Detection Range of Ultrasonic Sensor for Different Colors

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Abstract: **The ultrasonic sensor(HC-SR04) uses sonar to determine the distance of an object.It will sense the reflection of an impedance discontinuity. For the in-air type of sensor most likely being discussed, that would be the transition between air and solid or liquid surface and sensor receivers report the first major reflection.In this paper, we are using +ultrasonic sensor for safelanding of autopilot (MAV).This ultrasonic sensor detects the obstacle based on colour and size and thus avoids collision.**

I. INTRODUCTION

The ultrasonic range detector employs an ultrasonic model that consist of an transmitter and receiver along with an ATmega16a microcontroller. It works transmitting the pulse of sound at a frequency inaudible to the ear. This pulse will listen the microcontroller. By taking the input from the microcontroller we will measure the obstacle distance.

The objective of the proposed technique is to develop a device that can be used to measure the distance of the target with high precision using microcontroller. Many different methods have been designed and developed till date for the measurement of distance from the observer to a target. This is done for navigation, surveying, determining focus in photography, accurately aiming a weapon, etc.

Measuring the distance manually will give lot of errors. Research in the field of electromagnetism got significant importance due to the employment of EMW for measurement of distance [3]. IR rays were used for lesser distances but gave errors in the result. Thus, these disadvantages are eliminated by use of ultrasonic sensor. The proposed system employs ultrasonic waves for distance measurement, the highly directional properties of the wave and comparatively lower attenuation encountered makes it highly suited for distance measurement.

II. LITERATURE SURVEY

The ultrasonic sensor operates in millimetre range due to effects of environment accuracy[1]. In this paper, they have discussed the list of environmental parameters which have the major influence on the accuracy of the sensor. These environmental parameters were taken into consideration to calculate the instantaneous speed of sound by formulating a mathematical equation. The maximum percentage error of 0.33 was obtained when compared for temperature range of 0-50°C.

In this paper presented [2], they have employed an ultrasonic module with transmitter, receiver and an ATmega16amicrocontroller. Here a short pulse of ultrasonic sound is sent. The microcontroller listen to the echo. The distance is calculated by taking the time duration of the transmission and reception of pulse and echo respectively. In this paper, they designed anATmega16 microcontroller based on range finder using ultrasonic module. This module will measure distance up to 2.5m. By using ATmega16a and HC-SR04 they were able to reduce the cost and increase the efficiency. Thus, they implemented low power, low cost and simple system for distance measurement.

III. ULTRASONIC SENSOR

The HC-SR04 ultrasonic sensor uses sonar to determine distance to an object. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package. It will detect from 2cm to 400 cm or 1" to 13 feet. Its operation is not affected by sunlight or black material like Sharp rangefinders.It comes complete with ultrasonic transmitter and receiver module. Fig1 shows the layout of the ultrasonic sensor which consist of pins like VCC, Trig, Echo and GND

Fig 1: Layout of Ultrasonic sensor

IV. EXPERIMENTAL SETUP

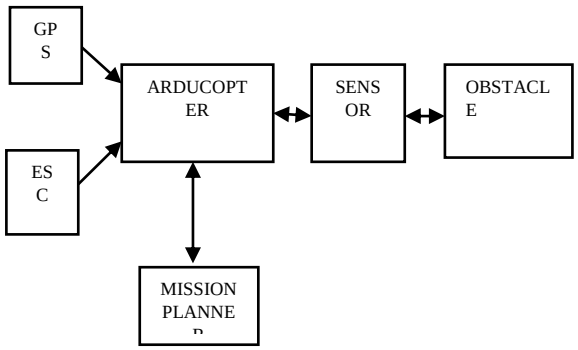

Fig2: Block Diagram for Detection of Obstacle

The control board present on the MAV is connected to the ESC and GPS. The arducopter consist of theAPM flight control board. The ESC is connected to control the power and GPS is taken as the reference signal. The arducopter is externally connected to the ultrasonic proximity sensor. The PWM signals are generated from the sensor. When the obstacle is present there is echo signal obtained back from the obstacle. In the ground station mission planner software gives the data of the voltage and the distance. The obstacle is tested with different colors of VIBGYOR. There were voltage changes for different colors. The experiment was conducted placing the obstacle at different distance from 2cm to 400cms. The measuring angle of the sensor is 30degrees. The sensor connected to the analog pin in the arducopter and the pin was enabled in the mission planner. Fig2 shows the block diagram of experiment.

Fig3: Experimental setup

Fig3 shows experimental setup conducted using quadcopter MAV. The sensors present on the APM board were calibrated before connecting to the quadcopter. Calibration like radio, compass, GPS and the ultrasonic sensors were done. The firmware was loaded on the board depending on MAV we used. The ultrasonic sensor was connected to the control board through the analog pin. The sensor can be connected from the AN0 to AN5 pin here we have connected to the AN1 pin. The control board was connected to the interfacing software mission planner through USB cable. The initial settings for connecting to the ultrasonic sensor to the mission planner were done. A particular obstacle was taken to this all the colors were individually pasted and the corresponding voltage and distance shown on the mission planner and this was noted. The noted distance and voltages were plotted.

V. RESULTS AND DISCUSSIONS

The experimental setup as shown in the Fig was conducted successfully. The obstacle was placed from 25cm to 500cms and the respective reading was obtained in the mission planner the obstacle taken was with different colors. There was a fluctuation in the voltage depending on the color of the obstacle used. For some of the colors the voltage became constant after particular distance. We checked for the colors in VIBGYOR and also white color. Fig 4 shows the results obtained by the mission planner for different colors. The voltage attains a saturation point for different colors. Fig 5 shows the graph obtained by the mission planner.

The voltage varies with different distance. The MAV was connected with the telemetry and that was sending the results to the ground station through the telemetry which is been connected to the mission planner software. Through this MAV another error plot is obtained with altitude sensor present in the flight control board Apm 2.6 and the ultrasonic sensor HCSRo4 attached externally to the board. This is shown in Fig 6. The altitude sensor shows continuously the altitude values, but the ultrasonic sensor gives the values upto 4m after this range the sensor does not detect.

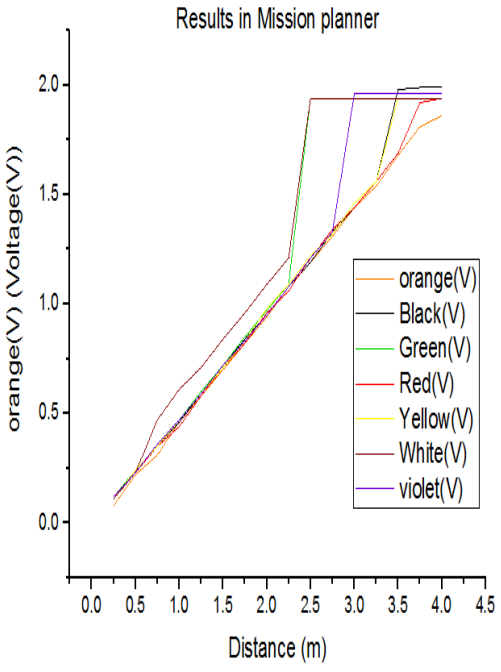

Fig4: Saturation Points Of Different Colors

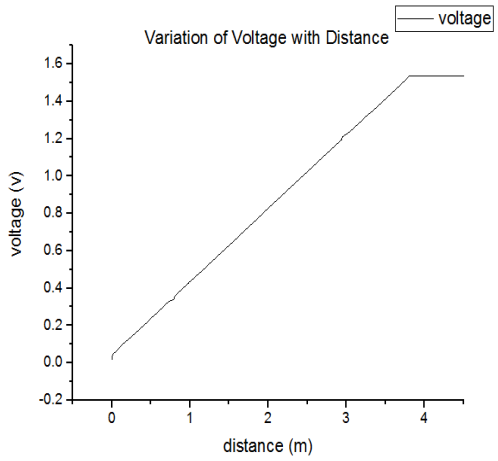

Fig5: Variation of Voltage with Distance

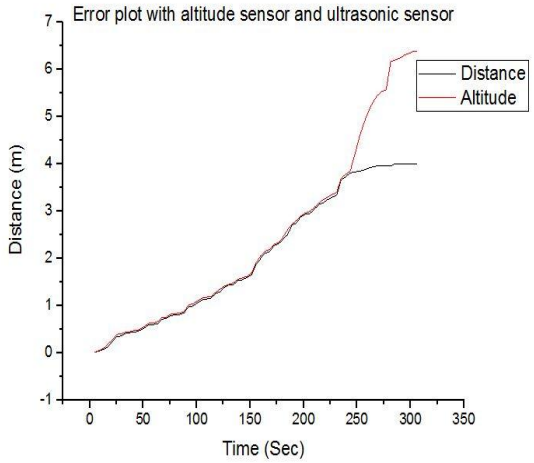

Fig6: Error Plot of Ultrasonic and Altitude Sensors

VI. CONCLUSION

In this paper we tested for different colors obstacle using Ultrasonic sensor(HC-SR04). The results show that the voltage was varying differently for different colors. The voltage became constant after some range, this indicates that for different colors the detecting range is stoped. The detecting range changes for each color with reference to the above figure. The mission planner was used to take the voltage and distance values.

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