FLOW MEASUREMENT

Special Assignment and Lab Project Report

Course: 2EC701CC23: Microcontroller and Interfacing

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1. Introduction

Water flow measurement is important in homes, industries, and irrigation systems. This project uses an **8051 microcontroller** to build a simple digital water flow meter. A **flow sensor** sends pulses as water flows, and the microcontroller counts these pulses to calculate the total volume. The result is shown on a **16x2 LCD**, while a **buzzer and LED** provide alerts when a set amount of water is measured. This system is **low-cost, reliable**, and useful for basic water management.

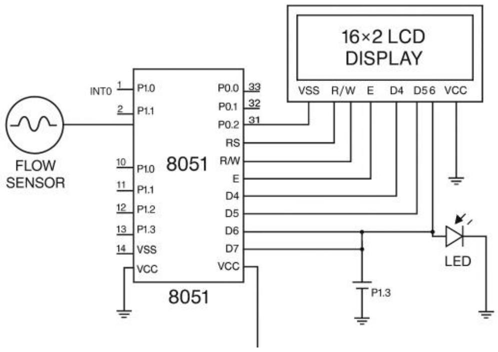
2. Theory

The flow measurement system using the 8051 microcontroller counts pulses generated by a flow sensor to calculate the volume of liquid flowing through a pipe. Each pulse represents a fixed amount of liquid, and the system uses interrupts to count these pulses. After every set number of pulses, the volume is updated. The total pulse count and volume are displayed on an LCD. Delay subroutines ensure proper timing for pulse counting and display updates. This system provides real-time monitoring of liquid flow in a pipeline.

3. Working

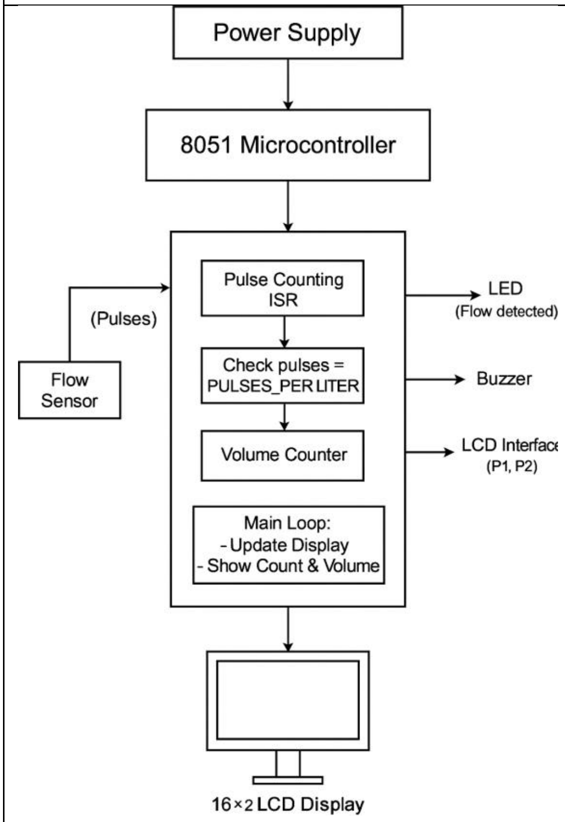
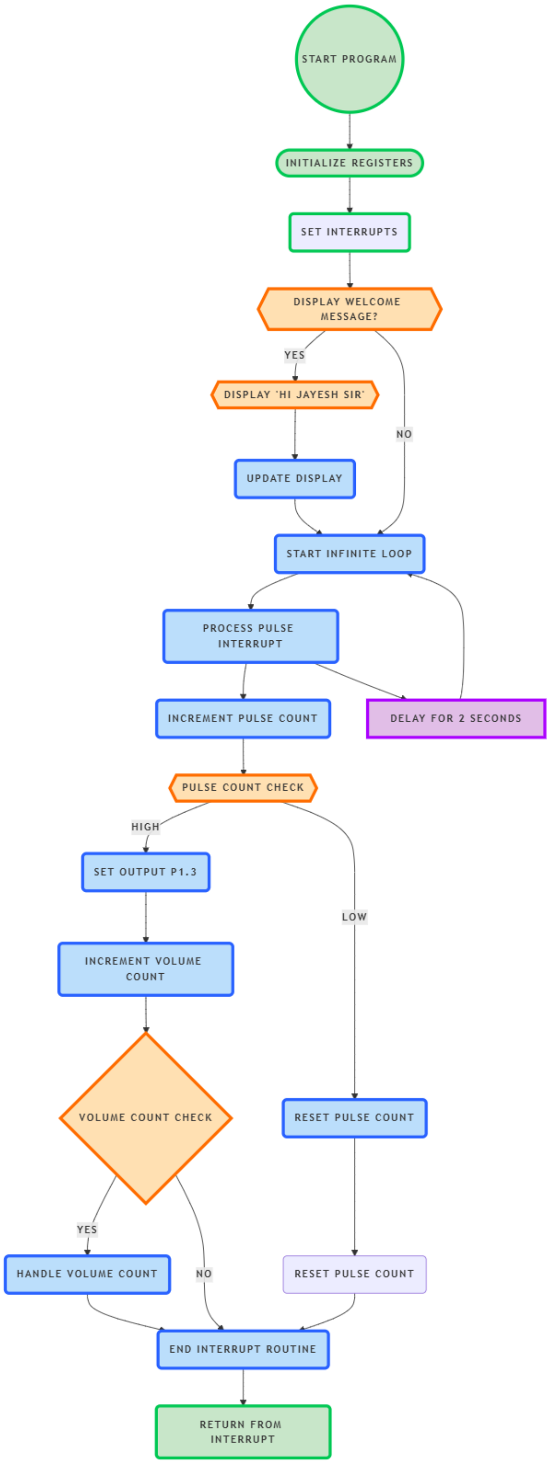
- **Pulse Counting**: Each pulse from the sensor increments a counter (`30H`), and every 10 pulses (defined by `PULSES_PER_LITER`), the volume (`31H`) increases by 1 liter.
- **Interrupt Handling**: An external interrupt (`EX0`) triggers the ISR, which counts pulses and updates the volume.
- **LCD Display**: The pulse count and total volume are displayed on the LCD. The `UPDATE_DISPLAY` subroutine refreshes the screen with the current values.
- **Delays**: The program includes delay subroutines to control timing, including a 2-second and 5-second delay for debounce and refresh purposes.

4. Circuit Diagram

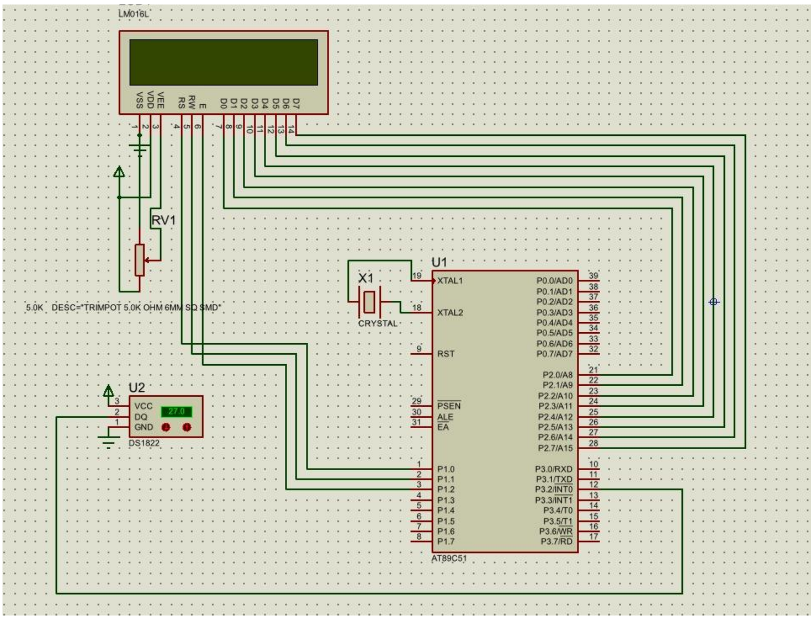


5. Algorithm

- Initialize microcontroller, counters, and LCD.
- Enable external interrupt for pulse detection.
- On each pulse, increment pulse counter.
- If pulse count reaches threshold, increment volume and reset pulse count.
- Continuously display pulse and volume on LCD.
- Use delays for stable display and output.

6. Block Diagram	7. Flowchart
	

8. Proteus Diagram



9. Code

```
ORG 0000H
        SJMP MAIN
         ORG 0003H
        SJMP Pulse_ISR_Direct
       ORG 0030H
PULSE_COUNT:    DS 2
TOTAL_vollume:   DS 2
PULSES_PER_LITER EQU 10

        ORG 0050H
MAIN:
        MOV SP, #60H
        MOV 30H, #0
        MOV 31H, #0
        MOV 32H, #0
        MOV 33H, #0
        SETB IT0
        SETB EX0
        SETB EA
   ACALL LCD_Start

        MOV DPTR, #welcome_sir
        ACALL LCD_STRING

 JJ:
        ACALL UPDATE_DISPLAY
        SJMP jj

Pulse_Isr_Direct:
        PUSH ACC
        PUSH PSW

               ACALL DELAY_2S
```

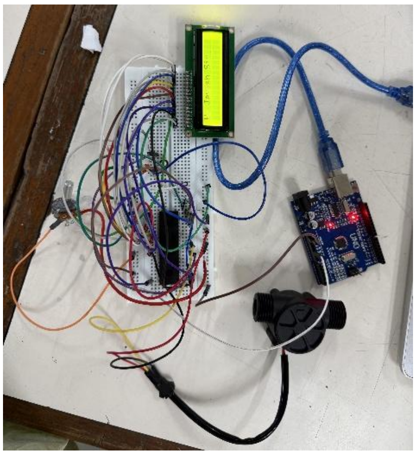
```
        INC 30H
        MOV A, 30H
        JNZ ISR_CHECK_HIGH
        INC 31H
    ISR_CHECK_HIGH:
        MOV A, 31H
        CJNE A, #HIGH(PULSES_PER_LITER),
ISR_END
        MOV A, 30H
        CJNE A, #LOW(PULSES_PER_LITER),
ISR_END

        SETB P1.3
                      ACALL DELAY_5S
                      INC 32H
        MOV A, 32H
        JNZ RESET_PULSE
        INC 33H

  RESET_PULSE:
        MOV 30H, #0
        MOV 31H, #0


                      MOV A, 33H
        ACALL DISP_HEX
LCD_start:
        MOV P2, #00H
        CLR P1.0
        CLR P1.1
        MOV A, #38H
        ACALL LCD_CMD
        MOV A, #0EH
        ACALL LCD_CMD
```

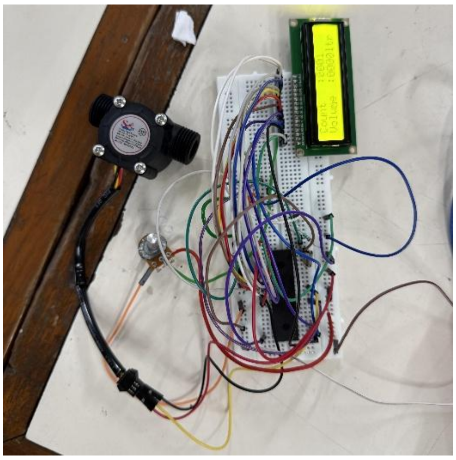
```
	MOV A, #01H
	ACALL LCD_CMD
	MOV A, #06H
	ACALL LCD_CMD
	RET

LCD_CMD:
	MOV P2, A
	SETB P1.2
	ACALL DELAY
	CLR P1.2
	ACALL DELAY
	RET

LCD_DATA:
	MOV P2, A
	SETB P1.0
	CLR P1.1
	SETB P1.2
	ACALL DELAY
	CLR P1.2
	ACALL DELAY
	CLR P1.0
	RET

LCD_STRING:
	CLR A
	MOVC A, @A+DPTR
	JZ LCD_STR_END
	ACALL LCD_DATA
	INC DPTR
	SJMP LCD_STRING

LCD_STR_END:
	RET

UPDATE_DISPLAY:
	MOV A, #80H
	ACALL LCD_CMD
	MOV DPTR, #impulse_string
	ACALL LCD_STRING
	MOV A, 31H
	ACALL DISP_HEX
	MOV A, 30H
	ACALL DISP_HEX

	MOV A, #0C0H
	ACALL LCD_CMD
	MOV DPTR, #vollume_string
	ACALL LCD_STRING
	ACALL DISP_HEX
	MOV A, 32H
	ACALL DISP_HEX
			MOV DPTR, #ltr
	ACALL LCD_STRING
RET
```

```
DISP_HEX:
	PUSH ACC
	SWAP A
	ANL A, #0FH
	ACALL HEX_TO_ASCII
	ACALL LCD_DATA
	POP ACC
	ANL A, #0FH
	ACALL HEX_TO_ASCII
	ACALL LCD_DATA
	RET

HEX_TO_ASCII:
	CJNE A, #10, HTA_CHECK
HTA_CHECK:
	JC HTA_NUM
	ADD A, #55
	RET
HTA_NUM:
	ADD A, #48
	RET


DELAY_2S:
   MOV R7, #20
DELAY_LOOP1:
   MOV R6, #200
DELAY_LOOP2:
   MOV R5, #250
DELAY_LOOP3:
   NOP
    NOP
   DJNZ R5, DELAY_LOOP3
   DJNZ R6, DELAY_LOOP2
   DJNZ R7, DELAY_LOOP1
   RET

DELAY_5S:
   MOV R7, #50
DELAY_LOOP11:
   MOV R6, #200
DELAY_LOOP22:
   MOV R5, #250
DELAY_LOOP33:
   NOP
   NOP
   DJNZ R5, DELAY_LOOP33
   DJNZ R6, DELAY_LOOP22
   DJNZ R7, DELAY_LOOP11
   RET


DELAY:
	MOV R6, #50
DELAY1:
	MOV R7, #100
DELAY2:
	DJNZ R7, DELAY2
	DJNZ R6, DELAY1
	RET
```

```
; Messages
welcome_sir:
	DB "Hi Jayesh Sir", 0
impulse_string:
	DB "Count :", 0
vollume_string:
	DB "Volume:", 0
ltr:
	DB "ltr",0
welcome_project:
	DB "Welcome to flow",0
	END
```

10. Result





11.Bill of Material

Component	Amount
Jumper wire	2*20 = 40
Breadboard	70
Flow sensor	270
At89C51	125
11.0592 crystal	5
10k resistor	1
10micro farad capacitor	1
Pushbutton	2
16*2 LCD display	100
Potentiometer	30

12. Applications

- Domestic water usage monitoring
- Irrigation systems for agriculture
- Industrial fluid flow control
- Smart water metering
- Water conservation and leak detection systems

13. Set of Questions:

1. What is the purpose of a flow measurement system?
2. Which microcontroller is used in this project?
3. What component is used to detect the flow of liquid?
4. How does the 8051 count the pulses from the flow sensor?
5. What does each pulse from the sensor represent?

Summary:

This project implements a digital water flow measurement system using the 8051 microcontroller and a flow sensor. The sensor generates pulses proportional to water flow, which are counted via external interrupts. The total volume is calculated and displayed on a 16x2 LCD. The system is simple, cost-effective, and suitable for various water monitoring applications.