Go Green: ReUse LED Tube Light and Make it WhatsApp Enabled Using ESP Module, Twilio, and ThingESP

Sudip Chakraborty [1] & P. S. Aithal [2]

[1] D.Sc. Researcher, Institute of Computer Science and Information Sciences, Srinivas University, Mangalore-575 001, India,
OrcidID: 0000-0002-1088-663X; E-mail: drsudip.robotics@gmail.com
[2] Director, Poornaprajna Institute of Management, Udupi, India,
OrcidID: 0000-0002-4691-8736; E-Mail: psaithal@gmail.com

Go Green: ReUse LED Tube Light and Make it WhatsApp Enabled Using ESP Module, Twilio, and ThingESP

Sudip Chakraborty [1] & P. S. Aithal [2]

[1] D.Sc. Researcher, Institute of Computer Science and Information Sciences, Srinivas University, Mangalore-575 001, India,
OrcidID: 0000-0002-1088-663X; E-mail: drsudip.robotics@gmail.com
[2] Director, Poornaprajna Institute of Management, Udupi, India,
OrcidID: 0000-0002-4691-8736; E-Mail: psaithal@gmail.com

ABSTRACT

Purpose: *Nowadays, we use LED tube lights or batten instead of fluorescent tubes. It is energy efficient and has higher light intensity. But it runs shorter than our old tube runs. After one or two years, it becomes defective and replaced with new ones at a higher cost. It would be great if we could reuse it. Here, we describe how to reuse our LED batten once it becomes defective. Another exciting thing is that we can add more value to it. In our everyday life, sometimes our bedroom light needs to be operated from the bed. Here, we will also describe the procedure for how our LED batten can be operated from our sweet bed using a mobile phone WhatsApp application.*

Design/Methodology/Approach: *The system's heart is a NodeMCU built of an ESP module. To switch on the load power, we use a solenoid relay module. The ESP module is powered up using a 5V power adaptor. Using the provided credentials, it will try to communicate with the internet. Once connected, it will connect with the ThingESP server to inform us whether the device is live or connected. When we send a WhatsApp command, it reaches the ESP Module via Twilio and the ThingESP server. We need to create an account in Twilio and ThingESP to use them. The ESP module executes two actions. One is to trigger the connected load and send a response back to the user via that server to keep the user informed.*

Findings/Result: *The mobile phone has become an essential electronic gadget nowadays. Most of the time, we keep it with us. Now, we desire to control every electrical gadget that uses it. We can control anything from our pocket cell phone using the provided procedure. If the internet is healthy, the device offers good performance.*

Originality/Value/ Novelty: *The mobile is available in almost every house. We do several tasks using our mobile. There are several apps available to control home appliances using the mobile phone. Most of the applications run using Alexa. However, the main drawback is that occasionally, the voice cannot be detected in a single try. So, message-based appliance triggering is becoming famous. WhatsApp is a popular mobile application. The dream has come true. Here, we describe how to control any electronic home appliance using our favorite mobile application, WhatsApp. So, these contemporary works provide value to us.*

Type of Paper: *Experimental-based Research.*

Keywords: WhatsApp-operated electrical appliances, WhatsApp-controlled LED batten, how to control any electrical gadgets using WhatsApp messaging, how to integrate Twilio in our project.

1. INTRODUCTION :

Problem statement: Many IoT applications are available to control home appliances. WhatsApp is a popular app on which we spend time. Sometimes, we want to maintain the appliance from our mobile. To do so, we need to purchase a Wi-Fi device. But the Wi-Fi-enabled device is too costly. Here, we provide the procedure so that any electrical appliances can be triggered using WhatsApp.

International Journal of Case Studies in Business, IT, and Education (IJCSBE), ISSN: 2581-6942, Vol. 8, No. 2, May 2024

SRINIVAS PUBLICATION

Indication of methodology: The system's heart is the ESP module, a WiFi-enabled controller. To control using WhatsApp, we need to use third-party services. There are several services available to the Whatsapp messaging services provider. After many studies, we suggested using Twilio, which is cheap and the best service we considered. Here, we use two third-party services: Twilio, which is free during the trial period, and ThingESP, which is entirely free to use the cloud server. Our hardware is directly connected to the ThingESP server. When we send the command through WhatsApp, it reaches Twilio and ThingESP. Finally, it came to our hardware. Our hardware parses the command and processes it. It activates the corresponding electrical load and responds to the user through the Twilio and ThingESP modules.

Essential findings of others in this field: various research work has already been done using Whats App messaging services. From medical applications to home appliances in all fields, now is the time to use the WhatsApp messaging platform. The research work (Karthik et al. (2023). [1]) demonstrates the use of messaging systems in the Onion Preservation field. Sierra et al. (2023). [2] describe how they use the messaging technology in the Monitoring Compressors in the Refrigeration and Air-Conditioning field. The researcher Venkatesan et al. (2017). [4] Design and implement an automated security system using Twilio messaging service. The researcher Beccaria, M. (2011). [8] provide live library information via SMS using Twilio. The messaging system performs well In the healthcare field. The researcher Priyanka et al. (2022). [21] developed a secured IoT-based healthcare monitoring System using body sensor network.

What study is done in this paper? Here, we study how to control our home appliances using our WhatsApp messaging platform. For this, we need the help of a third-party messaging platform. We also examined several platforms to determine which would best suit our needs. We also analyzed factors like cost, performance, availability, and privacy.

Principal conclusion: We use LED batten or tube light instead of old fluorescent. The primary advantage is that the light intensity is higher than the old. The problem is that it only lasts for a while. Here, we demonstrate how we can reuse the LED batten. Nowadays, most of our needs are managed by our mobile phones. Several applications are available to control the device over voice. However, there are a couple of drawbacks, as voice-based apps need to detect the command in a single try. But most of the time, it cannot detect the command using a single voice. The WhatsApp is popular now. So, using WhatsApp-based appliance control is comparatively easy and efficient. So, getting help from third-party cloud service providers and a couple of hardware, we are enabling the LED batten to WhatsApp.

2. REVIEW OF LITERATURE/ CURRENT STATUS :

Here, we included some research projects where we found good work already done in messaging systems. Table 1 lists a couple of research works that use technology.

Table 1 lists research work and technology used in level detection and notification.

S. No.	Focus/Subject	Technology/Algorithm/ Module/Components	Reference
1	Smart Energy Management System for Onion Preservation	Temperature, humidity controlling system	Karthik et al. (2023). [1]
2	Development of a Low Cost Iot Device Focused on Protection and Monitoring Compressors in Refrigeration and Air-Conditioning	IoT	Sierra et al. (2023). [2]
3	*a cognitively-informed critical metaphor analysis tracing the cultural model of the Quantified Self*	MIP, SMA methods	Cong. M. (2020). [3]
4	Design and implementation of an automated security system using Twilio messaging service	IoT, Twilio	Venkatesan et al. (2017). [4]
5	Hands-on chatbots and conversational UI development: build chatbots and voice user interfaces with Chatfuel, Dialogflow,	Chatfuel, Dialogflow, Microsoft Bot	Janarthanam et al. (2017). [5]

International Journal of Case Studies in Business, IT, and Education (IJCSBE), ISSN: 2581-6942, Vol. 8, No. 2, May 2024

SRINIVAS PUBLICATION

		Microsoft Bot Framework, Twilio, and Alexa Skills	Framework, Twilio, and Alexa Skills	
6		Intrusion Detection System Using Deep Convolutional Neural Network and Twilio	Deep Convolutional Neural Network and Twilio	Akhil Joseph Xavier et al. (20230). [6]
7		Python Network Automation Labs: Ansible, pyATS, Docker, and the Twilio API	Ansible, pyATS, Docker, and Twilio	Choi et al. (2021). [7]
8		How to provide live library information via SMS using Twilio	Twilio	Beccaria, M. (2011). [8]
9		Real Time system for handling customer queries using Twilio, Assembly Ai and NLP	Twilio, Assembly Ai and NLP	Poorna Pushkala et al. (2022). [9]
10		Appointment Scheduler for VIP Using Python and Twilio Check for updates	Python and Twilio	Krishna et al. (2023). [10]
11		Development of an Affordable Real-Time IoT-Based Surveillance System Using ESP32 and TWILIO API	ESP32 and TWILIO API	Okokpujie et al. (2023). [11]
12		Creating a Click-to-Call Call Center	Twilio, Flybase, Node. js	Stringer et al. (2021). [12]
13		Twilio breach highlights cloud supply chain risk and litigation vulnerability for organisations	Twilio	Daniell et al. (2022). [13]
14		Building a Live Blogging Tool	Twilio and Flybase with Node. js	Stringer et al. (2021). [14]
15		Sending Daily SMS Reminders	Twilio and Flybase	Stringer et al. (2021). [15]
16		Integrating text messaging into reference services		Frantz et al. (2011). [16]
17		Twilio services analyses and positioning by view of IN services implementation technology	Twilio	Konno. Y. (2019). [17]
18		Creating a Video Chat Site	Gatsby	Biswas et al. (2021). [18]
19		Building a Real-Time SMS Call Center. Real-Time Twilio and Flybase	Twilio and Flybase	Stringer et al. (2021). [19]
20		How to Configure IBM Watson IoT to Send Email, SMS	IoT	Ghosh, A. (2019). [20]
21		A secured IoT-based health care monitoring System using body sensor network	IoT	Priyanka et al. (2022). [21]
22		Advance alert system for traffic clearance to ambulance in emergency situation	IoT	Dongre et al. (2023). [22]
23		Building a Salesforce-Powered Call Center. Real-Time Twilio and Flybase	Twilio and Flybase	Stringer et al. (2021). [23]
24		Building a Real-Time Group Chat App	Twilio and Flybase	Stringer et al. (2021). [24]

International Journal of Case Studies in Business, IT, and Education (IJCSBE), ISSN: 2581-6942, Vol. 8, No. 2, May 2024

SRINIVAS PUBLICATION

25	Building a Real-Time Call Tracking Dashboard	Twilio and Flybase	Stringer et al. (2021). [25]
26	Wearable device for women safety using IoT	IoT	Prasad et al. (2021). [26]
27	Implementation of IoT-based smart video surveillance system	IoT	Gulve et al. (2017). [27]
28	IoT Based Smart Fire Emergency Response System	IoT	KUMAR et al. (2018). [28]
29	Third Generation ATM using Advanced Image Processing with Face Recognition	Image Processing with Face Recognition	Rao et al. (2022). [29]
30	RFID-Cloud Based Vehicle Identification System and Vehicle Monitoring System on Highways	RFID	Edukondalu et al. (2019). [30]
31	A Contactless Smart Home Security System to Prevent COVID Transmission	Image Processing with Face Recognition	Sethi et al. (2021). [31]
32	Sales: Myth-Busting–DevRel and Sales in Harmony	Abstract	Lewko et al. (2021). [32]
33	Design and implementation of a voice-based medical alert system for medication adherence	Voice Recognition	Eyesan et al. (2013). [33]
34	A Participatory Online Platform with Feature Phone Integration and Voice Recognition for Crowdsourcing Disaster Risk Reduction Strategies in the Philippines	Voice Recognition	Nonnecke et al. (2013).
35	Smart energy metering for cost and power reduction in house hold applications	ARDUINO UNO, RS485 TO TTL	Komathi et al. (2021). [35]
36	IOT based smart surveillance system. International Journal for Advance Research and Development	IOT	Gunnemeda et al. (2018). [36]
37	Connecting Your Apps to the World. Mastering Zoho Creator: Build Cloud-Based Business Applications from the Ground Up	Zoho Creator	Shabdar et al. (2017). [37].
38	Object recognition and security improvement by enhancing the features of CCTV	Object recognition	Kanyal et al. (2020). [38]
39	Application of IOT and machine learning in crop protection against animal intrusion	IOT and machine learning	Balakrishna et al. (2021). [39].
40	Video Surveillance System with Auto Informing Feature	Video Surveillance System	Chouhan et al. (2019). [40].

In Table 2, we included a couple of our projects that use various notifications through IoT technology. For the research work, we mainly used various ESP modules. For the notifications, we used various cloud platforms like AWS, Sinric Pro, etc. Our researcher can explore the research below to better understand IoT and notification systems.

International Journal of Case Studies in Business, IT, and Education (IJCSBE), ISSN: 2581-6942, Vol. 8, No. 2, May 2024

SRINIVAS PUBLICATION

Table 2: Lists the author's research on IoT, Data saving to the cloud, and sensors.

S. No.	Focus/Subject	Technology/Algorithm/ Module/Components	Reference
1	A Practical Approach To GIT Using Bitbucket, GitHub and SourceTree	Bitbucket, GitHub, and SourceTree	Chakraborty et. al. (2022). [41]
2	How to make IoT in C# using Sinric Pro	C#, Sinric Pro	Chakraborty et. al. (2022). [42]
3	Virtual IoT Device in C# WPF Using Sinric Pro	C#, WPF, Sinric Pro	Chakraborty et. al. (2022). [43]
4	MVVM Demonstration Using C# WPF	C# WPF	Chakraborty et al. (2023). [44]
5	Let Us Create An IoT Inside the AWS Cloud	IoT, AWS	Chakraborty et. al. (2023). [45]
6	Let Us Create a Physical IoT Device Using AWS and ESP Module	AWS, ESP Module	Chakraborty et. al. (2023). [46]
7	Let Us Create Multiple IoT Device Controller Using AWS, ESP32 And C#	AWS, ESP32 And C#	Chakraborty et. al. (2023). [47]
8	Let Us Create Our Desktop IoT Soft-Switchboard Using AWS, ESP32 and C#	AWS, ESP32 and C#	Chakraborty et. al. (2023). [48]
9	Let Us Create an Alexa Skill for Our IoT Device Inside the AWS Cloud	AWS, IoT	Chakraborty et al. (2023). [49]
10	Let Us Create A Lambda Function for Our IoT Device In The AWS Cloud Using C#	C#, AWS Lambda	Chakraborty et. al. (2023). [50]
11	Industrial Automation Debug Message Display Over Modbus RTU Using C#	Modbus RTU, C#	Chakraborty et. al. (2023). [51]
12	Modbus Data Provider for Automation Researcher Using C#	C#, Modbus	Chakraborty et. al. (2023). [52]
13	IoT-Based Industrial Debug Message Display Using AWS, ESP8266 And C#	AWS, ESP8266 And C#	Chakraborty et. al. (2023). [53]
14	IoT-Based Switch Board for Kids Using ESP Module And AWS	ESP Module And AWS	Chakraborty et. al. (2023). [54]
15	Let Us Create an Alexa-Enabled IoT Device Using C#, AWS Lambda and ESP Module	C#, AWS Lambda and ESP Module	Chakraborty et. al. (2023). [55]
16	Alexa Enabled IoT Device Simulation Using C# And AWS Lambda	C# And AWS Lambda	Chakraborty et. al. (2023). [56]
17	Smart Magnetic Door Lock for Elderly People Using AWS Alexa, IoT, Lambda and ESP Module	AWS Alexa, IoT, Lambda and ESP Module	Chakraborty et. al. (2023). [57]
18	Let Us Manage BP Monitor Data Using WordPress Server and C#	WordPress Server and C#	Chakraborty et al. (2024). [58]
19	Communication Channels Review For ESP Module Using Arduino IDE And NodeMCU	Arduino IDE and NodeMCU	Chakraborty et al. (2024). [59]
20	Let Us Build a MQTT Pub-Sub Client In C# For IoT Research	C#, IoT	Chakraborty et al. (2024). [60]

International Journal of Case Studies in Business, IT, and Education (IJCSBE), ISSN: 2581-6942, Vol. 8, No. 2, May 2024

SRINIVAS PUBLICATION

3. OBJECTIVES OF THE PAPER :

 Description for Objectives.
(1) To study the feasibility of WhatsApp-based electrical load triggering.
(2) To compare the performance of the various WhatsApp-based messaging service providers.
(3) To evaluate the performance of the electrical switch on/off using WhatsApp messaging.
(4) To test the performance of third-party messaging service performance.
(5) To prove the efficiency of the WhatsApp-based load-triggering system.
(6) Design a switching system using WhatsApp for electrical load.
(7) To interpret the flow of the WhatsApp-based switching system.

4. METHODOLOGY :

Figure 1 depicts the project block diagram. The project has software and hardware components. The hardware components are the ESP module, relay module, and wires connecting the ESP module and relay module. The relay module is attached to a free GPIO to trigger the relay. The LED batten is
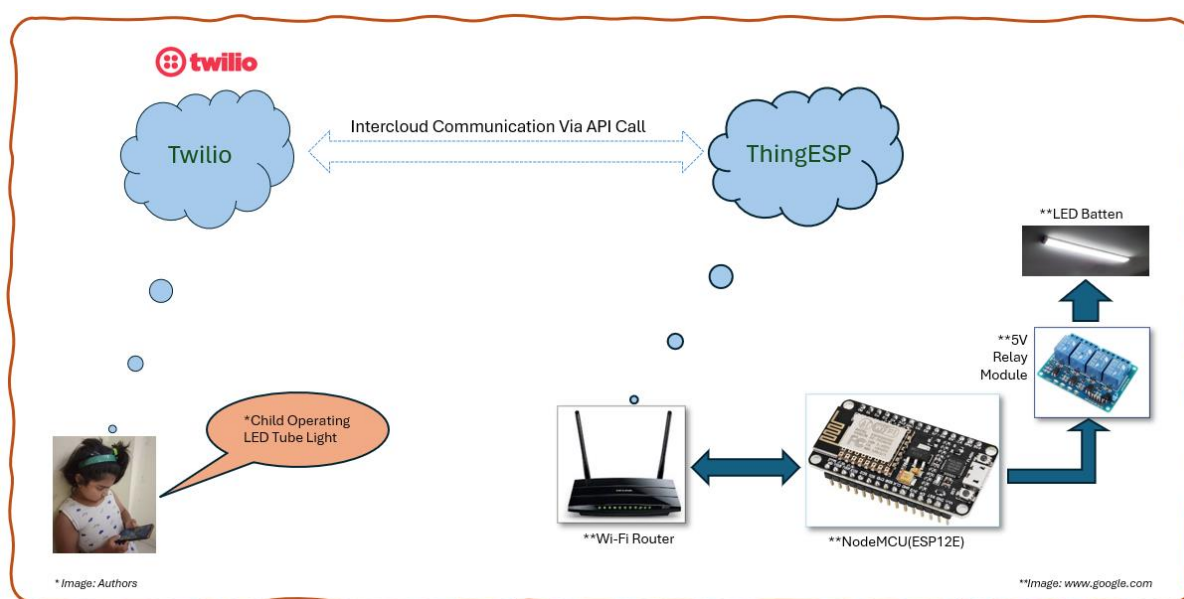

Fig. 1: The project Block Diagram

associated with the solenoid relay. Once the relay is energized, the tube light will be powered. The ESP module needs to upload the firmware. The firmware is available on the web or in the GitHub repository. First, we must create an account on Twilio. It will provide some credentials that are required for the firmware. On the ThingESP website, we need to make a profile. When the system runs, it will connect to the internet using the router credentials. Once it is attached to the cloud server, it sends data to the server. When the user sends a command from the mobile WhatsApp application, it will first go to the Twilio cloud services and send the data to the callback address. Here, we provided the ThingESP cloud address to the Twilio cloud services. When our ESP module powers up, it will connect with ThingESP and will always be connected until it is powered on. The ThingESP always keeps the status of the ESP module, whether it is connected or not. Once the user sends the required information through the app, Twilio forwards the request to ThingESP, and ThingESP again forwards the request to the ESP hardware module. The ESP module receives the command and parses it. Then, take action and send the response to the ThingESP cloud server, and the ThingESP will be sent back to Twilio, which sends a response to the WhatsApp server. Finally, the WhatsApp cloud server sends a response to the user application. The application displays the response in the chat box window.

5. ABCD ANALYSIS :

The list of advantages, benefits, contraints, and disadvantages are identified for this innovation and listed as per ABCD framework [61-70].

International Journal of Case Studies in Business, IT, and Education (IJCSBE), ISSN: 2581-6942, Vol. 8, No. 2, May 2024

SRINIVAS
PUBLICATION

5.1 Advantages:
(1) The high power load can be operated from a safe distance.
(2) Reusing the LED batten is environmentally friendly.
(3) The system is easy to install.

5.2 Benefits:
(1) Kids can turn on electronic gadgets without any harm.
(2) We can switch on it with a wet hand.
(3) It can operate remotely so that we can treat it as a remote switchboard.

5.3 Constraints:
(1) There are some initial costs involved in setting up the project.
(2) It is electronic devices. Once damaged, it must be replaced, or the LED batten can not run from mobile.
(3) The Internet should be available around the clock, especially during device operation.

5.4 Disadvantages:
(1) There is a recurring cost to run this system. The WhatsApp messaging service Twilio needs to pay to run it.
(2) To run this system, we need to run the system that consumes the cost of the electricity bill

6. EXPERIMENTS :

We can understand the system better by doing a practical experiment. Following the steps below, we can recreate the project in our lab to continue the research.

6.1 How to reuse the LED batten:
The LED batten is made of two things. One is an array of SMD(Surface Mount Devices) LED and a small power adaptor. In the typical scenario, the LED is not damaged. The power adaptor gets defective. The different power adaptors are available in online stores like Amazon (search text "LED tube light adaptor"). We can purchase and replace it. At first, open both end caps. Remove slowly and replace with a new one. Insert into defuse plastic case again. It is pretty simple. For this, a soldering arrangement is needed. If it is unavailable, the researcher can get help from an electronics service technician. If the power adaptor is more costly than a new one, the best way is to buy the new one and dispose of it in an environmentally friendly way.

6.2 How to create a Twilio Account Credentials:
1) Open in browser www.twilio.com
2) From the top left, click on the button "**Start for free**."
3) One sign-up form will appear. Fill up "First name," "Last name," "Email Address," and "Password." Provide a stronger password; otherwise, it will ask repeatedly. Click on the checkbox and click on the button "**Continue**."
4) Open the given Email, copy the verification code, paste it into the textbox, and click the "Verify" button. Once it is verified, you will be redirected to the phone number verification page.
5) Select the country code and enter the phone number. Then click on the "**Send code via SMS**" button.
6) Check the message received on the phone from Twilio. Enter the code in the textbox and click the "verify" button. Once verified, Twilio will provide us with a recovery code for future use in recovering the account. Copy the Recovery code and keep it in safe custody. Now click on "**Continue**".
7) If we find errors, we should close the browser and log in using only the created credentials. Now, we will get a page with a heading like "Ahoy, **XXXX XXXXXX, welcome to Twilio!**"
8) Under the combo box, "**What do you plan to build with Twilio?**". select "**others**"
9) the next combo box, "**Which Twilio product are you here to use?**". select "**WhatsApp**"
10) In the next section, "**Which best describes you/your organization?**" select "**Hobbist or Student**."

International Journal of Case Studies in Business, IT, and Education (IJCSBE), ISSN: 2581-6942, Vol. 8, No. 2, May 2024

SRINIVAS PUBLICATION

11) In the next section, "**How do you want to build with Twilio?**" select "**With no code at all**, **Launch a starter app with no code.**"
12) In the "**What is your goal today?**" select "**something else**"
13) Click on the button "**Get Started with Twilio**".
14) Now, the Twilio console will appear. On the middle top side, click on the button "**Get a trial phone number.**"
15) Now, at the bottom middle, the three essential pieces of information are available. "**Account SID**," "Auth Token," and "My Twilio phone number." Copy these and keep them in safe custody. It will be required later in our firmware.
16) from the left side, expand the "Messaging" menu and then "Try it out."
17) One "**Activate Your Sandbox**" message will appear. check "I acknowledge and agree to the preceding terms and conditions" and click "Confirm." If something goes wrong, refresh the browser.
18) Now, a page heading "Try WhatsApp" will appear. Under the Sandbox tab, we will get one WhatsApp number provided by Twilio for this account. Now, save the number in our contact list. Open WhatsApp and send the message code they provided, like "join meat-cry." Then, press the app send button on the mobile phone.
19) We will get a message like this: "**Twilio Sandbox:** ✅ **You are all set! The sandbox can now send/receive messages from whatsapp:+14155238886. Reply stop to leave the sandbox any time.**"
20) Now, One crucial setting. Under the "Sandbox settings," we need to add a callback link when a message arrives from WhatsApp where it will forward. In the field "When a message comes in," write the URL for the things.
21) Click on the "Save" button
22) Now, the Twilio Side is completed.

ThingESP Account Creation:
23) Open in the browser https://thingesp.siddhesh.me/#/
24) Click on the "Create Account" button. An account creation interface will appear.
25) Enter Username, Password, Email.
26) Checked on "**I'm not a robot**."
27) Click on the button "**Sign up**".
28) from the left side menu bar, click on the "**Projects**" menu.
29) from the right side, click on the "**Add New Project**" button
30) Fill in the "**Enter Project's Name**" like "WifiTubeLight." We need to follow some name convention.
31) Fill in "**Enter Project's Device Credentials**" like "ESP8266."
32) Keep slider ON(Green) position.
33) Enter Twilio SID and AuthToken, which we received when creating a Twilio account.
34) Click on the "**Submit**" button. Then, projects will be created successfully.
35) Now, from the left side, click the "**Endpoint URL for Twilio WhatsApp**" window. The URL will be copied into the clipboard
36) Now Open the Twilio Web interface. Under Messaging> Try it out > "Send a WhatsApp message, paste the link inside the "When a message comes in" textbox. Click the "**Save**" button. Close the Twilio Web interface.
37) Clos the ThingESP web interface.

Making Ready ESP8266 Firmware:
38) Download the project from *https://github.com/sudipchakraborty/ReUse-LED-Tube-Light-And-Make-It-WhatsApp-Enabled.git*
39) Open the project in Arduino IDE. Install library "ThingESP"
40) Enter ThingESP8266 thing("**Username**," "**project name**," "**project device credential**");
41) Enter Wifi Credentials.
42) Build and upload the project to the NodeMCU module.

International Journal of Case Studies in Business, IT, and Education (IJCSBE), ISSN: 2581-6942, Vol. 8, No. 2, May 2024

SRINIVAS PUBLICATION

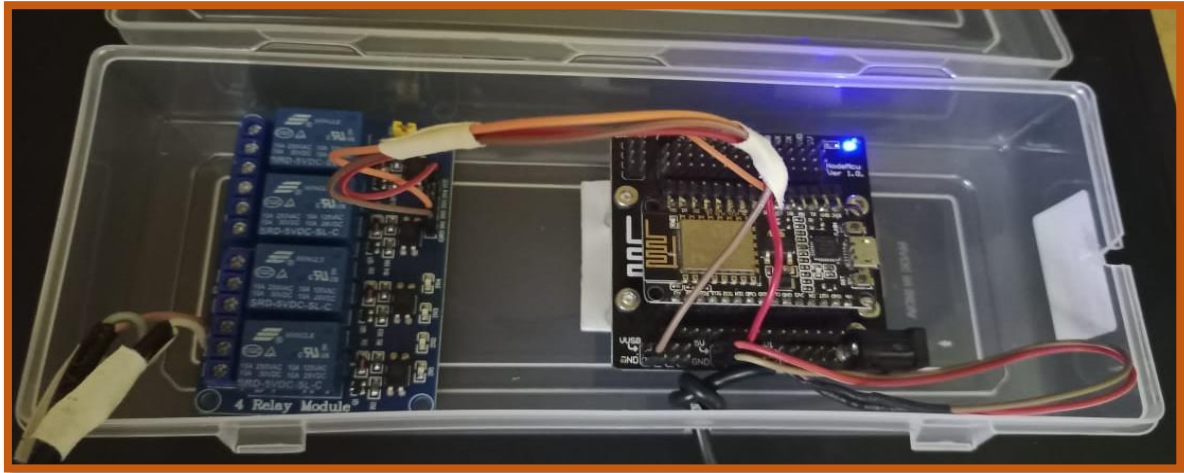43) Take one relay module and connect power, GND, and Signal with the D0 pin of the Esp module.

Fig. 2: Author's Prototype

44) Now power on. Enable Arduino IDE terminal message windows. See the status.
45) Now Open the WhatsApp. Write "led on," led off," or "led status." Observer the relay is being on or off.

7. RESULTS & DISCUSSIONS :

Running the system round the clock, we found it suitable for operating any electrical load using a mobile. It is convenient to use and safe for all family members, including children.

8. ANALYSIS / Comparison OF RESULTS :

We analyzed with various service providers for user message interactions to trigger the load. There are different factors we checked. Some service providers have accessible interfaces, but the messaging cost is too high. This kind of service is called "Ultramsg". It is too costly for general applications, which we use for load triggering. Accounting for all aspects, we suggested using Twilio. We need to use ThingESP, which allows us to receive messages for free. The only cost is Twilio. They are time-based or message count-based. We can use which one will fit us.

9. SUGGESTIONS :

To continue the research work, we add a couple of suggestions;
(1) Think about whether or not the system is needed because it has a device plus installation cost.
(2) To reuse the tube light, take expert help.
(3) Connect the system to a stable internet connection; an unstable connection can delay the light's triggering. We also received delayed acknowledgment from the server.
(4) Before the Twilio subscription, try the free trial. Once we are satisfied, we can subscribe as needed. There are various tariffs; choose wisely according to our use pattern.
(5) The code is available to download and continue research work.
(6) This procedure can control various home electrical loads or appliances. For high loads, a solenoid with a high capacity is needed; otherwise, it can burn.
(7) The contents adapted from https://www.youtube.com/watch?v=noeT7KGudpM&t=330s
(8) Search Amazon with "TECHNOBEAM 18W-20W,240 mA Tube light Driver."
(9) For common driver "Tubelight Driver T5 Output 18W-20W, LED Tube Light Driver".

10. CONCLUSION :

Direct switch press to switch off the electric gadgets sometimes creates problems. We can get shocked if we switch on the lights with water. We need to protect ourselves from babies for this event. So, using IoT technology, we switch on the light using our mobile phone. Here, we discussed how to get the

International Journal of Case Studies in Business, IT, and Education (IJCSBE), ISSN: 2581-6942, Vol. 8, No. 2, May 2024

SRINIVAS PUBLICATION

facility to use IoT technology. First, we introduced the subject we discussed here. We include some research works in this field that have already done good research in the IoT field. Then, we describe the methodology of this research work with a block diagram and a couple of pictures. We added experiment procedures inside the researcher's lab. Then, we discussed some advantages and disadvantages of the project. We examined the ABCD analysis also. Finally, we discussed the conclusion of the project.

11. ACKNOWLEDGEMENT :

12. LIMITATIONS :

There are some limitations to the project. The limitations are listed below:
- To continue using the service, we must pay a recurring cost.
- We need to provide internet cost
- The reusable cost is not as low. Sometimes, it may be more than or equal to the new ones.
- To install this, an expert is needed; otherwise, you can get electrically shocked.
- Sometimes, the power supply is not available in the market. At that time, we had to buy new tube lights instead of reusing them.
- If mobile service is unavailable, we can not turn on the light. In this event, we can arrange a parallel switch to switch on the light instead of using mobile availability.
- The complete system installation cost exceeds a regular switch-enabled light on-off system. We need to decide whether this installation is required.

REFERENCES :

[1] Karthik, V., Girishankar, P. L., Samraj, A. J., & Dhanush, S. (2023, December). Smart Energy Management System for Onion Preservation. In *2023 2nd International Conference on Automation, Computing and Renewable Systems (ICACRS)* (pp. 1-6). IEEE. Google Scholar↗

[2] Sierra, N., & Gonzalez, F. Development of a Low-Cost Iot Device Focused on Protection and Monitoring Compressors in Refrigeration and Air-Conditioning. *Available at SSRN 4468314*. Google Scholar↗

[3] Cong, M. (2020). *Drawing QSers' mind: a cognitively-informed critical metaphor analysis tracing the cultural model of the Quantified Self* (Doctoral dissertation, University of Nottingham). Google Scholar↗

[4] Venkatesan, S., Jawahar, A., Varsha, S., & Roshne, N. (2017, November). Design and implementation of an automated security system using Twilio messaging service. In *2017 International Conference on Smart Cities, Automation & Intelligent Computing Systems (ICON-SONICS)* (pp. 59-63). IEEE. Google Scholar↗

[5] Janarthanam, S. (2017). *Hands-on chatbots and conversational UI development: build chatbots and Chatfuel, Dialog flow, Microsoft Bot Framework, Twilio, and Alexa Skills voice user interfaces*. Packt Publishing Ltd. Google Scholar↗

[6] Akhil Joseph Xavier, K., & Shyam, G. K. (2023, March). Intrusion Detection System Using Deep Convolutional Neural Network and Twilio. In *International Conference on Communications and Cyber Physical Engineering 2018* (pp. 279-289). Singapore: Springer Nature Singapore. Google Scholar↗

[7] Choi, B. (2021). Python Network Automation Labs: Ansible, pyATS, Docker, and the Twilio API. In *Introduction to Python Network Automation: The First Journey* (pp. 675-732). Berkeley, CA: Apress. Google Scholar↗

International Journal of Case Studies in Business, IT, and Education (IJCSBE), ISSN: 2581-6942, Vol. 8, No. 2, May 2024

SRINIVAS PUBLICATION

[8] Beccaria, M. (2011). How do you provide live library information via SMS using Twilio? *Code4Lib Journal*, (14). Google Scholar↗

[9] Poorna Pushkala, K., Samundeswari, S., & Megala, J. (2022, November). Real Time system for handling customer queries using Twilio, Assembly Ai and NLP. In *2022 1st International Conference on Computational Science and Technology (ICCST)* (pp. 111-115). IEEE. Google Scholar↗

[10] Krishna, N. H., Krishna, V. S. H., Basha, S. N., Polineni, V. D., & Vinjam, A. (2023). Appointment Scheduler for VIP Using Python and Twilio Check for updates. *Expert Clouds and Applications: Proceedings of ICOECA 2023*, *673*, 403. Google Scholar↗

[11] Okokpujie, K., Okokpujie, I. P., Young, F. T., & Subair, R. E. (2023). Development of an Affordable Real-Time IoT-Based Surveillance System Using ESP32 and TWILIO API. *Journal homepage: http://iieta. org/journals/ijsse*, *13*(6), 1069-1075. Google Scholar↗

[12] Stringer, R., & Stringer, R. (2021). Creating a Click-to-Call Call Center. *Real-Time Twilio and Flybase: Build Real-Time Web Apps Using Twilio and Flybase with Node. js*, 55-70. Google Scholar↗

[13] Daniell, S. (2022). Twilio breach highlights cloud supply chain risk and litigation vulnerability for organisations. *PRIVACY LAW BULLETIN*, *19*(8), 156-158. Google Scholar↗

[14] Stringer, R., & Stringer, R. (2021). Building a Live Blogging Tool. *Real-Time Twilio and Flybase: Build Real-Time Web Apps Using Twilio and Flybase with Node. js*, 17-26. Google Scholar↗

[15] Stringer, R., & Stringer, R. (2021). Sending Daily SMS Reminders. *Real-Time Twilio and Flybase: Build Real-Time Web Apps Using Twilio and Flybase with Node. js*, 133-140. Google Scholar↗

[16] Frantz, P., & Tucker-Raymond, C. (2011). Integrating text messaging into reference services. *Library Hi Tech News*, *28*(5), 8-9. Google Scholar↗

[17] Konno, Y. (2019). Twilio services analyses and positioning by view of IN services implementation technology. *IEICE Technical Report; IEICE Tech. Rep.*, *119*(297), 39-44. Google Scholar↗

[18] Biswas, N., & Biswas, N. (2021). Creating a Video Chat Site. *Foundation Gatsby Projects: Create Four Real Production Websites with Gatsby*, 349-423. Google Scholar↗

[19] Stringer, R., & Stringer, R. (2021). Building a Real-Time SMS Call Center. *Real-Time Twilio and Flybase: Build Real-Time Web Apps Using Twilio and Flybase with Node. js*, 1-16. Google Scholar↗

[20] Ghosh, A. (2019). How to Configure IBM Watson IoT to Send Email, SMS. *The Customize Windows*. Google Scholar↗

[21] Priyanka, J. S., Kiran, M. S., & Nalla, P. (2022). A secured IoT-based health care monitoring System using body sensor network. In *Emergent Converging Technologies and Biomedical Systems: Select Proceedings of ETBS 2021* (pp. 483-490). Singapore: Springer Singapore. Google Scholar↗

[22] Dongre, S., Mohite, S., More, O., Patil, P., Sayantika, S., & Mangrule, S. (2023, December). Quick loop: Advance alert system for traffic clearance to ambulance in emergency situation. In *AIP Conference Proceedings* (Vol. 2981, No. 1). AIP Publishing. Google Scholar↗

[23] Stringer, R., & Stringer, R. (2021). Building a Salesforce-Powered Call Center. *Real-Time Twilio and Flybase: Build Real-Time Web Apps Using Twilio and Flybase with Node. js*, 71-131. Google Scholar↗

[24] Stringer, R., & Stringer, R. (2021). Building a Real-Time Group Chat App. *Real-Time Twilio and Flybase: Build Real-Time Web Apps Using Twilio and Flybase with Node. js*, 27-53. Google Scholar↗

International Journal of Case Studies in Business, IT, and Education (IJCSBE), ISSN: 2581-6942, Vol. 8, No. 2, May 2024

SRINIVAS PUBLICATION

[25] Stringer, R., & Stringer, R. (2021). Building a Real-Time Call Tracking Dashboard. *Real-Time Twilio and Flybase: Build Real-Time Web Apps Using Twilio and Flybase with Node. js*, 141-154. Google Scholar↗

[26] Prasad, M. M. S. N., Yasavi, K., Ramu, K. H., Teja, G. S., & Nikitha, P. (2021). Wearable device for women safety using IoT. *A Journal of Composition Theory,* Google Scholar↗

[27] Gulve, S. P., Khoje, S. A., & Pardeshi, P. (2017). Implementation of IoT-based smart video surveillance system. In *Computational Intelligence in Data Mining: Proceedings of the International Conference on CIDM, 10-11 December 2016* (pp. 771-780). Springer Singapore.

[28] KUMAR, N. M., JOHNSAIDA, K. R., RAHUL, L., & SHALINI, T. (2018). Iot Based Smart Fire Emergency Response System. Google Scholar↗

[29] Rao, M. J., Kumar, K. S., Bhavya, T. R., Venkat, A., Kumar, B. N., & Rao, S. S. (2022). Third Generation ATM using Advanced Image Processing with Face Recognition. *International Journal of Research in Engineering, Science and Management*, *5*(6), 185-188. Google Scholar↗

[30] Edukondalu, A. (2019). RFID-Cloud Based Vehicle Identification System and Vehicle Monitoring System on Highways. *Journal of Innovation in Electronics and Communication Engineering*, *9*(1), 13-15. Google Scholar↗

[31] Sethi, K., Kaul, S., Patel, I., & Sujatha, R. (2021, March). FaceLock Homes: A Contactless Smart Home Security System to Prevent COVID Transmission. In *2021 Sixth International Conference on Wireless Communications, Signal Processing and Networking (WiSPNET)* (pp. 75-79). IEEE. Google Scholar↗

[32] Lewko, C., Parton, J., Lewko, C., & Parton, J. (2021). Sales: Myth-Busting–DevRel and Sales in Harmony. *Developer Relations: How to Build and Grow a Successful Developer Program*, 227-234. Google Scholar↗

[33] Eyesan, O. L., & Okuboyejo, S. R. (2013). Design and implementation of a voice-based medical alert system for medication adherence. *Procedia Technology*, *9*, 1033-1040. Google Scholar↗

[34] Nonnecke, B., Mohanty, S., Lee, A., Lee, J., Beckman, S., Mi, J., ... & Goldberg, K. (2018, October). Malasakit 2.0: A Participatory Online Platform with Feature Phone Integration and Voice Recognition for Crowdsourcing Disaster Risk Reduction Strategies in the Philippines. In *2018 IEEE Global Humanitarian Technology Conference (GHTC)* (pp. 1-6). IEEE. Google Scholar↗

[35] Komathi, C., Durgadevi, S., Sundari, K. T., Sahithya, T. S., & Vignesh, S. (2021, February). Smart energy metering for cost and power reduction in house hold applications. In *2021 7th International Conference on Electrical Energy Systems (ICEES)* (pp. 428-432). IEEE. Google Scholar↗

[36] Gunnemeda, L. K., Gadde, S. C., Guduru, H., Devarapalli, M. B., & Peketi, S. K. (2018). IOT based smart surveillance system. *International Journal for Advance Research and Development*, *3*(2), 166-171. Google Scholar↗

[37] Shabdar, A., & Shabdar, A. (2017). Connecting Your Apps to the World. *Mastering Zoho Creator: Build Cloud-Based Business Applications from the Ground Up*, 193-203. Google Scholar↗

[38] Kanyal, H. S., Goel, M., Tomar, A. S., Yadav, H. K., & Singh, K. (2020, December). Object recognition and security improvement by enhancing the features of CCTV. In *2020 9th International Conference System Modeling and Advancement in Research Trends (SMART)* (pp. 245-248). IEEE. Google Scholar↗

[39] Balakrishna, K., Mohammed, F., Ullas, C. R., Hema, C. M., & Sonakshi, S. K. (2021). Application of IOT and machine learning in crop protection against animal intrusion. *Global Transitions Proceedings*, *2*(2), 169-174. Google Scholar↗

[40] Chouhan, L., Tyagi, E., Deeksha, S. P., Malhotra, C., Sahu, V. K., & Verma, J. (2019). *Video Surveillance System with Auto Informing Feature* (No. 2144). EasyChair. Google Scholar↗

International Journal of Case Studies in Business, IT, and Education (IJCSBE), ISSN: 2581-6942, Vol. 8, No. 2, May 2024

SRINIVAS
PUBLICATION

[41] Chakraborty, S., & Aithal, P. S., (2022). A Practical Approach To GIT Using Bitbucket, GitHub and SourceTree. International Journal of Applied Engineering and Management Letters (IJAEML), 6(2), 254-263. DOI: https://doi.org/10.5281/zenodo.7262771

[42] Chakraborty, S., & Aithal, P. S., (2022). How to make IoT in C# using Sinric Pro. International Journal of Case Studies in Business, IT, and Education (IJCSBE), 6(2), 523- 530. DOI: https://doi.org/10.5281/zenodo.7335167

[43] Chakraborty, S., & Aithal, P. S., (2022). Virtual IoT Device in C# WPF Using Sinric Pro. International Journal of Applied Engineering and Management Letters (IJAEML), 6(2), 307-313. DOI: https://doi.org/10.5281/zenodo.7473766

[44] Chakraborty, S., & Aithal, P. S., (2023). MVVM Demonstration Using C# WPF. International Journal of Applied Engineering and Management Letters (IJAEML), 7(1), 1- 14. DOI: https://doi.org/10.5281/zenodo.7538711

[45] Chakraborty, S., & Aithal, P. S., (2023). Let Us Create An IoT Inside the AWS Cloud. International Journal of Case Studies in Business, IT, and Education (IJCSBE), 7(1), 211- 219. DOI: https://doi.org/10.5281/zenodo.7726980

[46] Chakraborty, S., & Aithal, P. S., (2023). Let Us Create a Physical IoT Device Using AWS and ESP Module. International Journal of Management, Technology, and Social Sciences (IJMTS), 8(1), 224-233. DOI: https://doi.org/10.5281/zenodo.7779097

[47] Chakraborty, S., & Aithal, P. S., (2023). Let Us Create Multiple IoT Device Controller Using AWS, ESP32 And C#. International Journal of Applied Engineering and Management Letters (IJAEML), 7(2), 27-34. DOI: https://doi.org/10.5281/zenodo.7857660

[48] Chakraborty, S., & Aithal, P. S., (2023). Let Us Create Our Desktop IoT Soft-Switchboard Using AWS, ESP32 and C#. International Journal of Case Studies in Business, IT, and Education (IJCSBE), 7(3), 185-193. DOI: https://doi.org/10.5281/zenodo.8234036

[49] Chakraborty, S. & Aithal, P. S. (2023). Let Us Create an Alexa Skill for Our IoT Device Inside the AWS Cloud. International Journal of Case Studies in Business, IT, and Education (IJCSBE), 7(2), 214-225. DOI: https://doi.org/10.5281/zenodo.7940237

[50] Chakraborty, S., & Aithal, P. S. (2023). Let Us Create A Lambda Function for Our IoT Device In The AWS Cloud Using C#. International Journal of Management, Technology, and Social Sciences (IJMTS), 8(2), 145-155. DOI: https://doi.org/10.5281/zenodo.7995727

[51] Chakraborty, S., & Aithal, P. S. (2023). Industrial Automation Debug Message Display Over Modbus RTU Using C#. International Journal of Management, Technology, and Social Sciences (IJMTS), 8(2), 305-313. DOI: https://doi.org/10.5281/zenodo.8139709

[52] Chakraborty, S., & Aithal, P. S. (2023). Modbus Data Provider for Automation Researcher Using C#. International Journal of Case Studies in Business, IT, and Education (IJCSBE), 7(3), 1-7. DOI: https://doi.org/10.5281/zenodo.8162680

[53] Chakraborty, S., & Aithal, P. S. (2023). IoT-Based Industrial Debug Message Display Using AWS, ESP8266 And C#. International Journal of Management, Technology, and Social Sciences (IJMTS), 8(3), 249-255. DOI: https://doi.org/10.5281/zenodo.8250418

[54] Chakraborty, S., & Aithal, P. S. (2023). IoT-Based Switch Board for Kids Using ESP Module And AWS. International Journal of Case Studies in Business, IT, and Education (IJCSBE), 7(3), 248-254. DOI: https://doi.org/10.5281/zenodo.8285219

[55] Chakraborty, S., & Aithal, P. S. (2023). Let Us Create an Alexa-Enabled IoT Device Using C#, AWS Lambda and ESP Module. International Journal of Management, Technology, and Social Sciences (IJMTS), 8(3), 256-261. DOI: https://doi.org/10.5281/zenodo.8260291

[56] Chakraborty, S., & Aithal, P. S. (2023). Alexa Enabled IoT Device Simulation Using C# And AWS Lambda. International Journal of Case Studies in Business, IT, and Education (IJCSBE), 7(3), 359-368. DOI: https://doi.org/10.5281/zenodo.8329375

International Journal of Case Studies in Business, IT, and Education (IJCSBE), ISSN: 2581-6942, Vol. 8, No. 2, May 2024

SRINIVAS PUBLICATION

[57] Chakraborty, S. & Aithal, P. S. (2023). Smart Magnetic Door Lock for Elderly People Using AWS Alexa, IoT, Lambda and ESP Module. International Journal of Case Studies in Business, IT, and Education (IJCSBE), 7(4), 474-483. DOI: https://doi.org/10.5281/zenodo.10467946

[58] Chakraborty, S. & Aithal, P. S. (2024). Let Us Manage BP Monitor Data Using WordPress Server and C#. *International Journal of Case Studies in Business, IT, and Education (IJCSBE), 8*(1), 1-9. DOI: https://doi.org/10.5281/zenodo.10551926

[59] Chakraborty, S., & Aithal, P. S. (2024). Communication Channels Review For ESP Module Using Arduino IDE And NodeMCU. International Journal of Applied Engineering and Letters https://doi.org/10.5281/zenodo.10562843

[60] Chakraborty, S. & Aithal, P. S. (2024). Let Us Build a MQTT Pub-Sub Client In C# For IoT Research. International Journal of Management, Technology, and Social Sciences (IJMTS), 9(1), 104-114. DOI: https://doi.org/10.5281/zenodo.10603409

[61] Aithal, P. S., Shailashree, V., & Kumar, P. M. (2015). A new ABCD technique to analyze business models & concepts. *International Journal of Management, IT and Engineering*, *5*(4), 409-423. Google Scholar↗

[62] Aithal, P. S. (2016). Study on ABCD analysis technique for business models, business strategies, operating concepts & business systems. *International Journal in Management and Social Science*, *4*(1), 95-115. Google Scholar↗

[63] Aithal, P. S. (2017). ABCD Analysis as Research Methodology in Company Case Studies. *International Journal of Management, Technology, and Social Sciences (IJMTS)*, *2*(2), 40-54. Google Scholar↗

[64] Aithal, P. S., Shailashree, V., & Kumar, P. M. (2015). Application of ABCD Analysis Model for Black Ocean Strategy. *International journal of applied research*, *1*(10), 331-337. Google Scholar↗

[65] Aithal, A., & Aithal, P. S. (2017). ABCD analysis of task shifting–an optimum alternative solution to professional healthcare personnel shortage. *International Journal of Health Sciences and Pharmacy (IJHSP)*, *1*(2), 36-51. Google Scholar↗

[66] Aithal, S., & Aithal, P. S. (2016). ABCD analysis of Dye-doped Polymers for Photonic Applications. *IRA-International Journal of Applied Sciences*, *4*(3), 358-378. Google Scholar↗

[67] Raj, K., & Aithal, P. S. (2018). Generating Wealth at the Base of the Pyramid–a Study Using ABCD Analysis Technique. *International Journal of Computational Research and Development (IJCRD)*, *3*(1), 68-76. Google Scholar↗

[68] Aithal, P. S., Shailashree, V., & Kumar, P. M. (2016). The study of the new national institutional ranking system using ABCD framework. *International Journal of Current Research and Modern Education (IJCRME)*, *1*(1), 389-402. Google Scholar↗

[69] Shenoy, V., & Aithal, P. S. (2016). ABCD Analysis of On-line Campus Placement Model. *IRA-International Journal of Management & Social Sciences*, *5*(2), 227-244. Google Scholar↗

[70] Kumari, P., & Aithal, P. S. (2020). Growth & Fate Analysis of Mangalore International Airport–A Case Study. *International Journal of Case Studies in Business, IT, and Education (IJCSBE)*, *4*(2), 71-85. Google Scholar↗

****