Design Monitoring of Distribution Transformer Load by Messenger Based on Microcontroller Atmega 128

Firman Yudianto

Sistem Informasi, Fakultas Teknik, Universitas Nahdlatul Ulama Surabaya
Surabaya, Indonesia
firmanyudianto7@gmail.com

Abstract— **In order the distribution process of electricity to customers run properly, the distribution transformer should be noticed. But there are some obstacles such as the amount of the transformer is not proportional to the number of officers and the location of transformers are scattered in various places. These problem make officer hard to measure development of peak loads on old customers and new customers. Currently the growth of the transformer load is still not monitored properly. Therefore electric company need technology that is able to monitor transformer load. This research produces a tool that enables officers easier to monitor distribution transformers load in real time and throughout 24 hours. The output is visual data in the form of indicator lights that facilitate monitoring transformer load and data will sent periodically to the office server. If transformer is overload, tool will send warning message to officer so officer can take safety action in short time and can decreasing the risk of fire due to damage of transformer.**

Keywords— *Distribution transformer; overload of transformer load;, microcontroller atmega 128; Visual Basic 6.0;*

I. INTRODUCTION

System distribution transformers and Maintenance of distribution transformer is an important things to do so transformer can operate optimally. Maintenance can be done by monitoring the load of transformer. Measurement of distribution transformer peak load conducted at noon (office and market load) and night (housing load). But to measure load (at peak hours), officer get trouble. This is due to the amount of transformer is not proportional with number of office and location of transformers are scattered in various place.

Unbalance condition of transformer load is one of warning to officer to make action about transfer of transformer load. It must be done as soon as possible. If not, transformer can be at risk and transformer can be overload. Additionally unbalance of transformer load can cause neutral current losses.

The expected benefit and purpose of measuring distribution transformer load is officer can know development of transformer load so if abnormal thing happens, officer can take action immediately. If there is an overload and unbalance load on the distribution transformer that pupose to monitoring the load of the transformer. Therefore, to help some problem, officer need special equipment that can make officer easier in monitoring transfomer. Maintenance should be undertaken to prevent equipment damage suddenly and to maintain equipment performance in long time so it can increase image of PLN service in society.

II. MATERIAL AND METHODS

Material is used in this paper is transformer and microcontroller atmega 128. Transformer is an electrical equipment to distribution electric power from high voltage to low voltage or vice versa in same frequency. Transformer is also a major utility in the distribution substation and when installation is equipped with protector to protect it from influence from outside system or within system itself. The greater capacity of transformer, protector must be more complete and maintenance must be done in routine. The distribution transformer is a power transformer that has function to decrease voltage like from medium voltage of 20 KV (output voltage from substation transformer) to low voltage of 380 V to distribute load. Tansformer physically is shown in Figure 1.
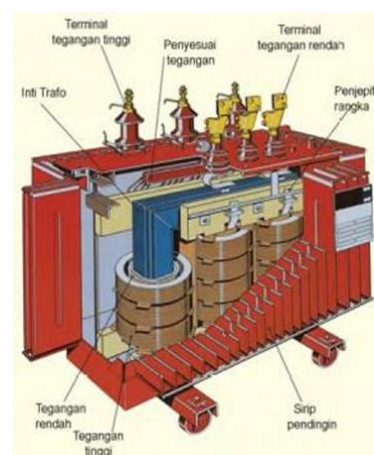

Figure 1. Transformer with three phase physically

Microcontroller Atmega is one of vendor who develop and market microcontroller products to become a standard technology for designers of electronic system. In some late years, Electronic designer design and develop AVR (Alf and Vegard's Risc Processor) generation that provide advanced

capabilities and economical cost. Microcontroller AVR has an 8 bit RISC architecture that all instruction is in 16 bit code (16 bists word) and most instruction can be executed in 12 clock cycles. RISC (Reduce Instruction Set Computing) is divided into 4 classes such as ATtiny family, AT90Sxx family, ATMega family and AT86RFxx family. The different between each class are memory, peripheral and its function but their architecture and instruction is almost same. Configuration pin of ATMega 128 is shown in Figure 2.
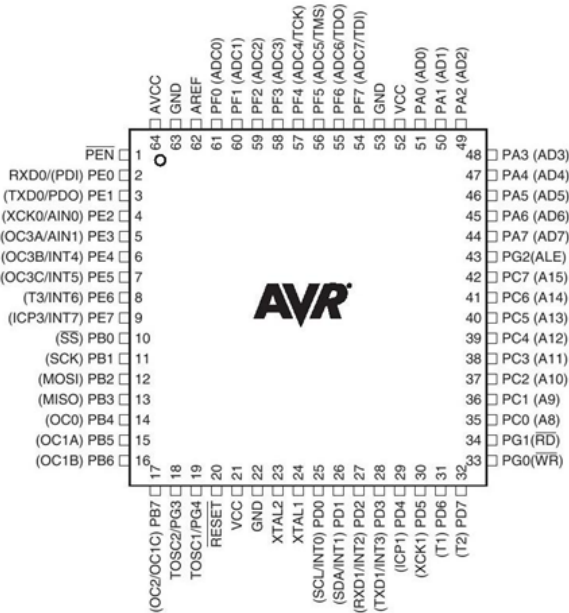

Figure 2. Configuration pin of ATMega 128

The paper is organized as follows. Section 2 gives information about material and methods. Results will be provided in Section 3 and finally Section 4 provides conclusion of this paper.

III. EXPERIMENTS AND ANALYS

Monitoring transformer load need some preparation both software and also hardware. Because this hardware is related to reading some sensor like current sensor, voltage sensor, zero cross detector sensor and sending messenger if there is overload and unbalance of transformer load. Messenger can be requested if officer want to know load in balance condition. Generally, the results are not accurate data but just an estimation so often there is error caused by software or hardware mistake. Design hardware system is used in this paper is shown in Figure 3.
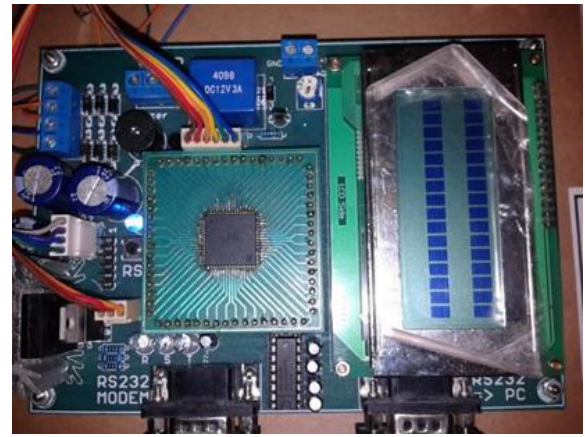

Figure 3. Design hardware system

Based on Figure 3, Design hardware system is consist of IC ATMega 128, LCD 16x4, Relay DC 12V 3A, Port RS232 for modem, Port RS232 to PC, Led (green, yellow and red). Its part has function like IC ATMega128 to process data from hardware sensor to hardware minsis (minimum system), LCD 16x4 to display data current, voltage, cos phi and power that is processed by minsis (minimum system), Relay DC 12V 3A is used to move contactor aiming fot turning off transformer load when there is unbalace load and overload, Port RS232 for modem is used to sender message to messenger, Port RS232 to PC to display visual interface so it can be monitored, Led with three colors are green, yellow, red as an indicator while transformer is in balance condition, unbalance and overload.

In this experiments, reading some parameter like current, voltage, cos phi can run well and show three phases have more load value, with same load per phase R in 200 watt, S loaded in 200 watt, T loaded in 200 watt. With overload condition can make transformer in dangerous state. Value of current, voltage, cos phi, power when transformer is overload is shown in Figure 4.

Figure 4. Value of current, voltage, cos phi, power when transformer is overload
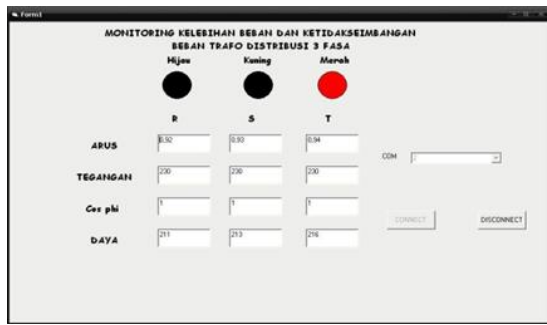
Figure 5. Visual interface when transformer is overload

In Figure 5 shows data from current sensor, voltage, cos phi and power through visual interface with red of led is on. In this condition can take conclusion if transformer is in overload condition so microcontroller will process report and send message by modem like in Figure 6. After then, a delay of 10 seconds contactor will work by turning off the auto transformer and load automatilly so transformer in safe mode.

Figure 6. Message that show value of current, voltage, cos phi and power of transformer

IV. CONCLUSION

We have presented a method to make officer know in short time about condition of transformer load. Transformer load is divided i n three categories are balance condition, unbalance condition and overload. When transformer is unbalance condition or overload, officer will get message from modem about value of current, voltage, cos phi and power. So with immindiately action from office, transformer will not burned by fire and will be in safe mode. Microcontroller atmega 128 is tool for monitoring ot transformer distribution PLN.

References

[1] Standart PT.PLN (persero), SPLN D3.002-2:2008, Spesifikasi Transformator Distribusi, Jakarta.

[2] Julius Sentosa Setiadji, dkk. 2012. Pengaruh Ketidakseimbangan Beban terhadap Arus Netral dan Losses pada Trafo Distribusi, Tugas Akhir Teknik Elektro Universitas Kristen Petra, Surabaya.

[3] Guru Elektronika. 2015. Modul Elektronika Digital Fungsi Logika Gerbang Dasar, Sekolah Menengah Kejuruan Program Keahlian Teknik Elektronika., Erlangga, Surabaya.

[4] Andrianto Heri. 2015. Pemograman Mikrokontroller AVR Atmega128, Informatika, Bandung

[5] S.V. Kulkarni, S.A. Khaparde. 2016. Transformer Engineering:Design, Technology, and Diagnotics, Second Edition, New York, USA.

[6] J.P. van bolhuis, E. Gulski, J.J. Smit. 2010. Monitoring and diagnostic of Transformer solid insulation. IEEE Transaction on Power Delivery 17-2.