

Development of Automatic Bottle Filling Machine of Different Volume and Grade

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Abstract - Lubrication is important in any automotive system. Production of engine oil is very difficult process for small scale industry. Currently, industries are moving towards automation and technology, but certain smaller-scale industries are not automated or totally automated therefore there are still human workers so as to reduce human error such as spilling oil while filling by human or amount of time etc. Using Arduino, the automatic bottle filling machine contributes significantly. Therefore, to make small-scale enterprises efficient, use a technology that runs automatically. This will allow all processes to run smoothly, resulting in steady prices and a reduction in labor costs and operating time.

Keywords: Automatic, Bottle Filling Machine, Volume, Grade.

1. Introduction

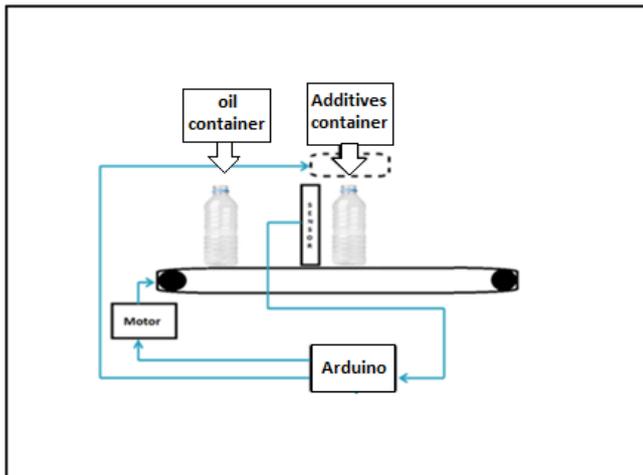
The primary goal of this study is to design and construct automatic oil filling system control system that can compete with Arduino on the market for a fair price. The manual filling procedure in small scale enterprises has several problems because the tasks are performed manually. It aims to address challenges brought on by tiny lubricating oil businesses. The objective of this project, an automatic bottle filling system using an Arduino microcontroller, is to make it straightforward for businesses looking for an economical alternative to use but unable to use Arduino. This type of project assists small businesses in expanding with fewer human errors and financial losses. The primary goal of this study is to design and construct automatic oil filling system control system that can compete with Arduino on the market for a fair price. The manual filling procedure in small scale enterprises has several problems because the tasks are performed manually. It aims to address challenges brought on by tiny lubricating oil businesses. The objective of this project, an automatic bottle filling system using an Arduino microcontroller, is to make it straightforward for businesses looking for an economical alternative to use but unable to use Arduino. This type of project assists small businesses in expanding with fewer human errors and financial losses. Viscosity is a measure of a fluid's resistance to flow. In the

context of engine oil, viscosity is an important property that determines how effectively the oil can lubricate and protect the engine's moving parts. It influences the oil's ability to flow and form a protective film between the metal surfaces, reducing friction and wear. Engine oil viscosity is commonly expressed using two numbers, such as 5W-30 or 20W-40. These numbers are defined by the Society of Automotive Engineers (SAE) and represent the oil's viscosity at different temperatures. The first number followed by the letter "W" (which stands for winter) indicates the oil's viscosity at low temperatures, specifically during cold starts. The lower the number, the less the oil thickens in cold conditions, allowing it to flow more easily. This is important because the oil needs to reach engine components quickly during startup, even in cold weather. The second number represents the oil's viscosity at high temperatures, typically measured at 100 degrees Celsius (212 degrees Fahrenheit). Higher numbers indicate thicker or more viscous oil, which provides better lubrication and protection at high temperatures and under heavy loads. It's important to use the oil viscosity recommended by the vehicle manufacturer because engines are designed with specific tolerances and operating conditions in mind. Using the wrong viscosity oil can lead to insufficient lubrication, increased wear, reduced fuel efficiency, and even engine damage. In summary, viscosity is a crucial property of engine oil that determines its ability to flow and provide effective lubrication. It's expressed as two numbers, with the first representing low-temperature viscosity and the second representing high-temperature viscos.

2. Literature Review

There are several studies on the design and development of automatic bottle filling machines. In a study by Sharma et al. (2017), an automatic bottle filling machine was developed using programmable logic controllers (PLCs) and was able to fill bottles of different sizes and shapes with high accuracy and consistency. The study concluded that PLC-based machines are efficient and reliable for the bottle filling process. In another study by Shaikh et al. (2018), a pneumatic-based automatic bottle filling machine was developed and tested for filling oil. The machine was able to fill bottles of different volumes and shapes with a high level of accuracy.

The study concluded that pneumatic-based machines are cost-effective and efficient for filling bottles of different volumes and grades. Research has also been conducted on the optimization of automatic bottle filling machines. In a study by Kansal et al. (2020), an intelligent filling system was developed using machine learning algorithms to optimize the filling process. The system was able to adapt to changes in the viscosity and density of the liquids being filled, and was able to fill bottles of different sizes and shapes accurately.



3. Requirements

Hardware requirements:

- IR sensor-3 sensor
- Pump- 6 pump
- Arduino mega microcontroller
- Servo motor
- Water pump
- IR sensor
- Resistors
- Jumper wires
- PCB boards
- Conveyor Belt – 72 cm
- 12v,5v Relay
- Wire connectors
- Motor driver modules

Software Requirements:

- Arduino ide

4. Objectives

- 1) To design an automatic bottle filling machine capable of filling bottles of different volumes and grades.
- 2) To fabricate the machine using standard fabrication techniques and materials.

- 3) To test the accuracy and efficiency of the machine in filling bottles of different volumes and grades.
- 4) To analyze the data obtained from the testing process using statistical software.
- 5) To optimize the machine using machine learning algorithms to improve its accuracy and efficiency.
- 6) To evaluate the suitability of the machine for use in the pharmaceutical and beverage industries.

5. Methodology

This Model is divided into four stages:

1) Research Phase:

Conduct a comprehensive literature review of existing automatic bottle filling machines to identify design features, components, and technologies used in their development.

2) Fabrication Phase:

Fabricate the machine using standard fabrication techniques and materials.

Assemble and integrate the various components of the machine.

3) Testing and Optimization Phase:

Test the machine's accuracy, efficiency, and performance in filling bottles of different volumes and grades.

Collect and analyse data on the machine's performance using statistical software.

4) Evaluation Phase:

Evaluate the suitability of the machine for use in the pharmaceutical and beverage industries based on its performance, efficiency, and compliance with industry standards.

6. Proposed System

1) Hopper:

A hopper is used to store the liquid to be filled in the bottles.

2) Filling Nozzles:

The filling nozzles are used to dispense the liquid into the bottles. The nozzles are designed to fill bottles of different volumes accurately and without spillage.

3) Conveyor Belt:

A conveyor belt is used to transport the bottles to and from the filling station. The speed of the conveyor belt is adjustable to match the filling rate of the machine.

4) Control System:

The control system consists of a microcontroller, sensors, and actuators. The microcontroller is used to control the operation of the machine, while the sensors are used to detect the presence of bottles on the conveyor belt and to measure the volume of liquid dispensed. The actuators are used to control the opening and closing of the filling nozzles.

5) Machine Learning Algorithm:

A machine learning algorithm is used to optimize the performance of the machine by adjusting the filling rate and volume based on the feedback received from the sensors. The proposed system is designed to meet the requirements of accurately and efficiently filling bottles of different volumes and grades while ensuring safety, ease of operation, and compliance with industry standards. The machine learning algorithm ensures that the machine's performance is optimized, and the use of a control system ensures that the operation of the machine is automated and reliable.

7. Outcomes

- Accuracy
- Speed and Efficiency
- Volume Flexibility
- Grade and Product Compatibility
- Reliability and Maintenance
- Automation
- Regulatory Compliance and Safety

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