Digital Distance measurement

Introduction-

Distance is the measure of length between two points. To measure is to determine how far apart two geometric objects are. The most common way to measure distance is with a ruler.You can find the distances between points in the x–y plane if the lines are horizontal or vertical. If the line is vertical, find the change in the y—coordinates. If the line is horizontal, find the change in the x—coordinates.

Suppose you want to measure your height, but the measuring tape you have is old and the end is broken off. for that by considering the need of it and to reduce time as well as power , we should innovate something that helps to find distance as well as area.Here we develope a small model of digital theodolite to find distance.

There are various ways to find the distance between two points like ultravoilet sensor,EDM,sound energy but we use LiDar i.e light detection and ranging to find accurate result. for the angle measurnment we use 360 rotatory encoder .

Components Required-

Arduino NANO

TF mini LiDar

M274 Rotary Encoder

LCD

Wires

Buttons

LedPower Supply

LiDar-

LIDAR (Light Detection and Ranging) is an optical remote sensing system which can measure the distance of a target by illuminating it with light. LIDAR technology is being

used in Robotics for the perception of the environment as well as object classification. The ability of LIDAR technology to provide 2D elevation maps of the terrain, high precision distance to the ground, and approach velocity can enable safe landing of robotic and manned vehicles with a high degree of precision.

LIDAR consists of a transmitter which illuminates a target with a laser beam, and a receiver capable of detecting the component of light which is essentially coaxial with the transmitted beam. Receiver sensors calculate a distance, based on the time needed for the light to reach the target and return LiDAR technology is an active remote sensing system which means that the system itself generates energy which will be light in the form of a rapidly firing laser to measure ranges and the exact distance of an object on the Earth's surface.

A LiDAR sensor has 3 primary components:

Laser

Send out and transmit pulses

Scanner

Receive and record the time delay between light pulse transmission and reception to calculate elevation values.

Specialized GPS receiver

Gives the location of the system with the LiDAR sensor

Similar to a "time of flight" mechanism, it works by firstly illuminating the target with the laser light and measuring the reflected light with a sensor where the distance of the object is deduced using the speed of light to calculate the distance traveled accurately. In addition, the differences in laser return times and wavelengths are then used to make precise digital 3D representations and surface characteristics of the target and visually map out its individual features.With the laser return time, LiDAR is able to measure the exact distance in a short time given the speed at which light travels. Here is the formula which analysts use to arrive at the precise distance of the object:

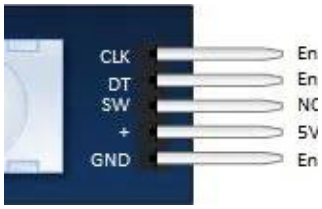
(Speed of light x Time of flight) / 2

360 Degree Encoder

A rotary encoder is a type of position sensor which is used for determining the angular position of a rotating shaft. It generates an electrical signal, either analog or digital, according to the rotational movement..A rotary encoder is an incremental electromechanical component with a shaft that converts the angular position or motion of a shaft or axle to digital code. The output of incremental encoders provides information about the motion of the shaft, which is typically further processed in processor / controllers into information such as speed, distance, and position.The shaft has unlimited 360 degree rotation.

The interface of 360 Degree Encoder is very basic consisting of five pins.

CLK and DT Pins: You can connect these pins to any digital pins of Arduino. SW Pin is the button Pin.Other two pins are VCC and GND.



Arduino NANO

The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328P; offers the same connectivity and specs of the UNO board in a smaller form factor.Arduino Nano is a small, compatible, flexible and breadboard friendly Microcontroller board, developed by Arduino.cc in Italy, based on ATmega328p (Arduino Nano V3.x) / Atmega168 (Arduino Nano V3.x).

It comes with exactly the same functionality as in Arduino UNO but quite in small size.It comes with an operating voltage of 5V, however, the input voltage can vary from 7 to 12V.Arduino Nano Pinout contains 14 digital pins, 8 analog Pins, 2 Reset Pins & 6 Power Pins.

Liquid crystall display-

16×2 LCD is named so because; it has 16 Columns and 2 Rows. LCD itself consists of an Interface IC. The MCU can either read or write to this interface IC. Most of the times we will be just writing to the IC, since reading will make it more complex and such scenarios are very rare. Information like position of cursor, status completion interrupts etc.

Advantages-

This is a small size, low power consumption, single point short-range LiDAR sensor.

TFmini Plus is a distance sensor of LIDAR which can emit near-infrared ray and measure the phase difference between the emitting ray and reflected ray to calculate the distance through ToF.

Because of the LIDAR principle, it is hard to give an accurate distance between the transparent objects like water or glass. However, it is still a sensitive distance sensor in measuring the moving object and calculate the distance between the object and TFmini in real-time.

This distance sensor leaves I2C and UART interface for developers and you can simply plug TFmini through the TTL to USB converter to the PC and get the distance data on your computer.