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Real-Time Oxygen Cylinder Tracking System

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Abstract - This paper presents the design and implementation of an Oxygen Cylinder Count Tracking System using Arduino Uno, an ultrasonic sensor, and an LCD display with I2C. The system aims to provide an automated and reliable solution for tracking the number of oxygen cylinders in storage or transit. By employing an ultrasonic sensor, the system measures the proximity of objects and determines whether they meet predefined criteria to be identified as cylinders. The cylinder count is displayed in real-time on an LCD, ensuring ease of use and accessibility. This paper discusses the system's architecture, functionality, and potential applications in medical and industrial settings.

***KeyWords*:** LCD (Liquid Crystal Display), Arduino,ultra sonic sensor,bread board,power Power supply

1. INTRODUCTION

The Oxygen Cylinder Count Tracking System is an innovative and efficient solution designed to automate the process of monitoring and tracking the number of oxygen cylinders in a storage or distribution environment. This system utilizes an Arduino Uno microcontroller as its core, along with an ultrasonic sensor for detecting the presence of cylinders based on their proximity. The count is displayed in real-time on a 16x2 LCD display integrated with an I2C module for simplified wiring and operation.

In environments such as hospitals, warehouses, or industrial facilities, managing oxygen cylinders manually can be time-consuming and prone to errors. This project aims to address such challenges by providing a reliable and user-friendly mechanism for tracking cylinders automatically. The ultrasonic sensor measures the distance to objects, enabling the detection of cylinders within a predefined range. Each detected cylinder is then counted and displayed on the LCD, allowing for quick and accurate inventory management.

The system is designed to be cost-effective, easy to deploy, and scalable, making it suitable for a wide range of applications. By automating the counting process, this solution helps reduce manual labor, improve accuracy, and ensure efficient utilization of resources, ultimately contributing to better operational efficiency and patient care in medical facilities.

2. Body of Paper

This project demonstrates an efficient method to track oxygen cylinder counts using an Arduino Uno, an ultrasonic sensor, and an LCD display with an I2C interface. The system addresses the need for precise inventory management in medical and industrial environments where oxygen cylinders are crucial.

The ultrasonic sensor (HC-SR04) measures the distance to objects based on the time taken for ultrasonic waves to reflect back to the sensor. Cylinders placed within a defined range (e.g., 5–15 cm) are identified as valid objects. Each detection increments the count, which is displayed in real-time on a 16x2 LCD. The I2C module simplifies LCD connectivity, reducing pin usage and enhancing the system's efficiency.

This project offers scalability and adaptability, allowing integration of additional features such as reset functionality, memory storage, or remote monitoring via Wi-Fi. It provides a reliable solution for inventory management, ensuring the timely availability of oxygen cylinders in critical situations.

System Design

Overview

This system tracks and displays the number of oxygen cylinders using an Arduino Uno, an ultrasonic sensor (HC-SR04), and a 16x2 LCD with I2C module. It detects the presence of cylinders based on proximity and increments the count displayed on the LCD.

Working Principle

1. The ultrasonic sensor emits sound waves and calculates the distance to objects by measuring the time taken for the echo to return.
2. If the measured distance falls within a predefined range (e.g., 5–15 cm, based on cylinder size), the Arduino increments the cylinder count.
3. The LCD displays the total count of cylinders detected.

System Features

1. **Real-Time Tracking:** Continuous monitoring and counting of cylinders as they are placed or removed.
2. **User Interface:** The 16x2 LCD shows the current count for easy readability.
3. **Customizable Distance Range:** Adjustable thresholds ensure accurate detection of cylinder sizes.

Enhancements

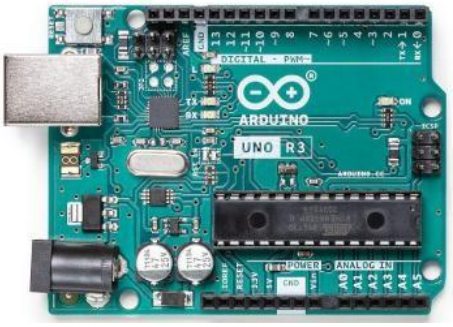
Future improvements may include a reset button, data logging using EEPROM, or wireless integration with IoT platforms for remote monitoring.
This compact system offers an efficient and cost-effective solution for managing oxygen cylinder inventories in medical or industrial settings.

Components

components	quantity	Description
Arduino uno	1	Microcontroller board with digital and analog input/output pins.
Ultrasonic sensor	1	Measures distance using ultrasonic sound waves.
LCD Display (16x2) with I2C Module	1	A 16x2 character display with an I2C interface for easy communication.
Breadboard	1	A prototyping board with interconnected holes for building circuits without soldering.
Jumperwires	as needed	Male-to-male and male-to-female wires for circuit connections.

Arduino UNO

Arduino UNO is a low-cost, flexible, and easy-to- use programmable open-source microcontroller board that can be integrated into a variety of electronic projects.



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LCD(Liquid Crystal Display) 16x2 I2C

LCD (Liquid Crystal Display) is a type of flat panel display which uses liquid crystals in its primary form of operation

Breadboard

The breadboard is a versatile prototyping tool used to build and test circuits without soldering. It allows quick connections between electronic components, making it an essential part of prototyping with Arduino and other microcontrollers.

Software Implementation

The **oxygen cylinder count tracking system** using Arduino Uno, an ultrasonic sensor, and an I2C-based LCD display is implemented as follows:

1. **Initialization**: Start by including the required libraries, such as Wire.h for I2C communication and LiquidCrystal_I2C.h for the LCD. Define the pins for the ultrasonic sensor: Trig and Echo.

2. **Setup**: In the setup() function, initialize the LCD, setting it to display the initial message "Cylinder Count:". Set up the ultrasonic sensor pins (Trig as OUTPUT and Echo as INPUT). The serial monitor is also initialized for debugging.

3. **Distance Measurement**: In the loop() function, trigger the ultrasonic sensor with a 10-microsecond pulse. Measure the time taken for the echo to return using the pulseIn() function. Calculate the distance in centimeters using the formula:

   distance (cm)=2duration×0.034 /2

4. **Cylinder Detection**: Check if the measured distance falls within a predefined range (e.g., 5-15 cm). If true, increment the cylinder count and update the LCD display. Use a short delay to avoid multiple counts for the same object.

5. **Display**: Update the LCD to show the real-time count of cylinders detected. Continuously refresh the data to reflect changes.
6. **Optional Enhancements**: Add a reset button to clear the count, or save the count in EEPROM for persistence after power loss.

The system is compact and easily scalable, providing an efficient solution for real-time tracking of oxygen cylinders in storage or usage scenarios. Adjust the sensor range as needed based on the cylinder size and placement.

Objectives

The objective of the Oxygen Cylinder Count Tracking System is to automate the monitoring of cylinder inventory using an Arduino Uno, ultrasonic sensor, and an LCD display with I2C. The system detects and counts cylinders by measuring their distance from the sensor and displays the count in real-time on the LCD. It aims to enhance efficiency, reduce manual counting errors, and provide accurate data for inventory management. The system is designed to be user-friendly, cost-effective, and scalable, making it suitable for hospitals, storage facilities, and industries handling oxygen cylinders. It ensures better inventory control and timely replenishment of stock.

Advantages

1. **Cost-Effective:** The system uses affordable components like Arduino Uno and ultrasonic sensors, making it budget-friendly.
2. **Easy Implementation: Simple hardware setup and readily available libraries for coding ensure quick development.**
3. **Real-Time Monitoring: The LCD display provides real-time cylinder count updates, ensuring instant tracking.**
4. **Compact and Portable: The small size of the components allows for a compact, portable system suitable for various environments.**
5. **Customizable: Easily adaptable to different cylinder sizes, ranges, and additional features like alerts or data logging for enhanced functionality.**

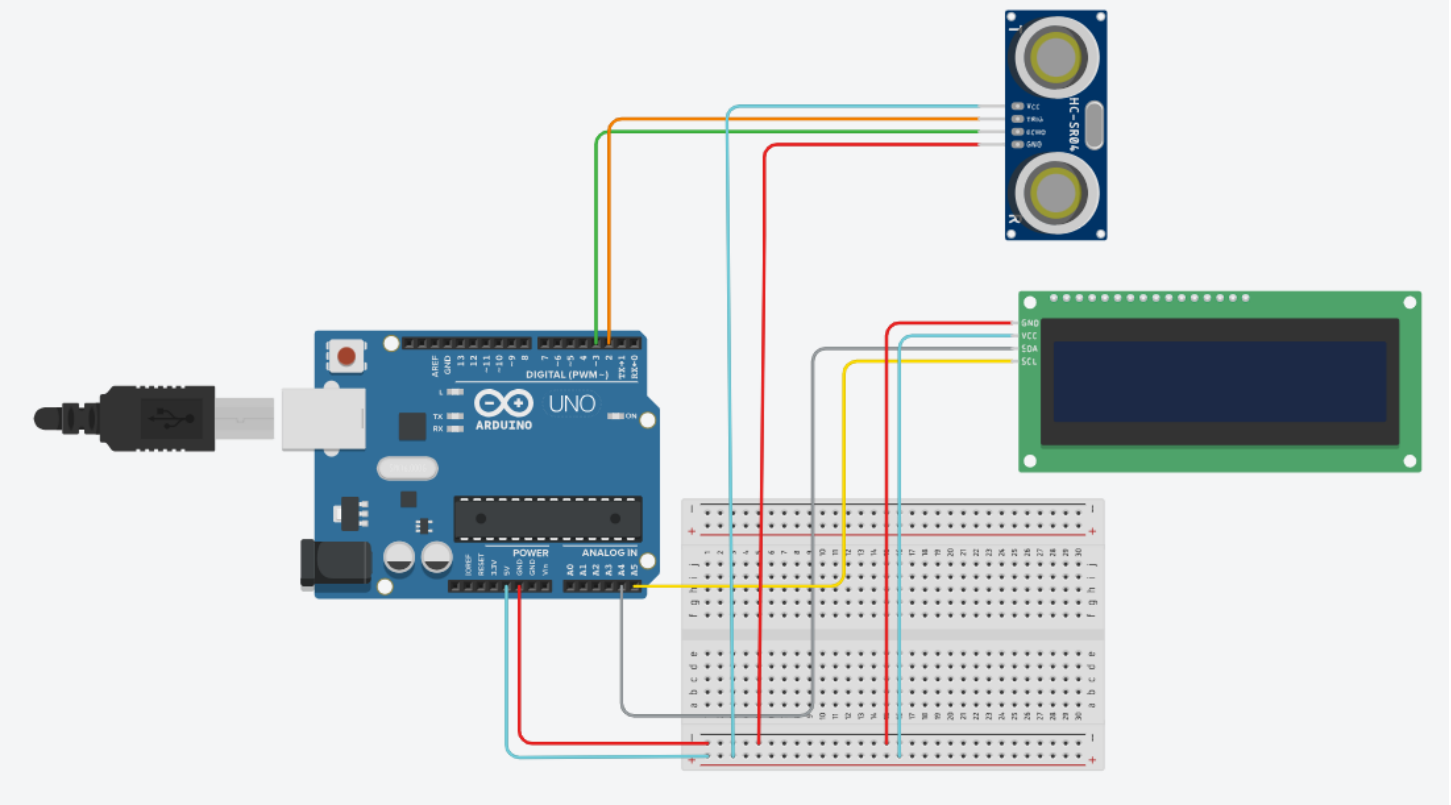
Observations

bservation	**etails**
istance Range etected	he ultrasonic sensor ccurately detects objects ithin 5–15 cm.
ylinder Count ccuracy	ystem reliably counts ylinders when placed one at a me in range.
CD Display	eal-time updates of cylinder ount visible on the 16x2 CD screen.
etection Speed	bjects detected within ~1 econd after placement.
alse ositives/Negatives	ccasional miscounts due to verlapping objects or ncorrect range setup.
ower Consumption	perates efficiently with 5V rduino power supply.
mbient Conditions	erforms well in stable ghting; minor issues in noisy nvironments.
ystem Reset	asy reset by restarting rduino or adding a reset utton in future builds.

CONCLUSIONS

The oxygen cylinder count tracking system using an Arduino Uno, ultrasonic sensor, and LCD with I2C offers an efficient, cost-effective solution for monitoring cylinder inventory. The system accurately detects cylinders based on predefined proximity ranges and updates the count in real-time on the LCD display. Its simplicity ensures ease of use and rapid deployment, while the modular design allows for customization, such as wireless connectivity or memory storage for advanced functionality. This system enhances operational efficiency, minimizes manual counting errors, and provides reliable data for inventory management in healthcare facilities or industries relying on oxygen cylinders.

Experimental Setup



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REFERENCES

Here are 7 references for building an **Oxygen Cylinder Count Tracking System** using an Arduino Uno, ultrasonic sensor, and LCD display with I2C:

1. Arduino Official Documentation

   The Arduino website offers comprehensive documentation on the use of sensors, displays, and general programming. It's a valuable resource for understanding how to use ultrasonic sensors and LCD displays with the Arduino platform.

2. HC-SR04 Ultrasonic Sensor Guide

   Numerous tutorials explain how to interface the HC-SR04 ultrasonic sensor with an Arduino to measure distances. This is essential for setting up the measurement range for counting cylinders.

3. LCD with I2C Tutorial

   For integrating a 16x2 LCD with I2C, this guide explains how to wire and program the display to show real-time information.

4. Arduino Ultrasonic Sensor Projects

   A collection of Arduino projects that use ultrasonic sensors for object detection. This can give you inspiration for improving the accuracy and functionality of your tracking system.

5. Oxygen Cylinder Management Systems

   Existing systems in healthcare for managing oxygen cylinder usage could provide insights into optimizing tracking and count methods.

6. Arduino Distance Measurement Projects

   This reference includes various Arduino projects focused on measuring distances with sensors, useful for calibrating your oxygen cylinder tracking system.

7. Arduino-Based Count Systems for Inventory Management

   Many Arduino-based projects for inventory and object counting can be adapted for cylinder tracking. These systems often include sensors like ultrasonic for proximity detection.

- These references will help you understand the components, programming, and potential improvements for your system.