LTTS
GLOBAL
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L&T Technology Services

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Team No:
Module: Model Based System Engineering

Document History

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ULTRASONIC DETECTING SENSOR

1.0 Introduction:

Ultrasonic detection is most commonly used in industrial applications to detect hidden tracks, discontinuities in metals, composites, plastics, ceramics, and for water level detection. For this purpose, the laws of physics which are indicating the propagation of sound waves through solid materials have been used since ultrasonic sensors using sound instead of light for detection.

2.0 Requirements:

2.1 SWOT ANALYSIS:

Strengths: It can work 24/7. It detects the distance using ultrasonic detection sensor. It is not dependent on external user.	Weakness: In some cases false detection happens. There was chance for false dection
Oppourtunities Provide more safety. Attarct large,wider targeted audience. It can save more lives.	Threats: Microcontroller can damage. Buzzer will give trouble in sometimes and checking is mandatory.

2.2 Components used in ultrasonic Detecting sensor:

Ultrasonic sensor HC SR04
Lcd(16*2) //HD4470-10
Arduino Uno

Potentiometer
Power supply
Ground

Ultrasonic sensor HC SR04:

- The ultrasonic sensor works on the principle of SONAR and RADAR system which is used to determine the distance to an object.
- An ultrasonic sensor generates the highfrequency sound (ultrasound) waves. When this ultrasound hits the object,it reflects as echo which is sensed by the receiver.
- HC-SR-04 module has an ultrasonic transmitter, receiver, and control circuit on a single board.

Power supply:
It is used to give the power supply to the circuit.

Lcd Display(16*2):

- The term LCD stands for liquid crystal display.
- It is one kind of electronic display module used in an extensive range of applications like various circuits and devices like mobile phones, calculators, computers, TV sets, etc.
- These displays are mainly preferred for multi-segment light-emitting diodes and seven segment display.

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Arduino Uno:

- The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.
- The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits

2.3 4WS & 1H

Where:

Ultrasonic sensor is used in **oil, chemical, milk or water tanks** for level measurements or for liquid level control.
This sensor is used in thru beam detection for high speed counting.
This sensor is used in robotic industry for robot sensing.

When:
The sensor is used in when the liquid level measuremens are high.

What:
An ultrasonic sensor is an **instrument that measures the distance to an object using ultrasonic sound waves**.
An ultrasonic sensor uses a transducer to send and receive ultrasonic pulses that relay back information about an object's proximity.
High-frequency sound waves reflect from boundaries to produce distinct echo patterns

Why:
Ultrasonic sensor is used in **oil, chemical, milk or water tanks** for level measurements or for liquid level control .

How:
It is shown in below figure how it connected and used.

2.4 TABLE OF REQUIREMENTS:

High level Requirements:

ID	Description
HRL-1	It shell send echo to find object
HRL-2	It shell able to detect Moving object
HRL-3	Moving object signal will displayed on a display unit

Low level requirements:

Id	Description
LLR-1	It shell find the exact location of an Target
LLR-2	It shell find distance of an object
LLR-3	It shell find speed of an object
LLR-4	It shell display distance of an object

Advantages:

- The ultrasonic sensor has high sensitivity, high frequency and high penetrating power therefore it can easilydetect the external or deep objects.

- The use of ultrasonic sensor makes this system more accurate and precise than other methods.

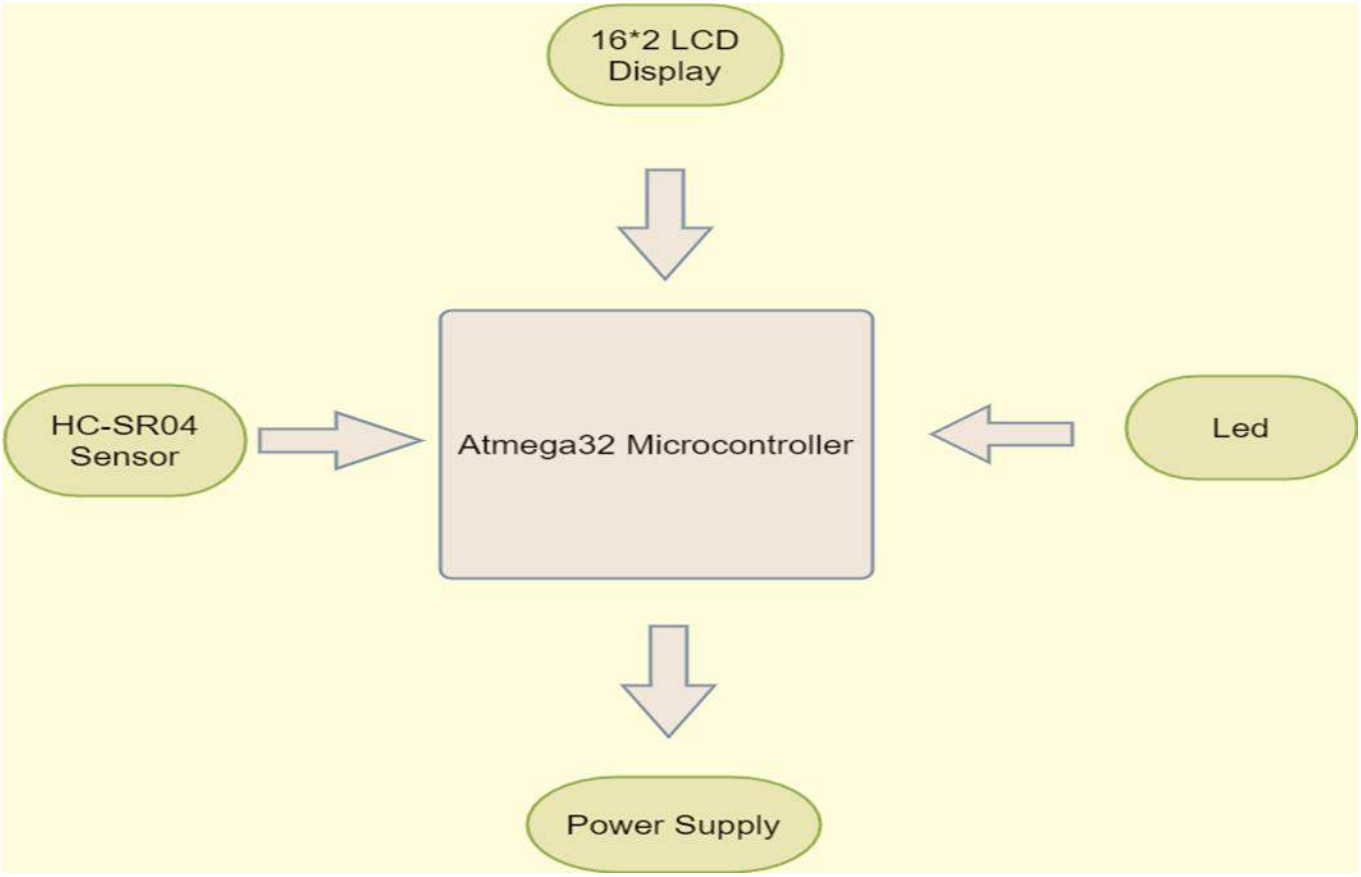
- This system is easy to use, not dangerous during operation for nearby objects, person, equipment or material.

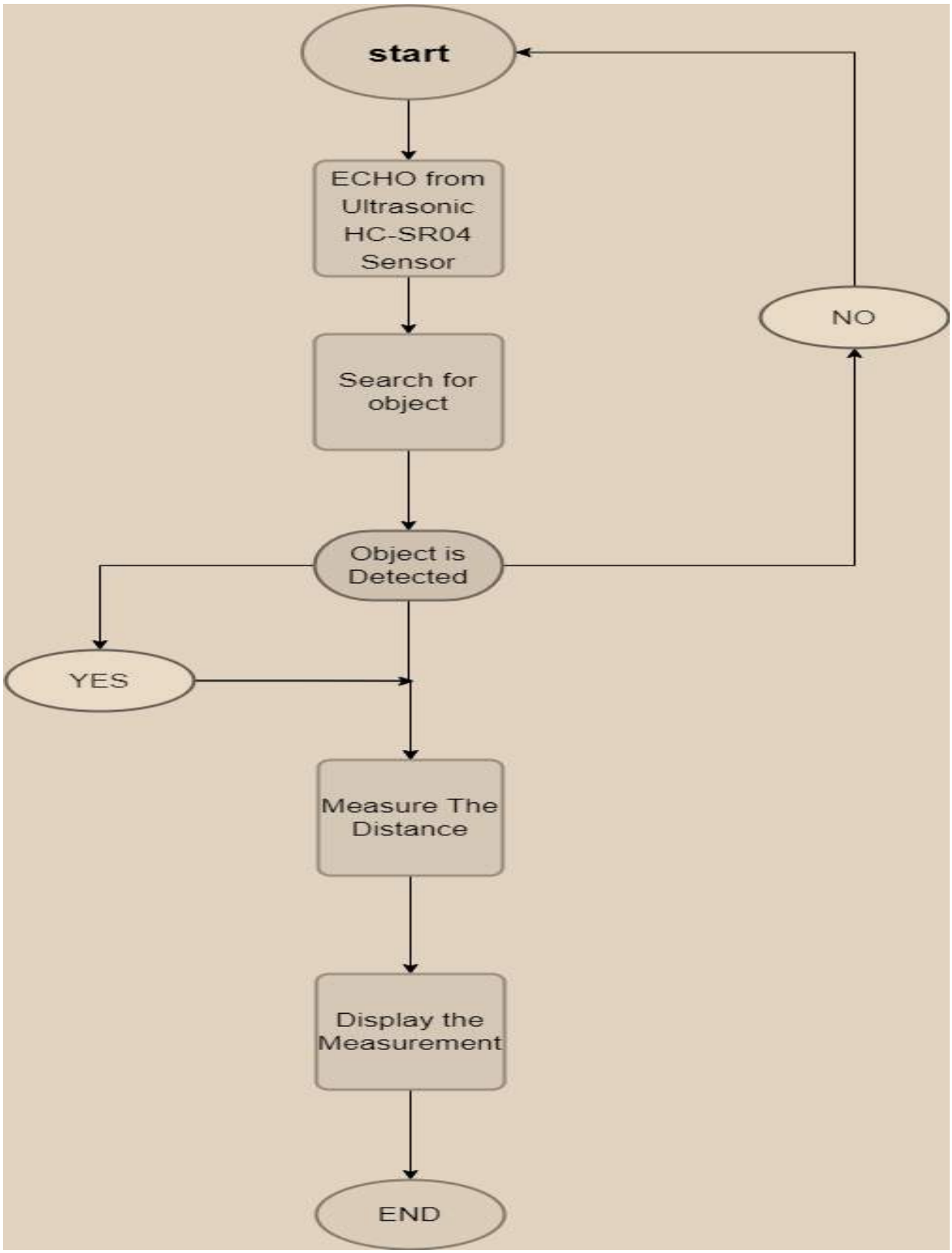
- Radar systems have a number of defense as well as civil applications.

Applications:

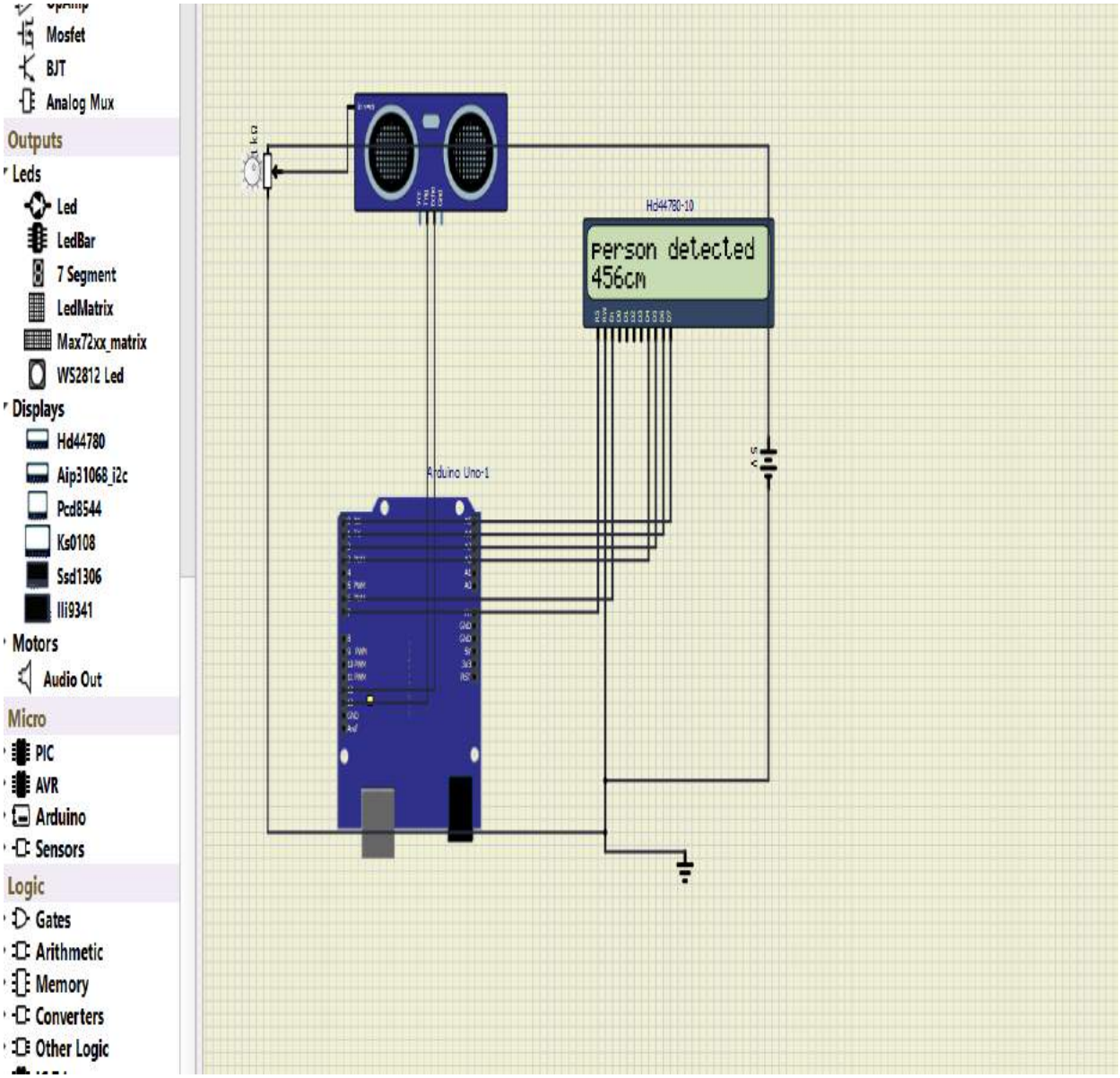
- It is used in machines like Automotive parking sensor obstacle warning systems,industrial distance measurements, terrain monitoring robots.
- Radar speed meters are used by the traffic police for enforcing speed limit.
- Marine radars used to locate the landmarks and other ships.
- Air traffic control uses radars to track aircraft on the ground, in the air and to guide planes for smooth landings.

3.0 ARCHITECTURE:


16*2 LCD Display
HC-SR04 Sensor
Atmega32 Microcontroller
Led
Power Supply


start
ECHO from Ultrasonic HC-SR04 Sensor
Search for object
Object is Detected
NO
YES
Measure The Distance
Display the Measurement
END

4.0 SIMULATION:



5.0 OTHERS:

8 Features of the Ultrasonic Distance Sensor:

- Supply voltage: 5V (DC).
- Supply current: 15mA.
- Modulation frequency: 40Hz.
- Output: 0 – 5V (Output high when obstacle detected in range).
- Beam Angle: Max 15 degrees.
- Distance: 2cm – 400cm.
- Accuracy: 0.3cm.
- Communication: Positive TTL pulse.

Specifications:

- Power supply: 5V DC
- Quiescent current: <15mA
- Effectual angle: <15°
- Ranging distance: 2cm – 350 cm
- Resolution: 0.3 cm
- Output cycle: 50ms