Upgradation of Smart Cabin Using Human Detection

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Abstract:—Internet of Things (IoT) is enabled by the advancements in the latest technologies including sensors, Radio Frequency Identification (RFIDS), internet protocols and communication technologies. The most important premises of IoT is to connect devices and sensors without human intervention. The proposed smart home automation system differs from other systems by allowing the user to access and operate the system from anywhere around the world through internet along with decision controls according to the needs. In this paper, we propose an algorithm for smart home automation system based on IoT using sensor nodes which are directly connected to Arduino Nano. The algorithm perform some basic local functions such as; Turning ON/OFF the lights based on the motion sensor and generating the alarm based on the gas sensor. In the proposed algorithm the Arduino Mega is connected to the internet using Wi-Fi module to monitor the power consumption of different home appliances and can be controlled from anywhere on the internet. The objective of the proposed system is to provide a low cost and efficient solution for home automation system by using IoT. Results show that the proposed system is able handle all controlling and monitoring function of home.

Keywords— Smart home system, Internet of Things, Motion sensor, Gas sensor, Alarm system

I. INTRODUCTION

The Internet of things [1] is a network of physical objects, devices, buildings and other items embedded with electronics devices, sensors and network connectivity that enable these objects to collect and exchange data. By means of IoT, we can control a door, lights, fans and other embedded electronics appliances which are connected to internet even if we are not present in the building.

IoT has revolutionize the business strategies, through this enterprise companies built a proprietary system to collect and organize data that is secure and complaint, and uses connected devices to transmit more data to the system. Parcel service companies use sensors on their vehicle to monitor the speed of a car, mileage, and number of stops. IoT has wide range of application, these applications are categorized as follows:

Building and Home Automation:- Buildings and homes are automated by means of temperature. Lights, AC and Fans are controlled based on room temperature observed. Energy Optimization is one of the prime concern of IoT. If we accidently left our home's lights we can switch them off with IoT technology. Connected Appliances is another application based on IoT, which includes; smart refrigerators, smart vacuum cleaner etc.

Smart Cities:- Residential E – meters is used to improve the efficiency of service and meet residents meet by telling us the amount of electricity consumed and its demand. Smart Grids is used to control the energy generating and/or consuming entities within the electricity network. Smart Street Lights are used to monitor switching, voltage, power, alarm, energy consumption and also set parameters and power line, lamp failure alarm etc. Surveillance cameras used for security purpose, operate in hidden mode, capture live events and save as video file, switching on and off, broadcast video live on internet.

Manufacturing:- IoT plays a vital role in manufacturing, these applications include: Real time inventory, the sale and inventory reports, more efficient manufacturing decisions, increase manufacturing agility, save money, boost sales. Asset Tracking help to control asset location, optimizing asset availability, increase efficiency by minimizing stock out cases. **Wearable's:-** Entertainment google glass is one example which uses exiting google apps like Gmail and google. Healthcare some medical instruments when connected to patient's body helps doctor to monitor him/her if he/she is not physically present there; e.g. smart stethoscope, B.P. apparatus etc. Smart Watch allows to check the metabolism and notifies when metabolism is disturbed by using internet. Location and Tracking/Pet Tracking uses microchips which are placed on person/pet body to track its location easily.

Health care:- Remote Monitoring smart medical apparatus help doctor to monitor the patient details and history directly when apparatus are attached to patient's body even when doctor is not available at particular place. Hospital Asset tracking smart cabins helps us to track any particular patient data/record and tells the location of different asset placed in smart cabins. Access Control, a smart medical instrument when applied to patient body tells him/her about present condition and recommended him/her about the type of specialist doctor. Ambulance Telemetry, having connection with internet and treat/diagnose patient in a community as well as in the hospital. Drug Tracking contain sensors in the pill which enables doctors to have more clear and better insights of human body. Predictive Maintenance device connected to patient's body and predict that when and how much medication is needed.

Automotive:- Automotive applications are related to smart vehicles Infotainment provide us information about vehicle and travelling and also entertainment contents. Smart wire corrector helps us to control its wiring and its replacement for better functioning of vehicle.

Retail:- Shopping Applications smart screens provide buyers deeper info about the items they are looking at, including up sells. A smart cabin tells us about over stock, out of stock. Supply Chain Management we can connect the supplying machine with the internet and control it with our smart phones from anywhere.

Environment:- Water Pollution sensors placed in the water channels, they detect the harmful entities above the safe limit so we can apply remedies. Air Pollution detectors placed at different places to detect the air pollution and alarm at specific air pollution and configuration control. Weather Monitoring Ethernet analogue sensor is used to monitor weather.

The IoT is an emerging technology that is providing a privilege to communicate all around the world. Its objective is Anything, Anyone, Anytime, Anyplace, Any service and any network.

Figure 1. C'S and A's of IoT

Figure 1 describes the combination of C's and A's that discloses, peoples and things can be connected anytime, anyplace with anything and anyone by using any available network and using any service. This elaborates addressing of elements such as convergence, content, repositories, computing, communication and connectivity in the framework where there is continuous interconnection between people and things or between things and things so the A and C elements are tightly coupled.

The main challenges faced by smart home systems are high cost of ownership, poor security, poor manageability, and inflexibility. However, the existing solutions are costly in terms of upgradation and installation. Therefore, an efficient and cost effective algorithm for the smart home system is needed to provide a feasible solution.

The rest of this paper is organized as follows; related works is discussed in section II, section III outlines the internet of things. Prototype of proposed smart home system is presented in section IV. Section V describes the performance evaluation of the proposed algorithm, whereas the last section concludes this paper.

II. **RELATED WORK**

This section presents the existing techniques of smart home system based on IoT, ZigBee, Bluetooth and smart phones.

In [2] the author aims to control the heat, light and temperature of house/office via smart bulbs, smarts heat detectors with the help of IoT. Furthermore, it can also clean house through smart vacuum cleaner and can turn OFF/ON the lights even when users are away at a distance from home. The work presented in [3] targets to find the lost things in house that we forgot where we placed them, thus with the help of trackers these objects are tracked easily and alarm is generated when these objects are moved from its appropriate place. An SMS notification is sent to the owner in case of misplacement. In [4], a car is replaced with a robot to automate the car by monitoring the path way, tracking the location by GPS, as a result, reduces the accidental risks. By using NFC tags [5], visual markers and numeric identifier are placed on posters and panels to get the needed information about the cost, number of seats availability, to automate the ticket system. The work presented in [6] aims to automate the availability of restaurants, their menu and rooms availability.

People can reserve hotel rooms directly being staying at home. Patient monitoring system is presented in [7], the goal of this research to automate the medical instruments to receive clinical data for diagnosis purposes. In [8], smart homes are introduced for the comfort, security, convenience and to provide energy efficiency to its occupants. In [9], author describes that with advancement in sensor networks there comes a rapid increase in automation. Everything going to be automated rather than manual. IoT is an emergent network of daily objects which is being monitored and controlled using mobile or internet. In [10], the author states that by making home environment intelligent enough, it can make life easy for disabled and elderly personals. In last few years there is much increase in home automation because of rapid increase in smart phone usage. In [11], the author suggests an idea that in order to make smart home low cost and flexible micro web server based on Arduino Ethernet, hardware interface modules and android based application is used. Using this system authorized users can remotely control and monitor home devices connected through 3G/4G or Wi-Fi. In [12], author proposes smart appliances based on Bluetooth. The smart appliances are controlled by Bluetooth technology with the use of Wi-Fi to efficiently monitor maximum energy consumption appliances. Therefore, to overcome the maximum use of energy consumption by turning OFF/ON those appliances. An information framework for creating a smart city through IoT is presented in [13], aims to enhance the life style. In [14] the author suggests an innovative, detached and flexible ZigBee based smart home system. The system is flexible and scalable that allows extra home appliances designed by multiple vendors to securely add to the home network with the minimum amount of extra work. The system allows its owners to monitor and control the connected devices locally, through multiple controls like any Wi-Fi enabled device which supports Java or using ZigBee based remote control. Moreover, in this system a common home gateway is used to integrate ZigBee based home automation system and Wi-Fi network. The network is interoperable, simple and flexible due to common home gateway that provides user interface, and remote access to the system.

INTERNET OF THINGS

Machine to Machine (M2M) communication and mobile technologies are the current revolution of the internet. It is the leading phase towards the IoT. IoT [15] will empower the physical objects in a way that they can hear, think and see. These objects can accomplish jobs by talking with each other and by knowing the status of other connected physical devices. Devices are connected so that they can share data and information to co-ordinate decisions. IoT has transforms the objects from traditional to smart by using existing technologies such as pervasive computing, communication technologies, sensor networks, ubiqtuous computing and internet protocols.

To get better insight into the real meaning and functionality of the IoT there is a need to understand its building blocks which are as follows and as shown in figure 2:

   i.   Identification
   ii. Sensing
   iii. Communication
   iv. Computation (hardware and software)
   v. Services
   vi. Semantics

Figure 2. IoT basic building blocks

According to a new data from the juniper research [16] the number of IoT connected devices in the future will have an increase of more than 285% from 13.4 billion at the end of 2015 and 38.5 billion at the end of 2020.

Home automation is needed to be enhanced by the integration of above mentioned technologies in the real world environment. This enhancement is the part of emerging concept called smart home system. Smart home system will change people's life radically with the new ubiqtuous computing and communication technologies. It will provide the devices and systems supported with the smart technologies. It will have the rapid response towards the change in the circumstances without human intervention. This new system will be able to learn from these circumstances.

Smart environment [17] is just like a small world where sensor enabled and network devices are integrated to work and collaborate continuously to make the lives of its inhabitants more comfortable as it was before.

Every Smart community has important requirements which make that community smart [18]. These requirements are:

Sensible: Sensor can sense the environment.

Connectable: All the networking devices should be connected for information sharing.

Ubiqtuous: It should be accessible for the user through the web Shareable: Object should be addressable and accessible as well as data.

Visible/Augmented: Information should be visible.

RFID is getting prominence in the identification technology due to its small size, low power, low price, light weight and inexpensive maintenance rates. It is going to be used in many advance fields like pharmaceuticals, manufacturing and retail. It is now in consideration to use RFIDs with the emerging technologies including ubiqtuous computing.

In general almost every home is connected to the internet and each home has nearly same objects which can be converted into the smart objects with the meaning of IoT such as doors, windows, fans, meters, security system and automation. All these objects can be converted into the smart objects by using sensors, Quick Response (QR), RFID, Near Field Communication (NFC) and by giving them significant level of intelligence [17]. The purpose is to allow operation of actuators and even power of decision making. All these characteristics of objects can transform a classical home into the smart home system.

PERFORMANCE EVALUALTION

This section briefly describes the performance assessment of the proposed algorithm on a webpage for the temperature and power consumption, while the motion sensor, gas sensor and door sensor works locally.

Figure 6 shows the energy consumption of a 100W bulb from 9am to 11am. Power is calculated by using ampere and voltage as under:

Power = Voltage * Current (amperes)

Both these values are graphically represented on IoT webpage working on the embedded static IP of the Wi-Fi module. If some appliances is consuming more power and exceeding the threshold (a maximum limit), the user can control the appliance through IoT webpage.

The real time temperature observed on the webpage against time is shown in figure 7. Thus, on the basis of temperature data the fan speed is automatically controlled. On the other, hand the

the voltage drops to the minimum limit. As voltage vary, the power consumption of the appliances also vary.

CONCLUSION

In this paper, an IoT based algorithm is proposed for the smart home system to automate the Fan, monitor the gas leakage and notify by means of an alarm, intrusion detection and energy monitoring. The proposed algorithm was practically implemented on Arduino mega for the testing purpose. The result shows that, the algorithm is capable to observe the motion of a human being, to observe the intrusion by monitoring the line of sight communication between door and senor. The temperature and power consumption are monitored on a web page globally and can be monitored and controlled being away from home. Simulation results show that, the system is efficient and cost effective in terms of providing reliable information and automation. In future, this work can be to implement in a real world home to automate it as smart home.

REFERENCES

[1] Atzori, L., Iera, A., & Morabito, G. (2010). The internet of things: A survey.Computer networks, 54(15), 2787-2805.

[2] C. Buckl, S. Sommer, A. Scholz, A. Knoll, A. Kemper, J. Heuer, A.Schmitt, Services to the field: an approach for resource constrained sensor/actor networks, in: Proceedings of WAINA'09, Bradford,United Kingdom, May 2009

[3] R. Yuan, L. Shumin, Y. Baogang, Value Chain Oriented RFID System Framework and Enterprise Application, Science Press, Beijing, 2007.

[4] G. Broll, E. Rukzio, M. Paolucci, M. Wagner, A. Schmidt, H. Hussmann, PERCI: pervasive service interaction with the internet of things, IEEE Internet Computing 13 (6) (2009) 74–81.

[5] D. Reilly, M. Welsman-Dinelle, C. Bate, K. Inkpen, Just point and click? Using handhelds to interact with paper maps, in: Proceedings of ACM MobileHCI'05, University of Salzburg, Austria, and September. 2005

[6] D. Niyato, E. Hossain, S. Camorlinga, Remote patient monitoring service using heterogeneous wireless access networks: architecture and optimization, IEEE Journal on Selected Areas in Communications 27 (4)(2009) 412–423.

[7] Piyare, R. and Lee, S.R., 2013. Smart home-control and monitoring system using smart phone. ICCA, ASTL, 24, pp.83-86.

[8] K. S. M. Vinay sagar K N, "Home Automation Using Internet of Things," International Research Journal of Engineering and Technology (IRJET), vol. 02, no. 03, pp. 1965-1970, 2015.

[9] Joshi, M., & Kaur, B. (2015). Web Integrated Smart Home Infrastructure Using Internet of Things. International Journal of Engineering Research and General Science, 3(6).

[10] Piyare, R., 2013. Internet of things: Ubiquitous home control and monitoring system using Android based smart phone. International Journal of Internet of Things, 2(1), pp.5-11

[11] P. McDermott-Wells, "What is Bluetooth?" IEEE Potentials, vol. 23, no. 5, pp. 33–35, Jan. 2005.

[12] J. Jin, J. Gubbi, S. Marusic, and M. Palaniswami, "An information framework for creating a smart city through Internet of Things," IEEEInternet Things J., vol. 1, no. 2, pp. 112–121, Apr. 2014.

[13] D. Uckelmann, M. Isenberg, M. Teucke, H. Halfar, and B. Scholz-Reiter, "Autonomous control and the

Internet of Things: Increasing robustness, scalability and agility in logistic networks," Unique Radio Innovation forthe 21st Century, pp. 163–181, 2010.

[14] Gill, K., Yang, S.H., Yao, F. and Lu, X., 2009. A zigbee-based home automation system. Consumer Electronics, IEEE Transactions on, 55(2), pp.422-430.J. Hurtado-López and E. Casilari, "An adaptive algorithm to optimize the dynamics of IEEE 802.15.4 networks," Mobile Networks and Management. 2013, pp. 136–148.