

IoT based Solar assisted Smart Home for Old age People

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ABSTRACT

This paper elaborates the idea of using solar system for managing household electricity consumption. The proposed solution aims at reducing the overall electrical energy consumption per household, thus decreasing their monthly electricity bills. The solution is based on controlling of Smart home which includes machines such as bulb, fan, water tank etc. This system monitors the water level in the tank and automate ON/OFF by specifying the threshold value and finally an emergence alert in the form of Push notification is sent to the nearby hospital and the relatives whenever elderly and old age people are in emergence condition. Solar Power has been interfaced with microcontroller and other house hold instruments. All these instruments can be controlled and wastage of energy can be curbed. Smart home automation system particularly for old age people is proposed based on java, arduino, raspberry pi and android application. The instruments are controlled by the Raspberry pi server, which operates according to the surrounding temperature and brightness factor and also the threshold level set as in case of water tank and sends a push notification to the adjoining infirmary and relatives to the mobile phone when old age people are in exigency condition.

Keywords. solar power, Raspberry pi, Android application.

I. INTRODUCTION

Smart home consists of the interconnections of ubiquitous devices planted in home appliance with sensors and actuators for automation. In India, we are suffering from an electrical power scarcity because the production is not sufficient for the actual consumption. India is a developing country with limited resources, consequently economic and power saving focused solutions are needed. In this paper, a simple integrated design of a smart house is introduced as a solution for a common Indian home to save the consumed power from home instruments. This design has main pillars. A smart system that controls the power consumption through monitoring the activity in the home to save the power as much

as possible and to monitor old age people in emergency condition by pressing just a button which send notification to the nearest hospital and relatives. In today's booming world, wireless technologies are also becoming advance. This rapid growth of wireless technologies influences one to use mobile phones. These days' wireless telephones are used to control as well as to monitor elderly and disabled people and reduces human labor. Home automation for the elderly and disabled can provide increased quality of life for persons who might otherwise require caregivers. It is very beneficial with respect to energy savings if forgotten lights and instruments on and left for the day.

II. PROBLEM STATEMENT

A. EXISTING SYSTEM

Home computerization system targets seeking luxury and trailblazed home automation platforms are using electricity for home automation that consumes more power and also it can't be reused. No fan controlling system according to the outside temperature. It does not target old age people in exigency medical issues.

B. PROPOSED SYSTEM

The proposed system includes control of lights, fans, water tank and if old age people get panic webcam captures the photo to notify the nearest hospital through mail. All these devices can automatically be powered off during hours of the day when they're not needed. This home automation system targets those with special needs like the elderly and the disabled people. This system is reasonably cheap, easy to configure, and easy to run with a good user interface.

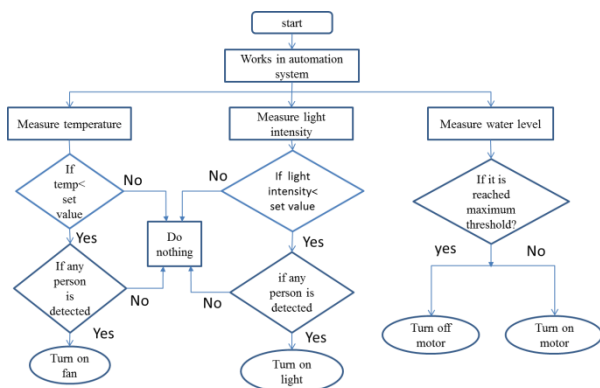


Figure 1. Flowchart

Integrants used.

1. Raspberry Pi.

It is the central core part of whole proposed system. It is used to get command from either android tablet or PC and according to the command, control the instruments connected to it on the output port. It is connected to android tablet or phone via a router by using Wi-Fi or Ethernet cable. It is also used as a webserver to store to status of instruments in the database and give it to the web application to display on the webpage. The Raspberry Pi is a credit-card-sized computer that plugs into your TV and a

keyboard. The Raspberry Pi 3 features a 1.2 GHz quad-core 64-bit Arm Cortex A53 processor, Chip antenna, 4 USB ports, an Ethernet Port, a GPIO, HDMI, 3.5mm Audio Output, WIFI chip, 1GB LPDDR2 for RAM Memory, and a MicroSD slot. The MicroSD card contains the Pi3's operating system and it can also be used for file storage.



Figure 2. Raspberry Pi

2. Arduino UNO.

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 ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online.

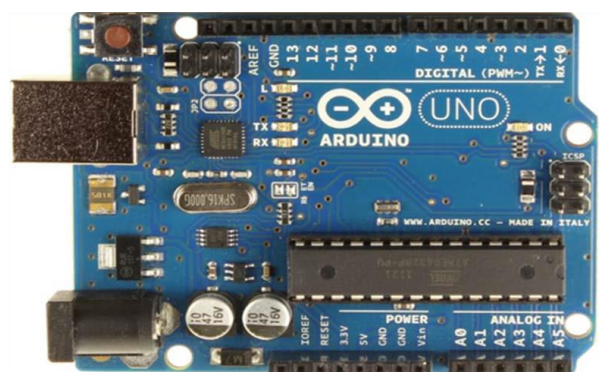


Figure 3. Arduino UNO.

3. PIR sensor

The Passive Infra-Red (PIR) sensors allow one to sense motion, almost always and is used to detect whether a human has moved in or out of the sensors

range. The PIR sensor is a pyroelectric device that detects motion by measuring changes in the infrared level emitted by surrounding objects. This



Figure 4. PIR Sensor

Motion can be detected by checking for a high signal on a signal I/O pin. They are small, inexpensive, low-power, easy to use and don't wear out. For that reason they are commonly found in instruments and gadgets used in homes. PIR sensor is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. They are most often used in PIR-based motion detectors. When the sensor is idle, both slots detect the same amount of IR, the ambient amount radiated from the room or walls or outdoors. When a warm body like a human or animal passes by, it first intercepts one half of the PIR sensor, which causes a positive differential change between the two halves.

4. LDR sensor

A photo-resistor (or light-dependent resistor, LDR, or photo-conductive cell) is a light-controlled variable resistor. The resistance of a photo-resistor decreases with increasing incident light intensity; in other words, it exhibits photoconductivity. A photo-resistor is made of a high resistance

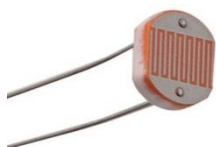


Figure 5. LDR Sensor

Semi-conductor. An LDR is a component that has a (variable) resistance that changes with the light intensity that falls upon it. This allows them to be used in light sensing circuits.

Temperature sensor

A temperature sensor is a device, typically, a thermocouple or RTD that provides for temperature measurement through an electrical signal. A thermocouple (T/C) is made from two dissimilar metals that generate electrical voltage in direct proportion to changes in temperature. Contact sensors include thermocouples and thermistors that touch the object they are to measure, And noncontact sensors measure



Figure 6. Temp Sensor

The thermal radiation a source releases to determine its temperature. The latter group measures temperature from a distance and often are used in hazardous environments.

Web Camera

A webcam is a video camera that feeds or streams its image in real time to or through a computer to a computer network. When "captured" by the computer, the video stream may be saved, viewed or sent on to other networks via systems such as the



Figure 7. Web Camera

Internet, and emailed as an attachment.

III. LITERATURE SURVEY

This technology is focused on control household instruments like light, fan, AC, etc. automatically, our main intension is to make use of the renewable resource called solar energy[1][2],and to help old age people[3].Power supply from the solar panel is given to the arduino board[4][6].The concept of smart home has 4 modules; Controlling light. Whenever the object movement is detected by the PIR sensor[5]

and based on intensity of light in the environment automatically light will glow. Regulating fans. When a person enters the room and if temperature reaches the specified range fan gets turn on automatically. Monitoring water tank. When water level in reaches below the threshold value it will turn on the motor automatically and fills the tank, if it reaches the maximum threshold automatically turn off the motor. Emergency alert. If the old age people needs any emergency medical help by pressing the emergency alert button they can notify their relatives and nearest hospital. The notification contains person's image with their address.

System Description

Solar cells absorb the solar energy from solar panel, converts AC into DC and stores in the battery. This acts as a source of energy for the Aurdino UNO which is connected to the Raspberry Pi. A temperature sensor is connected to Aurdino UNO. The raspberry pi is connected to the PIR sensor, LDR sensor, panic button, web camera, bulb, fan, cloud and tank. Whenever a person enters into the room, based on brightness, the light bulb will get turned ON and based on temperature the fans will be controlled. When a person presses emergency button, the web camera captures a photo and sends it to nearest hospital as well as to their relatives. Water tank is monitored without intervention of any person. It will be turned on/off when tank gets empty/full based on threshold level.

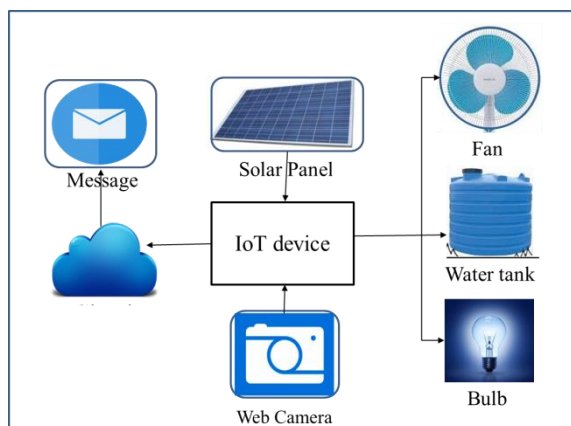


Figure 8. System Architecture

IV. METHODOLOGY

FCM.

Firebase Cloud Messaging (FCM) is a cross-platform messaging solution that lets you reliably deliver messages at no cost. Firebase serves as a module between your server and the devices that will be receiving the push notifications that you create. Your server informs Firebase that a notification has to be sent. Then Firebase does the work behind the scenes to get the notification published. In order to establish connection with Firebase, you need to create a project for your own app in the Firebase console. You must set up your project in such a way that every time a user installs it, their device is registered in Firebase with a unique token. Although this may seem complex, the setup is actually simple.

RS232 Protocol.

RS232 is one of the most widely used technique to interface external equipment with computers. RS232 is a serial Communication Standard developed by the Electronic Industry association (EIA) and Telecommunications Industry association (TIA). RS232 uses serial communication, where one bit of data is sent at a time along a single data line. This is contrast to parallel communication, where multiple bits are sent at a time using multiple data lines. The advantage of using serial communication over parallel communication is the number of wires required to make a full duplex data transmission will be very less.

Functional Specifications. Since RS232 is considered a complete standard, it defines more than electrical and mechanical characteristics. RS232 standard also defines the functions of different signals used in the interface. The signals are classified as. Common Data, Timing and control Signals.

Procedural Specifications. The procedural Specifications of RS232 specify the sequence of operations that must be carried out when a DTE and DCE are connected. Assume a computer (DTE) is

connected to a Modem(DCE) is connected to a Modem (DCE) through RS232 interface. In order to send data from computer to Modem. When modem(DCE) is ready to receive. it will send a DCE ready signal. When the computer (DTE) is ready to send the data. It send a Ready to Send(RTS) signals. The modem (DCE) then sends a clear to send(CTS) signals to indicate the data can be sent by computer (DTE). Finally, the Computer (DTE) send data on Transmit Data. When modem (DCE) is ready to receive. It will send a DCE ready signal. When the computer (DTE) is ready to send the data. It sends a Ready to Send (RTS) signal. The modem (DCE) then sends a clear to send (CTS) signals to indicate the data can be sent by computer(DTE). Finally the computer (DTE) sends data on Transmit Data (TD) line to the Modem(DCE).

V. RESULTS AND DISCUSSIONS

Controlling home automatically by sensors is showcased in our model where it includes monitoring the water level in the tank and to automate it to ON/OFF, controlling home instruments such as fan, light and finally an emergence alert using Push notification is sent to the nearest sickbay and the relatives when elderly and old age people are in emergence condition.



Figure 9. Layout of smart home

This figure8 convey the layout of the model which includes the integrant such as raspberry pi, Arduino UNO, Sensors like temperature, light and motion sensors, emergency button and water tank.

Push notification on exigency condition is sent to the nearest hospital and relatives whenever old age or elderly person presses emergency button.

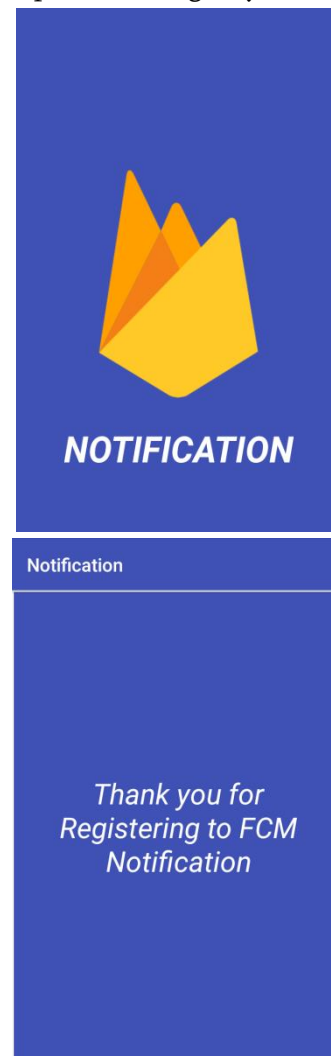


Figure 10. Android app for push notification.

When a push notification is sent to an android application the web camera will capture the photo of the old age people and sends along with the alert message.

VI. CONCLUSION

Home automation is a modern technique to control and monitor the home instruments via wireless profession. The proposed model of smart home is solar assisted. Solar power supply makes the system cost effective. This system has been proposed using Raspberry Pi module. AC Instruments like Bulb, Fan and water tank are controlled. Old age or physically challenged people are monitored by sending the push notification by capturing the photo to the

relatives and infirmity, when they are in need of medical supervision.

We can further improvise the system by implementing this to respond to voice commands and control the instruments with the unique door monitoring system based on face detection and recognition algorithms that will help elderly and disabled people from attacks.

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