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UPGRADATION OF PROTECTION OF POWER SYSTEM FROMFREQUENCY VARIATION USING MICROCONTROLLER BASED NUMERIC RELAY

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Abstract-The aim of this project is to analyze and upgrade existing transmission line protection system. This paper investigates the protection of power system from under/over frequency [1] using numeric relay. [2]The introduction of digital technology in the protection field has made tremendous changes in the art and power system protection. The new relays are multifunctional and operate digitally (numerically). [4] Apart from the basic protection function, these relays have extensive self-monitoring capabilities and can communicate with operator terminals and control system. This project is aimed to provide an overview of the latest technologies used in numeric based power system protection, their underlying theory, algorithms and areas of application

I. INTRODUCTION

Relay is an electric device that is designed to interpret input conditions in a prescribed manner and after specified conditions are met to respond, to cause contact operation or similar abrupt change in associated electric control circuits.[3].The protective systems are necessary with almost every electric plant. The power systems comprise many diverse items of equipment which are very expensive, so the complete power system represents a very large capital investment. No matter how well designed, faults will occur on a power system and these faults may represent a risk of life and property. The provision of adequate protection to detect and disconnect the elements of power system in the event of fault is therefore an integral part of power system design.[5] In order to fulfill the requirements of protection with optimum speed for the many different configurations, operating conditions and construction feature of the power system, it has been necessary to develop many types of relays that respond to various functions if the power system quantities.

A. NUMERICAL RELAY

Conventional electromechanical and static relays are hard wired relays. Their wiring is fixed, only their setting can be manually changed. Numeric relays are programmable relays. [4] The characteristics and behavior of the relay are can be programmed. They have numerous advantages. They have small burden on CT's and PT's. They can process and display the signals efficiently, accurately and fast as possible manner. The electromechanical relay devices occupy large amount of spacein the panel board. Although accuracy is maintained at a better level [3] it can be improved by the use of numerical relays.

[4]. Traditional electromechanical and static protection relays offers single-function and single characteristics. Range of operation of electromechanical relays is narrow as compared to numerical relay. Electromechanical Relay makes use of mechanical comparison devices, [5] which cause the main reason for the bulky size of relays. It uses a flag system for the indication purpose whether the relay has been activated or not. Electromechanical relay do not have the ability to detect whether the normal condition has been attained once it is activated thus auto resetting is not possible and it has to be done by the operating personnel.

B. NEED OF NUMERICAL RELAY

Numerical relays are highly compact devices, characterized with fast operation,[6] high sensitivity, self-monitoring and low maintenance.[3],[4] First generation numerical relays were mainly designed to meet the static relay protection characteristic, whereas modern numeric protection devices are capable of providing complete protection with added functions like control and monitoring,Numerical protection devices offer several advantages in terms of protection, reliability, and trouble shooting and fault information. [5] Numerical protection devices are available for generation, transmission and distribution systems. Modern power system protection devices are built with integrated functions. Multi-functions like protection, control, monitoring and measuring are available today in numeric power system protection devices. Also, the communication capability of these devices facilitates remote control, monitoring and data transfer.

Modern numeric protection offers multi-function and multiple characteristics. Some protections also offer adaptable characteristics, which dynamically change the protection characteristic under different system conditions by monitoring the input parameters. The measuring principles and techniques of conventional relays (electromechanical and static) are fewer than those of the numerical technique, capital cost and maintenance cost over electromechanical relays which can differ in many aspects like the type of protection algorithm used, sampling, signal processing, hardware selection, software discipline, etc. The disadvantages of a conventional electromechanical relay are overcome by using microcontroller for realizing the operation of the relays.[4] Microcontroller based relays perform very well and their cost is relatively low.

II. COMPONENTS USED

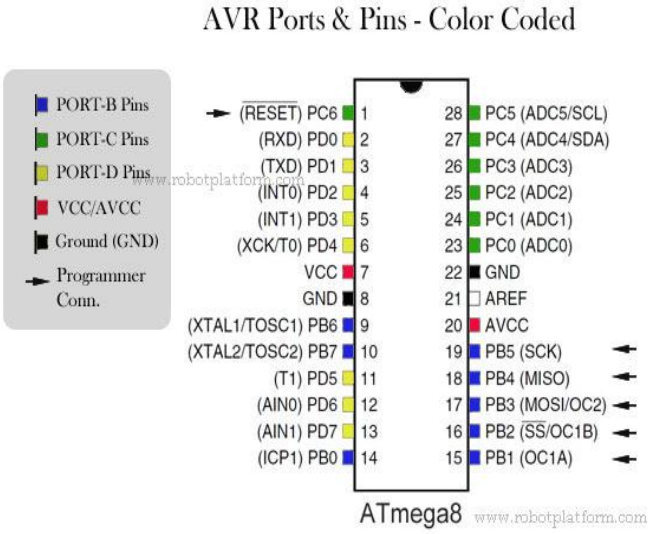
1. MICROCONTROLLER ATmega8

The ATmega8 is a, 3 port low-power CMOS 8-bit microcontroller based on the AVR RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega8 achieves throughputs approaching 1 MIPS per MHz, allowing the system designed to optimize power consumption versus processing speed.

2. 555 TIMER

The 555 monolithic timing circuit is a highly stable controller capable of producing accurate time delays, or oscillation. In the time delay mode of operation, the time is precisely controlled by one

external resistor and capacitor. For a stable operation as an oscillator, the free runningfrequency and the duty cycle are both accurately controlled with two external resistors and one capacitor. The circuit may be triggered and reset on falling waveforms, and the output structure can source or sink up to 200mA.



PIN No	Name	Function
1	VSS	Ground voltage
2	VCC	+5V
3	VEE	Contrast voltage
4	RS	Register Select 0 = Instruction Register 1 = Data Register
5	R/W	Read/ Write, to choose write or read mode 0 = write mode 1 = read mode
6	E	Enable 0 = start to latch data to LCD character 1= disable
7	DB0	Data bit 0 (LSB)
8	DB1	Data bit 1
9	DB2	Data bit 2
10	DB3	Data bit 3
11	DB4	Data bit 4
12	DB5	Data bit 5
13	DB6	Data bit 6
14	DB7	Data bit 7 (MSB)
15	BPL	Back Plane Light +5V or lower (Optional)
16	GND	Ground voltage (Optional)

3. LCD
4. PUSH BUTTONS
5. RELAY
6. AVR USB PROGRAMMER

7. POWER SUPPLY
8. BUZZER
9. INDICATING LED's

III. OPERATION

In this project, we are using a numeric relay having ATmega-8, an 8 bit micro-controller as the processing unit for the real time calculation of frequency and protection of power system from over and under frequency. IC 555 is used as a signal generator in astable mode whose frequency is measured using micro controller ATmega-8. This module has an operating frequency of 50Hz with a maximum tolerance of ± 10Hz, i.e., the operating range varies from 40Hz to 60Hz. This module also has a flexibility that provides user a control on tolerance level. A 16x2 alphanumeric LCD screen is used for user interface.

Power supply is given to circuit board. Square wave output of the 555 based signal generator is given to microcontroller as signal input. Using push buttons, we can set the tolerance value and depending upon that tolerance value the microcontroller calculates the standard operating frequency range. The micro-controller starts sensing frequency from signal generator and then compares it with the user defined values. When the frequency variation goes beyond safe operating range (defined by user at the time of start-up), the micro-controller sends a signal to relay which breaks the circuit. If the input frequency is below or above the standard set value of frequency, [1] microcontroller automatically sounds an alarm and trips the circuit.This tripping is shown by shutting off the line (BLUE LED) and powering on the alarming device (RED LED and BUZZER) connected in the circuit. Thus, it protects the connected power system equipments from over and under frequecy.

IV. FLOWCHARTAND CIRCUIT DIAGRAM

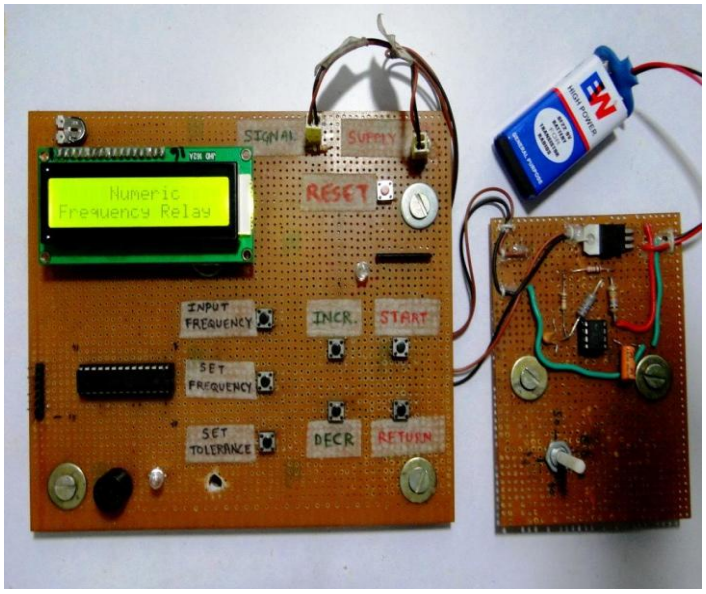
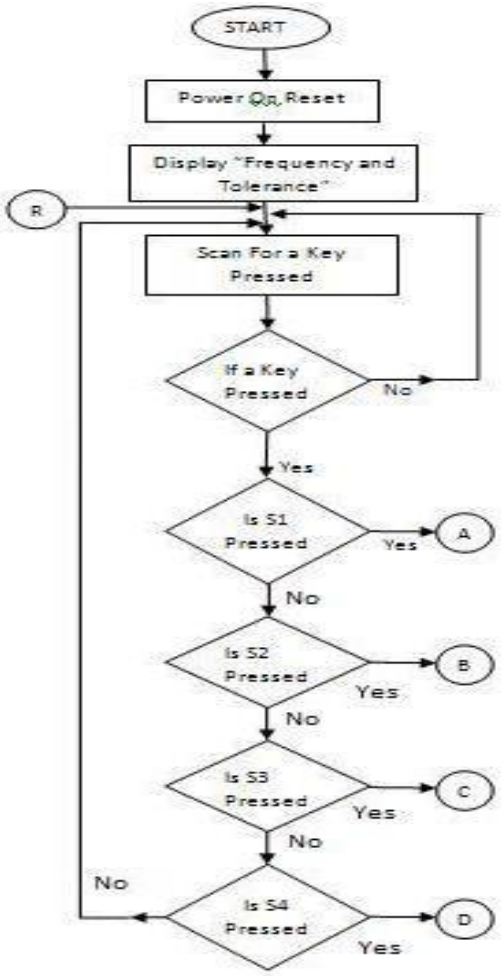
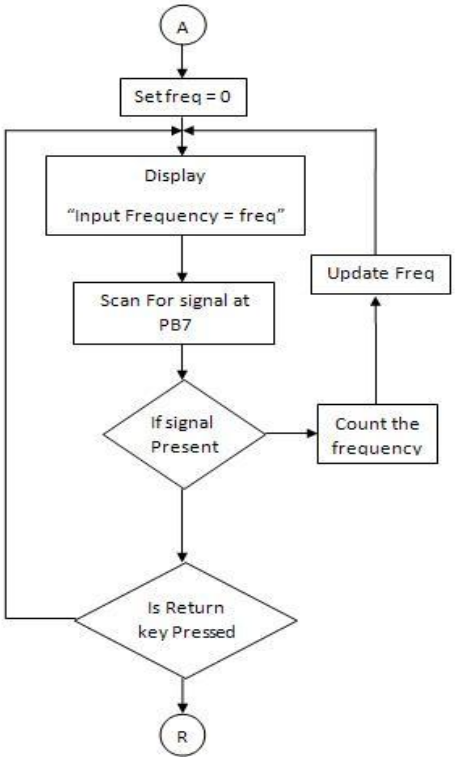
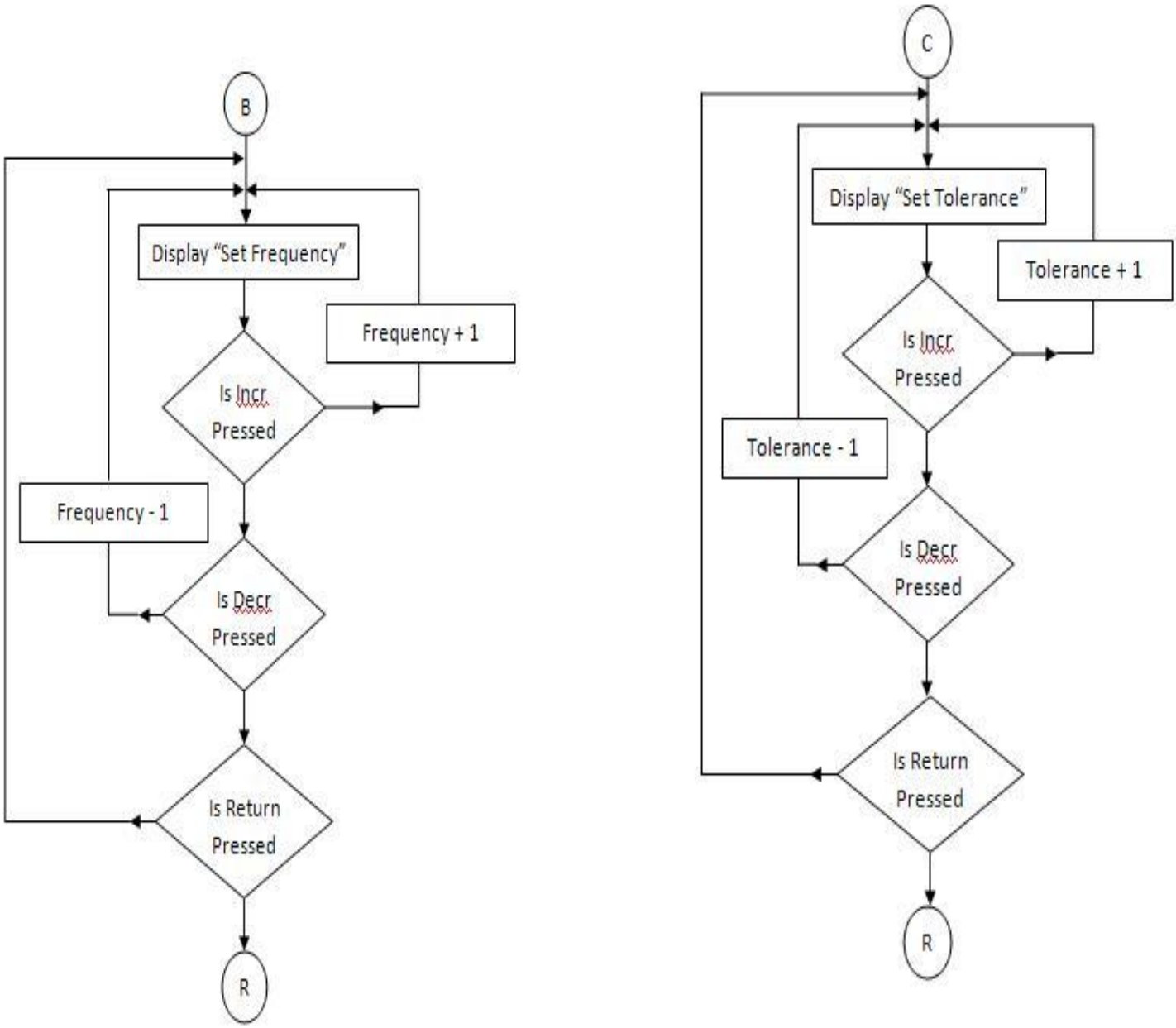


Figure 1: Circuit Design





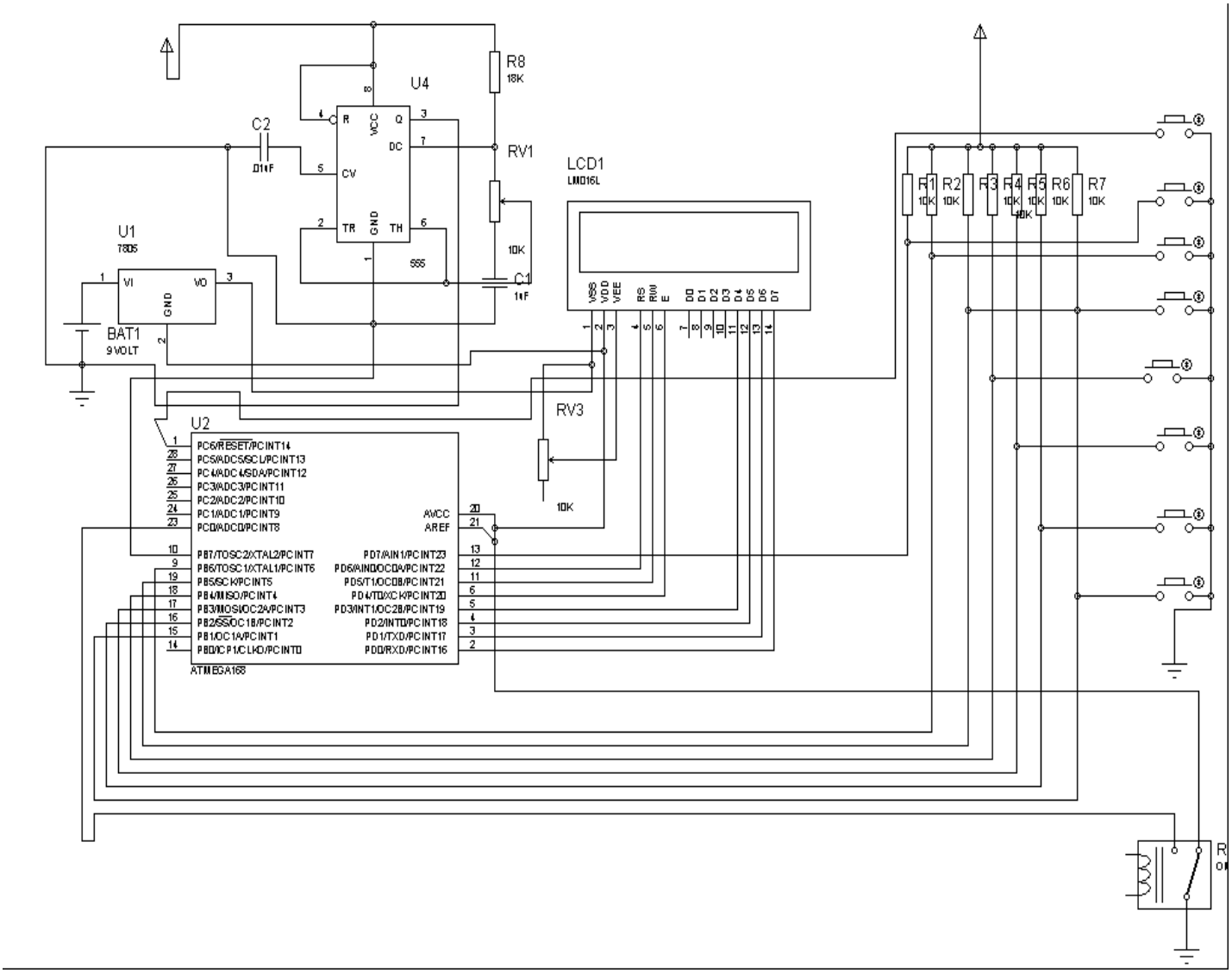


V. AVR STUDIO-4 (SOFTWARE USED)

The AVR Studio-4 is an Integrated Development environment for debugging AVR software. The AVR Studio allows chip simulation and in-circuit emulation for the AVR family of microcontrollers. The user interface is specially designed to be easy to use and to give complete information overview. The AVR uses the same user interface for both simulation and emulation providing a fast learning curve.

VI. CONCLUSION

The size of a numeric relay is very small as compared to that of electro-magnetic relay which are very large in size. The speed of operation of a numeric relay is more than that of electro-magnetic relay. Due to the presence of micro-controller and microprocessor in numeric relay, it is flexible in nature as the programming in the micro controller can be altered any time. Multiple operations are possible in numeric relay. Numeric relay is more accurate as compared to electro-magnetic relay. Very less maintenance is required in numeric relay. No effect in the calibration of the relay for a very long period of time whereas the calibration of electro-magnetic relay deteriorate with time.



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