Co-Ordinate Load control and Load shedding Balance by using Microcontroller

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Abstract-- Energy is the basic necessity for the economic development of a country. Energy production is more costly which is impossible for us, so we should distribute the energy as maximum user's right. Now a day's load-shedding is a common buzzword in our country, for this reason the industry doesn't continue the production, the aim of our research is to continue power flow in industry and load-shed the user as a balance condition. Hence, the load shedding control system, which was earlier done manually, now-a-days, is controlled by a computer based system, developed to some more extent to direct the society to a more convenient life. This paper focuses on developing a microcontroller based procedure for controlling the load-shedding system where manual work will be minimized by selecting the feeder, substation and duration of shedding time by the user, easy to detect fault using microcontroller, To continue industrial power for effective manufacturing, over load cut for Transmission line safety.

Index Terms: Load Shedding, Microcontroller, Current Transformer.

1. INTRODUCTION

Today the world in which we live is the world of Digital Electronics. The technological advancement has taken to stage where we can do nothing without the help of sophisticated instruments like computers, phones, mobiles; wireless etc. Bangladesh is a developing country with the vigorous development of the economy in Bangladesh; Bangladesh has experienced the continuous increase of load density over the whole power distribution system. The distribution feeders may become overloaded due to load growth and substation planning and it complicates the distribution system operation in areas with high load density. There is an acute power shortage every corner of Bangladesh, it becomes unavoidable, to cut down the load from one section & supply to other section, which can be done locally or through PC remotely. This Project is a very good example of embedded system as all its operations are controlled by intelligent software inside the microcontroller, [6]. The theme of our project is to control the power grid or for the purpose of load shedding. In this project, we are using **PIC16F676** Microcontroller [2], since this controller has two ports which are more than enough for our project. Technology used as microcontrollers are the core of the today's digital circuit design in industry, this system uses it for the centralized operation and digital processing. The technology used here is embedded technology which is the future of today's modern electronics.

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For developing automatic load shedding technique we have used different equipments such as microcontroller, power supply(12 volts), relay, transistor, voltage regulator, current transformer, LED, Dummy load, switch etc.
Finally we have developed a microcontroller based control system and a technique of load control for fixed load. Also, technique for overload protection system and load shedding time balancing system is shown here.

2. LOAD SHEDDING

When load increases in a system, unit governors will sense the speed change and increase the power input to the generator. Extra load will be handled by using the unused capacity of all generators operating in the system (spinning reverse)[1].If all generators are operating at the maximum capacity (spinning reverse is 0) it is necessary to disconnect a portion of the load, equal or greater than the overload, intentionally and rapidly. As frequency is a reliable indicator of an overload situation, frequency sensitive relays can be used to disconnect a portion of the load automatically. This arrangement is referred to as Load-Shedding or Load-Saving scheme and is designed to protect system against frequency interruptions. Under frequency relays are usually installed at distribution substations where selected loads can be disconnected which will balance load and generation. The first line of these relays is set just below normal operating frequency range (59.4-59.7Hz).[5-6] When the frequency drops below this level, these relays will drop a significant percentage of system loads. If the frequency stabilizes (or increase), it

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means the load drop was sufficient, but if the frequency continues dropping (with a slower rate) until it reaches the second line of relays, a second block of load is shed. This will continue until the overload is relieved or all the frequency relays have tripped.

4. Microcontroller IC

PIC16F676 - 8 bit M with 2K bytes Flash Program Memory:

Photograph:

Figure 01: Photograph of PIC16F676

3.1 Pin layout:

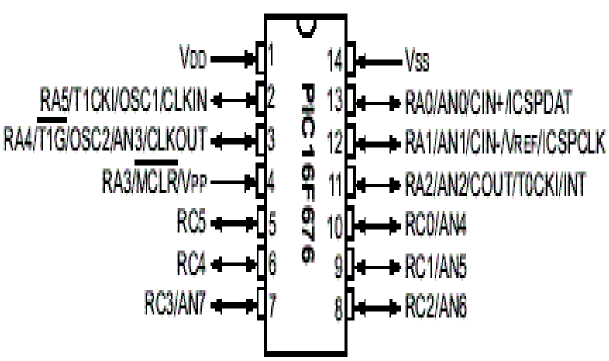

Figure 02: PIC16F676 Layout

3.2 Features:

High-Performance RISC CPU

- Only 35 single word instructions to learn
- All instructions are 1µs (@4MHz) except for program branches
- Operating speed: DC - 20MHz clock input

Peripheral Features

- One 8-bit timer/counter (TMR0) with 8-bit programmable presale
- 10 bit resolution
- High current source/sink for direct LED drive
- One Analog Comparators
- Capture/Compare PWM (CCP) Module

Special Microcontroller Features

- Power-On Reset
- Power-up Timer (PWRT) and Oscillator Start-Up Timer (OST)
- Brown-out Detect (BOD)

Low Power Features

- Standby Current: 1nA @ 2.0V, typical
- Operating Current: 8.5 µA @32 kHz, 2.0V, typical
- Watchdog Timer Current: 300 nA @ 2.0V, typical
- Timer1 oscillator current: 4 µA 32 kHz, 2.0V, typical

3.3 Pin description:

Pin Number	Description
1	VDD
2	RA5/T1CKI/OSC1/CLKIN
3	RA4/T1G/OSC2/CLKOUT
4	RC3/MCLR/VPP
5	RC5
6	RC4
7	RC3

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8	RC2/TX/CK - Port B
9	RC1
10	RC0
11	RA2/COUT/T0CKI/INT
12	RA1/CIN-/ISCPCLK
13	RA2/CIN+/ISCPDAT
14	Vss

4 VOLTAGE REGULATOR:

Voltage regulators are components that maintain a consistent voltage output. Electronic components are often made to accept only a low maximum voltage, and can be badly damaged by a power surge. Likewise, a low voltage can fail to provide enough power for the component. Voltage regulators are often responsible for maintaining a voltage within the range that the electronic component can safely accept.

A basic voltage regulator LM7805 has three legs, converts varying input voltage and produces a constant regulated output voltage. The most common part numbers start with the numbers 78 or 79 and finish with two digits indicating the output voltage. The number 78 represents positive voltage and 79 negative one. The 78XX series of voltage regulators are designed for positive input.

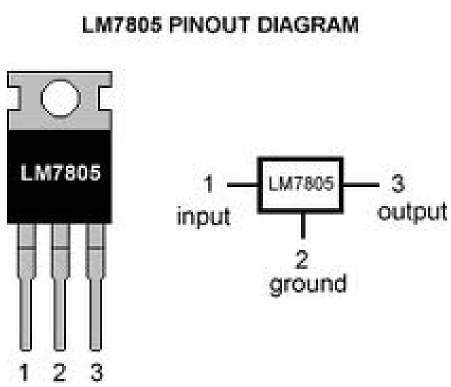


Figure 03: Standard configuration of LM7805.

5 CO-ORDINATE CURRENT CONTROL

5.1 Block diagram for co-ordinate current control:

Over load control and load balancing system is new technology in Bangladesh .Today nothing is manual to use. Automatic system is more reliable and safety for life. Here have a main generating station and one industry and two home user units. Industry is always supply by power because uninterrupted power bust be use in production unit. Our generating station max power generation is 8MW.Industry is dedicated for 5 MW two users is assign for 6 MW(3+3MW) when industries is over loaded then main controller shut off home power supply. And co ordinate load shedding respect of time of total over load of industry. And industry is warning by alarm that it's over loaded.

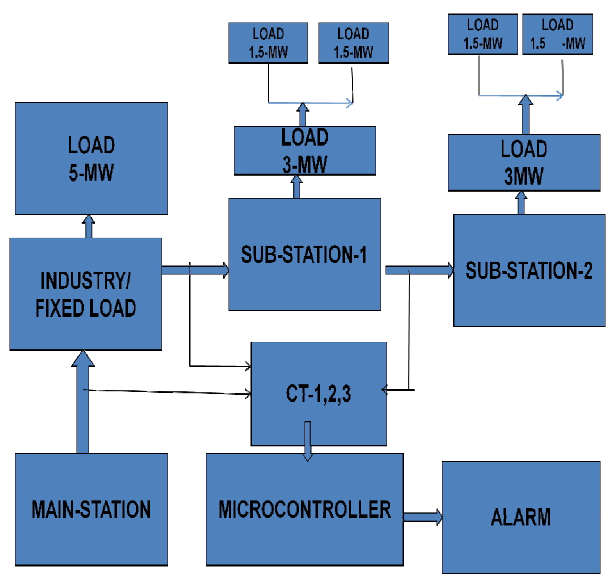


Figure 04: Block diagram for co ordinate current control

5.2 Schematic diagram for co-ordinate current control:

All transmission line is connected with CT .then all CT output is convert into DC Voltage. Which is connected with Microcontroller .Micro controller make logical decision and trigger Transistor and relay will on? if transmission line is overloaded then switch off all load. When industry signal is over to set value it will signal by alarm.

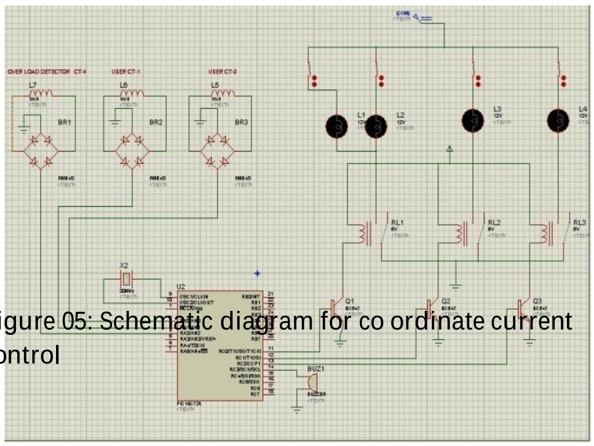
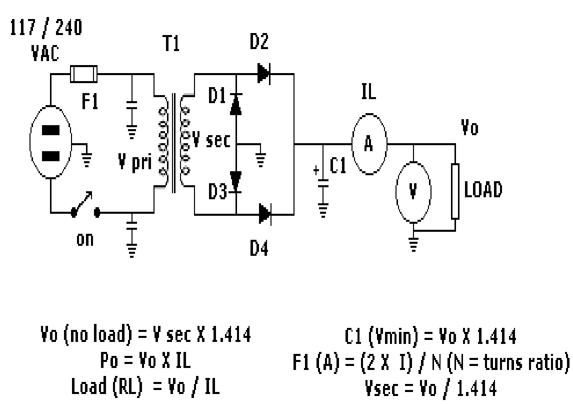


Figure 05: Schematic diagram for co ordinate current control

5.3 Power Supply:

The ac from the transformer secondary is rectified by a bridge rectifier D1 to D4 which may also be a block rectifier such as WO4 or even four individual diodes such as 1N4004 types. (See later re rectifier ratings).[3]

The principal advantage of a bridge rectifier is you do not need a centre tap on the secondary of the transformer. A further but significant advantage is that the ripple frequency at the output is twice the line frequency (i.e. 50 Hz or 60 Hz) and makes filtering somewhat easier.



As a design example consider we wanted a small unregulated bench supply for our projects. Here we will go for a voltage of about 12 - 13V at a maximum output current (I_L) of 500ma (0.5A). Maximum ripple will be 2.5% and load regulation is 5%.

Now the rms secondary voltage (primary is whatever is consistent with your area) for our power transformer T1 must be our desired output Vo PLUS the voltage drops across D2 and D4 (2 * 0.7V) divided by 1.414.

This means that Vsec = [13V + 1.4V] / 1.414 which equals about 10.2V. Depending on the VA rating of your transformer, the secondary voltage will vary considerably in accordance with the applied load. The secondary voltage on a transformer advertised as say 20VA will be much greater if the secondary is only lightly loaded.

If we accept the 2.5% ripple as adequate for our purposes then at 13V this becomes 13 * 0.025 = 0.325 Vrms. The peak to peak value is 2.828 times this value. Vrip = 0.325V X 2.828 = 0.92 V and this value is required to calculate the value of C1. Also required for this calculation is the time interval for charging pulses. If you are on a 60Hz system it it 1/ (2 * 60) = 0.008333 which is 8.33 milliseconds. For a 50Hz system it is 0.01 sec or 10 milliseconds.

The formula for C1 is:

$$C1\ (uF) = [\ (\ I_L * t\ )\ /\ Vrip\ ] \times 10^6$$
$$C1 = [\ (\ 0.5A \times 0.00833\ )\ /\ 0.92V\ ] \times 10^6$$
$$C1 = 0.00453 \times 10^6 = 4529 \text{ or } 4700\ uF$$

Remember the tolerance of the type of capacitor used here is very loose. The important thing to be aware of is the voltage rating should be at least 13V X 1.414 or 18.33. Here you would use at least the standard 25V or higher (absolutely not 16V).

With our rectifier diodes or bridge they should have a PIV rating of 2.828 times the Vsec or at least 29V. Don't search for this rating because it doesn't exist. Use the next highest standard or even higher. The current rating should be at least twice the load current maximum i.e. 2 X 0.5A or 1A. A good type to use would be 1N4004, 1N4006 or 1N4008 types. These are rated 1 Amp at 400PIV, 600PIV and 1000PIV respectively. Always be on the lookout for the higher voltage ones when they are on special.

TRANSFORMER RATING - In our example above we were taking 0.5A out of the Vsec of 10V. The VA required is 10 X 0.5A = 5VA. This is a small PCB mount transformer available in Australia and probably elsewhere. This would be an absolute minimum and if you anticipated drawing the maximum current all the time then go to a higher VA rating.

The two capacitors in the primary side are small value types and if you don't know precisely and I mean precisely what you are doing then OMIT them. Their loss won't cause you heartache or terrible problems.

6 ADVANTAGES

Here we have developed Intelligent load Control System which is more cost effective Control System. Also it is easy to detect fault using microcontroller. By this technique balance load shading time for user right can be set. To continue industrial power for effective manufacturing this technique can be more helpful. Also over load cut for Transmission line safety is possible.

7 PROSPECT OF BANGLADESH:

Bangladesh's energy infrastructure is quite small, insufficient and poorly managed. The per capita energy consumption in Bangladesh is one of the lowest (136 kWH) in the world. Noncommercial energy sources, such as wood, animal wastes, and crop residues, are estimated to account for over half of the country's energy consumption. Bangladesh has small reserves of oil and coal, but very large natural gas resources. Commercial energy consumption is mostly natural gas (around 66%), followed by oil, hydropower and coal. Bangladesh is developing country. Electricity is the major source of power for country's most of the economic activities. Bangladesh's installed electric generation capacity was 4.7 GW in 2009; only three-fourth of which is considered to be 'available'. Only 40% of the population has access to electricity with a per capita availability of 136 kWh per annum. We try to develop our country day by day. But we have no modern technology to apply our transmission line. Most of the device we buy from another country. it's very cost effective for our country. So we try to design a device to safe our transmission line and provide maximum user right to use power by controlling load shading when our production is lower from using load.

8 CONCULATION

In this paper the importance of a timely applied load-shedding action has been reconfirmed. If the spacific action is not performed in time, a more painful load-shedding action must be performed in order to avoid a voltage collapse. Based on the discrete dynamics of LTCs, which drive voltage instability when they lose voltage regulation capability, a method for the calculation of the critical load-shedding time has been presented. Finally we can say that, by using microcontroller the control of load shedding can be made more easily. It is shown at emphasizing on shedding load of a more critical bus yields more desirable results, as expected.

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