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Internet of Things (IoTs): Applications in Home Automation

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Abstract **-**Over the last decade in the field of science & technology, the internet has made significant impact in our economies & societies by bringing in remarkable communication & networking infrastructure. In continuation with this pattern, it is ready to develop as a "Web of Things (IoTs)" where the web will give a medium to physical world articles to take an interest in cooperation. Along these lines the computerized data innovation can incorporate the physical world to the online world, to give a typical cooperation stage. The Internet of Things (IoTs) portrays an overall system of intercommunicating gadgets.

It coordinates the worldwide correspondences, general figuring, and likewise the surrounding knowledge. Now, (IoTs) must be viewed as a dream where "things", particularly regular items, for example, almost all home machines additionally furniture, garments, vehicles, streets and shrewd materials, and more, are intelligible, conspicuous, locatable, addressable or controllable through the Internet. This will provide the basis for many new applications, such as energy monitoring, transport safety systems or building security. This vision will surely change with the passage of time, especially as collaborations between Identification Technologies, Wireless Sensor Networks, Intelligent Devices & Nano-technology will enable a number of advanced applications.

The innovative use of technologies is contributing to create a value proposition for Internet of Things stakeholders.We have successfully developed an IoTs system section of home automation applications for automating the AC appliances to be used at domestic level. This type of automation uses wireless communication between user & as well as devices to be used. The main back-end principle behind the communication established between all the devices is of serial type. Here we have also adjusted the developed system in such a way to operate manually the similar appliances, connected with it. It is advantageous in system's faulty situations & also for new users/guests.

Keywords: IoT ,AC , DC, TRIAC, R & D, RFID.

1. Introduction

First of all, here we have to define the Internet of Things (IoTs), e.g., what is IoTs? The answer to this question is that "The Internet of Things (IoTs) is the network of physical objects-devices, vehicles, buildings & other items-embedded with electronics, software, sensors, & network connectivity that enables these objects to collect & exchange data."The Internet of Things (IoTs) is a novel paradigm which becomes popular with research & industries involvement. The basic idea behind this is that the IoTs will connect objects around us to provide seamless communications (under the protocols to be adopted for the purpose of communication) & relative services provided by them [1-5]. The development of RFID tags, sensors, actuators, smart phones make it possible to materialize the Internet of Things, which interact & co-operate each other to make the service better & accessible anytime, from anywhere.

The Internet of Things (IoTs) is one of the new emerging technologies based automation & control System which is basically the updated version of the automation projects, to be done in previous decades [6-13]. The overall work is to be done on the cloud, which is a single data-base for all of the things connected with this system. The main advantage of using this project at both domestic & as well as industrial level is to control over the available resources, i.e., home appliances & as well as industrial processes control more intelligently. The main advantage we have adopted in this project is to reduce the power consumption.

Figure Error! No text of specified style in document.**: Internet of Things Applications**

As this designed system is totally automated, i.e., there is no involvement of humans to control the things, in this case the electric appliances & sensors based systems, attached with it. Only a communication medium is to be already installed in the system, which communicates the user commands with the system's controller (the brain of the project) [13-39]. And for automatic controlling, a mobile with the system's overall controlling section is installed, which helps the user to monitor the running appliances, according to his need. One of the example is the fan speed controlling.

2. Problem Statement

The Project (Internet of Things (IoTs): Applications in Home Automation), we have developed, is basically the set-up of automatic control system of electrical appliances in order to reduce the useless consumption of electric power. Moreover, the developed system will also reduce the dependency on human resources. Similarly, in this developed system, we have two switching techniques to switch ON/OFF the AC appliance. These switching techniques are automated & manual, at the same time. It is up to the user, to switch the appliance.

This technical report is basically an explanation & motivation of the concept of Internet of Things (IoTs), & also its several features to be used in the world. In addition to this, this report also describes some of the major problems (i.e., technical issues) to be faced with the previous technology Automation Projects to be installed & implemented. Based on this, the project of the Internet of Things (IoTs): Applications in Home Automation discusses the architectural to resolve the problem, related with those projects.

2.1 Examples

Up till now, some of the Internet of Things (IoTs) related projects are wired & some of which are wireless, in which some of those projects link with the low range applications & as well as those appliances, like for Bluetooth & as well as Infrared, there is a specific distance range, by keeping within that area there is a facility available for the user to control the Electrical Appliances, installed in his office or home. But with this, there are a lot of broad range applications related with this type of project. These types of projects are mostly adopted for the saving of electric power for the mobile users, which can offload computation save energy through the cloud application.

In developed countries, the millionaires & as well as the business consultants use the Internet of Things (IoTs) for their business enhancement & harnessing their data to create more powerful new business value.

Let us consider some of the examples related with the Internet of Things (IoTs), as follows;

2.1.1 Robotic Manufacturing Company, KUKA based on IoTs

A Robotic manufacturing company KUKA, which was the designer of the first industrial robot in 1973 & one of the world's leading suppliers of robotics, has a challenge to design an automated manufacturing process, which is capable of producing eight different Jeep Wrangler bodies on the same production line without interrupting the production flow. For this challenge, the KUKA has adopted the technology of Internet of Things (IoTs), which they applied on their existing & designed Robots, by using which all the other processes (e.g. maintenance etc.) & as well as the production of new Robots & for the replacement of new components required for the designing of new Robotic Systems. The overall process in this industry is hold by the Robots & which is done by the use of Internet of Things (IoTs) Technology.

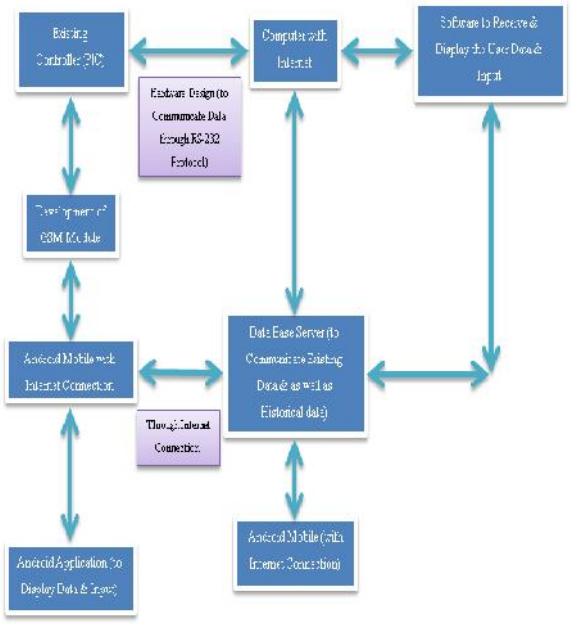
2.1.2 IoTs General Example

A general example of Internet of Things (IoTs) technology is the use of Google Drive, which is commonly used in the world, for the purpose of file sharing system. It is done in such a way that the users have an application of Google Drive in their Personal Systems, & if the multiple users want to share or access a data or document at a same time, then the file should be saved in the Drive & which can accessed by multiple users any time & as well as at any place in the world.

2.1.3 Oil Field R & D Organizations using IoTs

This example is mainly related with the oil-field research & development (R & D). Let us imagine a pumper at a well-site with a cell phone or radio as a connected device. As the pumper moves around the site, a great deal of visual, auditory, & thermal data can be collected & reported. Not only can the pumper gather data, but an analysis of site conditions can be processed, & the results are reported to the higher authority or to the supervisor via the communication device. Ideally, around-the-clock site coverage is desired. However, having someone on-site 24/7 is cost prohibitive, as is the idea of heavily instrumenting a well-site. This will begin to change with the application of IoTs technologies to oil & gas production. IoTs will touch key areas that operators are concerned about: productivity, safety, compliance, asset protection, & environmental stewardship. Several technology advances make IoTs possible: small & inexpensive components, greater functionality, sensor technology, high-speed wireless communications, new Internet services, greater computing speeds, & high-density storage technologies. As these areas improve, IoTs will proliferate into more aspects of oil production & expand to smaller producers. The consideration is that the smartphones will become an integral part of the IoTs' experience. Getting some of the actionable data needed for the site operation will no longer be tied to a desktop computer. For this to happen, installation of IoTs systems must be simple & system operation must be easy to comprehend & use. Relating that to smartphone usage, the device is extremely complex, but the interaction is made simple with the use of icons, color, shapes, & movement on the screen. Interaction with IoTs systems will be visual & intuitive, also based on interaction with mobile devices.

Block Diagrams



First of all, when the whole system is powered ON, then there is a section of network establishing between all the wireless devices, which is to be scheduled in the controller section program, after which the controller section established the serial communication with ESP module to check its status of operation & then the whole system is controlled via Android application, which continuously coordinate with the ESP module for getting new input/status about operation execution. From the side of mobile application, the switches send a specific character, which we have assigned for the switching purposes, for light we will assign *J & *K for switch light ON/OFF in the java file code, & similarly for switching fan we will also assign two characters for it. While on the other hand, for controlling the speed of fan, we have used a seek-bar which is an analog component, giving analog input to the controller, according to which the frequency of the AC waveform can be controlled. Alternatively, we have used multiple radio buttons for controlling the speed of fan. This work is done as there is a level assigned for each radio button i.e., 25% range for each button. Similarly, for this method we have also assign some specific delay value in the controller section to vary the frequency, by which the speed of fan can be controlled. For the intelligent testing of system, we have installed a zero-crossing module as an input to the controller section, which detects the presence of AC voltage & gives a specific type of pulse with the combination of opto-isolator & also here we have installed another modules for the purpose of manual switching of appliances, which directly connected with the manual switch board & its input is also applied to the micro-controller, which

decides to switch the appliances manually or automatically. At output section for the switching of AC appliances, we have installed two types of modules such as one of relay based & the other one is of TRIAC based, which is the plus point in this system, to automatically shift the whole system from respectively.

3. Applications

3.1 Overall Applications of Internet of Things Technology

If we talk about the Internet of Things from a side then we have a countless number of applications of it, which are commonly found in almost each field of life. Here, we have gathered various sections of life where the Internet of Things is applied in any of sense; the list is given as follows;

- Human Body
- In Homes
- Environment & City Management
- Cloud Memory Storage Access
- Industrial Production & Control
- Medical &eHealth
- Logistics
- Business
- Agriculture & Animal Farming

3.2 Applications of Internet of Things in Automation Field (Home Automation)

When we talk about the Internet of Things sub-field home automation, then we come to the point of controlling home appliances automatically from any place. From the enhancement of security to reducing energy & maintenance costs, the Texas instruments starts a new variety of products for their user, a wide range of innovative IoTs technologies for monitor & control of intelligent buildings & smart homes. The major applications related with the home automation side are;

- Access Control
- Energy Optimization
- Light & Temperature Control
- Predictive Maintenance
- All the Devices are on a Single Network
- Connected Appliances
- Light & Temperature Control

4. Future Work

After testing some of these whole developed systems in our homes & as well as at the domestic stages in our daily life, we will move towards applying the technique to develop whole smart home, which consists of automation of each & every appliance & device to be used daily in our homes, e.g., smart appliances switching & controlling including analog & digital appliances & devices. After that we will lead towards the development of smart city. The other side of research related with the IoTs is its applications in each & every field of life, due to which there is a huge scope of research in IoTs& in other words, we can say that the IoTs becoming a vast field of research.

Conclusion

We have quite successfully finalized our analysis & as well as hardware development of our project (the Internet of Things) in this short interval of time. During this time, we have bump into many problems i.e., package testing & package implementation of new devices or other versions of same device which are not met the operation & qualities of the system but we have tried our best to work in a continuous pattern & we don't lose hope for the best & with the blessings of Allah Almighty, our efforts & guidance from our respected teachers, we are able to finish this project, on time.

We hope to see the implementation of the Internet of Things (IoTs) technology in Pakistan at both domestic & as well as commercial scale, due to which the new ideas aroused in mind & also our country Pakistan will contribute the world in the field of research & development. The other importance of this project for the countries like Pakistan is that by the installing the IoTs technology at various levels, the power crisis are to be monitored with the help of automatic system because our country Pakistan is facing a lot of energy crisis due to more consumption of power resources instead of production. As based on this analysis further work can be done on different new ideas & techniques to take some technological advancement in our beloved country.

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