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IRRIGATION SYSTEM

Components
ATmega16 is an 8-bit high performance microcontroller of Atmel's Mega AVR family with low power consumption. Atmega16 is based on enhanced RISC (Reduced Instruction
Set Computing) architecture with 131 powerful instructions. Most of the instructions execute in one machine cycle. Atmega16 can work on a maximum frequency of 16MHz. ATmega16 has 16 KB programmable flash memory, static RAM of 1 KB and EEPROM of 512 Bytes. The endurance cycle of flash memory and EEPROM is 10,000 and 100,000, respectively. ATmega16 is a 40 pin microcontroller. There are 32 I/O (input/output) lines which are divided into four 8-bit ports designated as PORTA, PORTB, PORTC and PORTD. ATmega16 has various in-built peripherals like USART, ADC, Analog Comparator, SPI, JTAG etc. Each I/O pin has an alternative task related to in-built peripherals.

PIN DIAGRAM
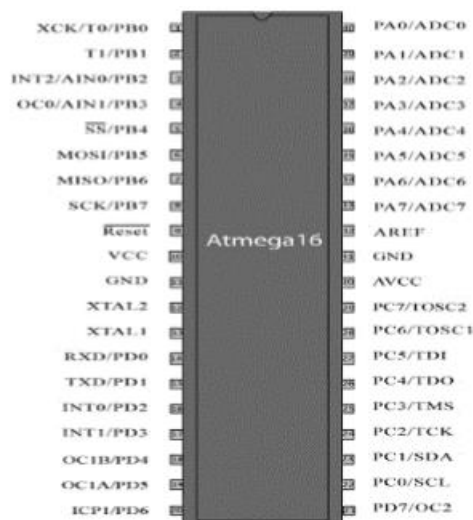
Soil Moisture Sensor is a simple breakout for measuring the moisture in soil and similar materials. The soil moisture sensor is pretty straight forward to use. The two large exposed pads function as probes for the sensor, together acting as a variable resistor. The more water that is in the soil means the better the conductivity between the pads will be and will result in a lower resistance.

Temperature sensor (LM35) is a precision IC temperature sensor with its output proportional to the temperature (in o C). The sensor circuitry is sealed and therefore it is not subjected to oxidation and other processes. With LM35, temperature can be measured more accurately than with a thermistor. It also possesses low self-heating and does not cause more than 0.1 o C temperature rise in still air. The operating temperature range is from -55°C to 150°C. The output voltage varies by 10mV in response to every o C rise/fall in ambient temperature, i.e., its scale factor is 0.01V/ o C.

Liquid Crystal Display (LCD) is an electronic display module which uses liquid crystal to produce a visible image. The 16×2 LCD display is a very basic module commonly used for displaying alphabets and numeric value. A 16X2 LCD has two registers namely, command and data. The register select is used to switch from one register to other. RS=0 for command register, whereas RS=1 for data register. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.

Relays are switches that open and close circuits electromechanically or electronically. Relays control one electrical circuit by opening and closing contacts in another circuit. Relays are generally used to switch smaller currents in a control circuit and do not usually control power consuming devices except for small motors and Solenoids that draw low amps Nonetheless, relays can "control" larger voltages and amperes by having an amplifying effect because a small voltage applied to a relays coil can result in a large voltage being switched by the contacts. The main operation of a relay comes in places where only a low-power signal can be used to control a circuit. It is also used in places where only one signal can be used to control a lot of circuits.
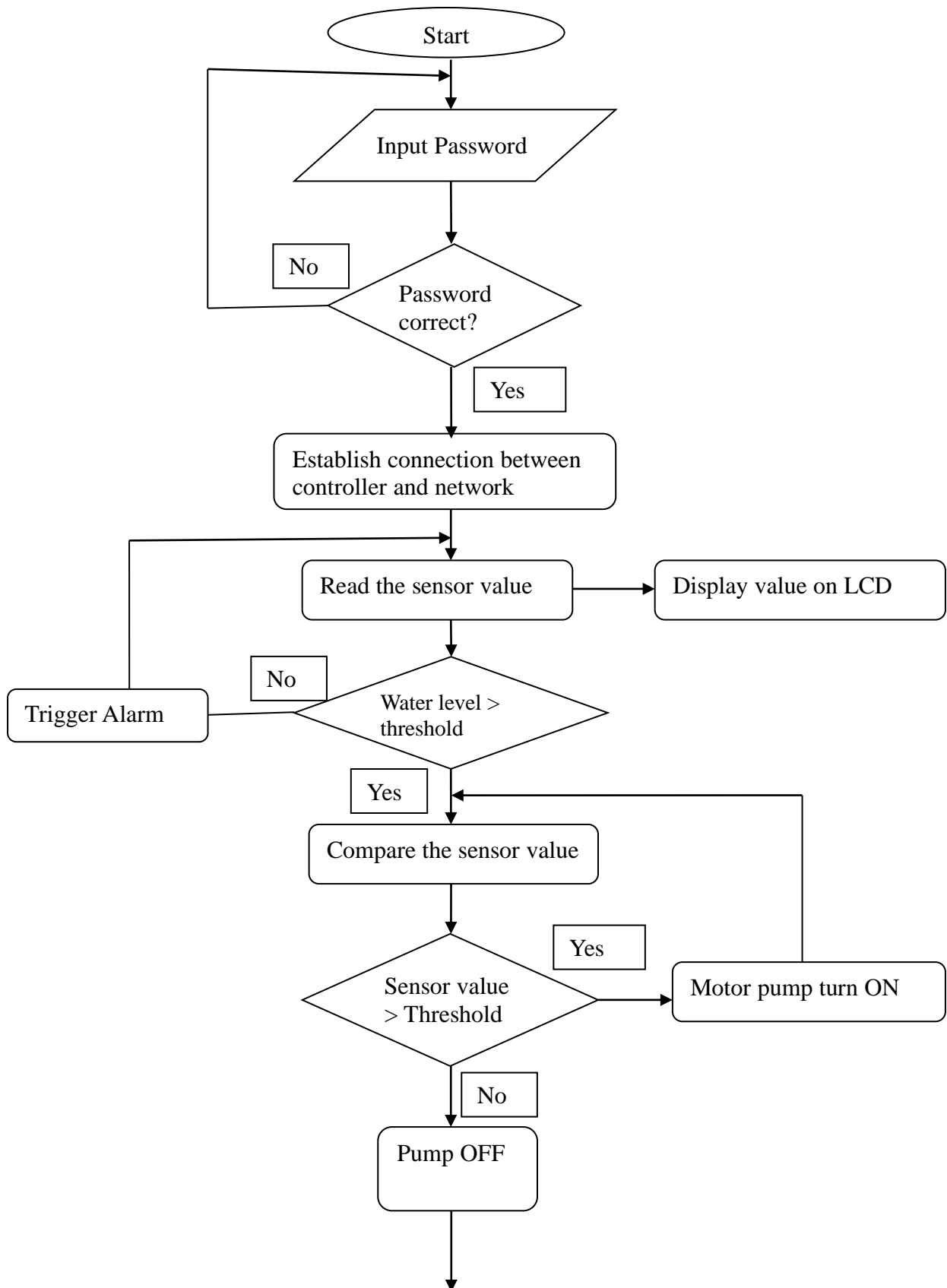
Motor pump

Ultrasonic Water level sensor

Working principle

This project is designed to develop an automatic irrigation system which switches the motor pump ON/OFF on sensing the moisture content of the soil and monitors the real time temperature of the farm. In the field of agriculture, use of proper method of irrigation is important. The advantage of using this method is to reduce human intervention and still ensure proper irrigation. In this project the Moisture sensor, Temperature sensor, LCD, Motor pump are interfaced with Atmega16. Moisture sensor and temperature sensor provides analog signal to Atmega16 microcontroller. Microcontroller needs to convert this analog signal into digital value. The ATmega16 has an inbuilt 8 channel, 10 bit analog to digital converter. Here, we will first convert a 5V signal and then a 0V signal with a reference voltage of 5V of ADC. After each conversion, the analog to digital converter of ATmega16 will give a 10-bit value for each signal (5V and 0V).These outputs of the analog to digital converter are displayed in a 2×8 LCD array. When a 5V signal is converted, the output of analog to digital converter is 0x3ff (1023) and when 0V signal is converted, the output is 0x00 (0).

The status of the water pump , soil moisture and temperature is displayed on the LCD, which is interfaced to the microcontroller. Thus, this automatic irrigation system depends on the output of the moisture sensor. When the moisture sensor sense the soil is dry then the microcontroller turn ON the motor pump and if moisture sensor senses the soil is not dry then microcontroller turn OFF the motor pump.

Flow Chart

```
                              ┌─────────────┐
                              │    Start    │
                              └──────┬──────┘
                                     │
                         ┌───────────▼───────────┐
                         /     Input Password     /
                         └───────────┬───────────┘
                                     │
         ┌────┐              ◇ Password ◇
         │ No │◄─────────────◇ correct? ◇
         └────┘              ◇          ◇
                                     │ Yes
                                     │
                         ┌───────────▼──────────────┐
                         │ Establish connection      │
                         │ between controller and    │
                         │ network                   │
                         └───────────┬──────────────┘
                                     │
                         ┌───────────▼──────────┐        ┌──────────────────┐
                         │ Read the sensor value │───────►│ Display value    │
                         └───────────┬──────────┘        │ on LCD           │
                                     │                    └──────────────────┘
       ┌──────────────┐        ◇ Water level > ◇
       │ Trigger Alarm│◄──No───◇ threshold      ◇
       └──────────────┘        ◇                ◇
                                     │ Yes
                         ┌───────────▼──────────┐
                         │ Compare the sensor    │
                         │ value                 │
                         └───────────┬──────────┘
                                     │
                              ◇ Sensor value ◇       ┌──────────────────┐
                              ◇ > Threshold   ◇──Yes─►│ Motor pump turn  │
                              ◇               ◇       │ ON               │
                                     │ No            └──────────────────┘
                         ┌───────────▼──────────┐
                         │ Pump OFF              │
                         └───────────┬──────────┘
                                     │
                                     ▼
```

- Start
- Input Password
- Password correct?
  - No
  - Yes
- Establish connection between controller and network
- Read the sensor value → Display value on LCD
- Water level > threshold
  - No → Trigger Alarm
  - Yes
- Compare the sensor value
- Sensor value > Threshold
  - Yes → Motor pump turn ON
  - No
- Pump OFF

```
            ⭕ Stop
```

Algorithm

i.   Start
ii. Input password
iii. If the password is correct, proceed.
iv. Else back to (ii).
v.   Establish connection between network and the controller.
vi. Read sensor, record and display values.
vii. If water level is greater than the threshold value, Proceed
viii. Else trigger alarm and go back to (vi)
ix. Compare all sensor values.
x.   If sensor value greater than threshold, motor pump on and go back to (ix)
xi. Else, pump off
xii. Stop

TOP-DOWN DESIGN

- Identify problem
- Research more about problem
- Analyze possible solution
- Design solution
- Develop and implement solution
- Testing
- Maintenance

A. In order for the system to work one must have a solid plan as to what the goal is and how to achieve it, the plan must be fool proofed to ensure its feasibility both financially and technology available by conducting adequate research and analysis. Once the above is completed successfully green light is given for circuit design and all flaws are removed by setting a standard and attempting to stick to it. System development kicks off right after which starts with data recording going on in the background, once it developed its tested to ascertain its performance to the previously prescribed one by checking for errors and documenting bugs if any and then implemented on the farm. After completion occasional testing and upgrade is performed in other to improve the standard of the system.