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Design of an Automated Bottle Filling System

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Abstract: The field of automation has had a notable impact in a wide range of industries beyond manufacturing. Automation is the use of control systems and information technologies to reduce the need for human work in the production of goods and services. In the scope of industrialization, automation is a step beyond mechanization. Whereas mechanization provides human operators with machinery to assist them with the muscular requirements of work, automation greatly decreases the need for human sensory and mental requirements as well. Bottle filling is a task carried out by a machine that packages liquid products such as cold drinks or water. The bottle filling project serves as an interdisciplinary engineering design experience.

Keywords: Bottle Filling, PLC, Process Automation, Conveyor Systems.

1. INTRODUCTION

An embedded control is done by a special purpose computer system designed to perform one or a few dedicated functions, often with real-time computing constraints. It is usually embedded as part of a complete device including hardware and mechanical parts. In contrast, a general-purpose computer, such as a personal computer, can do many different tasks depending on programming. Embedded systems control many of the common devices in use today. Embedded controllers are often the heart of an industrial control system or a process control application. The majority of computer systems in use today is embedded in other machinery, such as automobiles, telephones, appliances, and peripherals for computer systems. While some embedded systems are very sophisticated, many have minimal requirements for memory and program length, with no operating system, and low software complexity. Typical input and output devices include switches, relays, solenoids, LEDs, small or custom LCD displays, radio frequency devices, and sensors for data such as temperature, humidity, light level etc. Embedded systems usually have no keyboard, screen, disks, printers, or other recognizable I/O devices of a personal computer, and may lack human interaction devices of any kind.

2. FEASIBILITY STUDY

2.1 Understanding feasibility

Feasibility study means the analysis of a problem to determine if it can be solved effectively. In other words it is the study of the possibilities of the proposed system. It studies the work ability, impact on the organization ability to meet user's need and efficient use of resources.

2.2 Economical feasibility

The economical analysis checks for the high investment incurred on the system. It evaluates development & implementing charges for the proposed "Industrial Automation Project". The PLC used for the development is easily available at the market but they are very expensive & the software for programming comes with the PLC hence it results in high cost implementation.

2.3 Technical feasibility

This aspect concentrates on the concept of using computer meaning, "Mechanization"

of human works. Thus the automated solution leads to the need for a technical feasibility study. The focus on the platform used is the PLC based Industrial Automation. The proposed system require an in depth technical knowledge on various electrical machines and PLC hardware as well as software. This is required to improve the technical efficiency of the design. Otherwise the system development is simple and easy to understand. The result obtained should be true in the real time conditions.

2.4 Behavioral feasibility:-

Behavioral feasibility deals with the runtime performance of the proposed system. It must score higher than the present in the behavioral study. The project should have end user when the system is designed while designing. The programmer should be aware of the condition's user's knowledge input, output, calculations etc. Care should be taken to avoid non-working means & buttons.

3. PROBLEM FORMULATION

In order to implement the automated bottle filling system, a versatile control panel has been designed and developed. The previous discussion of this study involves the need for the study and review of literature involving similar control systems. After going through previous research papers a tentative design is prepared. The basic block diagram and working of the entire setup both are explained in the subsections below along with the detailed list of components and their specifications.

After designing the block diagram and deciding the features of the control system, hardware required for implementing the setup was studied. The components, circuits and other miscellaneous hardware was enlisted, bought and fabricated. For testing, the control panel was interfaced with the solenoids through relays and then was tested.

These relays were switched in a sequence for different time periods. The ON-time period for individual relays can be set by using an array of tactile switches interfaced with the microcontroller.

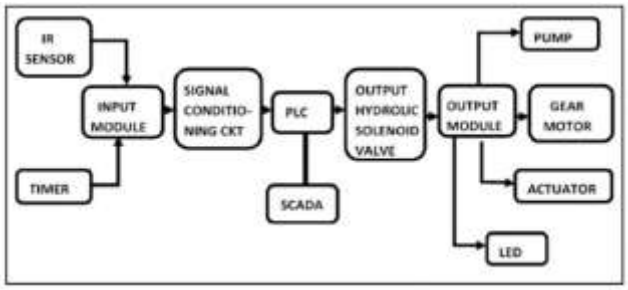

Fig 3.1: Block diagram of bottle filling

The liquid level in all the three tanks was measured by deploying an ultrasonic sensor in each tank individually. The output we got was on a multicolour LED array.

4. ARCHITECTURE OF IMPLEMENTED SYSTEM

The proposed model of an automated bottle filling system has been developed for the purpose of student demonstration in the laboratory. The aim is to enhance the knowledge of students about the practicalities of various automation based systems used in the industries. The system has been developed keeping in view the overall cost, versatility and portability of the system as PLC based automation systems are still bulkier and very costly for experimental purpose. The system has been developed around microcontroller platform. The architecture of the system has been shown below:

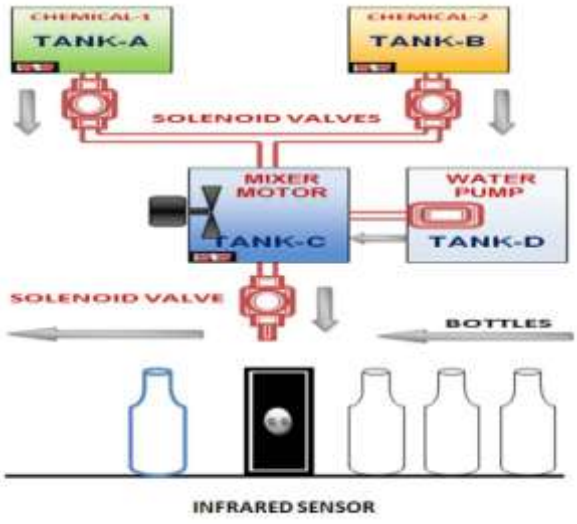

Figure 3.2: Architecture of Bottle Filling System

The algorithm used for designing the proposed system is shown in the figure below:

STEP 1	:	Press the "START" Push Button.
STEP 2	:	Then the "MOTOR" starts and the conveyor moves forward.
STEP 3	:	If the sensor detects the presence of bottle which is in position with the solenoid valve, then the conveyor will stop.
STEP 4	:	If the sensor does not detects any presence of the bottle, the conveyor keeps on moving.
STEP 5	:	After some delay the valve turn "ON" and the bottle will get filled till the timer gets off.
STEP 6	:	After the bottle is filler , a d3elay is provide and then after the delay the motor starts running.
STEP 7	:	And the process respects itself repeats itself from step 3

Figure 3.3: Algorithm used for Architecture of Bottle Filling System

5. CONCLUSION

The system can perform the task of Automatic bottle filling System and it is most suitable for student demonstration in laboratory for education purpose as definite process is set by programming. The developed system is found to be the cheap and best method to enhance knowledge of students and make them aware of what all factors need to be considered while designing a project based on automation. Further optimizations are possible in this system by the integration of more sophisticated techniques to make it more flexible and versatile with reduced cost.

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