Finding the area of the room to disinfect using LiDAR module & Stepper motor

Purpose of this Setup:

The LiDAR module & Stepper motor setup is a part of a UV light disinfection system which runs for a specific time based on the area of the space that needs to be disinfected. *The more space to be disinfected, the more time the UV light system should run.* This run-time can be determined by calculating the area of the room with the help of LiDAR module & Stepper motor setup which is fixed on the head of the UV light system.

Task:

The sensors of this UV light system are programmed on ESP32 LoRa WiFi V2 using Arduino IDE. A code needs to be written on Arduino IDE to combine the functionality of both TF-Luna LiDAR module and Stepper motor to find the area of the room which in-turn helps in determining the run-time of the system.

Logic workflow:

TF-Luna LiDAR Module is fixed to the rotor of a stepper motor and needs to give distance readings with the same frequency as that of the stepper motor. (i.e., for one step taken by the stepper motor, one reading is given by the LiDAR module)
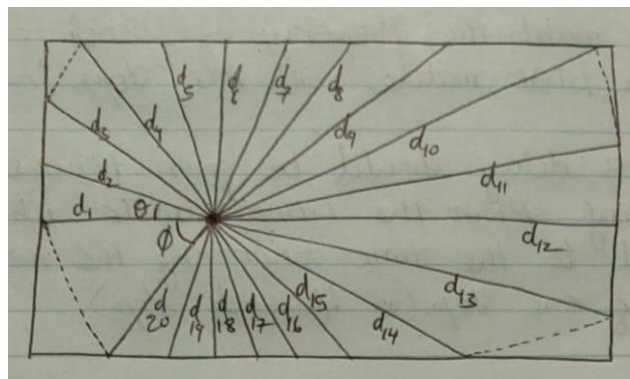
In the above example, assuming that the LiDAR module is at the origin and the distances from each point on the side walls are

$$d_1, d_2, \ldots\ldots, d_{20}$$

Assume, the motor takes 20 steps to rotate an angle of $'\alpha'$.

The total angle rotated by the motor is assumed to be,

$$\alpha = (360 - \phi)$$

The angle between each distance reading is,

$$'\theta'$$

Since the motor rotates less than 360°, the final angle is,

$$\phi = 360 - \alpha$$

Now, we know the lengths of two sides and an angle of each triangle which are used to find the area of the triangle.

$$Area_1 = \frac{1}{2}d_1 d_2 cos\theta$$

Similarly find areas of 20 triangles. The last triangle area can be calculated using ϕ,

$$Area_{21} = \frac{1}{2}d_{20} d_1 cos\phi$$

Then, the sum of areas of all the triangles gives the area of the room.

This process is repeated 3 times (clockwise – anticlockwise – clockwise) and then an average is taken to get a better value of the area of the room.

After getting the final area of the room, this value should be stored in a variable, and the motor & LiDAR module should stop working.