# TITLE: Low-Cost 2D LiDAR Using ToF Sensors & Arduino Nano

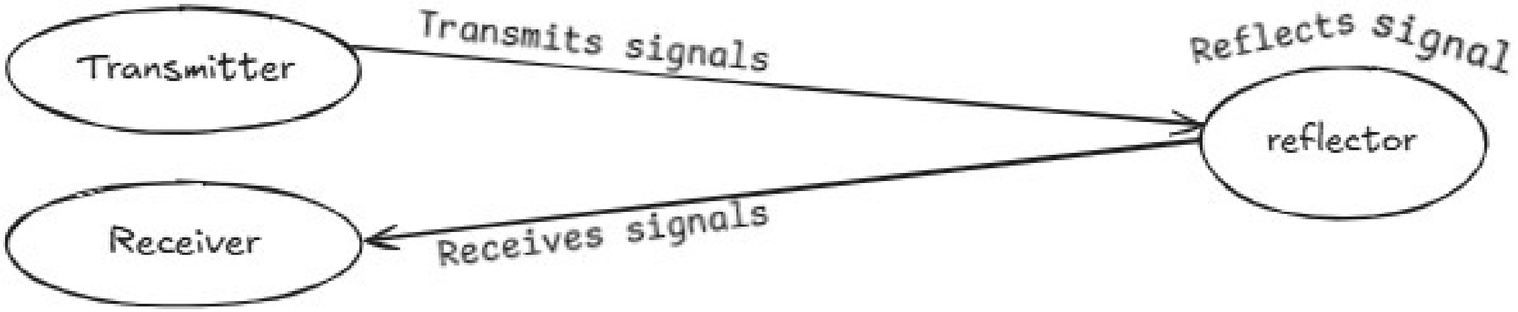
An Affordable Approach to Environmental Mapping

Team Name : Quantum Quest

# Introduction to LiDAR

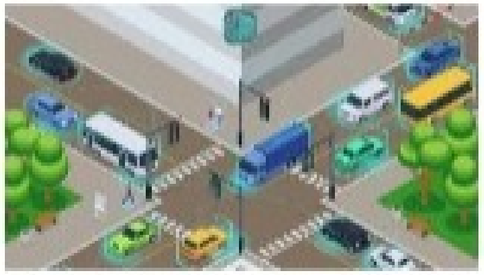
Lidar (Light Detection and Ranging) is a technology that uses laser pulses to measure distances to objects.

## Working of Lidar




## Applications of lidar

Autonomous vehicles & drones
(Navigation & obstacle detection).



Smart cities
(Traffic monitoring & urban planning).


Surveying & mapping
(Geospatial data collection)

Challenges with Traditional LiDAR Systems:

1.Expensive

2.High Power Consumption

3.Complex

## The Problem Statement?

How can we develop a budget-friendly LiDAR system that provides decent accuracy for applications like robotics and indoor mapping?

Solution:
Using ToF Sensor, Stepper Motor and Arduino Nano

1.Affordable: ToF sensors cost a fraction of traditional LiDAR systems.

2.Power-efficient: Works with a simple Arduino Nano microcontroller.

3.Compact & Lightweight: Ideal for small-scale applications.

# Why Use Time-of-Flight (ToF) Sensors for LiDAR?

Time-of-Flight (ToF) sensor measures distance by calculating the time taken for an infrared light pulse to hit an object and return.

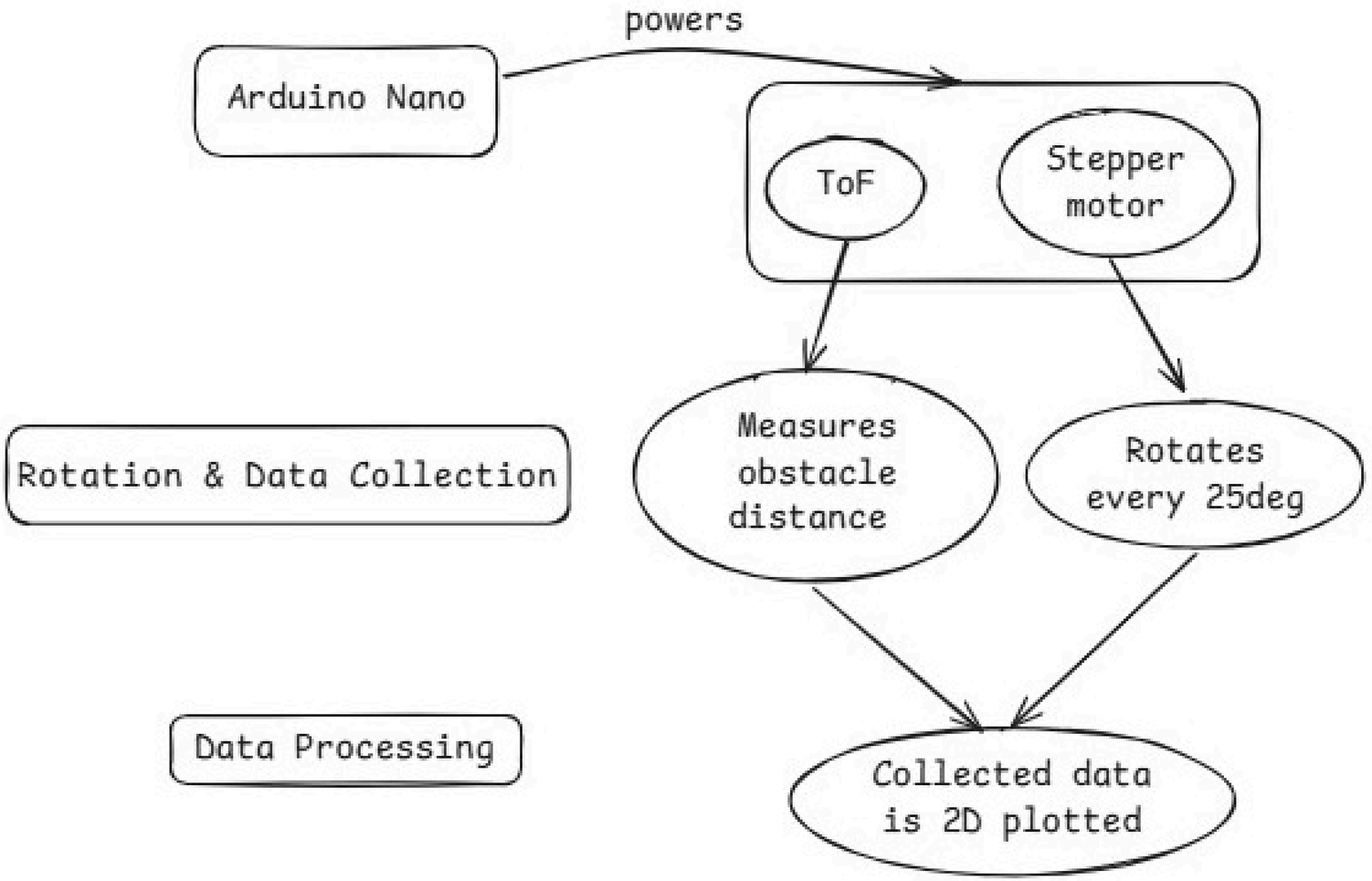
📌 Advantages of ToF Sensors Over Other Technologies:

| Feature | ToF Sensor | Ultrasonic Sensor | Traditional LiDAR |
|---|---|---|---|
| Accuracy | Millimeter-level precision | Centimeter-level | High (but expensive) |
| Speed | Fast response time | Moderate | High |
| Cost | Affordable | Very cheap | Expensive |
| Power Consumption | Low | Low | High |
| Environmental Impact | Works in dark and light conditions | Affected by reflections | Works well but requires powerful processing |

The range ofVL53L0X model ToF sensor is approximately 2m

# System Design

## How the 2D LiDAR System Works



# Efficiency

- **Fast Scanning Rate**:
  Can scan a full 360° in seconds.
- **Real-Time Processing**:
  Data is processed within milliseconds.
- **Low Power Consumption**:
  Runs efficiently on Arduino Nano.
- **High Accuracy**:
  Achieves millimeter precision with VL53L0X

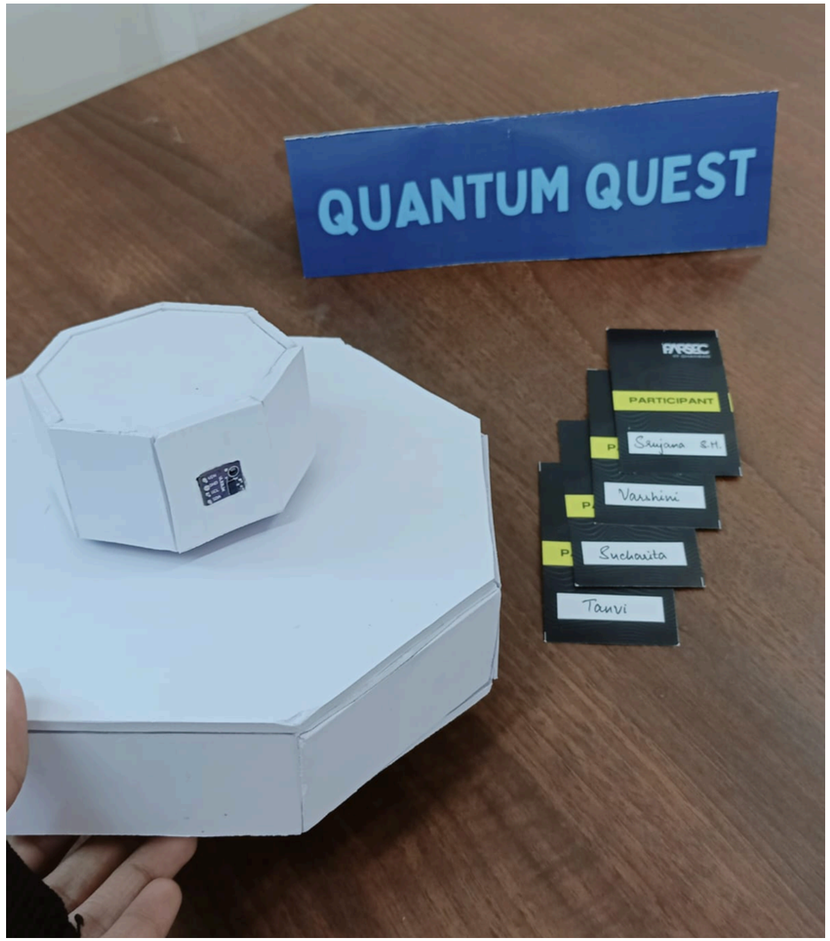
# Future Scope & Improvements

- **Longer Range ToF Sensors:**
  Use sensors like TFmini-S (12m range) for better coverage.
- **3D LiDAR Implementation**
  Adding vertical scanning for full 3D environment mapping.
- **Wireless Data Transmission**
  Implementing Wi-Fi/Bluetooth for remote data collection.
- **SLAM Integration**
  Applying Simultaneous Localization and Mapping (SLAM) algorithms for autonomous robots.

# Conclusion

**A low-cost ToF-based 2D LiDAR is a viable alternative to expensive commercial systems.**

# Thank You!!!


QUANTUM QUEST
PARTICIPANT
Sanjana S.H.
Vaishni
Suchanita
Tanvi