**LIQUID LEVEL DETECTION SYSTEM**

**Higher National Diploma in Software Engineering**

**Robotics Project Documentation**

**24.1F**

National Institute of Business Management

Kandy Regional Center

No 2, Asgiriya Road,

Kandy

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Robotics Project Documentation

24.1F

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The project is submitted in partial fulfilment of the requirement of the Higher National Diploma of Software Engineering of National Institute of Business Management.

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# **DECLARATION**

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# **ABSTRACT**

This project focuses on designing and implementing a liquid level detection system for an automated bottle filling system using sensors and Arduino. The system is designed to monitor the containers liquid level in a moveable conveyer belt.

Its helps in water management, chemical processing, and automated bottle filling system in industries. The Capacitive proximity sensor detect the liquid level and sends data to Arduino to the next process. Arduino decides the next process of the system such as remove the bottle from the belt or send to packing station.

This system helps to improve the efficiency, reduces manual monitoring, less manpower and ensures the accuracy of the bottle liquid level. It helps to improve the company reputation and advancing the technology.

# **ACKNOWLEDGMENT**

This report is the outcome of our final project. First, I would like to express my gratitude to all those who gave me the possibility to complete this report with great effort.

We would like to explain our gratitude to all who helped us in various ways giving their time & valuable assistance for the final project within the organization.

Our special thanks also go to Mrs. Anjula Weerasinghe project supervisor of NIBM for guiding us throughout this project to make it a success.

Also, the effort put out to broaden our knowledge and sharpen the skills by the staff & the management of NIBM is sleepy appreciated by all of us.

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# **INTRODUCTION**

Liquid level detection can be done in several different ways. In many industries and homes, especially water treatment plants, chemical manufacturing facilities, beverage production facilities, and automated filling systems, liquid level sensing is essential. Sometimes We need a accurate liquid level measurement without putting anything inside the liquid especially preferred in applications such as in the food industry ad chemical industry.

To maintain accuracy across all products that meet the same requirements, quality control is necessary for every step of the manufacturing process. It helps in developing a brand's reputation, developing customer loyalty, and increasing profit. For example, it is crucial in the bottle filling business to make sure that each bottle has the same amount of product as described on the label. Less than that, and the business may lose clients and run the risk of going to court; more, and the business would lose money by providing more than was advertised.

To ensure that fill levels are correct and accurate routine inspection using employees. Its need more manpower and high cost. The human vision accuracy level is lower than an automated computer system. So, we decided to automate a system to Detect the liquid level in a container using sensor and motors. In this project, we propose to use sensors and an Arduino microcontroller to build and implement an automatic liquid level detecting system. The system's goal is to offer a more effective, accurate, and efficient way to monitor and handle liquid levels in containers. The liquid level is continually checked using electrical sensors. The Arduino processes the data and can be programmed to take necessary steps, such activating alarms or managing pumps and valves.

# **LITERATURE REVIEWS**

Liquid level detection methods have replaced manual dipsticks and sight glasses to advance sensor system.

The literature shows multiple methods and sensor technologies for liquid level measurement, each having advantages and disadvantages. While resistance-based, capacitive, optical, and ultrasonic sensors have been commonly used, improved automation and real-time monitoring are made possible using Arduino and IoT technologies.

## **COMPONENTS**

**1.Arduino uno:-** It’s an open-source microcontroller board based on the ATmega328p and used to advance the electronics projects.it features digital and analog 1/0 pins. Its control sensors, motors, and other components.

**2.Motor driver shield:-** A motor driver shield is allowing an Arduino to control the speed and direction of DC motors. It is providing necessary power and control signals.

**3.Servomotor driver:-** controls the position, speed, and torque of a servomotor.

**4.Bread board:-** used to build and test electronic circuits without soldering components.

**5.12V DC motor:-** Used to rotate objects.

**6.IR Proximity switch:-** Detect the objects using rays.

**7.Capacity proximity sensor:-** Used to detect metallic and non-metallic objects.

**8.Robotic arm** **:-** Used to pick and place objects.

**9.Servo motor(sg90) :-** Controls positions and torque of an object.

## **LIBRARIES**

**#include <AFMotor.h> :-** Controlling DC motors and stepper motors

**#include <Servo.h>** **:-** Controlling servo motors using pulse signals

**#include <Wire.h>** **:-** Communications with I2C for connecting microcontroller, sensors and other components.

**#include <Adafruit\_PWMServoDriver.h> :-** Controlling up to 16 servos using PWM signals.

# **METHODOLOGY**

In this project DC motors used to create a conveyer belt to transfer the bottles one position to another position. While container bottle moving on the conveyer first IR Proximity switch detect the bottle and stop the conveyer movement.IR proximity switch have an wide range to detect the objects in the range. A capacitive proximity sensor used to detect he liquid level in the container. capacitive proximity sensor used to detect metallic and non-metallic type objects and liquids and oils. The system was designed by placing the sensor externally on the container side to avoid direct contact with the liquid. He Arduino microcontroller continuously reads the sensor output, which is processed to next action. When the containers liquid level is lower than a predefine calibration value the container will change to another conveyer using a piston. container move forward and lift by a robotic arm remove from the conveyer. If the expected level is correct, then the conveyer moves forward and deliver by using a car to the packaging station.

# **DEVELOPMENT PROCESS**

**1.Define requirement :-** To maintain accuracy of the liquid level of all products that meet the same requirements, quality control is necessary for every step of the manufacturing process.

**2.Choose the Components :-** Choose suits sensor to detect the liquid level inside the containers and other necessary components.

**3.Design the circuit :-** Create a connection between components.

**4.Develop the code :-** Write the program code using Arduino IDE and include necessary libraries. Get the sensor readings and create the next actions with code. Test the coding several times continuously.

**5.Develop the system :-** Assemble all the components using wires and create the circuit and test for several times. Verify all the components and sensors work properly.

**6.Finalize Design** :- Finalize the circuit and connections and ensure the system work properly with real world environment. Document the necessary details and instructions properly.

# **DISCUSSIONS**

In this liquid level detection project was designed to automate the monitoring and controlling the liquid level in the containers. Used an Arduino microcontroller to program. The sensor reliable challenges on environment noise, temperature, and liquid type impacts on the performance of the system. Accuracy was improved using calibration work. If the project's primary goal of automating the detection process was successfully achieved.

# **FUTURE IMPLEMENTATION**

Liquid level detectors are being changed by technological breakthroughs that enable real-time monitoring and predictive maintenance. These innovations include IOT integration, AI-driven analytics, and improved sensors, which increase efficiency and variety.

A variety of developments could be made to improve the system's reliability, accuracy, and scalability. For example, adding advanced sensors, like capacitive or optical ones, could provide more accuracy for detecting a larger range of liquid types and container sizes. Moreover, integrating continuous data collection and remote control through IoT (Internet of Things) platforms could allow for more effective management and automated adjustments, improving the system's ability to respond to industrial needs. Advanced algorithms, like based on machine learning models that predict, could be employed to project liquid levels, and optimize the control of the filling process, removing waste and improving productivity. Lastly, integrating the system with an improved automation framework that updates conveyor speeds and valve flow rates dynamically could result in even more improvements.

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# **GANTT CHART**

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| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **June**  **01 - June**  **14** | **June**  **15 - June**  **16** | **June**  **17 – July**  **19** | **July**  **20 –**  **Aug**  **26** | **Aug**  **28 –**  **Aug**  **30** | **Sep 1 – Sep**  **17** | **Sep 25**  **– Sep**  **26** |
| **PLANNING** |  |  |  |  |  |  |  |
| Discuss the topic |  |  |  |  |  |  |  |
| **ANALYZING** |  |  |  |  |  |  |  |
| Identify components and gathering |  |  |  |  |  |  |  |
| **DESIGN** |  |  |  |  |  |  |  |
| Designing the prototype |  |  |  |  |  |  |  |
| **DEVELOPMENT** |  |  |  |  |  |  |  |
| Start to build the project |  |  |  |  |  |  |  |
| **IMPLEMENTATION** |  |  |  |  |  |  |  |
| Develop the project features |  |  |  |  |  |  |  |
| **SUBMIT THE**  **PROJECT REPORT** |  |  |  |  |  |  |  |