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Robot Vehicle For Safety Monitoring Of Material Handling And Automated Navigation System

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ABSTRACT
Obstacle detection for mobile robot and robo vehicle is very essential in any automated manufacturing industry. Obstacle detection system helps automated navigation system of mobile robot and robot vehicle for safety monitoring of material handling, like raw material, under processing products and finished products. The proposed work is about obstacle detection using acoustics sensor. Ultrasound sensors are use to detect the objects in path of mobile robot for safety monitoring of products.

I.INTRODUCTION

Applications of ultrasonic are gradually increases in the field of robotics and automations; it is possible because of the development of electronics technology which helps the interface the sensors with the microcontrollers or processor or computers. In this project Ultrasonic (acoustics) sensor is use for the detection of the obstacle in a way of a robot. It works on the principle of ultrasonic measurement, that is the ultrasonic transmitter emits an ultrasonic signal or wave in particular direction and microcontroler records timing when it is launched. Ultrasound signals spread in the air and return immediately when they encounter an obstacle on the way. At last, the ultrasonic receiver stops timing when it receives the reflected wave. As ultrasonic spread velocity is 340 m/s in the air medium, based on this timer record 't', we can calculate the distance S between the obstacle and transmitter, namely:

S=300*t/2

Which is the so-called time difference distance measurement principle. This phenomenon of ultrasonic distance measurement uses the already-known air spreading velocity & records the time between sending and after receiving the reflected signal when it encounters obstacle, & then it calculates the displacement between the emitter and the obstacle according to the time and the velocity. Thus, this phenomenon of ultrasonic distance measurement is the same as with radar. Distance formula is expressed as:
V=L*H

Where, L stands for the measured distance, v is the ultrasonic spreading velocity in air, and tH represents time (The is half the time value from transmitting to receiving). In the design, the sensor emits pulses 40 kilo Hz when the controller send a command to the sensor trigger pin. Then sensor provides the amount of time it requires for the 40 kHz signal to get reflected back and then outputs a variable-width pulse proportional to the time measured. The microcontroller commands the trigger pin for this given interval spanning 15° to 165° of the servomotor positions by taking into account the variable-width pulses for each & every of the degrees with in the interval to find how far away the obstacles are. A piece of fuzzy logic rules, implemented in the ATMEGA328P fuzzy inference system which allows the controller to send back measurement quantity in linguistic terms. The proposed application that uses only one acoustic sensor is a particular case of beam forming in obstacle detection especially in automotive and vehicle navigation. Many onboard systems use acoustic propagation, such as radar, to detect obstacles and other cars. When they are low-cost, they use simple acoustic radar and cannot release an image of the obstacle or barrier.

II.LITERATURE SURVEY

Distance measurement of an obstacle using ultrasonic transducer by comparing known and unknown lengths. In this paper A distance measurement system using an ultrasonic transducer is described. The method is predicated on comparison of the unknown distance with a customary length within the same medium. The measure created is freelance of temperature, humidity, pressure, and the other atmospherically conditions. The planned methodology claims improved performance and accuracy over the ways identified to date. A resolution of 0.25 mm, with a maximum error of 0.5 percent, is obtained.[1]

Accurate Distance measure by using Autonomous inaudible System Combining Time-of-Flight and Phase-Shift ways. In This paper we learn about an efficient algorithm for distance measurement, combining both the pulse time-of-flight method and the CW phase-shift method. It copes with a low-rate sampling technique allowed by the limited bandwidth of two ultrasonic transducers working in air at 30 kHz and with modest software resources of autonomous devices. The measuring device was enforced and tested on a compact Motorola MC68HC16-based platform, with a minimum of

connected hardware. Experimental results show accuracy higher than one millimeter for a poor reflective target at a distance of concerning one meter.[2]

An inaudible ultrasound sensor is employed for Distance measure in Automotive Applications. This paper describes inaudible device that's able to live the space from the bottom of chosen points of a motorcar. The device is predicated on the measure of the time of flight of inaudible pulse, that is mirrored by the bottom. A affected optimization technique is utilized to get mirrored pulses that area unit simply detectable by suggests that of a threshold comparator. Such a way, that takes the frequency response of the inaudible transducers under consideration, permits a sub-wavelength detection to be obtained. Experimental tests, performed with a 40 kHz piezoelectric-transducer based sensor, showed a standard uncertainty of 1 mm at rest or at low speeds; the sensor still works at speeds of up to thirty m/s, although at higher uncertainty. The device consists of solely low value parts, so being apt for 1st automobile instrumentality in several cases, and is able to self-adapt to variety of conditions in order to give the best results. [3]

III.HARDWARE REQUIREMENTS

3.1Piezoelectric Effect

Since the waves of ultrasound are high - frequency waves than sensitivity of a measuring device to detect high-frequency waves plays very an important role in ultrasound wave detection. The electricity are often wont to observe still as generate supersonic waves. These days, most practical ultrasonic sources are made up of the piezoelectric materials and their principle for transconduction. Piezoelectric devices have the advantage in simple construction & the method of operation, which makes piezoelectric materials suitable for a number of applications.

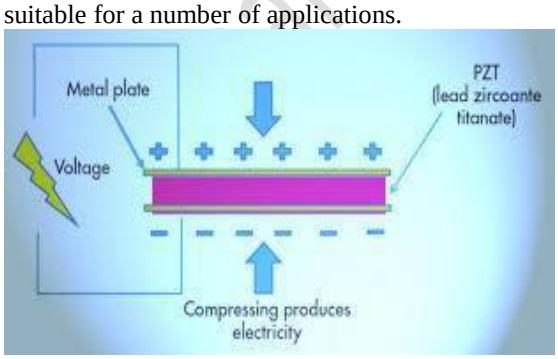

FIG:Piezo Electric Effect

3.2ULTRASONIC SENSOR

HC SR04 is a ultrasonic sensor which is used as ultrasonic sensor in this project. It can detect up 3m with 80% accuracy and 95% accuracy up to 1m.it has three pins and one transmitter and one receiver.

3.3DC MACHINE

A DC Machine is an electro-mechanical energy conversion device. There are 2 sorts of DC machines; one is DC generator, and another is a DC motor. A DC generator converts mechanical power (ωT) into DC electrical power (EI), whereas, the DC motor converts DC electrical power into mechanical power. the trade for conversion of electrical power into mechanical power, but at the places where the speed varies range widely and good speed regulation is needed, like in electric traction system, a DC motor is used.

The construction of dc motor and generator is sort of same. The generator is used during a very protected manner. Hence there is open construction type. But the motor is employed within the location wherever they're exposed to dirt and wet, and hence it requires enclosures for example dirt proof, fire proof, etc. according to requirement.

Although the energy storage cell is a very important supply of DC wattage, it can only supply limited power to any machines. Hence, at such places, DC generators square measure want to deliver power.

A Motor would be a machine that converts electricity into energy. There is no distinction between a DC generator and DC motor from a construction purpose of read. The only difference is that the generators are typically operated in additional protected locations and, therefore, their construction is generally of the open type.

L293D MOTOR DRIVERS:

L293D may be a typical Motor driver or Motor Driver IC that permits DC motor to drive on either

direction. L293D may be a 16-pin IC which might management a group of 2 DC motors at the same time in any direction. Dual H-bridge Motor Driver integrated circuit (IC).

It works on the concept of H-bridge. That H-bridge is a circuit which permits the voltage to be flown in either direction. As you recognize voltage got to amendment its direction for having the capability to rotate the motor in right-handed or anticlockwise direction, Hence H-bridge IC is necessary for driving a DC motor.

In a single L293D chip there are a unit 2 h-Bridge circuit within the integrated circuit which might rotate 2 DC motors severally. Due its smaller size it's gradually used in robotic applications to dominant DC motors. Given below is that the pin config. diagram of a L293D motor controller.

There are two Enable pins on L293D. Pin 1 and pin 9, for being able to run the motor, the pin 1 and 9 need to have high voltage. For driving the motor with left H-bridge you would have to change pin 1 to high voltage. And for right H-Bridge you would have to turn the pin 9 to high voltage. If anyone of this pin either pin1 or pin9 turns lower than the motors which corresponds to that pins can suspend operating. It's works same as a switch.

3.4 SERVO MOTOR

A servo motor is a device which may push or rotate AN object with nice exactitude. If you wish to rotate and object at some specific angles or distance, then you utilize servo motor. It is simply created of straightforward motor that runs through servo-mechanism. If motor is employed is 'DC' battery-powered then it's known as DC servo-motor, and if it is the AC powered motor then it is called AC servo-motor. We can get a awfully high torsion servo motor in a very tiny and light-weight & weight packages. Doe to these features they can be used in of the many applications like planes ,robotics, toy car, & RC helicopters and planes and Machine etc.

Servomotors area unit rated in kg / cm (kilo gram per centimeter) most hobby servo motors area unit rated at 6kg/cm or 5kg/cm or 10kg/cm. This kg / cm tells you the way abundant weight your servo - motor will raise for a selected distance. For example: A 6kg/cm Servo motor ought to be able to raise 6 kg if the load is suspended 1cm off from the motors shaft, the greater the distance the lesser the weight carrying capacty. The position of a servo motor is determined by electrical pulse & its electronic equipment is placed beside the motor.

ATmega328/P

The Atmel pico Power ATmega328/P may be a low-powered CMOS 8-bits microcontroller supports the AVR increased RISC {architecture} architecture. By corporal punishment powerful directions during a single clock cycle, the ATmega328/P achieves throughputs getting ready to 1MIPS per rate. This empowers system design to optimize the device for power consumption versus process speed.

The Atmel AVR core combines a fashionable instruction set with thirty two general purpose operating registers. All the thirty two registers are directly asses to the Arithmetic Logic Unit (ALU), permitting 2 freelance registers to be accessed during a single instruction dead in one clock cycle. The ensuing design is a lot of code economical whereas achieving throughputs up to 10 times quicker than typical CISC microcontrollers.

The ATmega328/P have the following feature : 32Kbytes of and PWM, 1 serial programmable USARTs , 1 byte-oriented 2-wire Serial Interface (I2C), a 6channel 10-bit ADC 8 channels in TQFP & QFN / MLF packages , a programmable Watch dog Timer with an internal generator and associated degree SPI port, and six software with selectable power saving mode. The Idle mode stops the CPU whereas permitting the SRAM, Timer / Counters, SPI port, and the interrupt system is functioning continuously. The Power - down mode saves the contents in the registers however it freezes the generator and start

disabling all varity of different chips which are functioning till the successive interrupt occur or hardware resets. The ADC mode of noise Reduction stops the CPU and each every one I/O modules except a synchronous timer and ADC to reduce the change in noise throughout its ADC conversions. This allows it in no time start-up combined with low power consumption.. The proprietary charge-transfer signal acquisition offers strong sensing and includes absolutely rebounced news of bit keys and includes Adjacent Key Suppression (AKS™) technology for unambiguous detection of key events. The easy-to-use QTouch Suite tool chain permits you to explore, develop and right your own bit applications. The device is factory-made exploitation Atmel's high density non-volatile memory technology.

The On-chip ISP Flash permits the program memory to be reprogrammed In-System through associate degree SPI serial interface, by a traditional non-volatile able memory applied to science, or by an On chip Boot program running on the AVR core. The Boot program will be useful in any interface to transfer the applying program within the Application non-volatile storage. Software with in the Boot Flash part can still run whereas the applying Flash part is updated, providing true Read-While-Write operation.

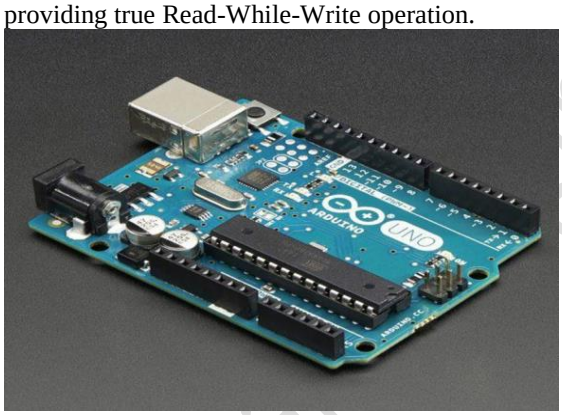

Fig: Arduino

IV.WORKING OF PROJECT

Mobile robot is an assembly which is manufactured with a help of 2 D.C. motors that are mounted to a chassis containing the wheels. Microcontroller ATMEGA328P is placed on the top of chassis for interfacing the ultrasonic sensor, temperature sensor, servo and D.C. motors by installing Mac OS using C language.

In this project, all required parts like DC motors with different rpm servo motors, different size of wheels, ultrasonic sensor, microcontroller, L293D driver are gather and then I tested all the equipments whether they are working properly. Tested the working of DC motors at different rpm then I tested it at different load conditions and check whether the speed is suitable or not. A motor is attached to the chassis and then programmed it on microcontroller with the help of L293D driver to move it in both direction and take left and right turns. To run chassis in forward direction I program is made in such a way that both side wheels should move in forward direction similarly to run the chassis in backward direction both the wheels should move in reverse or backward direction, To turn the chassis in left and right direction for right turn a programmed it in such a way that right wheel should move in backward direction and left wheels should move in forward direction, similarly for the left turn left wheels should move in backward direction and right wheels should move in forward direction. The turning of chassis is checked to see how much time require for turning particular angle. A servo motor is used for the purpose. Similarly a ultrasonic sensor is programmed to measure distance with it and checked its accuracy.

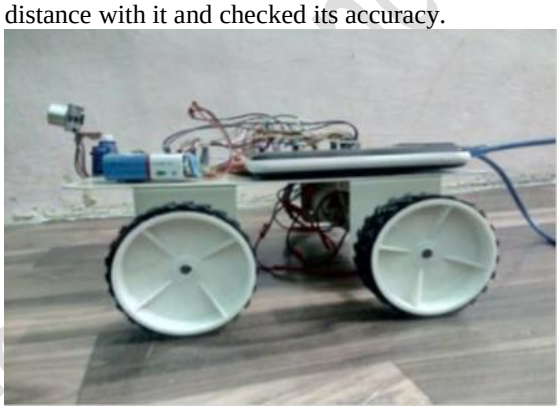

Figure ACOUSTIC CONTROL MOBILE ROBOT (SIDE VIEW)

Ultrasonic sensor (|HC SR04) is mounted on front side of mobile robot attached to servomotor. Servo motor rotates accordingly with the command given to it by program. The attached sensor is also rotating along with the servo motor. When sensor receives the signal means when program gives activate command to the trigger pin of the sensor.

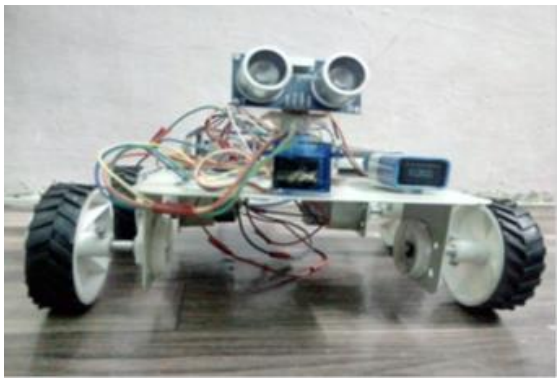

Figure : ACOUSTIC CONTROL MOBILE ROBOT (FORNT VIEW)

The transmitter of the sensor generates the ultrasonic wave. And at the time of giving signal a timer starts. if some obstacles are present in the sensor range .the ultrasonic waves get reflected

back which is receive by receiver of the robo and the timer stops. With the help of speed of the sound and time microcontroller calculates the distance. According to the constrains and logic given in the program the motor of the mobile robot is control to find obstacles in a given range and to avoid them. Continuously it detects the obstacle in its ways by emitting ultrasound waves. These wave gets reflected back whenever there is obstacle and thereby it sends a voltage signal to the micro controller and according to those signals microcontroller directs the mobile robot by controlling the D.C. motors. Microcontroller simultaneously receives signals from the temperature sensor. A diode can be used as temperature sensor If there is a high temperature in work volume of the mobile robot then the microcontroller stops it. According to the signal given by the ultrasonic sensor the fuzzy rules set the motors either forward or reverse. If ultrasonic sensor detect any obstacle in the ranges (left) 15° to 65° and (front) 65° to 115° and (right) 115° to 165° it give signal that respective region is near.

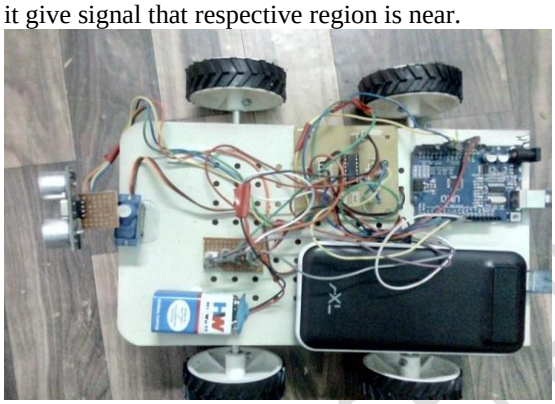

Figure : ACOUSTIC CONTROL MOBILE ROBOT (TOP VIEW)

V.RESULT:

The controlling of mobile robot is done using acoustic sensor (ultrasonic sensor),by programming microcontroller with the use of C-language and using ATMEGA328P micro controller.

VI.CONCLUSION:

The type embedded system is used for this project and all the hardware is used is standard The integration of all parts to complete and execute the project is the mechatronics application.

Future scope: This mobile robot can be improve for navigating the material handling and we can record the map and optimizes the time for material handling with the help of storing recording devices. It can utilize for spying or for observing the threats in military by integrating it with camera. This concept helps us to understand the concept of sonar technology, because it has similarities and can implement in ocean research.

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