate and noisy range-sensor data, such as that produced by ultrasonic sensors, and requires minimal computational overhead. Fast map-building allows the robot to immediately use the mapped information in real-time obstacle-avoidance algorithms. The benefits of this integrated approach are twofold: (1) quick, accurate mapping; and (2) safe navigation of the robot toward a given target.

IV. PAPER 4: SEPTEMBER/OCTOBER1989

Real-time Obstacle Avoidance for Fast Mobile Robots

Real-time obstacle avoidance is one of the key issues to successful application of mobile robot systems. All mobile robots feature some kind of collision avoidance, ranging from primitive algorithms that detect an obstacle and stop the robot short of it in order to avoid a collision, through sophisticate algorithms, that enable the robot to detour obstacle. The later algorithms are much more complex, since they involve not only the detection of an obstacle, but also some kind of quantitative measurements concerning the obstacle's dimensions.

In our system the ultrasonic sensor are continuously sampled while the robot is moving. If an obstacle produces an echo, the corresponding cell contents are incremented. A solid, motionless obstacle eventually causes a high count in the corresponding cells. Misreading, on the other hand, occur randomly, and do not cause high count in any particular cell. These methods yield a more reliable obstacle representation in spite of the ultrasonic sensor's inaccuracies.

2.3 DESIGN OF PROBLEM STATEMENT:

2.3.1 OVERVIEW:

Robotics is the branch of technology that deals with the design, construction, operation, and application of robots. A machine capable of carrying out a complex series of actions automatically, esp. one programmable by a computers is defined as a robot. The project is to develop a robot that will move according to the code assigned but find a free space, navigating from any obstacle on its way. This kind of obstacle is very useful in industries where automatic supervision is needed, for example, in places where it might be risky for humans to be. This robot can also be made by putting other sensors like light sensors or line sensors, ultrasonic sensors and ultrasound sensor depending on the need.

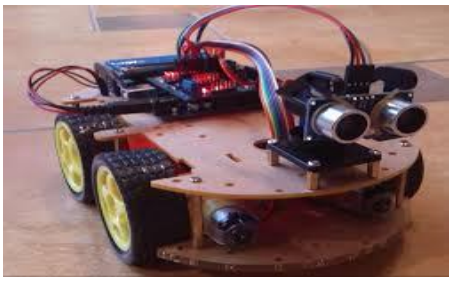

Fig: 2.2 Arduino based robot

2.5 ANDROID APPLICATION:

Android is a very familiar word in the world today. Millions of devices are running the Google Android OS and millions are being developed daily. Google has made the Android development platform open to everyone around the world, so there

are millions of developers. Although some developers just focus on building the apps or games for the android devices, there are numerous possibilities as well.

Fig: 2.3 Robot control Android application

3. BLOCK DIAGRAM

3.1 BLOCK DIAGRAM:

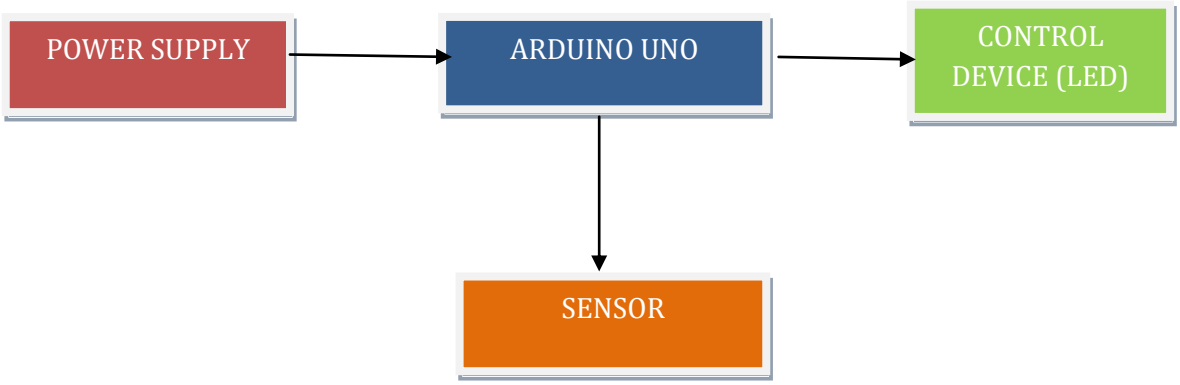

Fig-3: Block Diagram

Here we are going with Arduino controller use 12V power supply for running arduino board. Arduino uno used is ATMega328P controller. It is controlled using C programming. The feature of Arduino is includes wire and wireless controlling with sensor and relay. It is also controlling with wired and wireless system Using Android with Bluetooth, GSM, etc

Robot work basically this feature:

An Arduino uno is used to achieve the desired operation. A robot is a machine that can perform task automatically or with guidance.

This robotic vehicle is built, using an Arduino uno . An ultrasonic sensor is used to detect any obstacle ahead of it and sends a command to the Arduino.

The robot gets the information from surrounding area through mounted sensors on the robot.

Ultrasonic sensor is most suitable for obstacle detection and it is of low cost and has high ranging capability.

4. WORK-DONE & HARDWARE IMPLEMENTAION

4.1 HARDWARE MODEL:

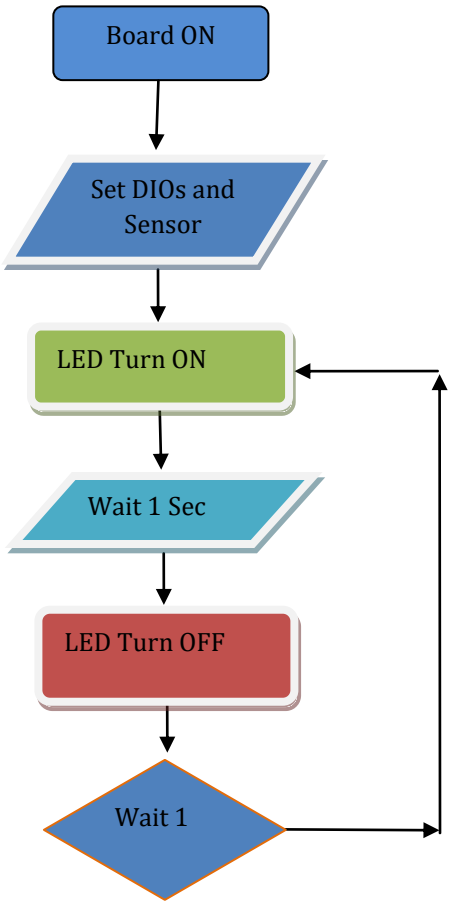

Fig-4: Flow chart

Thus we prepared our hardware model consisting Arduino, 12v power supply, Ultrasonic sensor and LED.

Using probe wires to interconnected the Ultrasonic sensor and LED.

12v Adapter is use to give power supply to Arduino board.

Sensor connected to the Arduino board at input interfacing.

LED at output interfacing.

Object take near to the sensor and sensor sense to object..

LED glow when object near to sensor and OFF when object away from sensor.

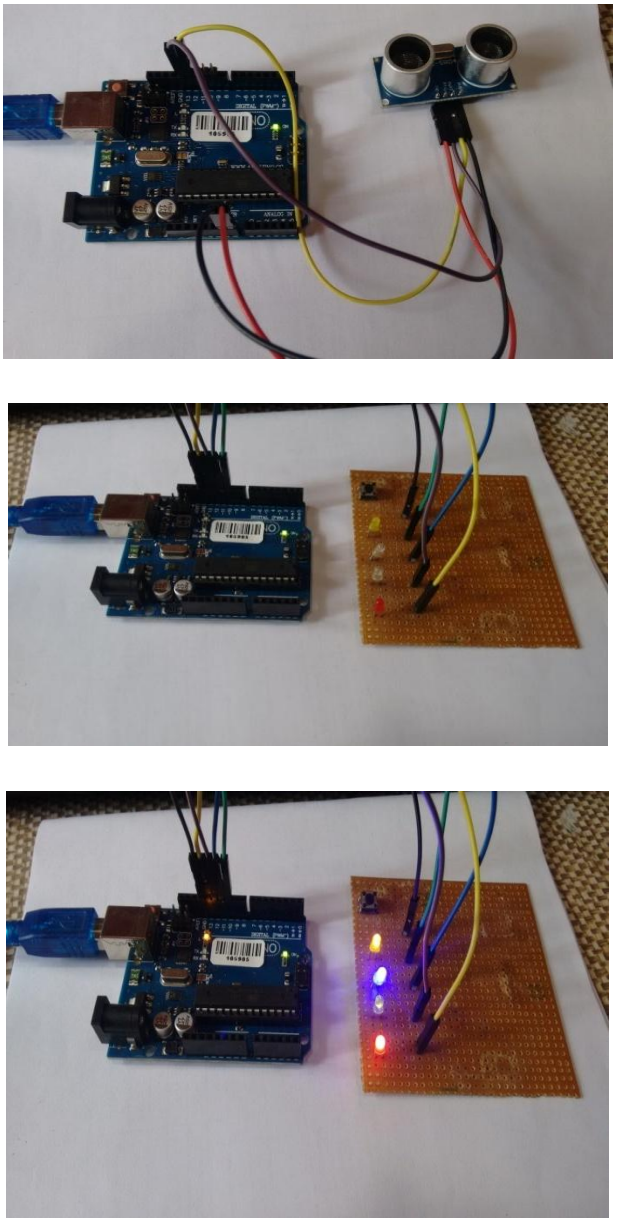

Fig-5: Hardware

4.2 WORKING:

- Once the Sensor and LEDs is connected to the Arduino board.
- Programmed the Arduino controller.
- Two demo are performed:

  (1) Distance measurement using sensor

  (2) LED blinking
- Give power supply to Arduino board.
- Object take near at sensor, it measure distance and give output at LED.
- Object near to sensor then LEDs are ON and Object away from sensor then LEDs are OFF.

5. ADVANTAGES & APPLICATION

5.1 ADVANTAGES

- It can be used as a movable Surveillance System.
- It can be controlled remotely.
- It does not require Man Power.
- It can be used for critical application like flood, bomb disposal, Fire, Terrorist attack, Earth quake, Spying.

5.2 DRAWBACKS OF EXISTING SYSTEM

- It is time consuming project.
- It is use for short distance only.
- It is not in human control.
- It is not recommended to keep the range very long because this would cause the robot to keep moving forward and backward as it senses obstacle, even far away from it.

5.3 APPLICATION

- This robot can be use for pick and place the require object by giving directions to the robot but IR pair should by replace depending upon the application.
- By doing extra things, it can be used in army application.
- Automatic change over's of traffic signals.
- Intruder alarm system.
- Counting instruments access switches parking meters.

- Back sonar of automobiles.

5.4 SCOPE

- Work for an extended period of time without intervention from human or a need for power supply.
- Avoid situations that are harmful.
- The designed mobile robot will be able to avoid obstacle perfectly like programmed.
- If the current project is interfaced with a camera robot can be driven beyond line of sight & range become practically unlimited as networks have very large range.
- By adding temperature sensor, water tank and making some change in programming we can use this robot as fire fighting robot.

CONCLUSION

Enormous amount of work has been done on wireless gesture controlling of robots. In this paper, various methodologies have been analyzed and reviewed with their merits and demerits under various operational and functional strategies. Thus, it can be concluded that features like user friendly interface, light weight and portability of android OS based smart phone has overtaken the sophistication of technologies like programmable glove, static cameras etc., making them obsolete. Although recent researches in this field have made wireless gesture controlling a ubiquitous phenomenon, it needs to acquire more focus in relevant areas of applications like home appliances, wheelchairs, artificial nurses, table top screens etc. in a collaborative manner.

ACKNOWLEDGEMENT

To learn the basic foundation laying fundamentals of professional career is always a matter of prime importance. Being a student of electronic and communication nothing can get better then learning those fundamentals during the project. We acknowledge the support and help provided by our internal guides, **Mr. Sachin Patel** and **Mr. Hardik Patel**. Without their support, guidance and encouragement this project couldn't have been put together.

We are highly indebted to our Head of Department Prof. **Mr. Jignesh Jethwa** for providing us this opportunity to prepare this project. We would also like to thank entire staff of Electronics and Communication Department. Being final year students, making of the project adds a final touch to our career. For this opportunity that was presented to us, we would like to thanks all our faculties who were instrumental during our project. We would also like to thank other members who have helped directly and indirectly. We express our sincere thanks to all.

REFERENCES

I. PAPER:

[1] International Journal of Advance Foundation And Research In Science & Engineering (IJAFRSE) Volume 1, Special Issue, Vivruti 2015.

[2] Aiman Ansari et al, / (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 6 (2), 2015, 1598-1600.

[3] International Journal of Electronic and Electrical Engineering. ISSN 0974-2174, Volume 7, Number 5 (2014), pp. 443-448.

[4] International Journal of Conceptions on Computing and Information Technology Vol. 2, Issue. 4, June' 2014; ISSN: 2345 – 9808

[5] International Journal of Engineering Trends and Technology (IJETT) – Volume 5 Number 5 - Nov 2013.

II. BOOKS:

Arpit Sharma, Reetesh Verma, Saurabh gupta, Sukhdeep Kaur Bhatia. "Android Phone Controlled Robot Using Bluetooth", Noida, India, 2014.

"Smartphone-based Mobile Robot Navigation" -Nolan Hergert, William Keyes, and Chao Wang,spring 2012

Roland Philippsen, "Motion Planning and Obstacle Avoidance for Mobile Robots in Highly Cluttered Dynamic Environments", Ph.D Thesis, Ecole Polytechnique Federale de Lausanne, 2004

III. WEB-SEARCH:

[1] http: //www.bluetooth.com/blurtooth/technology/work

[2] http://www.robokits.co.in

[3] http://www.robokitsworld.com

[4] http://www.arduino.cc/en/Main/arduinoBoardUno

[5] http://atmel.in