

Energy Saving Through Home Automation and Data Mining Technique

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Abstract: we build on electricity to power our appliances, and electronic devices in our home. As we consume more electricity in our homes, our electricity bills rise. Efficient products and energy-saving strategies can help us to save money and energy at home. Therefore there is a need of home automation system which would be a very good choice for energy saving and comfort. In the proposed paper a home automation system is proposed using and integration of Arduino UNO, Raspberry Pi 3 and sensors. The model will be developed using the concepts of data-mining techniques for the analysis so that one can cut the cost of the electricity bill. 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.

Index Terms— Android, Arduino UNO, Data mining, Raspberry Pi 3.

1. INTRODUCTION

Electricity is one of the most crucial blessings that science has given to mankind. It has many uses in our day to day life. It is used for lighting rooms, working fans and domestic appliances like using electric stoves, A/C and more. The dilemma is, these devices are sitting unproductive, engulfing electricity out of your home while waiting for a command from you or waiting for a scheduled task to run. You can start saving energy by connecting devices to the Internet. Proposed home automation system mainly consists of Arduino+Raspberry pi and Smart Phone. Data mining [1] is the process of analyzing data from diverging perspectives and encapsulating it into useful information - information that can be used to increase revenue, cuts costs, or both. It allows users to analyze data from many different approaches, categorize it, and summarize the relationships identified. The Smart Phone host the android app which enables the user to access the home appliances. The android app communicates with Arduino UNO connected devices. Variations in environmental properties can significantly affect the operations of wireless embedded systems, which can break IoT applications [2]. For this reason, Ethernet shield is used which is wired. The Arduino Ethernet Shield grants an Arduino Board to hook up with the Internet. It is stationed on Wiznet W5500 Ethernet chip. This Ethernet chip serves as a network stack suited for the pair TCP and UDP. It supports up to eight concurrent socket networks.

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.

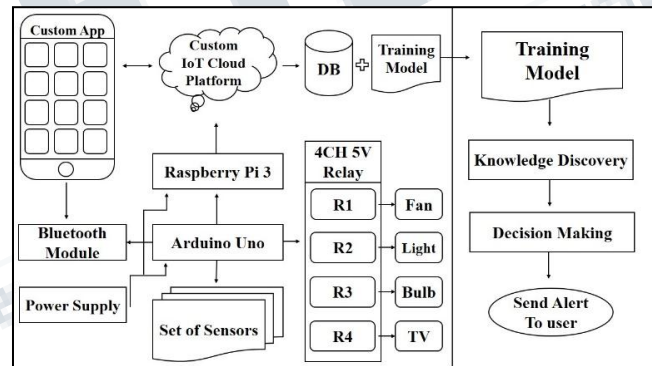


Fig 1. Proposed Architecture of Home Automation System.

II. LITERATURE REVIEW

IoT components get affected by variations in temperature and humidity. Even onboard temperature is distressing wireless sensors systems and it causes to reduce the received signal strength (RSS) (James, Utz, ff. Brown, Carlo, & kay).

Authors explain about the idea to reform the existing access control systems using the concept of IoT. They specified that Security through RFID (Radio Frequency Identification) reading & Fingerprint Scanning (Biometric sensor) are smart solutions for smart access control (Chirag, Vamil, & Raj, 2014).

The author aims to unify the principles of IoT and robotics. According to them, RFID i.e. radio frequency identification technology is a key enabler for developing IoT infrastructure. There are some issues in spite of benefits like security in terms of encryption, business model and many. (Cristina, Cornel, & Vasile).

Authors illuminated light on implementation models in order to make smart cities using IoT technology. Its preliminary study about solutions on traffic that includes illegal and convenient parking (Jaehak, Sooyeop, Jaehun, Sangphil, Yong-Tae, & Jong-Bae, 2016).

The authors presented the IoT-based system to monitor human comfort levels by using different sensors, control, and connectivity features. The presented open h/w and s/w platform able to manage four comfort levels of human i.e. acoustic, olfactory, visual and thermal comfort. Real-time data fetched and analyzed by the device and according to received data considerable action will be taken (Lucio, Francesco, Gianluca, Sauro, L., & Giacomo, 2016).

Byung Mun Lee (Byung, 2014) in his research aims to design healthcare model using IoT open platform. He introduced IoT platform architecture for healthcare service. By using this model user can manage his disease by himself.

Authors surveyed the most important aspects of the IoT with prominence on what is being done and what are the issues that require further research. Indeed, current technologies make the IoT concept feasible but do not fit well with the scalability and efficiency requirements they will face (Sapandeep, & Ikvinderpal, 2016).

The authors state that the inability to access and control the appliances from remote locations is one of the major reasons for energy loss. They defined many methods to archive energy consumption goals like Wi-Fi, GSM, Bluetooth, and ZigBee. More energy can be unspoiled by ensuring occupation of the house before turning on devices and checking brightness and turning off lights if not necessary (Satish, Naveen, Naren, Vidhyalakshimi, & Angel, 2015).

The author proposes smart appliances through IoT and controlling the simple home appliances light and bulbs. Also, the user can analyze the condition of various parameters in the home anytime and anywhere (Rajeev & Seong).

In the following paper, authors illuminated light on some critical factors like security, reliability, usefulness and price about Home automation system. Also, they aim to show the expediency of remote-controlled HASs. IP is one of the ways to interfacing with the devices in near future (Vinay & Kusuma).

III. RESEARCH METHODOLOGY

In a home environment, some appliances might be controlled by PDA (personal digital assistance) or smart phone for smart home. In an efficient aspect, a user can use their device for universal communication. A user can use this device for not only use for communication but control the connected devices i.e. home appliances. The Internet enables Arduino Uno board is the heart of the system which enables us to analyze the data. The Arduino Uno [12] 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 [7], 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. Bluetooth technology is wireless radio transmission in short distance providing a necessary technology to deliver controllability. Outside weather conditions may affect human comfort levels at home. 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. So that we can investigate the data. Custom Android app makes it possible to bypass all the situation and forcefully operate the home appliances. The smartphone also use to communicate with IoT cloud to perceive the real-time data according to that appropriate commands are send to Arduino.

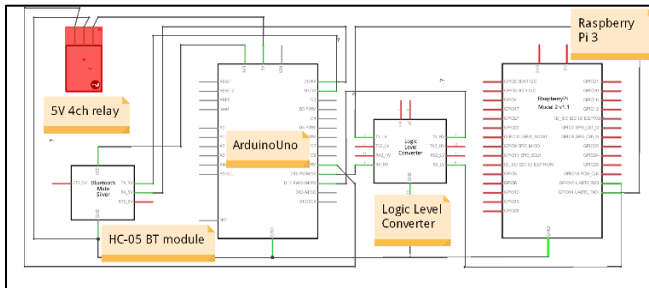


Fig.2. Proposed Interfacing Arduino and Raspberry pi for Home Automation System.

IV. PROPOSED ALGORITHM

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While (day)
  If PIR sensed the motion and temp° is less than equal to 26°c
    Then Open the curtains
  Else
    Keep Sensing
  End if

  If PIR sensed the motion and temp° is Greater than 26° C
    Then Open the curtains,
    Turned ON Fan,
    Increase the speed of fan with
    Increasing the temp°
  Else
    Keep Sensing
  End if
End while

While (night)
  If PIR sensed the motion and temp° is Less than equal to 26°c
    Then turned ON lights
  Else
    Keep Sensing
  End if

  If PIR sensed the motion and temp° is Greater than 26°c
    Then Turned ON lights,
    Turned ON Fan,
    Increase the speed of fan with
    Increasing the temp°
  Else
    Keep Sensing
  End if
End while
  
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In the smart home system, the Passive Infrared Sensor (PIR) motion sensor is installed on the top of the door to monitor the motion when a person enters into the room. When a person enters into the room the system will interpret according to the algorithm and take actions. Otherwise, sensor continuously senses the motion. Yahoo weather API will be used to monitor the outside weather and home automation system will dynamically change the human comfort parameters.

CONCLUSION

The primary purpose of this study is to examine and reduce the energy consumption by implementing automated home environment. The proposed algorithm will practically implement on Arduino Uno for testing. The algorithm is capable of observing the motion of human being & automating the home without any human interpolations. Proposed system can be monitor and control the real-time data globally being away from home. Earlier research suggests that a home energy management based on a set of a sensor according to human habits can minimize the domestic energy waste & strong relation between the saving in power and save in cost is obtained [13], By implementing this algorithm one can save energy. Idly sitting home appliances can be track by the system and therefore a waste of energy can be minimized. The low-cost IoT-based system is easy to install and maintain. To conclude, this research should help other researchers to achieve their goals with their future HAS projects and it will contribute positively to the E-Home community.

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