



OBSTACLE AVOIDING ROBOT CAR BY USING GSM MODEM TO GET ALERT MESSAGE

Yashashvi Gour¹, Unnati Ninawe², Ruchita Tetu³, Mohit Bhoge⁴, Prof. Mr. Harish Gorewar⁵

Department of Information Technology, KDK College of Engineering, Nagpur, Maharashtra, India^{1,2,3,4,5}

Abstract : Obstacle avoidance is one of the most important aspects of mobile robotics. 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. This project proposes robotic vehicle that has an intelligence built in it such that it directs itself whenever an obstacle comes in its path. so, to protect the robot from physical damages. This can be design to build an obstacle avoidance robotic vehicle using ultrasonic sensors for its movement. A micro - controller (AT mega 328P) is used to achieve the desired operation. An ultrasonic sensor is used to detect any obstacle ahead of it and sends a command to the micro- controller. Depending on the input signal received, the micro-controller red erects the robot to move in an alternate direction by actuating the motors which are interfaced to it through a motor driver. The GSM module we here going to use is Sim900 which is capable of connecting to GPRS and through which we can send and receive commands.

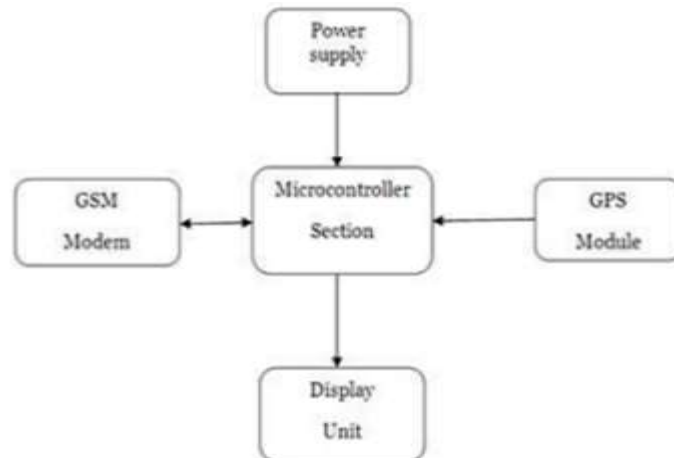
Key Words : Obstacle , Arduino ,LCD Display , Smart phone, Ultrasonic sensor, GSM.

1) INTRODUCTION :

The project is designed to build an obstacle avoidance robotic vehicle. "ROBOT" is an automatically operated machine that replaces manual work of humans, though it may not look much like a human being or function in a human like manner. Robotics has become one of the essential segments of modern automation systems. Autonomous mobile robots are being used in various industrial and non-industrial applications for the ease of human labor in day to day activities. Due to this demand of smart systems in every field of technology the automation is the preferred area for betterment of the society . Generally these kind of robots are made with either PIR Sensors or ultrasonic sensors .In this project we have made the robot using ultrasonic sensor and a GSM Modem. They can feature all the functionalities of a mobile phone through computer like making and receiving calls, SMS, MMS etc. Wireless Communication is the most evolving fields of application in current state, where different technologies can be used so as to have automated systems with easy to handle, durable and being highly accurate. To detect the accident, accelerometer sensor used. So, when accident happens, this sensor will be active. And the information sends to microcontroller. At the same time, GPS and GSM modem will also active which are interfaced to the same microcontroller. Through GPS the exact latitude and longitude of the accident location is obtained. And through GSM modem the same data send to the contacts which are stored in the database. So with this system, information is send to the Police Stations, friends etc. and also decrease the total action time and save the lives in emergencies. It provides working range as large as the coverage area of the providers of network, no interference with other controllers present in same place. So this system will be a powerful and reliable tool that will offer this service at any time, and from anywhere with the constraints of the technologies being applied.

2) TECHNOLOGY:

IOT(Internet of things). The internet of things, or IoT, is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.



- 3) BLOCK DIAGRAM :
- 4) framework OF THE SYSTEM
- a) methodology:

The sonar system is used in HC-SR04 ultrasonic sensor to determine distance to an object like bats do. It offers excellent non-contact range detection from about 2 cm to 400 cm or 1feet to 13 feet. Its operation is not affected by sunlight or black material. The ultrasonic sensor emits the short and high frequency signal. If they detect any object, then they reflect back echo signal which is taken as input to the sensor through Echo pin .Firstly user initialize Trigger and Echo pin as low and push the robot in forward direction. When obstacle is detected Echo pin will give input as high to microcontroller. Pulse In function is used for calculating the time of distance from the obstacle. Every time the function waits for pin to go high and starts timing, then timing will be stopped when pin go to low. It returns the pulse length in microseconds or when complete pulse was not received within the timeout it returns. The timing has been determined means it gives length of the pulse and will show errors in shorter pulses. Pulses from 10microseconds to 3 minutes in length are taken into consideration. After determining the time, it converts into a distance. If the distance of object is moderate then speed of robot get reduced and will take left turn, If obstacle is present in left side then it will take right turn. If the distance of object is short then speed of robot get reduced and will turn in backward direction and then can go in left or right direction. This robot was built with an Arduino development board on which microcontroller is placed.

TABLE I. INPUT PINS FOR MOVEMENT

Movement	Pin10	Pin11	Pin12	Pin13
Forward	1	0	0	1
Backward	0	1	1	0
Left	1	0	1	0
Right	0	1	0	1

Arduino board is connected with DC Motor through Motor driver board (pin10, pin11, pin12, pin13) which provides power to the actuators. Actuators are used to move robot in Forward, Backward, Left and Right directions. The brief description of inputs pins for movement of robot is given in below in table. The movement of robot will be stop whenever there is an obstacle is present on its path which can be detected by ultrasonic sensors. Ultrasonic sensors give time in length to the microcontroller as an input for further actions. A Sensors For Obstacle Avoidance Varieties of sensors are available which can be used for the detection of obstacles some of the very popular sensors are: Infrared sensors (IR), Ultrasonic sensors, Cameras, which can be used as a part of Computer Vision, Sonar. It can measure the distance in its field of view of about thousands to hundreds points In the design of robot, we are using ultrasonic sensors for obstacle detection and avoidance The ultrasonic sensors continuously emits the frequency signals, when obstacle is detected this signals are reflected back which then considered as input to the sensor. The ultrasonic sensor consists of a multi vibrator, which fixed at its base. The multi vibrator is combination of a resonator and vibrator the ultrasonic waves generated by the vibration are delivers to the resonator. Ultrasonic sensor actually consists of two parts: the emitter which produces a 40 kHz sound wave and detector which detects 40 kHz sound wave and sends electrical signal back to the microcontroller. HC-SR04 ultrasonic sensors are used which consist of 4 pins VCC, Trigger, Echo and GND

Features of Ultrasonic Sensor:

- Compact and light weight



- High sensitivity and high pressure
- High reliability
- Power consumption of 20mA
- Pulse in/out communication
- Narrow acceptance angle
- Provides exact, non-contact separation estimations within 2cm to 3m
- The explosion point LED shows estimations in advancement

3-pin header makes it simple to connect utilizing a servo development link

CIRCUIT DESCRIPTION : The circuit is excited by 9V power supply, the HC-SRO4 module is connected to the port A of the 8051series, and the Now you will need six digital output pins on your Arduino, two of which need to be PWM (pulse – width Modulation) pins. PWM pins are denoted by the tilde (“~”) next to the pin number, for example finally, connect the Arduino digital output pins to the driver module. In our example we have two DC motors, so digital pins D9, D8, D7 and D6 will be connect to the pins IN1, IN2, IN# and IN4 respectively. Then connect D10 to module pin 7 and D5 to module pin 12. The motor direction is controlled by sending a HIGH or LOW signal to the drive for each motor or channel. However the motors will not turn until a HIGH is set to the enable pin and they can be turned off with a low to the same pin. However if you need to control the speed of the motors, the PWM signal from the digital pin connected to the enable pin can take care of it.

SYSTEM COMPONENTS

This section gives knowledge about various components related to the system. Some of the important components are given below.

- ARM7 (Advanced RISC Machine) based LPC2148
- Global Positioning System
- GSM/GPRS
- ultrasonic sensor.
- arduino BOARD (MICROCONTROLLER)
- motor driver.
- lcd display
- power supply.

ARM7

The ARM7 is part of family of the ARM (Advanced RISC Machines). It is a low power, 32-bit RISC (Reduced Instruction Set Computer) microprocessor. The original ARM7 was based on ARM6 design. It has very simple, fine and fully static design. It can be used in applications or LPC2148 is the widely used integrated chip from ARM-7 family. It is manufactured by Philips and pre-loaded with many inbuilt peripherals. It is more reliable as well as efficient option for the beginners. It is also beneficial for high end application developer. LPC2148 has huge number of features. Some features are listed below.

- 1) It has 8 to 40 kB of on-chip static RAM.
- 2) It has 32 to 512 kB of on-chip flash program memory

SYSTEM COMPONENTS

This section gives knowledge about various components related to the system. Some of the important components are given below.

- ARM7 (Advanced RISC Machine) based LPC2148
- Global Positioning System
- GSM/GPRS
- ultrasonic sensor.
- arduino BOARD (MICROCONTROLLER)
- motor driver.
- lcd display
- power supply.

ARM7

The ARM7 is part of family of the ARM (Advanced RISC Machines). It is a low power, 32-bit RISC (Reduced



Instruction Set Computer) microprocessor. The original ARM7 was based on ARM6 design. It has very simple, fine and fully static design. It can be used in applications or LPC2148 is the widely used integrated chip from ARM-7 family. It is manufactured by Philips and pre-loaded with many inbuilt peripherals. It is more reliable as well as efficient option for the beginners. It is also beneficial for high end application developer. LPC2148 has huge number of features. Some features are listed below.

- 1) It has 8 to 40 kB of on-chip static RAM.
 - 2) It has 32 to 512 kB of on-chip flash program memory.
 - 3) It has 128 bit wide interface enables high speed 60 MHz operation.
 - 4) It does In-System/In-Application Programming (ISP/IAP) via on-chip boot-loader software.
 - 5) It does single flash sector or full chip erase in 400 ms and programming of 256 bytes in 1ms.
 - 6) It has Single 10-bit D/A converter provides variable analog output.
 - 7) Two 32-bit timers/external counters, PWM and watchdog.
 - 8) It has Multiple serial interfaces including two UARTs, two fast I2C-bus (400 kbit/s), SPI and SSP with buffering and variable data length capabilities.
 - 9) It has Vectored interrupt controller with configurable priorities and vector addresses.
 - 10) It has up to 45 of 5 V tolerant fast general purpose I/O pins in a tiny LQFP64 package.
 - 11) It has On-chip integrated oscillator operates with an external crystal in range from 1 MHz to 30 MHz and with an external oscillator up to 50 MHz.
 - 12) It includes Idle and Power-down power saving modes.
- Following figure shows lpc2148 pin configuration. The following figure shows the LPC2148 pin diagram.
- 13) It has low power real-time clock with independent power and dedicated 32 kHz clock input.

GSM/GPRS :

Global System for Mobile communication is a standard accepted worldwide for mobile communication. GSM/GPRS module is used for establishing communication link between a computer and a GSM-GPRS system. GSM is an architecture used for mobile communication in number of countries in the world.

GPRS (Global Packet Radio Service) is an extension of GSM.

It allows higher data transmission rate for the efficient communication purpose. GSM/GPRS module consists of a GSM/GPRS modem assembled together. It is assembled with power supply circuit and communication interfaces like RS-232, USB, etc for users' computer. We are using Sim300 in our system.

GPS :

GPS is one of the popular systems in communication. Global positioning system technology became a reality through the efforts of military of the American. It established a satellite-based navigation system consisting of a network of group of satellites orbiting the earth. There are 24 satellites in a system. GPS is also known as the NAVSTAR. It operates all across the world. It works in all weather conditions. It helps users to track locations as well as objects. By using GPS technology we can track each individual having GPS receiver. Thus we can say that the GPS technology can be used by any person having GPS on the earth.

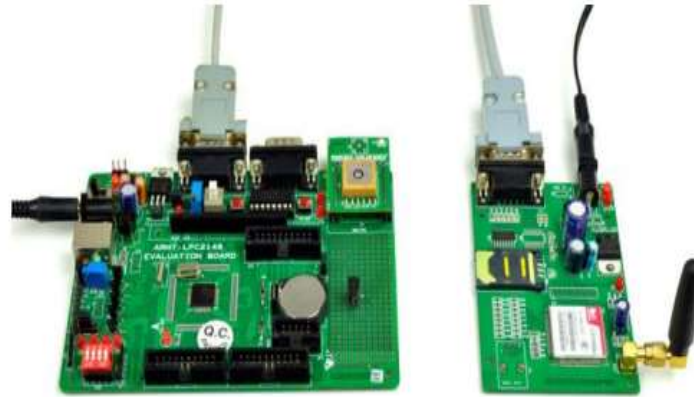


fig1: gps

ULTRASONIC SENSOR : An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e. the sound that humans can hear).the ultrasonic sensor diagram as shown in fig 2



fig 2 :

ULTRASONIC SENSOR

arduino BOARD (MICROCONTROLLER): The microcontroller heart of our project used here is At mega 32 which is a modified architecture 8- bit RISC single(Harvard) chip microcontroller, which was developed by Atmel in 1996 which helps in controlling actions of motor, GSM modem ,DTMF decoder and sensors. the microcontroller diagram as show in fig 3.



fig3: arduino BOARD (MICROCONTROLLER)

motor driver : A Motor driver has L293D with DC motors works in H-Bridge principle which receive the commands from microcontroller and helps in driving the motors for required directions. The Motor drive module diagram as shown in fig. 4

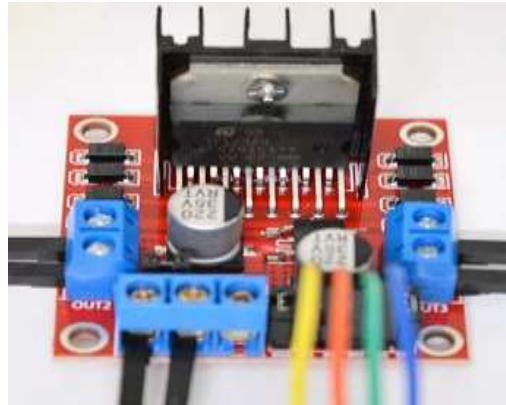


FIG4 : motor driver

lcd display : A LCD display of (16*2) is being used which helps in display of internal working taking place during the call process.



fig5 : lcd display

power supply : A power supply of 9V is used for power up of the robot devices used.



fig6: power supply.

5) **APPLICATION :**

- Obstacle avoiding robots can be used in almost all mobile robot navigation systems.
- They can be used for household work like automatic vacuum cleaning.

6) **ADVANTAGES :**

- a) It can be used as a movable surveillance system.
- b) It can be controlled remotely.
- c) It does not require Man Power.
- d) It can be used for critical application like Flood , Bomb disposal, Fire , Terrorist Attack, Earth quake, Spying.

7) **DISADVANTAGES:**

- a) It is time consuming project.
- b) It is use for short distance only.
- c) Bluetooth too low – bandwidth.



8) **SOFTWARE USE:** In this project, to design the OBSTACLE AVOIDING ROBOT, ARDUINO SOFTWARE is used. The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. This software can be used with any Arduino board.

9) **SCOPE :**

A. the aim is to design the obstacle is to maintain the social distancing, where human can't reach this can be useful.

B. this project is to design and implement a GPS based Land Surveying system, and find out time, latitude, and longitude of the boundary points and thereby take the survey of the land.

C. The kind of obstacles 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, fire sensor ultrasonic sensors and ultrasound sensors depending upon need.

D. Obstacle avoidance system provides safety for both mobile robot and obstacles around. This would prevent any costing for repair and without increase the cost of maintenance or repair of the mobile robot They can be used for household work like automatic vacuum cleaning

10) **LITERATURE REVIEW :**

sr.no	Name of Author	Title of Paper	year	discription
1	R.VAIRAVAN[1], S.AJITH KUMAR[2], L.SHABIN ASHIFF[3], C.GODWIN JOSE [4]	OBSTACLE AVOIDANCE ROBOTIC VEHICLE USING ULTRASONIC SENSOR, ARDUINO CONTROLLER	02 Feb 2016	This vehicle is used for detecting obstacle and avoiding the collision. We have programmed the controller to be used with ANDROID app.
2	IOAN SUSNEA, VIOREL MINZU, GRIGORE VASILIU.	Simple, real-time obstacle avoidance algorithm for mobile robots	January 2009	This paper proposes a novel, reactive algorithm for real time obstacle avoidance, compatible with low cost sonar or infrared sensors, fast enough to be implemented on embedded microcontrollers.
3	A Pandey, S Pandey, DR Parhi	Mobile robot navigation and obstacle avoidance techniques	January 2017	Discusses the literature review of various soft computing techniques used for mobile robot navigation
4	Faiza Tabassum Susmita Lopa, Muhammad Masud Tarek	Obstacle Avoiding Robot		In this paper an Obstacle Avoiding Robot is designed which can detect obstacles in its path and maneuver around them without making any collision

CONCLUSION:

By developing this robotic vehicle with its multi-tasking feature, the drawbacks have been overcome of that seen in RF communication based robots which had a limited range where in this vehicle can be controlled from anywhere by usage of DTMF technology with GSM module by providing immediate text alert to the user. Considering all the situations this can be used for surveillance and military applications with the help of installing the camera itself. With this system, an Embedded System is designed which can be most useful for Accidents. It's a low cost, Power efficient system by which the action time can be minimized and exact location



of an accident can also be defined with GPS service and also the information regarding accident can be sent to particular contact numbers e.g., Police stations, Doctors etc. Because of the flexibility of embedded system, this system is very much compatible to any kind of vehicles.

REFERENCE:

- 1) OBSTACLE AVOIDANCE ROBOTIC VEHICLE USING ULTRASONIC SENSOR, ARDUINO CONTROLLER R.VAIRAVAN[1], S.AJITH KUMAR[2], L.SHABIN ASHIFF[3], C.GODWIN JOSE [4] 1,2,3 UG Student, Dept. of Mechanical Engineering, PSN College of Engineering and Technology, Tirunelveli. 4 Assistant Professor, Dept. of Mechanical Engineering, PSN College of Engineering and Technology, Tirunelveli.
- 2) “Obstacle Avoidance Robotic Vehicle Using Ultrasonic Sensor, Android And Bluetooth For Obstacle Detection” 1Vaghela Ankit, Dept. Of E&C Engineering, Sigma Institute & technology, Gujarat, India 2Patel Jigar, Dept. Of E&C Engineering, Sigma Institute & technology, Gujarat, India 3Vaghela Savan, Dept. Of E&C Engineering, Sigma Institute & technology, Gujarat, India
- 3) GSM Based Wireless Robot Vehicle with POF features using DTMF. Mr Basavanna M1 , Ms Ashwini G2 , Ms Divyashree G N 2, , Ms Pooja Bhat M S2 , Ms Sanjana S Prabhu2 Assistant professor, Dept. of TCE, GSSSIETW, Mysuru, Karnataka, India1 Student, 8th semester, Dept. of TCE, GSSSIETW, Mysuru, Karnataka, India2
- 4) “ARM 7 Based Accident Alert and Vehicle Tracking System” by Salas K Jose; X. Anitha Mary; Namitha Mathew.