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IoT Based approach for Controlling Electrical Peripheral Devices of Auditorium

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Abstract: The aim of this paper is to provide easy and efficient control over electrical peripherals like lights, fans etc. and achieving trivial power saving. To implement this system, hardware like Raspberry Pi, Relay, Potentiometer, Wi-Fi module and software like Python programming language, Raspbian operating system are used.The simulation is done on a free platform called Autodesk® 123D® Circuits. To get a control over any electric switch the physical contact or the presence at particular place is required. After implementing Auditorium Automation using IoT the work of controlling can be done via computer or mobile phone by using web application. It can be extended from local network nearby place to any location in the world by using internet. This helps to control the peripherals efficiently saving a significant amount of power.

Keywords: IoT, Automation, Cloud, Simulation, Power Saving

I. INTRODUCTION

The fundamental pillar of the development of society is involved in the Communication and information. The theory of information shows that it should not be exchanged for monetary value, rather be considered as a right of the humanity. The trend of the Internet of Things (IoT) indicates that by the year 2020 more than 30 billion devices will be connected to the internet, which has created a very high expectation about how these devices will interact with each other and how people's lives will change when all objects in your environment have wireless capability.[1].

For the same 2020 the projections indicate that in a common home would be more than 30 devices all connected to the internet. With this in mind, the need for integration through some kind of intuitive control system, grouping all these devices together and facilitates the user interaction with their environment. It is now possible to create, at a reasonable price, intelligent environments built around devices based on commercially available wireless technologies. However, the mode in that, these devices interact with one another, their control and their ease of use, are which have not been fully resolved and on which many they are working, which has made their distribution difficult. Another reason that has caused that the systems of home automation did not receive a wide spreading and the lack of aneasy andnative user interface. The solutions available in the market are integrated into closed and proprietary applications of a company, for which the user is obliged to use not the same programs or devices to control their environment. The potential variables that a user would like to monitor depend on the function of the room. For example, in a food cellar as well as in a greenhouse, temperature and humidity; while in a home, lights, fan, television controlling to become very useful. With this in mind, the devices for filling the need are they chose taking into account that the information that they allow to visualize is of special interest for a residential user, generate real benefits and allow you to interact with space in ways which previously were not possible.

Sensors and actuators utilized as a part of houses and workplaces can make our life more agreeable in a few angles: rooms warming can be adjusted to our inclinations and to the climate; the room lighting can change as per the time; residential mischances can be maintained a strategic distance from with fitting checking and caution frameworks; and vitality can be spared via consequently turning off the electrical hardware when not required. For example, we may consider vitality suppliers that utilization powerfully changing vitality costs to impact the general vitality utilization in a way that smoothest stack tops. A robotization rationale may upgrade the power utilization costs for the duration of the day by watching when the costs, which are given by an outer web benefit and are set by the present vitality generation and utilization, are shoddy and by considering the particular necessities of every machines (lights, fans, ventilation systems)[2]

This paper is to approach the solution of easily controlling electrical peripheral through design and implementation of an auditorium automation system for a small and controlled space, in which the control and supervision of the devices is done remotely over the network.

II. RELATED WORK

Bellcore's AutoAuditorium (TM) System is a down to earth use of a Smart Space, transforming an auditorium into one that can naturally make communicates and recordings. The framework is for all time introduced in the room and uses optical and acoustic sensors (TV cameras and mouthpieces) to be "mindful" of what is occurring in the room. It utilizes this attention to broadcast the sound and pictures of the most well-known type of auditorium talk, a solitary individual on a phase, talking with anticipated visual guides to a neighborhood gathering of people3]. In this observing and controlling the apparatuses turns out to be exceptionally run of the mill to individual. In the event that less number of people enters in the auditorium at that point no compelling reason to switch on every one of the gadgets in that. On the off chance that they on it is misuse of energy. On the off chance that most extreme people are in that we have to ON every one of the gadgets without fizzle [4].Here they have proposed another technique for controlling the power supply of auditoriums utilizing, Image Processing. Initially they take a reference picture of an unfilled auditorium and any adjustmentin that reference picture is distinguished and afterward as indicated by that change separate gear alone are turned on and along these lines control wastage is controlled. This is double use framework in which a camera is utilized for identifying individuals and also observation purposes. This is extremely straightforward, productive and less expensive strategy to spare vitality. Another huge preferred standpoint is, this framework can be reach out up to applications like home mechanization and so forth [5]. In paper[6]a solid circuit that assumes control over the undertaking of controlling the room lights tooby checking number of people/guests in the room precisely. When some individual goes into the room then the counter is augmented by one and the LED light in the room will be exchanged ON and when any one leaves the room then the counter is decremented by one. The light will be just turned OFF until every one of the people in the room go out. The aggregate number of people inside the room is likewise shown on the show screen.

III. TOOLS AND TECHNOLOGIES USED

Raspberry-Pi

The Raspberry Pi is an ease, Visa measured PC that fittings into a PC screen or TV, and utilizations a standard console and mouse. It is a skilled little gadget that empowers individuals of any age to investigate processing, and to figure out how to program in dialects like Scratch and Python. It can do all that you'd anticipate that a desktop PC will do, from perusing the web and playing top notch video, to making spreadsheets, word-processing, and playing recreations [6].

Relay:A Relay is an electromagnetic switch worked by a moderately little electric current that can turn on or a significantly bigger electric current. A Relay is an electrically worked switch. To control a circuit by a low-control flag.

TECHNOLOGIES AND SOFTWARE:

Python: Python is a broadly utilized universally useful, high-level programming language. Its outline theory underlines code decipherability, and its linguistic structure enables software engineers to express ideas in less lines of code than would be conceivable in languages, for example, C++ or Java. The language gives builds proposed to empower clear projects on both a little and extensive scale. Python underpins different programming ideal models, including object-oriented, basic and useful programming or procedural styles.It highlights a dynamic sort framework and programmed memory management and has a vast and complete standard library [7].

Autodesk Circuits 123D: Autodesk Circuits 123D is a free web-based real-time and interactive simulation application allowing to build and experiment with circuits just as it would in real life. It provides all the necessary components and provide Arduino code attached to it.

IV. APPROCHES

A. Testing on Simulation

Circuits can regularly be a scary chaos of wires and parts. With a specific end goal to transform this chaos into a reasonable and straightforward circuit, one must have a decent comprehension of a couple of essential electrical circuit parts. Using the Electronics Lab from Autodesk Circuits, simple simulations can be seen how each component can be used in a circuit.

TEST 1: Light Bulb

In this simulation relay is used to on or off light bulb, which is an electromagnetic switch operated by relatively small electric current which can be on or off by Arduino. The relay is connected to PIN 8 and the GND of Arduino and other ends are connected with the high voltage alternate current. The code for Arduino is written in C. The pins on the Arduino can be configured as either inputs or outputs. But they are default to inputs so they don't need to be explicitly declared as inputs.

Step 1: Set PIN 8 as output pin.
Step 2: Create function which toggle the value of PIN 8.
Step 3: Call function whenever the need of on or off the light bulb.

After doing this simulation testing, the developer have not to worry about breaking the Arduino board or any other electronic components and get harm themselves and these tests can be done in zero budget because there is no need to get real devices.

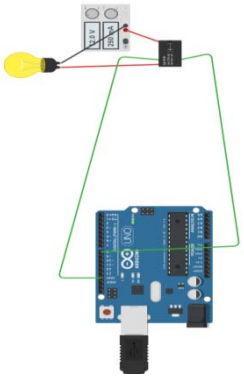

Figure 1: Light Bulb Test Simulation

TEST 2: Motor Speed Control with Potentiometer

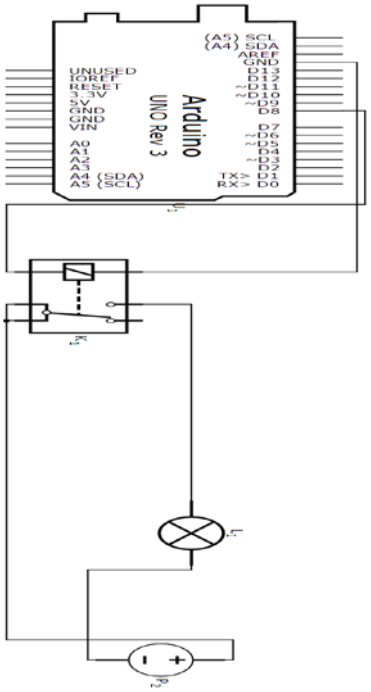

Figure 2 :Light Bulb Test Circuit

Table 1 : Components Required for Test 1

IDs	#	Components
K1	1	Relay SPDT 5V miniature power relay
L1	1	Incandescent light bulb 12V / 3W
U1	1	Arduino Uno R3
P2	1	Power Supply

Table 2 : Components Required for Test 2

IDs	#	Components
K1	1	Relay SPDT 5V miniature power relay
M1	1	DC Motor 25rpm/V
R1	1	Potentiometer 10k
U1	1	Arduino Uno R3
P2	1	Power Supply

TEST 3: Controlling multiple devices

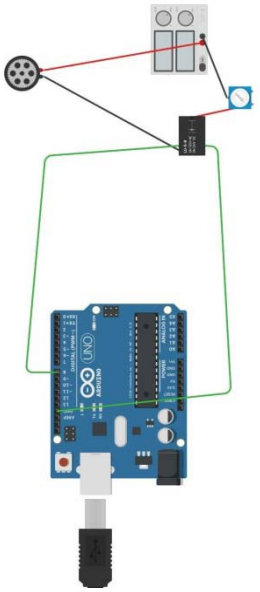

Figure 3 : Motor Test Simulation

In second test, the motor is used which works similar to the fan and relay is used as magnetic switch which can be operated by Arduino to completely On/Off the fan. If Potentiometer is connected with only two terminals which are one end and the wiper then it provides a variable resistance which can be used to get control over speed of motor. The resistance can be adjusted by rotating the contact which forms adjustable voltage divider. The wire connected from power supply to the relay is separated and one end connected to one terminal of potentiometer and other end is connected to wiper terminal of potentiometer. The direction of motor can be reversed by connecting it to other terminal.

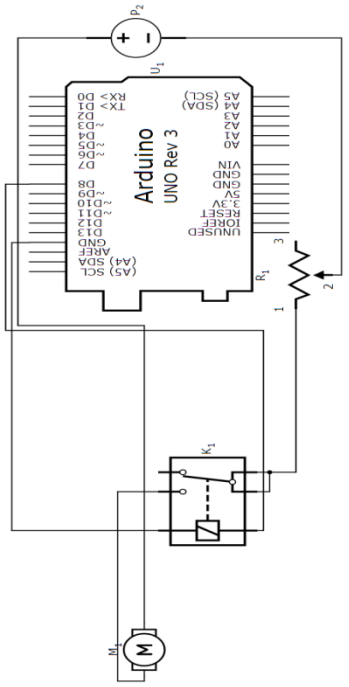

Figure 4 : Motor Test Circuit

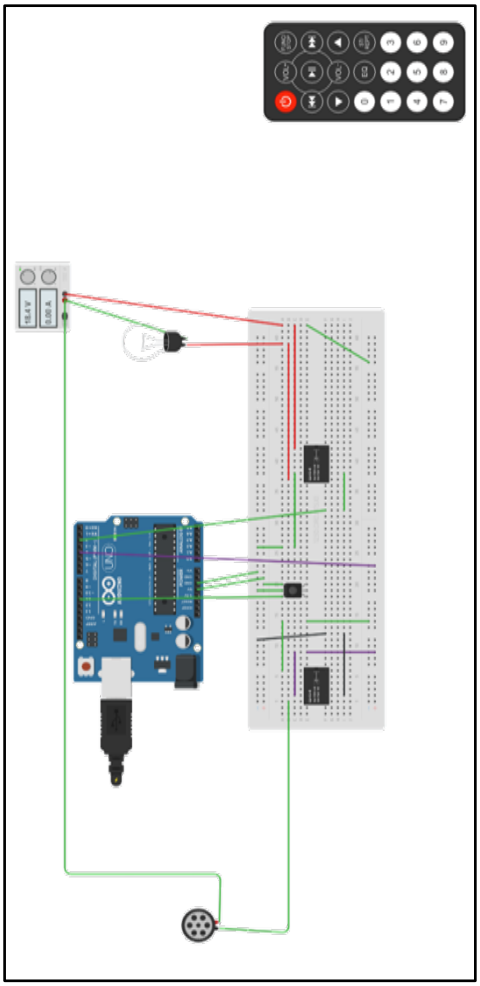

Figure 5 :Test 3 Simulation

In final test, it shows how it will work if there are multiple devices. The devices are connected with different relays. The controller Arduino has to decide which device should have to be turned on when it get a signal and what if the user want to turn the peripheral on or off from the remote location.

Infrared technology is used to overcome those problems. Using IR remote controller Arduino get signal which devices has to be turned on or off. The IR remote send the signal and IR receiver receives the signal sent from IR remote and transfer it to Arduino. At last Arduino have to distinguish the signal and take the given action on the particular device that should be either turn on or turn off.

The same technology is also used for Air Conditioner or Projector. So, Projector or Air Conditioner can be controlled simply by modifying the IR signals output and sent them to those devices.

Table 3 : Components Required for Test 3

IDs	#	Components
K1,K2	2	Relay SPDT 5V miniature power relay
M1	1	DC Motor 25rpm/V
U1	1	Infrared Sensor
U3	1	Arduino Uno R3
P2	1	Power Supply
L1	1	Incandescent light bulb 12V / 3W
U2	1	Infrared Remote

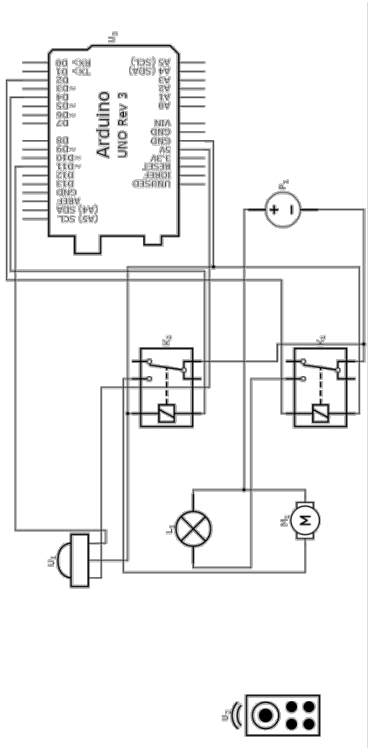

Figure 6 : Test 3 Circuit

B. Live Implementation

After successfully testing on the simulation, the system can be made easily by applying same setup. These can be done with both Arduino and Raspberry Pi.

1) Arduino

There is no need for any extra setup using Arduino. The same setup and C programming code can be applied to achieving same results. Wi-Fi Shield or Ethernet Shield is required to implement the functionality of remote access of the switch.

2) Raspberry Pi

The benefit of using Raspberry Pi is it is a micro sized computer, so it provides operating system and interface to make program with various programming languages like Python, Java, C, C++ etc. and also provide storage space, USB slots and Ethernet slot. To implement the system on Raspberry Pi, the operating system is required. Raspbian is the recommended operating system. The installation process of Raspbian is as follow:

i. Download Raspbian image from official Raspberry Pi Website.

ii. Write the image using any Image Writer software on any MicroSD card with storage sapce at least 8GB.

iii. Put MicroSD card in m Raspberry Pi andcomplete basic configuration.

iv. Use interface to create program with various languages and use GPIO pins to implement desired task.

V. CONCLUTION AND FUTURE WORK

The use of IoT and cloud services in Auditorium automation derives many benefits from quick and less work to energy savings and it is not only for intended to Auditorium. It can alsobeimplemented in Home, Movie Theaters, Shopping Mall, Stadiums etc. Although the system is very successful in achieving the primary goals, it should be noted that developed system is just a simple prototype and much more work had to be done to create a final working device. Several areas that need improvement are the size of the devices, the cost of the devices, energy sources used and the communication range. Currently, Raspberry Pi is too large to fit easily into an electrical switch box behind the wall. There are several ways this could be improved in future work. The use of surface mount components reduces the total size of the components. The SMT is also often less expensive, since they require less material to produce. This would help to reduce the total cost of the devices as well as size. [9]

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