Proceedings of "National Conference on Emerging Trends in Science and Advances in Engineering"
Organized by Phaltan Education Society's College of Engineering Phaltan, www.coephaltan.edu.in
International Journal of Innovations in Engineering Research and Technology [IJIERT]
ISSN: 2394-3696, Website: www.ijiert.org, July, 2023

Demand side Load Management Using AT 89s52 Microcontroller with renewable energy

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Abstract:

High power consumers, such as industries, require substantial electricity loads for their production processes. They are assigned a maximum demand limit by the electricity board, which represents the highest power drawn from the grid by the consumer during any 30-minute interval within the billing period. It is the responsibility of these consumers to ensure that their power consumption remains within this limit. Failure to do so results in significant penalties. Monitoring consumption manually is challenging and prone to errors, leading to additional charges on bills, which can be substantial. Therefore, controlling the maximum demand is crucial. To address this issue, the industry has categorized its loads as vital and non-vital. We propose a system that effectively manages maximum demand. When the demand exceeds the predefined maximum value, a sensor detects it and sends a signal to a microcontroller, specifically the AT89S52 model. The microcontroller then transfers non-vital loads from the main power supply (MSEB) to renewable energy sources instead of turning them off completely. The system utilizes renewable energy generated from solar panels and/or windmills. By doing so, we can ensure that the maximum demand remains within safe limits without cutting power to non-vital loads.

Introduction:

Voltage and frequency stability are critical concepts in the operation of a power system. Instability in these parameters poses significant threats to the overall security of the system. Factors such as short circuits, increased load, and insufficient generation capacity can disrupt both voltage and frequency, potentially leading to a complete system blackout. As the demand for electrical energy continues to rise in developing countries like India, efficient energy management becomes paramount. It is crucial to ensure that every load connected to the grid receives an adequate energy supply. Currently, there is an imbalance between the

demand for and supply of electrical energy. In this paper, we propose a system that manages electrical loads by categorizing them as vital or non-vital. Existing solutions typically involve turning off non-vital loads when the system approaches maximum demand in order to maintain the limit. However, we have developed an innovative solution that eliminates the need to shut down non-vital loads. Instead, we leverage renewable energy sources, such as solar panels and windmills, to address this challenge. The energy generated from these sources is intelligently stored in batteries and used during periods of maximum demand. By shifting non-vital loads to renewable energy, we gain better control over the maximum demand while ensuring a continuous power supply.[1]

Design of the system:

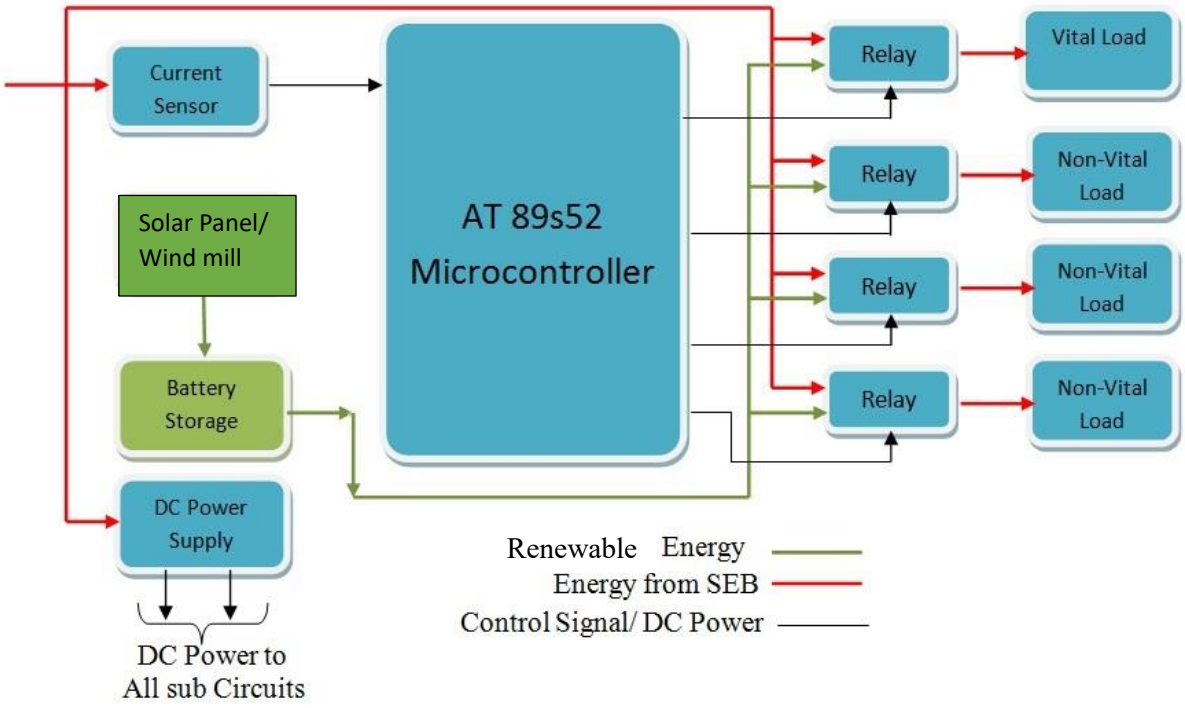

Figure 1 Block diagram of Maximum Demand Controller Using AT89s52

Working:

Here energy generated from solar panel and wind mill is stored inside batteries. The incoming supply is given to all loads through CT. The priority loads are controlled through relays connected to port P2. The maximum demand is sensed with the help of CT. The output of CT is interfaced with the microcontroller at pin P1.1 through the signal conditioner circuit. If the

CT output exceeds the set value, the Load1 connected to pin P2.0 is shifted on renewable energy. The microcontroller then again compares CT output to the set value of maximum demand. If it finds the maximum demand greater than set value then, Load2 connected to pin P2.1 is shifted on renewable energy. The process is carried out continuously. If the maximum demand is greater than set value after shifting of load4 then, microcontroller trips the critical load itself. If microcontroller finds that the CT output is less than set value of maximum demand then, the loads connected to port P2 are turned according to reverse priority.[2]

Flow chart

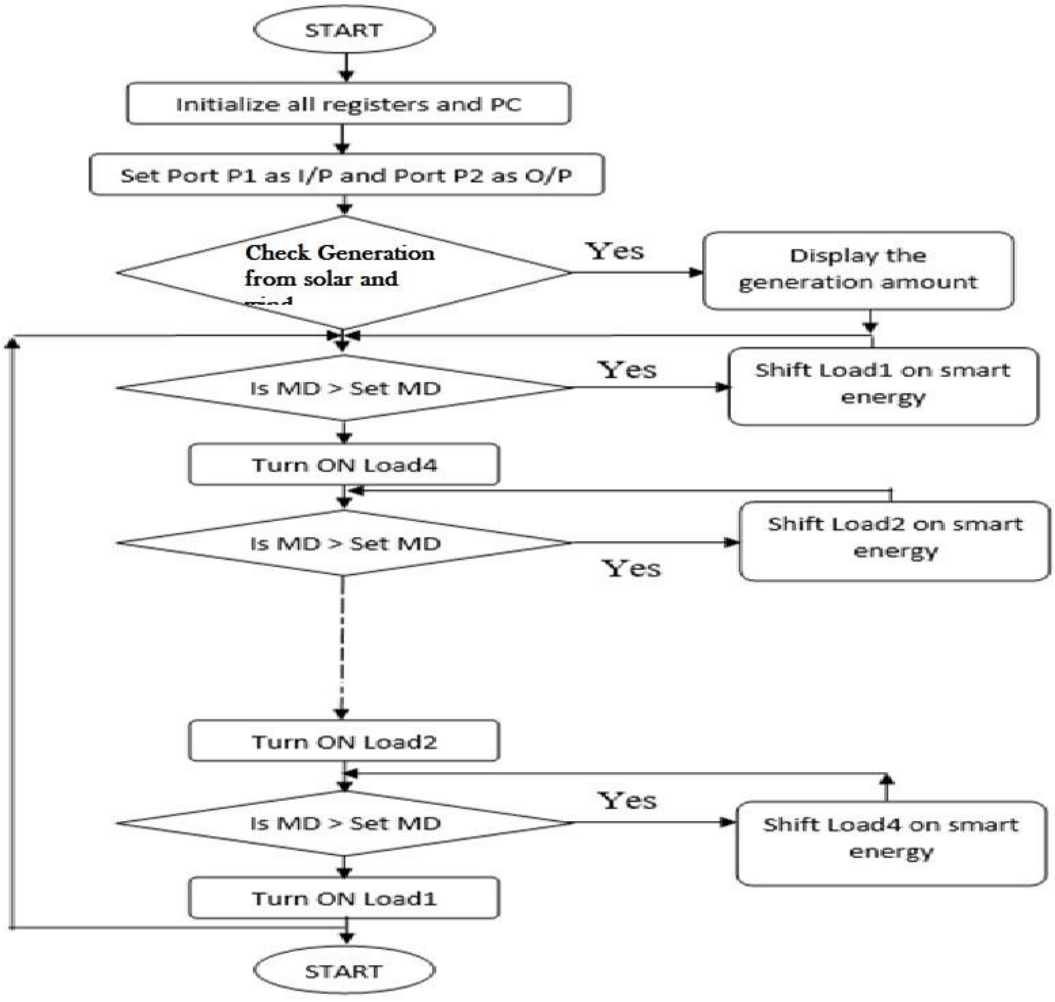

Figure 2 Flowchart of Maximum demand controller using AT 89s52

Controller:

The microcontroller used here is AT 89s52 and is having features like

- Compatible with MCS-51® Products
- 4K Bytes of In-System Programmable (ISP) Flash Memory – Endurance: 1000 Write/Erase Cycles
- 4.0V to 5.5V Operating Range
- Fully Static Operation: 0 Hz to 33 MHz
- Three-level Program Memory Lock
- 128 x 8-bit Internal RAM
- 32 Programmable I/O Lines
- Two 16-bit Timer/Counters
- Six Interrupt Sources
- Full Duplex UART Serial Channel
- Low-power Idle and Power-down Modes
- Interrupt Recovery from Power-down Mode
- Watchdog Timer
- Flexible ISP Programming (Byte and Page Mode) [3]

Conclusion

The aim of this system is to design and implementation of "Demand side Load Management Using AT 89s52 Microcontroller with renewable energy". It senses the maximum demand with the help of Current Transformer, and maintains the continuous supply to the critical load by shifting low priority loads on to a renewable energy, instead of turning it OFF. The system is applicable at the firms and organisations where two-part tariff is applied.

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