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B.Tech. Winter Semester 2023-24

School Of Computer Science and Engineering (SCOPE)

Digital Assignment - I

Embedded Systems

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Date: 22 January 2024

Contents

1 Question

Prepare a detailed analysis on the Automatic Garden Watering System in the following aspects (Digital or Hand written).
- Purpose and significance of the project.
- Requirement Analysis,
- Functional Diagram,
- Block Diagram, UML Diagrams (Use Case Diagram and/or/Sequence Diagram)

1.1 Answer

Purpose

The primary purpose of an Automatic Garden Watering System is to automate the process of watering plants in a garden or any designated area. It aims to deliver the right amount of water to plants at the right time, without manual intervention.

Significance

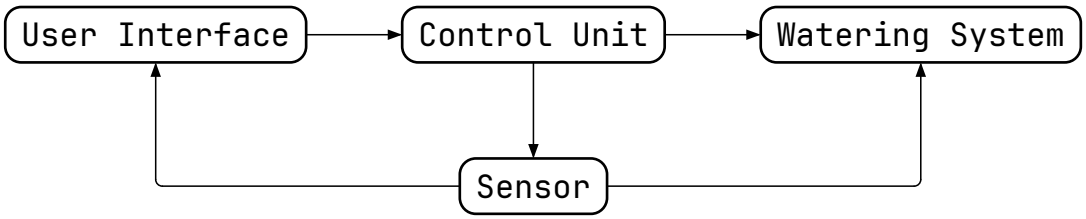
- Water Conservation: Optimizes water usage, reducing waste.
- Time Savings: Automates a time-consuming chore.
- Convenience: Provides consistent watering, even when the user is away.
- Plant Health: Promotes healthier plant growth through consistent moisture.

Requirement Analysis

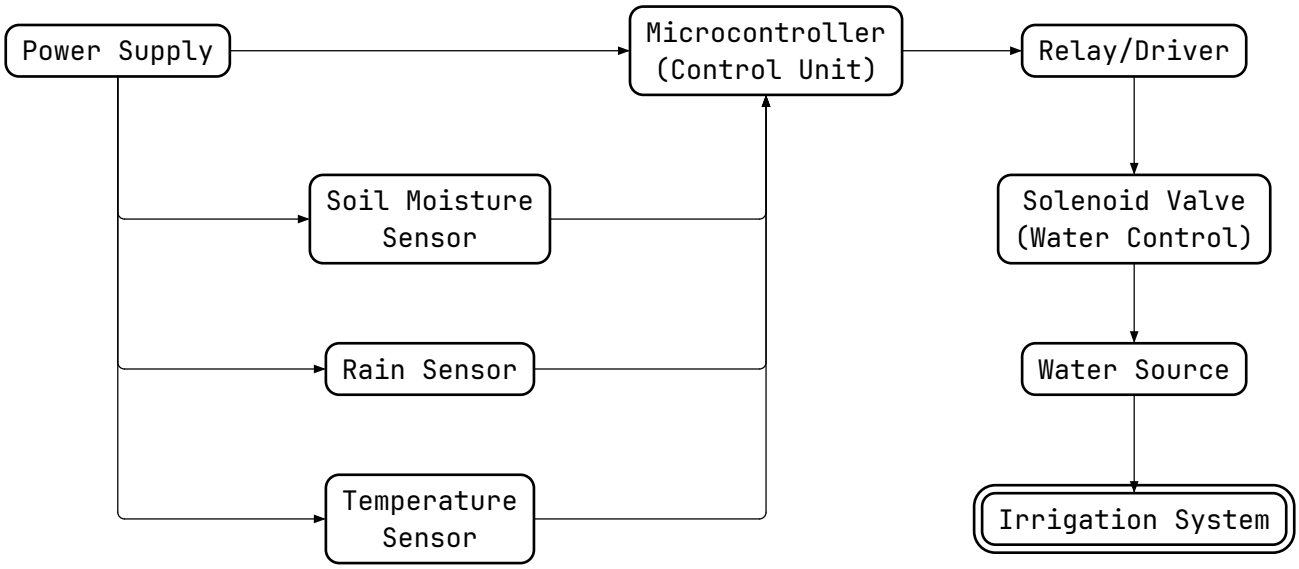
Functional Requirements:
- Soil Moisture Sensing: Detect soil moisture levels.
- Automated Watering: Trigger water flow when moisture is low.
- Adjustable Thresholds: Allow users to set moisture trigger points.
- Programmable Schedules: Enable watering at set times/intervals.
- Manual Override: Provide a manual on/off switch.

Non-Functional Requirements:
- Reliability: Consistent operation.
- Durability: Weather-resistant components.
- Power Efficiency: Minimize energy consumption.
- Ease of Use: Simple user interface.
- Safety: No electrical or water hazards.

Functional Diagram



Block Diagram



2 Question

Describe the special purpose register used for interrupt configuration. Assume that two switches are connected to pin p3.2 p3.3 . write a program to monitor the switch and perform the following using external hardware interrupt. if SW1=0, FLASH port0 with (FF to 00) if SW2 =0 , FLASH port2 with (55 to AA)

2.1 Answer

Ans 2:
Interrupt Enable (IE) is the special purpose register used to manage and configure interrupts.

IE Register Bit Detail.

BIT	Description
7	Global Interrupt 0/1
6	Reserved
5	Timer 2 Interrupt Enable 0/1
4	Serial Port Interrupt Enable 0/1
3	Timer 1 Interrupt Enable 0/1
2	External Interrupt 1 Enable 0/1
1	Timer 0 Interrupt Enable 0/1
0	External Interrupt 0 Enable 0/1

Here Bit0 is controlled by P3.2 and Bit2 is controlled by P3.3.

Program to Monitor Switches and Flash.

```
ORG 00H
LJMP MAIN

ORG 03H
LJMP INT0_ISR

ORG 013H
LJMP INT1_ISR

MAIN:
  MOV IE, # 10000101B.

  SETB P3.2
  SETB P3.3

  LOOP:
     SJMP LOOP
```

```
INT0_ISR
   JB P3.2, INT0_EXIT

   MOV A,#0FFH

   LOOP1:
     MOV P0,A
     ACALL DELAY
     CLR C
     RLC A
     JC INT0_EXIT
     JMP LOOP1
   INT0_EXIT
     RETI
INT1_ISR
   JB P3.3

   MOV A,#55H

   LOOP2:
     MOV P2,A
     ACALL DELAY
     CPL A
     CJNE A,#0AAH,LOOP2
     MOV P2,A
     ACALL DELAY
    INT1_EXIT:
      RETI

DELAY:
   MOV R7,#255

   LOOP3:
     DJNZ R7,LOOP3
     RET

END
```

3 Question

The 8051 microcontroller is configured for serial communication at a baud rate of 9600 using a crystal frequency of 11.0592 MHz. The UART is set in Mode 1 (8-bit data, variable baud rate), and Timer 1 is used in Mode 2 (8-bit auto-reload mode) to generate the baud rate. What value should be loaded into the Timer 1 TH1 register to achieve the desired baud rate?

3.1 Answer

Ans 3-

We know:-

$$\text{Baud Rate} = \frac{\text{Oscillator Frequency}}{32 \times 12 \times (256 - TH1)}$$

Then,

$$TH1 = 256 - \frac{\text{Oscillator Frequency}}{32 \times 12 \times \text{Baud Rate}}$$

Given:-

- Oscillator Frequency = 11.0592 MHz.
- Baud Rate = 9600

Then

$$TH1 = 256 - \frac{11.0592 \times 10^6}{32 \times 12 \times 9600}$$

$$= 253$$

$$= 0xFD$$

Then FD should be loaded to Timer 1 TH1

Code:-

```
MOV  TMOD, #20H
MOV  TH1, #0FDH
MOV  SCON, #50H
```

4 Question

Draw the following in A3.
1. architecture of 8051 microcontroller
2. PIn diagram
3. RAM (4 register banks with its address, bit addressable field)
4. SPR with address
5. TCON
6. TMOD
7. SCON
8. PCON
9. DPTR

4.1 Answer