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Home Automation Using IoT

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Abstract : Nowadays, the home automation systems are gaining a lot of popularity because of busy schedules of peoples. Home automation systems makes sure accurate actions with security which makes the users life easy and more comfortable. HAS mostly runs on the triggers initiated by the sensors such as air conditioner, lights, fans, etc. But HAS is mostly used in developed countries and not in developing countries because of the cost that it takes to setup the system, one more issue that user might face is that the system sometimes take iterative decision based on the hard coded logic which might not be idle every time. To overcome this issue of the system, a home automation system unified with the Wi-Fi network of a home will be the best solution. If we combine a simpler UI and good better UX with low cost it could make a huge impact on the developing nations.

I. Introduction

The IoT stand for Internet of things which refers to the intercommunication among smart devices by using embedded systems to exchange data among each other despite these, number of objects joining the internet of things in order to provide information, improve the industrial efficiency of applications etc. An IoT ecosystem contains smart devices that use embedded systems, such as sensors, processors and communication hardware, to collect, send data they acquire from their surroundings environment.

The IoT system is set of numerous elements that range from protocols, sensors, actuators, to cloud services and layers. The architecture which defines main concept of Internet of things are, namely the perception, network, and application layers which forms three-layer architecture. The Internet of Things based Home Automation system provides lot of flexibility over wired/wireless systems. it also come with various advantages like ease-of-installation, ease-of-use, avoid complexity of loose electrical connections, easy fault detection and triggering. Thus, IoT based system consist of sensors and servers.

Automation is the process of automatically performing everyday functions/task around the home to reduce your time, energy and money. The idea of a home automation is to developing a smart automated system for a home that charge to control the home appliances, lighting, entertainment systems. and climate over the Internet.

Home Automation concept has ben in existence for several years.” Smart Home”,” Intelligent Home” are the term used to introduce the concept of networking appliance within the house. Home Automation System has included centralized control and distance status monitoring of lighting, and other appliances and the system within house.

Due to advancement of wireless technology, there are several different types of connection are introduced such as BT GSM and WIFI. each of these connections has their own unique specification. Among the four popular wireless connection that often implemented in Home Automation System project, WIFI is being chosen with its suitable capability. The overall capabilities of WIFI module are more than enough to be implemented in the design. Also, most of the current laptop or Smartphone come with built-in WIFI adapter. It will indirectly reduce the cost of the system. The Wi-Fi shield needs internet connection from a wireless router or wireless hotspot and this would act as the gateway for the Arduino to established communication with the internet. With this in mind, an IoT-based home automation system for remote control and observing the status of home appliances is designed.

The Internet even utilized in home automation offers several decisions from economical use of energy to additional console, protection and safety. Even from great distances the user can monitor and manage their home door, various appliances and turn on/off the Fan. without any human interruption. Even with these advantages, home automation has however received extensive approval and an attention owing to its high significance and complexness

In this Project we are going to design and construct a home automation system that will remotely switch on or off lights, fans, draw/undraw curtains and lock/unlock doors using WIFI based android application.

II. Literature Review

HAS are popular because of the ease it brings to user’s life which makes it come in the focus of publications more often, but no publication ever analyzes or even reviews any open-source project in-depth.

O. Taiwo in ‘‘Smart home automation: Taxonomy, composition, challenges and future direction” 2020,
There are basically 5 sections in a HAS which include,

- Sensors
- Application layer
- Protocols
- Platforms
- Automation layer

These are the sections where the open-source HAS automations systems work on. Taiwo, et al also describes the trends also the challenges the HAS faces.
According to Taiwo, et al, currents trends of HAS circles around privacy, security, energy efficiency and reduction, and innovations. The challenges that open-source HAS has to face are security problems like authentication also authorization and privacy, production problems like system compatibility, efficient energy management, system’s high cost, etc.

S. Faroom in “Literature review on home automation system for physically disabled peoples” 2018, performed a detailed comparison on the approach of HAS’s towards the people with physical disability and issues with mobility. In his review, he extensively focused on advantages HAS provides to the physically disabled users, that is the system’s usability and accessibility characteristics. He explored these aspects of the system,

- Installation cost
- Security
- Scalability

Author concluded by saying HAS’s systems are solidifying their position in the market by providing such characteristics. But as our focus is on partial DIY HAS which will help us to reduce the cost of the system drastically.

Risteska Stojkoska in ‘‘A review of Internet of Things for smart home: Challenges and solutions’’2017, reviewed IoT applications in smart homes and the challenges they encountered. They identified 3 challenges,

- Challenge related to handling of big data and numerous requests, regarding the performance while processing the requests.
- Balancing between proper network protocol and cost and performance of the system is another challenge.
- Security and privacy is another concern which arises where wireless transmission takes place.

To summarize the author stated that, no work is done yet that can present an overview of available HAS that can perform active comparisons between systems functional and non-functional requirements.

III. IoT Architecture

The IoT-based architecture (design) provides high-level flexibility at the communication and information. It is an approach which is relevant in many environments such as patient monitoring system, security, traffic signal control or controlling various applications. The IoT project aims to bring out the various opportunities of using IPv6 and other related standards to overcome the disadvantages of using of the Internet of Things. The IoT projects prove a dominant and thorough study of all sensible functionalities, mechanisms and various protocols that can be used for building Io architectures, however interconnections may occur between all totally different IoT applications.

As within the networking field, where several solutions emerged at his infancy to leave place to a common model. The TCP/IP protocol suite, the emergence of a common reference model for the IoT domain and the identification of reference architectures can lead to a quicker, more focused development and an exponential increase of IoT-related solutions.

These solutions will give a strategic advantage to mature economies, as new business models can leverage those technological solutions, providing room for economic development.

IV. User Interface

The user interface is everything that the user can see and act with. During this module, the android enabled phone makes control of the home automation system. The Android Smartphone provides a range of pre-build program parts like structured layout objects and program controls that enable us to create the graphical program for our app. The Android OS also provides other User interface modules for special interfaces such as dialogs, notifications, and menus. The interface should enable the user to look at the device status and to regulate the device.

V. Limitation of existing HOS System

Based on the researches that have done, one of the main issues in most existing Home Automation System is their implementation and maintenance cost, which is not affordable for most users. as well, some current systems provide a view of the house from a web application which is inconvenience for end users, who must access the Web each time they want to control or view the status of their houses.

In addition, some Home Automation System lack of user-friendly interfaces for monitoring and controlling appliances. Besides, there are some limitations in the communication technologies that have used in the existing automation systems. For eg, the communication range of Bluetooth is limited to 10 meters. If more than 10 meters, the connection will be lost and the user not

able to control the home's appliances. Also, ZigBee is designed for low-rate wireless personal area networks with data rate 250Kb/s which is insufficient data rate. One more communication technology is GSM which can be access anywhere in the world, but it is costly, and it has low data rate of transmission and limitations in coverage for rural areas. For that reason, in this paper, we propose a new system to overcome the limitations of the existing home automation systems. This can be achieved by design and fabricate a low-cost Wi-Fi based Automation System for Smart Home prototype using Node MCU and Android-Based smartphone. The system developed to control all the electrical appliances at home easily and efficiently and enable the remote control by supporting the IoT concept.

Accordingly, in this paper, we propose a new system to overcome the limitations of the existing home automation systems. This may be achieved by design and fabricate a low cost Wi-Fi based Automation System for Smart Home prototype using Arduino microcontroller and Android-Based smartphone. The system developed to control all the electrical appliances at home easily and efficiently and enable the remote control by supporting the IoT concept.

VI. HARDWARE

3.1NodeMCU

Node MCU is an open source platform based on ESP8266 which can connect the objects and let data transfer using various Wi-Fi protocol. In addition, by providing some of the most important features of microcontrollers such as GPIO, it can solve many of the project's needs alone.

3.2 ESP8266 ESP-01 (WIFI Module)

ESP8266 Serial Wi-Fi Wireless Transceiver is a self-contained SOC with integrated TCP/IP protocol that can give any microcontroller access to your Wi-Fi network. The ESP8266 module have the ability to either hosting an application or offloading all Wi-Fi networking functions from another application processor. ESP8266 Wireless Transceiver comes pre-programmed with an AT command set firmware.

3.3Jumper Cable

The Jumper cables, also known as booster cables or jump leads, are a pair of insulated wires of sufficient capacity with alligator clips at each end to interconnect the disabled equipment with an auxiliary source, such as another vehicle or equipment with the same system voltage or to another battery.

3.4 DC 12V Metal Geared Motor

A 12V Geared Motor is a combination of a motor and gearbox. The addition of a gear head to a motor reduces the speed whereas increasing the torque output. The most important parameters with regard to gear motors are speed (rpm), torque (lb-in) and efficiency (%).

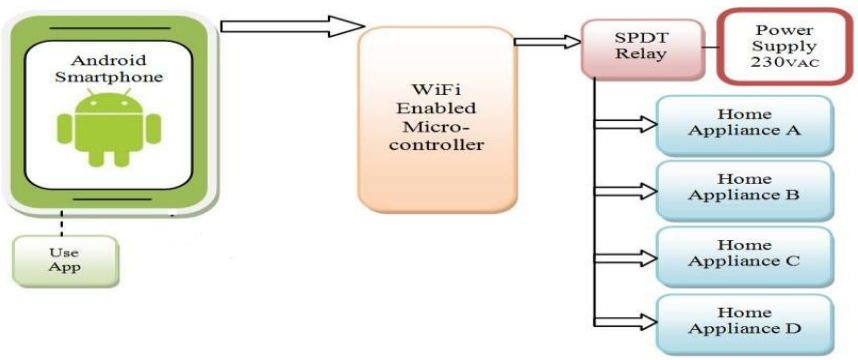
3.5 RC522 RFID Reader Writer Module

RC522 RFID Reader Writer Module is the highly integrated RFID card reader which works on non-contact 13.56mhz communication, is designed by NXP as low power consumption, low cost and compact size read and write chip, is the best choice in the development of smart meters and portable hand-held devices.

3.6 Relay Module

A 5v relay module is an automatic switch that is commonly used in an automatic control circuit and to control a high-current using a low-current signal.

VII. BLOCK DIAGRAM



VIII. FUTURE SCOPE

Future scope for the home automation project involves making homes even smarter. Homes are interfaced with sensors as well as motion sensors, light sensors and temperature sensors and provide automated toggling of devices based on conditions. A lot of energy can be conserved by ensuring occupation of the house before turning on devices and checking brightness and turning off lights if not necessary. The system is integrated closely with home security solutions to permit larger management and safety for home homeowners.

The next step would be to extend this technique to automate a large-scale environment, such as offices and factories. Home Automation offers a worldwide global standard for interoperable products. The Standardization enables smart homes that can control appliances, lighting, environment, energy management and security as well as the expandability to connect with other networks.

IX. CONCLUSION

It is clearly seen from this project work that an individual control home automation system can be cheaply made from low-cost locally available components and can be used to control multifarious home appliances ranging from the security lamps, doors and even the house lighting system. And better still, the components required are so small and few that they can be packaged into a small inconspicuous container. Home automation systems will be tested a number of times and certified to control home appliances used in the lighting system, doors and many more. Electrical devices will drastically go down as we will be using digital switches not electrical one. Through this System, user will be able to access the Appliances directly even if he is not familiar with the working room or environment.

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