Vol-08 Issue 05, May -2024 ISSN: 2456-9348
Impact Factor: 7.936

iJETRM
International Journal of Engineering Technology Research & Management

FABRICATION AND ANALYSIS OF AUTOMATIC LINEAR DISTANCE ADJUSTER

**Mr. J. Likhin Kumar, Mr. K. Ajay Kumar, Mr. K. Chandramouli Varma,
Mr. B. Prabhu Pavan**
Department of Mechanical Engineering, Nadimpalli Satyanarayana Raju Institute of Technology, Visakhapatnam.
Mrs. B Usha Rani,
Sr. Assistant Professor, Department of Mechanical Engineering, Nadimpalli Satyanarayana Raju Institute of Technology, Visakhapatnam.

Abstract:
The Automatic linear distance adjustment system tailored for robotics arms, capitalizing on ultrasonic sensor technology. The system's design, implementation, and evaluation are comprehensively explored, highlighting its ability to facilitate precise and autonomous adjustments of linear positions within the robotic arm's operational envelope. Real-time feedback mechanisms are integrated, enabling dynamic regulation of the distance between the end-effector and target objects or surfaces. This ensures optimal positioning and operational efficiency during various tasks such as pick-and-place operations, assembly processes, and object manipulation. By reducing reliance on manual adjustments, the system enhances automation and augments robotics arms' capabilities across diverse industrial and research applications. The seamless integration of the proposed system empowers robotics arms with heightened flexibility, accuracy, and adaptability, thereby fostering advancements in robotic automation and control. This innovation holds promise for streamlining manufacturing processes, enhancing productivity, and facilitating intricate tasks that demand precision and efficiency in robotic operations. Through rigorous evaluation and validation, the system demonstrates its potential to revolutionize robotic arm functionalities and pave the way for future developments in automation technologies

Keywords:
Arduino Uno , Ultrasonic sensor, Stepper Motor, Linear guide rail .

---

1. Introduction:

The objective of this Automatic linear distance adjuster is to develop, implement, and evaluate an automatic linear distance adjustment system specifically tailored for robotics arms. This system aims to leverage ultrasonic sensor technology to enable precise and autonomous adjustments of linear positions within the robotic arm's workspace.

An Automatic Linear Distance Adjuster (ALDA) is a device or system designed to automatically modify linear distances or positions according to predefined parameters or feedback mechanisms.

This technology finds applications in various fields, including manufacturing, robotics, automotive, and aerospace industries, where precise positioning is crucial.

ALDAs typically consist of sensors, actuators, and control units. Sensors gather information about the current position or distance, while the control unit processes this data and decides on the necessary adjustments. Actuators then execute the required movements to achieve the desired position.

The advantages of ALDAs include increased precision, efficiency, and automation of processes that involve repetitive or complex positioning tasks. In manufacturing, for instance, ALDAs can ensure consistent product quality by precisely aligning components during assembly. In robotics, they enable robots to navigate environments accurately and manipulate objects with precision.

The key objectives include:

1. Designing a efficient automatic linear distance adjustment system compatible with robotics arms.
2. Integrating state-of-the-art ultrasonic sensor technology to facilitate real-time distance measurements.
3. Developing algorithms for dynamic regulation of linear positions based on feedback from the ultrasonic sensors
4. Evaluating the performance of the system in maintaining optimal distances between the end-effector and target objects or surfaces.
5. Assessing the system's effectiveness in enhancing automation, accuracy, and efficiency in various robotic tasks such as pick-and-place operations, assembly processes, and object manipulation.
6. Investigating the potential benefits of reducing manual adjustments and improving operational capabilities in industrial and research applications.
7. Contributing to advancements in robotic automation and control by demonstrating the feasibility and

iJETRM
International Journal of Engineering Technology Research & Management

practicality of the proposed automatic linear distance adjustment system.

8. Overall, the objective is to develop a cutting-edge technology that empowers robotics arms with enhanced flexibility, precision, and autonomy, thereby driving progress in automation and robotics research and applications.

ROLE OF AUTOMATIC LINEAR DISTANCE ADJUSTER IN DIFFERENT INDUSTRIES

The automatic linear distance adjuster plays a crucial role in various industries, offering a wide range of applications and benefits:

Manufacturing: In manufacturing industries, automatic linear distance adjusters are integrated into robotics arms to optimize production processes. They ensure precise positioning of robotic end-effectors during assembly, welding, and machining tasks, improving product quality and throughput. Additionally, they enable the automation of repetitive tasks, reducing labor costs and increasing overall efficiency.

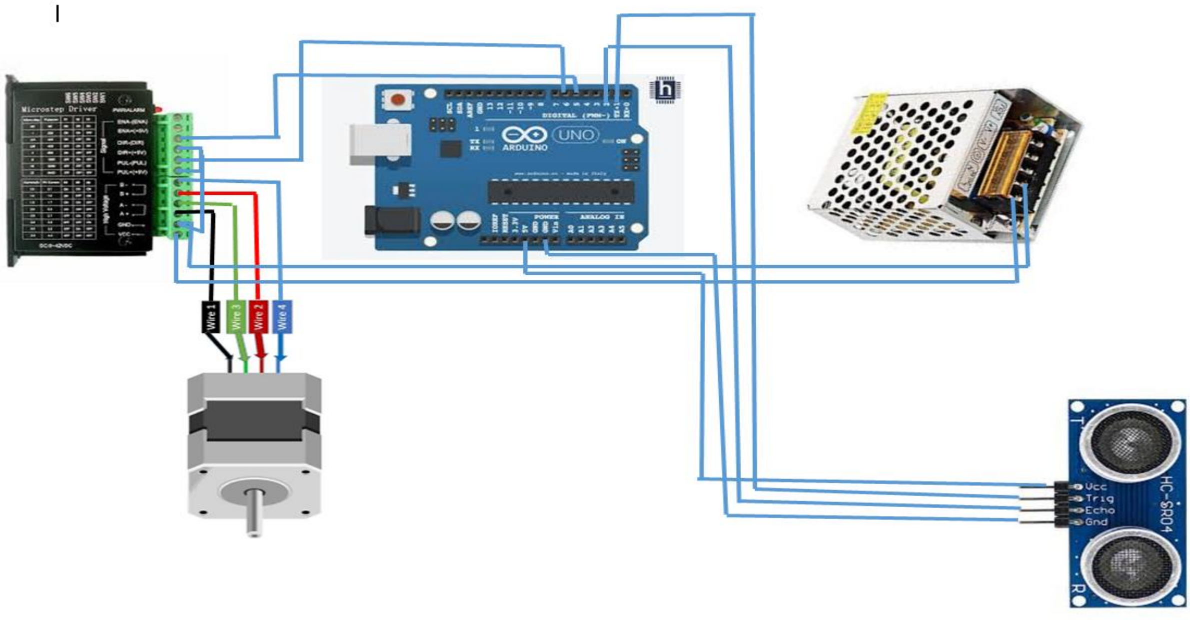
Automotive: In the automotive industry, automatic linear distance adjusters are utilized in robotic assembly lines for tasks such as welding, painting, and component placement. They enable robots to maintain consistent distances from workpieces, ensuring accuracy and reducing the risk of errors. This results in higher-quality vehicles and improved production efficiency.

Logistics and Warehousing: Automatic linear distance adjusters are employed in robotic systems used for material handling and logistics operations. They enable robots to accurately position grippers or end-effectors when picking up, transporting, and stacking items in warehouses and distribution centers. This enhances the speed and efficiency of order fulfillment processes, reducing fulfillment times and labor costs.

Healthcare: In the healthcare industry, automatic linear distance adjusters are utilized in robotic-assisted surgery systems. They enable surgical robots to maintain precise distances from anatomical structures during minimally invasive procedures, enhancing surgical accuracy and patient safety. Additionally, they facilitate the automation of surgical tasks, reducing surgeon fatigue and improving procedural outcomes.

Aerospace: In the aerospace industry, automatic linear distance adjusters are integrated into robotic systems used for manufacturing aircraft components and assemblies. They enable robots to precisely position tools and perform tasks such as drilling, riveting, and inspection with high accuracy and repeatability. This results in the production of lightweight, high-performance aircraft structures and reduces production lead times.

Electronics: In the electronics industry, automatic linear distance adjusters are employed in robotic assembly lines for the manufacturing of electronic devices and circuit boards. They enable robots to accurately place components, solder joints, and inspect assemblies, ensuring product quality and reliability. Additionally, they facilitate the automation of complex assembly processes, reducing production costs and time-to-market.

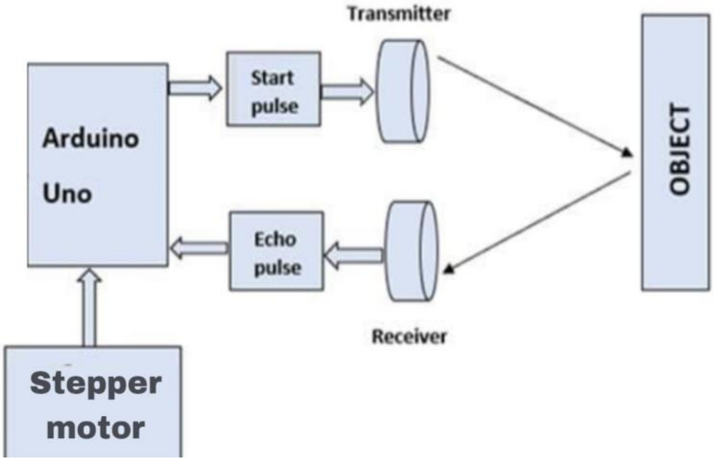


METHODOLOGY

iJETRM
International Journal of Engineering Technology Research & Management

EXISTING METHODOLOGY:
Ultrasonic sensors are commonly used as affordable methods to measure distance in industry. However, the accuracy of their measurements is often low, especially when inexpensive sensors and reasonably low-priced equipment are used. In this article, a low-cost ultrasonic-sensor module which is used for threshold-detection techniques is examined. Several numerical techniques, such as the least square method (LSM), piecewise LSM, and the Vandermonde method were applied to the sensor data to increase the accuracy of the distance measurement. Eventually, the smart filter signal detection algorithm was applied to the sensor data and the results were compared. The smartfilter-signal-detection algorithm provides 0.4-millimeter accuracy. In order to achieve this accuracy, the environment temperature is taken into account.

PROPOSED METHODOLOGY:
The distance measurement system will consist of the HC-SR04 ultrasonic sensor, Arduino board, and various output devices. The ultrasonic sensor will be mounted on the guide rail, moving forward and backward in linear direction to detect any surface irregularities in its path. When an surface irregularity is detected, the sensor will send a signal to the Arduino board, which will then process the data and provide feedback to the driver through the output devices. To implement this project,
we will need an Arduino board, ultrasonic sensors, jumper wires, and a power source. The ultrasonic sensors will be mounted on the rail guide and connected to the Arduino board through jumper wires. Once the hardware is set up, we will write a program code that controls the sensors and processes the distarice the measurements. The program will use algorithms to calculate the distance between the plain surface and irregular surface.The use of ultrasonic sensors and Arduino boards in robotics has a wide range of potential applications beyond just automatic linear distance adjusting.
For example, automatic linear distance adjusters are integrated into robotics arms to optimize production processes.
It could also be used in logistics and warehousing applications. ALDA are employed in robotic systems used for material handling and logistics operations. They enable robots to accurately
position grippers or end-effectors when picking up, transporting, and stacking items in warehouses and distribution centers..



WORKING OF PROPOSED SYSTEM:
The Automatic linear distance adjuter functions by utilizing an array of sensor, algorithms to autonomously traverse its surroundings. Equipped with sensors such as ultrasonic the ALDA gathers data about its environment. This data is then processed in real-time by the onboard computer, enabling the ALDA to detect obstacles along its path. Simultaneously, algorithms interpret sensor data to ensure the ADLA to maintain distance to avoid surface irregularities. In the event of an surface irregularity detection, the control system recalculates a distance of irregular surface so it cannot come into contact with it.Actuators, such as motors are then utilized to adjust the ADLA's motion calculated distance. Ensuring non contact and effiency work. This process operates within a feedback loop, allowing the ALDA to continuously adapt its behaviour to changes in its environment. Through the integration of Automatic linear distance adjuter capabilities, it achieves automatic detection of surface irregularities and to avoid them by maintaining safe distance for effiency work and effective work to fulfil its objectives.

METHODS AND ALGORITHM:

iJETRM
International Journal of Engineering Technology Research & Management

The method used in automatic linear distance adjuster that incorporate ultrasonic sensors typically involves the following steps:

- **Sensor Data Acquisition:** The ALDA is equipped with ultrasonic sensor placed strategically on a rail guide. These sensor continuously collect data about the ALDA surroundings in linear direction.
- **Obstacle Detection:**
  Ultrasonic Sensors: Ultrasonic sensors emit high-frequency sound waves and measure the time taken for the waves to reflect back from obstacles. The ALDA's onboard computer processes this data to detect obstacles within a certain range.
- **Linear distance calculation:** Algorithms interpret sensor data to ensure the ALDA stays on its trajectory. Its calculate the distance by the feedback given by the ultrasonic sensor.
- **Actuator Control:**Based on the calculated distance, the ALDA's actuato, such as motors, are instructed to adjust the ADLA's motion accordingly. This may involve guiding the rail through belt and pulleys.
- **Feedback Control:**The ALDA continuously monitors its environment using sensor and
  adjusts its behavior in real-time based on new information. This closed-loop feedback system ensures that the ALDA can adapt to changes in its surroundings and behave effectively.
- By integrating ultrasonic sensors, the ALDA can effectively detect irregular surface and follow predefined distance to avoid contact autonomously.

HARDWARE COMPONENTS REQUIREMENTS

1. ARDUINO UNO
2. ULTRASONIC SENSOR
3. TB6600 STEPPER MOTOR
4. NEMA 17 STEPPER MOTOR
5. MGN 12TH LINEAR GIUDE RAIL
6. 12 VOLTS 2 AMPHS POWER SUPPLY
7. GT2 TIMING BELT
8. GT2 BELT PULLEY
9. LIMITING SWITCHES

INTRODUCTION TO ARDUINO UNO

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller (MCU) and developed by Arduino.cc and initially released in 2010. The microcontroller board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by a USB cable or a barrel connector that accepts voltages between 7 and 20 volts, such as a rectangular 9-volt battery. It has the same microcontroller as the Arduino Nano board, and the same headers as the Leonardo board.

Fig Arduino UNO

POWER OVERVIEW OF ARDUINO UNO R3

iJETRM
International Journal of Engineering Technology Research & Management

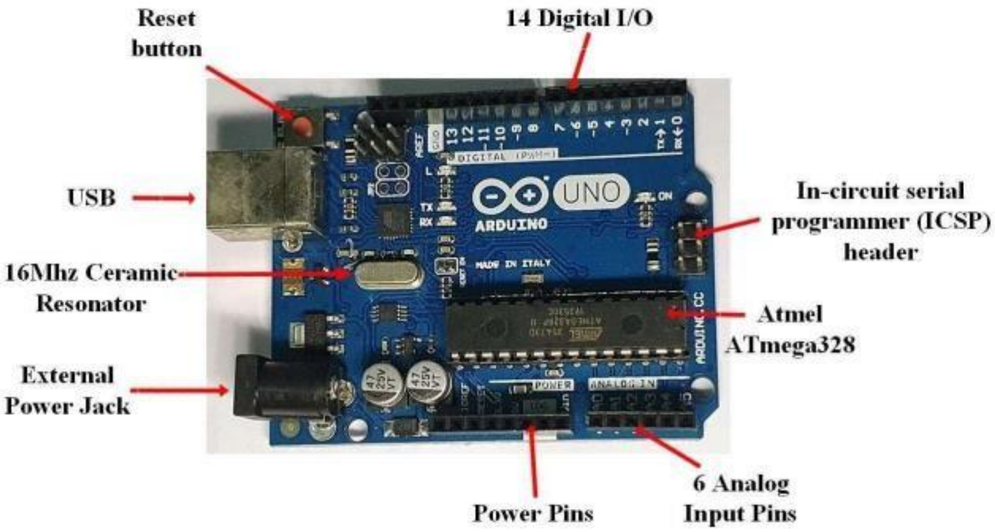


Fig 4.2.1.1 Arduino UNO R3 Board

- External power supply voltage: 7V to 12V DC
- USB power or externally via barrel jack connector

ARDUINO UNO R3 PINSOUT

The Arduino Uno pinout consists of 14 digital pins, 6 analog inputs, a power jack, USB connection and ICSP header. The versatility of the pinout provides many different options such as driving motors, LEDs, reading sensors and more. In this post, we'll go over the capabilities of the Arduino Uno pinout.

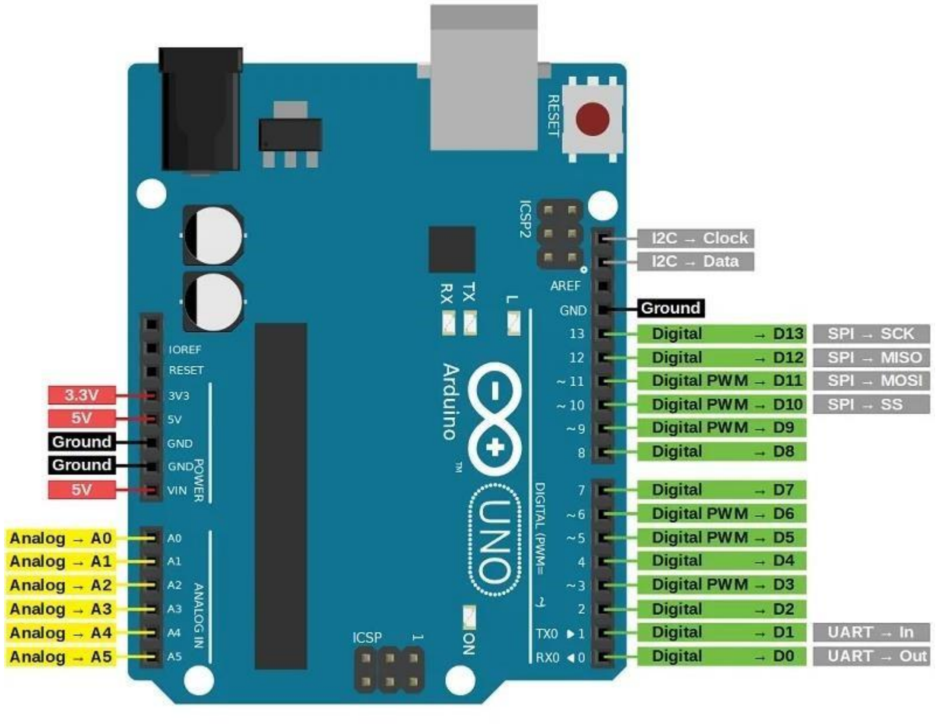


Fig 4.2.1.3 Arduino UNO R3 Pinsout

iJETRM
International Journal of Engineering Technology Research & Management

- **Vin:** This is the input voltage pin of the Arduino board used to provide input supply from an external power source.
- **5V:** This pin of the Arduino board is used as a regulated power supply voltage and it is used to give supply to the board as well as onboard components.
- **3.3V:** This pin of the board is used to provide a supply of 3.3V which is generated from a voltage regulator on the board
- **GND:** This pin of the board is used to ground the Arduino board.
- **Reset:** This pin of the board is used to reset the microcontroller. It is used to Resets the microcontroller.
- **Analog Pins:** The pins A0 to A5 are used as an analog input and it is in the range of 0-5V.
- **Digital Pins:** The pins 0 to 13 are used as a digital input or output for the Arduino board.
- **Serial Pins:** These pins are also known as a UART pin. It is used for communication between the Arduino board and a computer or other devices. The transmitter pin number 1 and receiver pin number 0 is used to transmit and receive the data resp.
- **External Interrupt Pins:** This pin of the Arduino board is used to produce the External interrupt and it is done by pin numbers 2 and 3.
- **PWM Pins**: This pins of the board is used to convert the digital signal into an analog by varying the width of the Pulse. The pin numbers 3,5,6,9,10 and 11 are used as a PWM pin.
- **SPI Pins:** This is the Serial Peripheral Interface pin, it is used to maintain SPI communication with the help of the SPI library. SPI pins include:

1. SS: Pin number 10 is used as a Slave Select
2. MOSI: Pin number 11 is used as a Master Out Slave In
3. MISO: Pin number 12 is used as a Master In Slave Out
4. SCK: Pin number 13 is used as a Serial Clock

- **LED Pin:** The board has an inbuilt LED using digital pin-13. The LED glows only when the digital pin becomes high.
- **AREF Pin**: This is an analog reference pin of the Arduino board. It is used to provide a reference voltage from an external power supply.

ULTRASONIC SENSOR

A transmitter and receiver are included with the HC-SR04 ultrasonic sensor. This sensor is used to determine the distance between the target and the sensor. The distance between the sensor and an object is determined by the amount of time it takes to transmit and receive the waves. Using non-contact technology, this sensor detects sound waves. The required distance for the target may be measured without causing damage using this sensor, and accurate details can be obtained. This sensor has a range of 2 to 400 centimetres.

HC-SR04 ULTRASONIC SENSOR WORKING

HC-SR04 has 4 pins: Vcc, Trigger, Echo, and Ground. This sensor is used to determine the precise distance between the sensor and the target. This sensor is mostly used to detect sound waves. When this module is given power, it emits sound waves that travel through the air and strike the required object. These waves strike and return from the object, which the receiver module catches. Because the time required to travel a greater distance is longer, both the distance and the time spent are directly related. When the trigger pin is held high for 10µs, ultrasonic waves are generated that travel at the speed of sound. As a result, it generates eight cycles of sound bursts, which are collected within the Echo pin. This ultrasonic sensor is connected to an Arduino board to determine the required distance between sensor and object. The following formula can be used to calculate the distance. $S = (V \times t)/2$ S - required distance V - sound's speed t - time taken for sound waves to return back after striking the object. Because the time it takes for the waves to travel and return from the sensor is twice as long, the real distance can be estimated by dividing the value by two .

iJETRM
International Journal of Engineering Technology Research & Management

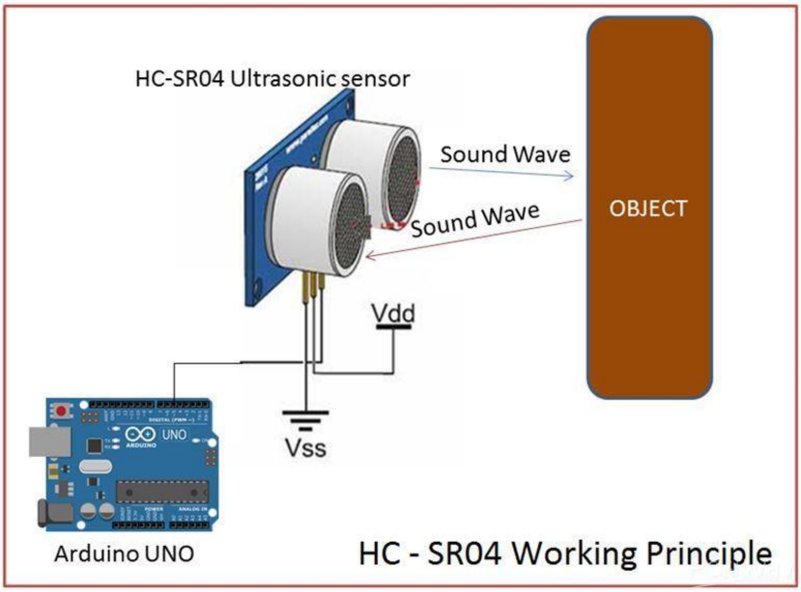


FIG Ultrasonic Sensor Working

4.2.3 TB6600 STEPPER MOTOR DRIVER

A motor driver that is designed to drive the motor like a stepper motor to rotate continuously by controlling the exact position without using a feedback system is known as a stepper motor driver. The drivers of this motor mainly provide variable current control as well as several step resolutions. They include fixed translators to allow the motor for controlling by easy step & direction inputs.

These drivers include different kinds of ICs that operate at less than 20 V supply voltage. The low-voltage and low-saturation voltage ICs are best to utilize for a two-phase stepper motor driver which is used in different portable devices like cameras, printers, etc.

Fig 4.2.3 TB6600 Stepper motor driver

These drivers are available in different ratings for voltage as well as current. So the selection of this can be done based on the requirement of the motor which will be utilized. Most of these drivers are available in 0.6″×0.8 size.

WORKING PRINCIPLE OF STEPPER MOTOR DRIVER

The working principle of this driver circuit is to control the operating of a stepper motor by sending current using a variety of phases in pulses in the direction of the motor. The designers not frequently used the wave driving technique due to the reasons like it provides small torque & inefficient because simply 1-phase of the motor uses at a time.

The essential components used to drive stepper motor are controllers like a microprocessor/microcontroller, a driver IC and a PSU (power supply unit)., and other components like switches, potentiometers, heat sink, and connecting wires.

Controller:

The first step is to select the microcontroller to design a driver. For the stepper motor, this microcontroller should have a minimum of four output pins. In addition, it includes ADC, timers, serial port based on the application of the driver.

Motor Driver:

The motor driver IC's are available at low cost and they are easy to execute in terms of design to progress the whole circuit design time. The selection of the drivers can be done based on the motor ratings like voltages and current. The most popular motor driver like ULN2003 is used in non-H-Bridge based applications. It is suitable for driving the stepper motor. This driver includes a Darlington pair that can handle the max current up to 500mA and the max voltage up to 50VDC. The stepper motor driver circuit is shown below.

iJETRM
International Journal of Engineering Technology Research & Management

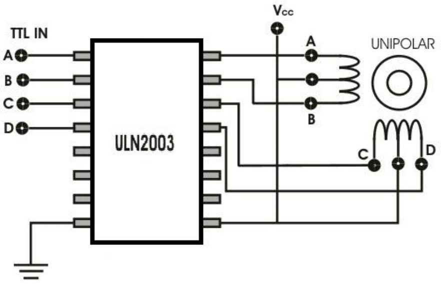


Fig stepper motor driver circuit

Power Supply:

The operating voltage range of the stepper motor ranges from 5volts to 12volts. The current supply drawn from this will be in the range of 100 mA to 400 mA. The design of the power supply can be done based on the motor specifications. The power supply should be regulated to avoid the fluctuations within torque and speed.

Stepper Motor Driver Types:

Drivers are mainly working in two modes like the pulse input mode as well as integrated controller mode. Based on the required operating system, one can select the desired combination.

Pulse Input Drivers:

The control of a stepper motor can be done with the help of a pulse generator offered through the consumer. Earlier, the i/p of the pulse generator is Operation data. The customer selects this input on the host programmable controller, and then enters the operation command.

Built-in Controller Type Drivers:

This kind of driver allows the stepper motor to be driving through a PC which is directly connected otherwise a programmable controller. Since no separate pulse generator is necessary, then drivers of this motor can save space & simplifies wiring.

NEMA 17 STEPPER MOTOR

A stepper motor is an electric motor whose main feature is that its shaft rotates by performing steps, that is, by moving by a fixed amount of degrees. This feature is obtained thanks to the internal structure of the motor, and allows to know the exact angular position of the shaft by simply counting how may steps have been performed, with no need for a sensor. This feature also makes it fit for a wide range of applications.

Stepper Motor Working Principle:

As all with electric motors, stepper motors have a stationary part (the stator) and a moving part (the rotor). On the stator, there are teeth on which coils are wired, while the rotor is either a permanent magnet or a variable reluctance iron core. We will dive deeper into the different rotor structures later. Figure 4.2.4.1 shows a drawing representing the section of the motor is shown, where the rotor is a variable-reluctance iron core.

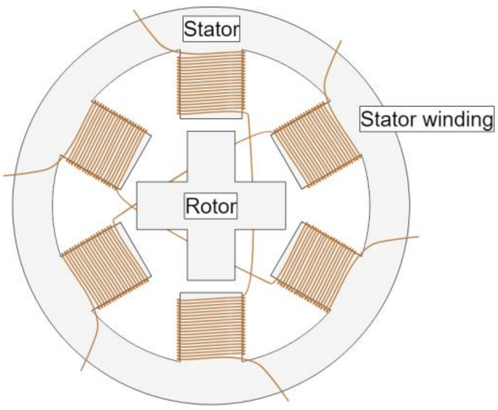


Fig Cross section of a stepper motor

The basic working principle of the stepper motor is the following: By energizing one or more of the stator phases, a magnetic field is generated by the current flowing in the coil and the rotor aligns with this field. By supplying different phases in sequence, the rotor can be rotated by a specific amount to reach the desired final position. **Figure 2** shows a representation of the working principle. At the beginning, coil A is energized and the rotor is aligned with the magnetic field it produces. When coil B is energized, the rotor rotates clockwise by 60° to align with the new magnetic field. The same happens when coil C is energized. In the pictures, the colors of the stator teeth indicate the direction of the magnetic

iJETRM
International Journal of Engineering Technology Research & Management

field generated by the stator winding.

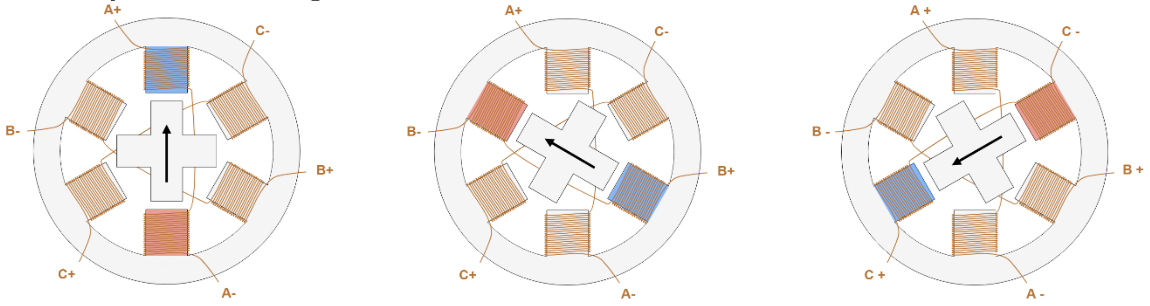


Fig 4.2.4.1.2 Stepper Motor Steps

MGN 12TH LINEAR GUIDE RAIL

Linear Rails are ideal for moving items through a production process with great precision and as little friction as possible if creating, packing, and distributing products. Linear Rail is a type of gadget that is frequently utilized in a variety of industries.

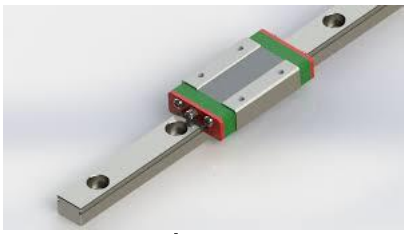


Fig MGN 12th linear guide rail

A linear rail system is one that is designed to sustain the movement and load of a piece of equipment in a vertical or horizontal direction. It's a pretty simple piece of mechanical equipment that does a very simple task well, allowing the movement of goods through the production or packaging process to be easy and safe.

Linear rails are referred to by a variety of names, including linear guide rails, linear guides, linear guideways, linear slides, and linear guiding systems. A linear rail efficiently transfers weights along a predetermined horizontal or vertical course with the least amount of friction or resistance.

Linear guide rails are normally made of corrosion-resistant high-strength, toughened, and galvanized steel. Before installing a roller runner, the metal is formed and contoured using a cold drawing method. Profiled rail guides are typically the best choice for large loads since they are designed to produce a very precise linear motion. Rail guides are available in a variety of sizes, starting with minuscule linear rails for moving small components in tight spaces.

12 VOLTS 2 AMPHS POWER SUPPLY

This 12V 2A power supply is mainly used in, chargers, microcontroller, portable amplifiers, audio-video players, Bluetooth/wifi modules, DC motors, led light circuits. Despite being small in size this power supply work effectively. The input voltage of this supply is 220VAC and the output is 12V DC. This supply can provide up to 2A current.

Fig 12 volts 2 amphs power supply

SPECIFICATIONS

Input Voltage Rating : 220 VAC
Output Voltage Rating : 12 VDC
Maximum Output Current : 2A

iJETRM
International Journal of Engineering Technology Research & Management

GT2 TIMING BELT

The PowerGrip GT2 Belt -Drive System is an advancement in product design over the older, standard HTD® system. The PowerGrip GT2 System, featuring a modified curvilinear belt tooth profile, provides timing and indexing accuracy superior to the conventional Belt System. PowerGrip GT2 Belts also have a higher capacity and longer belt life than trapezoidal belts.

Fig 4.2.7 GT2 timing belt

Advantages of GT2 Belts:

1. Longer Belt Life
2. Precision Registration
3. Increased Load-carrying Capacity
4. Quieter Operation
5. Precise Positioning

GT2 BELT PULLEY 5NM

The GT2 Pulley Kits are made of aluminum alloy. It has a stable structure, high hardness, high precision, high temperature resistance, not easy to heat, higher speed, lower noise, and longer service life.

Fig GT2 belt pulley

LIMITING SWITCHES

Small micro limit switches are used in automated equipment to detect the position of parts and to control the movement of machinery.

Fig limiting switch

iJETRM
International Journal of Engineering Technology Research & Management

PROGRAMMING THE ALDA

The Arduino microcontroller communicates with the PC via the USB connection. Data is transferred between the board and the PC bit by bit. An adaptor is used for power supply to the board and a USB programmer is used to burn the hardware program (written in Arduino IDE) into the board.

Arduino Code

```
#include <Stepper.h>
const int trigPin = 2;
const int echoPin = 3;
const int stepsPerRevolution = 200; // Change this value based on your stepper motor

Stepper stepper(stepsPerRevolution, 4, 5); // STEP pin to D4, DIR pin to D5

void setup() {
  Serial.begin(9600);
  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);
}

void loop() {
  long duration, distance;

  // Send ultrasonic pulse
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);

  // Measure the echo duration (travel time of the ultrasonic pulse)
  duration = pulseIn(echoPin, HIGH);

  // Calculate distance in centimeters
  distance = duration * 0.034 / 2;

  Serial.print("Distance: ");
  Serial.print(distance);
  Serial.println(" cm");



 // Control stepper motor based on distance
  if (distance > 20) {
    // Rotate clockwise
    stepper.setSpeed(100); // Set rotation speed (RPM)
```

iJETRM
International Journal of Engineering Technology Research & Management

```
  stepper.step(stepsPerRevolution); // Rotate one full revolution
 } else if (distance < 20) {
  // Rotate anticlockwise
  stepper.setSpeed(100); // Set rotation speed (RPM)
  stepper.step(-stepsPerRevolution); // Rotate one full revolution in the opposite direction
 }

 delay(500); // Adjust delay as needed
}
```

RESULT

Arduino-controlled Automatic linear distance adjuster which moves linear detecting irregular or uneven surfaces in its way and adjusting distance. During operation of the ALDA the ultrasonic sensor sends out an ultrasound wave to the linear direction an object is placed.When the wave strikes an obstacle, it bounces back and the distance is stored in linear direction After this, the microcontroller compares the values based on its algorithm and determines to maintain distance to avoid contact.

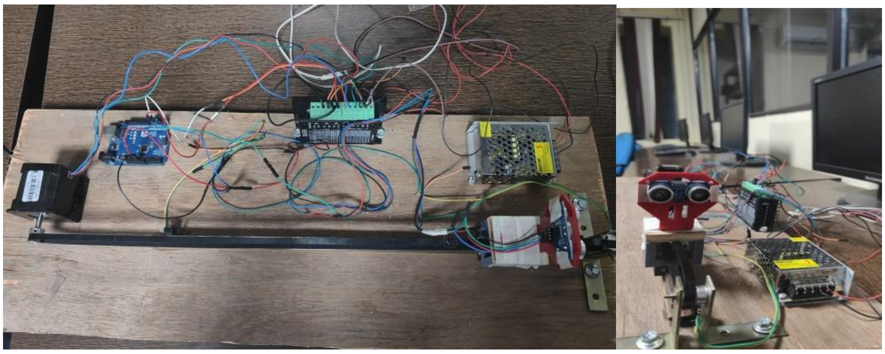


FIG Result

CONCLUSION

Distance measurement using ultrasonic sensors and Arduino is a popular research area with various applications. The results of this review indicate that ultrasonic sensors and Arduino are widely used in the development of electronic projects related to distance measurement. Further research is needed to explore the potential of these technologies in various other applications

Distance =speed*time

The human audible range can be converted measure the distance precisely manner

REFERENCES

[1] **B**. Duval, "Advances in Analog Distance Sensing", Sensors Magazine, September 2004.

[2] B. Legrand, Y. Dordet, J. Y. Voyant and J. P. Yonnet, "Contactless Position Sensor using Magnetic Saturation," Sens. Actuators A, vol. 106, pp. 149- 154, 2003.

[3] L. F. Root and L. Kaufman, "Noncontacting Low-Cost Instrument for Film Thickness Measurement," IEEE Trans. Instrum. Meas., vol. 41, no. 6, pp. 1014-1019, 1992.

[4] M. A. Mazidi, R. McKinlay and D. Causey, "PIC Microcontroller and Embedded Systems: Using Assembly and C for PIC18," PrenticeHall, USA, 2007.

[5] M. H. Bhuyan, M. A. Rabby and M. M. G. Tarik, "Microcontroller based Automatic Traffic Light Control System Design," Proceedings of the National Conference on Electronics and Telecommunications for Digital Bangladesh, Bangladesh Electronics Society, Dhaka, 2-3 June 2010, pp. 139-142.

[6] M. H. Bhuyan, M. A. Rabby, M. A. Parvez and M. M. G. Tarik, "Microcontroller Based Display System Design using LED Array," Proceedings of the Conference on Engineering Research, Innovation and Education, Shahjalal University of Science and Technology, Sylhet, Bangladesh, 11-13 Jan 2010, pp. 417-420.

[7] M. K. Ramasubramanian, R. A. Chandini and V. Mallapragada, "Optical Sensor for Noncontact Measurement of Lignin Content in High-Speed Moving Paper Surfaces," IEEE Sensors J., vol. 5, no. 5, pp. 1132-1139, 2005.

[8] M. K. Ramasubramanian, R. A. Chandini and V. Mallapragada, "Optical Sensor for Noncontact Measurement

iJETRM
International Journal of Engineering Technology Research & Management

of Lignin Content in High-Speed Moving Paper Surfaces," IEEE Sensors J., vol. 5, no. 5, pp. 1132-1139, 2005.

[9] P. Arce, M.G. Fernandez, A. Ferrando, M.I. Josa, A. Molinero, J.C. Oller, E. Calvo, C.F. Figueroa, T. Rodrigo, I. Vila, and A.L. Virto, "A Simple Method for Short Distance Measurements", Nuclear Instruments and Methods in Physics Research, A 517, pp.378-380, 2004.

[10] P. Purnell, T. H. Gan, D. A. Hutchins and J. Berriman, "Noncontact Ultrasonic Diagnostics in Concrete: A Preliminary Investigation," Cement and Concrete Research, vol. 34, pp. 1185-1188, 2004.

[11] S. Boedecker, W. Bauer, R. Krüger-Sehm, P. H. Lehmann and C. Rembe, "Comparability and Uncertainty of Shape Measurements with WhiteLight Interferometers," SPIE Conference Photonics Europe, 12-16 April 2010, Brussels, Belgium.

[12] S. Y. Yurish, "Non-Contact, Short Distance Measuring System for Wide Applications," 19th IMEKO World Congress, Fundamental and Applied Metrology, Lisbon, Portugal, 6-11 September 2009, pp. 643- 647.

[13] T. Hinz, F. Menke, R. Eggers and R. Knōchel, "Development of a Microwave Moisture Sensor for Application in the Food Industry," Lebensm.-Wiss. U.-Technol., vol. 29, no. 4, pp. 316-325, 1996.

[14] U. Grimaldi and M. Parvis, "Noise-Tolerant Ultrasonic Distance Sensor Based on a Multiple Driving Approach," Journal of Measurement, vol. 15, pp. 33-41, 1995.