AI BASED ENERGY MANAGEMENT FOR HOME AUTOMATION

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Keywords

Control of smart grid, Energy management system, Artificial Intelligence, Machine Learning, Decision making.

Introduction

Energy management and AI smart grid is basically an advanced electric power system of tomorrow that integrates the state of-the-art power electronics, computers, information and communication. Unfortunately, our present power grids are too old, obsolete, inefficient, unreliable, and provide inadequate protection for faults. We the existing energy resources, generating power effectively and intelligently is an equally important agenda. Supplementing the establishment of large power plants from conventional energy sources, there is also a need to focus on distributed small-scale generation of power particularly from renewable energy sources. Although Distributed Energy Resources need additional infrastructure and investment to connect them to the grid, these technologies obviate the need for an expensive transmission system and reduce transmission and distribution losses. Raspberry pi will collect the weather information to optimize the power supply efficiently and it also upload the collected data from sensors how much power is consumed by every appliance. The appliances are also optimized by the system as that required.

Objective

The overall aim of the project is to develop a AI-based decision-making tool to improve energy management of smart grid that balances different stakeholders' interests including energy suppliers - profit, end users - energy consumption and bill, governments - net zero carbon goal, while ensuring demand-supply balance. In order to reach this aim, the project has the following key objectives:

(a) Investigate computational models of electricity markets of smart grid systems at different scales, including smart home or distributed resource systems.

(b) Develop machine learning algorithms for demand response, including dynamic pricing, from energy suppliers' perspective.

(c) Develop machine learning algorithms to support smart scheduling of power consumption at peak time from energy users' perspective.

(d) Multi-criteria optimization of energy management from both energy suppliers' and end users' perspectives.

(e) Test and evaluate the proposed approaches in real-scenario experimental platforms.

Methodology

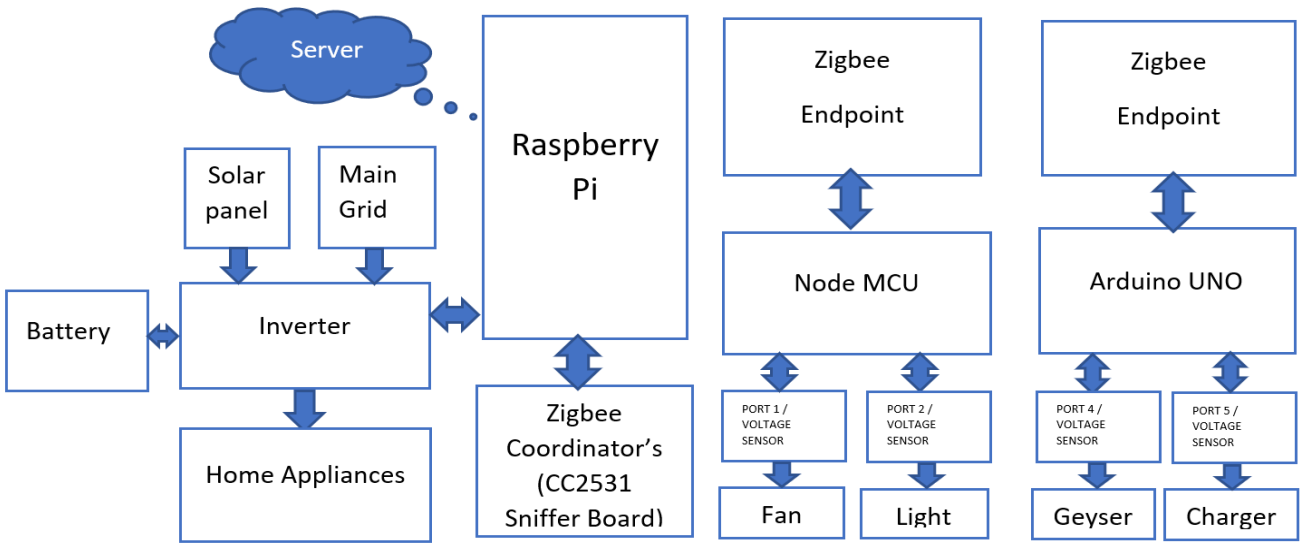


Figure 3.1: Block Diagram

Weather sensing portion from cloud server:

Raspberry Pi will collect the weather information data from internet server to optimize the usage of power supply of solar power over the main grid.

Energy monitoring portion:

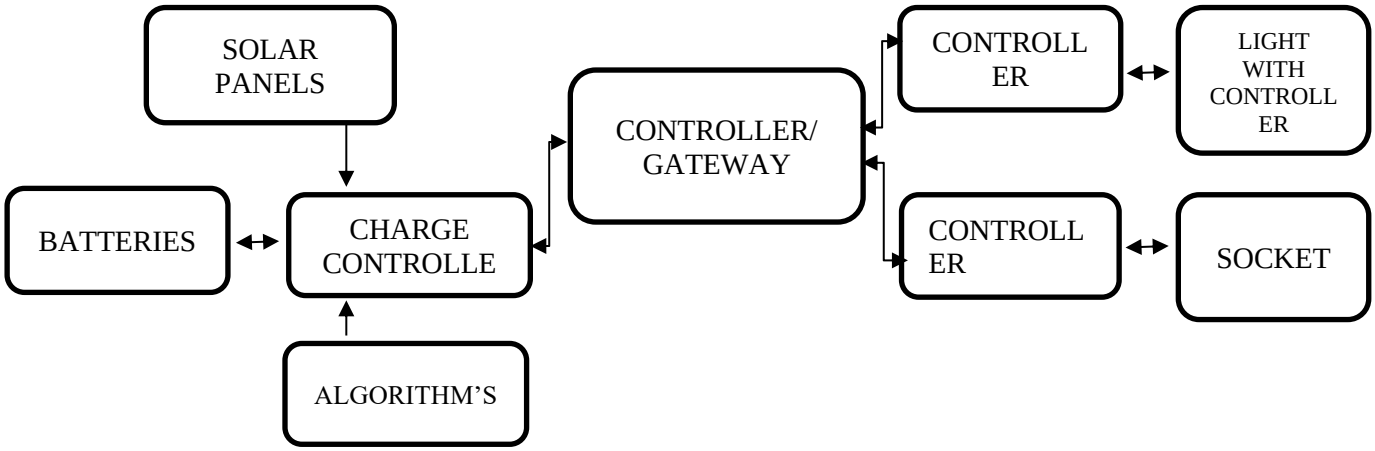
Energy generated by solar panels will charge the batteries via charging controller. In the case bad weather condition of next day's information collected by the raspberry pi, the system will optimize the usage of stored power supply. If the battery runs out of the power, appliances will get a supply from main grid.

Controlling appliances:

Raspberry Pi will collect info/data from the device via Controller how much current consumed by each appliance. We have taken examples of 4 power ports; Controller is used for

the communication between raspberry and Arduino. Controller coordinator will request the data from Controller endpoint which is connected to Arduino. ZigBee has to be configured initially whether it should act as Controller coordinator, Controller router or Controller endpoint using XCTU software. Arduino is used for creating the functionality of the end devices (light etc.), For example we have connected one DC light and DC Fan to Arduino, the light intensity and fan speed will controlled by Arduino according to user given value, comparing with sensors value. Arduino will act as ZigBee end device which will give control commands to the devices like fan, light and other appliances.

Flow chart:



Results and Conclusions

(a) Using weather prediction, the system decides whether the appliances must rely on solar or grid to supply electricity for home appliance.

(b) Dash board will have the complete information of the energy consumed by the devices and the power utilized from solar and grid.

(c) With this concept the user can reduce the power consumption from the grid and if there is less power utilized and more power generated by solar, the excess power can be exported to grid and the user can make a revenue from it.

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