

Energy saving technique by home automation and data mining

Dr.S.Jumlesha¹, G.Lakshmi Narayana², B.Sunil kumar³

¹Assoc.professor, Department of CSE & Annamacharya Institute of technology & Sciences-Tirupati

²Assistant.professor, Department of CSE & Annamacharya Institute of technology & Sciences-Tirupati

³Assistant.professor, Department of CSE & Annamacharya Institute of technology & Sciences-Tirupati

Abstract

We rely on electricity to fuel our household appliances and electronics. Our energy costs are rising as we use more power in our homes. Efficient goods and methods to conserve electricity will help us save money and resources at home. Therefore a home automation system is required which would be Very good option for energy saving and comfort. The proposed paper suggests the use and incorporation of Arduino UNO, Raspberry Pi 3 and sensors into a home automation device. The model will be built using the datamining techniques principles for the study so that the energy bill costs. The machine has features such as processing, monitoring, and networking. The system has features like computing, control, and connectivity. The integration of the system with an Android app makes it Possible to analyze the data and saves the electrical energy.

Key Words: Android, Arduino UNO, Data mining, Raspberry Pi 3.

1. INTRODUCTION

Power is one of the most essential gifts that science has given to humanity. It has numerous utilizations in our everyday life. It is utilized for lighting rooms, working fans and local apparatuses like utilizing electric stoves, A/C and that's only the tip of the iceberg. The situation is, these gadgets are sitting inefficient, overwhelming power out of your home while hanging tight for an order from you or trusting that a booked errand will run. You can begin sparing vitality by associating gadgets to the Internet. Proposed home robotization framework primarily comprises of Arduino+Raspberry pi and Smart Phone. Information mining is the way toward breaking down information from separating points of view furthermore, embodying it into helpful data - data that can be utilized to expand income, reduces expenses, or both. The Smart Phone have the android application which empowers the client to get to the home machines. The android application speaks with Arduino UNO associated gadgets. Varieties in natural properties can be influence the activities of remote inserted frameworks, which can break IoT applications. Android OS is one of the leading and most popularly preferred systems in a smartphone. Smartphone affordability increases day by day due to their size and portability. Android application which has the intelligence to control any sort of electrical appliances by providing remote access using Bluetooth. This creates PAN (personal area network) network in the home environment, where all these appliances can be interconnected and monitored using a single controller.

2. LITERATURE REVIEW

II. ENERGY MANAGEMENT

One of the major benefits of smart home to consumers is their ability to incorporate energy management features through lighting, air conditioning and home appliances.

A. LIGHTING

The lights in a smart home can be turned on and off automatically based on occupancy sensor. As example , when a person enters a room in the day time, the system will open the drapes instead of turning on the lights, but at night it would make sure the lights came on and they turned off when no one is in the room hence waste of energy can be preserved.

B. AIR CONDITIONING

An appropriate placement of temperature sensors and the use of heating and cooling timers can reduce the energy used and hence saving money and also the house can set to turn off air conditionings when no one is in the room.

C. HOME APPLIANCES

Smart homes can even go further in energy management by keeping track of the energy usage of each and every appliance in the house. The smart house controllers could schedule the operation of heavy power consuming appliances (such as dishwashers and electric water heaters) to take maximum advantage of off peak electric rates.

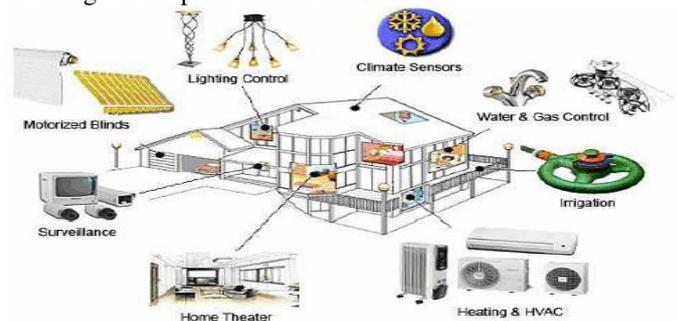


Figure 1: Smart home Integration services

Some appliances may be operated for smart home in a home setting by PDA (personal digital assistance) or smart phone.

In an effective way a user can use his computer to communicate uniformly.

A consumer can use this system to control the connected devices i.e. home appliances, not just for communication purposes. The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet).

It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. Some set of sensors is connected to Arduino to capture the human activities like PIR sensor used for motion and temperature sensor used to measure room temperature.

Human comfort level measurements as proposed in, are taken into consideration for controlling the home appliances. The 5v 4CH relay board is in the habit of connecting home appliances. Bluetooth HC-05 is used to interpret the command from Bluetooth enable smartphone.

For this reason, yahoo the daily weather report is taken into attention. According to outside atmosphere, human comfort parameters are set inside the house by changing the intensity of light and fan. The IBM Watson IoT Platform lets our apps communicate with aggregate data collected by our connected devices, sensors, and gateways. Our recipes make it super easy to get devices connected to our Internet of Things cloud. IoT cloud platform receiving the real-time data from Ethernet enable Arduino.

- Security
- Comfort & Convenience
- Centralised control
- Energy Efficiency
- Monetary savings
- Price

Data Collection

We first measure the baseline electricity appliances' power associated with the user in both buildings.

From responses to question additional security offered by any Home Automation System is very important, where almost 83% of respondents have rated it 4 and above. On similar lines, more than 85% of respondents believe that home automation system should bring Energy efficient as well.

Another unique feature of the Home automation system is that it allows centralised control of electrical appliances with which a consumer would be able to turn on or off them remotely. Questions tries to identify the importance of the centralised controlling capability of a Home Automation System and 77% respondents feel that centralised control is very important and this factor has been rated 4 and above these 77% respondents.

PROPOSED SYSTEM

Scenario management allows users to define a set of behavior rules. A lot of sequences can be implemented according to the habitant's age and its social status.

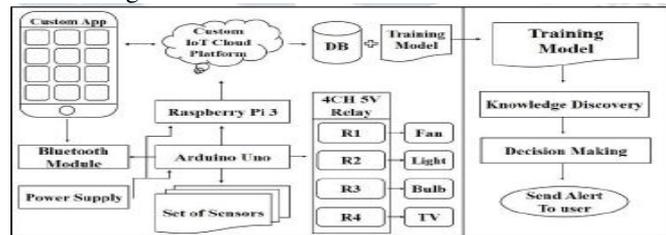


Fig: 2 Proposed Architecture of Home Automation System.

To provide precise information about the location at the occupant, the sensors are dispersed throughout the house. Occupancy sensors are used instead of motion sensors, as last sensors are chosen for protection rather than for monitoring of Building and lighting.

They only respond to movable objects, so if an person works at a desk in a house, motion sensors often stop seeing it.

Observation: the comparison in different granularities shows that there is **no direct and visible connection between the energy consumption and the occupancy rate**. In other word, a lot of energy is wasted regardless of the actual usage.

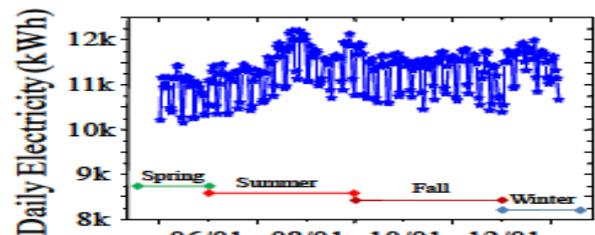
3. DATA ANALYSIS, RESULTS

The study is focused identifying if the identified to what magnitude would each of the identified factors contribute to adoption of home automation system. Below images show the results from the respondents of the survey. The male and female respondents where around 67% of the respondents were Male and remaining 33% percent were Female. Additionally, from chart 2, more than 90% of the respondents were in the age group of 20 to 40yrs.

	Mean	Std. Deviation	N
Adopt_HA	4.15	.967	73
Security	4.48	.852	73
Energy_Efficiency	4.12	1.027	73
Comfort	4.22	.946	73
Cost_Savings	4.08	1.127	73
Central_Control	4.08	.968	73
Affordability	4.27	.990	73

Table -1: Data Analysis

	Adopt_HA	Security	Energy_Efficiency	Comfort	Cost_Savings	Central_Control	Affordability
Pearson Correlation	Adopt_HA 1.000	.484	.415	.282	.536	.569	.567
	Security .484	1.000	.487	.299	.508	.440	.435
	Energy_Efficiency .415	.487	1.000	.372	.723	.395	.404
	Comfort .282	.299	.372	1.000	.386	.420	.409
	Cost_Savings .536	.508	.723	.386	1.000	.541	.590
	Central_Control .669	.440	.395	.420	.541	1.000	.512
	Affordability .667	.435	.404	.409	.590	.512	1.000
Sig. (1-tailed)	Adopt_HA .000	.000	.000	.008	.000	.000	.000
	Security .000	.000	.000	.005	.000	.000	.000
	Energy_Efficiency .000	.000	.000	.001	.000	.000	.000
	Comfort .008	.005	.001	.000	.000	.000	.000
	Cost_Savings .000	.000	.000	.000	.000	.000	.000
	Central_Control .000	.000	.000	.000	.000	.000	.000
	Affordability .000	.000	.000	.000	.000	.000	.000



To validate the adequacy of the survey data, I performed the KMO and Bartlett's test for the independent variables. From Descriptive statistics in Table 1.

Firstly, we compute the total electrical energy consumption for the above two periods and average them by the days. The results are shown in Fig. 9 which indicates that the electrical consumption varies very little for these two periods. We also compared the heating and cooling energy consumptions which are shown in Fig. 10. Daily average heating energy of the fall season is about 20% higher than summer, while daily cooling is 65% lower than summer season. Such results are consistent with the analysis results of the previous several subsections. If we separate the two periods into office hours and after hours, then we have a more detailed view of the energy consumption patterns. As shown in Fig. 11, we scale the daily energy consumption in Y axis into a 0 to 100 range.

We will discuss our major idea and corresponding prototyping and experimentation in the following two sections.

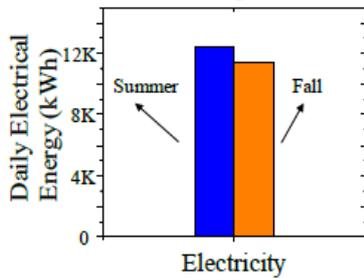


Fig. 9. Summer and Fall daily electrical energy consumption comparison

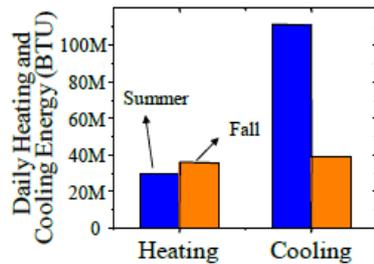
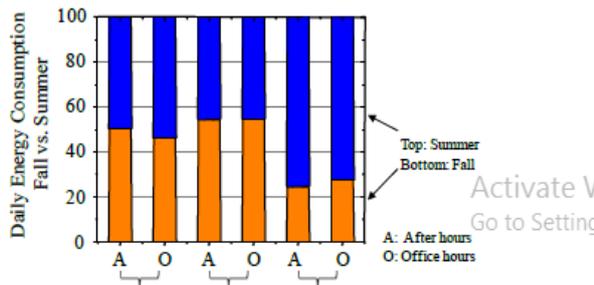


Fig. 10. Summer and Fall daily heating and cooling energy consumption comparison



4. CONCLUSIONS

The main role of this investigation is to look at and lessen the vitality utilization by executing computerized home condition. The proposed calculation will for all intents and purposes execute on Arduino Uno for testing. The calculation is equipped for watching the movement of individual and computerizing the home with no human introductions. Proposed framework can be screen and control the continuous information all around being ceaselessly from home. Prior research recommends that a home vitality the executives dependent on a lot of a sensor as indicated by human propensities can limit the household vitality squander and solid connection between the sparing in force and spare in cost gotten.

One can save energy by implementing this algorithm. The device can monitor idly sitting home appliances and thus reduce a waste of energy. The IoT-based device is low-cost and easy to deploy and maintain. In conclusion, this work will help other researchers achieve their goals with their future HAS projects and will make a positive contribution to the EHome community.

ACKNOWLEDGEMENT

This study has identified factors that contribute to the Home automation adoption decision making process. Below are the key finds from survey results as well as from the statistical

analysis:

When all considerations are to be measured, then customers agree that the comfort and convenience provided by the Home Automation system is the most significant and meaningful. While monetary savings are less meaningful or essential. Of all the advantages, the considerations Affordability and Comfort & Convenience have the highest correlation coefficients to Home Automation Adoption.

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