NEW HORIZON
COLLEGE OF ENGINEERING
New Horizon Knowledge Park, Ring Road, Marathalli
Autonomous College Permanently Affiliated to VTU, Approved by AICTE & UGC
Accredited by NAAC with 'A' Grade, Accredited by NBA

ULTRASONIC 2D MAP-MAKER

A MINI PROJECT

REPORT

Submitted by

NAME OF THE STUDENTS

KARTHIKEYA M -1NH18EC723

RAHUL A -1NH18EC740

YOGESH V -1NH18EC147

In partial fulfilment for the award of the degree of

BACHELOR OF ENGINEERING

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

NEW HORIZON
COLLEGE OF ENGINEERING
New Horizon Knowledge Park, Ring Road, Marathalli
Autonomous College Permanently Affiliated to VTU, Approved by AICTE & UGC
Accredited by NAAC with 'A' Grade, Accredited by NBA

Bonafide Certificate

This is to Bonafide that the mini project report entitled "**ULTRASONIC 2D MAP-MAKER**" submitted by **"KARTHIKEYA M, RAHUL A AND YOGESH V** Department of Electrical Engineering, New Horizon College of Engineering, Bangalore in partial fulfilment for the award of the degree of Bachelor of Engineering , is a record of bonafide work carried out by him/her under my supervision, as per the NHCE code of academic and research ethics.

The contents of this report have not been submitted and will not be submitted either in part or in full, for the award of any other degree or diploma in this institute or any other institute or university. The project report fulfils the requirements and regulations of the institution and in my opinion meets the necessary standards for submission.

Mr RAJIV GOPAL	Dr. SANJEEV SHARMA
Guide	HoD

Acknowledgement

With immense pleasure and deep sense of gratitude, I wish to express my sincere thanks to my supervisor **Mr.RAJIV GOPAL**, Professor, Department of Electronics and communication Engineering, New Horizon College of Engineering, without her/his motivation and continuous encouragement, this mini project would not have been successfully completed.

I am grateful to the Chairman of New Horizon Educational Institution, **Dr. Mohan Manghnani** for motivating me to carry out research in the NHCE and for providing me with infrastructural facilities and many other resources needed for my project work.

I express my sincere thanks to **Dr. Sanjeev Sharma** HoD, Department of Electronics and communication Engineering, New Horizon College of Engineering for his kind words of support and encouragement.

I wish to extend my profound sense of gratitude to my parents for all the sacrifices they made during my project and providing me with moral support and encouragement whenever required.

Date:

Place: BANGALORE

KARTHIKEYA M

RAHUL A

YOGESH V

Ultrasonic 2D map-making

ORIGINALITY REPORT

15%	%	15%	%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	"Computer Numerically Controlled Machine to Draw text on Ardunio-based Acrylic Board", International Journal of Recent Technology and Engineering, 2019 Publication	3%
2	Ashish Patankar, Tooraj Nikoubin. "Wearable System for Obstacle Detection and Human Assistance Using Ultrasonic Sensor Array", Proceedings of the 7th International Conference on Computing Communication and Networking Technologies - ICCCNT '16, 2016 Publication	2%
3	M.Senthil Sivakumar, Jaykishan Murji, Lightness D Jacob, Frank Nyange, M. Banupriya. "Speech controlled automatic wheelchair", 2013 Pan African International Conference on Information Science, Computing and Telecommunications (PACT), 2013	2%

ABSTRACT

Vision is one of the most electrifying senses you can bestow on your robot. The ability to perceive obstacles allows a robot to make a sophisticated decision regarding further movements.

However, it is also not the easiest senses to execute for a few reasons. Firstly, vision can be abstracted to a two-dimensional vector when it comes to computing, as contrasting to a single dimensional scalar such as, say, temperature. Secondly, it is an analog value like many other senses, so it requires a positive degree of digitization and processing for it to make sense to a computer. Finally, though this is not firmly a problem, is visualization. Vision data cannot be represented as simple numbers to humans. even though that is how computers process data, it makes no sense for a human to decipher digits. However, with the help of modern machinery, and fundamental knowledge of physics and math, we will be able to bestow our robot with the present of vision.

TABLE OF CONTENTS

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

The term “mapping technology” refers to the various technologies available for measurement. The distance to the room map. The two main types of technology are electromagnetic energy and sound. Waves, these categories also include different frequencies. All these differences To determine the most useful frequencies for this project, you need to compare the frequencies.

There have been many advances in the development of cartographic technology. In recent years, these technologies have been used in applications such as autonomous robots. Plan your room to avoid obstacles before moving forward. Key concepts underlying these technologies A wave of energy is emitted from the transmitter, reflected from the surface and picked up by the receiver. Pick up the reflected wave. Distance between sensor and surface Time difference between transmitting and receiving waves.

This project uses an ultrasonic sensor. Distance is measured by creating sound waves that go beyond the limits of human hearing and calculating the time it takes for these waves to reach the obstacles and return. This is similar to the principle used on bats and cruise liners.

This task depicts the utilization of ultrasound in mapping the environmental factors with the assistance of a Ultrasonic sensor and Arduino Uno Board. Bats and Dolphins use ultrasound to help their vision and to move around. A similar standard is utilized by journey boats to explore and get readings from somewhere inside the sea. A similar technique for profundity recognition has been utilized here to plot the 2-D diagram of the general condition. Dynamic ultrasound has been utilized to get the possibility of the separation between the BOT and the general condition.

CHAPTER 2

LITERATURE SURVEY

“The Idea” Army, Navy and the Air Force employ this technology. The use of such technology has been seen lately in the self-parking car systems launched by AUDI, FORD etc. And even the forthcoming driverless cars by Google like Prius and Lexus. This arrangement can be used in any systems the client may desire to use like in a car, a bicycle or something else. The use of Arduino in this provides even more elasticity of usage of the above-said unit according to the necessities. The idea of building an ULTRASONIC RADAR came as a piece of a study carried out on the functioning and mechanism of “mini radar”. Hence this instance we were able to get a hold of one of the Arduino boards, Arduino UNO.

So knowing about the power and immense processing capabilities of the Arduino, we thought of making it huge and a day to day application specific module that can be used and configured easily at any place and by everyone. Moreover, in this quick moving world there is an enormous need for the gear that can be used for the betterment of the mankind rather than disturbing their lives. Hence, from the thought of the self-driving cars came the idea of self-parking cars. The main trouble of the people in the world is protection while driving. So, this gave up a solution to that by making use of this project to continuously scan the area for traffic, population etc.

Autonomous robotic mapping/explorations have led us to places well beyond our reach or places where human expeditions are too dangerous, technically challenging, too expensive or all three. The mars expedition of 2004 is one such example where human beings are not able to venture to. Even though humans are capable of building vehicles which can venture into the deepest parts of the oceans there are factors such as life threatening risks, operational costs and limited availability still that prevent them from doing so. Thus come in the autonomous robots that provide none of the life threatening risks that human expeditions hold. They are able to take and convey readings from their surroundings, which later once run through several algorithms, give a 2D image of

their environment.

CHAPTER 3

EXISTISING SYSTEM AND PROBLEM STATEMENT

Ultrasonic mapping itself is not a technology that needs to be developed from scratch; many products available now use lasers, ultrasonic sound or other forms of sources to create images. For example, there is a company named 2D ultrasonic Mapping which focuses entirely on using ultrasonic to create maps of areas. their product is a hand-held tool which records images using ultrasonic while the user walks through an area, and a 2D map is created based on this data in a short time. The downside of this device is that it does take time; the image is not created instantly, and the user must walk around the area to gather the data. This company does have another similar product, which is mounted onto a robotic platform instead of being held by a person, which means it can be used in potentially dangerous environments without worrying. However, like before, this process takes time to create the image, which means it is not suitable for emergency use.

RISC laboratory constructed two mobile robots for this research based on DFRobotShop Rover V2-Arduino Compatible Tracked Robot from RoboShop. The robot was fitted with a Seeed Ultrasonic Sensor, a distance measuring module and a Bluetooth/XBee communication device. The Seeed Ultrasonic Sensor provided detecting range from three centimetres to 400 centimetres at 40k Hz frequency. The Seed Ultrasonic Sensor is positioned in front of the robot on a simple servo-based pan system (see fig. 2). This sensor provides three measured distances in 180o sonar scan coverage. The three measured information are taken from left, front, and right of the robot each at an angle 90o apart (see fig. 3). It is vital that these values are taken in every twenty centimetres apart when moved in forward direction. Since the summation of forward moving direction provided a rough estimated of a room’s length.

PROBLEM STATEMENT

Can the principle of SONAR be used to map the surrounding environment?

CHAPTER 4

PROPOSED METHODOLOGY

BLOCK DIAGRAM

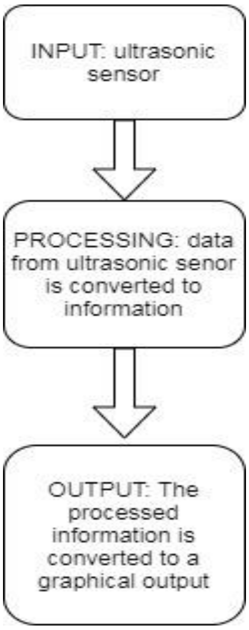

Figure 1

CIRCUIT DIAGRAM

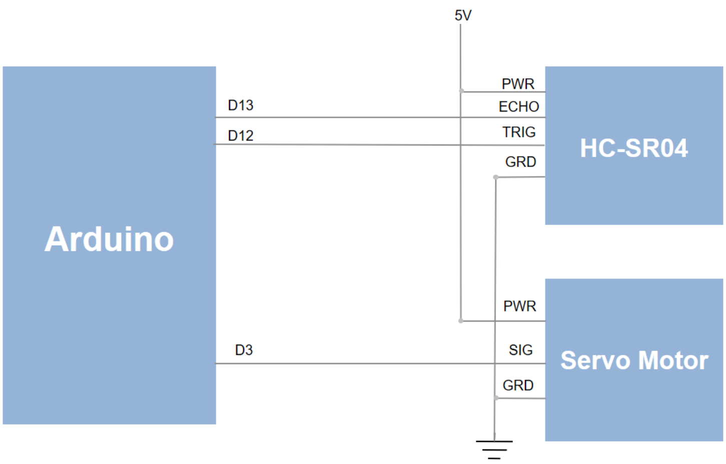

Figure 2

5 volts will go the power of ultrasonic sensor and the servo motor. ground is connected to the ground pins of the ultrasonic sensor and the motor as well. digital pin is connected to the echo pin of the ultrasonic sensor. Echo pin is an Output pin. This pin goes high for a period of time which will be equal to the time taken for the US wave to return back to the sensor. Each pin has an internal pull-up resistor which can be turned on and off using digitalWrite() (w/ a value of HIGH or LOW, respectively) when the pin is configured as an input. The maximum current per pin is 40 mA. Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. Digital pin 12 will be connected to the trigger pin of the ultrasonic sensor. Trigger pin is an Input pin. This pin has to be kept high for 10us to initialize measurement by sending Ultrasonic wave. Digital pin 3 will be connected to the signal pin of the servo motor. Servo motors have three wires: power, ground, and signal. The power wire is typically red, and should be connected to the 5V pin on the Arduino or Genuino board. The signal pin is typically yellow, orange or white and should be connected to pin 9 on the board.

WORKING

The working consists of three phases. The first phase is responsible for the signal generation, transmission, and reception. This is achieved by using the ultrasonic sensor array. We have used HC-SR04 sensors which work on 5V supply and generate a chirp signal with a frequency of 40 KHz. This phase is followed by the signal processing phase and the output phase. The system can be shown as in the figure given belo

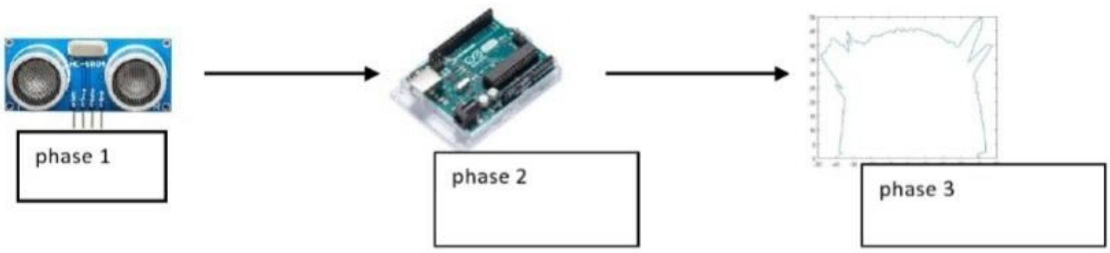

Figure 3

Signal processing is achieved by using the arduino uno. this is a well known approach which is used for signal processing. Arduino is a single-plate microcontroller designed to create interactive applications of objects or environments easier. the fabric consists of associate open supply hardware board designed round the 8-bit Atmel AVR controller or the 32-bit Atmel ARM. It can be programmed by using C coding for different types of programming levels. For a wide range output, we use the servomotor which helps us get output data of a 180 degree range .The 2D mapping is represented in terms of the projections offered by each plane. These projections are implemented using MATLAB.

FLOW CHART

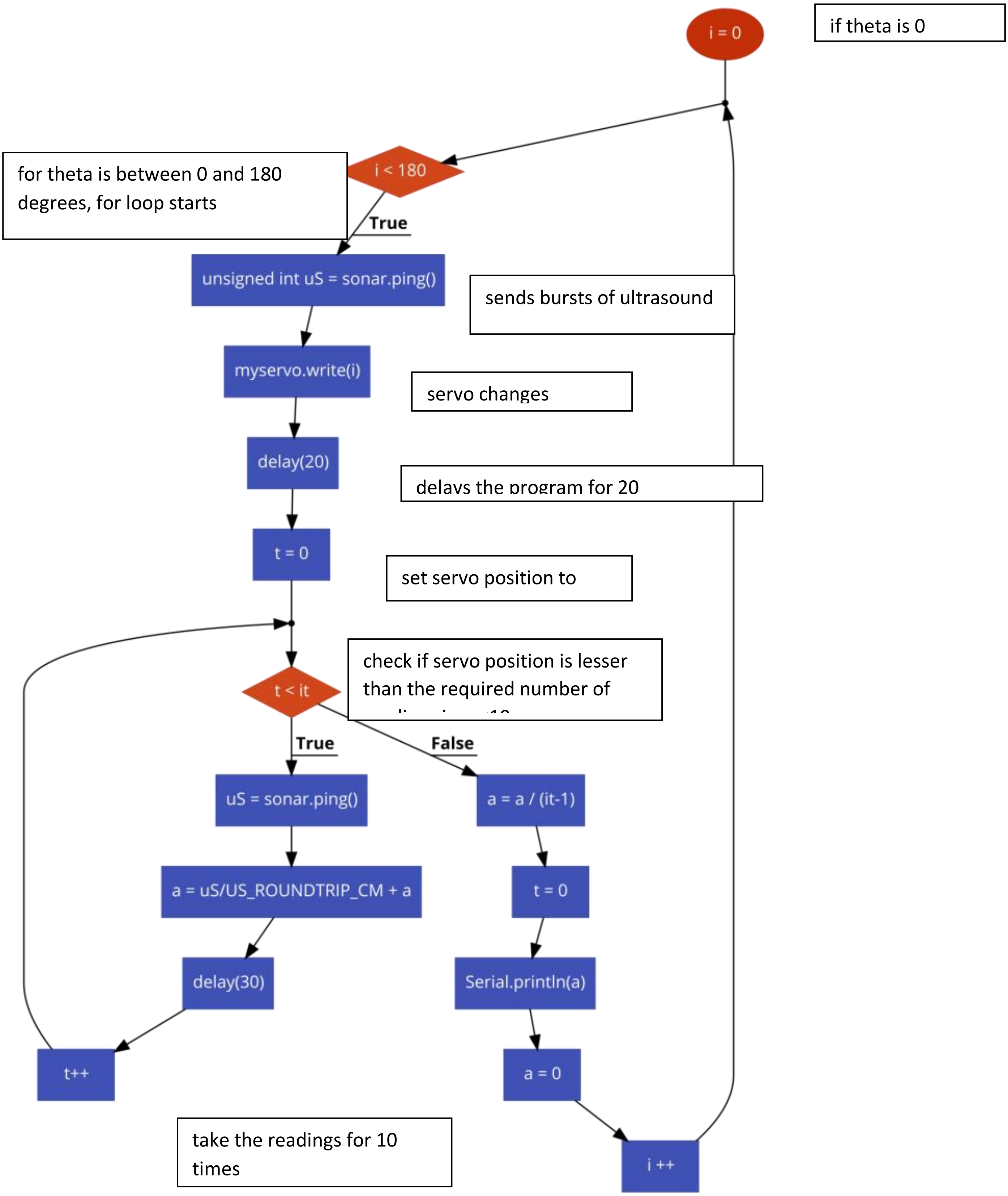

Figure 4

CHAPTER 5

PROJECT DESCRIPTION

A. HARDWARE DESCRIPTION:

1) ARDUINO UNO

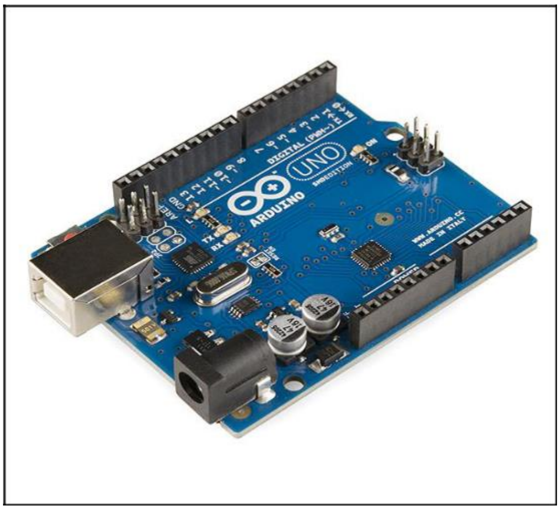

Figure 5

The development panel contains 14 digital I / O ports (six can output PWM), and 6 analog I / O ports, and can be programmed through Arduino IDE (Integrated Development Environment) through a USB Type-B cable, or via a USB battery cable External 9 volts, although it can accept voltages between 7 and 20 volts. It is some were similar to Arduino Nano and also Leonardo.

Material reference design is distributed under an ingenious Commons Attribution Share-Alike 2.5 license and might be found on the Arduino website. Planning and production documents may also be used for specific versions of the fabric.

The word "uno" means "one" in Italian and was chosen because the original version of the Arduino program. Is Uno the primary in a very series of USB-based Arduino boards?] Arduino IDE 1.0 is that the reference version of Arduino and has now evolved into a more modern version. ATmega328 is pre-programmed on the board with a boot loader that may send new code thereto without the utilization of external hardware developers.

The Arduino project started in Ivrea (IDII), Interaction Design Institute, Ivrea, Italy. At the time, students used the BASIC Stamp microcontroller, which was a large fee for many students. In 2003, Hernando Barajan created the wire development platform for the IDII graduate thesis project, which was implemented under the supervision of Massimo Banzi and Casey Rias, and they are known for their editing languages. The purpose of this project is to create simple, low-cost tools for non-engineers to create digital project.

But instead of continuing with the wiring work, they commissioned the project and renamed it Arduino. The first Arduino cards used FTDI USB for Serial Driver chips and ATmega168. Uno is different from all previous motherboards, it has ATmega328P controller and ATmega16U2 (Atmega8U2 to R2) USB serial adapter.

The wire platform consists of an electrical printed circuit (PCB) with ATmega168 controller, the IDE relies on editing and library functions, and will program the microcontroller easily.

General pin functions:

• LED indicator: There is a built-in LED indicator removed from the digital end 13. When the pin is high, the LED indicator lights up; when the pin is low, it turns off.

• VIN: When using an external power source, the input voltage of the Arduino / Genuino development board (as opposed to 5 volts from a USB connection or other adjustable power source). You can save voltage through this pin, or if you supply the voltage through a power outlet, you can access it through this pin.

• 5 V: This adjustable 5-pin pin extracts from the regulator on the board. The board can be powered by DC socket (7-20V), USB socket (5V) or VIN pin (7-20V) for the board. The voltages supplied via the 5V or 3.3V pin will exceed the regulator and the circuit board may be damaged.

• 3V3: 3.3V power generated by the built-in voltage regulator. The maximum current consumption is 50 mA.

• GND: Ground Pin.

• IOREF: This Arduino / Genuino pin provides reference voltage for the microcontroller operation. The correct shielding layer design can read the voltage at the IOREF pin and select the appropriate power source, or allow the voltage transformer at the output to operate at 5V or 3.3V. Reset: Usually used to add the back button to protect things on the board.

• RESET: Usually used to add the back button to protect things on the board.

Special pin functions:

Uno 14 digital and 6 analog pins is used for input or output under program control (using pin function), digital recording () & and digital reading () working at 5 volts. Each pin can provide or receive 20 mAh as the recommended working condition and has an internal fastening resistance of 20-50 km (by default, it is divided). Any I / O station should not exceed 40 mA max to avoid permanent damage to the microcontroller. Uno has 6 analog inputs called A0 to A5. Each provides 10-bit precision (i.e. 1024 different values). By default, actually the measurement range is from ground to 5 volts, but the upper bound of the range can be definitely changed using the AREF pin and the Analog Reference () function. In addition to this, some pins also have special functions:

• Serial / UART: Used to receive (RX) and send TTL serial data. These pins are attached to the pins corresponding to the ATmega8U2 USB-to-TTL serial chip.

• External interrupt: pins 2 and 3. These pins can be configured to create interruptions when they are low, up, down, or change in value.

• PWM: pins 3, 6, 5, 10, 9, and 11. PWM output can provide 8-bit with AnalogWrite () function.

• SPI (Serial Terminal Interface): pins 10 (SS), 11 (MOSI), 12 (MISO), and 13 (SCK). These pins support a SPI connection using the SPI library.

• TWI / I^2C: SDA (A4) Pin and SCL Pin (A5). Support for TWI connections using the Wire Library.

• AREF (analog reference): reference voltage of the analog input.

•

Communications:

Arduino Uno contains many tools for communicating with the computer, another Arduino / Genuino development board or another microcontroller. ATmega328 provides UART TTL (5V) serial communication, which can be used in 0 (RX) and 1 (TX) digital pins. ATmega16U2 on the board sends this serial connection via USB and displays it as the default software port on the computer. However, in Windows, an .inf file is required. Arduino (IDE) has a serial display that allows you to send simple text data between forms. When transferring data via USB to the serial chip and USB connection to the computer, the RX and TX indicators on the board will flash (but not for serial connections over the years 0 and 1). The serial programs library allows serialization.

2)SERVO MOTOR

Servo motors are rotary or linear drives that allow precise control of angular or linear position, speed and acceleration. It consists of a suitable motor connected to a position feedback sensor. You also need a relatively sophisticated controller. In many cases, this is a special module specifically designed for servomotors. Servomotors do not belong to a specific class of motors, but the term “servomotor” is often used to refer to a motor suitable for use in a closed-loop control system. Servo motors are used in areas such as robotics, CNC machines and automated manufacturing.

Figure 6

Servo motors are closed loop servo mechanisms that use position feedback to control their movement and end position. The input to this control is a signal (analog or digital) representing a given position on the output shaft.

A motor is coupled to some type of position sensor to provide feedback on position and speed. In the simplest case, only the position is measured. The measured output position is compared with the command position, which is the external input for the controller. If the output position is different from the desired position, an error signal will be generated and the motor will rotate in any direction to set the output shaft to the correct position. As the position approaches, the error signal resets and the engine stops.

A very simple servomotor uses only positioning using a potentiometer and motor control. The engine will always rotate (or stop) at full speed. This type of servomotor, although not widely used in industrial motion control, forms the basis of simple, inexpensive servos used in radio-controlled models.

More advanced servomotors use an optical rotation sensor to measure the speed of the output shaft and a variable speed drive to control the speed of the motor. Both of these enhancements can usually be combined with a PID control algorithm to move the servomotor to a specified position more quickly and accurately with less overshoot

However there are a couple of downsides of using the SG90 tower pro servo motor they are:

• The motor cannot take readings of surroundings of more than 180.

• The motor only moves horizontally and not vertically.

3)ULTRASONIC SENSOR HC-SR04

The HC-SR04 ultrasonic distance sensor is a sensor used to determine the distance to an object using a sonar. HC-SR04 uses a non-contact ultrasonic sonar to measure the distance to the object and consists of two ultrasound transmitters (mainly loudspeakers), a receiver and a control circuit.

Figure 7

An ultrasonic transducer or transducer is a type of acoustic transducer that falls into three broad categories: transmitters, receivers, and transceivers. A transmitter converts electrical signals into ultrasonic waves, a receiver converts ultrasonic waves into electrical signals, and a transceiver can transmit and receive ultrasonic waves.

Like radar and sonar, ultrasonic transducers are used in systems that evaluate a target by interpreting the reflected signal. For example, you can calculate the distance to an object by measuring the time between sending a signal and receiving an echo. A passive ultrasonic sensor is a microphone that detects ultrasonic noise present under certain conditions.

Ultrasound can be used to measure wind speed and direction (anemometer), fluid level in tanks or channels, and speed through air or water. To measure speed or direction, the device uses several detectors and calculates the speed from the relative distance to particles in air or water. To measure the liquid level in a tank or channel and sea level (tide sensor), the sensor measures the distance (distance) to the surface of the liquid. Further applications include humidifiers, sonar, medical ultrasound, burglar alarms, non-destructive testing and wireless charging.
Systems typically use transducers that convert electrical energy into sound and generate sound waves in the ultrasonic range (above 18 kHz), and when they receive echo signals, they turn sound waves into electrical energy that can be measured and displayed.

The technology can also detect approaching objects and track their location.

Ultrasound can also be used to measure the distance from point to point, sending and receiving discrete pulses of ultrasound between the sensors. This method is based on sono-time during which the transit time of an ultrasound signal is measured electronically (i.e. digital) and is mathematically converted to the distance between the transducers, assuming that the speed of sound in the medium between the transducers is known. Known as micrometry. Flight time measurements, the same incident (reception) reference level or waveform

Disadvantages of Using the HC-SR04 Sensor

- Poorer discriminatory ability than vision
- Susceptible to noise/distortion
- Can produce erroneous data (reflections)

4) CONNECTING WIRES:

The wire is a single, usually cylindrical, flexible thread or metal rod. Wires are used to carry mechanical loads or electrical and telecommunications signals. The wire is usually formed by drawing the metal through the hole in the die or draw plate. The wire gauges come in various standard sizes as expressed in terms of gauge number. Like "multistrand wire", the term 'wire' is more loosely used to refer to a bundle of such threads, more properly called a wire rope or an electrical cable in mechanics.

5) USB b cable

Universal Serial Bus (USB) is an industry standard that sets specifications for cables, connectors, and connection, communication, and power (interface) protocols between computers, peripherals, and other computers. [3] The USB standard, released in 1996, is currently supported by the USB Developer Forum (USB-IF). There are four generations of USB specifications: USB 1.x, USB 2.0, USB 3.x, and USB 4.

Figure 8

USB was designed to standardize the connection between peripheral devices and a PC, as well as for communication and power. It has largely replaced interfaces such as serial and parallel ports, and has become popular on a wide range of devices. Examples of USB-connected peripherals include computer keyboards and mice, camcorders, printers, portable media players, disk drives, and network adapters.

6)POWER SOURCE

Choosing an appropriate power source is crucial to ensuring the reliability of the mapping device. In order to fit the needs of this device, the power source must be portable and able to provide output for long periods of time without fully discharging. Different types of batteries were compared and their pros and cons weighed against one another. The power source will evolve with the progression of this project. For the proof-of-concept stage, the device does not necessarily need to be portable. In this stage, the device will be powered through a wired connection to a computer, where the data from the sensors will be sent. In later stages where the communication is wireless, the device will be battery-powered. Single-use alkaline batteries 27 are the optimal choice for this project due to their reliability versus rechargeable batteries. It was decided that alkaline batteries would be used due to their performance in the value analysis. Without having to worry about hydrogen leaks from charging and with the proper heat protection, the threat of an explosion occurring is diminished. The Arduino inside the device requires little power to operate, relative to the stepper motor. The chosen power source for the device is a set of alkaline AA batteries. These batteries provide 12 volts, which is enough to power the servo motor, as well as the other components. The Arduino and the motor shield can easily be powered from this source, so the device only requires a single power source.

B. SOFTWARE DESCRIPTION:

1)ARDUINO UNO

Figure 9

What is Arduino?

Arduino is basically an open source platform with easy-to-use programs and programs. The Arduino board can actually read the sensor input light - converting it to engine output playback, LED playback and content posting online. By sending a set of commands to the microcontroller on the motherboard, you will tell the motherboard what to do. For many years, from everyday objects to aristocratic scientific instruments, Arduino has been the mastermind of thousands of works. This open source platform brings together a global community of manufacturers, students, hobbies, artists, developers, and professionals. Their contributions add a lot of information and can greatly help novices and experts.

Arduino was born at the Ivrea Interaction Design School, a fast and easy-to-use original tool, especially suitable for college students without an electronic background and programming.

After entering the wider community, the Arduino development team started making changes to adapt to new needs and challenges, and expanded its product range from simple 8-bit tables to 3D IoT applications for portable and compact environmental products. All Arduino development boards are completely open source, allowing users to work

independently, and ultimately customize them according to their specific needs. The program is also open source and is developed through contributions from users all over the world.

2)MATLAB.

MATLAB (matrix laboratory) is a multi-paradigm numerical computing environment and proprietary programming language developed by MathWorks. MATLAB allows matrix manipulations, plotting of functions and data, implementation of algorithms, creation of user interfaces, and interfacing with programs written in other languages.

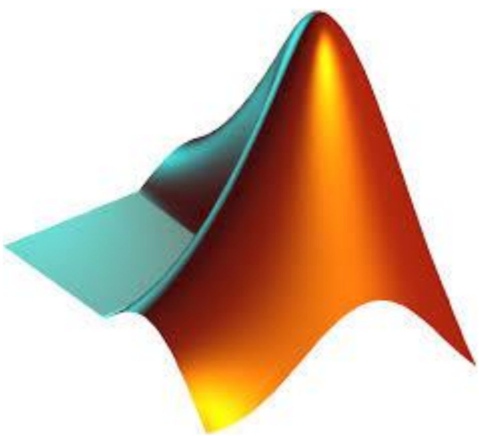

Figure 10

Although MATLAB is intended primarily for numerical computing, an optional toolbox uses the MuPAD symbolic engine allowing access to symbolic computing abilities. An additional package, Simulink, adds graphical multi-domain simulation and model-based design for dynamic and embedded systems.

The MATLAB application is worked around the MATLAB programming language. Regular utilization of the MATLAB application includes utilizing the "Order Window" as an intuitive scientific shell or executing content documents containing MATLAB code

MATLAB can call capacities and subroutines written in the programming dialects C or Fortran. A wrapper work is made permitting MATLAB information types to be passed and returned. MEX documents (MATLAB executables) are the progressively loadable article records made by incorporating such functions. Since 2014 expanding two-path interfacing with Python was being added.

Libraries written in Perl, Java, ActiveX or .NET can be legitimately called from MATLAB,and numerous MATLAB libraries (for instance XML or SQL support) are executed as wrappers around Java or ActiveX libraries. Calling MATLAB from Java is increasingly entangled, yet should be possible with a MATLAB toolbox which is sold independently by MathWorks, or utilizing an undocumented system called JMI (Java-to-MATLAB Interface), (which ought not be mistaken for the irrelevant Java Metadata Interface that is additionally called JMI). Official MATLAB API for Java was included 2016.

CHAPTER 6

ADVANTAGES AND APPLICATION

Advantages

1) Its not affected by color or transparency of objects: Ultrasonic sensors reflect sound off of objects, so the color or transparency have no effect on the sensor's reading
2) Can be used in dark environment :Unlike proximity sensors using light or cameras, dark environments have no effect on an ultrasonic sensor's detection ability.
3) Low-cost option: They are fully calibrated and ready to use. Generally they are low cost, high-quality sensors.
4) Not highly affected by dust, dirt, or high-moisture environments: Although the sensors work well in these environments, they can still give incorrect readings with a heavy build-up of dirt or water, especially in extreme conditions.
5) They have greater accuracy than many other methods at measuring thickness and distance to a parallel surface
6) Their high frequency, sensitivity, and penetrating power make it easy to detect external or deep objects
7) Our ultrasonic sensors are easy to use and not dangerous during operation to nearby objects, people or equipment
8) Our sensors easily interface with microcontrollers or any type of controller

Disadvantages:

1. Cannot work in a vacuum Because ultrasonic sensors operate using sound, they are completely nonfunctional in a vacuum as there is no air for the sound to travel through.

2. Not designed for underwater use These sensors have not been properly tested in this environment, so underwater use voids our warranty. This being said, we do supply documentation for customers who would still like to test our sensors underwater.

3. Sensing accuracy affected by soft materials ,Objects covered in a very soft fabric absorb more sound waves making it hard for the sensor to see the target.

4. Sensing accuracy affected by changes in temperature of 5-10 degrees or more Although this is true, we have a variety of temperature compensated sensors available that either calibrate upon start-up or before every range reading depending on the sensor model. During this time is when the sensor will calibrate with any change in temperature, voltage, etc. This dramatically decreases this problem.

5. Have a limited detection range At the moment, our longest range sensors have a maximum range of 10 meters, now our cargo sensor detects up to 16.5m. While this is a disadvantage in certain applications, our sensors have great mid-range capabilities and are still suited for many applications.

APPLICATIONS

1) Sonar technology can be used for defense purposes, such as environmental monitoring. It can also be used to detect and track enemy ships. You can also find submarines and enemy missiles, such as torpedoes under water.

2) Can be used to determine the depth of the seabed below the ship, which makes it safer to navigate

3) Now the pipeline test can be performed using a high-frequency scanning sonar.
Used to detect cracks to detect gas and oil leaks.

4) Can be used for observation purposes both above the ground and under water
Research missions are easy to complete.

5) Detection of abnormal machine parts.
6) Can be used for medical purposes, such as fetal detection

7) When passing through a large amount of material, ultrasonic waves are reflected at the interface Between different materials. This property can be used to detect defects in concrete. Or metal.

8) When ultrasound waves are transmitted, they are reflected at the interface Material and echo are returned. Measure the interval at which sound waves are sent Echo reception determines the distance to the target. Ultrasonic distance Measurements can be applied to any medium that carries sound, such as air and liquids. And metal.

9) Ultrasound is also used for welding plastics. High frequency Ultrasonic vibrations are used to weld some parts of plastic.

CHAPTER 7

FUTURESCOPE

In future we can upgrade this project in many ways.

1. Our current project is immobile and is capable of getting the mapped output only from a fixed place .so we can give it a set of wheels and make it mobile which moves around and we can be able to map and entire room with this. it can move to other places we can even make a blue-tooth controlled robot by using a blue-tooth module. with this our robot's movements can be controlled and we can make a map of the environment from a distance .

2. Since our current project has only one ultrasonic sensor, output mapping is limited to 180 degrees . we can add another ultrasonic sensor to get a 360 degree map of the environment. by this the field of vision of the robot is increased.

3. Since it is only limited less than 4m at its current stage ,we also have a chance to increase the range of mapping of the BOT by using a better quality sensor.
   for example the "sensix" ultrasonic senor claims to have a range of up-to 20m .

CHAPTER 8

CONCLUSION

The created model worked efficiently. the model gives us a map of 3 meters approximately in distance and a view of 180 degrees. the sound waves from the obstacles bounce back at a faster speed than the space where there is no obstacles thus creating a blocked region in the map. This maps the region where we have obstacles. The ultrasonic sensor took the reading twice and averaged the reading provided us with a more accurate result. the reading were mapped in MATLAB software. By this we can say that we can use the model to map the surrounding environment.

Now the device can receive signals from MATLAB and initiate operations. Collect data points and report to MATLAB. Here a 2D plot of the room using data gets Created. The graph showed some inaccuracy, which is probably due to the beam width. Sensor sent energy: repeats the same distance for one wall. Instead of steadily increasing the distance as the angle from the center of the wall increases.

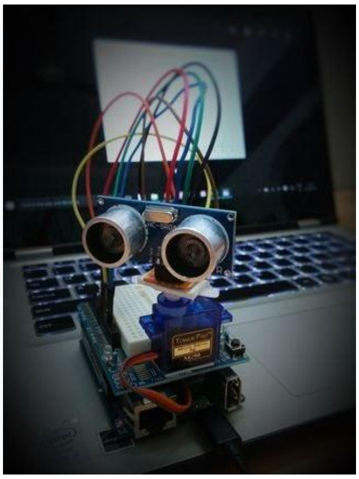

Figure 11

There are many ways that we can expand or improve in the future to achieve this project. Original goal. First, we need to eliminate the inaccuracy of the schedule.

APPENDIX

ARDUINO CODE:

```
#include <Servo.h>
#include <NewPing.h>

#define TRIGGER_PIN  12
#define ECHO_PIN     11
#define MAX_DISTANCE 200

NewPing sonar(TRIGGER_PIN, ECHO_PIN, MAX_DISTANCE);
Servo myservo;

int pos = 0;
int it = 10;

void setup() {
  myservo.attach(9);
  Serial.begin(9600);
  delay(3000);
}

void loop() {
  int i = 0;
  int t = 0;
  int a = 0;

  for (i = 0; i < 180; i ++)
  {
    unsigned int uS = sonar.ping();
    myservo.write(i);
    delay(20);
    for (t = 0; t < it; t++)
    {
      uS = sonar.ping();
      a = uS/US_ROUNDTRIP_CM + a;
      delay(30);
    }

    a = a / (it-1);
    t = 0;

    Serial.println(a);
    a = 0;
  }

}
```

MATLAB code

```
theta = 0:(pi/180):pi;
s = serial('COM10');
s.BaudRate=9600
fopen(s)
i = 0;

inc = 1;

while i<180
  A = fgets(s);
  num(i+1) = str2num(A);
  i = i+1;
end
fclose(s)

j = 1

while j<181
   tab(j,1) = (j-1)*inc
   tab(j,2) = num(j)
   tab(j,3) = num(j)*cosd((j-1)*inc)
   tab(j,4) = num(j)*sind((j-1)*inc)
   j = j+1
end
%figure
%polar(theta,num)

plot(tab(:,3),tab(:,4))
```