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## ARDUINO BASED LOW COST POWER PROTECTION SYSTEM

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### ABSTRACT

In this paper, harmonics, noises, reactive power etc. are considered as major concerns. This paper presents the development of simple power quality software for the purpose of protection of any system under fault conditions. By designing virtual instruments using LabVIEW software, the real time data of hardware are fed to the software using Arduino for interfacing with LabVIEW. The software recognizes the different types of fault conditions based on pre set values and indicates the type of fault occurred in system. It also disconnects the equipments on load side. Testing results and analysis indicate that the proposed method is feasible and practical for protection of the system during fault conditions.

**Keywords: Power quality, Fault conditions, Fault Protection, Power quality software,**

### I- INTRODUCTION

Power quality has become very important issue in the market. If the quality of power is poor, an electrical device (or load) may malfunction or not operate at all. It is very important to protect our electrical devices against different faults occurring in system. Now a day software based protection system is coming in the market and becoming more efficient and reliable [1], [2]. LabVIEW is an exceptionally beneficial working environment for making custom applications that cooperate with genuine information or signs in fields, for example, science and designing. The net after effect of utilizing an apparatus, for example, LabVIEW is that higher quality ventures can be finished in less time with less individuals included[3],[4].The monitoring of power quality parameters is very essential for good power quality. Fluctuations in power quality index are monitored and frequency spectrum analysis is used to observe the influences of fluctuations of power quality. Better understanding of power quality issues are very essential [5], [6]. Present power systems are facing heavy economic losses for poor power qualities. The cost of poor PQ is high and gradually rising. The business risk posed by PQ problems is a real one with even low tech industries exposed to serious financial losses. It has been observed that the consequences of poor PQ would have large financial impacts on a country's economy, and more initiatives are required from the concerned parties and regulating bodies to take corrective measures for maintaining better power quality[7] , [8]. In this paper, a highly reliable electrical protection system against different faults has been developed. This system disconnects the load in fault condition as shown in fig.7. Arduino may be used as an interfacing medium for labVIEW based software.

The LED (Load) turns off when there is any fault like over voltage etc. in the circuit that means the load has been disconnected from supply. Thus this software protects any system during fault successfully.

## II- POWER DEVICES PROTECTION

The investigator has designed software and arduino based protection system which very efficiently protects any system against following faults.

1. **Over voltage fault:** The alarming light will indicate if the voltage exceeds this set value.
2. **Under voltage fault:** The light will become red if voltage in line falls below the set value.
3. **Over current fault:** The light will become red if the current exceeds this set value.

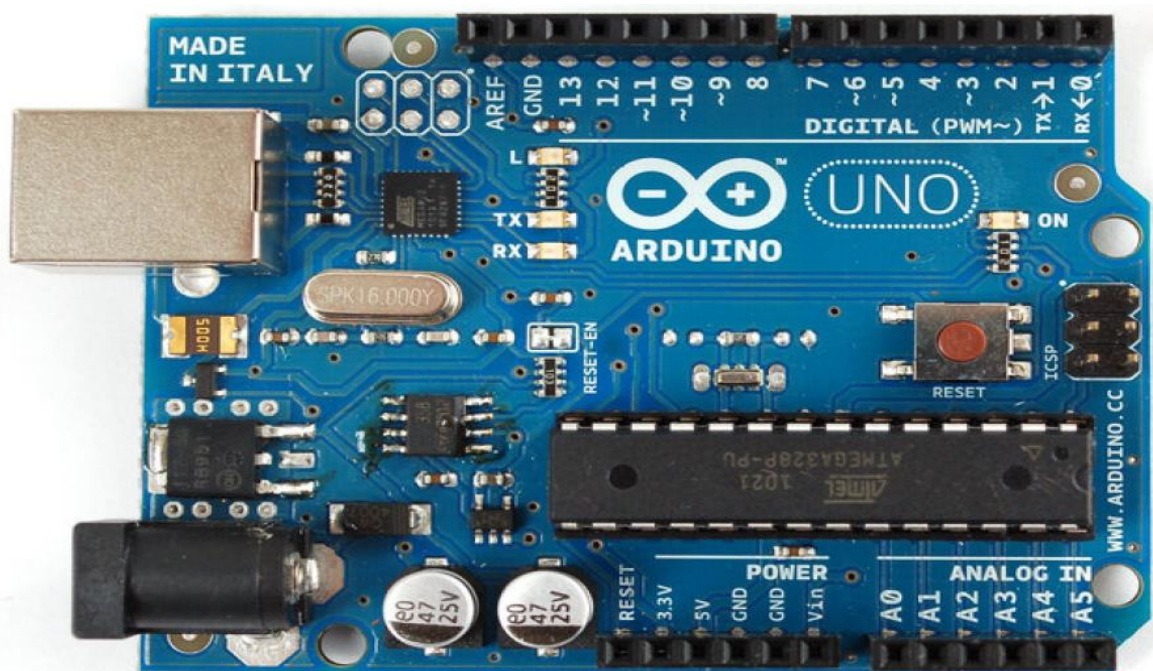
## III- TOOLS AND SOFTWARES USED

### LabVIEW

**LabVIEW** (short for Laboratory Virtual Instrument Engineering Workbench) is a system-design platform and development environment for a visual programming language from National Instruments.

### ARDUINO UNO

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board. In fig. 1, Arduino UNO is shown.



**Fig.1 Arduino UNO Chip**

## IV- PROPOSED WORK

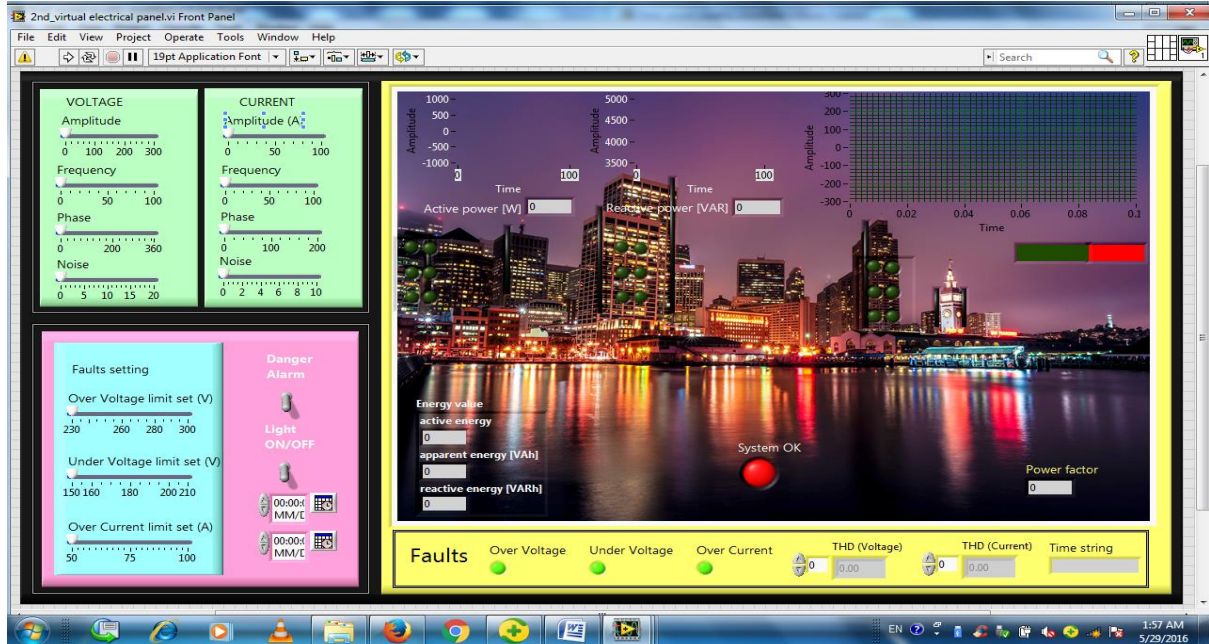
The main objectives of this work are as follows:

1. To grow minimal effort elite power quality measuring hardware/technology.
2. To create programming based (NI LabVIEW) power quality estimation system so that the expense of gadgets might be diminished ordinarily and more proficient strategy might be produced.

3. To develop the protection system against different fault conditions .

## V- SOFTWARE DEVELOPED FOR POWER PROTECTION

The investigator has developed highly powerful software which can protect any device against different types of faults. The GUI of the software is given below in fig.2.



**Fig.2 GUI of Software Developed**

In fig.2, graphic user interface of software developed is shown. In fig.3, the interfacing of LabVIEW and Arduino is shown.



**Fig. 3 Validation Using ARDUINO**

In fig. 3 and fig.4, the software operation is shown when there is no fault. The system OK light is glowing green which indicates that there is no fault. Also the lights of all three faults are glowing green in no fault condition.



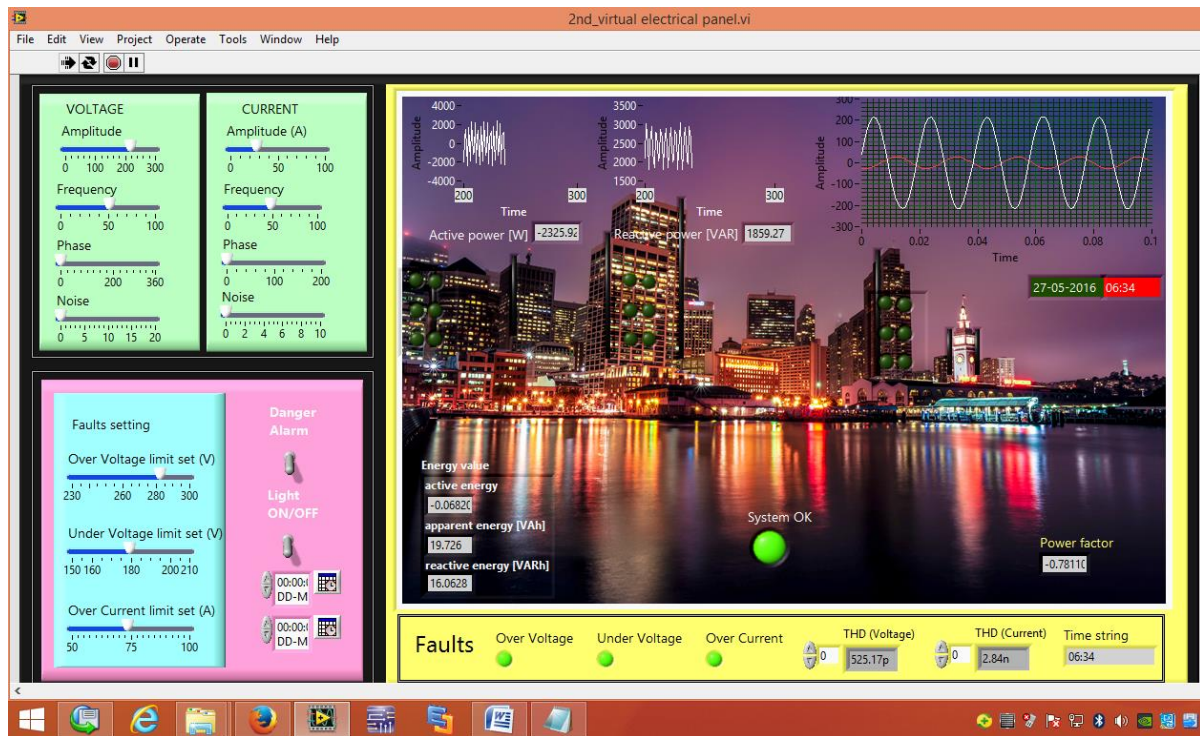


Fig.4 No Fault Condition

The block diagram of complete coding for fault protection is shown in fig.5.

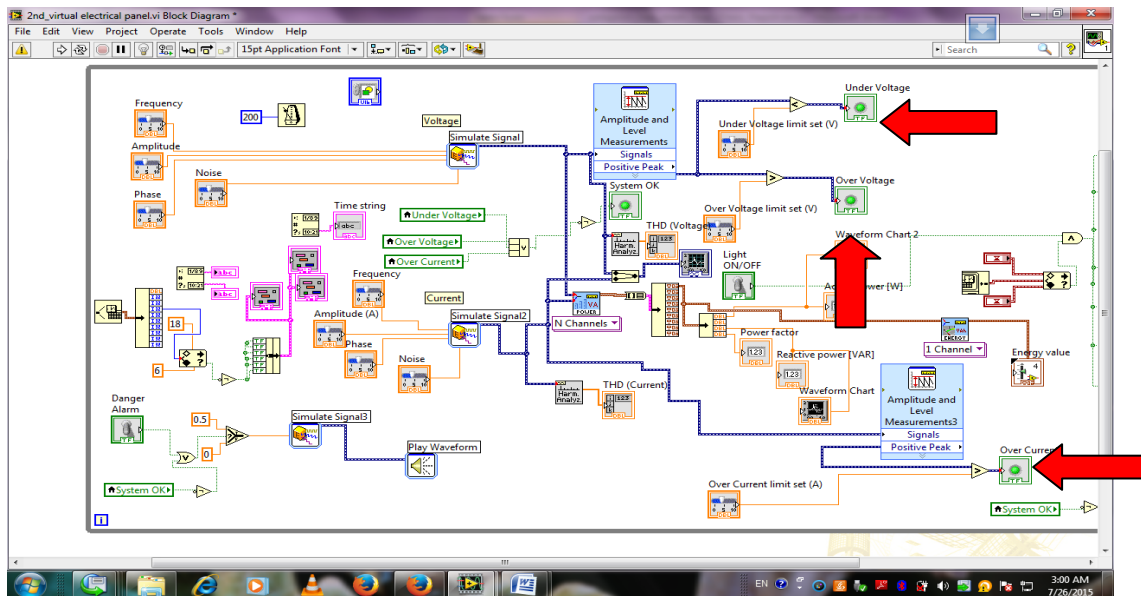
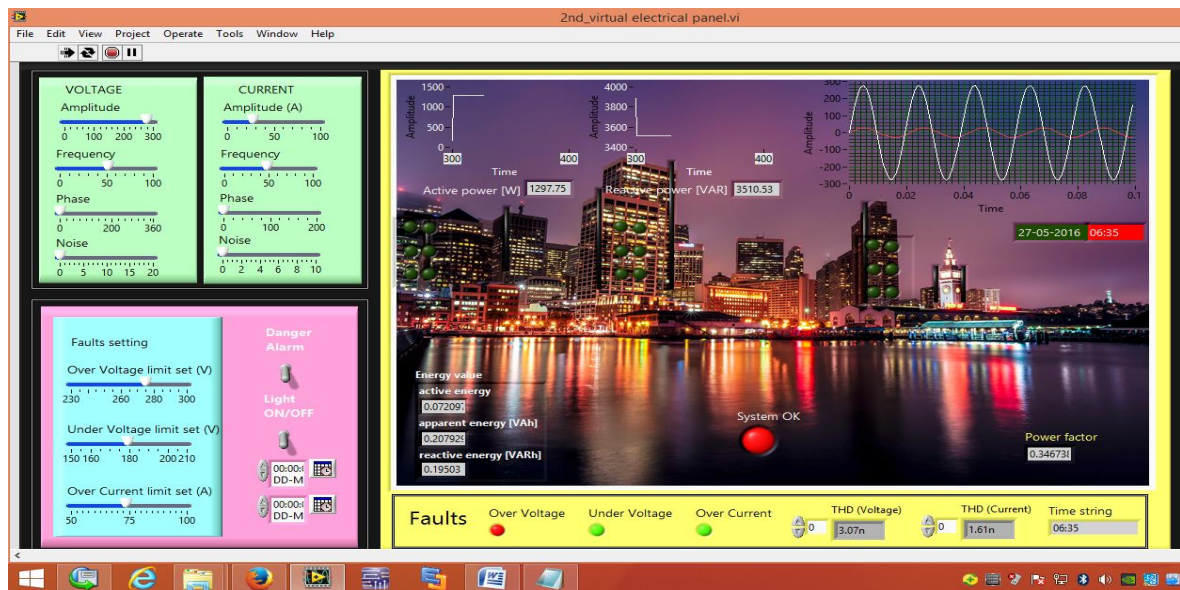


Fig.5 Coding in LabVIEW for Fault Protection

In fig. 6, over voltage protection is shown which is running successfully. The system OK light goes red in fault condition.

### (A) Over Voltage Condition



**Fig. 6 Over Voltage Fault**

The fig.7 depicts over voltage fault condition in which the LED (load) is not glowing and thus the system is protected against fault.



**Fig. 7 Over Voltage Fault (LED Load) OFF**

In fig.8, under voltage protection is shown which is running successfully. The system Ok light goes red and indicates that fault has occurred.



## (B) Under Voltage Condition

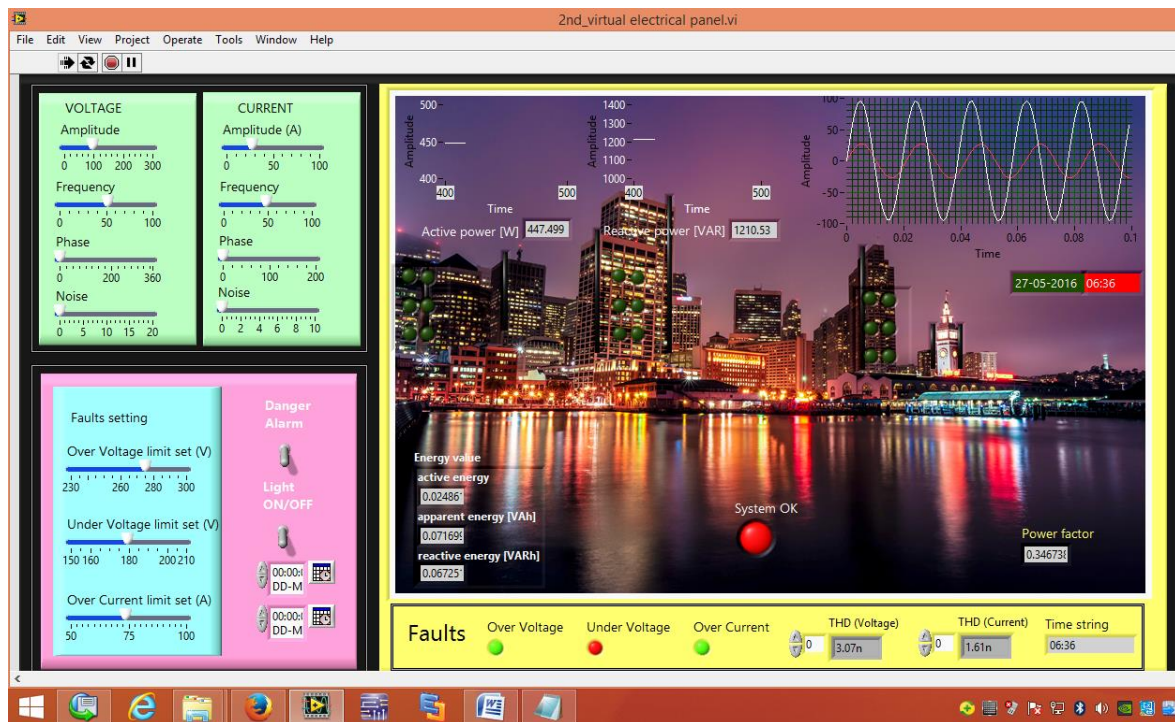


Fig. 8 Under Voltage Fault

In fig. 9, short circuit protection is shown which is running successfully. In over current fault, the system OK light goes red.

## (C) Over Current Condition

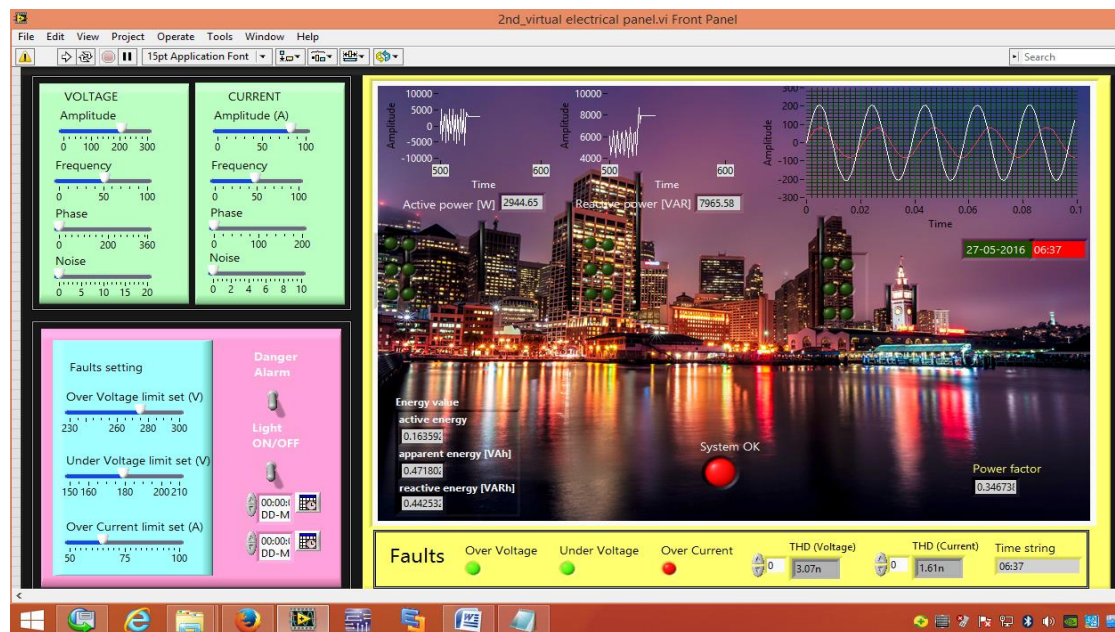


Fig. 9 Over Current Protection

## CONCLUSION

The investigator has developed highly powerful software which can be used for the protection of following faults:

- \* Over voltage fault
- \* Under voltage fault
- \* Over current fault

The protection system developed is working accurately and correctly.

The developed software is very useful for protecting any system against different faults mentioned above and by interfacing it using Arduino, very low cost power device protection system has been developed.

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