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Radar Guided Missile System

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***Abstract*: The aim of our project is to design a missile launcher which is controlled by the signals from a RADAR. The working is based on Arduino Uno, Servo motor, Ultrasonic sensor. The idea is to first code the entire working using our previous knowledge of programming. The code will then be simulated on software and later be interfaced with the hardware or Arduino Uno. The ultrasonic sensor movement is maintained by the servo motor fixed within it. The servo motor is made to revolve through fixed angles; if object is detected then the angle position is sent as the input to the launcher fixed servo motor. The launcher will release the missile fixed within it. This project will play an important role in defense purposes.**

***Keywords*: Arduino Uno, Ultrasonic sensor, Servo motor**

1. Introduction

RADAR is an object detection system which uses radio waves to determine the range, altitude, direction, or speed of objects. Radar was secretly developed by several nations before and during the World War II. The term RADAR itself, not the actual development, was coined in 1940 by United States Navy as a crony for Radio Detection and ranging. The modern uses of radar are highly diverse, including air traffic control, radar, astronomy, air defence systems, antimissile systems, antimissile systems; marine radars to locate landmarks and other ships; aircraft anti-collision systems; ocean surveillance systems, outer space surveillance. A radar system is the heart of a missile guidance system.

Our main aim of developing this project is to make the automated missile launching devices which is highly helpful in defence technology and surveillance in upcoming years. These launching vehicles can be used in army supported with tankers and other vehicles, used in navy by supporting with ships, and used in aircraft by installing it in air-crafts. These launchers will be actuated if there is any interruption in the radar signals.

2. Literature survey

Different types of researches have been made by different researchers in developing this type of project. However, they have a different application and have different technologies implemented. Some of those papers are mentioned below stating their technology and application. “The Idea” Army, Navy and the Air Force make use of this technology. The use of such technology has been seen recently in the self-parking car systems launched by AUDI, FORD etc. And even the upcoming driverless cars by Google like Prius and Lexus. This setup can be used in any systems the customer may want to use like in a car, a bicycle or anything else. The use of Arduino in this provides even more flexibility of usage of the above-said module according to the requirements.

D. A. Ghoghre [1], Ahire Dhanshri, Ahire Priyanka, have presented the radar system which is used for only object detection, and can be implemented for surveillance only and not available in defence technology.

Srijan Dubey [2], Supragya Tiwari and Sumit Roy, have performed an object detection system with the help of ultrasonic sensor and published “Implementation of Radar using Ultrasonic Sensor”, this system is used for detecting objects in an open surface and provide alarming system to indicate the interference of objects. This is a surveillance system which can able indicate.

Kadam D. B. [3], Patil Yuvr J. B., Chougale Krishna V., Perdeshi Swagat S., have published “Arduino Based Moving Radar System”. This system is based on making a vehicle which is moved automatically by the signals of the ultrasonic sensor, controlled by the Arduino Uno processor and its software commands.

Sanjeev Kumar Verma [4], Sudhir Sing Badhuriya, and Saleem Akhtar, have worked on material analysis and non-destruction technology with the help of ultrasonic sensor and many types of material analyzing tools and different materials. Pamfil Somadiag [5]., He has designed “Air and Ballistic Missile Defense Systems LTC.” This system is used to launch the missile with the help of air through ballistic missile launching vehicle. These systems are designed to provide low cost in defence technology, but it has low efficiency than other system and needs proper maintenance.

T. V. Karthikeyan., A. K. Kapoor [6]., Scientists Defence Research and Development laboratory, Hyderabad, have published paper on “Guide Missiles”. They have worked on the team of human controlled and semi-automatic missile launching devices. They tell about computer controlled and automated missile system which is highly actuated by huge power systems, however these systems needs human interface or help while locking the target to be attacked. Bo Zhang [7], Zhou Wang and Tao Wang, Publishedon the topic of “Research on Movement Characteristics of Launching Mechanism of Portable Missile”. They have studied about the

portable mini-missile launching vehicles highly adaptable to the war land. These need alternative power backups to overcome the power scarcity, because these systems needs more power to handle normal or huge sized missile. These devices cannot able to withstand high loads, and needs specially designed missile to work in high efficiency.

C. Isik., S. K. Ider., B. Acbar [8]., worked on "Modelling and verification of a missile launcher system." They have developed a reusable launcher which is highly support the financial wastages in defence testing and other working systems. However, these missile systems after a single usage will be affected highly, and needs more spares and small operating systems for rebuilding the launching tools. It also needs proper housing which is high in cost than normal missile launching tools.

Ohtsuka Hirohito [9]., Yagi Kazuhiro, Kishi Kohichi, Nohara Masaru, Sano Naruhisa, Worked on JAXA on "Research on Advanced Solid Rocket Launcher". These are the world's best solid rocket launcher. But it is large in size and bulky and high in cost. Whereas this is a complex design.

3. Components

A. *Arduino Uno*

Fig. 1. Arduino Uno

Arduino Uno is a physical computing platform that released under open-source license and based on a simple microcontroller board (Fig. 1). Integrated Development Environment (IDE) is devoted for coding the device. In most applications, the Arduino Uno board is used as a controller. Initially, the device requires a direct connection to a computer at the first setting steps. The most important advantage with Arduino is the programs can be directly loaded to the device without requiring any hardware programmer to burn the program. This is done because of the presence of the 0.5KB of Boot loader which allows the program to be burned into the circuit. All we have to do is to download the Arduino software and writing the code.

B. *Ultrasonic Sensor*

HC-SR04 Ultrasonic (US) sensor is a 4 pin module, whose pin names are V_{cc}, Trigger, Echo and Ground respectively. This sensor is a very popular sensor used in many applications where measuring distance or sensing objects are required. The module has two eyes like projects in the front which forms the Ultrasonic transmitter and Receiver. The sensor works with the simple high school formula that The Ultrasonic transmitter transmits an ultrasonic wave, this wave travels in air and when it gets objected by any material it gets reflected back toward the sensor this reflected wave is observed by the Ultrasonic receiver module.

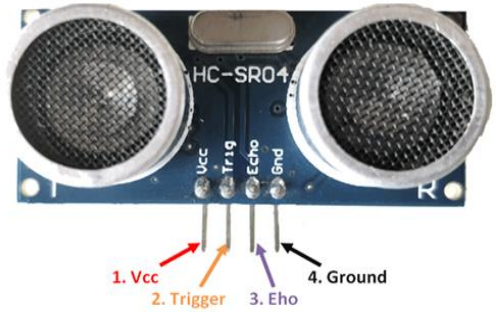

Fig. 2. Ultrasonic Sensor

C. *Servo Motor*

Fig. 3. Servo motor

A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors. Because servo motors use feedback to determine the position of the shaft, you can control that position very precisely. As a result, servo motors are used to control the position of objects, rotate objects, move legs, arms or hands of robots, move sensors etc. with high precision. Servo motors are small in size, and because they have built-in circuitry to control their movement, they can be connected directly to an Arduino. Servo motor consist of Black/Brown ground wire, Red power wire (around 5V), and Yellow or White PWM wire.

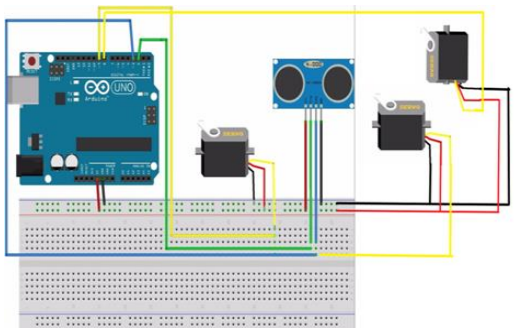

Fig. 4. Circuit connection

4. Working

Initially, upload the code to Arduino after making the connections. You can observe the servo sweeping from 0^0 to 180^0 and again back to 0^0. Since the Ultrasonic Sensor is mounted over the Servo, it will also participate in the sweeping action. When an object is detected in ultrasonic sensor then the rotation of sensor fixed servo motor will be stopped. The angle in which the sensor fixed is stopped then that angle is sent as the input angle for the launcher fixed servo motor. If both the servo motors performed in a perfect manner then, at the last the servo motor which will trigger the launcher will release the fixed missile at the desired position where the object is detected.

Now, open the processing application and paste the above given sketch. In the Processing Sketch, make necessary changes in the COM Port selection and replace it with the COM Port number to which your Arduino is connected to. If you note the Processing Sketch, I have used the output display size as 1280×720 (assuming almost all computers now-a-days have a minimum resolution of 1366×768) and made calculation with respect to this resolution. In the future, I will upload a new Processing sketch where you can enter the desired resolution (like 1920×1080) and all the calculations will be automatically adjusted to this resolution. Now, run the sketch in the Processing and if everything goes well, a new Processing window opens up.

5. Conclusion

In this paper a radar system which controls the missile launching vehicle triggering and positioning was designed with the help of Arduino, servomotor and ultrasonic sensor, which can detect the position, distance of obstacle which comes in its way and converts it into visually representable form in the Arduino processing software. This system can be used in defence for object detection and destruction system. Range of the system depends upon type of ultra-sonic sensor used. We used HC-SR04 sensor which range from 2 to 40 cm.

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