Obstacle avoidance for autonomous drone using ultrasonic sensor and ARM cortex

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Agenda

- Introduction and motivation
- Interfacing the ultrasonic sensor
- Interfacing BLDC motor
- Integration of Ultrasonic sensor and BLDC motor
- Explanation of code
- Demonstration
- Future scope

Introduction and Motivation

What is Autonomous drones and what are its application

- An autonomous drone is a unmanned aerial vehicle (UAV) that is capable of flying and performing tasks **without the need for direct human input or control**.

Applications

- Delivery services, Agriculture, Construction etc.

Why obstacle avoidance is important?

- Obstacle avoidance is critical for UAVs because it ensures safe and efficient operation.

Interfacing Ultrasonic sensor

What is Ultrasonic sensor and how it works

- It sends out a pulse of high-frequency sound waves.

- The pulse travels through the air until it reaches an object.

- When the pulse hits the object, it bounces back and returns to the sensor.

- The sensor measures the time it took for the pulse to travel to the object and back.

Interfacing Ultrasonic sensor

Characteristics of sensor

- Working Voltage -DC 5 V
- Working Current -15mA
- Max Range- 4m
- Min Range- 2cm
- Measuring Angle- 15 degree
- Trigger Input Signal 10uS pulse
- Echo- Output PWM signal
- Dimension 45*20*15mm

BLDC Motor Interfacing

- The BLDC motor consists of a rotor and a stator.

- The rotor contains permanent magnets and the stator has multiple windings of copper wire.

- When electric current is applied to the windings of the stator, it generates a rotating magnetic field.

- The permanent magnets in the rotor are attracted to the magnetic field and start rotating.

- The electric current flowing through the stator windings is controlled by an electronic speed controller Electronic speed control.

BLDC Motor Interfacing

- Features of DJI 2212 920KV Brushless Motor:

- KV(rpm/v): 920.

- Max Power: 370W.

- Max Thrust: 1200 grams.

- Weight: 53 grams.

- Shaft Diameter: 4mm.

- Shaft Length: 49mm Recommended Propeller

- Battery: Li-Po.30A ESC (recommended).

Electronic Speed Controller

- Used to control the speed and direction of BLDC motors

- Receives input signals from a control system or transmitter, which specifies the desired speed and direction of the motor.

What are the other benefits of ESC??

Explanation of Code

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- Initialize the clocks for ports.
- Set the MODER for respective pins
- PB7 pin for trigger and PC6 pin for Echo.
- Calibrate the BLDC motor.
- Trigger ultrasonic sensor and wait for echo pulse.
- Calculate the distance and select the PWM of motor.
- Run continuously to get realtime distance.

Time for demonstration!!!

Trigger

Echo

Distance

PWM of motor
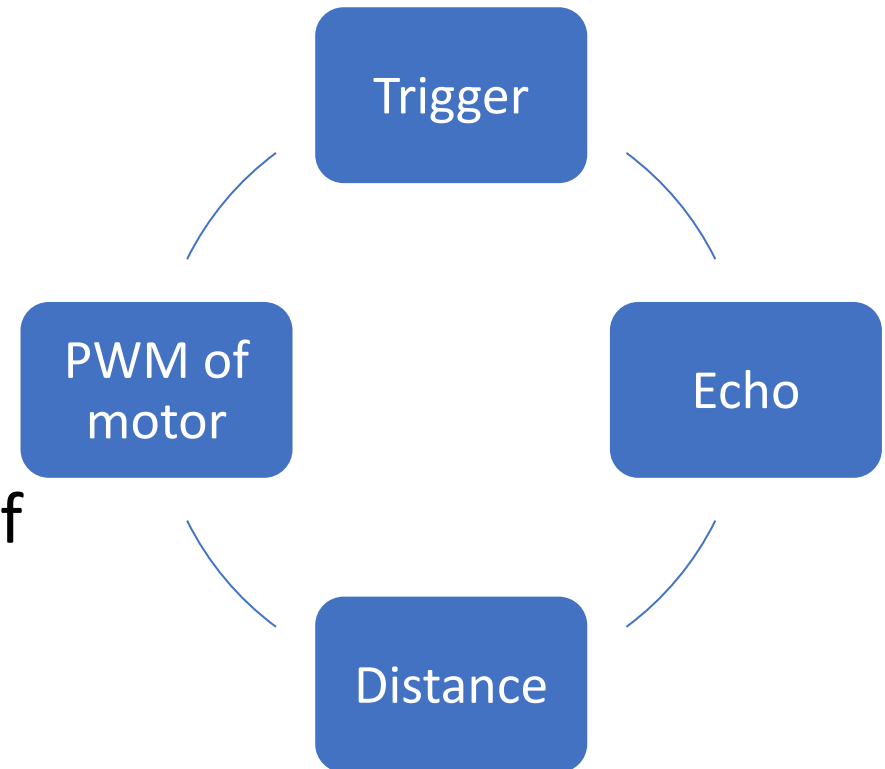
Explanation of Code (Please see the attached video)

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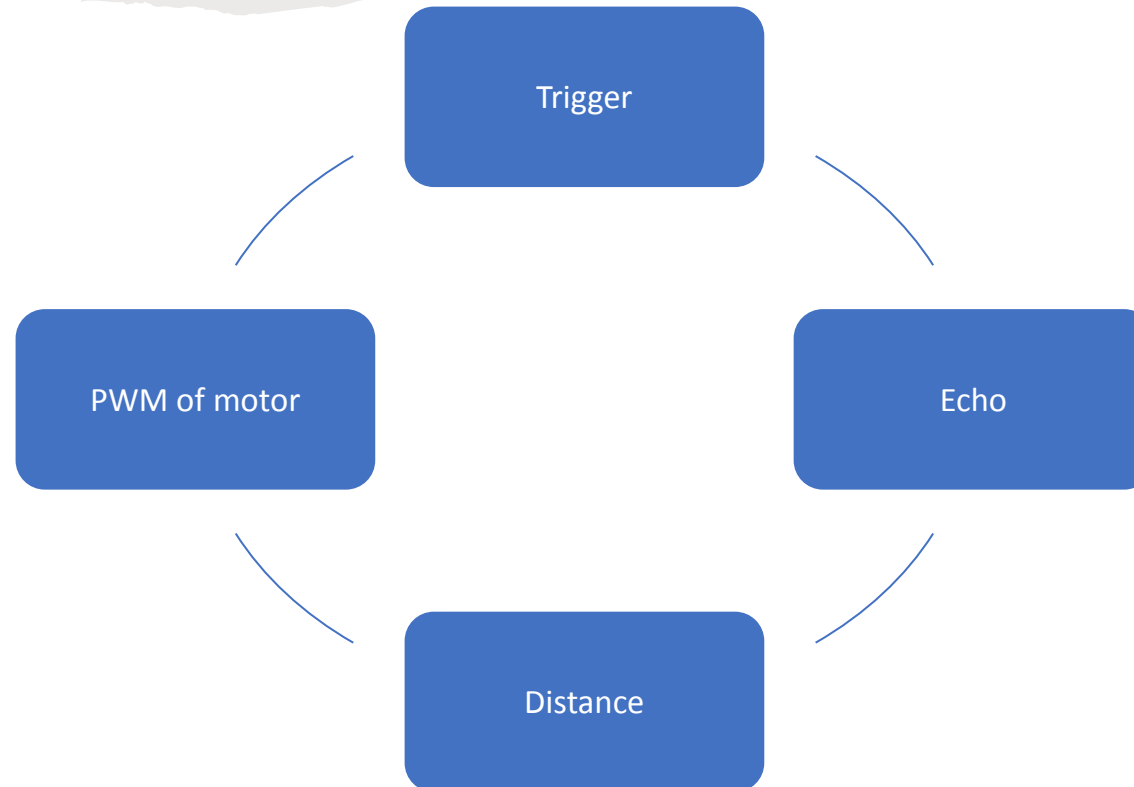
Future Scope

- To integrate zigbiee and collect battery voltage, speed data from UAV and transfer it to the Ground station for Real time analysis of the system.

- Use better sensor for obstacle avoidance like LiDAR (Light Detection and Ranging) sensors, Camera etc.

THANK YOU

Any questions??