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AN ADVANCED MICROCONTROLLER BASED MECHANISED LIQUID MIXING SYSTEM

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ABSTRACT

In various industrial activities, mixing of liquid is an important activity. This activity is performed in specially designed plant. The quality of product will be decided by the accuracy and exactness of the mixing process. This calls for an efficient control of mixing plant. If we employ manual control, it may be hazards or inaccurate. In order to have such control automation is vital. This can be achieved using micro controller with the help of PC monitoring.

KEYWORDS: Automation, Microcontroller, Solenoid Valve, Temperature Sensor, DC Motors

INTRODUCTION

In various industrial activities, mixing of liquids is an important activity. This activity is performed in a specially designed plant known as mixing plant. The quality of a product will be decided by the accuracy and exactness of the mixing process. This calls for an efficient control of mixing plant. If we employ manual control, it may be hazards or inaccurate. In order to have such control automation is vital. This can be achieved using micro controller with the help of PC monitoring.

The industrial automation evolution in current manufacturing system demands established rules between equipment manufacturers and customers that use production techniques based on operation and integration of automatic equipment. Now a days automated machines are in demand for they make numerous activities not only easier but also efficiently. These machines require minimal human intervention to do its job.

WORKING

The system has several electronic and mechanical components- all of which are divided into five groups namely, the microcontroller board, the dispensers, the sensors, dc motors and the mixing container. the physical structure of the dynamically reconfigurable temperature and volume base liquid mixing system to which all the five components are strategically placed.

The microcontroller board consists of keypad, LCD unit, microcontrollers and ADC's. The first component of the microcontroller board is keypad & LCD unit. It serves as the interface where the user can access and operate the machine. It is a 3x4 keypad and is capable of displaying data in its 16x2 LCD display. It is also used to show the status of the system whether it is ready to accept inputs or not. It is placed in the middle of the system.

Basically, the microcontroller receives data from the key pad & LCD Unit as inputted by the user and delivers this data to the microcontroller. The microcontroller functions as collect volume data indispenser1 and collect temperature from mixing \ container. The microcontroller collects the volume and temperature from microcontroller. If the required volume is not present in TANK1it was programmed to display in the LCD unit an error message that indicates "please fill the TANK1with sufficient liquid".

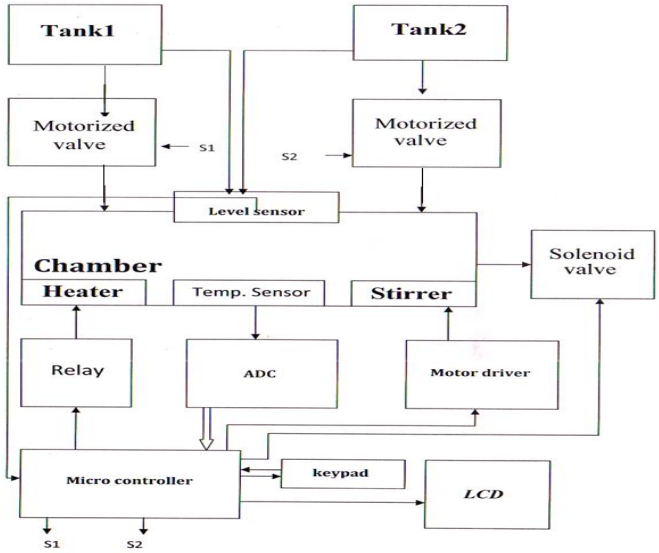

Figure 1: Block Diagram

Similarly check the required volume and temperature in TANK2.If the required volume is not present in TANK2 it was programmed to display in the LCD unit an error message that indicates "please fill the TANK2 with sufficient liquid". If getting sufficient volume in TANK2 check for temperature if required temperature is not in TANK2, display a message. Please wait and switch on the heater. After getting required temperature check the mixing container is empty or not. If the mixing container is not empty it was programmed to display in the LCD unit an error message that indicates "Please empty the mixing container".

The second component is the TANK. The system has three TANKS. Two TANKS contain Ingredients used in producing mixing. The liquid the prototype TANK fill with the liquid. One tank is used to mixing process. It is where the dispensed ingredients are mixed by the valves. It comprises of a valve and a dc geared motor. The dc motor is responsible for opening the valve for getting required volume and temperature.

Consists of two sensors their job is to collect the temperature and volume present in tank throughLM35 temperature sensor and liquid level indicators. A water level sensor was placed inside the tank together with the pumps. Its operation was based on the shorting of two pins; that is, if the liquid was in contact with the two pins, they were shorted otherwise, they were open. If one of the water level sensors was open, the system informed the user via an LCD unit. To signal the user which one of the containers had in sufficient ingredient required for an operation for an operation. Sensor circuitry present inside the tank.

The fourth component of system consists of two high torque geared dc motors for controlling the valves of the tank it will responsible for mixing of the liquids to be with greater speed and accuracy. Stirrer operated by DC motor. This is used mixing the liquid in proper manner. The fifth component is the solenoid valves. In industry some solenoid material are used to mixing in liquid then used to solenoid valves. In our project micro controller is interfaced with solenoid valves through relays.

Finally after getting required volume and temperature display a message "Process completed successfully".

Microcontroller (89S52)

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density non volatile memory technology and is compatible with the industry-standard 80C51 instruction set and pin out.

The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional non volatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications.

The on chip oscillator of 89C52 can be used to generate system clock. Depending upon version of the device, crystals from 3.5 to 12 MHz may be used for this purpose. The system clock is internally divided by 6 and the resultant time period becomes one processor cycle. The instructions take mostly one or two processor cycles to execute, and very occasionally three processor cycles. The ALE (address latch enable) pulse rate is 16th of the system clock, except during access of internal program memory, and thus can be used for timing purposes.

DC Motor

Dc motor is an electric motor converts electrical energy into mechanical motion. The reverse task that of converting mechanical motion into electrical energy, is accomplished by a generator or dynamo. In many cases the two devices are identical except for their application and minor construction details.

DC motors are used when there is positioning requirement and also changes in load and torque. DC motors can be conveniently interfaced to Bipolar DAC, or MPUs can generate PWM to control them.

The classic DC motor has a rotating ligature in the form of an electromagnet. A rotary switch called a commutate reverses the direction of the electric current twice every cycle, to flow through the armature so that the poles of the electromagnet push and pull against the permanent magnets on the outside of the motor. As the poles of the armature electromagnet pass the poles of the permanent magnets, the commutate reverses the polarity of the armature electromagnet. During that instant of switching polarity, inertia keeps the classical motor going in the proper direction.

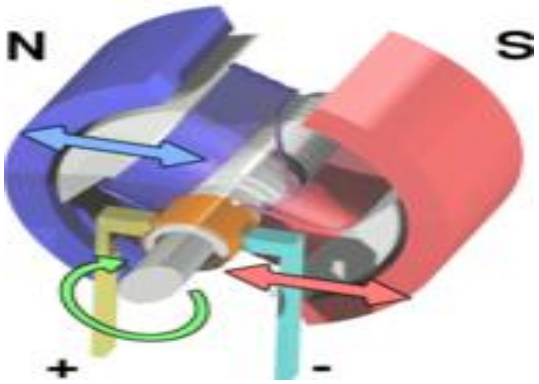

Figure 2: DC Motor

A simple DC electric motor. When the coil is powered, a magnetic field is generated around the armature. The left side of the armature is pushed away from the left magnet and drawn toward the right, causing rotation.

When the armature becomes horizontally aligned, the commutate reverses the direction of current through the coil, reversing the magnetic field. The process then repeats.

Solenoid Valve

A **solenoid valve** is an electromechanical valve for use with liquid or gas. The valve is controlled by an electric current through a solenoid: in the case of a two-port valve the flow is switched on or off; in the case of a three-port valve, the outflow is switched between the two outlet ports. Multiple solenoid valves can be placed together on a manifold.

Solenoid valves are the most frequently used control elements in fluidics. Their tasks are to shut off, release, distribute or mix fluids. They are found in many application areas. Solenoids offer fast and safe switching, high reliability, long service life, good medium compatibility of the materials used, low control power and compact design.

Solenoid valves may use metal seals or rubber seals, and may also have electrical interfaces to allow for easy control. A spring may be used to hold the valve opened or closed while the valve is not activated.

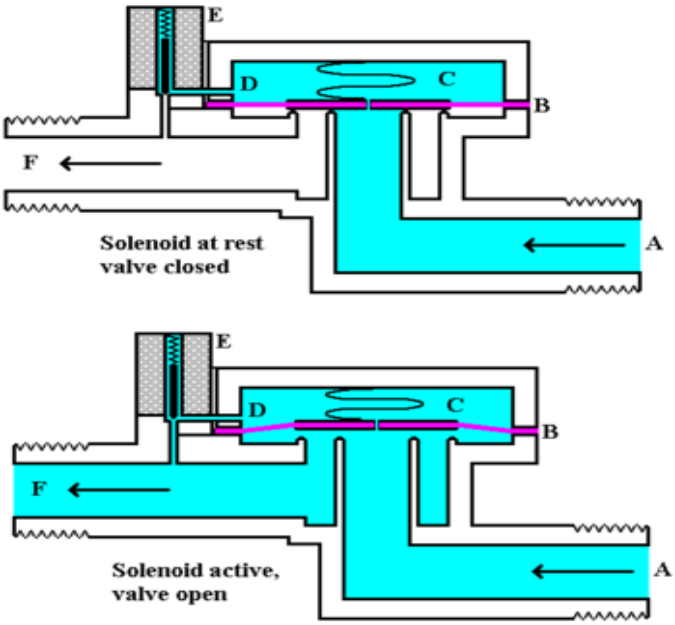

Figure 3: Solenoid Valve

Analog to Digital Converter

The ADC0808 and ADC0809 each consists of an analog signal multiplexer, an 8-bit successive-approximation converter, and related control and output circuitry. The Successive approximation ADC converts the Analog Signal to Digital form.

LCD Display

LCDs can add a lot to your application in terms of providing an useful interface for the user, debugging an application or just giving it a "professional" look. The most common type of LCD controller is the Hitachi 44780, which provides a relatively simple interface between a processor and an LCD.

Temperature Sensor

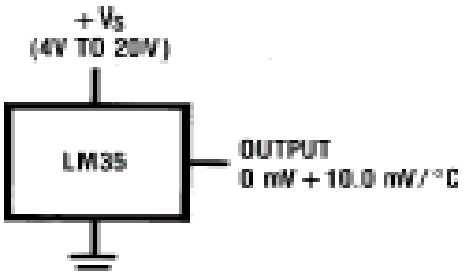

Figure 4: Temperature Sensor

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient

Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±1/4°C at room temperature and ±3/4°C over a full -55 to +150°C temperature range. Low cost is assured by trimming and calibration at the wafer level. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies. As it draws only 60 µA from its supply, it has very low self-heating, less than 0.1°C in still air. The LM35 is rated to operate over a -55° to +150°C temperature range, while the LM35C is rated for a -40° to +110°C . The LM35 series is available packaged in hermetic TO-46 transistor packages, while the LM35C, LM35CA, and LM35D are also available in the plastic TO-92 transistor package. The LM35D is also available in an 8-lead surface mount small outline package and aPlastic TO-220 package.

Relay

A Relay is a device that opens or closes an auxiliary circuit under some pre-determined condition in the Main circuit. The object of a Relay is generally to act as a sort of electric magnifier, that is to say, it enables a comparatively week current to bring in to operation on a much stronger current. It also provides complete electrical isolation between the controlling circuit and the controlled circuit.

CONCLUSIONS

Significance

This system uses microcontrollers that functions as the brain of the system to which all the operating functions of each module are chronologically programmed in it. The quantity of each ingredient to be dispensed is controlled and monitored by the microcontrollers programs. Now a days automated machines are in demand for they make numerous activities not only easier but also efficiently. These machines require minimal human intervention to do its job.

This paper is developed with very low cost microcontrollers which are very widely available in consumer electronics market. The program is developed with the help of keil evaluation version IDE which is most popular tool available for microcontrollers. The simulation of system is done in protest simulator which is helped debugging logical errors which makes the system improper functioning in practical situation. So from the above it is very clear that this system can basically develop with low expenditure.

Conclusions

The automated microcontroller-based liquid mixing system provided a very satisfactory performance with a minimal percentage error. The decision to use microcontrollers was based on the elimination of idle time and the optimization of the mixing process. In addition to this, the utilization of the various proposed components such as dispensers, sensors, pumps, relays, dc motor, solenoid valves,, stirrer operated by DC motor and an input device was also accomplished.

APPLICATIONS

- Medical application
- To produced different colour
- Chemical industries
- Cold drink industries
- Agriculture pesticide

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