

A Simulink based System to Monitor Parameters of Transformer

Shashank Shekhar Somvanshi, DR. Deependra Pandey

Department of Electronics and Communication, Amity University, Lucknow Campus (UP), India

Department of Electronics and Communication, Amity University, Lucknow Campus (UP), India

ABSTRACT: In power systems, distribution transformer is electrical equipment which distributes power to the low-voltage users directly. Its operation condition is an important component of the entire distribution network operation. An embedded system is used to monitor and regulate different parameters which directly affect transformer. Various sensors are used to monitor the temperature, coil voltage, coil current and oil level. According to the interpretation of the sensors, microcontroller controls various devices so that a constant operating condition can be maintained. The complete project is aimed to implement a low, cost easy to use Simulink based system design. Simulink is an extension of MATLAB and uses drag and drop approach. **Keywords:** Transformer, embedded system, Simulink, sensors.

I. INTRODUCTION

In India, overloading and overheating are the main cause of transformer failure. During summer transformer failure rate increase. This paper deals with the monitoring system that protect transformer from the failure.

Magnetic core is the main component of any transformer or electric motor and is made by magnetic material with a high magnetic permeability. Magnetic core with copper binding makes the coil of a transformer. In the following section, we provide a basic idea to increase the life of a transformer by reducing the failure rate, caused by overload, over temperature and low oil level.

The reliability of transformer units and extending their life depend greatly on the degree of monitoring of their functional parameters with a view to determining the proper predictive maintenance measures, according to their interpretation^[3].

I. Block Diagram of System

The block diagram shows basic idea of the hardware implementation.

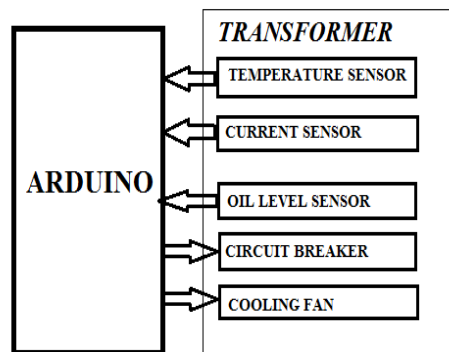


Fig.1: Block diagram of the hardware.

Arduino is an open source hardware and software which is used to make small projects. The Arduino board is made by various atmega microcontrollers. It is an embedded system which is widely used in system design and projects.

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In this project, Arduino controls, all subsystem and sensors. Sensors are used to estimate the condition of a transformer by measuring three main parameters (ie. Temperature, Current and Oil Level) according to the sensors' reading, circuit breaker and cooling fan are controlled.

Arduino Uno, there are 6 analog pins which takes analog input and convert it in to digital data. It gives the freedom to interface 6 sensors simultaneously.

II. FLOW CHART AND SOFTWARE REQUIREMENT

MATLAB is a high-performance language. It combines computation, visualization, and programming at one platform. Generally, MATLAB is used for Math and computation, algorithm development So, that it is very convenient to use MATLAB for large as well as for small projects. MATLAB provides drag and drop approach in the form of Simulink, an extension of MATLAB which various blocks for a function.

There is a flexibility to use blokes as either we can use pre-defined block or we can make a new block using "user defined blocks" in Simulink.

We use Simulink here as it is easy to use and provides hassle-free debugging. We can merge MATLAB and Simulink by using user define block.

A user can make its own block which gives more flexibility in the system design. In this project, we use MATLAB function block. This block compares two input and gives an output(0 or 1).

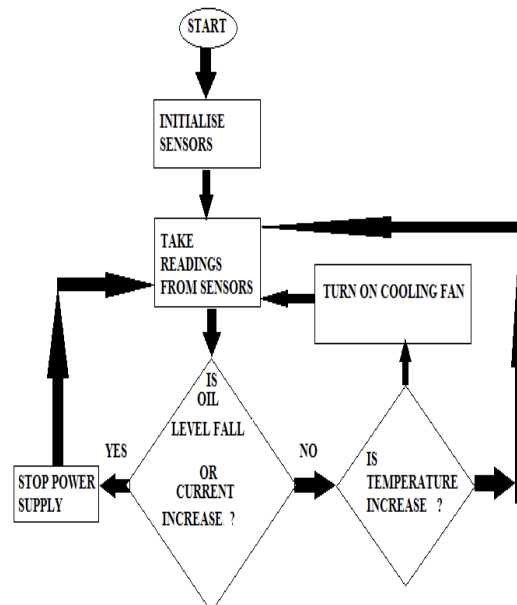


Fig.2: Flow chart of program

III. HARDWARE IMPLEMENTATION

Arduino/Genuino 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 quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller [5].

Temperature sensor is a device that converts heat in to an electric signal. The LM35 is a precision integrated-circuit who's output voltage linearly-proportional to the Centigrade temperature. It is Calibrated Directly in Celsius with 0.50 Celsius ensured accuracy (at 250 C). The LM35 can measure temperature from -55⁰ C to 150⁰ C with Linear + 10-mV/°C Scale Factor.

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The Allegro ACS712 is a current sensing module which provides economical and precise solutions for AC or DC current sensing. It can be used in industrial, commercial, and communications systems. The device package allows for easy interfacing with any microcontroller. Typically, it can be used in motor control, load detection and management, switch mode power supplies, and overcurrent fault protection. The device consists of a precise, low-offset, linear Hall circuit with a copper conduction path located near the surface of the die. Applied current flowing through this copper conduction path generates a magnetic field which the Hall IC converts into a proportional voltage^[6]. A liquid level sensor is used to detect the oil level with in the transformer.

IV. RESULTS

We have been succeeded to make a cost effective and effective system to monitor the parameter of transformer. The Simulink window is given below.

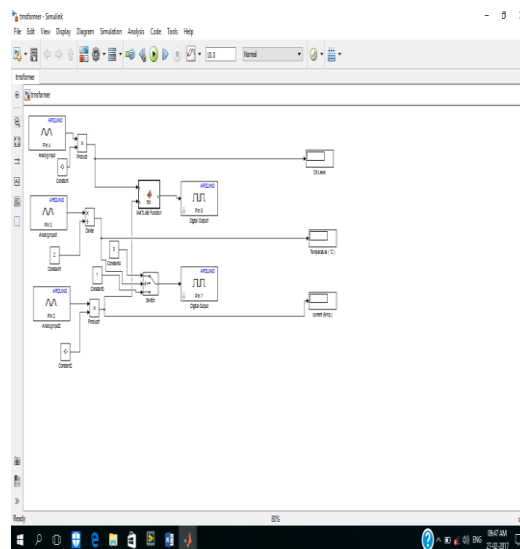


Fig.3: Simulink output

The above system provides a hassle-free operation. An operator can easily understand readings of the sensors and make a change in the operating conditions. Operator can also add and delete any block according to the system to ensure efficient use of the system.

V. FUTURE SCOPE

Transformers are the key component of a power transition system. There is a bright future for the devices or the system which are made to protect transformer.

In every decade transformers became more strong and durable but still there is a place for such device which protect these expensive machines. Time to time people introduce various monitoring system. Some systems cost more but cannot be used with single system. Some are less expensive but they cannot be used in more than one or two Transformers.

In the future, we shall make a data base so that it is easy to trace the performance and fault in any transformer. This data base will help to upgrade the transformer so that failure can be reduced. An online system is required to remotely access the transformer.

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VI. CONCLUSION

The environment conditions specific to substations (high electromagnetic fields especially for load switching on and switching off, voltage levels, a multitude of protection, signalling, control and measuring equipment and circuits), are the enemy of any transformer. These cannot be eliminated but we can control some condition. This project does not provide the overall solution for transformer failure but it can control some major parameter so that it can be a good solution for transformer failure.

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