DESIGN AND IMPLIMENTATION OF SMART SWITCHBOARD

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Abstract : Internet of Things (IoT) conceptualizes the idea of remotely connecting and monitoring of electrical appliances through the Internet. Now days, all the things are being automated, things like IoT are being introduced to world. In our project we are replacing conventional switch with smart switch board user can access the appliances remotely with android application/webpage. Problems of conventional switch board are solved by using soft switches and real time controlling and monitoring of electrical appliances through Wireless Fidelity (Wi-Fi). Microcontroller calculates the power consumption, voltage applied to the controller board and current consumed by the load and display on LCD and also gives indication on android application/Webpage when the user is not present in the house.

IndexTerms - Wireless fan speed control, Voltage and current monitoring, Energy meter, Wi-Fi Module, Android application/Webpage.

I. INTRODUCTION

Home Automation is a concept which involves real time controlling and monitoring of various electrical appliances. The Microcontrollers are programmed to perform specific tasks such as, reading sensor values, controlling appliance and providing information to user. The modules will be communicating through the UART serial port and I2C protocol to the Wi-Fi module. The additional benefits of this methodology are its security features which include some more features such as Fire Alarm System, Wireless speed control of an induction motor [1].

Conventional switch boards consist of mechanical switches for switching loads and regulators for controlling motor appliances. This board do not provide a wireless control to the user, without a physical contact user cannot operate the board. There are few other drawbacks of these boards such as they do not calculate the power consumption of the load connected to the board; they do not have the timely control of the load.

In order to solve all the above mentioned problems and to provide a solution that will fulfill the requirements of the users. We have designed and developed a switch board that uses soft switching devices which can control the load with the features such as wireless AC fan speed control, Real time load switching, Timely load control, Power consumption monitoring system. The Wi-Fi technology provides an excellent medium through which multiple devices can be connected to one network. The benefit of this inter-linkage is the concurrent monitoring and controlling of smart devices. The Wi-Fi module sends data to the MQTT server where it is stored and can be retrieved for future use. The choice of hardware elements in devising the system is the key in fixing its overall cost. Well, while automating these things one should take care of safety parameters.

II. METHODOLOGY

To automate the conventional switchboard system it should be interfaced with the microcontroller, one will need a power supply to make that microcontroller working. The power supply will be used to power on the whole controlling circuitry which will be designed according to the required specifications.

The concept of controlling AC fan speed wirelessly using Wi-Fi module is one of the key feature. The real time controlling of the load from the android app/webpage is also provided as it gives the indications of the load in case if user is not available in the house [5]. The energy meter provides the energy consumption of the load this is helpful for user to monitor the power consumed by each of the load. The Wi-Fi module sends data to the MQTT server where it is stored for future use [3]. It houses the ESP8266 Wi-Fi module connected to the web server with a designated IP address. Mobile commands will be given to the Message Queuing Telemetry Transport (MQTT) server which is accessed by the user on the android application/webpage.

The switching of the appliances and wireless controlling speed of fan connected to the load will be done with the TRIAC's and Wi-Fi Module, here will be an wireless interface with the switchboard via webpage which will provide commands to the board through internet or Wi-Fi [3]. The switching of the devices isn't hazardous because the sparkling of the conventional system due to mechanical switches is replaced by the soft switches. Current sensors on the board provide indications to user. Microcontroller will have a track on the values of these sensors, if any casualty occurs then according to the programming microcontroller will inform the user. The status of the current load will be provided to the user on the Liquid Crystal Display (LCD) screen.

III. BLOCK DIAGRAM

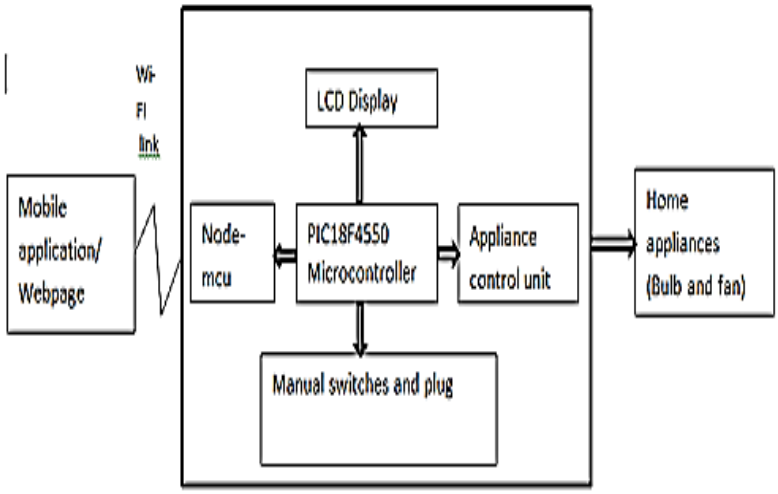


Fig 1: Block diagram of proposed system

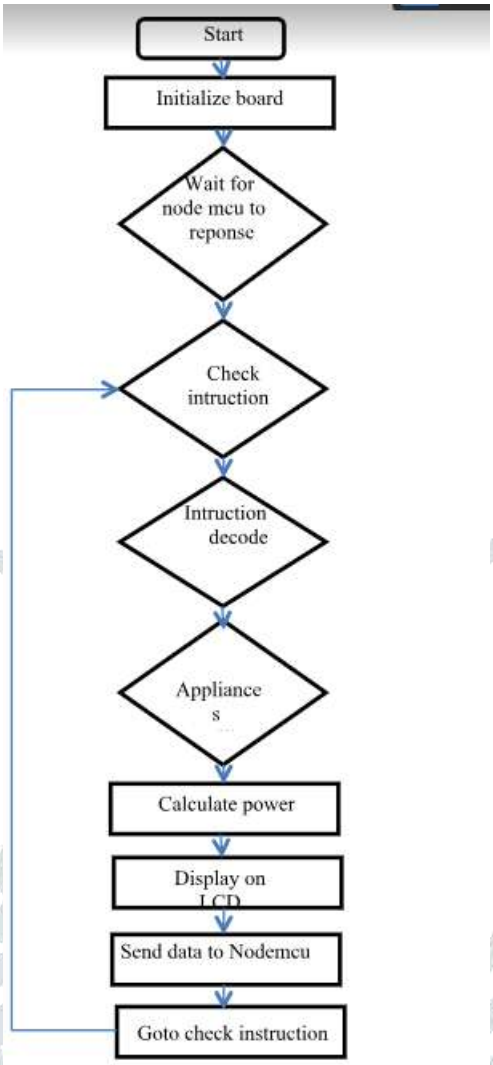
To automate the conventional switchboard system it is interfaced with the microcontroller. Power supply is given to the microcontroller to control the whole circuit. Conventional switchboards consist of mechanical switches for switching loads and regulators for controlling appliances. These mechanical switches are replaced by push to on off button for soft switching of load. The signal from the push to on off button will be applied to a microcontroller for further processing. After receiving digital signal from the push to on off button switch controller will trigger the TRIAC for AC switching, as the TRIAC will not suffer from bouncing or sparking while switching from off state to on state there will be no any possibilities of danger [2].

The switching of the appliances and wireless controlling speed of fan connected to the load will be done with the TRIAC's and Wi-Fi Module; there will be an wireless interface with the switchboard via webpage which will provide commands to the board through internet or Wi-Fi. The real time controlling of the load from the android app/webpage is also provided as it gives the indications of the load in case if user is not available in the house. Mobile commands will be published to the MQTT server which is accessed by the user on the Smartphone via the android application. The energy meter provides the energy consumption of the load this is helpful for user to monitor the power consumed by each of the load.

The energy meter measures the voltage being applied to the circuit and the current consumed by the load with the help of the measured voltage and current; the microcontroller will calculate the power consumed by the load. Once the current and voltage is measured there is no need of any extra circuitry for calculating the power consumption as it is done by the program itself.

Voltage measurement is carried out by down converting the AC voltage to a desirable range for the microcontroller. The down converted AC signal is given to the Analog to Digital Converter (ADC) module of the microcontroller which converts the signal into a digital value so that it can be processed further. The digital result is processed in such a way that it will display the value of the AC voltage on the LCD display of the system. The current sensing is done by the Hall Effect based current sensor WCS-1700. This sensor consists of an on board Hall Effect transducer which generates an equivalent analog voltage output. Mathematical conversions are done by programming then analog to digital conversion is done the microcontroller to display the current measurements. Hence, power in VA can also be obtained.

IV. FLOW CHART



V. TEST & RESULTS

As per shown in above block diagram (Figure1), In this working module we have used current and temperature sensor to provide information such as current and temperature to the user this parameter will be displayed on LCD and also on android application/Webpage. We have used Wi-Fi module to control fan speed and electrical appliance through internet by android application and manually.

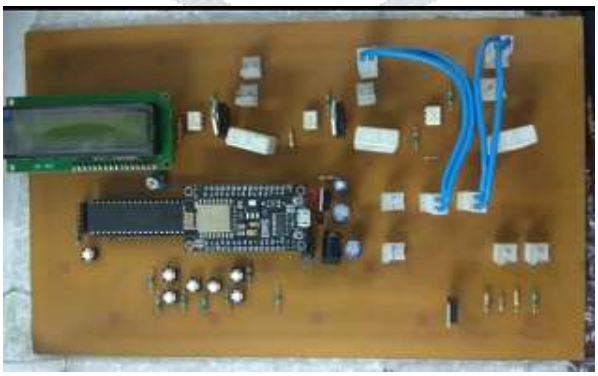


Fig3: working model

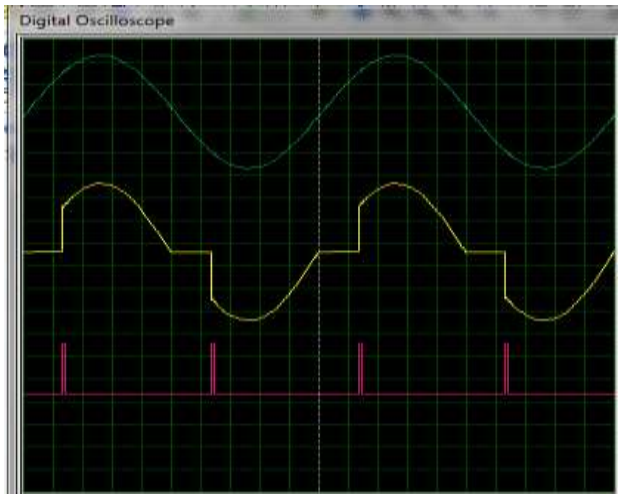


Fig4: Triac triggering and phase control simulation waveform

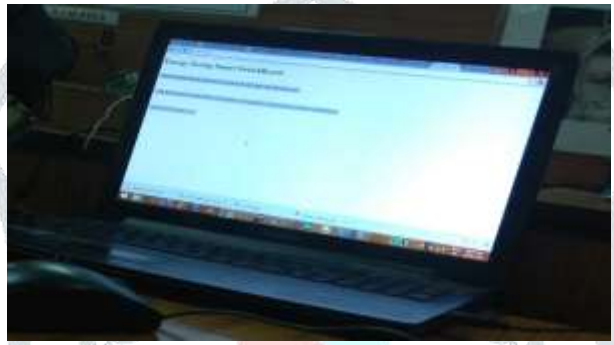


Fig5: Webpage

Fig6: voltage and current readings

VI. CONCLUSION

In this paper we described the design, implementation, of IoT based smart switch board using PIC microcontroller, Wi-Fi module, current sensor and android application/webpage. Comparing other existing device this system has low cost, low power consumption and easy to maintain. By using references mention below we have studied that home appliance can be made fully automated.

VII. REFERENCES

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