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# IMPLEMENTATION OF HOME AUTOMATION BY INTEGRATING SOLAR BASED SYSTEM WITH INTERNET OF THINGS

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**Abstract:** It is IoT that allows objects to be sensed & controlled remotely across existing network infrastructure, creating opportunities for more direct integration of physical world into computer-based systems, & resulting in improved efficiency, accuracy & economic benefit. In this research we have integrated Solar based system to implement home automation.[3] The objective of research is Home automation using IOT with integration of Solar based energy system. Integration of sensing & actuation systems, connected to Internet, is likely to optimize energy consumption as a whole. It is expected that IoT devices will be integrated into all forms of energy consuming devices (switches, power outlets, bulbs, televisions, etc.)[12] & be able to communicate with utility supply company in order to effectively balance power generation & energy usage. Solar Energy System that is properly installed & adequately sized will not really require much in way of management[2].

## [1]Introduction to Home Automation using IOT

The objective of research is Home automation using IOT with integration of Solar based energy system.[1] Integration of sensing & actuation systems, connected to Internet, is likely to optimize energy consumption as a whole. It is expected that IoT devices will be integrated into all forms of energy consuming devices (switches, power outlets, bulbs, televisions, etc.) & be able to communicate with utility supply company in order to effectively balance power generation & energy usage. Solar Energy System that is properly installed & adequately sized will not really require much in way of management. To make this relationship clear, & for those who might think solar energy is complicated, I designed & wrote this simulation to demonstrate basic operation of a solar energy electric power system. Only 3 things need to be considered first is level of charge on battery bank. (AmpHour Meter), Second is Amount of charging power coming in. (Solar Amps Meter), Third is Amount of power being used. (AC Amps Meter)

IoT is especially relevant to Smart Grid since this provides systems to gather & act on energy & power-related information in an automated fashion with goal to improve efficiency, reliability, economics, & sustainability of production & distribution of electricity.[5]

There are several planned or ongoing large-scale deployments of IoT, to enable better management of cities & systems. For example, Songdo, South Korea, first of its kind fully equipped & wired smart city, is near completion. Ambient intelligence & autonomous control are not part of original concept of Internet of Things. Ambient intelligence & autonomous control do not necessarily require Internet structures, either.

In future Internet of Things may be a non-deterministic & open network in which auto-organized or intelligent entities Web services, SOA components, virtual objects also known as avatars will be interoperable & able to act independently pursuing their own objectives or shared ones depending on context, circumstances or environments.[3]

Environmental monitoring applications of IoT typically use sensors to assist in environmental protection by monitoring air or water quality, atmospheric or soil conditions ,and could even include areas like monitoring movements of wildlife & their habitats. [8]

Usage of IoT devices for monitoring & operating infrastructure is likely to improve incident management & emergency response coordination, & quality of service, up-times & reduce costs of operation in all infrastructure related areas.[1]

The objective of research is Home automation using IOT with integration of Solar based energy system. Integration of sensing & actuation systems, connected to Internet, is likely to optimize energy consumption as a whole. It is expected that IoT devices will be integrated into all forms of energy consuming devices (switches, power outlets, bulbs, televisions, etc.) & be able to communicate with utility supply company in order to effectively balance power generation & energy usage. Solar Energy System that is properly installed & adequately sized will not really require much in way of management. To make this relationship clear, & for those who might think solar energy is complicated, I designed & wrote this simulation to demonstrate basic operation of a solar energy electric power system. Only 3 things need to be considered first is level of charge on battery bank. (AmpHour Meter), Second is Amount of charging power coming in. (Solar Amps Meter), Third is Amount of power being used. (AC Amps Meter)[12]

IoT is especially relevant to Smart Grid since this provides systems to gather & act on energy & power-related information in an automated fashion with goal to improve efficiency, reliability, economics, & sustainability of production & distribution of electricity.

## [2] Solar Energy Electric Power System

Solar Energy System that is properly installed & adequately sized will not really require much in way of management. For those times of marginal sun or very large power requirements, it is important to understand relationship between your battery charge level, amount of charge that they

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are receiving, & power being withdrawn from system[3] .

To make this relationship clear, & for those who might think solar energy is complicated, I designed & wrote this simulation to demonstrate basic operation of a solar energy electric power system. Only 3 things need to be considered these are Level of charge on battery bank, amount of charging power coming in, amount of power being used.[2]

**[3] Detailed instructions for Solar Energy Electric Power System Simulation.**

This Solar Energy Electric Power System Simulation is representative of a small 4 KiloWatt solar energy system. solar panel array is eight 100 watt panels or 800 watts total. With a average solar day of 5 hours, 800 watts times 5 hours equals 4000 watts or 4 KiloWatts (4KW). battery bank capacity is 1000 AmpHours at 12 volts. The Simulation may run at 5 different speeds including real time (1 second = 1 second sim time). At fastest speed, it may be a real challenge to keep things under control. default speed of 1 second = 1 minute of Simulator time is a good starting speed. Click drop down arrow to change speeds. If you like things to move along a little faster try 1 second = 10 minutes speed.[4]

In a real Solar Energy Electric Power System, a single quality multi-function meter is capable of displaying all readings of first 4 meters in Simulator. To better see what is happening, Simulator displays all these readings at same time. I added AC meter so you may easily see that power appliances use does not go into batteries.[7]

**3.1 Solar Panel Amps Meter**

This meter shows output Amps from solar panel array. Simulator uses 8 solar panels rated at 100 watts each for a total output of 4 KiloWatts based on an average solar day of 5 hours. 800 watts times 5 hours equals 4000 watts or 4 KiloWatts (4KW). meter will display 0 amps to 56 amps in 8 amp increments. For example: a Sun Intensity setting of 1 will produce 1 amp from each of 8 solar panels for a total output of 8 amps displayed on meter. 0 is of course completely 'OFF' & a Sun Intensity of 7 will produce maximum output of 56 amps. This power may charge batteries or run appliances. Of course, any power appliances use will not go into batteries.

**3.2 Battery Bank Amps Meter**

This meter shows Amps going into or out of batteries. If you are using more power than solar panels are delivering, this number will be negative & you will be using power stored in your battery bank. At same time you will notice AmpHour meter become more negative as your batteries lose charge. When batteries are 100% charged, 8 amps represents float charge level & will not go any higher. batteries have all they want!

### 3.3 Battery Bank Voltage Meter

This meter monitors battery bank voltage level. If it is below 12.7 batteries are less than full or under load. If greater than 12.7 batteries are full or are charging. To see actual battery voltage, turn off all appliances & set sun intensity to 0. voltage level will now be determined solely by AmpHour reading. [2]

### 3.4 Battery Bank AmpHours Meter

The AmpHour meter shows Amps into & out of battery bank relative to battery bank size. Simulator uses a battery bank size of 1000 AmpHours of battery capacity. So if meter shows negative 100 AmpHours, batteries are 10% discharged or 90% charged. In practice this number will normally be negative unless battery bank is fully charged. As power is withdrawn from batteries negative reading will increase. When batteries are being charged readings will become less & less negative. When meter reading reaches 0, battery bank is fully charged.[4] When AmpHour meter reading is at 0, Simulator (like a charge controller) will reduce charging automatically (by reducing Sun intensity) to prevent over charging of batteries. Also, if batteries become more than 50% discharged, the Simulator will disconnect AC power from inverter, shutting off all appliances. (In real world, this AC cut out point may be set at any battery voltage level on better quality power inverters.)

### 5) AC Amps load Meter

This is combined Amps of all appliances you have turned on. Normally, at 120 volts AC it would display 1/10 amps that you would be using at 12 volts DC (1 amp at 120 volts is 10 amps at 12 volts). [2]To make simulator easier to understand, this meter will display Amps at 12 volts instead of at 120 volts. This way you may easily see that if solar panels are putting out 24 amps & TV is using 15 amps, this leaves only 9 amps charging batteries.

## [4] CASE STUDY

### CASE 1

Refrigerator is on & sun intensity is 3

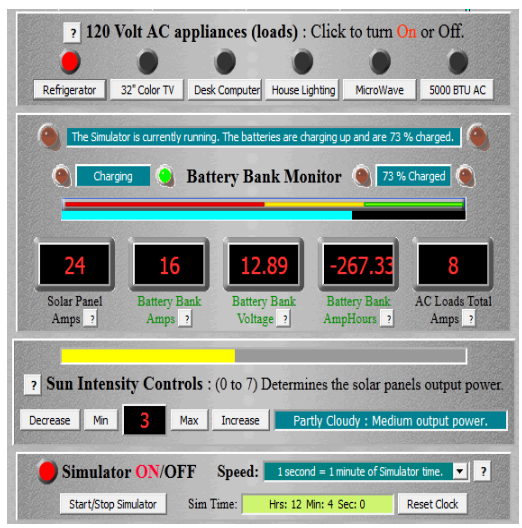


**Fig 1 Refrigerator is on & sun intensity is 3**

### Case 2

Refrigerator & tv is on & sun intensity is 3

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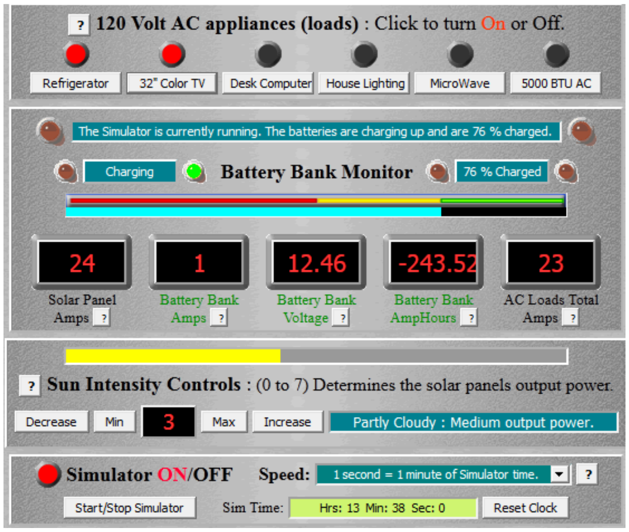


**Fig 2** Refrigerator & tv is on & sun intensity is 3

**Case 3:** Refrigerator,tv,Desk computer is on & sun intensity is 3

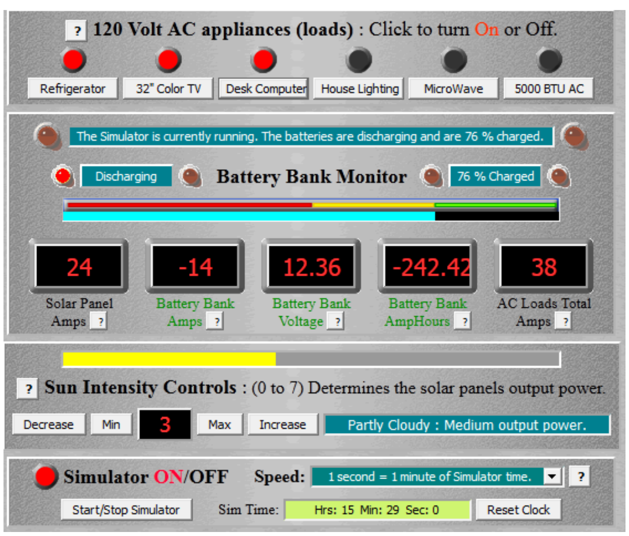


**Fig 3** Refrigerator,tv,Desk computer is on & sun intensity is 3

**Case 4 :** Refrigerator,tv,Desk computer & house lighting is on & sun intensity is 3

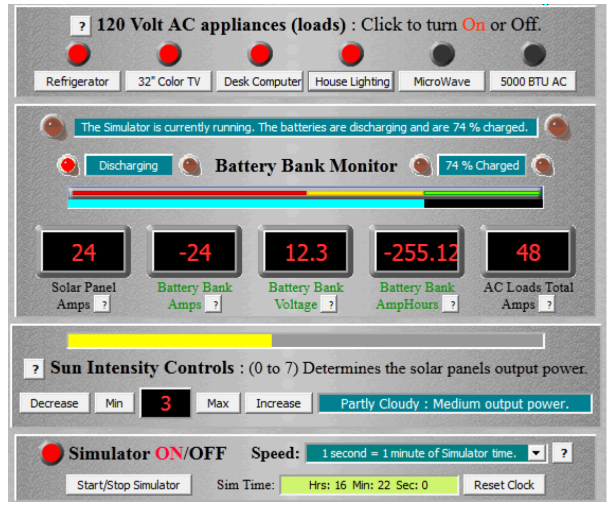


**Fig 4** Refrigerator,tv,Desk computer & house lighting is on & sun intensity is 3

**Case 5:** Refrigerator,tv,Desk computer,House lighting,microwave is on & sun intensity is 3

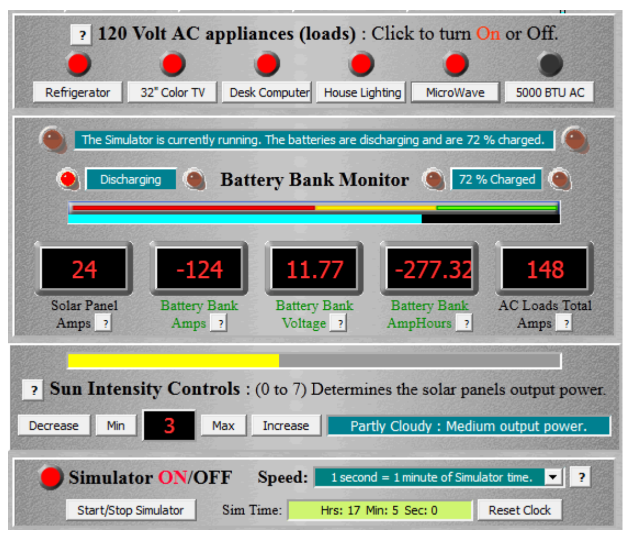


**Fig 5** Refrigerator, tv, Desk computer, House lighting, microwave is on & sun intensity is 3

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**Case 6:** Refrigerator,tv,Desk computer,House lighting,microwave,5000 BTU AC is on & sun intensity is 3

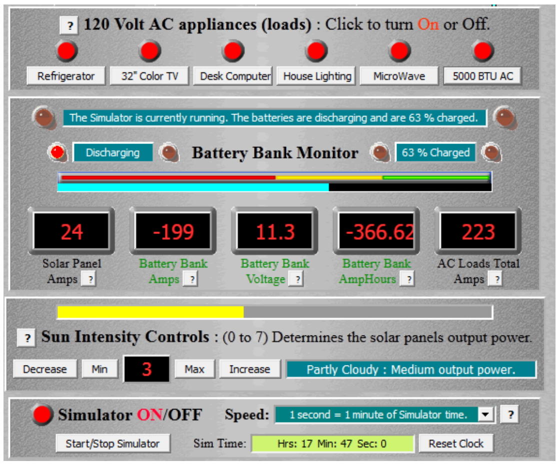


**Fig 6** Refrigerator, tv,Desk computer,House lighting,microwave,5000 BTU AC is on & sun intensity is 3.Solar Panel Amps, Battery Bank Amps when Refrigerator is on

## [5] Result and discussion

### 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 |

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

sun_int =

     0     1     2     3     4     5     6     7

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

Solar_panel_Amp =

     0     8    16    24    32    40    48    56

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

Battery_Bank_Amps =

    -8     0     8    16    24    32    40    48

>> plot(sun_int,Solar_panel_Amp,'r+-')

>> hold on

>> plot(sun_int,Battery_Bank_Amps,'b*-')
```

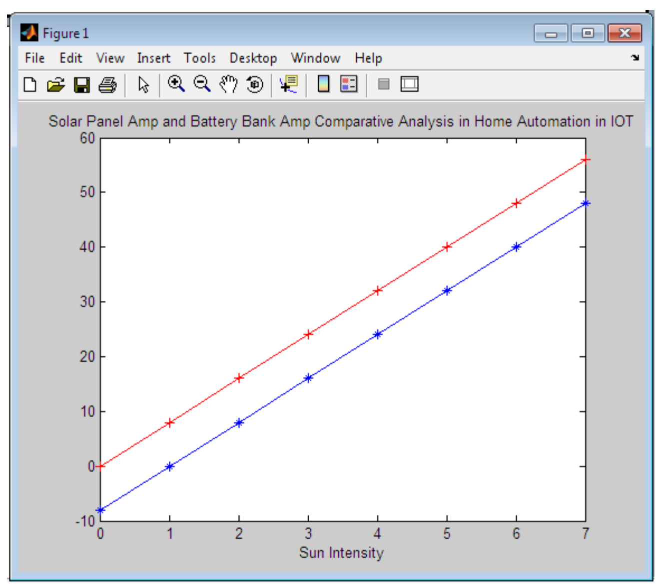

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**Fig 7** Solar Panel & Battery Bank Amp Comparative Analysis in Home Automation in IOT

## [6] FUTURE SCOPE

The system will likely be an example of event-driven architecture bottom-up made (based on context of processes & operations, in real-time) & will consider any subsidiary level. Therefore, model driven & functional approaches will coexist with new ones able to treat exceptions & unusual evolution of processes (Multi-agent systems, B-ADSc, etc.).[12]

In an Internet of Things, meaning of an event will not necessarily be based on a deterministic or syntactic model but would instead be based on context of event itself: this will also be a semantic web. Consequently, this will not necessarily need common standards that would not be able to address every context or use: some actors will accordingly be self-referenced and, if ever needed, adaptive to existing common standards predicting everything would be no more than defining a global finality for everything that is just not possible with any of current top-down approaches & standardizations[8].

## [7] CONCLUSION

In order to program & control flow of information in Internet of Things, a predicted architectural direction is required. It is being called BPM. Everywhere that is a blending of traditional process management with process mining & special capabilities to automate control of large numbers of coordinated devices.[8]

## Reference:

[1] M1 Security and Automation Controls. http://www.elkproducts.com/m1 controls.html.
[2] Ivanpah Solar Electric Generating System, retrieved 2014-02-18
[3] Control4 Home Automation and Control. http://www.control4.com.
[4] A solar panel in the contiguous United States on average delivers 19 to 56 W/m² or 0.45 - 1.35 (kW·h/m²)/day."us_pv_annual_may2004.jpg". National Renewable Energy Laboratory, US. Retrieved 2006-09-04.
[5] T. Abdelzaher, S. Prabh, and R. Kiran, On Real-Time Capacity Limits of ad hoc Wireless Sensor Networks, *RTSS*, December 2004.
[6] Y. Aguiar, M. Vieira, E. Galy, J. Mercantini, and C. Santoni, Refining a User Behavior Model based on the Observation of Emotional States. *COGNITIVE* , 2011.
[7] V. Bradshaw. The Building Environment: Active and Passive Control Systems. John Wiley & Sons, Inc., River Street, NJ, USA, 2006.
[8] B. Brumitt, B. Meyers, J. Krumm, A. Kern, and S. A. Shafer. Easyliving: Technologies for Intelligent Environments. *HUC*, 2000.
[9] G. Burnham, J. Seo G. Bekey, A. Identification of Human Driver Models in Car Following. *IEEE Transactions on Automatic Control 19*, 6, 1974, pp. 911–915.
[10] J. Deng, R. Han, and S. Mishra, Secure Code Distribution in Dynamically Programmable

Wireless Sensor Networks, *Proc. of ACM/IEEE IPSN*, 2006. pp. 292-300.

[11] R. Dickerson, E. Gorlin, and J. Stankovic, Empath: a Continuous Remote Emotional Health Monitoring System for Depressive Illness. *Wireless Health* , 2011.

[12] C. Dixon, R. Mahajan, S. Agarwal, A. Brush, B. Lee, S. Saroiu, and P. Bahl, An Operating System for the Home, *NSDI*, 2012.

[13] T. He, J. Stankovic, C. Lu and T. Abdelzaher, A Spatiotemporal Communication Protocol for Wireless Sensor Networks, *IEEE Transactions on Parallel and Distributed Systems*, Vol. 16, No. 10, Oct. 2005, pp. 995-1006.

[14] M. Huang, J. Li, X. Song, and H. Guo, Modeling Impulsive Injections of Insulin: Towards Artificial Pancreas. *SIAM Journal of Applied Mathematics 72*, 5, 2012, pp. 1524–1548.

[15] M. Kay, E. Choe, J. Shepherd, B. Greenstein, N. Watson, S. Consolvo, and J. Kientz, Lullaby: a Capture & Access System for Understanding the Sleep Environment. *UbiComp*, 2012.

[16] A Liu, and D. Salvucci, Modeling and Prediction of Human Driver Behavior, *Intl. Conference on HCI* , 2001.

[17] J. Lu, T. Sookoor, V. Srinivasan, G. Gao, B. Holben J. Stankovic, E. Field, and K. Whitehouse, The Smart Thermostat: Using Occupancy Sensors to Save Energy in Homes, *ACM SenSys*, 2010.

[18] M. Maroti, B. Kusy, G. Simon, and A. Ledeczi, The Flooding Time Synchronization Protocol, *ACM SenSys*, November 2004.

[19] S. Mohammed, P. Fraisse, D. Guiraud, P. Poignet, and H. Makssoud, Towards a Co-contraction Muscle Control strategy for Paraplegics. *CDC-ECC*, 2005.

[20] S. Munir, J. Stankovic, C. Liang, and S. Lin, New Cyber Physical System Challenges for Human-in-the-Loop Control, *8th International Workshop on Feedback Computing*, June 2013.

[21] S. Munir and J. Stankovic, DepSys: Dependency Aware Integration of Systems for Smart Homes, submitted for publication.

[22] S. Ravi, A. Raghunathan, S. Chakradhar. Tamper Resistance Mechanisms for Secure, Embedded Systems, *Proc. of 17th International Conference on VLSI Design*, 2004. p. 605.

[23] B. Rong Chen, G. Peterson, G. Mainland, and M. Welsh, LiveNet: Using Passive Monitoring to Reconstruct Sensor Network Dynamics, *DCOSS 2008*, June 2008.

[24] S. Rost and H. Balakrishnan, Memento: A Health Monitoring System for Wireless Sensor Networks. *SECON 2006*, September 2006.

[25] L. Ruiz, J. Nogueira, and A. Loureiro, MANNA: A Management Architecture for Wireless Sensor Networks. *IEEE Communications Magazine*, February 2003.

[26] G. Schirner, D. Erdogmus, K. Chowdhury, and T. Padir, The Future of Human-in-the-Loop Cyber-Physical Systems. *Computer 46*, 1, 2013, pp. 36–45.

[27] J. Stankovic, When Sensor and Actuator Networks Cover the World, invited Keynote Article, Special Issue on Ubiquitous Sensor Networks, *ETRI Journal*, Korea, Vol. 30. No. 5, October 2008, pp. 627-633.

[28] J. Stankovic, I. Lee, A. Mok, R. Rajkumar, Opportunities and Obligations for Physical Computing Systems, *IEEE Computer*, Vol. 38, No. 11, Nov. 2005, pp. 23-31.

[29] J. Stankovic, A Vision of a Smart City in the Future, *Smart Cities*, Vol. 1, Issue 10, Oct. 2013.

[30] K. Tsui, D. Kim, A. Behal, D. Kontak, and H. Yanco, I Want That : Human-in-the-Loop Control of a Wheelchair-Mounted Robotic Arm.

*Journal of Applied Bionics and Biomechanics 8*, 2011.

[31] P. A. Vicaire, E. Hoque, Z. Xie, and J. A. Stankovic, Bundles: a Group Based Programming Abstraction for Cyber Physical Systems, *ICCPS*, 2010.