RADAR MODEL FOR TARGET DETECTION USING ZIGBEE COMMUNICATION

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ABSTRACT:
Radar is an object-detection system which uses waves to determine the range, altitude, direction, or speed of objects. The object returns a tiny part of the wave's energy to a dish or antenna which is usually located at the same site as the transmitter.In an automatic target tracking radar system for tracking selected target signals in the presence of interfering signals, a range tracking circuit for automatically tracking selected received signals.Here in this project the radar is fitted with DC geared motor and its operation is controlled byAT89S52 microcontroller. Buzzer and Speaker are being used for indicating target detection.In this project RADAR antenna is placed at an altitude to track various frequencies emitted by different radio stations. The rotation of RADAR antenna is based on the signal tracked by a pair of Infrared Sensor based command signal generated through it. Once the signal is matched antenna will stop in that particular direction it indirectly turns ON the relay to switch ON the particular music indication system. In this way we can track the signal and can switch ON the particular desired frequency channel. By using ultrasonic sensor the moving targets can be detected and the distance between the target and antenna can be determined. ZigBee modules are being used for the wireless communication between transmitter and receiver.

KEYWORDS: Radio waves, AT89S52 Microcontroller, IR sensors, RADAR, Ultrasonic sensor, ZigBee.

1. INTRODUCTION:

The main objective of this project isthe radar target direction with remote station alert system and calculating its RANGE and VELOCITY. Radar signal containing selected target simulations modulates an optical, infrared signal, in accordance with the selected target simulations. Radar target system is provided with selectively direct modulated IR radiation onto selected areas of an RF (Radar Frequency) array. Radar target identifier is selected with areas of the RF array function to add target angular simulations and target space position and scintillations to the other simulations contained in the radar signal. The IR radiation is converted to a radar frequency signal in the RF array and is transmitted to the radar test system.

This Project basically has two sections: Tx Section and Rx Section. The target will be detected and the range will be calculated. Round trip time will also be measured and then by using the formerly calculated/measured values, the Velocity can also be calculated.

All these values are displayed on the LCD on the TX side. These values can be displayed on the LCD on the Rx side by using Zig-Bees.

The rest of the paper is organized as: Basic Principle of Radar in Section [2], Working Process is explained in Section [3], Conclusion in section [4], Advantages in section [5], Applications in section [6] and References in Section [7].
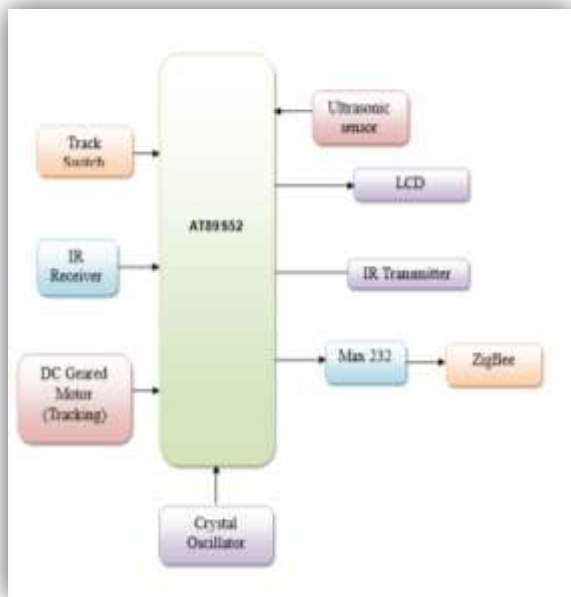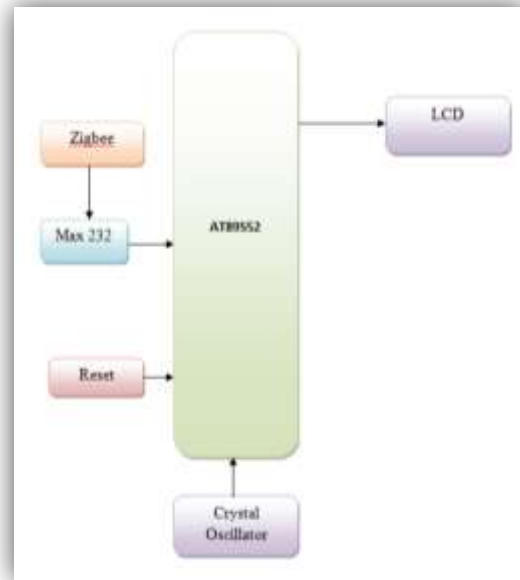
Figure1. TRANSMITTER   **Figure 2. RECEIVER**

2. BASIC PRINCIPLE OF RADAR:

A radar system has a transmitter that emits radio waves called radar signal in predetermined directions. When these come into contact with an object, they are usually reflected or scattered in many directions. Radar signals are reflected especially well by materials of considerable electrical conductivity especially by most metals, by seawater and by wet ground. The radar signals that are reflected back towards the transmitter are the desirable ones that make radar works. If the object is moving either towards or away from transmitter, there is a slightly equivalent change in the frequency of the radio waves, caused by the Doppler Effect.

RADAR EQUATION:

The power P_{rec}, returning to the receiving antenna is given by the equation:

$$P_{rec} = \frac{P_t \, G^2 \, \lambda^2 \, \sigma}{(4\pi)^3 \, R_{max}^4} = \frac{P_t \, G^2 \, c^2 \, \sigma}{f_o^2 \, (4\pi)^3 \, R^4}$$

$$P_{rec} = P_t \, G^2 \left(\frac{\lambda}{4\pi R}\right)^2 \underbrace{\frac{\sigma}{4\pi R^2}}_{}$$

$$\underset{\text{range loss}}{\underbrace{\text{between transmit}}} \quad \underset{\text{loss due to}}{\underbrace{\text{target reflection}}}$$
antenna & target   & range

Figure3. Radar Range Equation

where
Pt = Transmitting Power
G = Gain Of the Transmitting Antenna
c = Effective Aperture of Receiving Antenna

σ = Radar Cross Section
λ =(c/f)=Wavelength
Rmax=Maximum Range of Radar
Our Project is based on the principle of **DOPPLER EFFECT.** Doppler Effect states that when the radar waves are sent towards a moving target or object, they are reflected back and received by the radar. If the

frequency of the reflected wave is increased, the target is moving towards the radar. If the frequency of the reflected wave is decreased, the target is moving away from the radar.
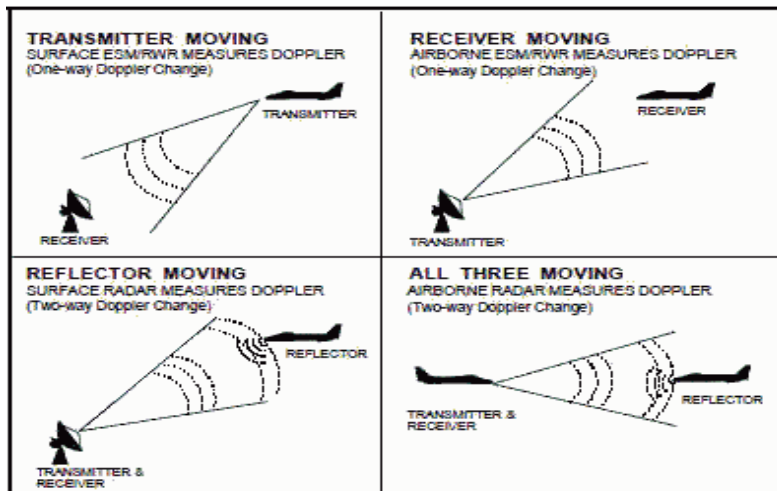

Figure4. Doppler Creation

In our project we are showing the detection of signal by using IR pair sensor. The principle behind infrared sensors is the transmission and reception of infrared light. An element known as a light emitting diode (LED) transmits active infrared light, which is reflected and received by an optical receiver known as a photo diode (PD). As long as there is no movement or object in the path of the light beam, the light pattern is static and the sensor remains in stand-by mode. When a person or object crosses the beam, the reflection of the light is distorted. This is registered by the PD, which gives off an impulse.
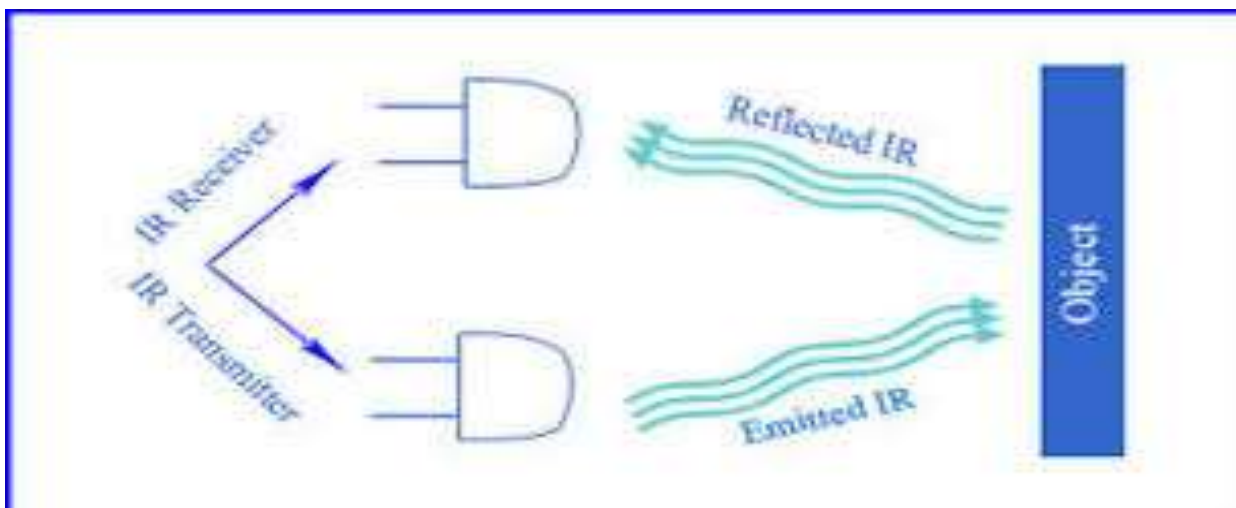

Figure5. IR effect when object is present

In this project, Ultrasonic sensor is also being used for the detection of the moving targets and calculating the distance of the target from the antenna system. The chirp is sent from the ultrasonic sensor and when this signal strikes the target an echo is received at the sensor.
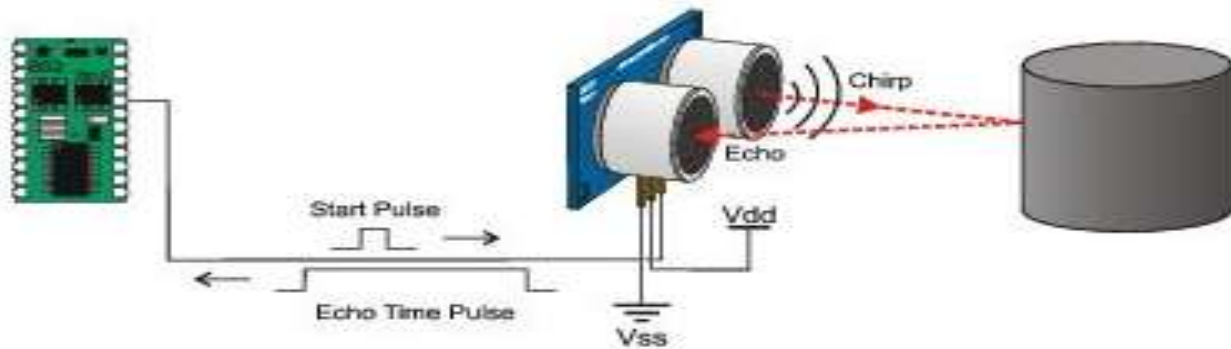
Figure6. Working of ultrasonic sensor

3. WORKING PROCESS:

Here, 230 volts AC supply is given to step down transformer which produces the output as 12 volts AC which is passed through the bridge rectifier. Rectifier output is pulsating DC that passes through the capacitive filter which blocks AC components and thus its output is DC that contains very less ripples, which is further given to 721 voltage regulator. The output of VR is constant DC.
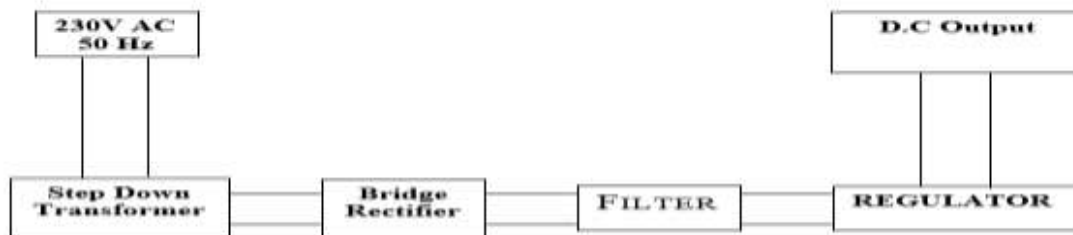

Figure7. POWER SUPPLY TRANSMISSION

The working process of the project is described below:

1. The power supply is provided to the AT89S52 microcontroller which passes the power to all the components to it.
2. When the user presses the track switch for the first time, the DC motor starts rotating which is controlling the RADAR antenna which is placed at an altitude to track various frequenciesemitted by different radio stations. The rotation of RADAR antenna is based on the signal tracked by a pair of infrared sensor based command signal generated through it. Once the signal is matched RADAR bowl will stop in that particular direction. It indirectly turns ON the relay to switch ON the particular music indication system.
3. Again if the user press the TRACK switches automatically RADAR bowl will track for another radio frequency signal and turns ON the relay to switch ON the Speaker.
4. If track switch is pressed again another command based code is generated from IR remote automatically it turns ON relay to switch ON audio buzzer indication system. In this way we can track the signal and can switch ON the particular desired frequency channel.

Meanwhile whenever the moving target comes in the region of ultrasonic sensor it can be detected and the range of the target can also be recorded.

Every time the target is detected, the master ZigBee sends the data to all the connected slave ZigBees. The slave ZigBees give the received data to the microcontroller which in turn sends the data toLCD for the display purpose.
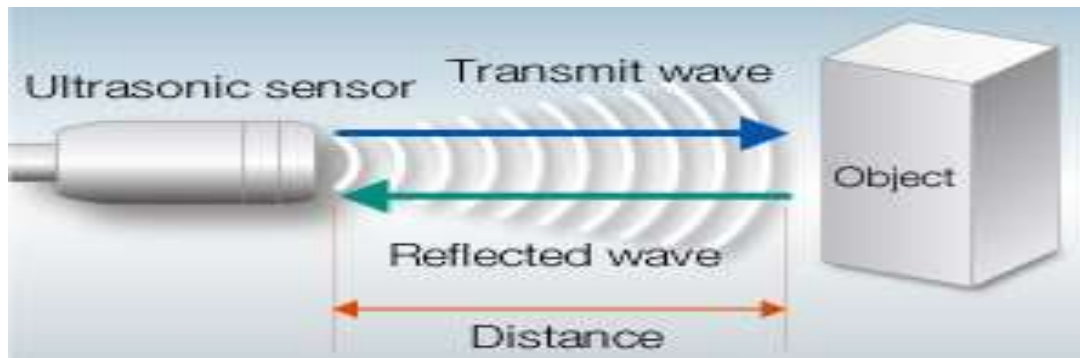
Figure8. Ultrasonic Sensor - when object is present

4. ADVANTAGES:
1) Very flexible - can be used in a number of ways
• Stationary mode
• Moving mode
• Two Directional mode
2) Beam spread can incorporate many targets
3) Can often select fastest target, or best reflection
4) Still very reliable
5) High Penetration capability.
6) Long Range

5. APPLICATIONS:
• Mapping radar scans a large region for remote sensing and geography applications.
• Wearable radar which is used to help the visually impaired.
• Air traffic control uses radar to reflect echoes off of aircraft.
• Weather radar uses radar to reflect echoes off of clouds.
• Some weather radars use the Doppler Effect to measure wind speeds.
• Missile Tracking System.
• Marine radars are used to measure the bearing and distance of ships to prevent collision with other ships.

6. CONCLUSION:
Radar target system is provided with selectively direct the modulated IR radiation. Radar target identifier is selected with areas to add target angular simulations and target space position and scintillations to the other simulations contained in the radar signal. This project presents Radar modal target Direction identifier with remote station alert system is been designed and implemented with AT89S52 controller in embedded system domain. Experimental work has been carried out carefully. The result shows that higher efficiency is indeed achieved using the embedded system according to requirement of the user.

7. REFERENCES:
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