IoT-Based Switch Board for Kids Using ESP Module And AWS

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ABSTRACT

Purpose: To trigger the electrical switchboard by the kids not only harmful but also life risk. We always keep our kids away from it. We take lots of precautions not to touch it anyway. However, sometimes we need to operate electrical loads like a fan, TV, etc., by our kids when we are engaged with another essential task. We know it is unsafe, but sometimes we do. Here we demonstrate how to create a switchboard for kids to turn on/off the bedroom electrical load safely. We created an electrically isolated switchboard for them. It operates using small batteries and has no electrical connection with high-voltage AC. It is fixed on the wall using glue inside the kid's reachable area. It is entirely IoT based. When Kids press any switch, the ESP module sense and upload the corresponding command to the AWS shadow register. Then, AWS sends the updated content to the MQTT client running in another ESP module connected to all electrical equipment. According to the command module, turn the equipment on/off. The Code is available on GitHub to continue the research work.

Design/Methodology/Approach: we installed some feather-touch soft switches inside the system. All buttons are connected with NodeMcu (ESP Module) GPIO. The complete tiny module may be fixed beside the Bed. We need two nos. AAA battery as a power supply to run the miniature system. Turn on the system. It will try to communicate with the nearest configured wifi router. If the wifi connection is OK, it will try connecting with the AWS IoT server using the hardcoded configuration profile inside the “secret. h” file. After successfully connecting with the AWS IoT server, the ESP module is ready to send the command. On the other hand, another Wifi module is connected to all electrical equipment. When powered up, it tries to communicate with the AWS IoT server through the internet using connected Wifi. Once connected, it is ready to receive the command to trigger the load.

Findings/Result: The described procedure is a unique application of an electrical switchboard that kids will use. We tested it in real life. It is working well. The AWS IoT is also a secure and robust, and cheap solution. So recurring cost to operate the device is as low as possible. The automation researcher or enthusiast can replace traditional switchboards with IoT-based intelligent devices for our daily life operations.

Originality/Value: We designed a switchboard for kids differently using the latest emerging technology IoT. The traditional electrical switchboard is unsafe for kids, but this technology is better and completely safe. So we can quickly adapt to our modern lifestyle.

Paper Type: Experimental-based Research.

Keywords: IoT Switchboard, Wireless Electrical Switchboard, Intelligent Switchboard, Electrical hazards safe switchboard for Kids.

1. INTRODUCTION :

The electrical switchboard is not safe for our small children. We installed our electrical switchboard outside of the children’s reachable area. However, naughty kids trigger the light using some stools. It is also harmful to us if we touch it with wetted hands. It can kill our life if mishandled. When our two hands are engaged, sometimes we command to on the light or fan to our baby. We do not want to do it,

but sometimes we do. So the issue is still present in our current system. The defective switch may also be harmful to elders. We can change this scenario. We can make a switchboard without a physical connection to the electrical wire. Using the IoT, we can make it possible. For the procedure, we need two Wifi modules. One module will be connected to the physical load and the other to the fake keyboard. For this project, we need Amazon IoT services. We will connect the AWS IoT server through our Wifi module using our Wifi router. The module will connect with AWS IoT and update the IoT shadow register. A 3V battery operates the complete switchboard. It is Completely isolated from the high-voltage AC.

2. RELATED WORKS :

Kodali et al. (2020) presented an IoT monitoring system for grain storage. The study focused on utilizing IoT technologies to monitor and manage grain storage facilities, addressing temperature, humidity, and pest control [1]. Krishna and Sampath (2017) proposed a healthcare monitoring system based on IoT [2]. García and Vega (2018) explored the application of low-power sensor nodes in domotic systems using IoT [3]. Jayalakshmi, A. et al. (2021) designed an intelligent school bus monitoring and reporting system using IoT. The study addressed the safety and security concerns associated with school buses [4]. Rastogi et al. (2020) proposed an IoT-based discrete-time Markov chain model for analyzing and predicting indoor air quality index. The study emphasized the application of IoT in monitoring indoor air quality [5]. Karmore et al. (2020) developed an IoT-based humanoid software for identifying and diagnosing COVID-19 suspects. The study showcased IoT technologies and artificial intelligence in addressing public health challenges [6]. Wiryasaputra et al. (2023) reviewed an intelligent indoor environment monitoring and management system for COVID-19 risk mitigation [7]. Krishnan et al. (2022) presented an affordable, competent, fully functional, innovative ventilator system using IoT [8]. Cruz-Piris et al. (2018) proposed an access control mechanism for IoT environments based on modeling communication procedures as resources [9]. Penzenstadler et al. (2018) introduced an affordable DIY resilient smart garden kit using IoT. The study showcased the application of IoT in intelligent gardening, providing a cost-effective solution for monitoring and managing gardens using sensor technologies [10].

In summary, the reviewed literature encompasses a range of topics related to IoT monitoring systems and applications. The studies explore various domains, including agriculture, healthcare, home automation, public health, and security. These papers provide valuable insights into IoT monitoring systems' development, implementation, and impact in different contexts.

3. OBJECTIVES :

This research aims to provide the information to create an electrically safe switchboard that our kids may use. Generally, we build switchboards directly connected to the load. That creates several hazards. Several accidents happened. The direct switchboard can kill human life. Not only that, There are several drawbacks present. We can get shocked easily if we use the switchboard with a wet hand. It is a mechanical switch, and when the load contacts through it, on time being the contact plate gets damaged. So now we need to change our switchboard into high technology enabled to benefit from it. So here we provide a technological concept of how to design our shockproof switchboard.

Figure 1 depicts the block diagram of the project. Let us discuss a couple of blocks.

1) **Switchboard:** This is the Input of the overall architecture. Instead of a mechanical switch, we will use a slim membrane switch. We can add some load pictures on the top so our kids can understand easily, as depicted in Figure 2. Finally, it can be fixed kids a reachable area.
2) **Input Handled ESP Module:** All switches are connected to the ESP module's GPIO. By default, assigned Input is high(weak pulled-up). When switch contact happens, the corresponding Input gets Low through the connected ground. The controller senses the potential change, creates data packets in JSON format, and updates the AWS shadow register.
3) **AWS Server:** We need an AWS IoT server to send commands to the ESP module connected with the device load. It acts like a bridge between two ESP modules. Before using the AWS IoT, we need to configure it. We must go through several processes to set up the AWS credentials. A couple of

our paper link related to AWS IoT is provided in the recommended section for a workout before experimenting with this research work.

4) **ESP Module for Load:** This ESP module is configured to load the trigger. The relay will be driven using its IO. When powered on. It will connect with AWS utilizing a Wifi connection. Once associated with AWS, it is ready to receive the command from the remote ESP module coupled with the switch input. The prototype relay module is depicted in Figure 3.
5) **Load Trigger:** The electrical load is on/off using a 5V relay. Each relay is connected to the ESP module's IO. For the power supply, we need 5V SMPS; it should be capable of driving the relay coil.

4. APPROACH AND METHODOLOGY :

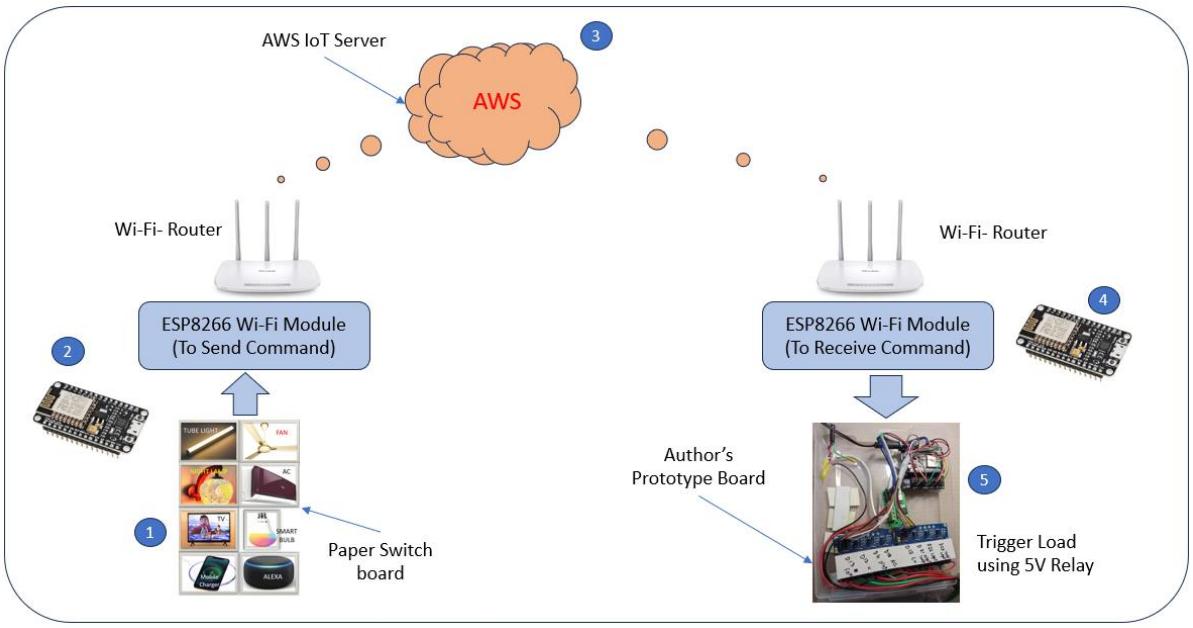

Fig. 1: Project Block Diagram [Source: Author's]

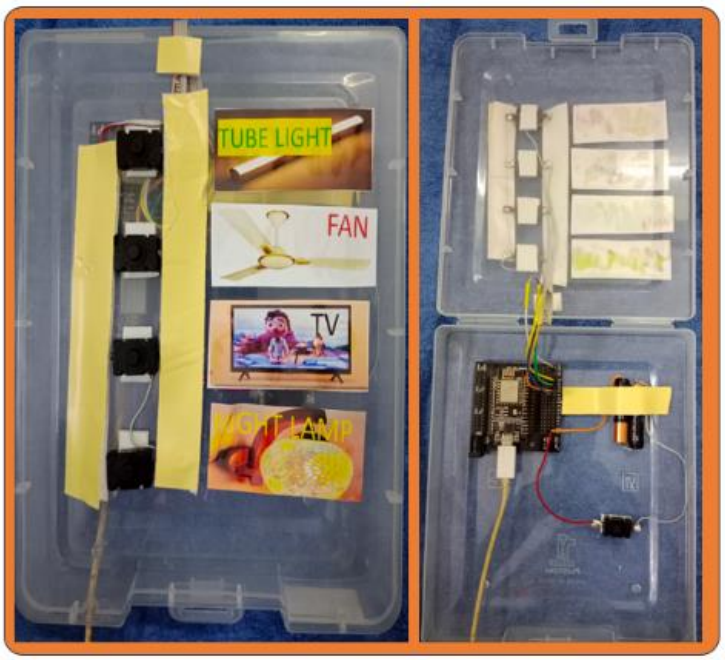

Fig. 2: Switch Board Side of the project [Source: Author's]

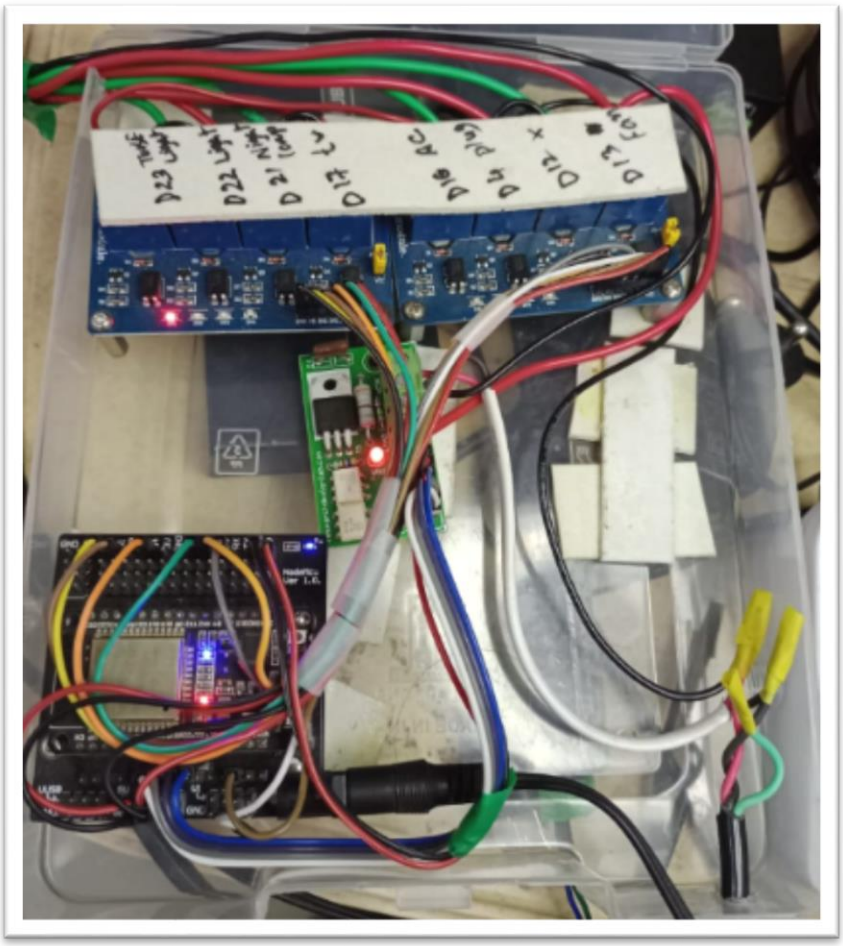

Fig. 3: Equipment Side of the project [Source: Author's]

5. EXPERIMENT :

Now we do experiment on it. We need to follow the below procedure.

(1) First, create an AWS IoT account on the Amazon IoT server. Keep note of the AWS-provided credentials.
(2) Create an AWS shadow register to update the command.
(3) Create both side hardware.
(4) Download the Code from https://github.com/sudipchakraborty/IoT-Based-Switch-Board-For-Kids-Using-ESP-Module-And-AWS.git.
(5) Unzip the Code. Fill in the "secret. h" available at the time of IoT creation.
(6) Add Wifi credentials.
(7) Upload Code to the module, which acts as a switch—power on the device. The test code will update the AWS shadow register 1 and 0 simultaneously. Open the AWS IoT console and observe that the shadow register changes the value.
(8) Now upload the Code to the Load trigger module. Power on the module.
(9) When the shadow register is updated, the load triggers the equipment.
(10) If the described process does not happen, carefully debug one by one module—the best way to debug according to signal flow.

6. RECOMMENDATIONS :

- The paper on IoT device creation Inside the AWS: https://doi.org/10.5281/zenodo.7726980 [11].
- The article to create a physical IoT Device: https://doi.org/10.5281/zenodo.7779097 [12].

- The article Create Multiple IoT Device Controller: https://doi.org/10.5281/zenodo.7857660 [13].
- The paper to make Alexa Skill in the AWS cloud server: https://doi.org/10.5281/zenodo.7940237 [14].
- The article to create a Lambda function inside the AWS server: https://doi.org/10.5281/zenodo.7995727 [15].
- Complete Code we provided, we kept it easy to understand better.
- Experience researchers can add more functionality.
- We skip exception handling due to the complexity of the Code. The researcher must add it before going for production.

7. CONCLUSION :

Electrical switchboard should not be accessible to the kids due to the probability of electrical shock. Here, through a step-by-step procedure, we described how we can make a shockproof electrical switch, which is for our safety also when we press the switch even wet finger. It is completely isolated from electricity but acts as a traditional switchboard on the wall. Using the IoT technology, we made it possible. The automation researcher can get some valuable information from this work. They can enhance this work. The Code is available to download.

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