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Technique for Fault Identification and Auto Retrieving to Healthy Condition for Transmission Line Network

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Abstract: Transmission line protection has become a very vital issue in power system as the transmission line connects the generating station to the end users(loads), the generating station are far away from the load end thus, runs several kilometers and hence the chances of fault occurring in the line is maximum. More than 75 percent of power system faults are occurring in transmission lines. Amongst the other electrical power system component, this transmission lines detriments more from unexpected potentially catastrophes. Due to which the reliability of the operating system degrades earlier to its worst condition. Thus, in this project our task is to make a protective system based on adaptive technique to prevent the propagation of these faults and safeguard the system against the abnormal conditions faced. The role of the protective system will be to detect and classify the type of fault also send a tripping signal to reset it back to the healthy condition after a preset value of timer. Determination of different types of faults on the transmission line is achieved by application of evolutionary programming tools of MATLAB software and Arduino mega 2560(microcontroller).

Index terms: transmission line, Adaptive technique, MATLAB version6, Arduino Mega2560.

I. INTRODUCTION

With the advancement in digital computer during 1960's ,the software engineers also went ahead in a big way, however, in the beginning it was only software oriented but with the development of microcontrollers and mini computers online relaying schemes such as less maintenance ,low burden ,fast operation with higher flexibility is possible. Unfortunately, these approaches do not work on real time system and majority of the various existing techniques are unable to deal with the hazy information contained in the faults. Adaptive protection would be a better solution in these regard. In other words, more sophisticated fault detection technique is required to maintain safe and secured power distribution system.. In this research, a new method is proposed for fault detection and classification.

And auto retrieve from the fault in Power Transmission Lines based on MATLAB with Arduino Mega 2560 hardware which greatly reduces the manpower, saves time and operates efficiently without human interference. In the transmission line feeding any number of loads, an indication is provided to the microcontroller (Arduino 328). When the voltage through the line get below the predefined value of voltage then an action is taken immediately by the microcontroller which provides suitable feedback in form of trip signal to isolate the load from the unbalanced supply provided and gives results what type of fault has occurred and which phase is affected. This result can be viewed in computer screen. Also graphical representation of faulted ad healthy phase can be generated.

II. REASONS FOR DIFFERENT LOSSES ENCOUNTERED

1) Average line losses equals to 1 to 2% for electrical high voltage transmission line and distribution system.
2) Average line losses is about 4to 6% for distribution line losses is maximum at peak power and can raise up to 10 to 15% because of higher resistance and reactance power consumed.
3) According to Joules Law, it states that the energy losses are directly proportional to the square of the current which thus results in reduction of resistive losses. And the line losses are dissipated in form of heat, hot conductor sag and thus the thermal constrained are imposed on transmission lines.

III. TYPES OF FAULTS

Faults in any transmission line can be basically classified as balanced fault and unbalanced faults. These faults are well known as symmetric and asymmetric faults respectively. In maximum cases it is seen that faults which are encountered are of asymmetric type. The symmetric and asymmetric faults are further categorized as series and shunt type faults.

A series fault occurs in the impedance of the line and it does not involve any neutral or ground or any interconnection between the phases. It shows increase of voltage and frequency level and decrease of current level in the affected phases. For example opening of one or two lines by the circuit breaker. And the shunt faults are

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unbalance between phases and ground or between different phases.

Different types of faults can be viewed in following forms as shown in figures 1:-

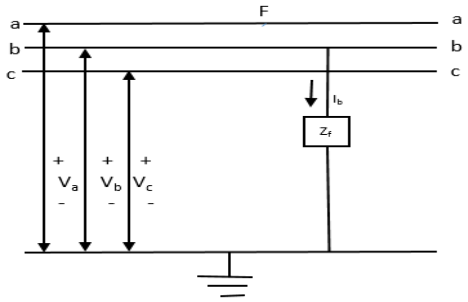

Fig1.1**:** Single line fault (LG)

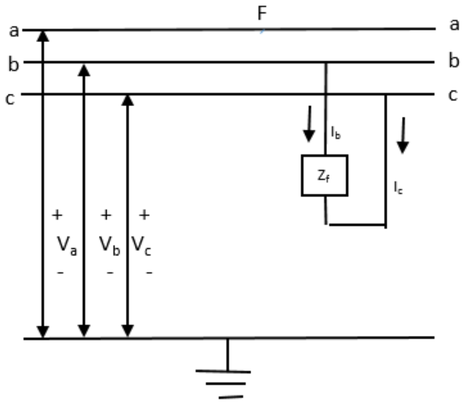

Fig 1.2: Line to line faults (LL)

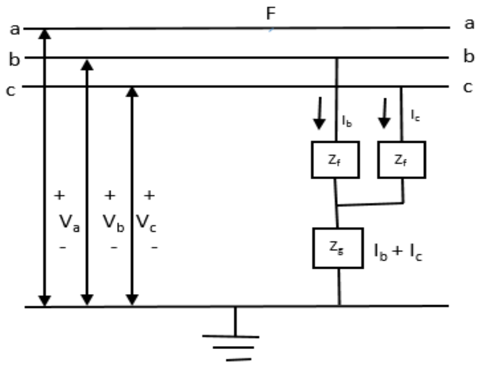

Fig 1.3: Double line to ground faults (LLG)

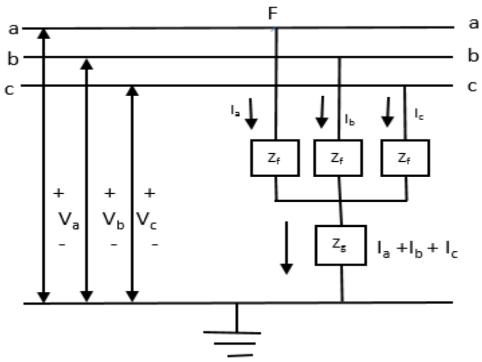

Fig 1.4: Three phase fault (LLLG)

IV. SCHEMATIC BLOCK DIAGRAM OF FAULT DETECTION SYSTEM

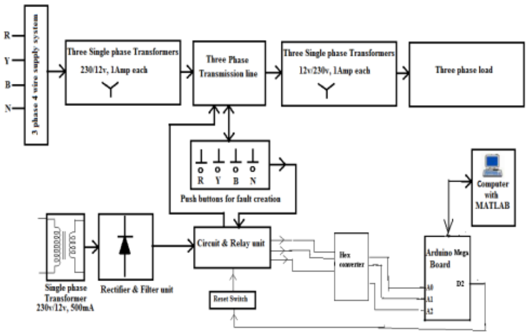

Fig 2: Block diagram of fault detection system

The figure 2 represents the block diagram for accurate fault detection, classification & takes up again the correct pattern upon analysis. A 230 V AC supply is required for the operation of the device.12 V supply is fed to the relay circuitry for its satisfactory operation. With the help of hex converter the applied AC voltage get converted into corresponding DC for applying that in a Arduino Mega 2560.Microcontroller circuit is fed by a +5 V supply and the ports are assigned their respective operations. Different types of faults are considered When there occurs any fault in the phase ,this is noticed by the microcontroller it immediately sends the signal to display the type of fault and which phases are affected simultaneously it starts the timer .If the fault persist for more than predefined period it automatically clears that faults and once again healthy condition is retained . Among the key components required to establish the project, few of them are: Power Transformer 230V/12V, 3 amps Relay (12V, 10amp), Hex converter, Push buttons, Arduino Mega2560.

A) Power transformer:
Power Transformer is the most important part of these project used to step down the alternating voltage from 230V to 12V. For this project purpose, considering six 230 V/12V step down power transformer of rating 220/12 has been used to represent a realistic representation of the three phase transmission line.

B) Arduino Mega 2560:
The Arduino Mega2560 as shown in fig 3 below is a microcontroller board based on the ATmega328 .It has 54 digital input/output pins of which 14 can be used as PWM outputs. 16 analog inputs, a 16MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It has built in function we merely have to make connection with the computer by USB wire or power it by battery or AC/DC adapter. The Mega differs from the rest by that it does not use any FTDI USB to serial driver chip .Instead it features the Atmega8U2 programmed as a USB to serial converter. The pins are used as input or output by the function pinmode(), digitalread() and digitalwrite().Each 16 analog input pins provide 10 bits of resolution thus provides 1024 different values. By defaults its measures from 0 to 5V but the upper end value can be changed with the help of analogreference() function.

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Fig 3: overview of Arduino Mega

V. RESULT

	Phase 1	Phase 2	Phase 3	Affected Phase		
1	678	0	430	Phase 2 effected	LG Fault	01-Apr-2016 19:02:25
2	676	0	429	Phase 2 effected	LG Fault	01-Apr-2016 19:02:25
3	677	0	430	Phase 2 effected	LG Fault	01-Apr-2016 19:02:24
4	679	0	430	Phase 2 effected	LG Fault	01-Apr-2016 19:02:23
5	676	0	431	Phase 2 effected	LG Fault	01-Apr-2016 19:02:22
6	676	0	431	Phase 2 effected	LG Fault	01-Apr-2016 19:02:22
7	678	0	430	Phase 2 effected	LG Fault	01-Apr-2016 19:02:21
8	676	0	431	Phase 2 effected	LG Fault	01-Apr-2016 19:02:20
9	680	0	430	Phase 2 effected	LG Fault	01-Apr-2016 19:02:20
10	679	1	431	Phase 2 effected	LG Fault	01-Apr-2016 19:02:19
11	677	2	430	Phase 2 effected	LG Fault	01-Apr-2016 19:02:18
12	677	3	432	Phase 2 effected	LG Fault	01-Apr-2016 19:02:18
13	677	3	430	Phase 2 effected	LG Fault	01-Apr-2016 19:02:17
14	678	5	430	Phase 2 effected	LG Fault	01-Apr-2016 19:02:17
15	681	6	432	Phase 2 effected	LG Fault	01-Apr-2016 19:02:16
16	681	7	430	Phase 2 effected	LG Fault	01-Apr-2016 19:02:16
17	680	8	431	Phase 2 effected	LG Fault	01-Apr-2016 19:02:16
18	677	9	430	Phase 2 effected	LG Fault	01-Apr-2016 19:02:16
19	677	12	430	Phase 2 effected	LG Fault	01-Apr-2016 19:02:15
20	677	14	432	Phase 2 effected	LG Fault	01-Apr-2016 19:02:14
21	679	16	432	Phase 2 effected	LG Fault	01-Apr-2016 19:02:14
22	0	0	0	0		01-Apr-2016 19:02:14

	Phase 1	Phase 2	Phase 3	Affected Phase		
1	647	79	106	Phase 2 effected	LG Fault	01-Apr-2016 19:11:39
2	650	115	155	none	Healthy	01-Apr-2016 19:11:38
3	658	171	230	none	Healthy	01-Apr-2016 19:11:37
4	672	258	351	none	Healthy	01-Apr-2016 19:11:36
5	685	341	411	none	Healthy	01-Apr-2016 19:11:36
6	687	399	415	none	Healthy	01-Apr-2016 19:11:34
7	685	398	412	none	Healthy	01-Apr-2016 19:11:34
8	682	394	411	none	Healthy	01-Apr-2016 19:11:33
9	677	390	404	none	Healthy	01-Apr-2016 19:11:32
10	670	385	397	none	Healthy	01-Apr-2016 19:11:31
11	658	373	386	none	Healthy	01-Apr-2016 19:11:30
12	632	355	367	none	Healthy	01-Apr-2016 19:11:29
13	597	330	341	none	Healthy	01-Apr-2016 19:11:28
14	536	291	303	none	Healthy	01-Apr-2016 19:11:27
15	418	220	230	none	Healthy	01-Apr-2016 19:11:26
16	201	112	119	none	Healthy	01-Apr-2016 19:11:25
17	0	0	0	Phase1 and Phase 2 ...	LL fault	01-Apr-2016 19:11:24
18	0	0	0	Phase1 and Phase 2 ...	LL fault	01-Apr-2016 19:11:23
19	0	0	0	Phase1 and Phase 2 ...	LL fault	01-Apr-2016 19:11:21
20	0	0	0	Phase1 and Phase 2 ...	LL fault	01-Apr-2016 19:11:16
21	0	0	0	Phase1 and Phase 2 ...	LL fault	01-Apr-2016 19:11:15
22	0	0	0	Phase1 and Phase 2 ...	LL fault	01-Apr-2016 19:11:14
23	0	0	0	Phase1 and Phase 2 ...	LL fault	01-Apr-2016 19:11:13
24	0	0	0	Phase1 and Phase 2 ...	LL fault	01-Apr-2016 19:11:11
25	0	0	0	Phase1 and Phase 2 ...	LL fault	01-Apr-2016 19:11:06
26	0	0	0	Phase1 and Phase 2 ...	LL fault	01-Apr-2016 19:11:05
27	0	0	0	Phase1 and Phase 2 ...	LL fault	01-Apr-2016 19:11:04
28	0	0	0	Phase1 and Phase 2 ...	LL fault	01-Apr-2016 19:11:03
29	0	0	0	Phase1 and Phase 2 ...	LL fault	01-Apr-2016 19:11:01
30	0	0	0	Phase1 and Phase 2 ...	LL fault	01-Apr-2016 19:10:57
31	0	0	0	Phase1 and Phase 2 ...	LL fault	01-Apr-2016 19:10:56
32	0	0	0	Phase1 and Phase 2 ...	LL fault	01-Apr-2016 19:10:54
33	0	0	0	Phase1 and Phase 2 ...	LL fault	01-Apr-2016 19:10:53
34	0	0	0	Phase1 and Phase 2 ...	LL fault	01-Apr-2016 19:10:52
35	3	0	0	Phase1 and Phase 2 ...	LL fault	01-Apr-2016 19:10:47

	Phase 1	Phase 2	Phase 3	Affected Phase		
1	0	394	0	Phase1 and Phase 3 ...	LL fault	01-Apr-2016 19:27:44
2	6	393	4	Phase1 and Phase 3 ...	LL fault	01-Apr-2016 19:27:38
3	18	394	13	Phase1 and Phase 3 ...	LL fault	01-Apr-2016 19:27:35
4	57	393	41	Phase1 and Phase 3 ...	LL fault	01-Apr-2016 19:27:31
5	287	402	211	none	Healthy	01-Apr-2016 19:27:26
6	636	420	395	none	Healthy	01-Apr-2016 19:27:22
7	635	417	392	none	Healthy	01-Apr-2016 19:27:20
8	622	407	388	none	Healthy	01-Apr-2016 19:27:18
9	557	359	331	none	Healthy	01-Apr-2016 19:27:15
10	241	158	136	none	Healthy	01-Apr-2016 19:27:12
11	0	39	0	Phase2 and Phase 3 ...	LL fault	01-Apr-2016 19:27:09
12	0	146	0	Phase1 and Phase 3 ...	LL fault	01-Apr-2016 19:27:06
13	0	395	0	Phase1 and Phase 3 ...	LL fault	01-Apr-2016 19:27:00
14	0	397	0	Phase1 and Phase 3 ...	LL fault	01-Apr-2016 19:26:57
15	0	394	0	Phase1 and Phase 3 ...	LL fault	01-Apr-2016 19:26:55
16	0	395	0	Phase1 and Phase 3 ...	LL fault	01-Apr-2016 19:26:52
17	0	393	0	Phase1 and Phase 3 ...	LL fault	01-Apr-2016 19:26:50
18	0	393	0	Phase1 and Phase 3 ...	LL fault	01-Apr-2016 19:26:43
19	0	393	0	Phase1 and Phase 3 ...	LL fault	01-Apr-2016 19:26:41
20	0	393	0	Phase1 and Phase 3 ...	LL fault	01-Apr-2016 19:26:38
21	0	395	0	Phase1 and Phase 3 ...	LL fault	01-Apr-2016 19:26:36
22	0	392	0	Phase1 and Phase 3 ...	LL fault	01-Apr-2016 19:26:35
23	0	392	0	Phase1 and Phase 3 ...	LL fault	01-Apr-2016 19:26:30
24	0	393	0	Phase1 and Phase 3 ...	LL fault	01-Apr-2016 19:26:29
25	0	392	0	Phase1 and Phase 3 ...	LL fault	01-Apr-2016 19:26:28
26	0	393	0	Phase1 and Phase 3 ...	LL fault	01-Apr-2016 19:26:27
27	0	392	0	Phase1 and Phase 3 ...	LL fault	01-Apr-2016 19:26:25
28	0	390	0	Phase1 and Phase 3 ...	LL fault	01-Apr-2016 19:26:20
29	0	392	0	Phase1 and Phase 3 ...	LL fault	01-Apr-2016 19:26:19
30	0	390	0	Phase1 and Phase 3 ...	LL fault	01-Apr-2016 19:26:18
31	0	390	0	Phase1 and Phase 3 ...	LL fault	01-Apr-2016 19:26:17
32	0	390	0	Phase1 and Phase 3 ...	LL fault	01-Apr-2016 19:26:15
33	0	390	0	Phase1 and Phase 3 ...	LL fault	01-Apr-2016 19:26:10
34	0	389	0	Phase1 and Phase 3 ...	LL fault	01-Apr-2016 19:26:09
35	0	389	0	Phase1 and Phase 3 ...	LL fault	01-Apr-2016 19:26:08

For different types of faults table is generated showing different phase values next its shows the affected phase that is the phase in which fault occurred It also shows type of fault and the date and time of occurrence of fault..After a predefined time it auto retrieves to its normal healthy condition.

VI. CONCLUSION

In this concept retrieving and updating the load parameters to the power house can efficiently identify the theft current and load interruption in transmission lines. The fault indication technology is effectively finds out the fault current by the line patrol staff in the field and rectified.

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