Auto Watering System For Substation Earthing Using Soil Moisture Sensors

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ABSTRACT

Earthing system for sub transmission station is actually imperative for the electric power system stability, the touch and step potential in the transmission station earthing system maintains a good grounding grid design which enable substation permissible limits, based on fibrillation discharge limit. This research is aimed at improving the earthing system in sub transmission station. The improvement was chosen carefully by taking account of the moisture of the soil with determined value. When the moisture level in soil decreased the water will be supplied using water pump until it approaches to specific moisture level. In this project work we are using AVR family microcontroller, 4 soil moisture sensors and 4 DC water pump. All sensors will be interfaced to controller and the present moisture percentage will be displayed on 16x2 LCD. As the moisture level reaches to its lower level the controller send command to start water pump using relay. After maintaining the moisture level in soil the pumps will get turn off. This process will be continue, hence the earthing system will work properly.
Keyword : - Soil Moisture Sensor, DC Water Pump, SPDT Relay, AVR Atmega328, LCD 16x2.

1. INTRODUCTION

The most important component of any power system is the earthing system, it is design and constructed to guarantee safety of persons and devices. Earthing of power generating stations, transmission substations and lines are of great importance, they are design for easy upgrade, the components of earth mat in Substation earthing system was fundamental not only to deliver the security of individuals working in the region of earthed facilities and hardware's against risk of electric shock yet additionally to keep up optimal power flow in electrical system.

In contemporary extra-high-voltage and ultra- high AC voltage, earthing is a foremost complications of system design.The error in the measurement of non-uniformity of the soil resistivity data affect other factors during simulation. The designed impedance value of the earthing system must be patterned by the restrained earthing system construction standard. Destructive soil with high dampness content, high salt substance, and high temperatures can corrupt earth poles and their links. The periodic checks of increase in earth resistance using grounding tester of more than 20% should be measured to help maintain uptime with indispensable troubleshooting tools.

The system of earthing gives a low impedance way to electric flow to pass through to the earth without surpassing the working furthest reaches of the gear. This research aimed at improving the existing earthing system for substations. Abnormal conditions can cause over voltage that may result in extensive damage of equipment or insulation failure. Achieving this research, the collection of necessary data on the existing earthing resistance values of the substation was computed.

2. LITERATURE REVIEW:

- The wellbeing of electrical cables and mechanical assembly in substations and provincial control place are the general reasons for a substation which include: Voltage change, connecting point for transmission lines, switchyard for framework development, observing point for control focus [8]. The foremost determination of power scheme substation grounding is to sustain consistent process and deliver safety for employees and apparatus throughout fault conditions [9].
- The old conventional ways of Power Transformer substation earthing were to dig a large pit and bury all the earth rods and just connect two or three leads which will be extended to all the power transformers and substation equipment [10]. The electrode grounding (Earthing) system resistance influencing factors

includes, a) The surface area of the rod with its diameter and the type rod material is a function of the electrode resistance. b) The ground rod materials and dimensions have little considerable alteration in the electrode resistance [11].

- The resistance of the soil is the key factor that determines proper installation of electrode grounding system, the low ground resistance of the rod must be driven and obtained by its depth, this imply that the soil varies with it resistivity depth and the electrolyte in the soil (the type of concentration of soluble chemical in the soil, the moisture content and soil temperature) [12].

- The Design of the Ground System Single earth terminal crashed into the ground are regularly found outside our structure while the perplexing establishing frameworks are mounted at power generation stations or transmission substations, focal workplaces, and cell tower areas which involve different ground poles, ground plates and ground circles [13].

2. HARDWARE COMPONENTS:

The main hardware components to implement the system are: soil moisture sensor, current sensor, microcontroller, DC water pump, 16x2 LCD and 12V SPDT relay. The detailed description of components used in this project work are mentioned below,

2.1 ACS712 Current Sensor

Fig -1: Soil Moisture Sensor

Soil moisture sensors measure the water content in the soil and can be used to estimate the amount of stored water in the soil horizon. Soil moisture sensors do not measure water in the soil directly. Instead, they measure changes in some other soil property that is related to water content in a predictable way. For a soil sensor to work, no matter the type, it must make contact with the soil. The highest accuracy will be obtained when the soil sensor is entirely surrounded by the soil, with no gaps between the probe and the soil. Soil moisture profiling probes measure moisture content across a vertical soil profile, typically spanning a range of 30cm to 120cm. Most usually consist of multiple single-point sensors housed within an elongated enclosure; this type of geometry allows for several points to be installed quickly and at one time

2.2 DC Water Pump

Fig -2: Mini DC Water Pump

This is a low cost, small size Submersible Pump Motor which can be operated from a 2.5 ~ 6V power supply. It can take up to 120 liters per hour with a very low current consumption of 220mA. Just connect tube pipe to the motor outlet, submerge it in water and power it. Make sure that the water level is always higher than the motor. The dry run may damage the motor due to heating and it will also produce noise.

SPECIFICATIONS:

- Operating Current : 130 ~ 220mA
- Flow Rate : 80 ~ 120 L/H
- Maximum Lift : 40 ~ 110 mm
- Continuous Working Life : 500 hours

- Driving Mode : DC, Magnetic Driving
- Material : Engineering Plastic
- Outlet Outside Diameter : 7.5 mm
- Outlet Inside Diameter : 5 mm
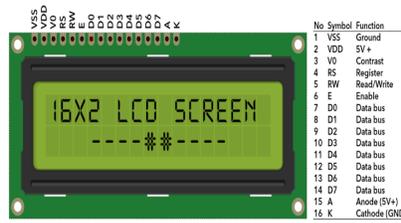
2.3 16x2 LCD

Fig -3: 16x2 LCD Display

LCD stands for Liquid Crystal Display, this screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic and is very commonly used in many devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons are: LCD is economical, easily programmable, no limitation of displaying special & even custom characters.. A 16x2 means it can display 16 characters per line and there are 2 such lines, each character is displayed in 5x7 pixel matrix. 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.
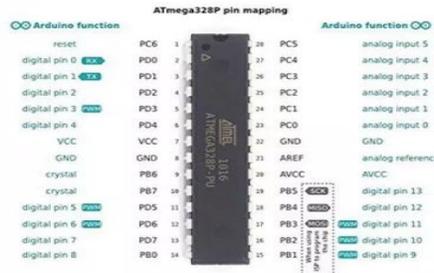
2.4 Microcontroller ATmega328

Fig -4: Microcontroller ATmega328

It is a Atmel 8-bit AVR RISC-based microcontroller with 32KB ISP flash memory and read-while-write capabilities, 1KB EEPROM, 23 general purpose I/O lines, 32 general purpose working registers, 3 flexible timer/counters with compare modes, internal, external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts.
Key parameters for ATmega328 :
Flash (KBytes):32kBytes, Pin count :28, Max. Operating Frequency (MHz): 20MHz, CPU: 8-bit AVR, Touch channels: 16, Hardware touch Acquisition: No, Max I/o pins: 22, Ext Interrupts:24, SPI: 221, TWI(12c):1, UART:1, ADC Channels:8
ADC Resolution (bits) : 10, ADC speed (kbps): 15, Analog comparator:1, DAC Resolution:0, Temperature sensor: yes, Operating voltage: 1.8 to 5.5

3. PROGRAMMING SOFTWARE DISCRIPTION (ARDUINO IDE):

Arduino IDE is open source software that is mainly used for writing and compiling the code into the Arduino Module. It is an official Arduino software, making code compilation too easy that even a common person with no prior technical knowledge can get their feet wet with the learning process. It is easily available for operating systems like MAC, Windows, Linux and runs on the Java Platform that comes with inbuilt functions and commands that play a vital role for debugging, editing and compiling the code in the environment. A range of Arduino modules available in market, each of them contains a microcontroller on the board that is actually programmed and accepts the information in the form of code. The main code, also known as a sketch, created on the IDE platform will ultimately generate a Hex File which is then transferred and uploaded in the controller on the board. The IDE environment mainly contains two basic parts: Editor and Compiler where former is used for writing the required code and later is used for compiling and uploading the code into the given Arduino Module. This environment supports both C and C++ languages.

4. BLOCK DIAGRAM AND WORKING PRINCIPLE
4.1 Block Diagram of System
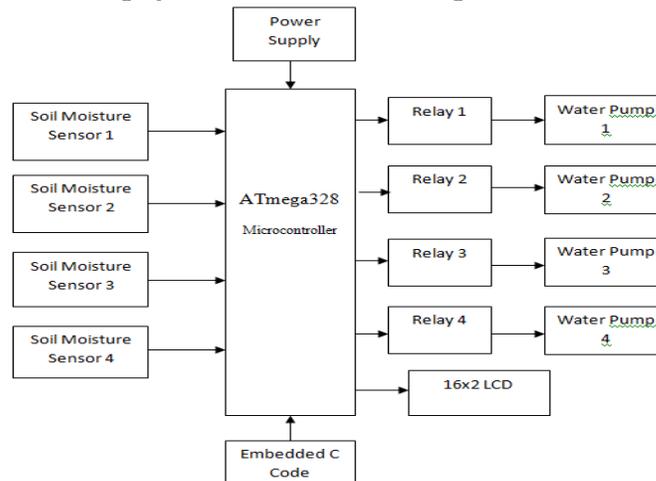The block diagram of Auto Watering System For Substation Earting is shown below,

Fig -5: Block Diagram Of System

4.2 Working Principle
The circuits connections are made as per block diagram. First the AC power applied to primary coil of step down transformer, at secondary coil we get the unregulated AC 12v. Then this 12V AC applied to bridge rectifier and filter capacitors, so we will get a pure DC output. This pure DC output given to the 7805 voltage regulator, so we will get a regulated DC 5 Voltage. 5V DC is given to the microcontroller, Soil Moisture sensor and 16x2 LCD. The 12 Volt DC is for Relay. In this system 16x2 LCD is used to monitor the percentage level of soil moisture. Whenever soil moisture level decreases the microcontroller turn ON and OFF the DC water pump until the moisture level reaches to its appropriate percentage.

7. REFERENCES

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