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DESIGN AND DEVELOPMENT OF SMART ENERGY SAVER WITH PROTECTION FOR DOMESTICAL AIRCONDITIONERS

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ABSTRACT:

Embodiments of the present product relate to a smart voltage protector cum energy saver system. Specifically, the present invention relates to a stabilizer cum power saving system that senses the temperature, displays the current temperature and saves energy by controlling power to the air conditioner unit with reference to the upper and lower limits of temperature set by the user. The product is designed using advance microcontroller with specific indications to the end user. The product is designed in replacement for conventional voltage stabilizers in market. The advanced features that this product has (1) it protects the air conditioner unit from low and high voltage problems in fraction of seconds by disconnecting the load. (2) It also protects the load from over load and short circuit problems. (3) Its human interface system is designed with four simple buttons for entering low and high temperature limits by the end user. (4) The product is designed to display current room temperature, low limit of temperature for which the air conditioner to turn off and high limit of temperature for which the air conditioner to turn on.The product can be further developed by including user customizable voltage limits, current limits for protection and can also be linked with IOT system for turning ON/OFF air conditioner anywhere from the world .

INTRODUCTION:

All electrical and electronic systems are designed and manufactured to operate at maximum efficiency with a given supply voltage, called the nominal operating voltage. For various reasons the voltage of the energy distribution does not remain constant, showing considerable fluctuations in the nominal value, which leads to the apparatus, not only a loss of efficiency (sometimes even the impossibility of operation), but also a significant increase in failure rate. The smart energy saver is an electronic device responsible for allowing the supply to the load only when the voltage of the electrical power supply is within healthy limits (Low Limit: 180Volts and upper limit: 270Volts) to provide a stable and secure power supply to equipment, allowing for a stable voltage and protecting the equipment from most of the problems due to the voltage fluctuations.

The problem in usage of Air-conditioning units in countries like India where most of the population is middle class, is that most of the end users will not run air conditioners (AC) for entire night. They will keep on switch ON and OFF of AC as per their comfort which affects the health of customer in a negative way with lot of disturbance in sleep. All the efforts were made to resolve above mentioned problems at affordable price range So that

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the consumer can use it as plug and play device for A.C.'s. Apart from the afore mentioned problems, other problems include increase in the operational cost of the hotels due to the continuous usage of the AC by the guests at the hotel irrespective of the need of Air Conditioners.

Prior research:

Before developing the device, the existing system in domestic air conditioners is studied. The domestic air conditioners(Non-inverter Model) will work based on the coil temperature present in indoor unit. The customer will turn on the air conditioning unit and set for desired temperature. The controller inside the air conditioner unit will first senses the room temperature, if the room temperature is above the set limit the controller will turn on compressor after waiting for three minutes to avoid voltage fluctuations. The controller maintain the on state of the compressor until the coil temperature reaches below $1^{O}C$ of the set limit. once the temperature is below the limit, the controller will turn off the compressor. Due to high temperature the room temperature will keep on increasing and reaches the set limit. once the coil temperature reaches $1^{O}C$ above the set limit, the controller will turn on the compressor for cooling the environment. This cyclic process is done by controller for maintaining the room temperature constant. In this process the compressor which is made of induction motor keeps turns on and off for every $2^{O}C$ temperature difference. This makes the air conditioner unit to consume more and more energy from utility grid. The domestic air conditioners(Inverter Model) will work by adjusting the power supply frequency of the compressors. The compressor will run continuously at lower speeds and when needed gas pumping, the compressor is made to run at high speeds. This will reduces the power consumption by around 7% when compared with non inverter model air conditioners. In this model also the speed of the compressor will vary for every $2^{O}C$ temperature difference. But as per survey, in India most of the people will feel comfort while sleeping in the temperature range of $25^{O}C$ to $30^{O}C$. The requirements for developing the product are (1) To protect air conditioner unit from high and low voltages (2) To protect the air conditioner unit from over current (3) The customer can adjust lower and upper temperature for room (4) To display current room temperature (5) To design a simple human Interface Mechanism very simple to be used by any customer.

PROPOSED SYSTEM:

The Shift register is used for displaying the current temperature, lower limit and upper limit of the room temperature. The temperature is displayed using six seven segment led's. The functional block diagram of the 8bit shift register is shown below in Figure 1.

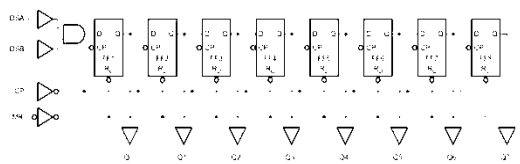

Figure 1: Functional block diagram of Shift register

The product is designed using 16 MHz advanced STM8 core with Harvard

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architecture based microcontroller. The controller supports 8 Kbyte Flash memory; data retention 20 years at 55 °C after 100 cycles. The block diagram of the controller is shown below figure1.

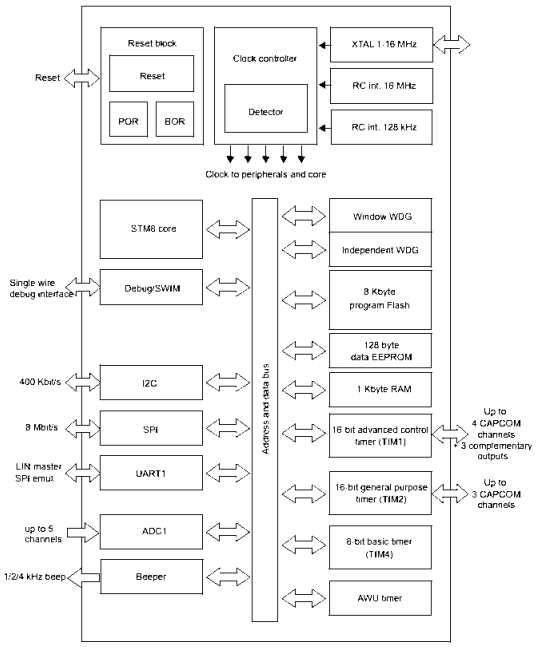

Figure 2: Block diagram of Microcontroller

NTC 10K, negative thermal coefficient temperature coefficient thermistor is used for sensing the room temperature. This is the standard thermistor used in all air conditioning units. Four momentary buttons are provided for changing the temperature limits by the consumer. A sugar cube relay is also provided for turning ON/OFF the device based on the temperature limits. The functional flowchart of the system is shown in figure3.

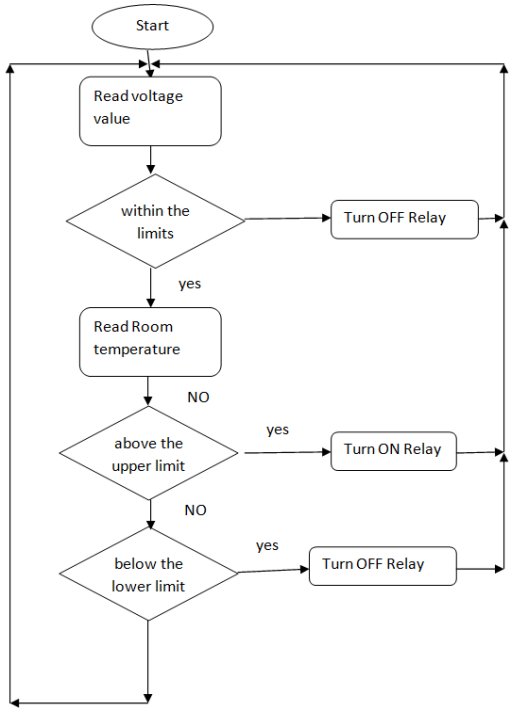

Figure 3: Functional Flow chart of the device

IMPLEMENTATION:

The entire project design work is simulated in proteus software. The programming code for the product was done in embedded C. The figure.4 represents the screenshot of the proteus software simulation.

The below figure.5 represents the product outer body.

Figure 5: Product Outer Body

The figure.6 represents the final product designed and installed in lab setup.

The product is designed to connect in series with supply and load as stabilizer show in figure7.

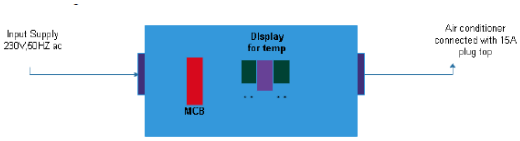

Figure 8: Connection diagram

CONCLUSION:

The product was designed as per the requirement. the work is published in indian patent website with No: **201841043204.** The product was tested in real time environmental conditions. The test results are found to be satisfactory with a saving of 15% to 30% based on season and temperature range. The longer the range longer will be the saving. The product is commercially marketed by HK Technologies, Guntur. Further research is going for further implementing features and to make it as IOT device.

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