Designing of Human Machine Interface

Pooja R. Thakare [1], Dr. Dinesh M. Chandwadkar[1]
[1]*Karmaveer Kakasaheb Wagh Institute of Engineering Education and Research, Nashik, India*

Abstract – The paper represents the designing of Human machine interface for transformer protection relay. Interface are of 2 types 1) command line interface, 2) graphical user interface. The graphical user interface (GUI) is the most important element of the overall Relay Assistant design. Its functions for test and waveform handling as well as, signal processing and displaying different parameter on LCD ddisplay, including voltage, current , harmonics etc. In addition, GUI provides the required software/hardware transparency.

Keywords- *Differential transformer, digital signal controller, keyboard interfacing, 160 *160 LCD display, USB interfacing.*

I. INTRODUCTION

Graphical User Interface is a type of user interface that allows users to interact with electronic devices through graphical icons and visual indicators such as secondary notation as opposed to text based interfaces, typed command labels or text navigation. The actions in GUIs are usually performed through direct manipulation of the graphical elements. The main topic of project is designing of graphical user interface using 16 bit digital signal controller. It includes interfacing of LCD display of 160*160, USB interfacing for communication with PC system, keypad interfacing with digital signal controller. UART (universal asynchronous receiver transmitter) is interface with DSC as well as main application processor that is digital signal processor which performs all calculation of magnitude of voltage, current, phase shift etc. and it sends data to the digital signal controller. This relay has lots of different features, it continuously monitors the function of transformer and display the fault if any on LCD display with all its primary and secondary winding values of voltage and current along with Time and Date at which the fault occur.

The paper is organized as follows. Section II presents Literature Review. Overview of system structure is presented in section III. The Implementation of system hardware and software is discussed in Section IV and section V respectively. Finally, the section VI presents conclusions drawn.

II. LITERATURE REVIEW

The design of a DSP (Digital Signal Processor) based Adaptive Numerical Mho relay, to be used for distance protection schemes of long distance transmission lines. The relay settings will be automatically adjusted with the changes of power system parameters with the variation of frequency as well as with the variation of percentage compensation which may occur due to fault/damage in the compensating device itself for a series compensated line. The signal conditioning is oriented on the Inverse Discrete Fourier Transform (IDFT) and the relaying algorithm is based on Memory Mapped

Targeting Technique Siemens-7SJ series- The Siemens 4 7SJ61 relays can be used for line protection for high and medium voltage networks with earthed (grounded), low resistance earthed, isolated or compensated neutral point. When protecting monitors, the SIEMENS 4 7SJ61 is suitable for asynchronous machines of all sizes. The relay performs all functions of backup protection supplementary to transformer differential protection.

ABB-REF series- REF610a is primarily intended forth protection of incoming and outgoing feeders in distribution substations of resistance earthed and solidly earthed power systems. REF610 is suitable for employment in marine and o_-shore environments. Supplied with an optional arc protection function, REF610 also provides fast substation bus bar arc-fault protection. REF610s are also used for back-up protection of motors, transformers and generators to increase protection redundancy in critical utility and industrial applications.

These are DSP processor based relays in contrast to other relays that are electromechanically controlled. It uses a microprocessor to analyze power system voltages, currents or other process quantities for the purpose of detection of faults in an industrial process system. These relays provide great precision and convenience in application in sophisticated electronic products. By combining several functions in one case, differential relays also save capital cost and maintenance cost over electromechanical relays.

In the era of electromechanical and solid state relays, any one relay could implement only one or two protective functions, so a complete protection system may have many relays on its panel. In DPR, many functions are implemented by the processor programming. Any one DPR may implement one or all of these functions.

III. SYSTEM STRUCTURE

The general functions of DPR are listed below:

1. Protection: They present a very ample range of protection functions, distance protection, directional and non-directional, over current protection, residual voltage, over voltage and under voltage control of synchronism.
2. Condition monitoring: Monitoring functions check the circuit breakers.
3. Control: Local and remote control functions check the circuit breakers

Current based differential protection has been applied in power systems since the end of the 19th century, and was one of the first protection systems ever used. Faults are detected by

comparing the currents flowing into and out of the protected object as shown in Figure1.

Within the differential relay two quantities are derived:

- The stabilizing current (often as well called bias or restraining current) which flows through the restraining circuitry "s" shown in Figure 1; and
- The differential current (i.e. the current Id shown in Figure 1).

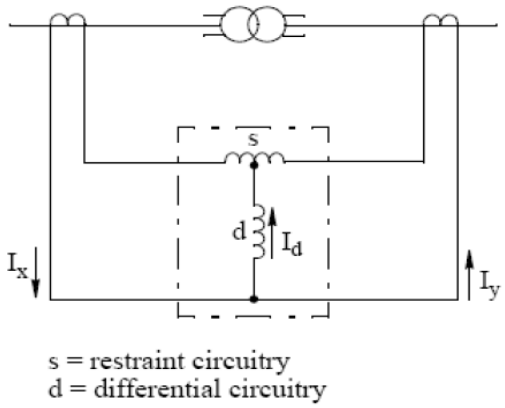

Fig.1: Principal connections for transformer differential protection

A. TRANSFORMER DIFFERENTIAL PROTECTION

Percentage restraint differential protective relays have been in service for many years. Fig. 2 shows a typical differential relay connection diagram. Differential elements compare an operating current with a restraining current. The operating current (also called differential current), Id, can be obtained from the phasor sum of the currents entering the protected element:

Functional Overview

The scheme design is being taken in consideration based on functional requirement. Fig. 2 shows Graphical functional overview.

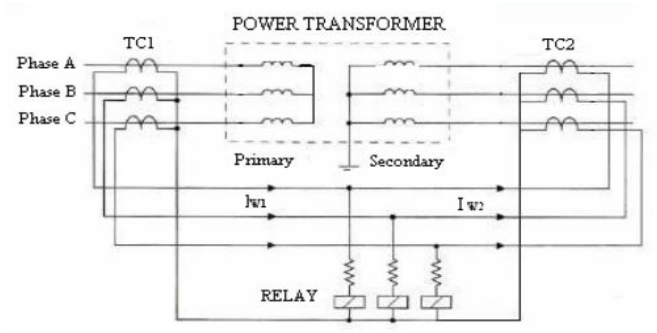

Fig.2: Simple diagram connection for differential power transformer protection

IV. SYSTEM HARDWARE IMPLEMENTATION

We are using the Altium software for designing circuit diagram and PCB designing. General steps for creating new project in Altium.

- Creating a new PCB project
  - File » New » Project » PCB Project
- Creating a new schematic sheet
  - File » New » Schematic
- Locating the component and loading the libraries
- Wiring up the circuit
- Compiling the project
  - Project » Compile PCB Project.
- Updating the PCB
  - Design » Update PCB Document
- Designing the PCB
- Manually routing the board

V. SYSTEM SOFTWARE IMPLEMENTATION

MPLAB Integrated Development Environment (IDE) is a comprehensive editor, project manager and design desktop for application development of embedded designs using Microchip PIC MCUs and dsPIC DSCs.

In order to create code that is executable by the target PIC MCU, source files need to be put into a project. The code can then be built into executable code using selected language tools (assemblers, compilers, linkers, etc.). In MPLAB IDE, the project manager controls this process.

All projects will have these basic steps:

1. Select Device
   The capabilities of MPLAB IDE vary according to which device is selected. Device selection should be completed before starting a project.
2. Create Project
   MPLAB IDE Project Wizard will be used to Create a Project.
3. Select Language Tools
   In the Project Wizard the language tools will be selected. For this tutorial, the built-in assembler and linker will be used. For other projects, one of the Microchip compilers or other third party tools might be selected.
4. Put Files in Project
   Two files will be put into the project, a template file and a linker script. Both of these files exist in sub-folders within the MPLAB IDE folder. It is easy to get started using these two files.
5. Create Code
   Some code will be added to the template file to send an incrementing value out an I/O port.
6. Build Project
   The project will be built - causing the source files to be assembled and linked into machine code that can run on the selected PIC MCU.
7. Test Code with Simulator Finally, the code will be tested with the simulator

VI. CONCLUSION

This relays provides integrated Numerical Protection, Control, Monitoring and Measuring functions with Communication functionality with cost effective solution. Graphical display is used to indicate different harmonics. We can provide setting through keypad and also from laptop. It records latest faults, disturbances and shows different faults on LCD. These relays use for protection of transformer, motor etc. The tools are quite flexible and facilitate the following tasks related to selection and tuning of relay settings:

- Automate analysis of relay operations to identify relay miss operations
- Investigate miss operations by replaying recorded waveforms and changing relay settings until optimal settings/operating characteristic are selected

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Pooja R. Thakare is pursuing Masters of Engineering in Electronics and Telecommunication, with specialization as VLSI and Embedded Systems from K. K. Wagh Institute of Engineering Education and Research, Nashik. This research work is sponsored by Crompton Greaves Ltd., and this paper is published as a part of the research work done for the fulfillment of degree of Masters.

Prof. Dr. D.M. Chandwadkar is a Head of Department of Electronics and Telecommunication Engineering, K. K. Wagh Institute of Engineering Education and Research, Savitribai Phule Pune University. He has pursued his PhD in Audio Signal Processing. His area of interest is Power electronics, Audio Signal Processing.