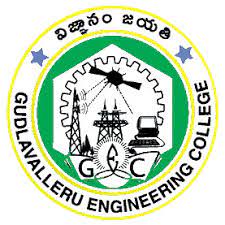
**GUDLAVALLERU ENGINEERING COLLEGE**

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**ELECTRONICS AND COMMUNICATION ENGINEERING**

**Smart Fire Management System For Industries**

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**1.Introduction**

1. **Overview:**

The Project Smart fire management system for industries is designed on python programming language. House combustion is one of the main concerns for builders, designers, and property residents. Singular sensors were used for a long time in the event of detection of a fire, but these sensors cannot measure the amount of fire to alert the emergency response units. To address this problem, this study aims to implement a smart fire detection system that would not only detect the fire using integrated sensors but also alert property owners, emergency services, and local police stations to protect lives and valuable assets simultaneously. The proposed model in this paper employs different integrated detectors, such as heat, smoke, and flame. The signals from those detectors go through the system algorithm to check the fire's potentiality and then broadcast the predicted result to various parties using GSM modem associated with the system. To get real-life data without putting human lives in danger, an IoT technology has been implemented to provide the fire department with the necessary data. Finally, the main feature of the proposed system is to minimize false alarms, which, in turn, makes this system more reliable.

1. **Purpose:**

The purpose of this “Smart fire management system for industries” is Nowadays, fire incidents have become a critical issue, which must be dealt with on time without any unnecessary delay to avoid the loss in lives and belongings . It is considered a fire situation when the monitored temperature exceeds 50o C. In critical places such as hospitals, schools, and banks, personnel's arrival time to come for help in fire hazards is around 15 minutes. According to the National Fire Protection Association (NFPA), two-third of U.S. household fires occur in premises with no working smoke alarms, alarms with no proper maintenance, or misplaced alarms. The appropriate allocation of fire alarms with a proactive warning could save lives and reduce property losses. Particularly, there are many types of fire alarms as heat detectors and smoke detectors; studying these types helps to decide which type is more suitable for home or store. For instance, heat detectors are classic options when the temperature reaches a certain level. Thus, it is more suitable for applications that rapid response is not required or in an environment where smoke detectors cannot be placed like frozen areas. Heat detectors have a lower false alarm rate but still slower in response because the temperature rises slowly. With all these lacks, smoke detectors remain better than heat detectors. The concept of Internet of things (IoT) nowadays is applied in many applications ranging from the smart industry, smart agriculture to smart healthcare , and smart home application . Home automation is an area where IoT has several advantages. In the case of remote plant locations, for example, technology enabling remote operation and maintenance will benefit; autonomous inter-appliance such that devices are mutually aware of the information exchange, thereby minimizing engineering costs in handling all devices involved. Nowadays, fires can get out of control because people intend to save money rather than installing proper fire alarm systems. Some problems are still on, such as affordability, effectiveness, and responsiveness. Previous related works such as Network-Based Real-time Integrated Fire Management and Alarm System have been done to overcome these problems.

**2.Literature Survey**

**a.. Existing problems:**

In general, fire alarm systems and devices will not work without power and will not function properly unless they are maintained and tested regularly.

* The amount of “smoke” present may be insufficient to alarm smoke detectors. Smoke detectors are designed to alarm at various levels of smoke density. If such density levels are not created by a developing fire at the location of detectors, the detectors will not go into alarms.
* Smoke detectors, even when working properly, have sensing limitations. Detectors that have photo electronic sensing chambers tend to detect smoldering fires better than flaming fires, which have little visible smoke. Detectors that have ionizing-type sensing chambers tend to detect fast flaming fires better than smoldering fires. Because fires develop in different ways and are often unpredictable in their growth, neither type of detector is necessarily best and a given type of detector may not provide adequate warning of a fire.

1. **Proposed Solution:**

Many studies have been conducted to address these issues like [26-28]; however, fire detection issues are not addressed properly since these systems rely on machine vision, where the algorithms need more images to train, and the detection rate is not satisfactory. Other approaches like [29,30] suffer from some limitations, mainly slow time responses and low accuracy. Thus, this paper aims to minimize false alarms, provide faster response, and a new IoT approach than previous studies that used mostly Node-Red. The contribution is as follows: (1) To determine which combinations and algorithms of sensors can accurately and quickly detect fires, (2) We have designed and then developed a system that detects fire and activates the fire alarm, (3) the proposed system evaluates the situation and initiates an automatic water sprinkler where the water unit was designed separately, and (4) the system analyses the collected data using IBM platform which results in a faster response. Thus, the highlighted four points make the proposed system superior in terms of affordability, effectiveness, and responsiveness.

**Web-cam opens**

**3.TheoreticalAnalysis**

**a. Block diagram:**



IOT DEVICE

Fast2sms

Python code

Figure 1.Smart fire management system for industries.

**Explanation:**

According to Figure 1, in case of fire, flame, temperature, and gas sensors send continuous readings to the Arduino. Updated readings are sent into a wifi module that translates the data into a graphical and statistical manner. A web page created to analyze the data and a response extracted conditionally to launch a water sprinkler as shown. Batteries feed the system as a back-up source while the primary Alternating Current (AC) source function.

**b. Hardware/software designing:**

We follow a step-by-step procedure to set up all the interfaces required for our project and develop the code in python to list the stock of products in an organisation to the cloud. The following software is required:

* Python Idle (with specified packages installed)
* IBM cloud
* Node Red service

**4.Experimental Investigations:**

Early fire detection is best achieved by the implementation and maintenance of fire detection equipment in all rooms and areas of the house or building in accordance with the requirements and recommendations of the current edition of the National Fire Protection Association Standard 72, National Fire Alarm Code (NFPA 72), the manufacturer’s recommendations, State and local codes and the recommendations contained in Guide for the Proper Use of System Smoke Detectors, which is made available at no charge to all installing dealers. For specific requirements, check with the local Authority Having Jurisdiction (ex. Fire Chief) for fire protection systems.

The displayed data is stored in IBM cloudant and using node-red services,a node-red flow is created which retrives data from IBM cloudant.

**6.Flow Chart**

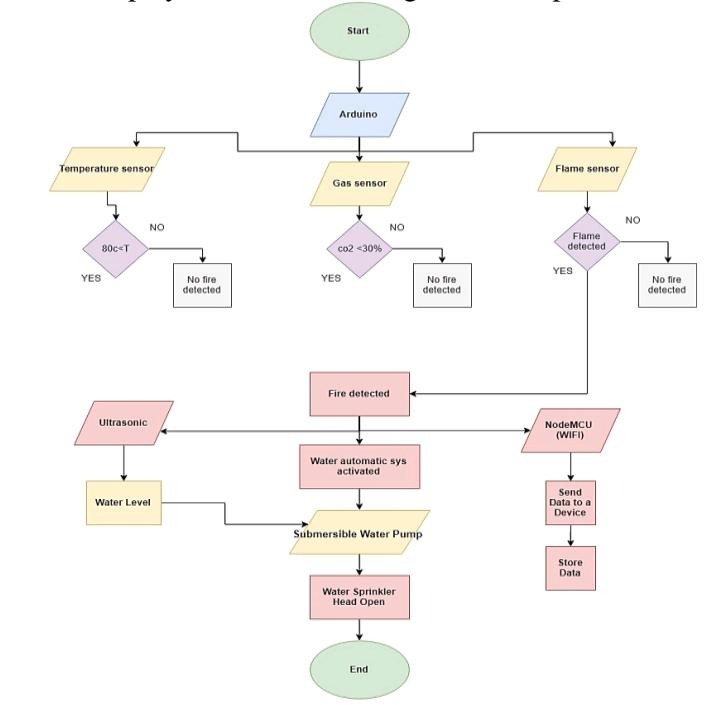
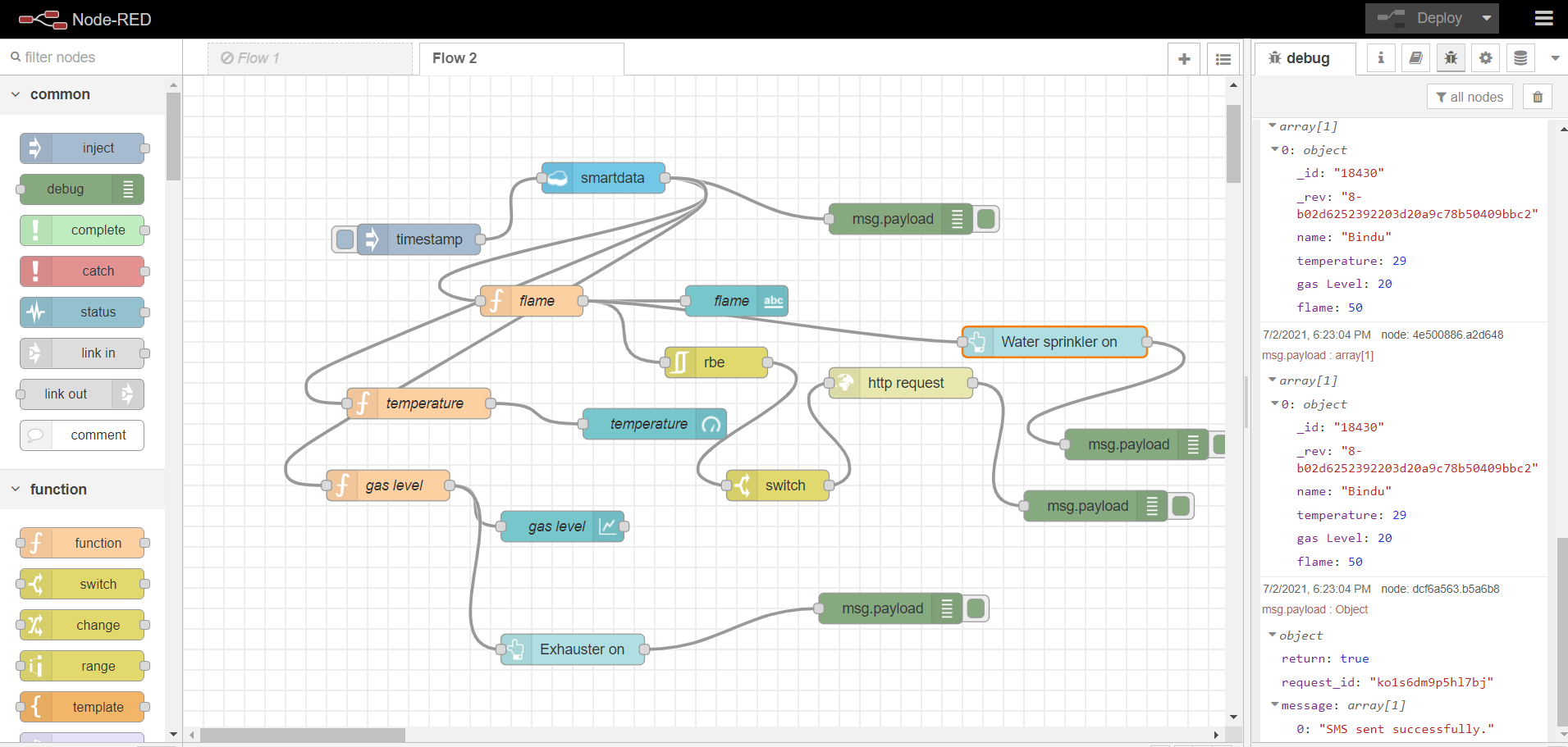
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Figure 2. Flowchart of the Proposed System

Figure 2 depicts the proposed fire detection system with an automatic water sprinkler. As described in the figure, the Arduino Mega controls the sensors to extract reading from the surroundings. Each indicator for these readings has a threshold to check the potentiality and criticality of fire. For example, the temperature exceeds 80C, CO2 exceeds 30%, and/or flames detection. Smoke and flame, indicators of fire criticality, represent the extra needed readings to see fire plus, if one sensor does not work, then back up reading is required. If the above thresholds are met, the water system would be activated to stop the danger. The 12V pump sucks water from the tank to pass into the sprinkler head through the pipe. An ultrasonic sensor reads the water level on the tank. The feedback is linked to IoT updates that control the water pump with other sensors that detected fire. Besides, LED and Buzzer are used in the system as visual evidence to show danger. NodeMCU stores data and display continuous reading on a smartphone.

**6.Result**



**Explanation:**

The result of our project fulfils our requirements. We have successfully

Executed the designed program and the results have been as expected. The proposed IOT based fire alarm system basically detects fire at an early stage, generates an automatic alarm and notify the remote user or fire control station about the fire outbreak .This prototype **s**ystem can help users to improve their safety standards with immediate response by preventing accidents.

**PYTHON SHELL OUTPUT:**

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**7.Advantages:**

* Smart Fire Systems saves lives by warning building occupants of emergencies so they can get out of danger.
* Early Fire Detection
* 24/7 Monitoring.
* Easy & Affordable

**Disadvantages:**

* The system is essentially useless if the batteries aren't charged
* Very sensitive, which can lead to false alarms as a product of cooking.
* Expensive
* Use of radioactive material is a concern

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**8.Applications:**

* **Used for  visual and audio signalization to warn people about a possible fire, smoke, or carbon monoxide occurrence in the area of coverage .**
* **Used To warn people when smoke, fire, carbon monoxide or other fire-related emergencies are detected.**
* **Used to activate people automatically from smoke detectors, and heat detectors or may also be activated via manual fire alarm activation devices such as manual call points or pull stations.**

**9.Conclusion:**

The fire detection systems proposed in the literature served fire stopping with no care of the responsiveness. Thus, this study considers the existing issues and build an efficient and effective fire detection system based on IoT technology, gas, temperature, and smoke sensors to collect the data accurately and rapidly. The continuous readings sent over WIFI modules to the central unit to analyze the data and trigger the water sprinkle. This system structure enhances the efficiency and effectiveness of fire detection. Moreover, using the Ubidots platform in this system made the data exchange faster and reliable. However, this study's proposed approach obtained an average response of 5 seconds to detect the fire and alert the property owner. Meanwhile, the water pump activated to suck water from the tank and release it into the water sprinkler to minimize the fire until the property owners and emergency services reached. Hence, the proposed system overcame the challenges of the issues of affordability, effectiveness, and responsiveness. The proposed system still needs further enhancements. Thus, one of the enhancement directions is integrating machine learning with the system to predict the potentiality of fire based on the collected data from different sources. Machine learning may help the operators find and overcome the vulnerabilities in their building to prevent fire instead of detection only

**10.Future Scope:**

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Fire detection technologies have been slow to evolve compared to rapidly advancing smart devices. Understandably, global companies focus their efforts on developing high-return products, especially ones that connect consumers with popular trends. While fire alarms aren’t exactly at the forefront of social advancement, innovative companies are developing new methods of approaching fire and gas-related threats.

**11.Bibliography:**

ttps://www.researchgate.net/publication/345062499\_A\_Smart\_Fire\_Detection\_System\_using\_IoT\_Technology\_With\_Automatic\_Water\_Sprinkler

ttps://ifpmag.mdmpublishing.com/iot-technologies-for-fire-safety-in-smart-buildings-and-cities/

**12.Appendix**

**a. Source code:**

from cloudant.client import Cloudant

from cloudant.error import CloudantException

from cloudant.result import Result

from cloudant.result import Result, ResultByKey

# IBM Cloudant Legacy authentication

client = Cloudant("apikey-v2-1g7tj4xulwlrroyh29chec014k4gviohl80g7himpt33", "3cff79c3fe501830264565beac3e3793",

url="https://apikey-v2-1g7tj4xulwlrroyh29chec014k4gviohl80g7himpt33:3cff79c3fe501830264565beac3e3793@0bcba821-607c-40f9-9c92-262a84f9742e-bluemix.cloudantnosqldb.appdomain.cloud")

client.connect()

database\_name = "smartdata"

my\_database = client.create\_database(database\_name)

if my\_database.exists():

print(f"'{database\_name}' successfully created.")

json\_document = {

"\_id": "18430",

"name":"Bindu"

}

new\_document = my\_database.create\_document(json\_document)

if new\_document.exists():

print("Document '{new\_document}' successfully created.")

result\_collection = Result(my\_database.all\_docs, include\_docs=True)

# Get the result for matching a key

result = result\_collection['18430'] #search by id, if id=1001

print("---------------")

print("the data with id =18430 is")

print (result)

print("---------------")

# Iterate over the result collection

for result in result\_collection:

print(result)# it will print all the records

# First retrieve the document

for document in my\_database:

my\_document = my\_database['18430']

# Update the document content

# This can be done as you would any other dictionary

my\_document['temperature'] = 29

my\_document['gas Level'] = 20

my\_document['flame'] = 50

# You must save the document in order to update it on the database

my\_document.save()

result\_collection = Result(my\_database.all\_docs, include\_docs=True)

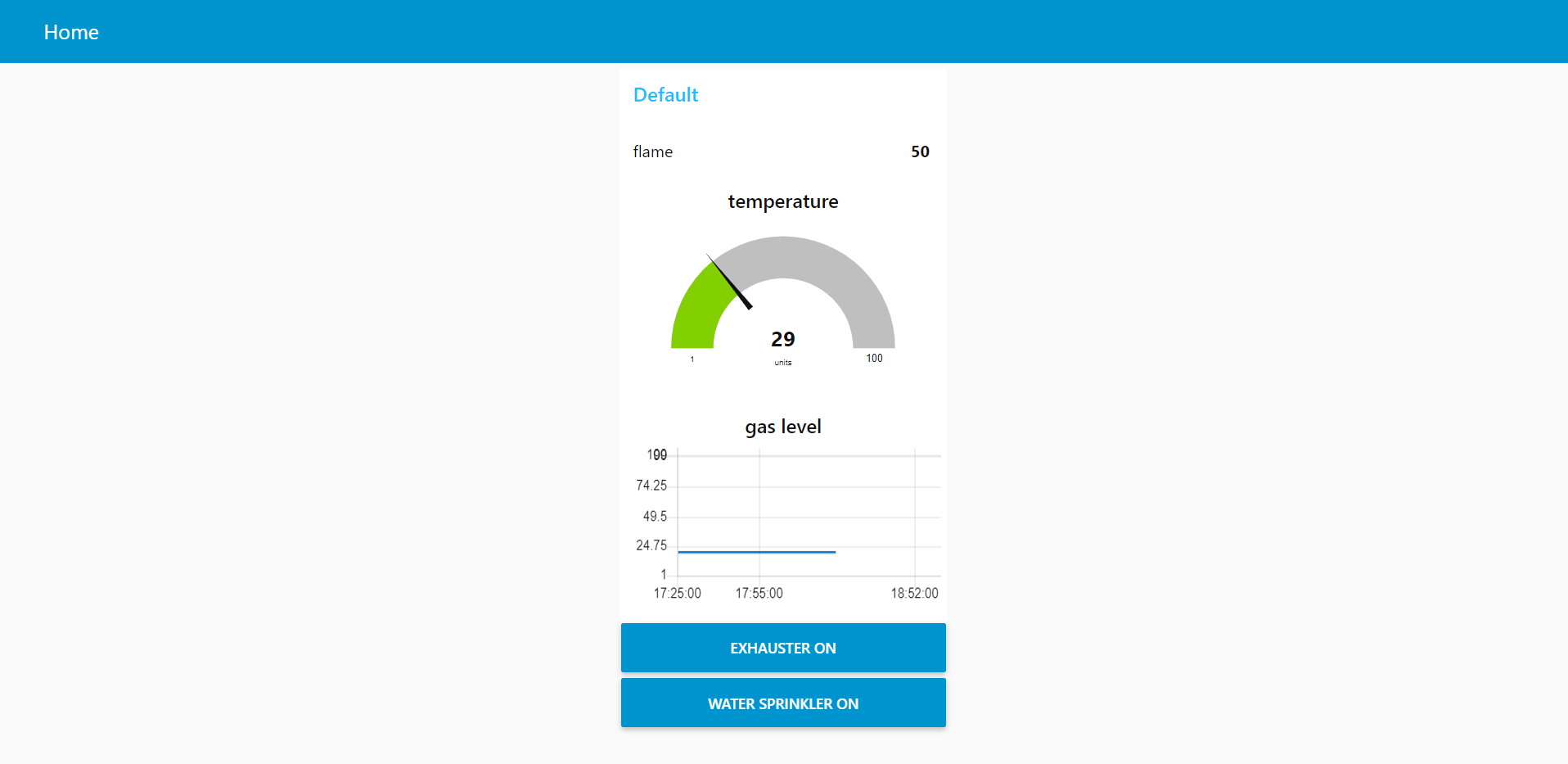
# Get the result for matching a key

result = result\_collection['18430']

# Iterate over the result collection

print (result)

**b.UI output:**

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