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AUTOMATIC BOTTLE FILLING SYSTEM USING ARDUINO

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Abstract: This project is used in soft drinks Manufacturing Company and Medicine Manufacturing Company in which drinks and Syrup are automatically filled in the Bottle. In this project Bottles are placed in the Mechanical arrangement this Mechanical arrangement may be a round type tray or Straight-line tray in which Bottles are placed with particular distance. Infrared Transmitter is the one type of LED generally called IR. When the supply is given to this LED it generates and transmits the infrared rays. IR Receiver is used to receive such type of Infrared rays transmitted by the IR Transmitter. IR Receiver should be placed in straight line with IR Transmitter.

When power is ON the IR Transmitter will pass the ray to the receiver and giving signal to the Microcontroller through signal conditioning unit. Initially the Micro controller activates the DC Motor through the Driver circuit which is connected to the tray. So, the Bottles are moving, when the Bottles comes in between the IR Transmitter and IR Receiver it blocks the rays. Now the Microcontroller deactivates the DC motor so movement of tray will be stopped. The bottle position is straight line to the filling system. Correspondingly Microcontroller activates the motor for filling system. Now the bottle is filled with concerned material. After setting time limit for the quantity to be filled in the bottle, the DC motor 2 is switched OFF for filling system and DC Motor 1 is switched ON for moving tray system. Likewise, the Bottles are filled with materials automatically.

Introduction

The aim of this project is to filling the bottle automatically This paper explains how the general design of this project is the used in soft drinks Manufacturing Company and Medicine Manufacturing Company in which drinks and Syrup are automatically filled in the Bottle. The main objective of this project is to develop a Automatic liquid filling to bottles of different height with Microcontroller Integration. The present machines are that it can fill only a particular type of containers of specific volume, and the filling amount is as set by the operator. To develop a filling machine which can fill different volume of bottles on the bases of volume. This can used in different industries like medicine to fill syrups, oil, chemical etc.

1. Working Principle

The main objective of an Automatic Bottle Filling System is to complete the process of filling without human intervention. When the power supply is switched on, the LCD starts displaying, "PRESS START". After pressing the start button, the conveyor belt starts moving, powered by a steppermotor. The belt moves to and stops at its pre-determined position. The LCD displays, "START FILLING". The water pump starts at this point filling the bottle kept under it through the solenoid valve. After filling the user feed quantity of water in the bottle, the pump is stopped. The belt moves to its new position and the next bottle comes under the pipe. The pump is again started and the second bottle isfilled. The pump is stopped and the belt moves ahead after the bottle is filled. The process is subsequently repeated until every bottle of the batch has been filled. The stepper motor powering the conveyor belt is then turned off. The water pump is turned off.

2. Block Diagram

. It involves assembly of all the components listed above. A simple conveyor belt will be stretched between two rollers, one roller which pushes it and other roller which pulls belts as the belt moves. The conveyor belt and rollers are accommodated on table frame. The Infrared sensor is fixed at certain position on table frame in such way that it is able detect the bottle. All electrical components are situated on the ply at the bottom of table frame. The bottles to be filled are arranged on conveyor belt. A tank or sink is placed using support. A rotary pump is controlled by the Arduino which dispense metered quantity of water in bottle.

The four motors are clamped on the table frames which are driven by 12V dc supply and 30rpm. The electrical circuit and display and keyboard are clamped on the table top along with the battery A gravity operated filling system has a big difficulty in measuring the correct volume of liquid to be filled. A separate arrangement of a timer operated valve or a secondary tank arrangement requires an extra sensor and valves which adds up unnecessary cost to the system. A rotary pump arrangement as shown in figure uses a rotary pump arrangement to provide a varying volume of liquid to flow into the bottles. On the input provided by the user for volume, the program calculates the time for which the motor must be kept on and a delay time is provided. The pump gets ON for given period of time to fill required amount of liquid into bottles.

Arduino board 2560 Mega is used to write programs & create interface circuits to read switches & other sensors. The power of the Arduino is not its ability to crunch code, but rather its ability to interact with the outside world through its input-output (I/O) pins. The Arduino has 14 digital I/O pins labeled 0 to 13 that can be used to turn motors and lights on and off and read the state of switches.

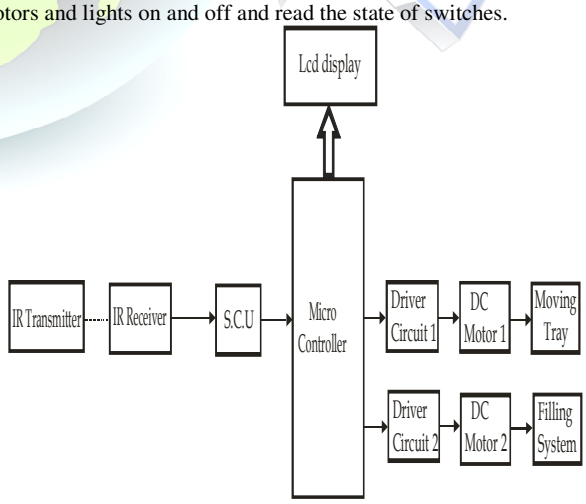

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Figure 2.2.1 Proposed block diagram

Each digital pin can sink or source about 40 mA of current. This is more than adequate for interfacing to most devices, but does
mean that interface circuits are needed to control devices other than simple LED's. An Infrared sensor emits an infrared signal or a beam of electromagnetic radiation (infrared), and looks for changes in the field or return signal. The object being sensed is often referred to as the Infrared sensors target. Different Infrared sensor targets demand different sensors. For example, a capacitive or photoelectric sensor might be suitable for a plastic target; an inductive proximity sensor always requires a metal target.

The maximum distance that this sensor can detect is defined "nominal range". Infrared sensors can have a high reliability and long functional life because of the absence of mechanical parts and lack of physical contact between sensor and the sensed object. Infrared sensors are commonly used on smartphones to detect (and skip) accidental touch screen taps when held to the ear during a call.

A Flat Belt Conveyor as shown in figure 2.2.2 is used to support the bottles on their location & carry them forward sequentially to fill with water. A Flat Belt is passed over three rollers to performed rolling action. The system involves four motors. Two motors are used to run conveyor belt and secondary motor is used to transfer filled bottles from one production line to another production line.

The primary motor is controlled by Arduino microcontroller and secondary motor run continuously for smooth operation. A DC motor is an essential part in the conveyor system. A motor is a rotary mover that allows for precise control of angular position, velocity and acceleration. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with motors. DC motors are a specific class of motor although the term motor is often used to refer to a motor suitable for use in a closed-loop control system.

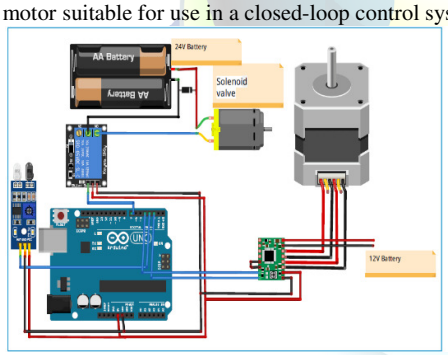


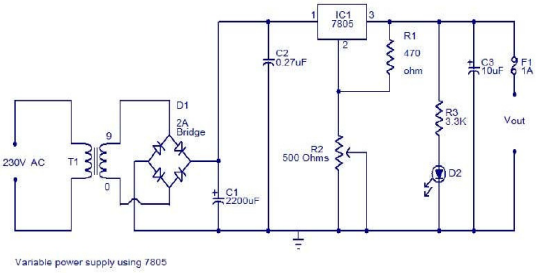
Figure 2.2.2 Proposed Circuit diagram

Dc motors are used in applications such as robotics, CNC machinery or automated manufacturing operations. A relay as shown in figure 6 is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays.

Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits) The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

The system uses 2-line, 16-character LCD display as shown in figure 3. It has 4-bit interface. It is relatively easy to use once you have it mapped into your processor's memory mapped I/O. Then characters need to send to display, they show it up on the screen. The input pin of the Relay module is connected to pin 7 of Arduino. Direction and Step pins of the A4988 module are connected to 2 and 4 pins of Arduino. In this project, an IR sensor is used as an external interrupt to Arduino. In Arduino Uno, digital pin 2 & 3 are the interrupt pins, so connect the Out pin of IR sensor to the 3rd pin of Arduino. Solenoid Valve is powered by a 24V power source, and Stepper motor is powered by a 12V power source.

POWER SUPPLY



This section gives an overview of the whole circuitry and hardware involved in the project. The aim of the project is to protect the failing or damage of transformers having applied more loads on it and to share these overloads with another transformer. In this project we are giving power supply to all units, it basically consists of a Transformer to step down the 230V ac to 18V ac followed by diodes. Here diodes are used to rectify the ac to dc. After rectification the obtained rippled dc is filtered using a capacitor, Filter. A positive voltage regulator is used to regulate the obtained dc voltage. But here in this project two power supplies are used one is meant to supply operating voltage for Microcontroller and the other is to supply control voltage for Relays.

In this project, we are using two transformers instead of one transformer. Whenever applying the more loads on one transformer exceeding the particular limit then it will not break down but the excess load must be shared by another transformer. Therefore, no failure of transformers will occur.

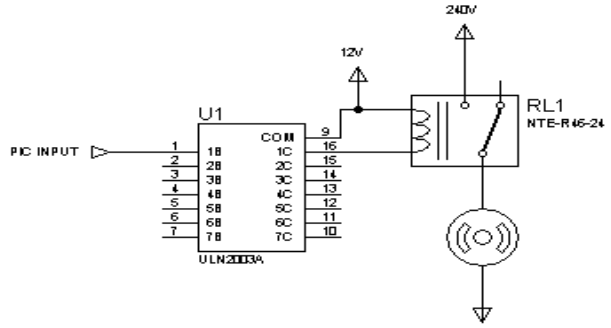


Figure 3.1.3 Circuit diagram of Relay circuit

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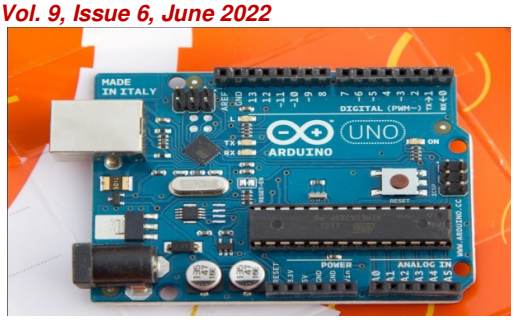


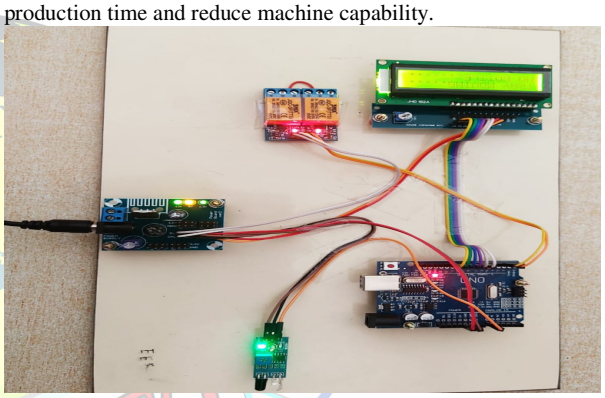
The Arduino environment performs a few transformations to your main sketch file (the concatenation of all the tabs in the sketch without extensions) before passing it to the avr-gcc compiler. First, #include "Arduino's", or for versions less than 1.0, #include "Program's" is added to the top of your sketch. This header file (found in <ARDUINO>/hardware/cores/<CORE>/) includes all the definitions needed for the standard Arduino core. [5] proposed a novel method for secure transportation of railway systems has been proposed in this project. In existing methods, most of the methods are manual resulting in a lot of human errors. This project proposes a system which can be controlled automatically without any outside help. [7] discussed that the activity related status data will be communicated consistently and shared among drivers through VANETs keeping in mind the end goal to enhance driving security and solace. Along these lines, Vehicular specially appointed systems (VANETs) require safeguarding and secure information correspondences. [2] discussed about a system, GSM based AMR has low infrastructure cost and it reduces man power. The system is fully automatic, hence the probability of error is reduced. The data is highly secured and it not only solve the problem of traditional meter reading system but also provides additional features such as power disconnection, reconnection and the concept of power management.

Next, the environment searches for function definitions within your main sketch file and creates declarations (prototypes) for them. These are inserted after any comments or pre-processor statements (#includes or #defines), but before any other statements (including type declarations). This means that if you want to use a custom type as a function argument, you should declare it within a separate header file. Also, this generation isn't perfect: it won't create prototypes for functions that have default argument values, or which are declared within a namespace or class.

Conclusion

With the world increasingly moving towards Automation due to its various benefits, efforts should be made to make this technology more accessible to various small and medium scale industries. It can eventually help them in diversifying the fruits of the endeavor to the general public and contribute to the overall growth of the country's economy. Filling is an important operation carried out in various stage of the process in many industries. This process is carried out by ARDUINO machine in large scale industries. While ARDUINOs are efficient, adapted to industrial conditions and easy to use, their initial costs and maintenance costs are very high. Thus, many small-scale industries continue to work manually as they cannot afford a ARDUINO. This project attempts to solve that problem by using an Arduino board as the microcontroller in the system. An Arduino is efficient, robust and widely available microcontroller. An interface circuit has to be constructed to facilitate the operation using an Arduino board. This substantially reduces the cost of the machine. Overall, our Automatic Bottle Filling Machine is efficient, economically friendly and accurate.

The automated bottle filling system using pump filling concept was successfully implemented and studied. Various observations were taken which closely resembled the actual volume to be filled. The reasons for deviations of the readings are studied accordingly. The automated bottle filling system was beneficial in reducing work, time and cost of filling. The fabricated model of automated bottle filling system can be used where high precision is not necessary and time limits not bound. Hence it must be used application specific and must not be used in places where faster and more accurate methods of filling are available. It will slow down the production time and reduce machine capability.



MODEL FIGURE

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