Smart Socket for Eliminating Phantom Power

Rajesh Ramachandran, Suryaprakash Shanmugasundaram, BalaKumar.A.P

Abstract: ***In our modern age, many people have multiple devices such as laptops, tablets, and smartphones, all of which needs to be frequently charged to keep us connected. This has led to multiple chargers being left at home and at the office, often plugged into the wall with the cord conveniently waiting to charge your phone for next time. Chargers continually draw power from a wall socket, even when your device is not attached, and while this amount could be as little say 0.25 Watts of energy, imagine that compounded over 4-5 devices for a year will lead to 2190 Wh per year for a single user. According to Telecom authority of India, Tamil Nadu has 71.81 million smartphone subscribers [1] so this phantom power consumption must be accountable. Additionally standby loads are found to be next phantom power consumers which consumes power when appliance switched off or not performing its primary functions. This proposed work will eliminate wastage of power at standby and prevent overcharging of mobile phones furthermore turn off scheduler is incorporated for planned operated loads.***

Keywords: Standby loads, Smart socket, Over charging, Demand, Energy saving

I. INTRODUCTION

In India, As per Ministry of Statistics and Programme implementation 2017 report, the total installed capacity is 3,02,088 MW where thermal power plants accounted for an overwhelming 73.50% of the total installed capacity, other renewable Sources (excluding hydro) accounting for 12.62% of the total installed capacity[2]. The share of Hydro and Nuclear energy was only 12.23% and 1.65% of total installed capacity. Non-utilities accounted for 13.78% (48279 MW) of the total installed electricity generation capacity [2]. In consideration with all other production the thermal power plant accounts the most power generation which affects the environmental directly, but for meeting the base demand thermal power plants are deliberated to be the best source of energy. According to National Renewable Energy Act; it focus in promoting the production of energy from renewable energy sources in order to reduce dependence on fossil fuels, ensure energy security and reduce local and global pollutants. India attains globally 4th and 6th position in global Wind and Solar Power installed capacity. As per MNRE-2017 review reports, Indian government aims to achieve 175 GW installed capacity of renewable energy by 2022[2]. These efforts are being taken continuously to give us clean energy, so effective use of energy is more important. Nowadays, Green building is most popular among designers which save energy, resources but incorporating green building are so costlier and reforming an old building are tooexpensive [3]

Meanwhile the mobile phone subscribers are increasing exponentially which requires continuous charging of mobile phone to keep us connected and this has led to multiple chargers being left at home and at the office, often plugged into the wall with the cord conveniently waiting to charge your phone for next time. At the same time remote operated loads, in specific standby loads have been increased for the users convenient, it also make the user to spend on phantom power.[4,5] A new class of device is to be designed in order to eradicate phantom power with less expenditure

II. PROBLEM DEFINITION

Sustainability of electricity is becoming too concerned as electricity reaches us with lot of resources being sacrificed. So conservation of energy needs to be seriously accounted [5,6].

The lists of problem identified are

- Wastage of power at standby and at no load condition.
- Overcharging of battery operated loads

An arrangement is being made in finding the power consumed by mobile charger. A Socket, Ammeter (mA), Mobile charge,

TABLE I
(Typically mobile charger will be rated between 3-7W)

Parameters	Chargers Connected with Mobile phone [40% SoC]	Chargers Not Connected with Mobile phone
V_{rms}	162.63 V	162.63
I_{rms}	37.10 mA	1.51 mA
Power	6.03 Watts	0.245 Watts

Table 1 Typically mobile charger

AC mains and mobile phone are used

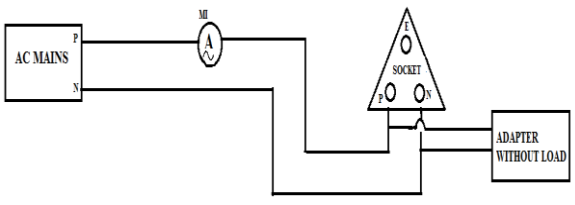

Fig.1. Block diagram

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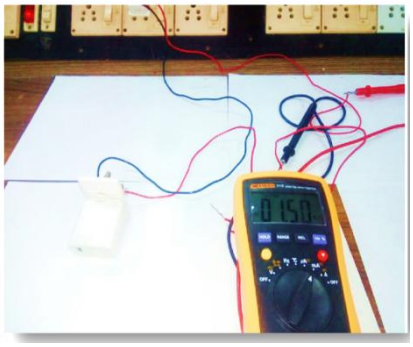

Fig.2.Consumption of current by mobile phone from mains

A.Measured Value

Fig.3. Consumption of current by charger from mains

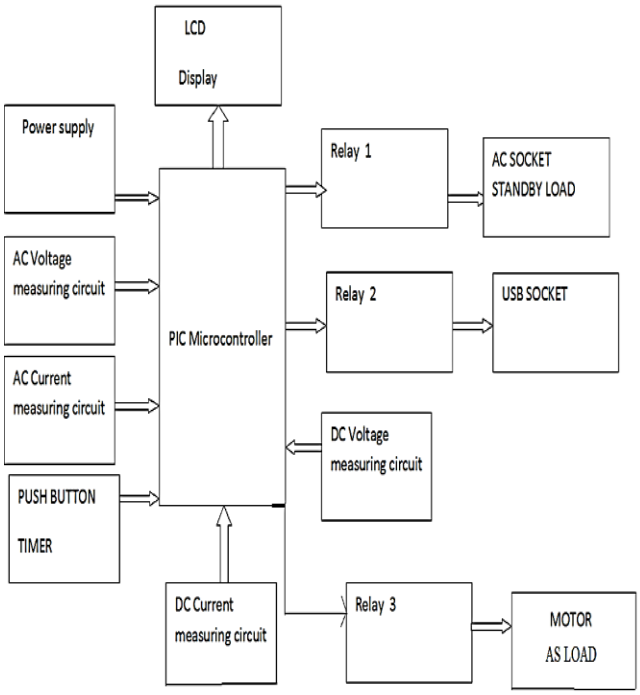

Fig.4. Block diagram

III. DESIGN OF SMART SOCKET

To overcome the problem definition, a smart socket is designed with PIC (16F877A) controller which helps us to eliminate the phantom power due to overcharging and standby loads. In this system two sockets are used separately for AC and DC supply in order to distinguish the operation.

The power supply from the mains is used to power both the driver and microcontroller, it requires a step down transformer of 230/12 V, 500mAand a voltage regulator for a steady DC output voltage using LM7805, LM7812for PIC microcontroller, LCD and driver. Relay (12V) is used to connect/disconnect socket from the supply according to the instruction received from the microcontroller [7,12]. AC and DC current sensor are used to measure the current values of AC and USB socket which help us to update the values for each 10 seconds.

Timer circuit is used to schedule the power supply from the socket to the load; a push button is used to feed the timing value through the PIC microcontroller and a 16 x 2 LCD is used to display the current, timer values.[7,8]

In this design, a turn off scheduler is incorporated which help us to automatically cut off the supply from the mains using relay circuit for the predefined input value and motor is connected as load to ensure the behavior of scheduler. All this process are been controlled by PIC microcontroller[13].

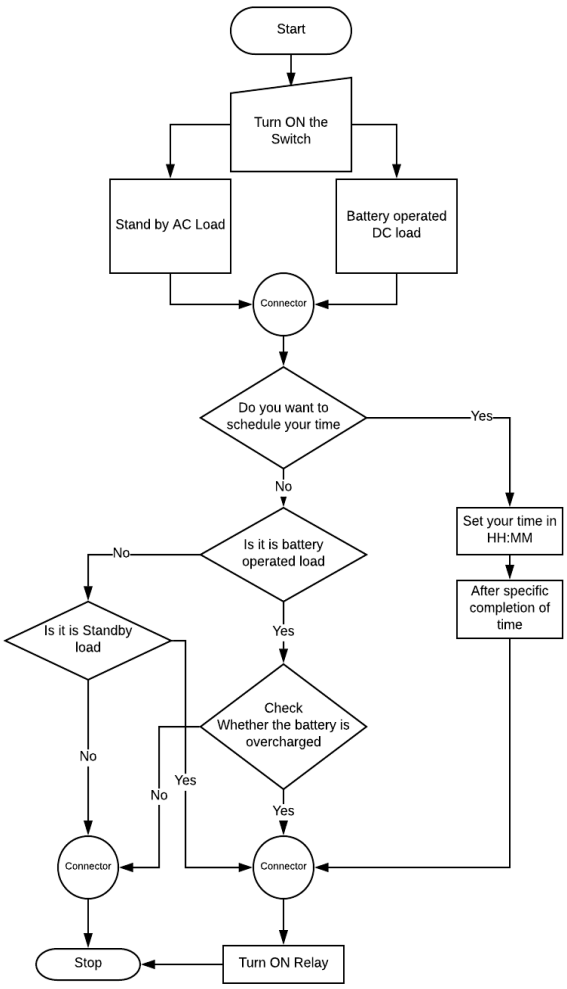

Fig.5. Flowchart

IV. METHODOLOGY

To eradicate the problem definition a smart socket is designed with PIC controller which helps us toeliminate the phantom power due to overcharging and standby loads

The process is categorized into 3 cases:

B. Standby Load

Standby loads are the major part of power consumer when not in use [4]. Stand by load is connected to the AC socket the microcontroller turns ON and senses the value of current using AC current Sensor. As per the instruction given in the program, the current values are measured for every 10 seconds and if the value is below threshold limit, the output pin (RB033rd pin) of PORT C which relates to relay will turns ON and disconnect the Standby load from the mains.

C. Mobile Charger

As number of mobile phone subscribers is increasing drastically, the waste of energy using unplugged mobile charger exist[8,9]. Let us assume the SoC of mobile

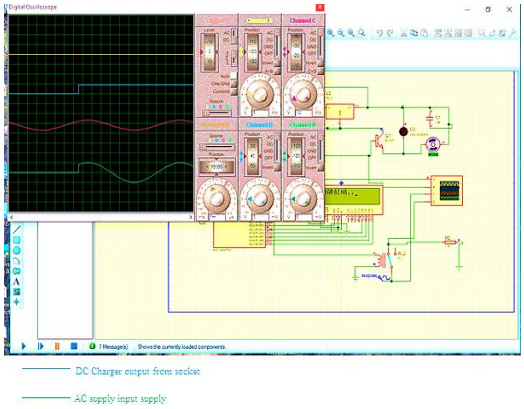

FIG.6. Mobile Phone Charging Period

The results of simulation tool is displayed in digital oscilloscope where blue line indicate DC charger output and green indicate input AC

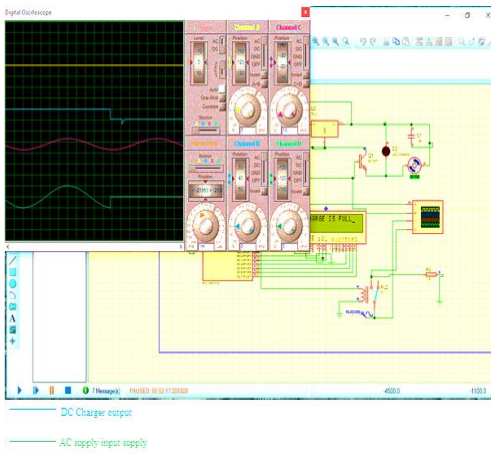

Fig.7. Mobile cut off period – SoC 100%

Fig.8.Mobile goes to cut off stage @ 100% SoC

V. CONCLUSION

Chargers continually draw power from a wall socket, even when your device is not attached, and while this amount could be as little as 0.245 Watts of energy. For assumption, lets imagine 1,00,000 users don't have a habit of unplugging their charger from sockets, which would lead to = (0.245*24*365*1,00,000) = 2,14,620 kWh We are in the midst of green revolution, so this phantom power consumption must be accountable [2,3]. Hopefully the proposed smart energy and environment.[3]

HARDWARE OUTPUT

The proposed system is implemented and tested for standby load, mobile charger and a motor is connected to ensure the response of turn off scheduler.

Fig.9.Implemtation of Smart Socket

Fig.10. Current reached zero during standby load

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