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DESIGN ANALYSIS OF LAND SURVEYING ROBOT USING ARDUINO UNO

K. Chidhambaram, S. Anil Kumar, T. Mohan Kumar, D. Dhanasekar

Assistant Professor, Department of Mechanical Engineering, Adhiparasakthi College of Engineering, Vellore, Tamilnadu, India

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Abstract - This paper is the idea of us to make the land survey by using a robot using the updated technology known as Arduino uno. Here, we have made a robot for survey the land. It is made especially for making the area calculation of the given land .The survey robot is entirely controlled by using Bluetooth module to move the robot to the entire land for survey. The total distance travelled in the land is calculated by using the timer concept, and then the obtained values are transmitted to LCD screen. The second process involves in area measurement module using Arduino/Genuino uno software allowing the user to determine the area of the land given for surveying. The Land Survey using a Robot is an effort being put to cater the needs of land survey, in particular, area measurement. Here a robot is being used for area measurement. Surveying or land surveying is the science and technique of accurately determining the terrestrial or three-dimensional position of points, distances and angles between them. To accomplish their objective, surveyors use elements of mathematics (which includes geometry and trigonometry), physics, engineering and law. Also, wide range of surveying equipments is used for this purpose.

Key Words: Land Measurement, Area Measurement, Arduino Uno.

1. INTRODUCTION:

Land surveying forms an integral part of this conversion. Survey Robot, also referred as SURVOBOT is being designed keeping in mind the complexities that are involved in present techniques of area measurement and land survey. Area measurement module. Timer concept is used to calculate the distance travelled by the robot and the value is transmitted to the LCD screen using Bluetooth technology. The advantages of this robot is that manpower required to carry out such area calculation activities can be reduced drastically and also the number of equipment's required. It helps both in time saving and achieving better accuracy compared to the conventional methodologies. Bluetooth technology is a bi-directional wireless communication technology for lower complexity, lower cost & power consumption. Also because of low data rate, this technology is mainly used in automatic control of systems.

2. LITERATURE SURVEY:

In olden days, the land is surveyed by the surveyor, as he needs several measuring instruments and he also wants to submit the complete sketch of the measured land. It may take more time and he may not be accurate at all times. The olden designed robots were controlled to instruct the humanistic robot by means of hand gestures using image processing technique. Similarly, the blob detection and image predefining were used to obtain the sign language of humans. In conventional survey operations, a primary requirement of the survey party is to determine distance between two points. The surveyor has many devices that are used to determine distance. These range from the 30-meter steel tape to electronic instruments. Distance measurement is a basic operation that every surveyor must be able to perform with the tools available.

Horizontal Taping — horizontal taping is used in conventional surveys. Measure the horizontal distance between the rear station and the forward station. Usually the distance between stations is more than a full tape length. The taping team determines the distance by measuring successive full tape lengths. When the distance remaining is less than a full tape length, the team measures the partial tape length. The total distance between the stations is determined by multiplying the number of full tape lengths by the length of the tape and adding the partial tape length.

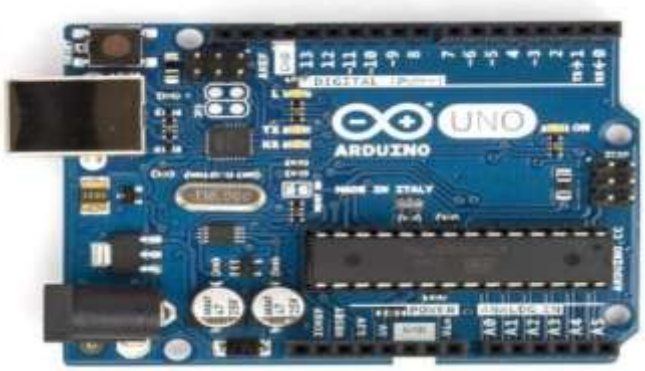
1. EDM — Survey sections equipped with the EDM (Electronic Distance Measurement) can measure distances in minimum time. The EDM is a compact, lightweight, economical, and simple-to-operate instrument that is especially suitable for short- and medium-range survey operations. The EDM consists of the distance meter and the retro reflector prisms. The distance meter and the retro reflectors are packaged and transported in separate carrying cases—the distance meter case and the retro reflector cases.

3. ARDUINO UNO

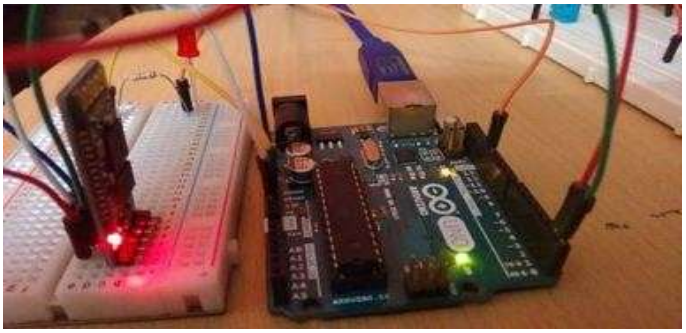
The Arduino Uno board is a microcontroller based on the ATmega328. It has 14 digital input/output pins in which 6 can be used as PWM outputs, a 16 MHz ceramic resonator, an ICSP header, a USB connection, 6 analog inputs, a power jack and a reset button. This contains all the required support needed for microcontroller.

3.1 SPECIFICATIONS:

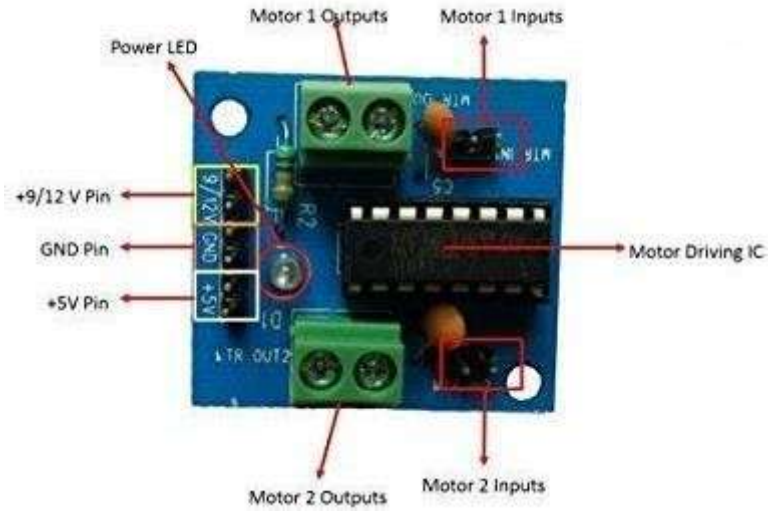
1. Microcontroller ATmega 328
2. Operating Voltage 5V
3. Input Voltage (recommended) 7-12V
4. Input Voltage (limits) 6-20V
5. Digital I/O Pins 14 (of which 6 provide PWM output)
6. Analog Input Pins 6
7. DC Current per I/O Pin 40Ma
8. DC Current for 3.3V Pin 50 mA



The Arduino Uno can be programmed with the Arduino software (download). Select "Arduino Uno from the Tools > Board menu (according to the microcontroller on your board). For details, see the reference and tutorials. The ATmega328 on the Arduino Uno pre burned with a boot loader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original 500 protocol (reference, C header files). You can also bypass the boot loader and program the microcontroller through the ICSP (In-Circuit Serial Programming) header; see these instructions for details. The ATmega16U2 (or 8U2 in the rev1 and rev2 boards) firmware source code is available.



3.2 L239D:



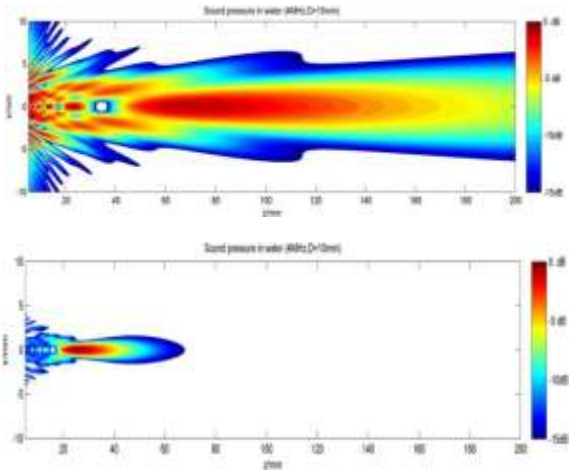
L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motors with a single L293D IC. Dual H-bridge Motor Driver integrated circuit (IC).The l293d can drive small and quiet big motors as well. VCC is the voltage that it needs for its own internal operation 5v; L293D will not use this voltage for driving the motor. For driving the motors it has a separate provision to provide motor supply VSS (V supply). L293d will use this to drive the motor. It means if you want to operate a motor at 9V then you need to provide a Supply of 9V across VSS Motor supply. The maximum voltage for VSS motor supply is 36V. It can supply a max current of 600mA per channel. Since it can drive motors Up to 36v hence you can drive pretty big motors with this l293d.VCC pin 16 is the voltage for its own internal Operation. The maximum voltage ranges from 5v and up to 36v. A DC motor is not the same as a "gear motor" - a "gear motor" may be an AC or DC motor coupled with a gearbox or transmission. A gear motor adds mechanical gears to alter the speed/torque of the motor for an application. Usually such an addition is to reduce speed and increase torque. A gear motor is a specific type of electrical motor that is designed to produce high torque while maintaining a low horsepower, or low speed, motor output. Gear motors can be found in many different applications, and are probably used in many devices in your home.

To control the speed, the input voltage is varied using pulse width modulation. To control a DC motor from a microcontroller, you use switching arrangement known as an H bridge. It looks like this: When switches 1 and 4 are closed and 2 and 3 are open, voltage flows from the supply to 1 to the motor to 4 to ground.100RPM 12V DC geared motors for mostly used in

robotics applications. Very easy to use and available in standard size. Nut and threads on shaft to easily connect and internal threaded shaft for easily connecting it to wheel.

ULTRASONIC SENSOR:

Ultrasonic transducers or ultrasonic sensors are a type of acoustic sensor divided into three broad categories: transmitters, receivers and transceivers. Transmitters convert electrical signals into ultrasound, receivers convert ultrasound into electrical signals, and transceivers can both transmit and receive ultrasound. In a similar way to radar and sonar, ultrasonic transducers are used in systems which evaluate targets by interpreting the reflected signals. For example, by measuring the time between sending a signal and receiving an echo the distance of an object can be calculated. Passive ultrasonic sensors are basically microphones that detect ultrasonic noise that is present under certain conditions.



1. Sound field of a non-focusing 4 MHz ultrasonic transducer with a near field length of N = 67 mm in water. The plot shows the sound pressure at a logarithmic db.-scale.

2. Sound pressure field of the same ultrasonic transducer (4 MHz, N = 67 mm) with the transducer surface having a

spherical curvature with the curvature radius R = 30 mm.

Ultrasonic sensors can detect movement of targets and measure the distance to them in many automated factories and process plants. Sensors can have an on or off digital output for detecting the movement of objects, or an analog output proportional to distance. They can sense the edge of material as part of a web guiding system. Ultrasonic sensors are widely used in cars as parking sensors to aid the driver in reversing into parking spaces. They are being tested for a number of other automotive uses including ultrasonic people detection and assisting in autonomous UAV navigation. Because ultrasonic sensors use sound rather than light for detection, they work in applications where photoelectric sensors may not.

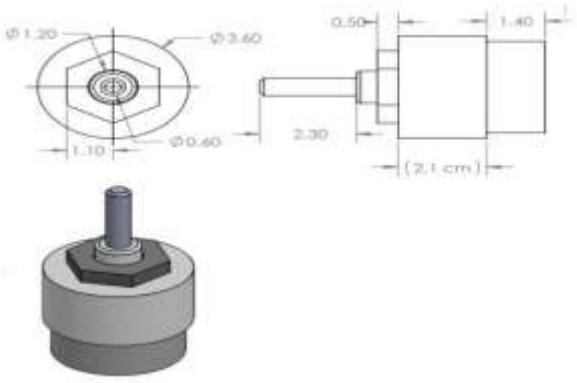


Fig-1: Layout of the 100 rpm Motor

JUMPER WIRES:

The jumper wires used in Arduino uno and breadboards is of three major types they are as follows.

- Male to male jumper wires.
- Male to female jumper wires.
- Female to female jumper wires

Fig-2: Male to Male Jumper Wire

Fig-3: Male to Female Jumper Wire

Wires suitable for prototyping these wires can be connected to any header with a 2.54 mm (0.1") pitch. Handy for making wire harnesses or jumpering between headers on PCB's they have 0.1" sockets on either end or fit cleanly next to each other on standard-pitch header. For best results, when plugging these in a line, have the sides with the 'silver latch bit' sticking out since that side is a tiny bit wider.

MALE TO FEMALE JUMPER WIRES:

These premium jumper wires are 6" (150mm) long and come in a 'strip' of 40 (4 pieces of each of ten rainbow colors). They have 0.1" male header contacts on one end and 0.1" female header contacts on the other. They fit cleanly next to each other on standard-pitch 0.1" (2.54 mm) header. The best part is they come in a 40pin ribbon cable. You can always pull the ribbon wires off to make individual jumpers, or keep them together to make neatly organized wire harnesses. This male to female jumper wires are used robotics and embedded projects for interfacing devices. Electrical wiring is an electrical installation of cabling and associated devices such as switches, distribution boards, sockets and light fittings in a structure. Wiring is subject to safety standards for design and installation. Allowable wire and cable types and sizes are specified according to the circuit operating voltage and electric current capability, with further restrictions on the environmental conditions, such as ambient temperature range, moisture levels, and exposure to sunlight and chemicals. Associated circuit protection, control and distribution devices within a building's wiring system are subject to voltage, current and functional specification. Wiring safety codes vary by locality, country or region. The International Electro technical Commission (IEC) is attempting to harmonize wiring standards amongst member countries, but significant variations in design and installation requirements still exist.

METHODOLOGY:

Initially the required materials and equipment's are taken then design layout of chassis is made to eradicate the accuracy of the measurement by the robot. Hence required program is created by using Arduino uno software and then the created code is then transmitted to the Arduino uno board. The motor driver is connected the Arduino followed by the respective pins given in the program for Arduino uno.as per the program the 100 rpm motors are connected at the either side of the chassis. Then the Bluetooth module is connected with the Arduino to receive the signals for the movement of the robot from the mobile similarly the roller ball is inserted at the front of the chassis. Hence ultrasonic sensor is placed at the top of the chassis to get the estimated accurate reading is going to be measured by the plotting values of the given land. The value measured by the robot will be displayed in the given LCD screen connected along with the Arduino uno board. Then the photodiode and infrared sensor is inserted at either side of the chassis to detect the obstacle that reaches the robot. For controlling the robot we have generated the app to control the movement if the robot directions such as forward, backward, left, right, etc. and also the land mapping diagram is received through the Bluetooth module to the laptop. Finally the methodology of our robot is explained above clearly.

APPLICATION (APP) PAGE FOR OUR PROJECT:

We have created an app to control the overall movement of the robot using Arduino uno. An app is generated through the Mit app inventor for the easy transferring of data from the mobile device to the Arduino uno through the Hc-05 Bluetooth module. According to the Arduino uno coding the app is generated and the created program is then inserted. Then the app is to be opened and connect the Bluetooth device which is connected to the Arduino uno and move the robot using this device and finally measure the values using ultrasonic sensor connected to Arduino.

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