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Prototype of distribution transformer load reliability system based using visual basic interface

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Prototype of distribution transformer load reliability system based using visual basic interface

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Keywords— *transformer load, electrical power load, visual basic interface*

Abstract— *Developing the operation and maintenance of distribution transformers is one of the services in keeping and maintaining the process of electricity distribution to customers run well. Services to meet the demand for electrical stability require improvement in determining transformer trouble points not proportional to the number of State Electricity Company officers available dealing with the measurement of the transformer peak load that keeps changing due to the large number of new customers or those adding electrical power load. The development of the constantly increased electrical power load cannot be monitored properly anymore, and there is not yet appropriate technology applied for monitoring it. Therefore a new device is required so as to function facilitating officers in the distribution transformer load monitoring across various places in real time 24 hours, and the data can also be retrieved in real time as desired. The output of this device is in the form of visual data. If the transformer is overloaded, it can be designed using a visual basic interface, and in the system there is a microcontroller able to provide information for the officers quickly, to reduce investment in purchasing new transformers.*

I. INTRODUCTION

Performing distribution transformer maintenance is an important task to keep the optimal operation of the transformers. One way to do so is by monitoring the transformer load. The measurements of the peak load of the distribution transformers are carried out during the day (office and market loads) and during the night (housing loads). To be able to measure the maximum load (at peak load hours) the officers commonly have difficulty due to the large number of transformers not proportional to that of the officers available. As well as that the posts of the transformers scattered in various locations can be an obstacle for officers to measure the load on time.[1]

The condition of the unbalanced transformer load is a warning for the officers to immediately take actions to make it balanced or move the transformer load, otherwise

damage occurs. As the transformer gets loaded unbalanced, one of the transformer phases gets loaded more than the other. As the load increases, it increases the risk of the phase becoming overloaded. Besides, the unbalanced transformer loading causes neutral current losses.[1]

The expected benefit of measuring the load of the distribution transformer is that the officers are able to see the progress of the transformer load so as to take an effective action as soon as possible in the event that things get abnormal. Thus, to help overcome such problems, a special equipment is required to make it easier for the state electricity company officers to monitor the transformer properly. Maintenance measures are necessarily taken to prevent any possible sudden equipment breakdowns and to maintain the maximum possible performance of it, in

accordance with the technician age. This can keep the positive image of PLN's services.[2]

II. LITERATURE REVIEW

2.1 Distribution Transformer

Transformer is an electrical equipment functioning to distribute electrical power from high to low voltage or vice versa with the same frequency. It is also the main utility at the distribution substation, so in its installation it is equipped with safeguards to protect influences from outside the system and from within the system itself. The larger the transformer capacity, generally the more complete safety system, the more complete maintenance within the shorter period of time. The distribution transformer is a power transformer having a smaller power capacity than a substation transformer and is used to lower the voltage from a medium voltage of 20 kV (the output voltage of the substation transformer) to a low voltage (380 V) for further distribution to the load.[3]

The working principle of a transformer is as shown in Figure 1. When the primary coil is connected to an alternating voltage source, changes in the electric current in the primary coil cause a changing magnetic field. The changing magnetic field is amplified by the presence of an iron core and the iron core is delivered to the secondary coil, so that at the ends of the secondary coil causes an induced emf (electromotive force).[4]

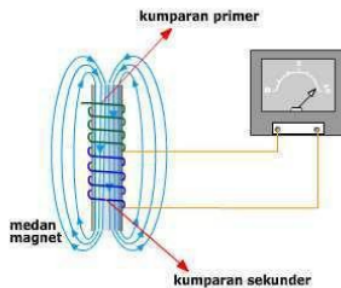


Fig.1. Primary and Secondary Coils of a Transformer against a Magnetic Field

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. Figure 3 are:

(a) shows a vector flow diagram in a balanced state. Here it can be seen that the sum of the three current vectors (I_R , I_S , I_T) is equal to zero so that there is no neutral current (I_N). While in Figure 3

(b) shows a vector diagram of unbalanced currents. Here it can be seen that the sum of the three current vectors (I_R , I_S , I_T) is not equal to zero so that a magnitude appears, namely the neutral current (I_N) whose magnitude depends on how big the imbalance factor is.

Alternating current source when the applied load is purely resistive which has a $\cos \phi$ value of 1. then the voltage and current waves are in phase. The flow of alternating current is caused by an alternating voltage with the same frequency. If the current and voltage pass through zero and rise to their highest value in the same direction at all times, the current is said to be in phase with the voltage. But in some types of circuits the zero and highest values of current and voltage do not occur at the same time. If this happens, the current is said to be out of phase with the voltage. The current and voltage may be in phase as shown in Figure 2.[3]

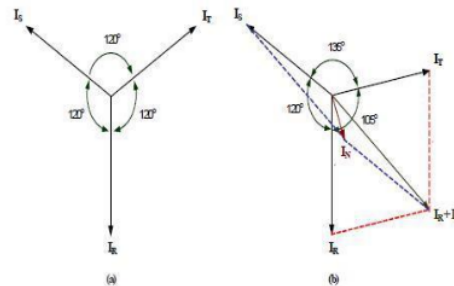


Fig.2. Diagram Vector Current

2.2 Interface Visual Basic (IVB)

VBI, Visual Basic 6.0 Interface, and its parts discussed includem : ●Toolbox ●Properties ●Project ●Explorer ●Form ●Code Editor ●Event ● Project Management. All these were needed during the interface making until running or implementing the interface we created. See the visual basic interface with its parts below (Figure2)

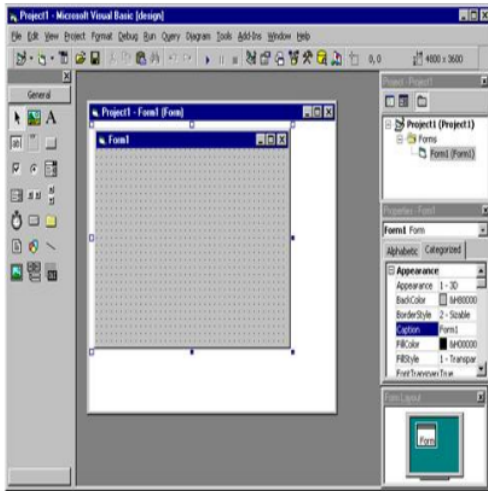


Fig.3. Interface Visual Basic

The Visual Basic Interface is a large environment consisting of several small parts, all of which have property of being able to slide to any position you desire, able to resize as you can resize Windows window and paste to other adjacent parts.(Figure 3) [5]

1. Control Menu

Control menu is a menu primarily used to manipulate the Microsoft visual basic window. From the menu we can resize, move, or th Microsoft visual basic window or other windows. The control menu consists of Restore, Move, Size, Minimize, Maximize, dan Close.

2.Menu Bar

The microsoft visual basic menu consists of all microsoft visual basic commands that can be selected to perform a specific task. The menu contents are almost the same as most programs in general.

3.Toolbar

Toolbar are buttons representing specific commands from the microsoft visual, functioning to access any command quickly. Each of the buttons can be directly clicked to perform a specific command. melakukanperintahtertentu. Usually the buttons are commands frequently used and there is also a Microsoft visual basic menu.

4.Form Window

Form window is the main work area, where we can make visual basic visual basic application programs. In this form we can design text, images, command buttons, scrollbar, and others. This form window, at first, looks small, but its size can be changed according to the needs of the application we make.

5.Toolbox

Toolbox is a box of tools covering all objects or controls needed to make an application program.

6. Properties window

The properties window contains all information of the objects provided in the Microsoft visual application. Properties of objects are as identified by their names such as color, size, position, and so on.

7.Form Layout Window

Form layout window is a window describing the position of the form displayed on the monitor screen. The position of the form the form layout window is an indication of where the application created will be displayed.

8. Code window

The code window is one of the most important windows in Microsoft Visual Basic. This window contains program codes, instructions for visual basic applications created. Each object in Visual Basic can be added with program codes to perform specific tasks such as closing applications, canceling commands, and so on

9. System Application

Making application programs using Visual Basic is done by making the application display on the form, then given a script program in the required components. The form is composed of components that are in the [Toolbox], and each component that is used must have its properties set through the [Property] window.

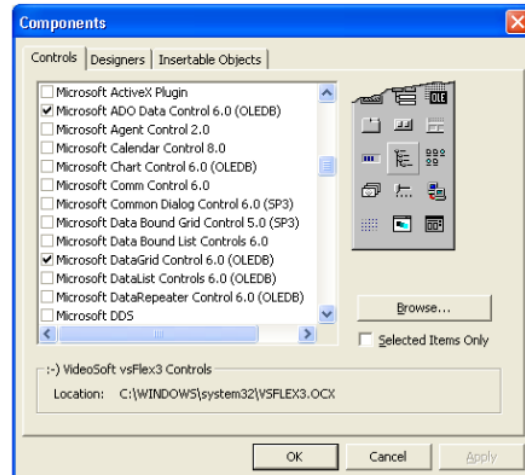


Fig.4. Interface Visual Basic Properties

III. DESAIN SYSTEM

3.1 Visual Basic 6.0 Interface Interface Desain Planning

To make it easier to monitor overload and unbalance loads, distribution transformer, a Visual Basic 6.0-based interface is used which is connected to the microcontroller via a serial USB connection. On the interface, the results of the sensor readings are displayed in the form of current, voltage, zero cross detector and power. This interface is also used to make it easier to see the monitoring of the transformer remotely.

In conducting monitoring, it is necessary to carry out various preparations, both the preparation of the required software and hardware. Because this tool is related to current sensor readings, voltage sensors, zero cross detector sensors and can send SMS if there is an overload and imbalance in the load on the transformer. And also can request sms if we want to know the load is in balance. In general, the test results are not really accurate data, but an estimate. So it is not uncommon for errors caused by software or hardware.

3.2 System Prototype Result

The result of the IVC prototype using Code Vision AVR in Figure 4 with C programming language, with programming logic principles and producing a binary number. The ATmega 128 IC has 8 bytes. So that it has a broad and diverse program thinking.

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. Making application programs using Visual Basic is done by making the application display on the form, then given a script program in the required components. The form is composed of components that are in the [Toolbox], and each component that is used must have its properties set through the [Property] window.

Alternating current source when the applied load is purely resistive which has a cos phi value of 1. then the voltage and current waves are in phase. The flow of alternating current is caused by an alternating voltage with the same frequency. If the current and voltage pass through zero and rise to their highest value in the same direction at all times, the current is said to be in phase with the voltage. The Visual Basic Interface is a large environment consisting of several small parts, all of which have property of being able to slide to any position you desire, able to resize as you can resize Windows window and paste to other adjacent parts.

```

1 #include <math>\langle math \rangle</math>.h
2 #include <math>\langle delay \rangle</math>.h
3 #include <math>\langle math \rangle</math>.h
4 #include <math>\langle stdlib \rangle</math>.h
5 #include <math>\langle stdio \rangle</math>.h
6
7 #define ARUS 0
8 #define TEGANGAN 1
9 #define COSPHI 2
10 #define DATA 3
11 #define OFFER 4
12 #define UNBALANCE 5
13 #define REQUEST 6
14
15 #define led_t_on PORTB<math>\langle 1 \rangle</math><<7
16 #define led_s_on PORTC<math>\langle 1 \rangle</math><<3
17 #define led_t_on PORTC<math>\langle 1 \rangle</math><<4
18
19 #define led_t_off PORTB<math>\langle 1 \rangle</math><<7
20 #define led_s_off PORTC<math>\langle 1 \rangle</math><<3
21 #define led_t_off PORTC<math>\langle 1 \rangle</math><<4
22
23 #define relay_off PORTF<math>\langle 1 \rangle</math><<7
24 #define buzzer_off PORTA<math>\langle 1 \rangle</math><<3
25
26 #define relay_on PORTF<math>\langle 1 \rangle</math><<7
27 #define buzzer_on PORTA<math>\langle 1 \rangle</math><<3
28
29 // Alphanumeric LCD Module functions
    
```

Fig 5. Code Vision AVR programming

The use of Visual Basic to get information in real time is the same as the results shown by the LCD, in Figure 5 is a program snippet from Visual Basic which will be synchronized with the microcontroller whose results are displayed on the LCD and Visual Basic interface.

```

Dim i As Integer
Dim j As Integer
Dim menuk As String
Dim V(255) As String
Dim arus_R As String
Dim tegangan_R As String
Dim cosphi_R As String
Dim daya_R As String
Dim arus_S As String
Dim tegangan_S As String
Dim cosphi_S As String
Dim daya_S As String
Dim arus_T As String
Dim tegangan_T As String
Dim cosphi_T As String
Dim daya_T As String
Dim led As String

Private Sub cmddisconnect_Click()
    MSComm1.PortOpen = False
    cmdconnect.Enabled = True
    cmddisconnect.Enabled = False
    Combo1.Enabled = True
End Sub

Private Sub Form_Load()
    On Error Resume Next
    For i = 1 To 100
        MSComm1.CommPort = i
        MSComm1.PortOpen = True
        If MSComm1.PortOpen Then
    
```

Fig 6. Visual Basic Interface Prototype Programming

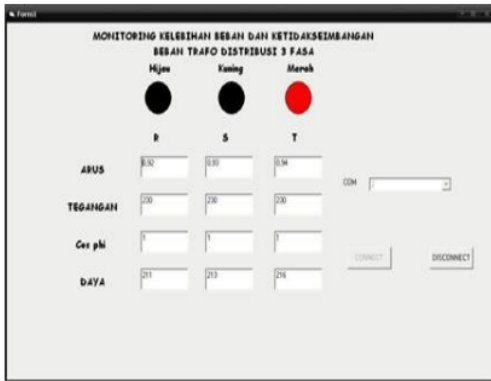


Fig.7. Visual Interface when Overload

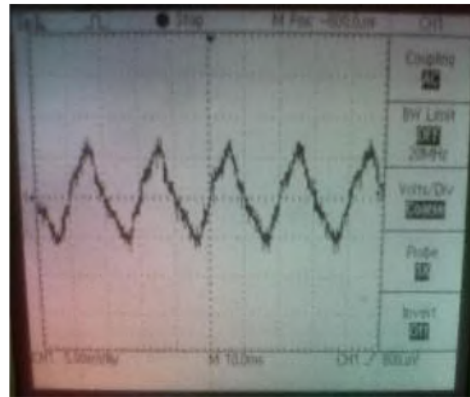


Fig.9. AC Voltage Waveform Toroidal Current Sensor Output

In Figure 7 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 automatically so transformer in safe mode. Installing and setup motion detection on raspberry pi, first of all installing Raspbian on micro SD or Interface Visual Basic . And the installing and setup motion detection voltage sensor output signal (Figure 8).[6]

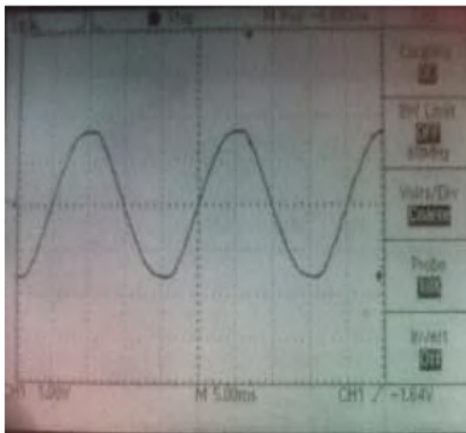


Fig.8 . Voltage Sensor output sign

The toroidal current sensor is used as a reading of the incoming current to the source that has been loaded with light bulbs from all three phases, after that, it is entered and processed by the microcontroller whose results appear on the LCD.(Figure 9)



Fig.10. Toroidal Current Sensor Input Current

IV. CONCLUSION

The transformer load experiencing overload and imbalance was immediately known by the officer through the IVC design prototype sent to the officer's cellphone. The officer was able to see the transformer load in real time through the officer's cellphone by sending an SMS to the device and sending the temporary transformer load data directly. So, the need for accurate and fast data could be fulfilled. Transformer load is divided in 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 immediately action from office, transformer will not burned by fire and will be in safe mode.

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