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A Novel Design for Home Automation by Integrating Solar based System with Internet of Things

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Abstract

In this research we have made a novel design for home automation by integrating solar based system with Internet of Things. The main motive of research is to simulate domestic device with integration of Solar based energy system. Here we have simulated the power consumption of home appliances. Energy source is solar system in this research. Solar operated system works with battery. The power is consumed as the devices are switch on. IOT based online simulator that will keep track of status of all device in remote database server.

Keywords: Home Automation, IoT, Smart Grid, Solar System, SOA (System Oriented Architecture), Web Services

1. Introduction to Home Automation using IoT

IoT is relevant to Smart Grid because it provides systems to gather and act on energy and potential information in a robotic fashion with objective to improve reliability, efficiency, economics and sustainability of production[4].

There are many planned or ongoing large-scale deployments of IoT to enable better administrative of cities and systems. Intelligence and autonomous control do not require Internet structures.

In future Internet of Things is supposed to be non-deterministic and unsecured network in which auto-arranged or intelligent entities Web services, SOA components, virtual objects also known as avatars would be interoperable and able to act separately pursuing their objectives depending on context, circumstances or environments[1].

Several applications of IoT usually make use of sensors in order to assist in environmental protection by tracking air or water quality, atmospheric conditions could even consist of areas like track movements of wildlife and their habitats[5].

Usage of IoT devices for track and operating infrastructure is likely to improve incident management and exigency response coordination and quality of service, up-times and lower costs of operation in all infrastructure related areas[6].

2. Objective of Research

The objective of research is to use IoT to simulate the power consumption of home appliances. To do this the energy source taken is solar system. The solar operated system works with battery. The power is consumed as the devices are switch on. The objective is to make an IoT based online simulator that will keep track of status of all devices in remote database server.

3. Tools and Technology

Hardware

- CPU (1 GHz).
- RAM 1 GB
- Hardisk (100 Gb).

Software

- WINDOWS 7.
- .NET STUDIO.
- MATLAB.

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4. Proposed Work

The proposed work is to make IoT based online simulator with following features:

- To design interface for IoT to set sun intensity, device usage.
- To keep track of status of house hold device on remote database server.
- To make a system to restore the last status of device so that power consumption could be traced.
- To make reading in different sun intensity level.
- To make simulation of readings in MATLAB.

5. Case Study

Here we have taken reading of amps in Solar panel, voltage of battery, amps of Battery, Amp hours battery, AC load total Amps is taken when home appliances such as refrigerator, color TV, computer etc. that is produced by solar system and different sun intensity.

Case 1: In this case reading of Solar console amperes, battery voltage, battery amps, battery Amp hours, Amps of AC load is taken when refrigerator is ON and when sun intensity is 3.

Case 2: In this case reading of Solar console amperes, battery voltage, battery amps, battery Amp hours, Amps of AC load is taken when refrigerator and TV is ON and when sun intensity is 3.

Case 3: In this case reading of Solar console amperes, battery voltage, battery amps, battery Amp hours, Amps of AC load is taken when refrigerator, TV and computer is ON and when sun intensity is 3

Case 4: In this case reading of Solar console amperes, battery voltage, battery amps, battery Amp hours, Amps of AC load is taken when refrigerator, TV and computer and house light is ON and when sun intensity is 3.

Case 5: In this case reading of Solar console amperes, battery voltage, battery amps, battery Amp hours, Amps of AC load is taken when refrigerator, TV and computer and house light, microwave is ON and when sun intensity is 3.

Case 6: In this case reading of Solar console amperes, battery voltage, battery amps, battery Amp hours, Amps of AC load is taken when refrigerator, TV and computer and house light, microwave, 5000 BTU AC is ON and when sun intensity is 3.

Results

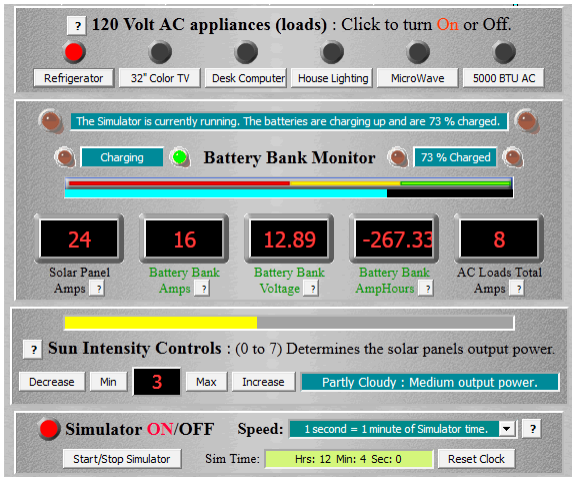

Figure 1. Refrigerator is on and sun intensity is 3.

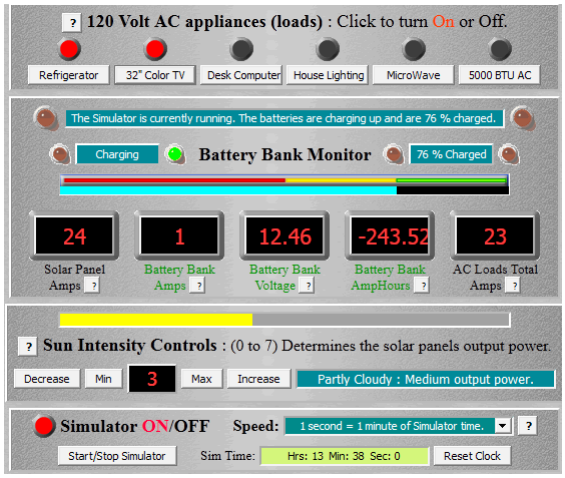

Figure 2. Refrigerator and TV is ON and sun intensity is 3.

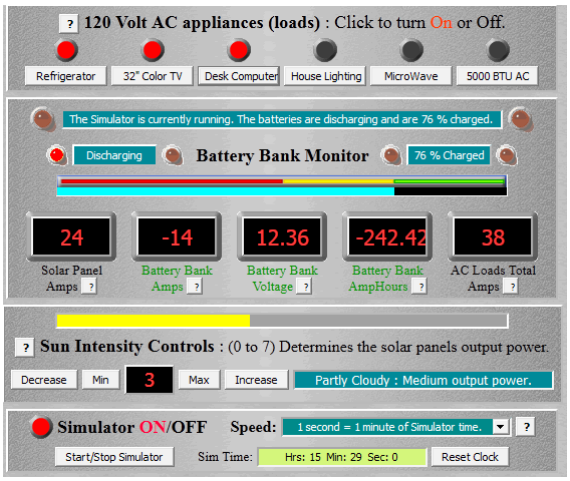

Figure 3. Refrigerator, TV and desk computer is ON and sun intensity is 3.

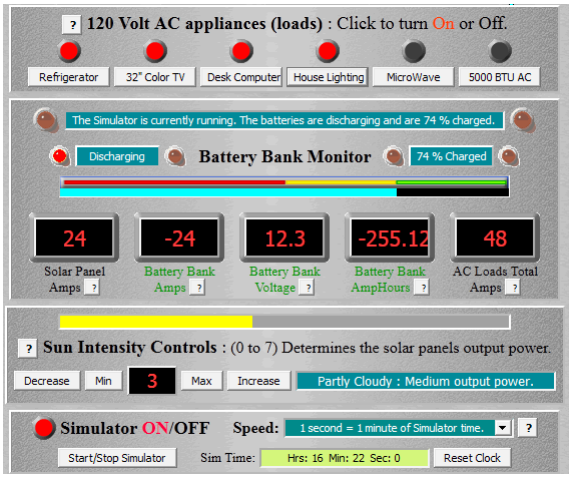

Figure 4. Refrigerator, TV, desk computer and house lighting is ON and sun intensity is 3.

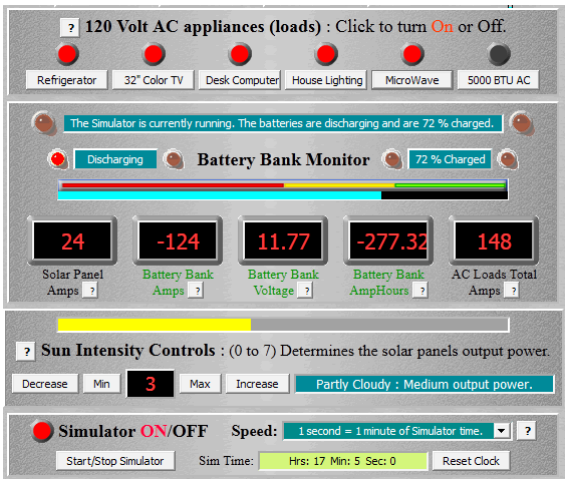

Figure 5. Refrigerator, TV, desk computer, house lighting and microwave is ON and sun intensity is 3.

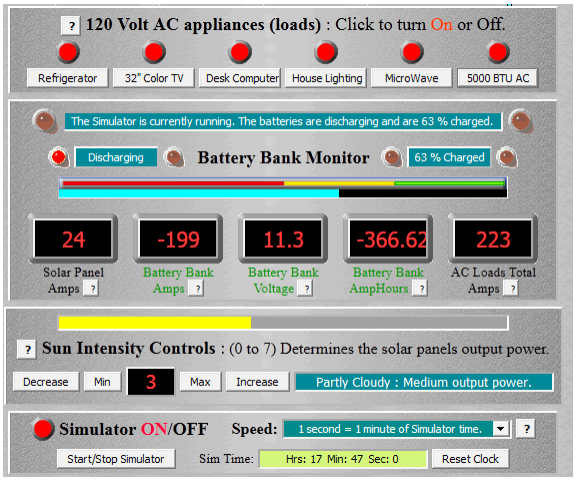

Figure 6. All devices are ON and sun intensity is 3.

6. Result and Discussion

Here we took reading of solar panel in amp and battery bank in amp at different sun intensity levels. As intensity of sun increases solar panel and battery bank amp also increases.

Refrigerator is ON

Sun intensity	Solar Panel Amp	Battery Bank Amps
0	0	–8
1	8	0
2	16	8
3	24	16
4	32	24
5	40	32
6	48	40
7	56	48

Here we get sun intensity in sun_int variable

```
>> sun_int = [0 1 2 3 4 5 6 7]
sun_int = 0  1  2  3  4  5  6  7
```

Here we get Solar panel Amp in Solar_panel_Amp variable.

```
>> Solar_panel_Amp = [0 8 16 24 32 40 48 56]
Solar_panel_Amp = 0  8  16  24  32  40  48  56
```

Here we get Battery Bank Amps in Battery_Bank_Amps variable.

```
>> Battery_Bank_Amps = [-8 0 8 16 24 32 40 48]
Battery_Bank_Amps = –8  0  8  16  24  32  40  48
```

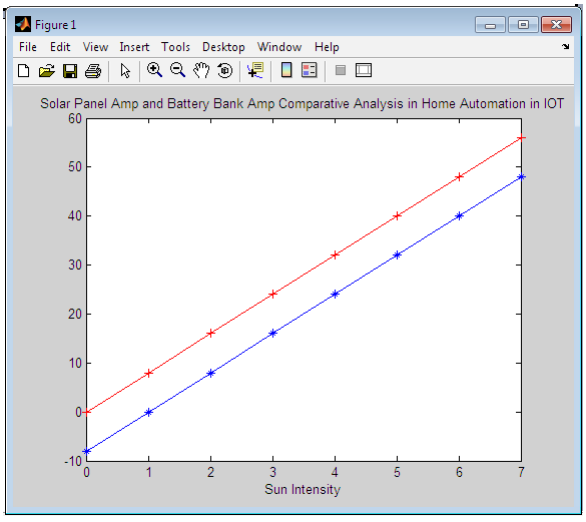

Figure 7. Solar panel and battery bank amp comparative analysis in home automation in IoT.

Here we plot comparative chart of Battery_Bank_ Amps and Solar_panel_Amp at different sun intensity.

```
>> plot (sun_int,Solar_panel_Amp,'r+-')
>> hold on
>> plot (sun_int, Battery_Bank_Amps,'b*-')
```

7. Future Scope

Combination of solar system and home automation would be beneficial for professionals who mostly spend time outside and willing to control home devices remotely and they need not pay electricity bill because electricity would be provided by solar system and at night battery bank would deliver battery backup[5].

8. Conclusion

Internet of Things has made life of professional comfortable by introducing mechanism of remote home automation and integrate it with solar system so that home appliances could get power by user command from his laptop or mobiles[5].

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