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Mc68hc908kx8 Microcontroller-Based Water Circulation Control and Monitoring System

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ABSTRACT

In an industry it is often necessary to have an automatic control in every industrial process. Misainya in chemical companies. Where each industrial process requires the mixing of several chemicals in liquid form continuously all at once and in each mixing constant and controlled circulation is desired. So we want a tool that can be used to regulate the circulation of water and control it constantly and monitor the volume of liquid from the control center without having to visit each of the mixing tanks. This system uses the MC68HC908KX8 microcontroller made by Motorola included in the 8-bit processor as the central controller. The im water circulation control system consists of several controller circuits including keypad circuits, water sensor circuits, microcontroller circuits, display circuits, and driver circuits for motors and pumps. The process starts from reading the water sensor, where this sensor is in the form of a probe that is installed sequentially from the bottom to the top of the tub with a level level from 0 to 8. The output from this water sensor is fed to the microcontroller which will eventually be displayed on the water level display. In addition to reading the water level and sensor, the m.krokontroler also looks at the desired water level request according to the level selection from the selection button displayed on the button display. During the control process, the microcontroller will always see a display where the selection number will be used as a reference for the microcontroller to maintain the water level according to demand. The water level sensor system used is very good for salt water and not so good for clean water or bathroom wastewater. The size of the work area on this tool is still relatively imperfect, because the wiper motor and water pump as input output water use little power. Besides that, the water sensor used is simple and made of iron wire which corrodes easily. So it is necessary to develop the use of a motor with greater power and a water sensor that is anti-corrosion, capable of detecting and working well for any liquid. Besides that, the water sensor used is simple and made of iron wire which corrodes easily. So it is necessary to develop the use of a motor with greater power and a water sensor that is anti-corrosion, capable of detecting and working well for any liquid.

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1. INTRODUCTION

In an industry, an automatic control is needed in every industrial process. Misainya in chemical companies. Where each industrial process requires the mixing of several chemicals in liquid form at once and in each mixing a constant and controlled circulation is desired. From these problems, we want a tool that can be used to regulate liquid circulation and control it constantly and monitor the volume of liquid from the control center without having to visit each of the mixing tanks.

2. RESEARCH METHOD

2.1 System overview

The hardware built is a control and monitoring system for a water circulation. This system uses the MC68HC908KX8 microcontroller as the control center. System controller circulation this water consist of a number of Suitecontrollers which include a series of keypads, a series of water sensors, a series of microcontrollers, dı.syluy circuits, and olriver circuits for motors and pumps. In general, how the system works can be explained as follows:

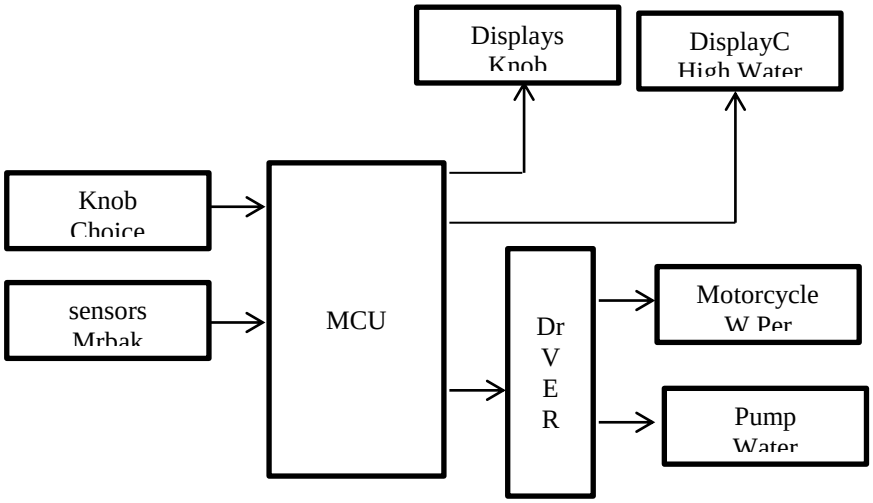

Image 1. System Block Diagram

Figure 1 is a block diagram of the entire system. The process starts from reading the water sensor placed in the water bath, where this sensor is in the form of a probe that is installed sequentially from the bottom to the top of the tub with levels /cve/ 0 to 8. The output of this water sensor is fed to the microcontroller which in turn will be displayed on the water level dı.ty/ay. In addition to reading /eve/ from the water senser, the microcontroller also sees the desired love/water request according to the /eve/ option and the selection buttons displayed on dı,›'pl y buttons. During the control process the microcontroller will dive into the display display, where the various options will be used as a reference for the microcontroller to maintain the condition of /evc/ water according to demand.

2.2 Hardware Design

a. Option Button Design

The selection key is made with an IC keyyad with serial number MM74C922N. This IC is a keypad IC with 4 output bits in the form of binary codes according to the button pressed. During production, this lC was configured for 12 buttons which were arranged in a 3x4 matrix and labeled 0,1,2,...,8, along with 2 symbols, namely . # and *. KeypaJ key arrangement can be seen in the picture

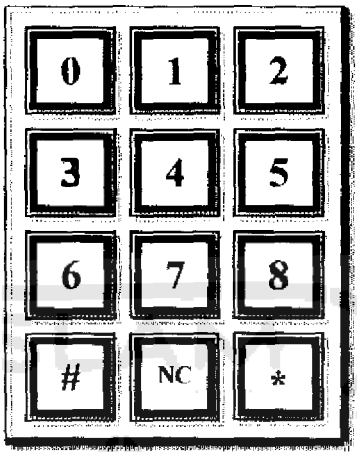

Figure 2. Keyyatf Key Arrangement

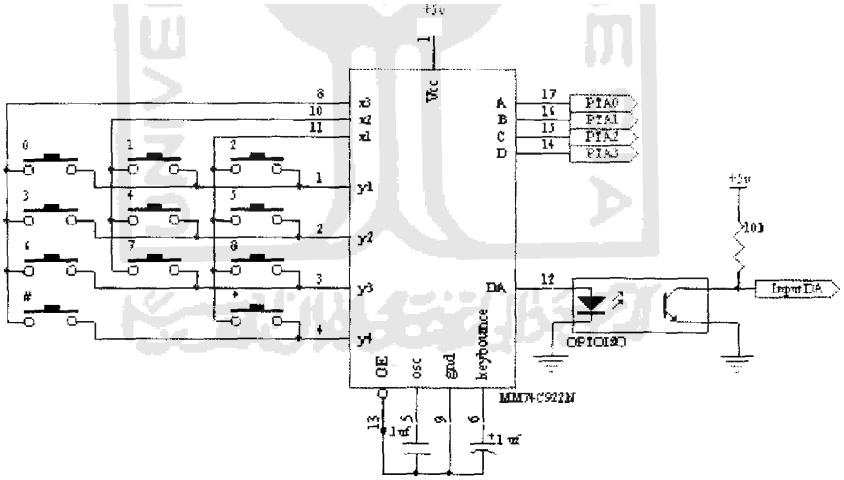

Figure 3.E eypud key chain

b. Water Sensor Design
The water Ücrisor circuit consists of 2 probes, where the main proh‹ perpendicular) is used as a voltage source and the second probe frob '0-ß) is used as a voltage receiver which is channeled from the main proh‹• through water as an intermediate. In Figure 3.4 it is shown that the second yrøhe was installed as much as 9 so that from this configuration a water level of 8 levels was obtained and the top 1 level was used for the leys/upper barrier. The condition of this frohe-f›rnhe is fed to the IC s/iJf register for ralel in-seriul out (MC74HC 165) which functions as an add-on port in the MCU and retrieves parallel data from the sensor to be read by the microcontroller r hurt and displayed to the water level display.

c. 4ficrocontroller t/nio (MCU) design.
The controller system is made using a Motorola output microcontroller with cent number MC68HC908kX8. As a whole all the pins of the MC68lJC90bKX8 are functioned as yorf Inyut tlulpul (I/O), where fr›rfA0,l,2, and 3 are inputs to receive 4 bit data from the IC kcypod MM74C922N output, while /'r›rfA4 is functioned as input to receive serial data from the water sensor. The IRQ pin functions as a signal for the microcontroller to retrieve 4-bit data from IC MM74C922 N when a button is pressed.

d. Display Design
In making Jf.splay, 2 units of 7-.‹egmcø/ common unoJu were used as the level/water display and the hive/option button display. IC is used for sending data. lit/r register 74HC595, where this lC functions to convert serial data into parallel data.

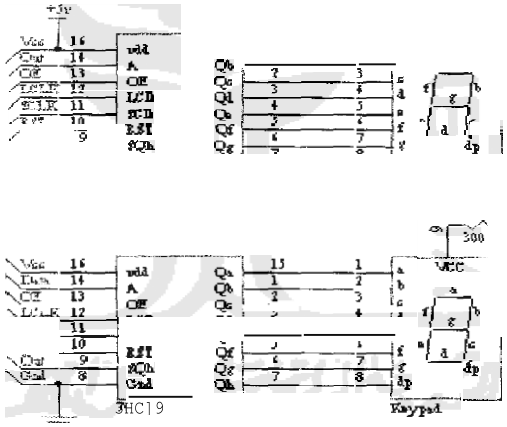

Figure 4. Ni.i¡ ley circuit

3. RESULTS AND DISCUSSIONS

3.1 Analysis WR*d

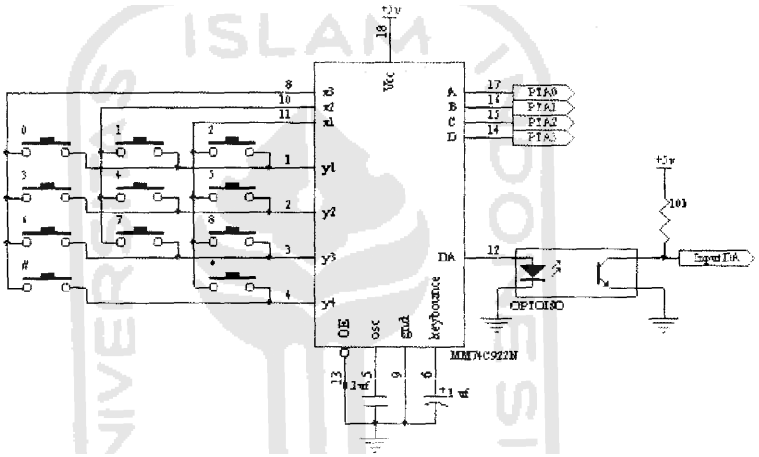

Figure 5.K eypud key chain

The keypad circuit uses the MM74C922N IC, this IC is a keypad IC with 4 output bits. If any keypaJ key is pressed, the column and band where the key is located will go low logic. So, if for example, according to the arrangement of the keypad, the 0 column X and row I buttons are pressed, so that X4XsX, X will be equal to 1011 and Y, YiY 2Y i equal to 1 110. This keystroke is detected by the kevbourJ encoder MM74922N and translated into binary code.

For button 0 pressed DCBA output from cnc ‹›â‹ r will be equal to 001O. The capacitor connected to pin 5 lC MM74C922N is required to complete the internal oscillator circuit of this IC. This oscillator is needed to perform tracking of Al Xi and Y t inputs. . Y, to index the kc ypuJ button that was pressed. condenser on pin b IN“ MM74C922N, is needed to dampen mechanical vibrations (icy hounc'c) that can arise when a button is pressed. An internal register in the MM74C922N remembers the number of the last button pressed, even after the button was released. After enc'‹›Jc•r detects a button being pressed, the EA (Info av‹iilable) output of the IN MM74C922N will go high. High output on this DA indicates that the input data has been received by encoder. After the button is released, the DA output will again be low. Low to high logic changes in the DA result in an interrupt on the microcontroller and the output data from IC 74C922N is taken to be encoded and displayed on the df.splay button display. Table 4. I is the output data from IC MM74C922N Participants in the button trap function.

3.2 Water Sensor Circuit Analysis

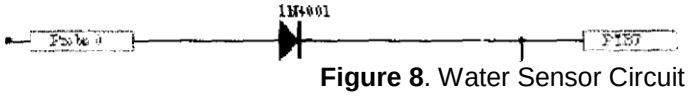

Figure 8. Water Sensor Circuit

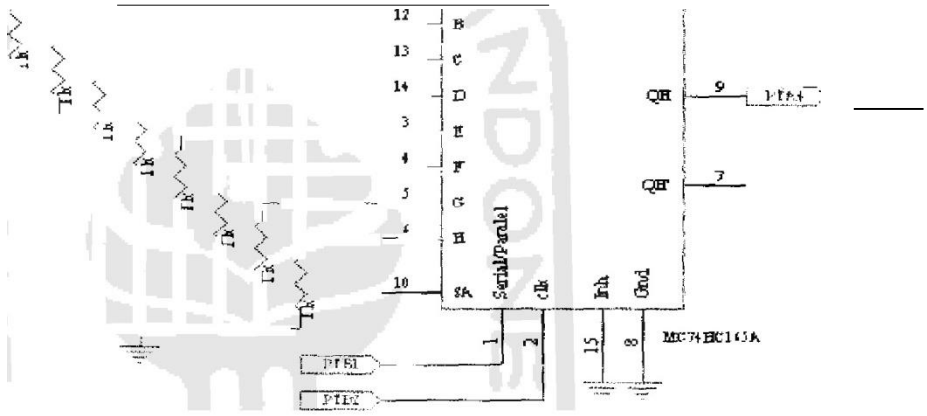

Figure 6. Water Sensor Circuit

The water sensor circuit uses water as a medium for conducting electricity from the main probe to the second probe. MCS will receive high data (5 volts) when the second prohe is connected to the main prohe and will receive low data when the second prohc is not connected to the main prohe. Table 4.2 is a list of conditions for each yr‹ih‹• trap on the sensor and display 7-.ieymeof. For the miniature, the comparison between the display and the water level is 1 on the display and 1.5 cm in the water tank. The probe used as a water sensor is made of iron wire. However, for actual planning, it is expected to use materials that are stainless or corrosion resistant so that they can receive good electrical conductivity, for example, aluminum or something else. The purpose of testing the water level sensor from the various types of water being tested is to show differences in sensitivity in readings. Types of AIT used include purified/clean water, wastewater and bathrooms, and salt water. Of the various types of water tested, it turned out that the one with the best conductivity was salt water, clean water, and bathroom waste water. To restore normal reading back f›r‹›he must be scrubbed first.

Table 1. List of Sensor Outputs and 1 display of the 7-MCNI sub-district

Probes								Appearance Display Levels	Levels Water
8	7	6	5	4	3	2	1		
0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	1	1
1	1	0	0	0	0	0	0	2	2
1	1	1	0	0	0	0	0	3	3
1	1	1	1	0	0	0	0	4	4
1	1	1	1	1	0	0	0	5	5
1	1	1	1	1	1	0	0	6	6
1	1	1	1	1	1	1	0	7	7
1	1	1	1	1	1	1	1	8	8

3.3 Uriver Chain Analysis

a. Washer Motor Drivers

In the planning used 5 motors iv‹1,vlier connected in parallel and to control it used a MOS FET UF 330 which has an output current rating of up to 14 Amperes

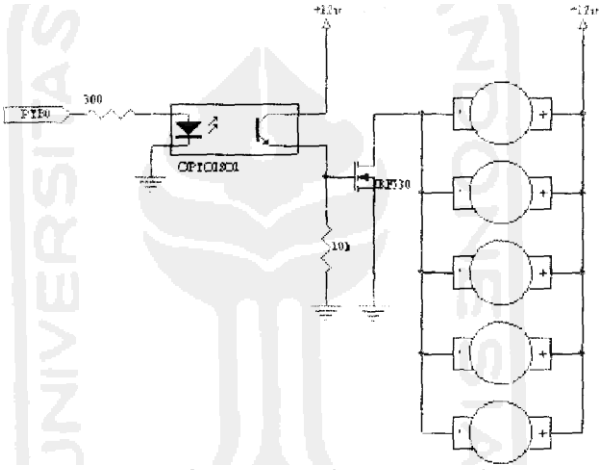

Figure 7. Waher Motor Drivers

"The wiper motor drive.r above uses oplocoupf‹•r 4N 23 as electrical isolation between the input and output circuits. PortBo MCU is a driver circuit controller, where when portB0 is in a state /iig/i (5 volts) the LED on ‹.›ptocouyl‹r will be ON and will cause the optocoupler transistor to saturate. In this state the polished pin on the transistor will log /iig/i and make MOSSL 1" IRS 540 ON. This situation will make the motor rotate. Vice versa when port B0 is low

b. Water Pump Drivers

The water pump drive circuit uses a relay to disconnect and connect 220 Volt AC to the pump. The relay is activated by a transistor which functions as an .iwic//i transistor.

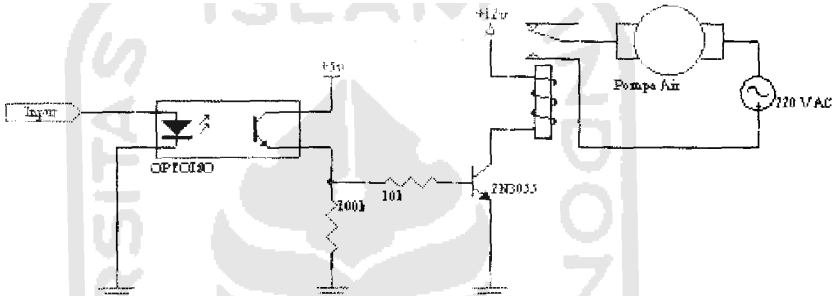

Figure 8.‹lri»er series of water pumps

The pump driver above uses a transistor circuit as a switch, where for that purpose the transistor is operated in the cofo/f and .soturuli‹›n (saturated) regions. PortB6 on the MCU is used to control this circuit. When port B6 liiii/i the transistor is in a saturated state and the relay will be ON so that the central terminal leg (220 volt AC power) will be connected to the second terminal which is already connected to the pump, so that in this condition the pump will be ON. When portB6 /‹›u the transistor will cuff›// and the pump will be OFF.

3.4 Itanghaian analysis I3isplay

In making the display, we used 2 7-segment commons as the few/air display and the levc'f selection button display. IC .'lii//rest is used for sending data. teF 74HC595, which ie has the function of converting serial data into parallel data.

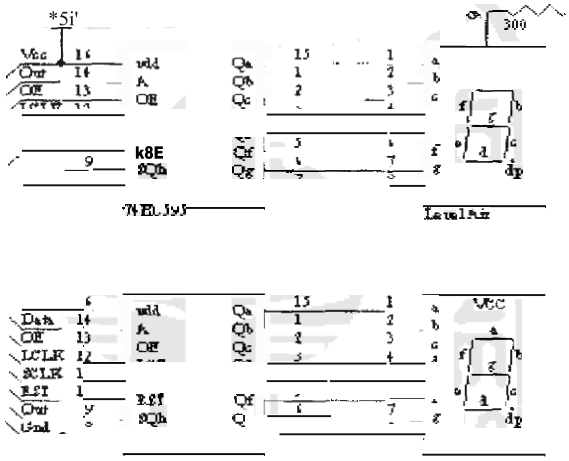

Figure 9. Display Series

The two displays above are sent serially and sequentially, starting from the level display and the keypad at high speed. In the MCU data is sent via port l33 and for shifting data to be displayed Jkan to 7-.veyincrif is used .s/ii// clock and la/c/i clock on IC 74HC595.

3.5 Analysis of the Performance of the System

This water circulation control and monitoring system uses two power supplies to distribute the voltage and current. The use of two power supplies is intended so that the distribution of voltage and current in the circuit is minimal, especially in motor driver circuits that require large currents. When the hardware starts to turn on, the first circuit that works is the water sensor (probe). This section will detect the water level. From the results of this detection, two pieces of data will be sent at once, namely the water level scan data and the button data (kcvy«/). Initially the output data of the water level scan which is in the form of parallel data is converted into serial data by IC 74HC165 then this serial data enters the microcontroller for further processing and is fed to IC 74HC595. This IC converts serial data into parallel data so that the water level can be displayed on the seven segment display. For sending button data to the seven segment display, initially it is made blank if there has been no request (interruption). To enable the 4x3 matrix button, an IC MC74C922 is used. As a 4-bit IN decoder the MC“74C922 can be configured with a microcontroller for interrupt facilities (IRQ). Sending the button data starts when the button is pressed and gets interrupted. Then this IC will provide output logic to be fed to the microcontroller input port. After entering and processing on the microcontroller memory the 4-bit señal data is sent to the IC 74HC595 input to be displayed on the seven segment display. Sending these two data uses an internal clock generator with a frequency of 30.72 MHz, bus clock = 7.68 MHz.

After doing several ui trials, this water circulation control system runs well and is stable as expected. Int is proven when water starts to fill the main tub from the lowest level to the upper limit, the water sensor (probe) is able to detect it accurately and is always in sync (according) with the seven segment display. This control system can actually be divided into 2. When there is no demand for water, it will continue to fill, if the water has touched the top probe the motor is on, meaning that the water will be continuously reduced until it reaches the lowest level, this condition repeats itself as long as there is no demand. When there is a demand for a certain level of water, it will always be maintained at a constant level according to the request. At this time the motor will work continuously on and off to control the water so that it is at a constant level. Basically .

4. CONCLUSION

From observations during the analysis for planning and manufacturing as well as measurements that have been carried out, it shows that the planned tool meets the following criteria. Probes made of iron are not good for making water sensors, this is because the material is not resistant to corrosion. The water level sensor system used is very good for salt water and not so good for clean water or bathroom wastewater. The water circulation control and monitoring system can work well on pumps and motors with small power I for pumps <18W, 12V washer motors. Conversely, this system is not suitable when using pumps and motors that exceed the power, voltage according to the provisions above.

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