Smart-Home using "IoT"

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Abstract In recent years, there has been considerable attention towards the development of IoT in different fields especially in smart homes as it provides reliability, efficiency, wide-range control, and information analysis.

Smart home systems achieved great popularity in the last decades as they increase the comfort and quality of life. Most smart home systems are controlled by smartphones and microcontrollers. A smartphone application is used to control and monitor home functions using wireless communication techniques. We explore the concept of smart home with the integration of IoT services and cloud computing, by embedding intelligence into sensors and actuators, networking of smart things using the corresponding technology, facilitating interactions with smart things using cloud computing for easy access in different locations, increasing computation power, storage space and improving data exchange efficiency. In this chapter, we present a composition of three components to build a robust approach to an advanced smart home concept and implementation.

1. INTRODUCTION:

After the development that took place over the past late years and the enormous technological development in various activities and fields, mankind had to go to automation of their homes A smart home is a habitation that utilizes web-connected devices to enable far off monitoring and management of appliances and systems, for example, lighting and heating Smart home innovation, also often alluded to as home automation gives homeowners security solace, accommodation, and energy efficiency by allowing them to control smart devices often by a smart home app on their smartphone or another organized gadget Apart of the web of things (IoT) smart home systems and devices often operate together, sharing buyer usage data among themselves and automating actions based of the homeowners. home automation systems consist of a smartphone microcontroller and some sensors and actuators to play out the program instructions flashed on the microcontroller. Then the output data will be uploaded/downloaded to/from the cloud. A smartphone application is utilized to control and screen home appliances. We will utilize the type of wireless communication techniques "Wi-Fi" to connect it to an IoT cloud which will gather all the data and process it and then executes whatever it should, in the same time using Bluetooth communication techniques controlling our home in a shorter range utilizing of speed, and in case losing internet connection.

In order to avoid system failure due to sudden power outages, we provide our system with an external power supply.

2. STATISTICAL ANALYSIS:

It is known that any study needs a sample, and the larger the sample size, the greater the effectiveness of the study to the degree of verification, so here are some reasons why we should change our homes into smart ones:

- According to Statista, the current number of smartphone users in the world today is 3.8 billion, and this means 48.33% of the world's population owns a smartphone.
- By 2020, the number of smartphone users in Egypt is estimated to reach 96 million, meaning that every person, whether educated or illiterate, has or He owns a smartphone, can easily use our user-friendly application,
- other main reasons for changing to a smart home user:

Security:

Terrorism and other small crimes are now very common and, in this era, everyone wants to make their home secure. A burglary occurs every 30 seconds. *The average loss from burglary is $2,661. Smart homes will allow you to make your home secure as well as it will also allow you to monitor the security very easily through your smartphones.

Utility Bills:

The world is getting expensive day by day and people are very concerned about their utility bills. A smart home ensures you save electricity and reduce your power and water bills. Often it is observed that lights remain on due to the laziness of standing up and turning them off. A smart home will allow you to turn off lights and other electronic items even when you are in bed and going to sleep. It will save you a huge amount of cash.

Time-saving:

13.57% of the people who use smart devices say theysave enormous time.

Economical-benefits:

54% of homeowners believe that installing smart homesystems will make the house sell faster.

3. WHAT IS "IoT"?

The internet of things, or IoT, is a system of interrelated computing devices, mechanical and digital machines, objects, animals, or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

A thing in the internet of things can be a person with a heart monitor implant, a farm animal with a biochip transponder, an automobile that has built-in sensors to alert the driver when tire pressure is low, a flame sensor that tells the homeowner if there is a fire or any other natural or man-made object that can be assigned an Internet Protocol (IP) address and can transfer data over a network.

4. PROPLEM STATEMENT & MOTIVATION:

- Elderly and the handicapped user faced problems to manually access control of light and fan instead of the automation process.
- The status and safety of the house are unknown when the user is away from the house for certain days.
- The complexity of installing and high-cost configuration of previous home automation systems leads to not receive much demand and attention.

- The motivation for developing smart home systems comes from many reasons, but the most prominent are convenience, security, energy management, connectivity, and luxury.
- The biggest motivation behind smart home systems is convenience. Convenience is another way of saying "time saver", and into a day's world where everything is moving faster, every second has value. Most of the technology we use today is based on convenience

5. SYSTEM ARCHITECTURE:
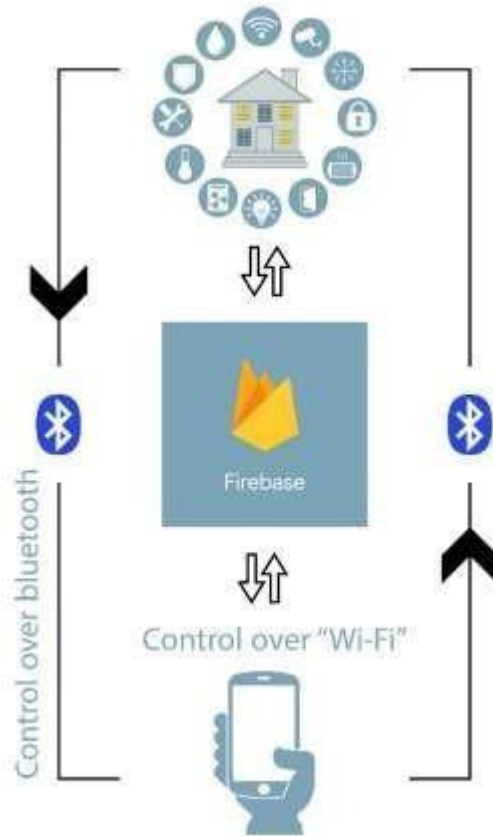
6. SOFTWARE IMPLEMENTATION:

Software implementation is divided into:

1. Mobile Application:

An Android/IOS app that we developed from scratch using React Native, designing it to meet our needs in controlling everything in the house receiving alerts, notifications, and readings from each sensor in the house using either Bluetooth in short-range and "Wi-FI" in Long-range and based on the internet connection, the internet is the main method that connects to the Database on the cloud and takes the readings and changes the status of any gadget in the house.

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486

2. Database (Firebase):

Using the internet connection method, the database is in the middle between the mobile application and the MCU, the microcontroller (using the WiFi module) sends to the database all the sensors' readings and statues of every door, light, or curtain and it can change them if the mobile app sends an order to do so, and when an event that needs to send a notification to the app such as fire the MCU sends to the database that sends to the app if the internet connection is not down.

3. Microcontroller (MCU):

The Microcontroller is the brain of the house, as it is connected to everything, to take readings and control, either automatically based on the readings or from orders it takes from the mobile application, with its code was written using C it contains a function for each system in the house, and to functions that connect the MCU with Bluetooth and the database (using WI FI module).

7.   SYSTEM FUNCTIONS:

1.   Controlling lights:

This System provides an easy way to control lights that are located all around your house using the app and provides another option to be automatically closed when no one is in the room to save power. in the next figure.

2.   Auto cooling:

Turning the fan (air-condition) on a certain temperature and off at a certain temperature as configured by the user.

3.   Auto Gardening:

Provides soil with water if needed using a specific soil sensor. And controlling it manually using the mobile application as shown in the next figure

4.   Anti-theft:

Placing Ultra-sonic sensors on every wall adjusting its range so that anyone who tries breaking into the house sends alerts to the mobile application and siren is on.

5.   Auto curtain control:

Automatically opens the curtain upon sensing sunrays and closing it at night and can also be controlled using the app, as shown in the next figure.

6.   Garage control:

The garage door opens using either an RFID card with the homeowner or using the mobile app, as shown in the next figure

7.   Fire and Earthquake:

Automatically opens the alarm and sends an alert to the app upon sensing fire or earthquake.

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487

study and control are interior temperature and lighting, movement around the house, and water level of the pool. The house has three main operating modes. In automatic mode, it performs the measurement and executes the control of the variables, regulating itself according to the conditions to which it is exposed. In contrast, the remote mode is achieved using the mobile application that allows the user to modify the variables. Finally, in alarm mode, it controls the parameters that assure the security of the house when the proprietor is away from home.

To capture the signals, the prototype has temperature, lighting, movement, and water level sensors installed, and for regulation and control it has a fan, some LED, an acoustic warning device, and a water pump. The core is an Arduino Mega board that allows the application operation and receives, from an Android mobile application, operating modes commands and, if it is operating remotely, orders to individually control the different actuators. The data transmission from the mobile to the board is used communication via Bluetooth.

For future improvements:

ADD Camera on the door (Videos and Images). Improve the performance by improving the hardware.

Using image recognition to make the camera recognize the stuff of the ground that surveillance to ignore non-threatening breaches on the fence from sending Alert/Notification to Mobile Application.

Make a side admin system.

Work on security to encrypt data that send to Database.

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8 CONCLUSIONS AND FUTURE WORK

This project is based on the construction of a model simulating home automation with different operation modes which can be controlled also by a mobile application.

To achieve this objective, a scale house that captures different signals, both digital and analog, has been developed. To approach the house to a real home automation application the variables under

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488