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Substation Monitoring and Control Using GSM

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Abstract: A mobile embedded system is implemented in this project to observe the quality of load current, frequency, voltage and temperature of a power substation. Integration of a microcontroller, different sensors and global service mobile (GSM) modem is installed at the transformer site and above key parameters are observed. With the help of analog to digital converter parameters are processed and stored in system memory. Any disastrous failure occurs the system sends a SMS to the mobile phone according to predefined values given by microcontroller. Hence helps in smooth functioning of power substation Through this project, it can be determined whether the load shedding is happening, how the output power will be turned off when the voltage is high, and if the frequency is low, then the output load will stop.

We have designed a project through this project we will be able to determine the voltage current and frequency very easily and by measuringthrough these units we will learn how load shedding or high voltage is determined considering these aspects depending on these units we have a project Designed if ever the voltage becomes high the output will power off if beyond a certain amperage if more ampere load is taken then the output will power off if the frequency is decreasing still the output power will be off. It has been made so that anyone can make it and use it. Special attention has also been paid to ensure that no project is bought from abroad and brought to this country or any machine brought from abroad is not used in this country. Another thing to note is that the authorities will get an instant SMS througha GSM model with variation of the output and will know when a system has been turned off or on.

Keywords: Arduino, Real time monitor,voltage controller, GSM.

I. INTRODUCTION

One of the most convenient and practical forms of energy is electricity. It is becoming more and more important in our contemporary industrialized world. The electrical power systems are highly non- linear, extremely huge and complex networks. Such electric power systems are unified for economic benefits, increased reliability and operational advantages.

These electric power systems are integrated for improved operating efficiency, enhanced dependability, and financial gains. They are among the most important components of the global and national infrastructure, and their failure has a considerable negative influence on both the national security and the economy, both directly and indirectly. Today electricity still suffers from power outages and blackouts due to the lack of automated analysis and poor visibility of the utility over the grid.

Substation monitoring and control using GSM (Global System for Mobile Communications) refers to the integration of GSM technology in the management and operation of electrical substations. Electrical substations play a crucial role in the distribution and transmission of electrical power. Monitoring and controlling these substations are essential for ensuring the reliability, efficiency, and safety of the power grid. The incorporation of GSM technology enhances the capabilities of substation monitoring and control by providing real-time Monitoring

OBJECTIVE OF PAPER

- Remote controlling
- Real time monitoring
- Maintain Continuous power supply
- Auto cutoff power

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BLOCK DIAGRAM

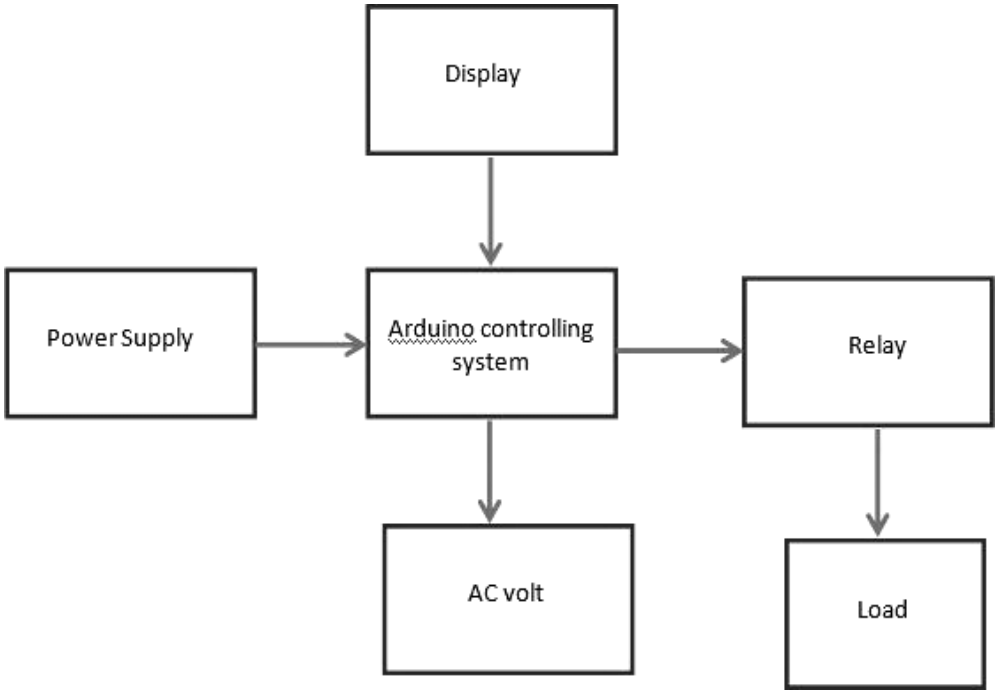

Fig-1: Block Diagram

II. CIRCUIT DIAGRAM

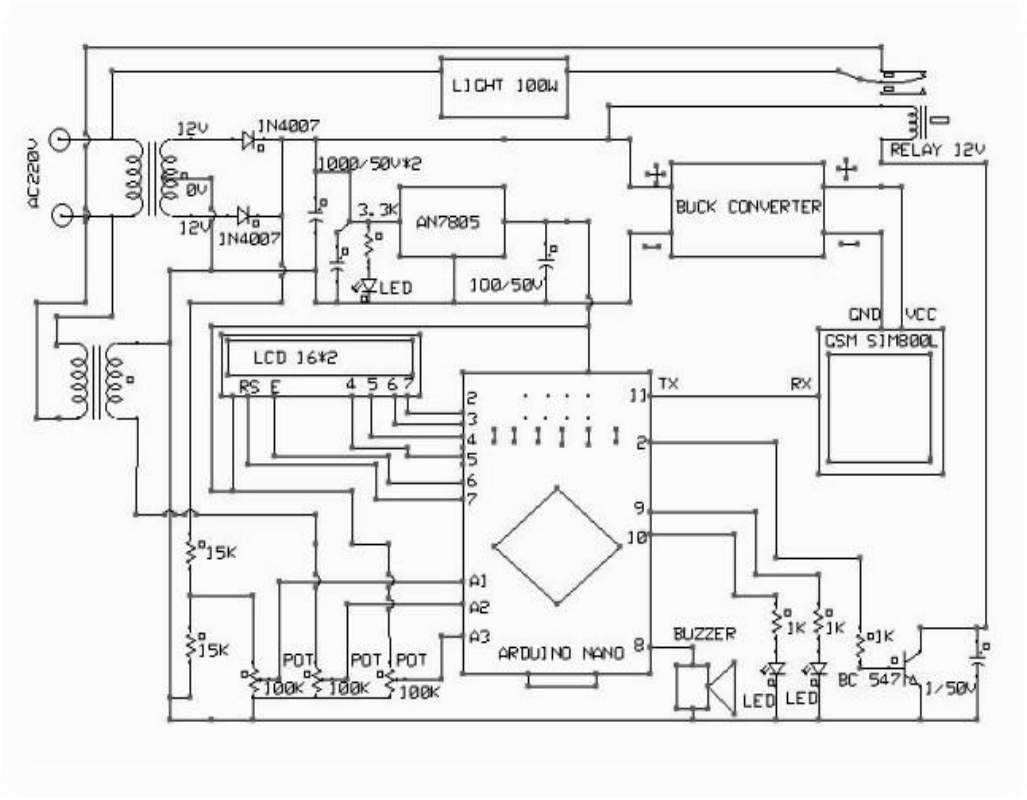

Fig-2: Circuit Diagram

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III. HARDWARE IMPLEMENTATION

3.1 CURRENT SENSOR

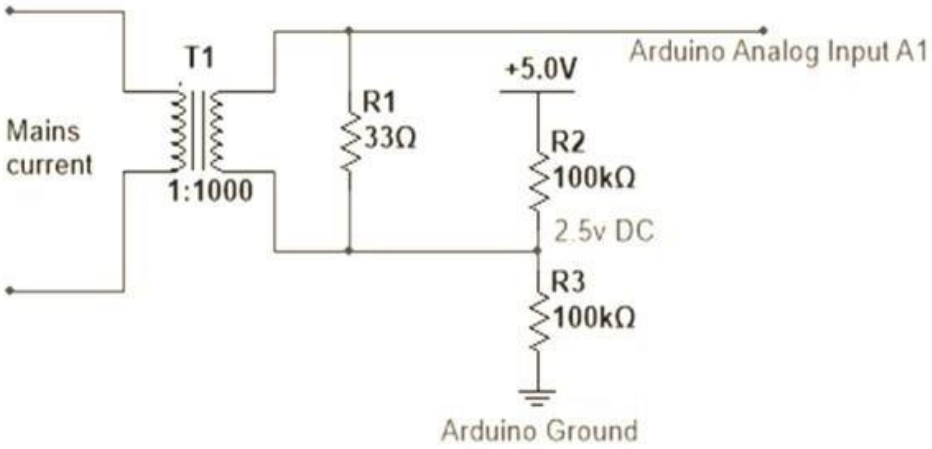

Fig-3: Current sensor

A current sensor is a device that measuresthe flow of electric current in a circuit. It typically works by detecting the magneticfield generated by the current and converting it into a measurable signal, which can be used to monitor ,control or protect electrical systems.

3.2 VOLTAGE SENSOR

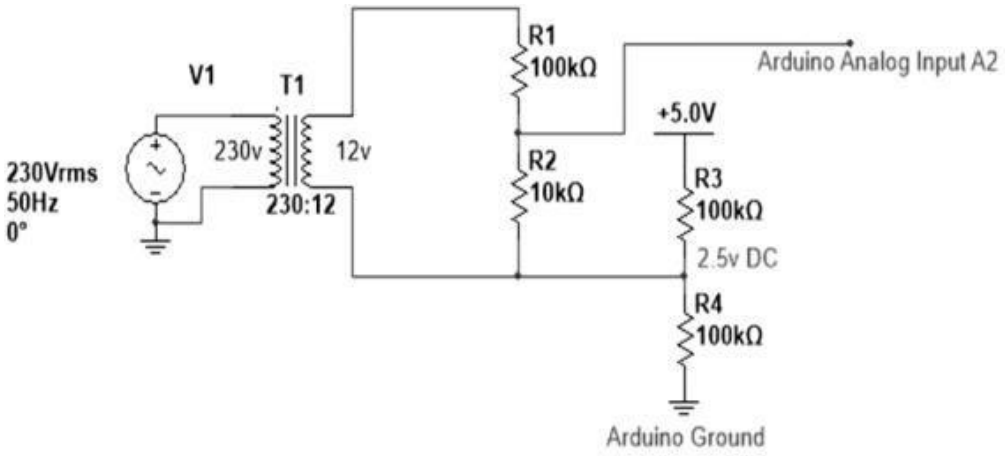

Fig-4: Voltage Sensor

An AC voltage sensor is a device used to measure AC voltage in electrical circuits.Itdetects and measures the amplitude ,frequency and phase of a AC voltage signals,typically converting them into a form that can be interpreted by other devices or systems,such as digital display or control systems.It commonly used in power monitoring ,industrial automation and electronic instrumentation.

3.3 GSM

In a substation control and monitoring project, GSM modules are used to establish communication between the substation and the control center .They enable the transmission of data collection from sensors and devices in the substation to the control center for real time monitoring.GSMSupports different frequency bands, such as 850 MHz, 900 MHz, and 1900 MHz, The module typically consist of a modem chip, a SIM card slot,and various interface for connecting with other devices.

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3.4 ARDUINO NANO

Depending on the version, the ATmega328or ATmega168 chip serves as thefoundation for the compact and adaptable Arduino Nano microcontroller board. Witha smaller physical factor than the Arduino Uno, it is comparable and perfect for projects with limited space. The Nano features several input/output pins for attaching sensors, actuators, and other parts, as well as a USB port for programming and computer connectivity.

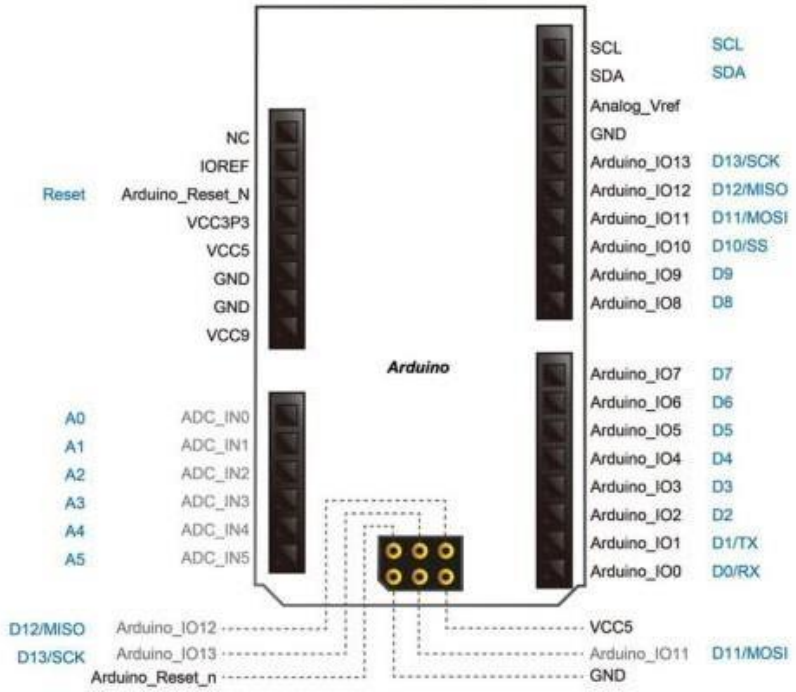

Fig-5: Pin Diagram Arduino Nano

3.5 RADIO MODULE

For wireless communication, a radio module is a small electrical device that combines the capabilities of a transmitter and a receiver. Common uses for it includeremote control systems, wireless sensors, Internet of Things (IoT) devices, and wireless data transmission, among other applications that demand wireless communication capabilities.

3.6 TRANSISTOR

An essential electronic component for amplifying and switching electrical power and signals is the transistor. It is composedof semiconductor material, such as silicon or germanium, and has three terminals: a base, a collector, and an emitter.

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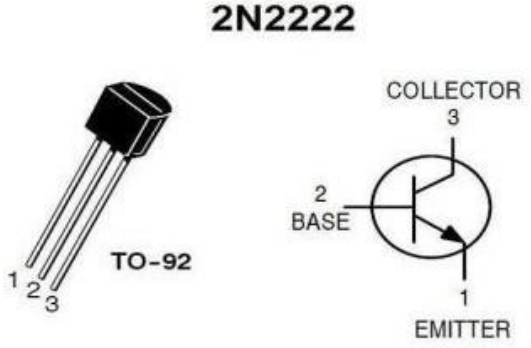

Fig-6: Transistor

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3.7 LCD 16x2 display

An LCD 16x2 display is a common type ofalphanumeric display that consists of 16 columns and 2 rows. Each column can display a single character, and there are a total of 32 characters that can be displayedat a time.

3.8 RELAY

Relays are electromechanical devices used in circuits to regulate the flow of electrical current. A coil and one or more sets of contacts make up its components. The coil creates a magnetic field that attracts and releases the contacts as electricity passes through it, opening and closing the circuit

3.9 TRANSFORMER

Transformer is one of the main equipment in this substation monitoring and control system. We use I/P 220V,50Hz AC to O/P 12V,600mA step down transformer as a demo and actually a three-phase step downtransformer will be use in real life setup of this substation monitoring and controlsystem.

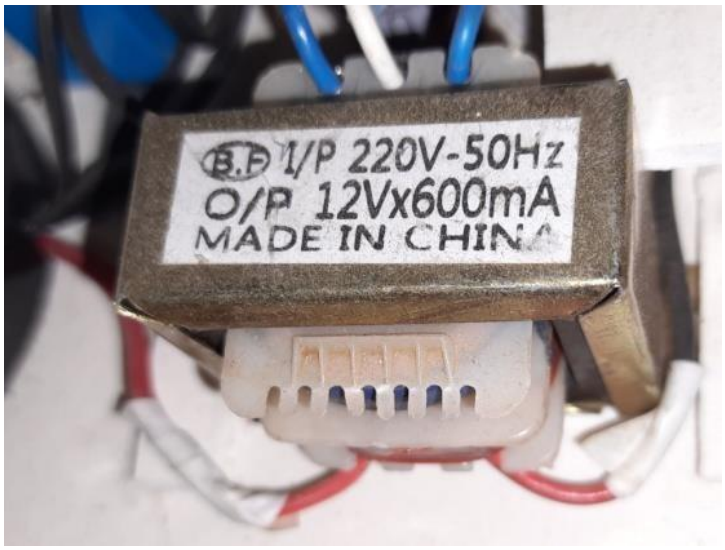

Fig- 7: Transformer

3.10 BRIDGE RECTIFIER

A bridge rectifier circuit is a system that can convert the Alternating current (AC) into Direct current (DC).In our project we also need Direct current (DC) to operate the Arduino nano microcontroller. We need transformer, capacitor, diode and resistor to build a rectifier circuit.

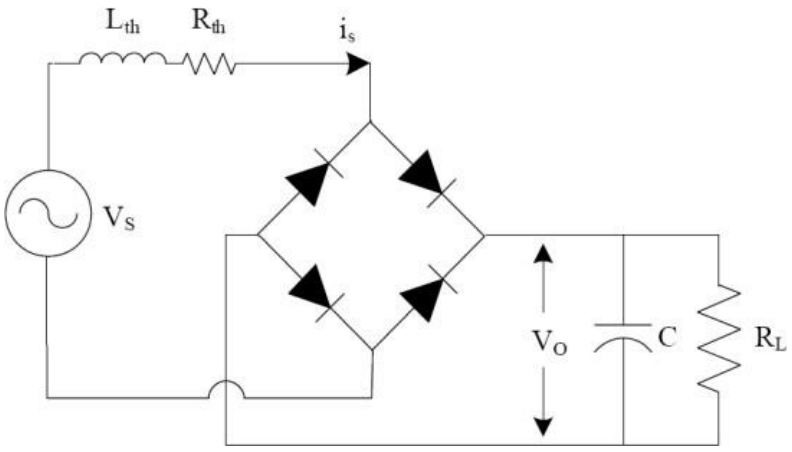

Fig- 8: Bridge Rectifier

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IV. SOFTWARE IMPLEMENTATION

In this project Arduino nano is used as a microcontroller that control the overall system by electrical signal. It containsATmega328 microcontroller based on 8-bit that means it processes data andinstructions in 8-bit chunks at a time.

We upload the written program or sketch bythe help of Arduino IDE software and ourArduino nano is ready and compatible foruse in this project.

V. WORKING PROCEDURE

Temperature, voltage, and current are the parameters that we need to measure. The microcontroller, which is the main component, is coupled to the sensors that measure temperature, voltage, and current. The substation that we are in charge ofoverseeing and monitoring is the local station.

The relay, RF transceiver, The micro controller has loads connectedto it as well. Temperature, voltage, current,relay, and load sensors are connected to the microcontroller's input pins in a substation circuit.

The microcontroller's output pin is linked to an RF transceiver. The transceiver uses a microcontroller to receive the corresponding data when the specified points for temperature, voltage, and current are exceeded. The current is turned off using the relay.

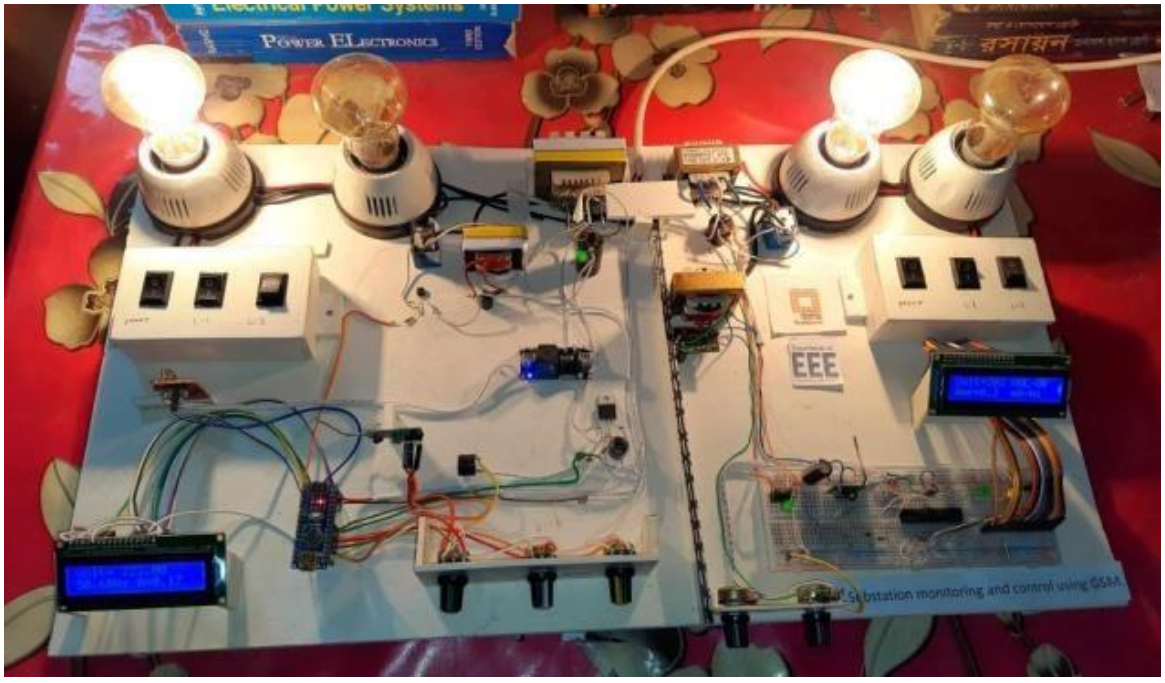

Fig-9: Complete Setup

VI. RESULT

A GSM-based substation monitoring system can offer real-time tracking of vitalparameters, permitting early detection of faults or abnormalities.

This can result in progressed reliability of the electric grid through permitting operators to take proactive measures to save you outages or system failures.

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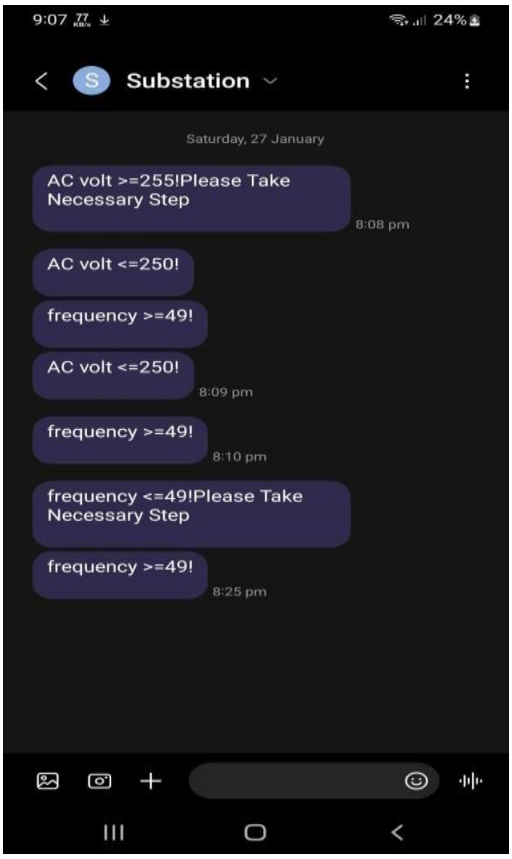

Fig-10: Real Time Update By GSM

With inaccessible observing capabilities empowered by GSM network, administrators can rapidly recognize and react to issues without requiring to physically visit the substation.

This could result in quicker reaction times tooccurrences, minimizing downtime and decreasing the effect on clients.

VII. CONCLUSION

Generally, the effective usage of a substation checking framework utilizing GSM can lead to a more effective, solid, and secure electrical framework, eventually profiting both utilities and end- users.

VIII. ACKNOWLEDGEMENT

It is a great and joyful moment for me to present this paper. I worked for this projectand research about this project. It is must to say that it will not be easy or even impossible without the help of my teammate and our honorable teacher and supervisor **Nasrullah Masud** sir. Thanks to all of them for their contribution.

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