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Load Shedder Using Arduino

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Abstract : ***When the demand is more than the generation load shedding will be done to relieve stress on the utility grid and during this time, the entire area of the consumer premises including the street lights will be shut down. During such situation, most of the anti-social activities take place and it will be difficult to cope up with the emergency situation. The main idea of this paper is to manage the available power from the utility grid in a fair manner to all consumers while avoiding complete blackout. Some loads in the consumer premises are assumed to be priority loads while others are non-priority load. In the proposed smart load shedding system, consumer premises will always have a minimum illumination for dealing with emergency situation and all the street lights will be ON. A centralized control supply interrupter where the officials can connect or disconnect a consumer from the utility grid is also employed here. In addition to this the monthly bill and consumption will be displayed at the consumer premises itself by connecting a user interface with system. The main benefit of this project is supplying uninterrupted power supply to consumer without load shedding and displaying the consumption of electricity by the consumers at their premises.***

I. INTRODUCTION

The level of demand for electricity is very high as it is human necessities of life either during day time or night. Most of human daily routines such as work, economy, livelihood, healthcare and leisure depend on a constant power supply. Thus, even a temporary power failure can cause chaos, financial loss, and possible loss of life. There are several unexpected causes of power failure such as natural causes like weather, short circuit, components broken and others. As the demand of electricity has increased throughout the decade, the failure of power system will affect the daily routines. Therefore, the methods to overcome power outages are developed and delivered worldwide such as the usage of solar energy, wind energy and bio fuels energy as a backup system. Load shedding is an intentionally-engineered electrical power outage where electricity delivery is stopped for non-overlapping periods of time over geographical regions. For manually maintaining load shading periods, some man power may be employed or by using computer it can be controlled efficiently. This project demonstrates the need for a modern load shedding scheme and introduces the idea of developing a 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. The project describes possibility to apply innovation technology of Smart Grid for power system emergency automation. Operational characteristics of existing emergency automation and new suggested one are compared. The method for liquidation of drawback of existing automation is suggested. This report gives the idea about electricity and load shedding monitoring. It will be monitoring current of two zones which are being 9 diverted via the Distribution Point (DP). Two relays are also provided to cut off the loads in these two zones for load shedding or any other emergency purpose. In India the most common problem is that most DPs are open which increases the number of accidents. This project gives a clear view about the effect of load shedding strategy on interconnected power systems stability when a blackout occurs. In this report effect of load shedding strategy on restoring the power system in stable condition and preventing of other blackout in power system are studied. The system may even collapse in severe imbalances. Rapid and selective shedding of loads from the system may be a good option to restore the balance and maintain the system frequency. When a power system is exposed to a disturbance, its dynamic and transient responses are control by two major dynamic loops. These loops are:

1.1. Excitation loop (including ARDUINO): This loop will control the generator reactive power and voltage. The excitation loop is operating via the excitation current regulation.

1.2. Frequency loop (including LFC): When the system is exposed to a disturbance this loop control is the active power and frequency of system. This loop is operating via regulating of Governor.

This report gives an idea about the power system load shedding (LS) key issues and new perspectives. This report presents an overview of the key issues and new challenges on optimal LS synthesis concerning the integration of wind turbine units into the power systems. Following a brief survey on the existing LS methods, the impact of power fluctuation produced by wind powers on system frequency and voltage performance is presented. The most LS schemes proposed so far used voltage or frequency parameter via under-frequency or under-voltage LS schemes. Here, the necessity of considering both voltage and frequency indices to achieve a more effective and comprehensive LS strategy is emphasized. Then it is clarified that this problem will be

more dominated in the presence of wind turbines. The implementation of advanced instruments and application and communication requirements are described. These advanced devices can be controlled through IoT. Detaching of power is done to minimize the load being consumed 10 by the user through several substations which are connected to the main power station and the main station instructs the sub-stations to cut some of the feeders for a certain period of time and thus the shedding procedure continues. In recent years, conventional load shedding schemes have been integrated with power management systems to provide an efficient load shedding system. It can provide faster and optimal load relief by utilizing actual operating conditions and knowledge of past system disturbances.

II. RELATED WORK

The principle behind the proposed system is to manage the available power from the utility grid in a fair manner to all consumers while avoiding complete blackout. Some loads in the consumer premises are assumed to be priority loads while others are nonpriority loads. In the proposed smart load shedding system, consumer premises will always have a minimum illumination for dealing with emergency situation and all the street lights will be ON. A centralized control supply interrupter where the officials can connect or disconnect a consumer from the utility grid is also employed here. In addition to this the monthly bill and consumption will be displayed at the consumer premises itself by connecting a user interface with system. Whenever the officials send the load shedding commands to the system through cloud, it informs the consumer by a warning alarm before a particular time of load shedding. If someone uses electricity without paying their electricity bill, then there is no need of a person to go there and disconnect the consumer from the utility grid since the smart load shedding system facilitates remote disconnection and connection from the electricity authority.

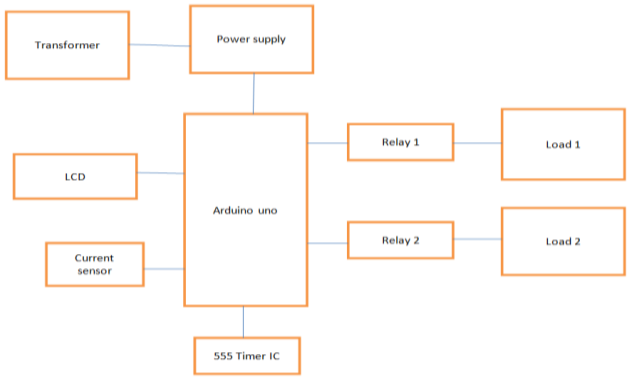

Fig. 1. Block diagram of load shedder

2.1. ARDUINO UNO

Arduino board is the heart of our system. Entire functioning of system depends on this board. Arduino reacts to the 5V then calculates the power consumption and then calculates the power consumed and also the cost. This data is continuously displayed on the display screen, so that users can visit any time and check their consumption and cost. It even reacts accordingly as programmed, to the situations like message sending during threshold value etc. 13 Figure2.1. Block diagram of load shedder ARDUNIO UNO Arduino board is the heart of our system. Entire functioning of system depends on this board. Arduino reacts to the 5V supply, keeps on counting the power consumption and then calculates the power consumed and also the cost. This data is continuously displayed on the display screen, so that users can visit any time and check their consumption and cost. It even reacts accordingly as programmed, to the situations like message sending during threshold value etc. The uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. Each of the 14 digital pins can be used as an input or output, using pinMode(), digitalWrite() and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive 20mA as recommended operating condition and has an internal pull-up resistor (disconnected by default) of 20-50k ohm. A maximum of 40mA is the value that must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller.

2.2. CURRENT SENSOR

Current sensor in this system detects electric current in the circuit, and generates a signal proportional to that current. The generated signal could be analog voltage or current or even a digital output. The generated signal can be then used to calculate and display the value of power consumption and can be used for the purpose of relay operation. 16

2.3. RELAY

A relay can be defined as a switch. Switches are generally used to close or open circuit manually. Relay is also a switch that connects or disconnected two circuits. But instead of manual operation a relay is applied with electrical signal, which in turn disconnects or connects another circuit. A relay is an electrically operated switch. In our system two circuits are controlled by relays. The circuits are load shedding circuit and disconnection and connection circuit.

2.4. LIQUID CRYSTAL DISPLAY

LCD is a type of display used in digital watches and many portable computers. LCD displays utilize to sheets of polarizing material with a liquid crystal solution between them. An electric current passed through the liquid causes the crystals to align so that light cannot pass through them. LCD technology has advanced very rapidly since its initial inception over a decade ago for use in lap top computers. Technical achievements has resulted in brighter displace, higher resolutions, reduce response times and cheaper manufacturing process. The liquid crystals can be

manipulated through an applied electric voltage so that light is allowed to pass or is blocked. By carefully controlling where and what wavelength (color) of light is allowed to pass, the LCD monitor is able to display images. A backlight provides LCD monitor's brightness. Over the years many improvements have been made to LCD to help enhance resolution, image, sharpness and response times. One of the latest such advancement is applied to glass during acts as switch allowing control of light at the pixel level, greatly improving LCD's ability to display small-sized fonts and image clearly. Other advances have allowed LCDs to greatly reduce liquid crystal cell response times. Response time is basically the amount of time it takes for a pixel to "change colors", in reality response time is the amount of time it takes a liquid crystal cell to go from being active to inactive.

2.5. CRYSTAL OSCILLATORS

A crystal oscillator is an electronic circuit that uses the mechanical resonance of a vibrating crystal of piezoelectric material to create an electrical signal with a very precise frequency. This frequency is commonly used to keep track of time (as in quartz wristwatches), to provide a stable clock signal for digital integrated circuits, and to stabilize frequencies for radio transmitters and receivers. The most common type of piezoelectric resonator used is the quartz crystal, so oscillator circuits designed around them were called "crystal oscillators". A miniature 4 MHz quartz crystal enclosed in a hermetically sealed HC-49/US package, used as the resonator in a crystal oscillator.

III. PROPOSED SYSTEM

The following softwares are used:

3.1. EAGLE

EAGLE (Easily Applicable Graphical Layout Editor) by Cad soft is a flexible and expandable EDA schematic capture, PCB layout, auto router and CAM program widely used since 1988. EAGLE is popular among hobbyists because of its freeware license and rich availability of component libraries on the web.

3.1.1. Schematic Capture

EAGLE contains a schematic editor, for designing circuit diagrams. Parts can be placed on many sheets and connected together through ports.

3.1.2. PCB layout

The PCB layout editor allows back annotation to the schematic and auto-routing to automatically connect traces based on the connections defined in the schematic. EAGLE saves Gerber and PostScript layout files and Excellon and Sieb & Meyer drill files. These standard files are accepted by many PCB fabrication companies.

3.2. ARDUINO

Arduino is a source single, designed to make the process of using electronics in multidisciplinary projects more accessible. The hardware consists of a simple open hardware design for the Arduino board with an Atmel AVR processor and on-board I/O support. The software consists of a standard programming language and the boot loader that runs on the board. Arduino hardware is programmed using a Wiring-based language (syntax + libraries), similar to C++ with some simplifications and modifications, The project began in Ivrea, Italy in 2005 to make a device for controlling student-built interaction design projects less expensively than other prototyping systems available at 27 the time. As of February 2010 more than 120,000 Arduino boards had been shipped. Founders Massimo Banzi and David Cuartielles named the project after a local bar named Arduino. The name is an Italian masculine first name, meaning "strong friend". The English pronunciation is "Hardwin", a namesake of Arduino of Ivrea. The Arduino IDE is a cross-platform application written in Java, and is derived from the IDE for the Processing programming language and the Wiring project. It is designed to introduce programming to artists and other newcomers unfamiliar with software development. It includes a code editor with features such as syntax highlighting, brace matching, and automatic indentation, and is also capable of compiling and uploading programs to the board with a single click. There is typically no need to edit make files or run programs on the command line. The Arduino IDE comes with a C/C++ library called "Wiring" (from the project of the same name), which makes many common input/output operations much easier. Arduino programs are written in C/C++, although users only need define two functions to make a runnable program:

Setup() – a function run once at the start of a program that can initialize settings

loop () – a function called repeatedly until the board powers off.

IV. ALGORITHM

4.1. Headers Includes and constants definitions

In this part, header files (.h) are included into your source code. Those headers files can be system headers to declare the name of SFRs, to define new constants, or to include mathematical functions like trigonometric functions, root square calculations or numbers approximations. Header files

can also contain your own functions that would be shared by various programs.

4.2. Variables declarations

More precisely, this part is dedicated to 'Global Variables' declarations. Variables declared in this place can be used anywhere in the code. Usually in microcontroller programs, variables are declared as global variables instead of local variables, unless you are running short of RAM memory and want to save some space, so we use local variables, whose values will be lost each time you switch from a function to another. To summarize, global variables as easier to use and implement than local variables, but they consume more memory space.

4.3. Function body

Here you group all your functions. Those functions can be simple ones that can be called from another place in your program, as they can be called from an 'interrupt vector'. In other words, the sub-programs to be executed when an interrupt occurs is also written in this place.

4.4. Initialization

The particularity of this part is that it is executed only one time when the microcontroller was just subjected to a 'RESET' or when power is just switched ON, then the processor continues executing the rest of the program but never executes this part again. This particularity makes it the perfect place in a program to initialize the values of some constants, or to define the mode of operation of the timers, counters, interrupts, and other features of the microcontroller.

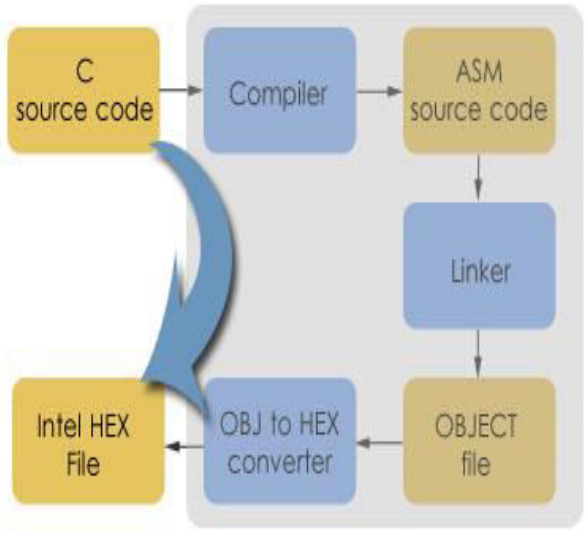

Fig. 2. Code generation process

V. CONCLUSION AND FUTURE WORKS

This article proposed a new approach of load shedding by using Arduino UNO as microcontroller and Node MCU as interface with the users in the purpose of the flexibility of the customers to monitor their current bill, power consumptions and load shedding period can be displayed with an LCD provided at the consumer side. If the consumer does not pay the monthly electricity bill the officers can remotely disconnect the power supply without going to the consumer house. We know that most of the anti-social activities are take place during load shedding and it will be difficult to cope up with the emergency situations. Hence, a system for providing minimum illumination for dealing with emergency situations

REFERENCES

[1] I.Şerban, C.P. Ion, C. Marinescu, Frequency Control and Unbalances Compensation in Autonomous Micro-Grids Supplied by RES, The IEEE International Electric Machines and Drives Conference, CD Proceedings, Turkey, May 2007.

[2] R. Sebastian, J. Quesada, Distributed Control System for Frequency Control in a Isolated Wind System, ScienceDirect – Renewable Energy, 31, 3, pp. 285–305 (2006).

[3] I. Şerban, C. Ion, C. Marinescu, M. N. Cîrstea, Electronic Load Controller for StandAlone Generating Units with Renewable Energy Sources, The 32nd annual conference of the IEEE Industrial Electronics Society – IECON 06, Paris, France, 2006, pp. 4309–4312.

[4] C.S. Chang, W. Fu Area load-frequency control using fuzzy gain scheduling of PI controllers Electr. Power Syst. Res, 42 (1997), pp. 145–152

[5] Z.M. Ai-Hamouz, Y.L. Abdel-Magid Variable-structure load-frequency controllers for multi area power systems Int. J. Electr. Power Energy Syst, 15 (5) (1993), pp. 23– 29

[6] M.Deb , A.Das , G.Deb, Control of Voltage and Frequency of a Wind Electrical System using Frequency Regulator, International Journal of Engineering Research & Technology (IJERT) Vol. 3 Issue 3, March – 2014.

[7] Juan M. Ramirez, Emmanuel Torres M, An Electronic Load Controller for SelfExcited Induction Generators.

[8] I. Şerban, C. Marinescu Power Quality Issues in A StandAlone Microgrid Based On Renewable Energy, Revue Roumaine Des Sciences Techniques - Serie Électrotechnique Et Énergétique ·January 2008.