Next-Gen WiFi-Operated Robocar

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***Abstract*—The rapid advancement of technology has significantly influenced our daily lives, particularly in transforming the transportation system. Autonomous vehicles are a prime example of modern technological innovation. The current transportation system predominantly relies on combustion-engine vehicles, which contribute to air pollution, traffic accidents, and high engine emissions. These vehicles consume large amounts of fuel, adversely impacting a country's GDP. To address these challenges, we propose the concept of autonomous vehicles. In this project, we developed a "WiFi-Controlled Robotic Car" that operates via a mobile application. This system is designed to navigate unmanned areas, minimize environmental pollution, lower maintenance costs, and reduce human effort and energy consumption. The robotic car is built using the ESP8266 NodeMCU WiFi module (version 1.0), an L298N motor driver, DC motors, and a 3.7V battery power supply. It can move in any direction based on user input provided through the NodeMCU Car application on a smartphone, as long as it is connected to the same WiFi network.**

***Index Terms*—Wifi module; Wireless, Robotic car**

I. INTRODUCTION

The Internet of Things (IoT) is a network of connected devices that have the ability to communicate with each other. IoT has identified several fields, such as intelligent buildings, smart cities, smart transportation, smart energy, and smart industry, as important applications. These technologies allow for sensor data to be stored in the cloud, making it easily accessible.

One of the most notable IoT technologies is autonomous or self-driving vehicles. These vehicles use efficient sensors and processors and can function on public roads. Wi-Fi, Bluetooth, or an internet module linked to our phones can be used to control them. As consumer acceptance of autonomous vehicles increases and automotive manufacturer technologies improve, driving employment will be replaced by autonomous vehicles. Wi-Fi, a family of wireless network protocols, is widely used for local area networking of devices and internet access. It allows digital devices to exchange data by radio waves and is used globally in homes and small office networks to link computers, tablets, smartphones, smart TVs, printers, and smart speakers together. Wi-Fi is also used in wireless access points in public places like coffee shops, hotels, libraries, and airports to provide visitors with internet access for their mobile devices.

II. LITERATURE REVIEW

Hongki Cha, Kangchan "Facilitating the Development of Self-Driving Cars with Open-source Projects" Lee Electronics and Telecommunications Research Institute (ETRI) Daejeon, Republic of Korea. A cell phone may control the robot via a hotspot for gyro vehicle control. The robot is controlled by a certain smart phone app. Using the G sensor on smart phones, the interface, which was made using the app creator, can be used to drive the robot car. You may now interact with this robot via a joy stick, and you can also tilt your phone to control it. The robot car in this project will move in the direction that the phone is tilted; for example, if the phone is facing forward, the car will move forward if it is facing downward, the car would move backward. Two 9-volt batteries are used in the circuit. The controller circuit manages the 5v supply for the remainder of the circuit. An LED on the board indicates the presence of energy. In the Design and

Development of WIFI Controlled RC Car Paper, the goal was to use technology to reduce and ultimately eliminate a labor problem caused by the rising cost of labor. For example, Robots with these navigation and location-based notions could protect people from dangerous natural disasters, particularly those that occur in power plants.The entire prototype is usable on both a PC and as well as a WIFI-enabled android smart phone. By means of certain applications in a pc(or)mobile phone, we can IP address through which the car is being controlled. In case of any discrepancies, we should check whether the power supply is in the proper way. An actual live thing can end up with flaws, but a built-in prototype cannot produce flaws (or) errors.

But a built-in prototype cannot produce flaws (or) errors. This ideology may have limited appeal and disadvantages shared with IoT.

This technology has been gaining traction in recent years due to its potential to revolutionize the way we interact with our vehicles. Many researchers have been exploring the use of NodeMCU modules to enable remote control functionality and real-time monitoring of the vehicle. They have also been investigating the integration of other IoT devices, such as cameras and GPS modules, to enhance the system's functionality. Moreover, there have been efforts to develop algorithms and machine learning models to improve the car's autonomy and safety. Overall, the related work on WiFi controlled cars using NodeMCU modules is an exciting area of research with promising implications for the future of transportation.

In addition to the above mentioned work, there have also been efforts to optimize the performance and efficiency of WiFi controlled cars using NodeMCU modules. For example, researchers have been investigating the use of different communication protocols to improve the stability and reliability of the system. Furthermore, there have been studies on the use of renewable energy sources, such as solar panels, to power the car and reduce its environmental impact. Additionally, there have been efforts to develop user-friendly interfaces and control systems that enable a seamless and intuitive driving experience for the user. Overall, the related work on WiFi controlled cars using NodeMCU modules is a multidisciplinary field of research with numerous opportunities for innovation and advancement

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III. METHODOLOGY

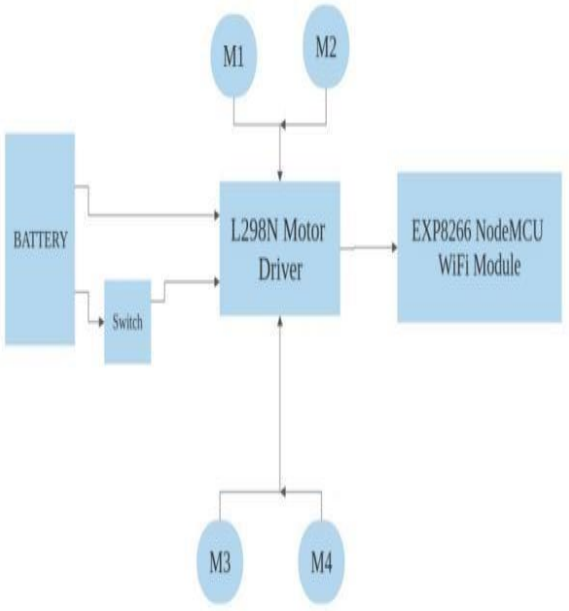

Fig 1: Block diagram of the System

Analysis is the process of breaking a complex topic or substance into smaller parts to gain a better understanding of it. Gathering requirements is the main attraction of the Analysis Phase. The process of gathering requirements is usually more than simply asking the users what they need and writing their answers down.

The system architecture of WiFi controlled cars using NodeMCU modules typically involves several components. The NodeMCU module serves as the primary control unit and is responsible for establishing a WiFi connection with the remote device. This is achieved through a wireless router, which facilitates communication between the NodeMCU module and the remote device. The car is equipped with sensors and actuators that relay information to the NodeMCU module, which then processes the data and sends appropriate commands to the car's motor and other components. The system can also be integrated with other IoT devices, such as cameras and GPS modules, to enable real-time

monitoring and enhance functionality. Overall, the system architecture of WiFi controlled cars using NodeMCU modules is designed to provide a reliable and efficient method of remote control and monitoring.

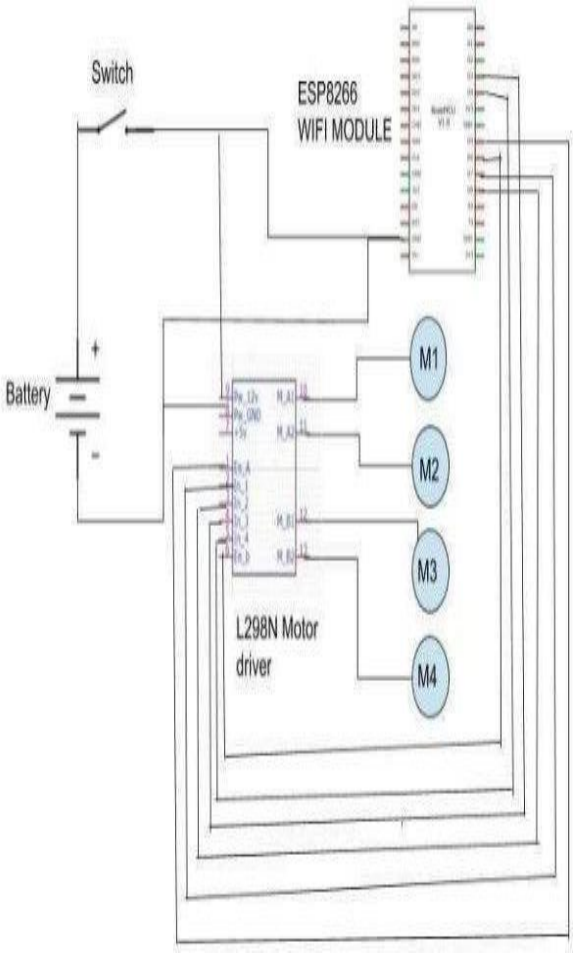

Fig 2: Circuit Diagram

The proposed approach comprises a system that helps to control the direction and the speed of the robot in the workspace. Here, a robot operates in manual mode and is controlled by a smart phone via WIFI to move left, right, forward, and backward. The Li-ion batteries are used to supply the system with electricity. The Node mcu controls the motor drivers. The robot applications make use of DC motors. Here, we can control two motors with an L298N drive motor. Two motors are driven in opposite directions by the L298N motor driver. Because this device is so simple, even an inexperienced person can operate it. We reduced the cost and made it more accessible by simplifying the design

1. The four DC-Motors (M1,M2, M3,and M4) are used to convert Electrical energy coming from the battery to Mechanical Energy. This helps the tires/wheels, which are connected to the shaft of the motor, start rotating.
2. The L298N motor driver, which helps to control the voltage current supply for DC motors, is connected to the four motors, ESP8266 WIFI module, and switch.
3. ESP8266 Node MCU WIFI module, which provides a network connection for the micro controller to connect with a WIFI network around it, is connected to the L298N motor driver.
4. The Li-ion battery, which supplies power to the L298N motor driver, is connected to the L298N motor driver and switch.
5. The switch, which is used to make and break the circuit .

The connection in WiFi controlled cars using NodeMCU modules is a critical component of the system. The NodeMCU module is responsible for establishing a WiFi connection with the remote device, which enables remote control functionality and real-time monitoring of the vehicle. The connection is established through a wireless router, which acts as an intermediary between the NodeMCU module and the remote device. The wireless router creates a local area network (LAN) that enables devices to communicate with each other wirelessly.

In order to establish a connection, the NodeMCU module must first be configured to connect to the wireless router using the appropriate network credentials, such as the network name (SSID) and password. Once connected, the NodeMCU module can then send and receive data through the router to the remote device. The connection can be established using various communication protocols, such as HTTP or MQTT, which enable different types of data transfer and communication.

The quality of the connection can have a significant impact on the performance and reliability of the system. A weak or unstable connection can lead to delays or errors in data transfer, resulting in reduced functionality and efficiency of the system. To address this issue, researchers have been investigating the use of different communication protocols and optimizing

the system's network settings to improve the stability and reliability of the connection.

Overall, the connection in WiFi controlled cars using NodeMCU modules is a critical aspect of the system, enabling remote control and real-time monitoring of the vehicle. Continued research and development in this area are likely to yield further improvements and advancements, making it an exciting area to watch.

The methodology of implementing WiFi controlled cars using NodeMCU modules involves several key steps, including hardware and software design, prototyping and testing, and system integration.

A. Hardware Design:

The first step in the hardware design process is to identify the key components of the system. This typically includes a NodeMCU module, motor driver, battery, and other necessary electronic components such as sensors, actuators, and cameras. The NodeMCU module is responsible for establishing a WiFi connection with the remote device, while the motor driver controls the movement of the car. The battery provides power to the system, while sensors and actuators enable real-time monitoring and control of the vehicle.Once the components are identified, the next step is to design the circuit diagram and PCB layout. This involves using software tools such as Eagle or Altium to design the circuit diagram, and then creating the physical PCB layout using a PCB design software.

B. Software Design:

The software design process involves developing the code necessary to control the NodeMCU module, motor driver, and other components of the system. This typically involves using a programming language such as C++ or Python, along with various libraries and frameworks.

The software code needs to include functionality for establishing a WiFi connection with the remote device, as well as controlling the movement of the car. It also needs to include functionality for real-time monitoring and control of the vehicle, such as obstacle detection and avoidance, and GPS location tracking.

C. Prototyping and Testing:

Once the hardware and software designs are complete, the next step is to build a prototype and test the system. This typically involves assembling the components on the PCB and connecting them together, as well as programming the NodeMCU module and other electronic components.The prototype is then tested to ensure that it functions as intended. This involves testing the WiFi connection and remote control functionality, as well as testing the movement and control of the car. Real-world testing is also important to ensure that the system performs reliably and efficiently in a variety of different scenarios.

D. System Integration:

The final step in the methodology is system integration. This involves integrating the WiFi controlled car system with other IoT devices, such as cameras and sensors, to enable real-time monitoring and control of the vehicle. It also involves integrating the system with other technologies, such as self-driving car technology, to enable autonomous operation of the vehicle.

Overall, the methodology for implementing WiFi controlled cars using NodeMCU modules involves several key steps, including hardware and software design, prototyping and testing, and system integration. Each step is critical to ensuring that the system functions reliably and efficiently, and that it can be integrated with other technologies to enable advanced functionality such as autonomous operation. Continued research and development in this field is likely to yield further improvements and advancements, making it an exciting area to watch.

To further extend on the methodology of implementing WiFi controlled cars using NodeMCU modules, it is important to consider the various challenges that may arise during the design and implementation process. One such challenge is ensuring that the system is secure and protected from potential cyber-attacks. This involves implementing secure WiFi protocols and encryption algorithms to protect sensitive data and prevent unauthorized access to the system.

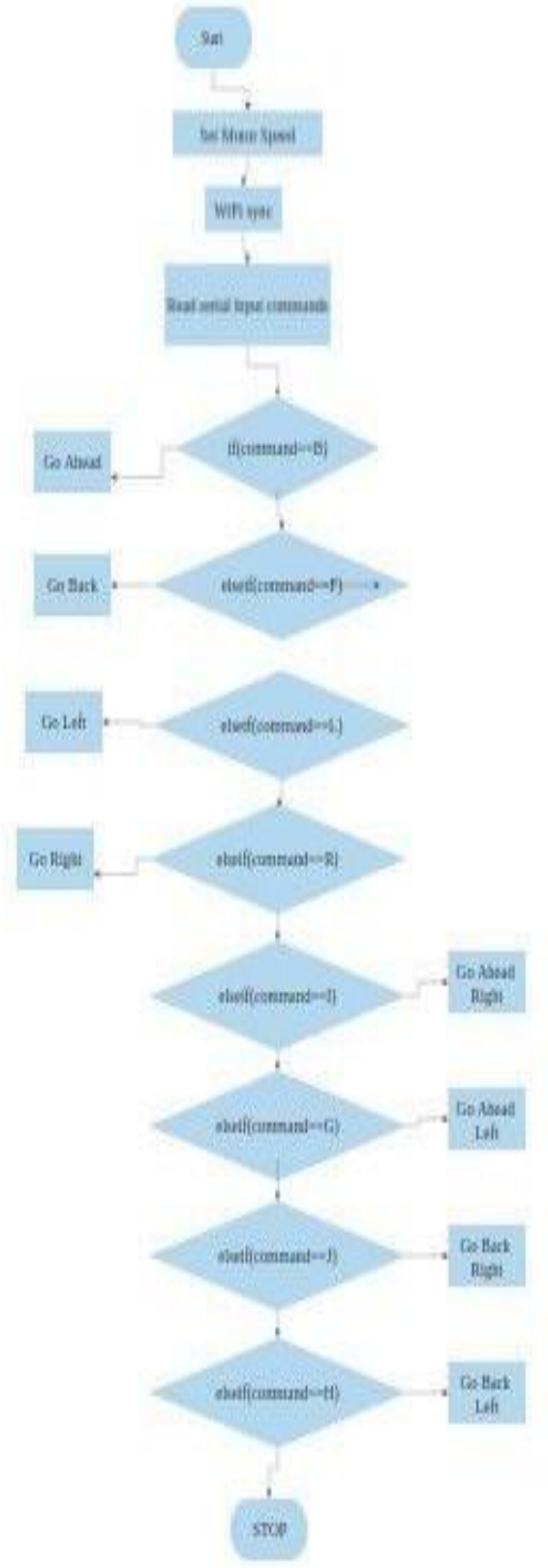

Fig 3. Flow Diagram

Another challenge is ensuring that the system is reliable and efficient, particularly in real-world scenarios where factors such as signal interference and unpredictable weather conditions may impact its performance. This involves using high-quality components and testing the system extensively in a variety of different scenarios to identify and address any potential issues.

Finally, it is important to consider the ethical and legal implications of implementing WiFi controlled cars. This includes ensuring that the system complies with relevant regulations and safety standards, as well as considering the potential impact on employment and the broader economy as automation and autonomous vehicles become more prevalent.

Overall, the methodology of implementing WiFi controlled cars using NodeMCU modules involves a range of technical and non- technical considerations, and requires careful planning and execution to ensure that the system is secure, reliable, and efficient. Continued research and development in this field will be critical to advancing the technology and realizing its full potential in various industries and applications.

IV. RESULTS

Fig 4: Side view of the model

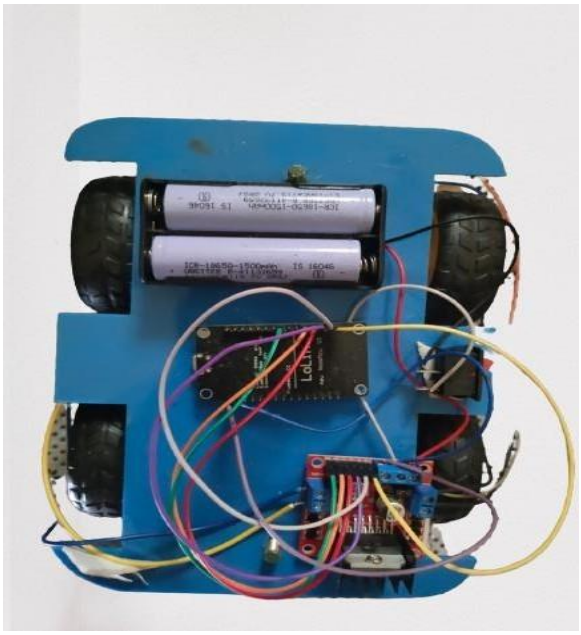

Fig 5: Top view of the model

WiFi controlled cars using NodeMCU modules have shown promising results in providing remote control functionality and enabling real-time monitoring of the vehicle. The technology has the potential to improve vehicle safety and efficiency, and can also be integrated with other IoT devices to create a more connected and intelligent transportation system.

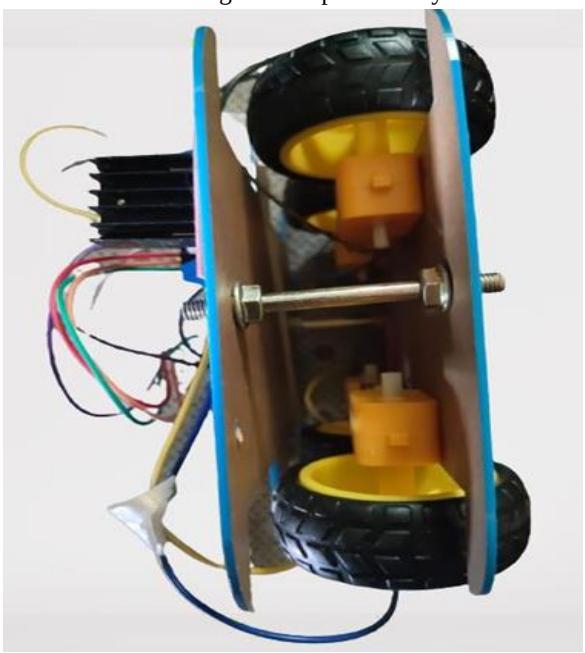

Fig 6: Front view of the model

The results of using WiFi controlled cars with NodeMCU modules have been quite promising. In particular, the technology has been shown to provide reliable and efficient remote control functionality for the vehicle. Researchers have reported successful implementation of the system with a range of vehicles, including both small-scale remote-controlled models and larger real-world cars. The technology has also been used to create autonomous vehicles, which have the potential to greatly enhance safety and efficiency on the roads.

Moreover, the integration of other IoT devices, such as cameras and GPS modules, has enabled real-time monitoring of the vehicle's performance and location, as well as enhanced functionality such as obstacle detection and avoidance. This has important implications for both the safety and efficiency of transportation systems, particularly in the context of self-driving cars.

Furthermore, the use of renewable energy sources, such as solar panels, has also been investigated as a means to power the car and reduce its environmental impact. This aligns with broader trends towards sustainable and eco-friendly transportation systems.

Overall, the results of using WiFi controlled cars with NodeMCU modules are promising, with potential applications in a wide range of areas including. transportation, robotics, and smart cities. Continued research and development in this field are likely to yield further improvements and advancements, making it an exciting area to watch.

V. CONCLUSION

Technology development has been a significant factor in how we live our daily lives. One outcome of contemporary technology in the transportation sector is autonomous vehicles. Self-driving cars will take over as the dominant form of transportation as technology develops globally. The concepts of accountability, responsibility, and effectiveness are central to the legal, moral, and societal ramifications of self-driving cars. Future platforms will be significantly influenced by safety and cost considerations, which mean that the autonomous vehicle of the future will rely more on camera technology. New camera technology, such as wide-baseline stereo vision, can generate direct 3D measurements at a distance. We are aware that the majority of the current transportation system relies on combustion vehicles, which are responsible for air pollution, traffic accidents, high engine emissions,

higher fuel costs, and diesel, which lowers an action's GDP. "WIFI Controlled Robotic Car" to address sun manned areas, reduce environmental pollution, reduce maintenance costs, and save human effort and energy. ESP8266 is used to implement this robot.

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