IJAREEIE

e-ISSN: 2278-8875
p-ISSN: 2320-3765

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

Volume 10, Issue 8, August 2021

ISSN INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.282

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering (IJAREEIE)

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.282|

|| Volume 10, Issue 8, August 2021 ||

| DOI:10.15662/IJAREEIE.2021.1008038 |

Smart Substation Using IOT

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ABSTRACT: This project presents the applications of single-phase matrix converter (SPMC) as an AC-DC controlled rectifier. For basic operation the multiple-PWM technique was used to calculate the switch duty ratio to synthesize the output. Safe commutation strategy was developed to avoid voltage spikes due to inductive load. Active current wave-shaping technique are also proposed to ensure that the supply current waveform is continuous, sinusoidal and in phase with the supply voltage. This approach utilizes boost rectifier technique for compensation. Selected experimental results are presented to verify the concept.

I. INTRODUCTION

This project is based embedded system used for monitoring the voltage, current, and temperature and oil level of a transformer by. Moreover the system displays the same on a PC or android mobile at the main station which is at a remote place. Further more it is capable of recognizing the break downs caused due to overload, high temperature, over voltage and oil level intimation of transformer by. The design generally consists of units, one in the substation unit, called as display unit, display units in the substation is where the voltage, current and temperature are monitored continuously by AVR microcontroller and is displayed through the display unit. The ultimate objective is to monitor the electrical parameters continuously and hence to guard the burning of transformer or power transformer due to the constraints such as overload, over temperature, input high voltage and double protection of CB operation. If any of these values increases beyond the limit then the entire unit is shut down by the designed controlling unit.

II. LITERATURE OF SURVEY

Problem statement

In an existing system power transformer or substation don't has an automated system to protect from the variations of voltage, current, oil level and temperature. Power transformer will fail due over temperature, fail due to low oil level and high current also affects to other devices due high voltage.

Draw back of existing system:

- No automated over voltage protection
- No automated over current protection
- No automated over temperature protection
- No low oil level intimation system
- No remote monitoring and alerting system

Proposed system

This innovative design to develop a system based on AVR micro controller that is used for monitoring the voltage, current, and temperature and oil level of a transformer by. In a substation and to protect the system from the rise in mentioned parameters. Providing the protection to the transformer can be accomplished by shutting down the CB with automated system and switching CB by.

Advantages of proposed system:

- Automates the monitoring voltage and gives intimate and shut down the transformer if voltage beyond or less than defined voltage.

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● Automates the monitoring current and gives intimate and shut down the transformer if voltage beyond or less than defined current.
● Automates the monitoring temperature and gives intimate and shut down the transformer if voltage beyond or less than defined temperature.
● Automates the monitoring the oil level and intimates if oil level is low.
● You can monitor CB by application by PC or mobile.
The Basics, Working and Pin Configuration of AVR Micro Controller studied by "The AVR Micro Controller". The programming of the Micro Controller studied by Embedded C by Mazidi.

The simulation of the circuit diagram and code done by Multisim, Live wire & PCB wizard, arduino Software tools. The basics of all circuit s like rectifier circuit, filtering circuits etc studied by the Basics of electrical book

BLOCK DIAGRAM

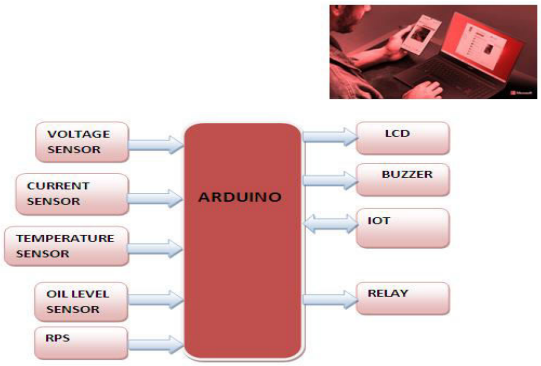

Figure 1: Block Diagram

HARDWARE REQUIREMENT

- ARDUINO Micro Controller
- Regulated Power Supply Unit
- 16x2 LCD
- Voltage sensor preset, current sensor preset
- Temperature sensor
- Oil level sensor by distance relay or by voltage sensing unit
- module
- Relay

SOFTWARE REQUIREMENT

- **ARDUINO Software tool**

Power supply is the main part of the circuit; the circuit needs the12V DC supply. But in our home 230 AC supply is available. So it has converted it to 12V DC and 5V DC by Rectifier circuit by regulator IC 7812 and 7805 respectively.

Arduino Uno
is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the icrocontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.. You can tinker with your UNO without working too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

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LCD (Liquid Crystal Display)
screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over even segments and other multi segment LEDs. The reasons being: LCDs are

Voltage Sensor

- Voltage input range : 0-25 V DC
- Voltage Detection range DC0.02445 V-25
- Voltage analog resolution : 0.00489
- Operating voltage output : 3.3V – 5V MAX 5) 100% Arduino Compatible

Current sensor
Accurate sensor to measure AC/DC current up to 20A. The sensor can even measure high AC mains current and is still isolated from the measuring part due to integrated hall sensor. The board operates on 5V

LM35
is an analog, linear temperature sensor whose output voltage varies linearly with change in temperature. LM35 is three terminal linear temperature sensor from National semiconductors. It can measure temperature from-55 degree celsius to +150 degree celsius. The voltage output of the LM35 increases 10mV per degree Celsius rise in temperature. LM35 can be operated from a 5V supply and the stand by current is less than 60uA.
Internet of Things () : is a network of physical objects or people called "things" that are embedded with software, electronics, network, and sensors that allows these objects to collect and exchange data. The goal of is to extend to internet connectivity from standard devices like computer, mobile, tablet to relatively dumb devices like a toaster.
Relays are switches that open and close circuits electromechanically or electronically. Relays control one electrical circuit by opening and closing contacts in another circuit.
The application program for the microcontroller will be written in embedded ‘Embedded C’ /Assembly and will be stored in the flash memory of the microcontroller.

Working :

- Monitors continuously voltage and gives itimate and shut down the transformer if voltage beyond or less than defined voltage. Monitors continuously current and gives intimate and shut down the transformer if voltage beyond or less than defined current.
- Monitors continuously voltage and gives intimate and shut down the transformer if voltage beyond or less than defined temperature.
- Continuously monitors the oil level and intimates if oil level is low.

You can monitor CB by application by PC or
mobile.
Steps Followed In Designing the System.

Three general steps can be followed to appropriately select the control system:

- Step # 1: Identify measurable variables important to production. It is very important to correctly identify the parameters that are going to be measured by the controller’s data acquisition interface, and how they are to be measured.
- Step # 2: Investigate the control strategies. An important element in considering a control system is the control strategy that is to be followed. The simplest strategy is to use threshold sensors that directly affect actuation of devices.
- Step # 3: Identify the software and the hardware to be used. Hardware must always follow the selection of software, with the hardware required being supported by the software selected. In addition to functional capabilities, the selection of the control hardware should include factors such as reliability, support, previous experiences with the equipment (successes and failures), and cost.

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DESIGN

Design of Rectifier Circuit

- Transformer Voltage

A transformer's required secondary A.C. voltage varies greatly with the type of rectifier chosen and filters arrangement.Use the formulas below as a guide based on the D.C. voltage you require and the rectifier/filter chosen. All A.C. voltage references are R.M.S. Don'tForget to take into account losses (not included in this guide), especially diode voltage drop. Leave an adequate safety margin for D.C. regulator voltage
Requirements and minimum operating line voltage.

- Transformer Current Ratings

A transformer's A.C. current rating needs to be recalculated from the D.C. load current. The required currentVaries with type of rectifier chosen and filter type. Use the formulas below as a guide, shown for common D.C. supplies. Included in the formulasHigher peak to peak capacitor charging current in the filter.

- Rectifier Selection Notes

When selecting rectifiers remember, average current in a full wave circuit is .5 x I D.C. per diode. In a half wave
Circuit, average current is equal to I D.C. per diode. A rating at least twice the output current is recommended to cover turn on surge. In full wave
Circuits, the reverse voltage rating should be in excess of 1.4 x V A.C. In half wave circuits, the reverse voltage rating should be in excess of
2.8 X V A.C.

- Capacitor Selection Notes

When choosing capacitor voltage, allowances should be made for D.C. voltage rise due to transformer regulation. Remember, R.M.S. ripple current in a filter capacitor can be 2 to 3 timesD.C. load current. Capacitor life is greatly increased by reducing its temperature via less R.M.S. current or reduced ambient temperature.

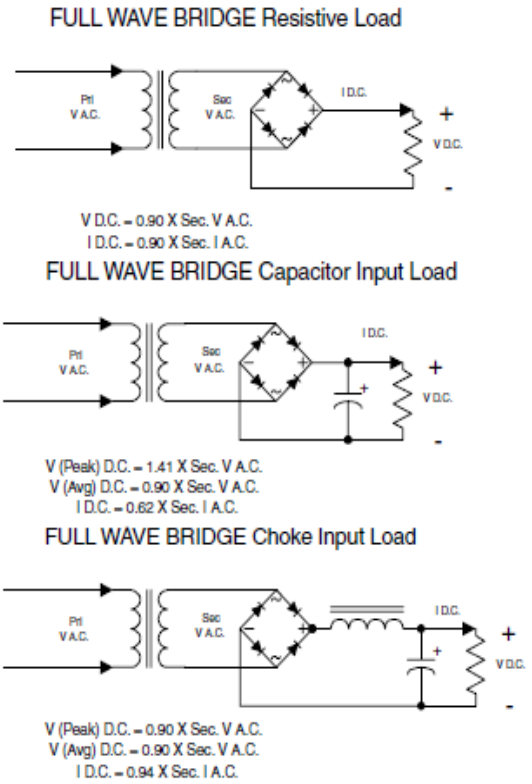

Figure 2: Full Wave Bridge

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- Criteria for Choosing a Microcontroller

The basic criteria for choosing a microcontroller suitable for the application are

1) The first and foremost criterion is that it must meet the task at hand efficiently and cost effectively. In analyzing the needs of a microcontroller-based project, it is seen whether an 8- bit, 16-bit or 32-bit microcontroller can best handle the computing needs of the task most effectively. Among the other considerations in this category are:

Speed: The highest speed that the microcontroller supports.

Packaging: It may be a 40-pin DIP (dual inline package) or a QFP (quad flat package), or some other packaging format. This is important in terms of space, assembling, and prototyping the end product.

This is especially critical for battery-powered products.

The number of I/O pins and the timer on the chip.

How easy it is to upgrade to higher –performance or lower consumption versions.

Cost per unit: This is important in terms of the final cost of the product in which a microcontroller is used.

1) The second criterion in choosing a microcontroller is how easy it is to develop products around it. Key considerations include the availability of an assembler, debugger, compiler, technical support.
2) The third criterion in choosing a microcontroller is its ready availability in needed quantities both now and in the future. Currently of the leading 8-bitmicrocontrollers, the 8051 family has the largest number of diversified suppliers. By supplier is meant a producer besides the originator of the microcontroller. In the case of the 8051, this has originated by Intel several companies also currently producing the8051.Thus the microcontroller AT89S52, satisfying the criterion necessary for the proposed application is chosen for the task

APPLICATION AND FEATURES

- Monitors continuously voltage and gives intimate and shut down the transformer if voltage beyond or less than defined voltage.
- Monitors continuously current and gives intimate and shut down the transformer if voltage beyond or less than defined current.
- Monitors continuously voltage and gives intimate and shut down the transformer if voltage beyond or less than defined temperature.
- You can know the present parameters of station you can get it whenever you by texting an SMS.
- Each and every parameter like voltage, current, temperature displays on LCD.
- Each and every parameter like voltage, current, temperature displays & oil level on LCD.

Working Model

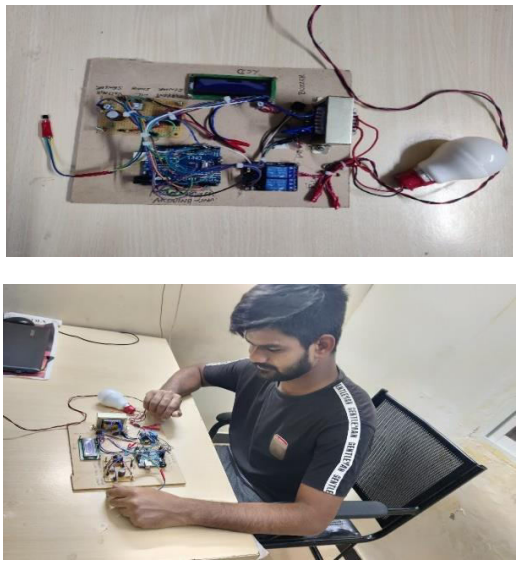

Figure 4: Working Model

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III. CONCLUSION

Our project microcontroller based substation monitoring and control system with module . But in future we can also add modem is mainly intended to operate the devices like fans, lights, motors etc.., through a based mobile phone.

The system has a iot modem, temperature, current, voltage sensors and the devices tobe operated through the switches like relaywhich are interfaced to the micro controller.

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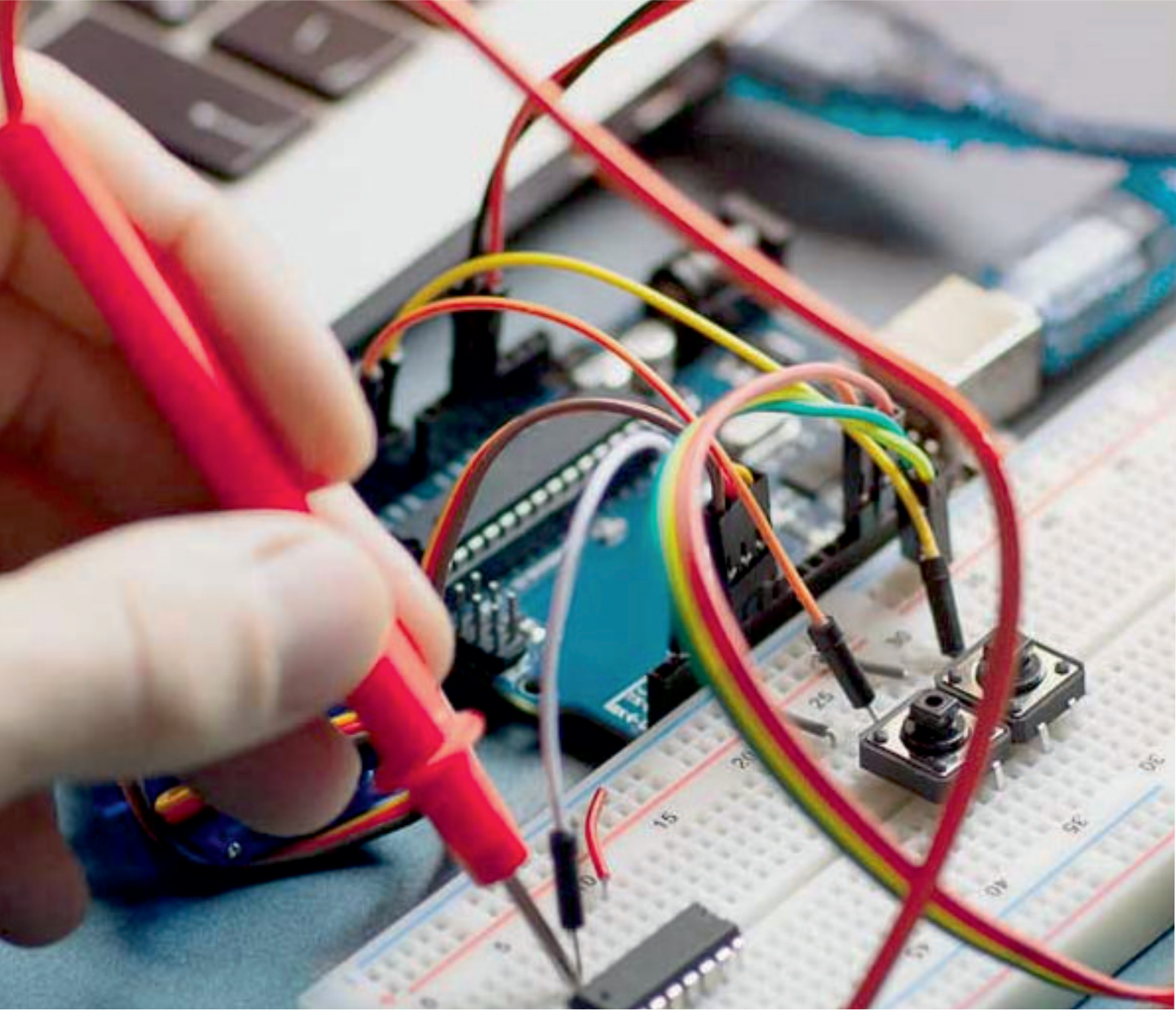

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Impact Factor: 7.282

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