

Solar Powered Smart Home Design with IoT

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Abstract - This paper presents the design of solar powered smart home with wireless sensor network which deals with smart energy management, smart health care, smart ventilation, along with smart people management. The sensor network is spread at entrance Gate, Corridor, living room and kitchen. The two internet of things (IoT) design prototypes are used for wireless communication first one is developed by using Bluetooth for short range offline communication and another by using Global system for mobile communication (GSM) for long range offline communication. ZigBee and Wi-Fi is used for online control and monitoring. The smart home derives power from the solar panel through Maximum power point tracking (MPPT) controller which provides maximum efficiency. Internal infrastructure is able to take action against certain unpredictable situation when owner may not present in the home. The owner is also notified about the problem that has been occurs. A hardware model is developed with proper sensor control scheme. This model is developed to provide online and offline control and monitoring of smart home. All power requirement of smart home is meet by self-generated solar power. The complete system is designed in the laboratory.

Keywords - Internet of things (IoT), Smart home, MPPT, Bluetooth, ZigBee.

I. INTRODUCTION

The diffusion of smart devices with embedded sensor and wireless interface have enabled the fast growth of IoT [1]. The vision of IoT states that “things” that are connected will be connect to network to collect and exchange data [2]. According to Cisco report, it is estimated that more than 50 billion devices being connected to internet by 2025. Nearly 6 trillion dollars will be spent on IoT solution by 2025 [3]. A smart home is home which is able to do all kind of automated functions. It possesses automated system for its functionality. It is able to forecasting its power

requirement. User friendly interface should be set up for monitoring and control of home appliances efficiently. Fast enough to provide reliable communication [4].

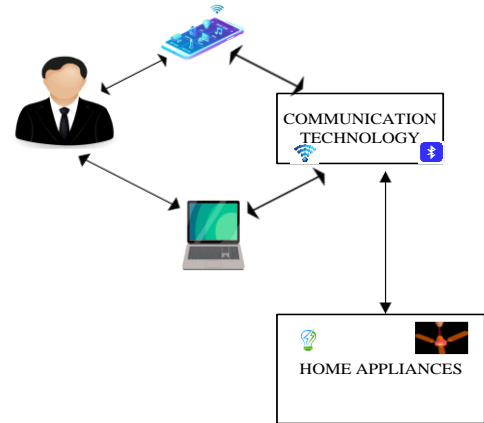


Fig. 1 Graphical of representation IoT based control

This paper described the implementation and working of solar powered smart home as shown in Fig.1. The house is controlled and monitored in real time with wireless sensor network. The power of entire smart home is done using solar energy as the primary energy sources. It involves low maintenance cost. The issue of security, fire, health care monitoring is addressed in this paper and their possible remedial measures is also described. The system is capable to actuate in certain situation when owner is not present in the house. It also endowed the issue of smart personal management by monitoring the issue that arises in day to day life taking some decision to resolve them.

This paper is organized as follows. Section II contains system architectures; section III contains methodology; section IV contains implementation details, in section V conclusions and future work is discussed respectively.

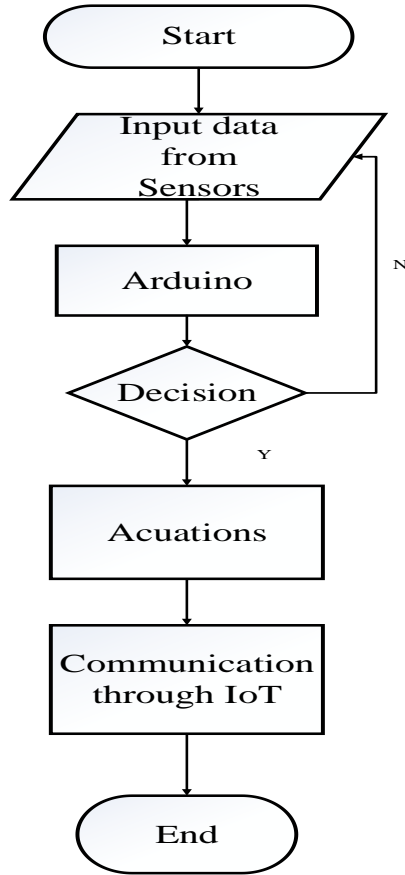


Fig. 3 Flow chart of methodology applied in smart home architecture.

Smart personal management is maintained in the smart home. The light and other electrical equipment is ON and OFF with the help of Smartphone by using Bluetooth. The hose is monitored online and offline with communication network using IoT platform.

IV. IMPLEMENTATIONAL DETAILS

A. Smart energy management

The energy requirement of this proposed smart home is catered by using solar power system. A solar modules supply depends on the level of solar irradiance impinging on panel and cell temperature. For optimum performance it becomes necessary to force the system on its MPPT. MPPT is used for transferring maximum power from PV modulus during different hours of the day, through changing weather condition with altering roof pitches and different number of panel per string. We can't make the use of solar during night time, cloudy days to

overcome this situation we store the energy in battery. To regulate the produced voltage; voltage regulator is taken into action which step up or step down the voltage as per requirement of home appliances. It protects them from burn out and under performance. Arduino is also powered by solar energy and all sensors derive their power from Arduino.

The IR is given in each room for detecting the presence of a person entry into room. The light get turned ON by presence and get OFF when no one is in the room. This help in conservation of energy

B. Sensor Network

- Entrance gate- The ultrasonic sensor calculates the distance of an individual from the gate. If the distance is less than 10 cm then it send the input signal to the Arduino. Arduino give command to the servo motor for opening of gate.
- Corridor-The PIR sensor in corridor determine the presence of an intruder in the smart house. Notify the owner regarding this. When an Intruder is found a pop up message is sent to the smartphone through Bluetooth and GSM modules and on PC by ZigBee. The buzzer is also provided with PIR. It started ringing as an unknown person entered into the house
- Living room-Temperature and humidity is measured by DHT 11 sensor. Real time temperature and humidity is access by Smartphone using Blynk app. When temperature increases from above threshold value the Fan get stared. If below the lower threshold the heater get started. If there is an abruptly in into the value of temperature then it is data is compared with the data of MQ 2 to sensor for determining the situation of fire in the house.
- Smart Health care network-The LM 35 and pulse rate sensor is fitted for health scanning. Their value are printed on LCD screen attached with Arduino. If there detect the value body temperature and pulse rate respectively beyond the normal the Email is sent to the user whose Email ID is described in the process.

- (e) Kitchen-The amount of smoke is measured by MQ 2 sensor if the value is beyond the setup limit the buzzer rang and exhaust fan is started. If the value of smoke is abruptly high than it check the temperature if it is also high then it is called as fire in house and alert is send to the residence through ZigBee. The load sensor is connected to the LPG to check its weight if it is found low then call is set up the agency for providing the new LPG cylinder.

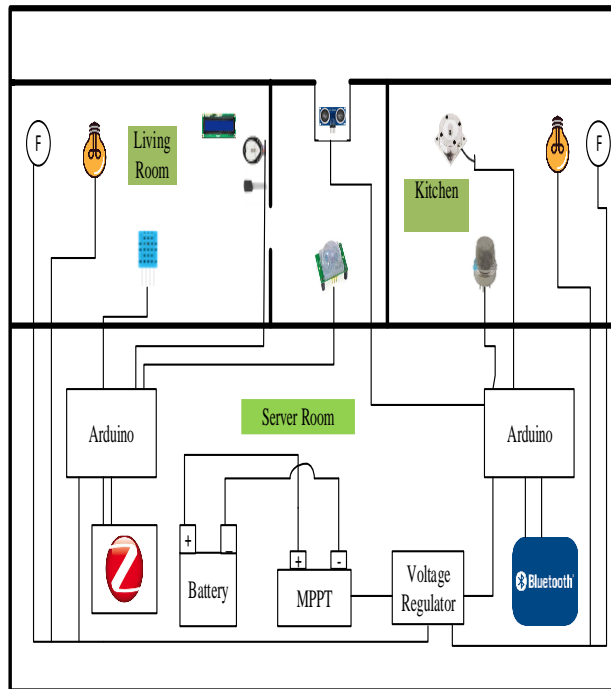


Fig. 4 System architecture of smart home

C. Communication Network

- (a) Bluetooth-The reading of the entire sensor is given in the Smartphone through the use of Bluetooth. The Blynk app is taken into the application which works as an interface between Arduino and Smartphone. The electrical appliance of each room is also controlled by this.
- (b) ZigBee-It is use for online assessment of home. The data is transited by ZigBee router and received by the coordinator. The X-CTV software configured with it for providing information on PC.

- (c) GSM-The text message and call is set up automatically on the provided number with use of GSM modules. It is taken into application when the information is sent for longer distance.

The implementation model of smart home is shown in Fig. 4 and prototype experimental model of smart home is shown in Fig. 5.

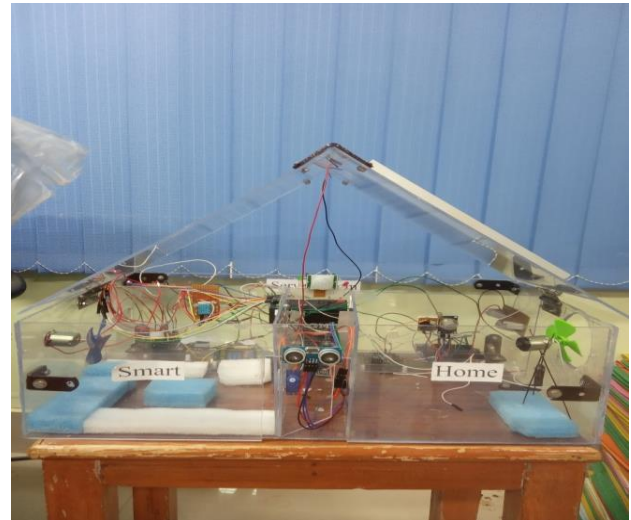


Fig. 5 Prototype model of smart home

V. CONCLUSION AND FUTURE WORK

This paper presented solar powered smart implemented using IoT principle. The monitoring of various parameter of the room and controlling application is achieved using Zig Bee, Bluetooth and GSM interface. It ensures security by altering and taking preventative measures. It proposed sustainable system with clean power source. This proposed system is extended further in novel ways by setting up a grid connected solar rooftop system with smart metering. If surplus power is generated, the energy is fed to the grid.

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