A Technical Report

On

Node-RED

Submitted in partial fulfillment of the

Requirements for the award of degree of

Bachelor of Technology

in

Computer Science and Engineering

by

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<u>CERTIFICATE</u>

This is to certify that the Technical Report entitled **"Node-RED"** being submitted by **GAJAM NIKHIL** bearing the Hall Ticket number **19H61A05D5** in partial fulfillment of the requirements for the award of the degree of the **Bachelor of Technology** in **Computer Science and Engineering** to **Anurag Group of Institutions (Formerly CVSR College of Engineering)** is a record of bonafide work carried out by her under my guidance and supervision from _____to _____.

Mr. G.Balram   **Dr.G.VishnuMurthy,**
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ACKNOWLEDGEMENT

<u>DECLARATION</u>

I hereby declare that the Technical Report entitled "**Node-RED**" submitted to **Anurag Group of Institutions (Formerly CVSR College of Engineering)** in partial fulfillment of the requirements for the award of the degree of **Bachelor of Technology (B.Tech)** in Computer Science and Engineering is a record of an original work done by me under the guidance of **Mr.G.Balram, Asst. Professor, Dept. of CSE** and this report has not been submitted to any other university for the award of any other degree or diploma.

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ABSTRACT

Node-RED is an open-source visual programming tool that provides a browser-based interface for wiring together hardware devices, APIs, and online services in new and interesting ways. It is designed for people who are not necessarily experts in software programming and provides an easy-to-use drag-and-drop interface for building complex applications. Node-RED uses a visual flow-based programming model, which makes it simple to wire together flows using nodes that represent inputs, outputs, functions, and more. The flows can be deployed to a runtime environment, where they can be executed and interact with other systems.

Node-RED provides a large library of pre-built nodes for common IoT devices and services, such as IoT platforms, communication protocols, and web services. This makes it easy to integrate and control a wide range of devices and services, without the need for complex coding. Node-RED also supports custom nodes, allowing developers to extend the platform and add new capabilities.

Overall, Node-RED is a flexible and powerful tool that can be used for a wide range of applications, from simple automation tasks to complex data processing and control systems.

CONTENTS

1. INTRODUCTION

Node-RED is a visual programming tool for connecting devices, APIs, and online services. It is an open-source tool that runs on Node.js, a popular JavaScript runtime environment. Node-RED provides a browser-based interface for building applications and automating tasks, making it accessible to people with little or no programming experience.

The main concept behind Node-RED is flow-based programming, which allows you to build applications by connecting nodes together. Each node represents a specific function, such as reading data from a device, processing data, or sending data to a web service. To build an application, you simply drag and drop nodes onto a canvas, wire them together, and deploy the flow.

Node-RED provides a vast library of pre-built nodes for popular IoT devices, communication protocols, and web services, making it easy to integrate these systems into your applications. You can also create custom nodes to add new capabilities to Node-RED.

Node-RED is highly flexible and can be used for a wide range of applications, from home automation to complex data processing and control systems. It supports multiple platforms, including Raspberry Pi, IBM Cloud, and Amazon Web Services, making it accessible to a large community of users.

In summary, Node-RED is a powerful and easy-to-use visual programming tool that makes it simple to build applications that connect devices, APIs, and online services.

2. LITERATURE SURVEY

[1] "Toward a Distributed Data Flow Platform for the Web of Things (Distributed NodeRED)" by Blackstock M. and Lea. This paper of Node-RED reveals that it has been used in a variety of applications, such as home automation, smart grid management, industrial control systems, and Internet of Things (IoT) applications. The tool's user-friendly interface and the ability to easily connect and integrate various devices and services have been cited as key factors contributing to its popularity.

[2] "Green Industrial internet of things architecture : an energy-efficient perspective using NodeRED" by Kun Wang, Yihui Wang, Yanfei Sun, Song Guo, Jinsong Wu. This paper have shown that Node-RED can simplify the development of IoT applications, making it easier for non-expert users to create complex systems. It has been used to create prototype IoT systems, as well as to deploy full-scale production systems. And it presents a simple IoT application that transmits data collected by temperature and humidity sensors connected to a Raspberry Pi via a Node-RED interface to an IBM Bluemix Cloud and then the collected data can be accessed by the user via a simple mobile phone. The purpose of the writer is to show how easy it is to integrate IoT sensors on the Node-RED platform.

[3] "IoT based home automation using node-red." by Kodali, Ravi Kishore, and Arshiya Anjum. This paper explains about the home automation using the NodeRed. Node-RED has also been evaluated in terms of its performance, scalability, and security. Research has shown that it provides good performance and scalability, and can handle a large number of connected devices and services. Its user-friendly interface, ability to easily connect and integrate various devices and services, and good performance and scalability have made it a popular choice for IoT applications. However, security remains an important concern and should be taken into consideration when using Node-RED. A literature survey of Node-RED reveals that it is a powerful and versatile tool for building and deploying applications and automating tasks in a variety of domains. Its user-friendly interface, ability to easily connect and integrate various devices and services, and good performance and scalability have made

it a popular choice for IoT applications. However, security remains an important concern and should be taken into consideration when using Node-RED.

[4] "Industrial Communication based on Modbus and Node-RED." by Tabaa, Mohamed. This paper explains about Industrial communication based on Modbus and Node-RED is a system that allows for the exchange of data between industrial devices and systems using the Modbus protocol and the Node-RED platform.

Modbus is a widely used industrial communication protocol that is used to connect devices and systems in a variety of industries, including manufacturing, energy, and building automation. Modbus provides a simple and efficient way to exchange data between devices, allowing them to communicate and exchange information.

Node-RED is a visual programming tool that allows users to build and deploy applications and automations by connecting nodes representing devices, services, and functions. Node-RED provides a simple and intuitive way to build applications, making it accessible to users with a wide range of technical backgrounds.

When combined, Modbus and Node-RED provide a powerful and flexible system for industrial communication. The Modbus protocol provides the low-level communication functionality, while Node-RED provides the visual interface for building and deploying applications and automations. This system allows for the integration of a wide range of industrial devices and systems, making it possible to collect, process, and analyze data from these devices, and control them from a single platform.

3. METHODOLOGY

The methodology for using Node-RED typically consists of the following steps:

1. Installing Node-RED: Node-RED can be installed on a variety of platforms, including Raspberry Pi, IBM Cloud, and Amazon Web Services. It can be installed using a command-line interface or a browser-based interface, and installation instructions are available on the Node-RED website.

2. Creating Flows: After installation, you can start creating flows in Node-RED. Flows are created using a visual interface that allows you to drag and drop nodes onto a canvas, wire them together, and define their properties. You can use pre-built nodes from the Node-RED library or create custom nodes to add new functionality to your flows.

3. Connecting Devices and Services: Node-RED makes it easy to connect to various devices and services, including IoT devices, APIs, and web services. To connect to a device or service, you can use a pre-built node from the Node-RED library or create a custom node.

4. Debugging and Testing: Once you have created your flow, you can debug and test it to ensure that it works as expected. Node-RED provides a range of debugging and testing tools, including a debug panel, message inspector, and flow context inspector.

5. Deploying Flows: After you have tested your flow, you can deploy it to a runtime environment. Node-RED supports deployment to a variety of platforms, including Raspberry Pi, IBM Cloud, and Amazon Web Services.

In summary, the methodology for using Node-RED involves installing the tool, creating flows, connecting devices and services, debugging and testing your flows, and finally deploying them to a runtime environment. This methodology provides a straightforward and intuitive way to build and deploy applications and automating tasks using Node-RED.
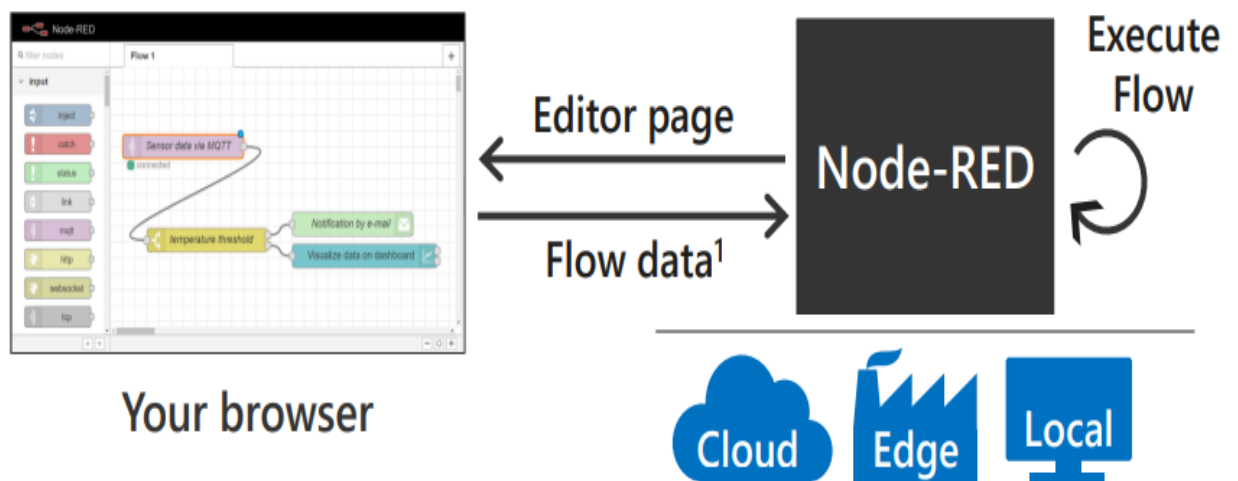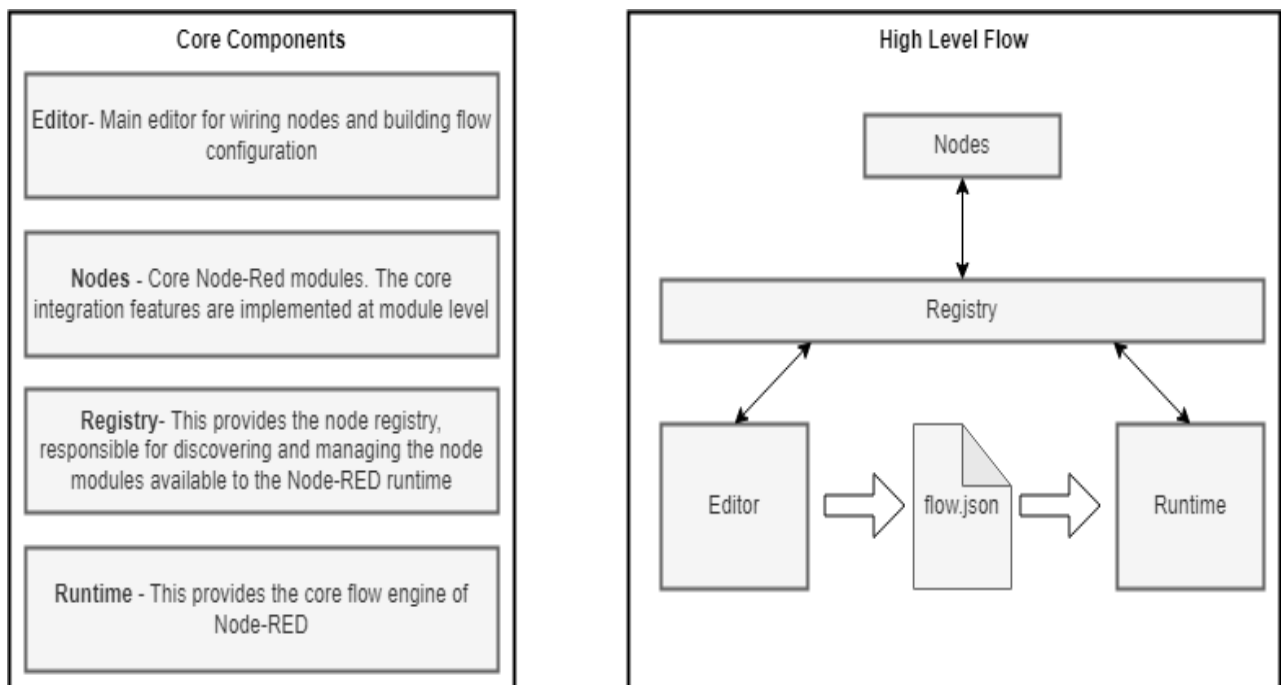
Fig 1: Node-RED Methodolgy

Fig 2: Node-RED Architecture

3.1 EXISTING SYSTEM

Before Node-RED, building applications and automating tasks typically involved writing code in a text-based programming language, such as Python or JavaScript. This was a complex and time-consuming process that often required a high level of programming expertise.

Existing systems for building applications and automating tasks were also limited in their ability to easily connect and integrate devices and services, which often involved writing complex code to interact with different APIs and protocols. This made it difficult to create and deploy applications that integrated multiple devices and services. In contrast, Node-RED provides a visual interface for building applications, which makes it easier for non-expert users to create and deploy complex systems. The tool's drag-and-drop interface allows users to easily connect and integrate various devices and services, eliminating the need for complex coding. Additionally, Node-RED provides a large library of pre-built nodes for popular IoT devices and services, which makes it easy to integrate and control a wide range of devices and services without the need for complex coding. This makes it a more accessible and user-friendly tool compared to traditional text-based programming environments. Overall, Node-RED represents a significant improvement over existing systems for building applications and automating tasks. It provides a visual interface that makes it easy to create and deploy complex systems, and it provides a large library of pre-built nodes for popular IoT devices and services.

3.2 DRAWBACKS OF EXISTING SYSTEM

Although Node-RED provides several benefits over traditional text-based programming environments for building applications and automating tasks, there are also some drawbacks to consider.

1. **Limited Customization:** Node-RED is designed to be user-friendly, which can limit the level of customization that is possible. For example, you may need to write custom code to extend the functionality of Node-RED or to implement complex logic that is not possible using the visual interface.
2. **Performance Limitations:** While Node-RED is designed to be fast and efficient, it may not be suitable for large-scale or resource-intensive applications. The performance of Node-RED depends on the hardware it is running on and the complexity of the flows you are building.
3. **Security Concerns:** Node-RED is a flexible tool that provides easy access to a variety of devices and services, which can present security risks. For example, if you are connecting to an IoT device, you need to ensure that it is secure and that it will not compromise the security of your Node-RED system.
4. **Learning Curve:** Although Node-RED is designed to be user-friendly, there is still a learning curve involved in using the tool. Users need to familiarize themselves with the visual interface and the various nodes available in the Node-RED library.

In conclusion, while Node-RED provides several benefits over traditional text-based programming environments for building applications and automating tasks, it is important to be aware of its limitations. The tool is not suitable for all applications and may have performance limitations, security concerns, and a learning curve for users. It is important to carefully consider these limitations when evaluating Node-RED for your specific use case.

3.3 PROPOSED SYSTEM

The proposed system for using Node-RED is to use it as a tool for building applications and automating tasks in a visual, user-friendly manner. The key features of this proposed system include:

1. **Visual Interface:** Node-RED provides a visual interface for building applications, which makes it easy for users to create and deploy complex systems without the need for complex coding. The drag-and-drop interface allows users to easily connect and integrate various devices and services.
2. **Large Library of Pre-Built Nodes:** Node-RED provides a large library of pre-built nodes for popular IoT devices and services, which makes it easy to integrate and control a wide range of devices and services without the need for complex coding.
3. **Cross-Platform Compatibility:** Node-RED supports deployment to a variety of platforms, including Raspberry Pi, IBM Cloud, and Amazon Web Services, which makes it easy to deploy applications on a range of platforms.
4. **Debugging and Testing Tools:** Node-RED provides a range of debugging and testing tools, including a debug panel, message inspector, and flow context inspector, which makes it easy to test and debug applications.

The proposed system for using Node-RED is designed to provide a visual, user-friendly way to build and deploy applications and automate tasks. By using the visual interface, the large library of pre-built nodes, and the debugging and testing tools, users can create and deploy complex systems with ease. The proposed system is designed to be flexible, scalable, and accessible to users with a wide range of skill levels.

4. APPLICATIONS

Node-RED can be used for a wide range of applications, including:

1. **Internet of Things (IoT) Applications:** Node-RED can be used to control and automate IoT devices and services, such as smart home devices, sensors, and actuators. Node-RED provides a visual interface for building IoT applications, which makes it easier for users to connect and control devices and services.

2. **Home Automation:** Node-RED can be used to automate tasks and control devices in a smart home environment, such as turning on lights, adjusting the thermostat, and controlling smart appliances.

3. **Robotics:** Node-RED can be used to control and automate robotic devices, such as robots, drones, and other connected devices.

4. **Business Process Automation:** Node-RED can be used to automate business processes, such as data collection, data analysis, and reporting.

5. **Chatbots:** Node-RED can be used to build chatbots that can interact with users, process requests, and provide information and services.

6. **Environmental Monitoring:** Node-RED can be used to monitor and control environmental systems, such as temperature, humidity, and air quality.

7. **Healthcare:** Node-RED can be used to monitor and control medical devices, such as glucose monitors, blood pressure monitors, and heart rate monitors.

8. **Automated Reporting:** Node-RED can be used to automate the process of collecting, analyzing, and reporting data from multiple sources.

Node-RED is a versatile tool that can be used for a wide range of applications, from simple automation tasks to complex IoT applications and business processes. Its visual interface, large library of pre-built nodes, and debugging and testing tools make it a powerful tool for building and deploying applications and automating tasks.

5. CONCLUSION

Node-RED is a powerful and versatile tool for building and deploying applications and automating tasks. With its visual interface, library of pre-built nodes, and debugging and testing tools, Node-RED provides a simple and intuitive way to connect and control devices and services.

Node-RED is widely used in a range of applications, including IoT, home automation, robotics, business process automation, chatbots, environmental monitoring, healthcare, and automated reporting. Its popularity is a testament to its ability to simplify the process of building and deploying applications, making it accessible to users with a wide range of technical backgrounds.

The future of Node-RED is promising, with potential for further enhancements in areas such as user experience, security, performance, and integration with other tools. By continuing to evolve and improve, Node-RED has the potential to become an even more powerful tool for building and deploying applications and automating tasks.

Overall, Node-RED is a valuable tool for anyone looking to build and deploy applications and automate tasks, and it has the potential to continue to grow and improve in the future.

6. FUTURE ENHANCEMENT

There are several potential areas for future enhancements in Node-RED, including:

1. **Improved User Experience:** The visual interface of Node-RED can be improved to make it even more user-friendly, with a focus on making it easier to build, deploy, and debug applications.

2. **Enhanced Security:** The security of Node-RED can be improved to ensure that applications built with the tool are secure and that sensitive data is protected. This could include improvements in the authentication and authorization systems, encryption of data in transit, and secure storage of data at rest.

3. **Increased Performance:** The performance of Node-RED can be improved to ensure that it can handle large-scale and resource-intensive applications. This could include improvements in the underlying architecture and algorithms, as well as optimization of the Node-RED nodes.

4. **Expansion of Library of Pre-Built Nodes:** The library of pre-built nodes for Node-RED can be expanded to include more devices and services, making it easier for users to connect and integrate a wider range of devices and services.

5. **Integration with Other Tools:** Node-RED can be integrated with other tools, such as cloud services and AI algorithms, to provide enhanced functionality and capabilities.

6. **Increased Platform Support:** Node-RED can be made available on a wider range of platforms, including mobile devices, to make it more accessible and usable for a wider range of users.

These are some of the potential areas for future enhancements in Node-RED. By continuing to improve the user experience, enhance security, increase performance, and expand the library of pre-built nodes, Node-RED can continue to provide a powerful and flexible tool for building applications and automating tasks.

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