Design and implementation of ultrasonic radar system for distance measurements using Arduino

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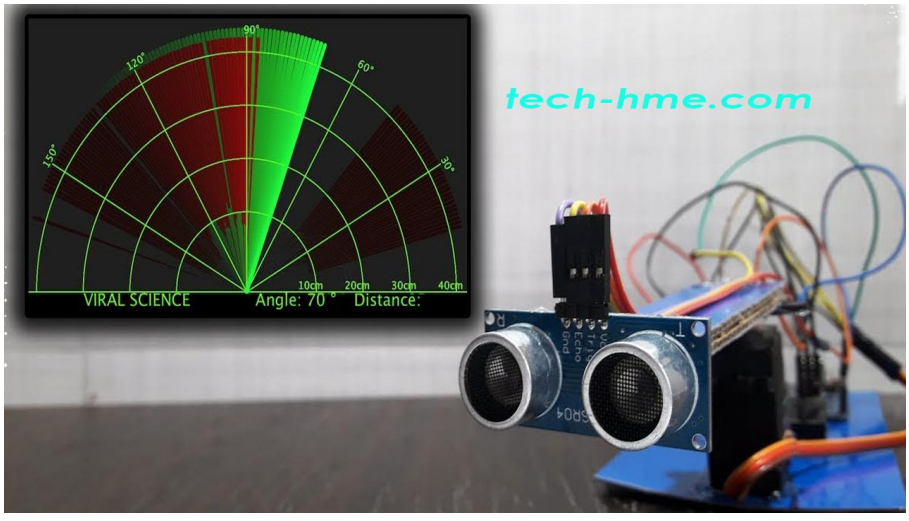
Radar is an electronic device which utilizes electromagnetic waves to determine the altitude, range, direction, or speed of both moving and immovable objects. In contrast, ultrasonic waves are used instead of electromagnetic waves in ultrasonic radar. The low power consumption, low cost and ease of implementation are considered the main features of the ultrasonic radar to be devoted in several applications such as security purposes, object detection and avoidance systems in robotics. This work presents a design and implementation of ultrasonic radar for distance measurements. The design consists of an ultrasonic sensor, an Arduino board as a controller, a servo motor and a java applica-tion. The detection range of the proposed system is tested up to 500 cm with the angle of rotation from (0 to +180) and (180 to 0) degrees for different types of obstacles or objects (sponge, wood an aluminum). The design is built using open source hardware which is coded via Micro C environment as a software entity. The effectiveness of the proposed design is measured using a statistical analysis of the distance error between the radar and the obstacles. The results obtained for all types of obstacles are tabled and graphed to prove that a very small error can be achieved using the proposed design.



In this work, an ultrasonic radar system was designed and implemented experimentally for distance measurements purposes to be used in various applications. An Arduino Uno device was used as a controller in the design beside other requirements such as servomotor, ultrasonic sensor and computer for distance calculation of objects or obstacles placed at different angles (from 0 to 180 degrees) within the range up to 5 meters. Three types of materials (wood, sponge and aluminum) were used in the design as obstacles. The error between the actual distance and measured distance was used statistically to validate the design. The results show that the percentage distance error recorded for wood, sponge and aluminum obstacles do not exceed 2%, 7% and 6% respectively which can be accepted in many applications.

Keywords: Arduino Uno 328; Ultrasonic Sensor; Servomotor; Java Application.