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Smart Lamp with Integrated Voice Assistant

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Abstract: Over the past few years, IoT (Internet of Things) has become one of the most important technologies of the 21st century. Now that we can connect everyday objects to the internet via embedded devices, seamless communication is possible between people, processes, and things. Using IoT we have connected our smart lamp with an application to control and monitor it. This research paper aims on the development of a lamp with multiple features and operating via application using IoT technology. The application offers users to control the lamp using this mobile application and a LDR (Light Dependent Resistor) to adjust lightning effects. In addition to the mobile application, this lamp consists of an air-purifier which purifies the surrounding air and lightning effects provide comfort and convenience to the user. Furthermore, to reduce electricity consumption, this lamp will have dual charging methods, electric as well as solar. Also, this lamp will provide a charging slot to allow users to charge their mobile phones instead of using a separate power bank. For all this features to be integrated in a single device, Raspberry Pi is the most important tool used here. The proposed smart lamp with multiple features and the integration of the raspberry pi and air filter offers numerous benefits to users. It provides convenience, flexibility, and energy efficiency by allowing users to control the device simply using an application. The integrated voice assistant is one of the most important features to handle the device.

Keywords: Air purifier, Energy conservation, Home Automation, IoT, Smart lamp, Voice-controlled, Wireless connectivity

I. INTRODUCTION

This research paper aims on the development of a lamp with multiple features and operating via application using IoT technology. The application offers users to control the lamp using this mobile application and a LDR (Light Dependent Resistor) to adjust lightning effects. In addition to the mobile application, this lamp consists of an air-purifier which purifies the surrounding air. The lightning effects provide comfort and convenience to the user.

Till now various research has been done on this topic, some used LED lights instead of CFL to reduce power consumption, whereas some only focused on home automation with access to mobile application. Some simply developed a voice assistant to perform task whenever the user asked to do. Some used raspberry pi as a micro-computer for the system. Various technologies have been used like lithium-ion technology and in one of the research paper, author had discussed the issues faced due to a greater number of automated households and remote access for monitoring the appliances.

After doing research on this topic, we are developing this smart lamp with a special feature i.e., air purifier or an air filter. On which, not a single paper has made this addition. Lamp is something which we need not only for study purpose but also while travelling it is very useful. To provide user with comfort and convenience by purifying surrounding air and providing a healthier environment. The switch of the air filter will be present on the lamp itself. Also, we are providing the user with a charging slot. And LDR will be fixed at the top of the lamp so that the sensor will be able to adjust the brightness of light. Moreover, the lamp will be charged by solar plates too, if in case electricity is not available. A mic and a speaker are attached with the lamp to respond to user's command via voice assistant. User can perform various task with the help of this voice assistant.

II. LITERATURE REVIEW

[1] Angel Deborah S. focused on features to be possessed by an ideal system for home automation with remote access. The author identified the data channel of GSM as a candidate for this. Also they created a web application to control the households like turning on/off lights fans etc.

[2] K. Vikram Reddy developed a voice controlled personal assistant which will use the Natural language processing and can be integrated with various households to achieve a smart assistant which will make human life comfortable. He included some phases such as Data collection in the form of voice ; voice analysis and conversion to text; data storage and processing; generating speech from the processed text output. This application mainly focus on making life easier of those who are physically disabled.

[3] Nimesh Patil simply developed a voice assistant that can perform task when the user tells them to do just like Siri, Alexa, Google assistant, etc. They did it using python for all window version.

[4] Pankaj Bharadwaj discussed a general system's architecture and the barriers, challenges, benefits and future trends that future smart home will face. But the issue they faced is, that there will be more number of remote controls or monitoring terminals as there are a lot of automated households.

[5] Anand Nayyar have used raspberry pie which is around two thousand rupees. It is a compact credit card sized computer. Though it is small, it has so many possibilities for project development in embedded systems, daily routing and innovative projects. It has so many uses like learning programming languages, Linux administration, server administration implements of emails, cloud, web servers, etc. Various interfacing like sensors LED's etc. Can be interfaced via GPIO like for embedded systems.

[6] Y.K. Cheng compared the power characteristics and lighting characteristics of LEDs and other traditional lighting devices available in the market. After comparing, LEDs are better than other traditional lighting devices available in the market. To make such a mission come true, the first important thing that should be done is to lower the unit cost and secondary to have a proper and reliable power circuit. And suitable optics are needed to control the light pattern from the LEDs which includes focus, diffusion, reflection and light amplification.

[7] R. Jegadeesan made a virtual assistant for the desktop that uses python which increases productivity and efficiency. There are so many virtual assistants available in the market, because they have access to all your smartphone's resources, these new software applications outperform PDA devices. Because they are portable and can be used anytime and anywhere. Virtual assistant is more dependable than a personal assistant because they have access to internet and can access more information than any other assistant. Python based virtual assistant on the desktop is dependable and user friendly.

[8] Arumugam Manthiram knew that despite the current lithium-ion technology based on insertion reaction cathodes and anodes has limited energy density dictated by the number of crystallographic sites available as well as the structural and chemical instabilities at deep charge, will continue for the foreseeable future. Many efforts have been made in conversion reaction cathodes and anodes because they provide an order of magnitude higher capacities than insertion reaction electrodes, but it involves many challenges. Nowadays, interest in employing lithium metal as an anode and replacing liquid electrolytes with a solid electrolyte because it offers safer cells with higher operating voltages and charge storage capacity, but only time will reveal their practical viability. For safer, long life and affordable systems we must focus on high nickel layered oxide cathodes, liquid electrolytes compatible with and forming stable SEI on both graphite anode and high nickel cathodes, innovations in cell engineering to fabricate thicker electrodes and reduce inactive components.

[9] In this paper, Jawaaz Ahmad and Romana Yousuf proposed a better replacement for the current high-cost light intensity meter. Technicians and lighting solutions engineer, who don't want to spend much money on a single lux meter can use this and get their job done easily. This low-cost lux meter is based on Light Dependent Resistor (LDR). For low-cost operations, this design is perfect and much more feasible to buy and use because of its simple and easy to use design.

[10] Maharani Putri and Solly Aryza Lubis designed security tools using sensor light dependent resistor(LDR) through mobile phone. This tool is designed to ensure the safety of the room , can be detected by user of the tool either indoors or outdoors or not in the room. This will also reduce the cost when compared to using the services of security guards and improve the security of a room.

[11] Aditya Roy, Chetan Mishra, Sarthak Jain, and Naveen Solanki wrote this review of general and modern methods of air purification. In this review, they mentioned the use of air filters like HEPAfilters, electrostatic smoke precipitators activated carbon, transparent PAN filters, photocatalytic materials, and soy proteins and silk. They also mentioned how efficient these filters are, their advantages and disadvantages.

[12] Balaji Pandiyan gives a review on air purifier. Air purifiers are considered as life savers since many disease occur due to VOC', molds and improper ventilation at home and it reduces carbon dioxide levels in our home. Natural air purifiers include free ventilation to home, avoiding paraffin candles, using air purifier plants can reduce risk of indoor air pollution. Indoor plants perform the function of natural living air purifiers since the foliage and roots can absorb chemical pollutants.

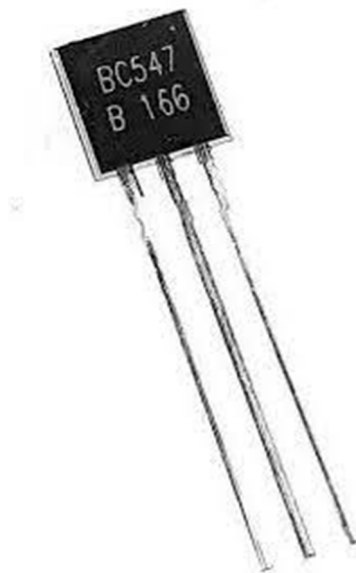
III. METHODOLOGY

A. Materials Used

1) *Light Dependent Resistor (LDR)*: LDR is used to detect light intensity in the surroundings. It is used in automatic lights which switch on and off according to light, in laser-based security systems. LDR works on the principle that its resistance is directly proportional to the intensity of light falling on it.



- 2) *BC547 transistor*: A transistor is type of a semiconductor device that can be used to conduct and insulate electric current or voltage. It basically acts as a switch. For this purpose, we are using npn transistor, more specifically a BC547 transistor. It is used in quick switching, pulse width modulation and current amplification.



- 3) *Car air filter*: A car air filter is an essential component of a vehicle's engine system designed to clean the air entering the engine. Its primary function is to prevent dust, dirt, debris, and other contaminants from entering the engine cylinders, thereby ensuring that only clean air mixes with the fuel for combustion.



- 4) *12-volt DC fan*: A 12-volt DC fan is an electronic device designed to provide air circulation or cooling in various applications that operate using a 12-volt direct current (DC) power supply. These fans are commonly used in automotive cooling systems, computers, electronics, and other equipment where efficient airflow and cooling are required.



- 5) *Female DC Power Jack*: A female DC power jack, commonly referred to as a DC power connector or socket, is an electrical component used for connecting external power sources to devices that require direct current (DC) input.



- 6) *Raspberry pi zero w*: Raspberry pi is a small single board computer, which will integrate the project. It will also contain the voice assistant. Raspberry pi zero w is the cheapest as well as the smallest model which supports audio input and output, which is why it is being used here.



B. Air filter

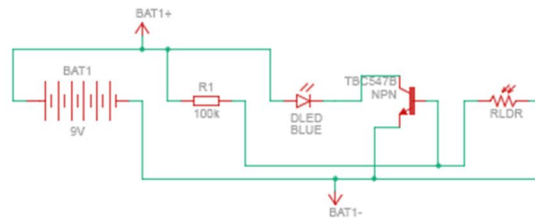
Making:-

- 1) Take measurement of air filter on 3 cardboard and cut the cardboard to make an oval hole.
- 2) Take these 3 cardboard boxes and 1 new cardboard (no cut) and stick them in a square or rectangular shape.
- 3) Take measurement of 12V DC fan on a cardboard and make a round cut out on it, and then stick the fan on it so that the air passes through hole when the fan is turned on.
- 4) Connect female DC power jack with the 12V DC fan to supply 12 V to the fan.
- 5) Stick this cardboard on top of the rectangular shaped cardboard such that the air flows outward.

IV. WORKING

When we turn on the switch, the air from the surroundings enters inside the air filter through the oval hole. The air gets filtered. It removes contaminants and particles from the air, making the air clean. And the clean air comes out through the fan. When we turn on the fan, it creates a vacuum inside the air filter and forces the air from surroundings to enter the air filter. They draw in air from the room, pass it through the purification system where pollutants are trapped or neutralized, and then release the cleaner air back into the environment.

The Night Lamp
Block Diagram :-



Explanation :

- 1) When the area is illuminated, current flows through the LDR, into the negative terminal of battery. The base of the transistor doesn't receive any current so it works as an opened switch, so the LED doesn't glow.
- 2) When the area is not illuminated, current doesn't flow through the LDR and stays at the base of the transistor, which eventually activates it. Now, the transistor is working as a closed switch, so the LED glows.

V. RESULTS

As a result, our smart lamp contains a voice assistant, an air purifier and can be controlled using the mobile application. A slot for charging phones and a slot for charging the lamp, in addition to this, solar plates are also attached at the bottom for charging. User have to simply connect the lamp to the application via Bluetooth and is able to customize, adjust color, brightness and lightning effects according to their preferences. Energy efficient bulbs and sensors are used to reduce power consumption.



VI. FUTURE SCOPE

This smart lamp can further be used for travellers, and can add advanced features in the voice assistant. The air purifier will be modified. A mechanism will be implemented which will check the quality of air. The voice assistant will be modified in such a way that it can control the smart lamp and air purifier completely.

VII. CONCLUSION

In conclusion, the smart lamp with integrated voice assistant offers a range of significant advantages, one of the major feature, which can handle most of the tasks is the voice assistant. The air filter is the unique feature of our project, which can work efficiently and in addition with the auto control of light based on the surrounding light. The mobile application will provide user an ease to monitor the lamp simply by connecting via Bluetooth. We developed our mobile application using python and used some major components such as raspberry pi and LDR. Overall this app is helpful for people of all generations.

VIII. ACKNOWLEDGMENT

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