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RADAR TO DETECT THE 'STEALTH AIRCRAFT'

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Abstract - *Stealth aircraft are shaped to avoid detection by high-frequency beams, microwave radar, and are less stealthy to meter wave radar. (Global Times). The main idea of this project is to detect stealth aircraft. Here the radar transmits the signal continuously and that signal is received continuously. If any aircraft is entered in that path then the signal will be distorted and hence by processing the signal it can displays whether it is stealth aircraft or normal aircraft.*

Key Words: stealth aircraft, ultrasonic sensor, signal processing, sky wave propagation.

1. INTRODUCTION

Every county has its own borders and it is important to secure those borders and don't allow others to enter. An aircraft is used to drop the bombs and it travels through sky therefore it is impossible to see it with the naked eye therefore radar is used to identify aircrafts. A radar is a device which is used to detect the objects or aircraft that are not watched by naked eyes. Military radar is used to detect the aircrafts and ships of the enemy. A radar uses an echo signal to find the target, But a stealth aircraft doesn't produce an echo which makes the stealth aircraft invisible to the radar. As the properties of ultrasonic and radar signal (electromagnetic wave) are same whenever they touch an object. We use ultrasonic radar because it is cheap when compare to radar. The only difference between a ultrasonic and EM (electromagnetic) wave is an ultrasonic requires a medium where an EM wave does not require any medium to penetrate. The example of stealth aircraft is show below.

1.1Example of Stealth Aircraft

The aircraft shown in figure 1 has been designed in such a way that it reflects the radar signal away from the radar.

Fig-1. Stealth aircraft it reflects the echo away from radar due to its shape

The aircraft shown in figure 2 has radiation paint on it so that it will observe the radar signal.

Fig-2. Stealth aircraft it has radiation absorb paint on it so that it absorb the radio wave

1.2 How does a Radar Work for a Normal Aircraft

Whenever a radio wave touches the target then an echo or some signal is reflected back to the radar such that the target is detected. In an normal radar the target is detected based on the echo signal.

1.3 How Does a Radar Work for a Stealth Aircraft

Whenever a radar signal touches the stealth aircraft then the radio signal may observe or reflect away from the receiver, therefore the radar is blind stealth aircraft.

1.4How Does a Stealth Detection Radar Work

Here the transmitting and receiving are not done by the same antenna. The receiver continuously receives the signal after it is reflected from the ionosphere, whenever a stealth aircraft comes in the way of the signal then the signal is not received. Therefore a stealth aircraft is detected.

2. LITERATURE SURVEY

1. The ultrasonic signal is a high frequency sound signal where as a radio signal is a high frequency EM signal. Both the signals are used to detect objects but ultrasonic is mostly in medical whereas radio signals are used in radar.[1][2]
2. The radio waves of frequency (3-30MHz) are used for sky wave propagation, these signals are reflected back by touching the ionosphere'. (sci-hub.se/10.1109/lawp.2019.2929780). [3][7]
3. If any object enters in the sky wave propagation path then the signal will be distorted .[4][8][9]
4. Stealth aircraft are shaped to avoid detection by high-frequency beams. "Meter wave radars can detect stealth aircraft because modern stealth aircraft are mainly designed to avoid detection by microwave radar, and are less stealthy to meter wave radar. (Global Times). [5][6]

3. PROPOSED METHOD

Here we demonstrated the process by using the ultrasonic sensor. The only difference in between the ultrasonic and electromagnetic signal (radar signal) is an ultrasonic signal is a sound signal and it requires medium to travel (it can't travel in vacuum), where an electromagnetic signal does not require any medium(it can travel in vacuum). Rather than that both the signals have the same property when they touch any object. They may reflect or refract based up on the frequency of the signal. If the radar signal frequency is in between 3-30MHz then those signals can penetrate through the ionosphere hence they will reflect back. Here we used an ultrasonic radar and an arc shape shield which acts like an ionosphere layer. The signals are continuously transmitted and received by the receiver, there are 2 cases which process the signal.

Case 1: (Detecting the Stealth Aircraft)

The receiver continuously receives the signal which is reflected back after touching the ionosphere. If a stealth aircraft gets in that path then it observes the signal such that there are no echo signals, so that the receiver receives the null value therefore it displays that it is a stealth aircraft.

Case 2: (Detecting Normal Aircraft)

The receiver continuously receives the signal which is reflected back after touching the ionosphere. If a normal aircraft gets in that path then the signal frequency is changed, therefore it displays that it is a normal aircraft.

3.1 Block diagram

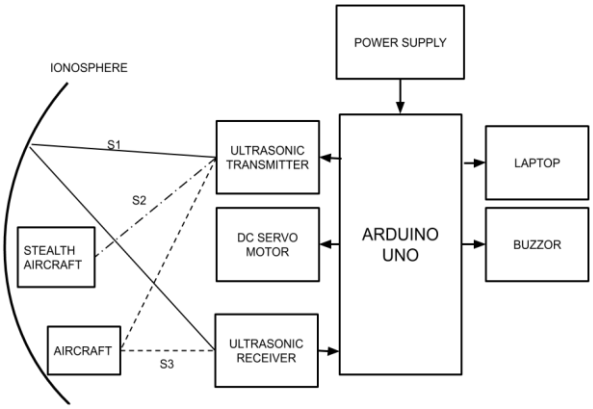

Fig-3. Block diagram

3.2 Working

The Arduino Uno transmits the electrical signal to the ultrasonic transmitter, it converts the electrical signal into ultrasonic signal. The ultrasonic receiver is used to receive the ultrasonic signals.

There are three cases.

Case 1: (When There is no Aircraft)

The signal S1 occurs when there is no aircraft. The signal S1 touched the ionosphere and reflected back to the radar and the frequency of the signal was unchanged. Then it displays nothing on the laptop and the buzzer is OFF.

Case 2: (When There is Stealth Aircraft)

The signal S2 occurs when a stealth aircraft enters the zone. From figure 3 you can conclude that there is no reflecting signal or echo signal from stealth aircraft. Then it displays stealth aircraft in blue color on the laptop and

the buzzer is ON.

Case 3: (When there is a normal aircraft)

The signal S3 occurs when an normal aircraft enters the zone then the frequency of the reflected signal or echo signal is changed due to Doppler effect. Then it displays aircraft in red color on the laptop and the buzzer is ON.

4. RESULTS

Figure:4 given below shows the aircraft and figure 5 shows the stealth1 aircraft. Here we created the models of the aircraft (normal aircraft and stealth aircraft).

Fig-4.Prototype for normal aircraft

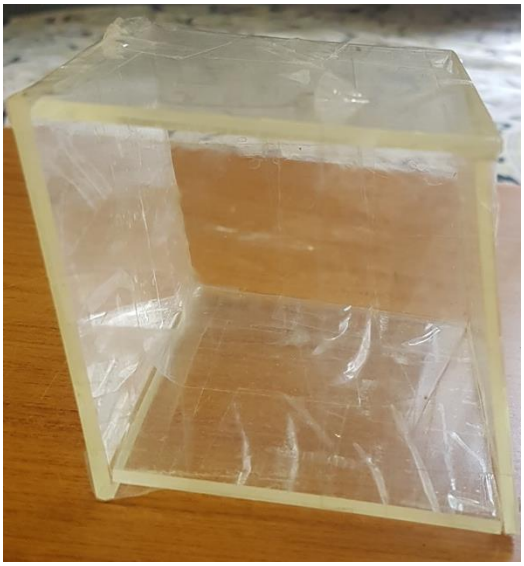

Fig-5. Prototype for stealth aircraft(as you can see that its shape bumps the signal away from the radar)

Our project is shown in figure 6 and 7, it shows what our project physically looks like.

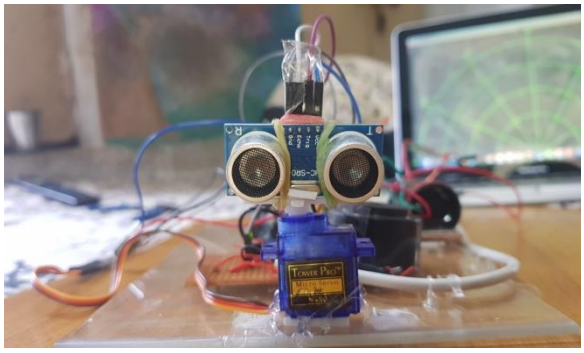

Fig-6. front view of the project

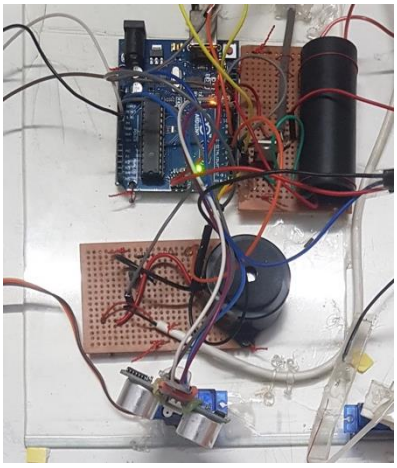

Fig-7. Top view of the project

4.1 Normal Radar with Normal Aircraft

Here we show how a normal radar displays the normal aircraft. If any object is present then it is represented by a red line, otherwise it shows a green line. It is shown figure 8 and figure 9.

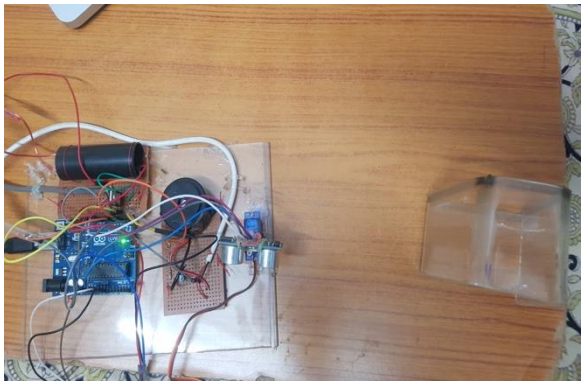

Fig-8. Normal radar detecting normal aircraft

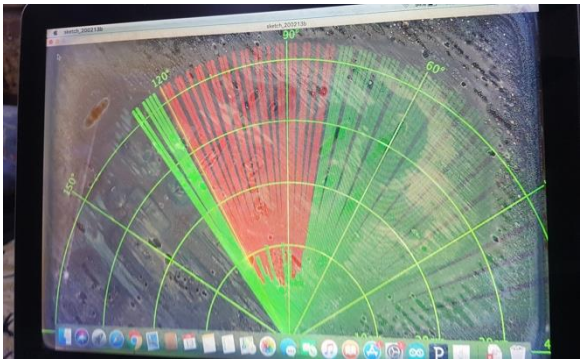

Fig-9. Displaying the output (normal aircraft represented in red color)

Red color- normal aircraft.
Green color-no aircraft.

4.2 Normal Radar with Stealth Aircraft

Here we show how a stealth aircraft isn't detected by the normal radar, it is shown in figure 10 and figure 11. The stealth isn't detected so that there is no red line displayed.

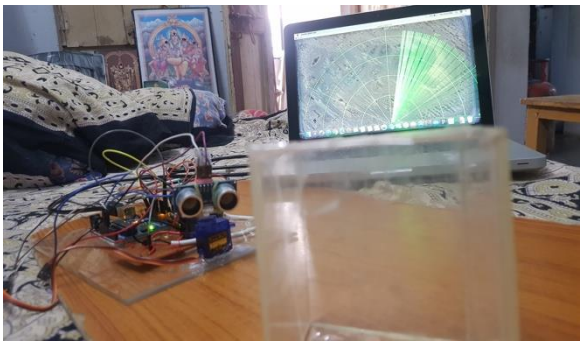

Fig-10. Normal radar with stealth aircraft

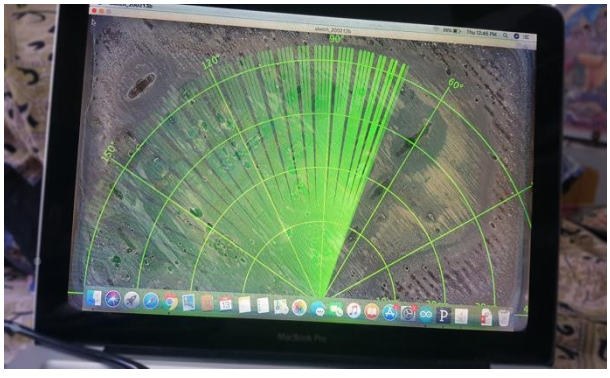

Fig-11. Output display (an normal radar can't detects the stealth aircraft)

4.3 Radar That Detects Stealth Aircraft

Here we show how we programmed the radar so that it can detect the normal aircraft as well as stealth aircraft too. The ideal radar is shown in figure 12. If there is no object then it displays in green line.

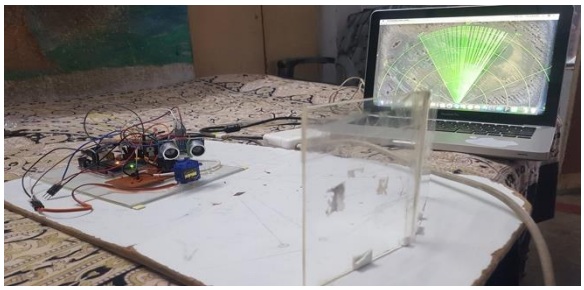

Fig-12. Modified radar

Here we show how our radar detects the normal aircraft, it is shown in the figure 13 and figure 14 The place and the position of the aircraft is shown in red.

Fig-13. Modified radar detecting normal aircraft

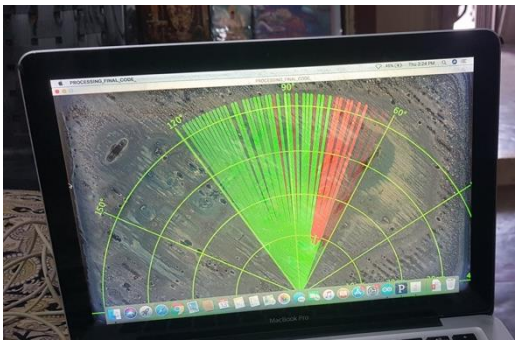

Fig-14. Output of normal aircraft in modified radar

Red color- normal aircraft.
Green color-no aircraft.
Blue color-stealth aircraft.

Next we are shown how our radar detects the stealth aircraft, it is shown in figure15 and 16. The stealth aircraft is shown in blue.

Fig -15. Modified radar detecting stealth aircraft

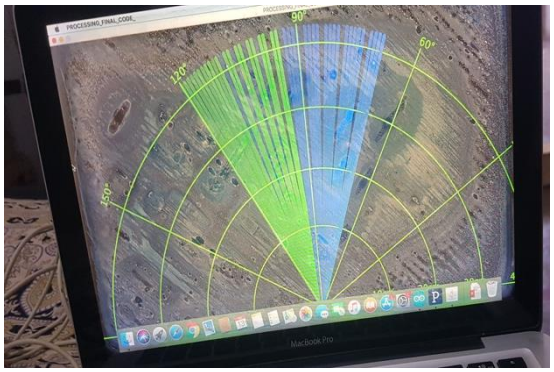

Fig-16. Output for stealth aircraft in modified radar

Next we are showing that the detection of normal aircraft and stealth aircraft at a time is shown in figure 17 and 18. The stealth is represented by blue line and the normal aircraft is shown in red line.

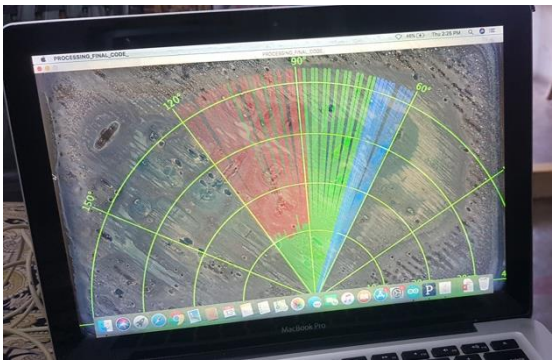

Fig-17. Displaying normal aircraft and stealth aircraft at a time

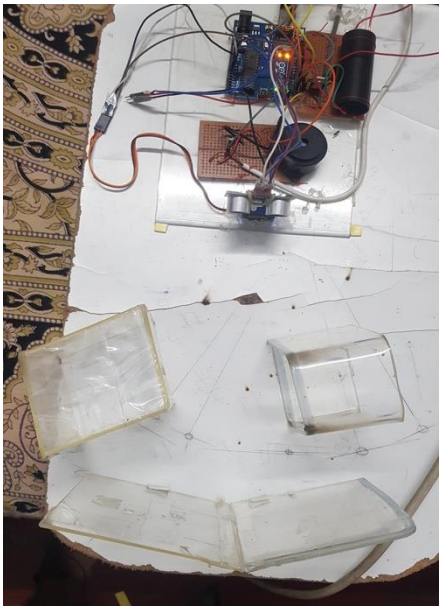

Fig-18. Radar detecting normal and stealth aircraft at a time

5. CONCLUSION AND FUTURE SCOPE

5.1 Conclusion

By using this radar we can detect the normal aircraft positon and range of the normal radar, where this radar can detects the position of the stealth aircraft and display it as blue in color in the display. The normal aircraft is displayed as red color.

5.2 Future Scope

In future we can modify this radar so that it can show the range of stealth aircraft too.

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BIOGRAPHIES

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