ANDRIOD CONTROL MOBILE ROBOT VEHICLE via Wi-Fi with NodeMCU

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Abstract: Robots are essential on the modern society. Their application is far reaching and can encompass a variety of different machines. Nowadays robots are everywhere as a step ahead we entered into the custom robotics. This paper gives a broad idea about designing a remotely mobile phone controlled four-wheel mobile robotic vehicle control over a Wi-Fi network by using NodeMCU. Android apk is developed by MIT inverter. A robot is a machine which is designed to perform one or more tasks simultaneously and frequently with speed and precision. It is a virtual artificial mediator, usually an electro-mechanical machine that is directed by a computer or controller program to perform tasks based on electronic circuitry and functionality. Robots have replaced humans in performing repetitive and dangerous tasks which humans do not prefer to do because of size limitations. Mobile Robot Vehicles are designed to do the operations in extreme environments such as outer space, the bottom of the sea etc., the prototype model is a four-wheel mobile robot vehicle it's connected with motors.

Keywords: Robot, Wi-Fi, NodeMCU, Vehicle

1. INTRODUCTION

Wi-Fi technologies are supported by nearly every modern personal computer operating system, most advanced game consoles and laptops, and many printers and other peripherals. Wi-Fi technology expanded to next level because Wi-Fi connection not only use to surf internet but also Wi-Fi connection can be used to control home appliances such as television, stereo, room lighting, alarm and many more appliances wirelessly. The devices are completely autonomous, do not emit noise at work and have extensive features that make the surveillance as convenient as possible even for sucking users. The small sizes that the digital recorder has allow it not only to install in any room, but even if necessary – in the car. Hence it is possible to control a robot using a Wi-Fi connection. Autonomous robot can control over Wi-Fi. On the robot, a module that can connect the Wi-Fi connection is called NodeMCU. It can interface with electronic devices. A controller is mobile phone in range of Wi-Fi the robot. The mobile phone has specific the application software to send control signal for robot which is implemented by MIT app inverter. Whenever a mobile phone sends the control signal, it is transmitted wirelessly and is captured by the NodeMCU mounted on the robot. Microcontroller analyses this signal and it takes appropriate action to rotate the motor i.e., either forward or reverse or left or right.

2. RELATED WORKS

Robot controlling through Wi-Fi is an interesting tool to perform laboratory experiments within Electronics and Telecommunication Engineering. Designing of the system requires the knowledge of physical components, sensors, embedded system and decision algorithm. As we know humans cannot perform many tasks which a Robot can do. Robots are required where human interventions are nearly impossible. Due to this, a concept of designing a robot which can be controlled through Wi-Fi emerged in our minds. Here controls of the robot are integrated on a webpage. This project comprises of basically the following modules Wi-Fi Module, Router, Microcontroller and Smartphone and laptop with which handles all basic functionalities of a robot. It was possible to control the robot over the internet in a very cost efficient and user-friendly way. This method can be used for any robot with Bluetooth communication system. The robot can be used in any disaster case for scouting of distressed areas. It can supply live video feed going to places inaccessible for larger mechanical devices or human [1]. The robot can be used for spying and surveying reported places especially in Warfield. This can be used for live feed from any region needed to be looked out for.

The author describes a brief review of several wireless technology usages that might be used to control mobile robots. It is important to compare this technology and the bandwidth, frequency, data rate to transfer data among the devices for better development for mobile robot controller. Selection of wireless technologies depends on the type of application to be developed considering the following: range, frequency and data rate. The author explained the improvement of this project by using Wi-Fi which would enable long distance communication [2].

In 2015, Muhammad Gulfamet al., created a Surveillance Robot using socket programming. This paper presents a way of controlling a surveillance robot using android mobile devices through socket programming. Socket is one of the major technologies of computer Network programming [3].

In 2016, Subankar Roy et al., developed a rover which can be controlled through Bluetooth. The main aim of this paper was to provide simpler robot's hardware architecture with powerful computational platforms to enable robot designer to focus on the implementation and tests. This paper explains a very simple architecture for the robot which can further be used for various experimental courses. The advantage of low cost makes it more advantageous for students to use [4].

In 2015, ShoebMaroof Shaikh et al., implemented a Wireless Video Surveillance Robot, to help in security purpose [5].This paper describes the implementation of the application for the mobile devices that run on Android operating system. It is controlled through the Bluetooth technology. This paper also discusses the use of the camera attached on the robot that transmits live video feed onto the designed android application using Wi-Fi technology. This application lets the robot control interactions with the help of GUI.

3. PROPOSED SYSTEM DESIGN

The block diagram of the proposed android control mobile robot vehicle via Wi-Fi is as shown in Figure1. This proposed system is implemented using NodeMCU. In this system, there is one Wi-Fi network, NodeMCU and mobile phone with android application for this system. The NodeMCU receive the command form mobile application via Wi-Fi link. This command may be robot directions: forward, backward, left and right etc. The motors are connected with the NodeMCU with driver module.

Wi-Fi Router, Wi-Fi module and Smartphone are connected in same WLAN and an IP address is registered automatically by Wi-Fi module on robot vehicle. This IP address has to be written on an android application in Smartphone and system will be connected. This custom android application includes all keys for operation. There are keys namely Forward, Reverse, Left, Right, and Stop. When any key is pressed a signal from Wi-Fi router is transmitted and received by Wi-Fi module (NodeMCU) mounted on mobile robot vehicle. The signal processed by NodeMCU. When Forward key is pressed NodeMCU gives signals to motor driver IC which drives the motor in forward direction and similar operations for other controls.

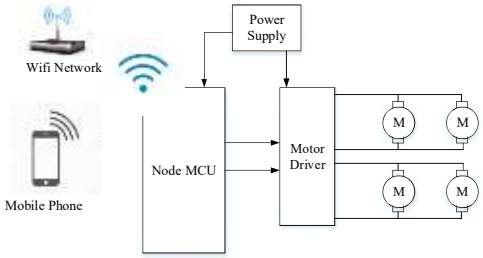

Figure1. The proposed system of mobile robot vehicle via Wi-Fi with NodeMCU

4. HARDWARE AND SOFTWARE REQUIREMENTS OF THE SYSTEM

This section describes about the implementation of the proposed system that needs the hardware and software requirements.

4.1. Controller (NodeMCU)

NodeMCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espress if Systems, and hardware which is based on the ESP-12 module. The term NodeMCU by default refers to the firmware rather than the development kits. The firmware uses the Lua scripting language.

A "core" is the collection of software components required by the Board Manager and the Arduino IDE to compile an Arduino C/C++ source file for the target MCU's machine language. Some ESP8266 enthusiasts developed an Arduino core for the ESP8266 Wi-Fi SoC, popularly called the "ESP8266 Core for the Adriano IDE". This has become a leading software development platform for the various ESP8266-based modules and development boards, including NodeMCUs. The photo of NodeMCU is as shown in Figure 2.

Figure2. NodeMCU [6]

4.2. 4WD Robot Car Chassis Kit

In this work, the demonstration of the mobile robot vehicle is needed. So, the prototype model of the robot car kit is used as the vehicle in the system. The frame of the kit acts the vehicle is as shown in Figure 3. It has four wheels with dc motors. These motorsare needed to driver circuit.

Figure 3. The car chassis

4.3. Motor Driver Module

Arduino Uno can't drive the dc motor directly. The current and voltage levels are not match with controller and dc motors. There is circuit that completer function of the driver for dc motor. That is called L298 motor drive module. In this system, there is one L298 module is used. The photo of L298 module is as shown in Figure 4. So, the L298N motor is used for line follower robot [7].

Figure 4. L298 driver module [7]

4.4. Power Supply

The mobile robot vehicle needs the power to run the system. Therefore, this system uses the power form Lithium battery pack with 12v@3A battery to supply power for all necessary circuit. The Figure 5. shows the 12V DC Rechargeable Lithium that used in this system. This rechargeable battery is a 12V 3000mah Li-ion Battery and it is specially designed for powering the system device which uses 12V DC power.

Figure 5. 12V Li-Ion lithium battery

4.5. LM2596 DC-DC Buck Converter Step-Down Power Module Output

This is an LM2596 DC-DC buck converter step-down power module with high-precision potentiometer, capable of driving a load up to 3A with high efficiency, which can work with it arduino UNO, other mainboards and basic modules. When the output current keeps greater than 2.5A (or output power greater than 10W), please add a heat sink on it. The Figure 6 shows the dc step down converter module that is used to step down the 12v dc to 5v dc for NodeMCU.

Figure 6. LM2596 dc-dc buck converter

The overall circuit diagram of the mobile robot vehicle is as shown in Figure 7. That includes the NodeMCU (controller with Wi-Fi module), 12 V dc battery, converter module, motor driver and motors (mobile robot vehicle) in this Figure 7. The 12Vdc battery power supply is directly connected to l298N driver module and NodeMCU with dc-dc converter. The NodeMCU drives the mobile robot vehicle via L298N (motor driver module) with 6 controls signal pins.

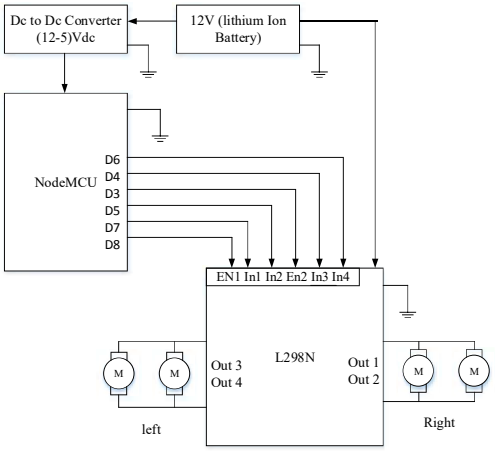

Figure7. The schematic diagram of the proposed system

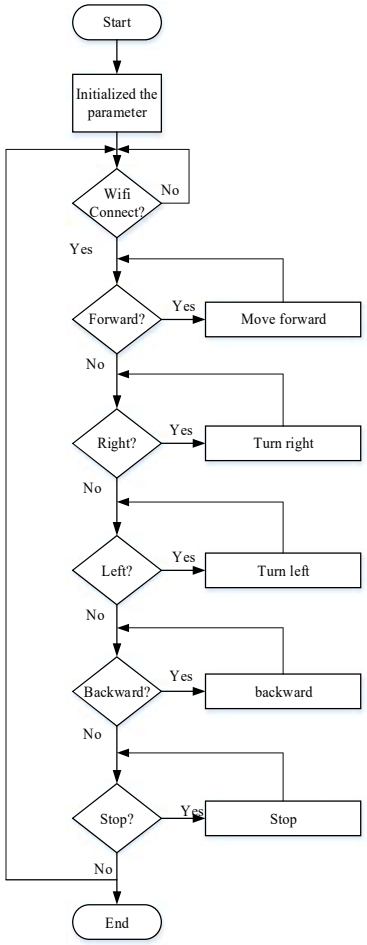

Figure 8. The flow chart for operation of NodeMCU

The android apk is developed by using MIT app inverter. This inventor is described in section.

The software of the NodeMCU is developed with Arduino IDE. The program development flow chart of this controller is as shown in Figure 8. The flow chart of the android application is as shown in Figure 9.

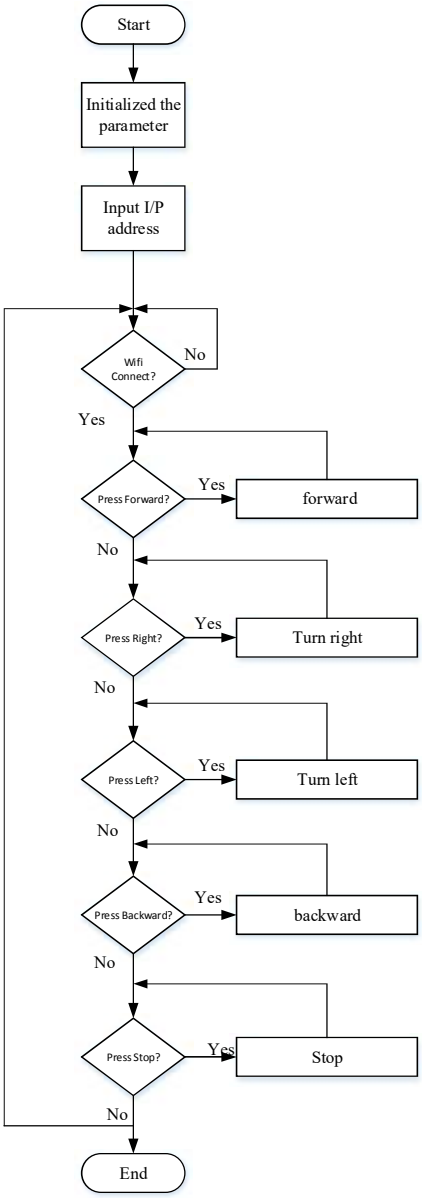

Figure 9. The flow chart for android application of the proposed system

5. EXPERIMENTAL RESULTS

The experimental results of the proposed system are described in this section. The Figure 10 shows that the mobile robot vehicle is assembled with NodeMCU. The Figure 11 shows the android application of the system. In this Figure 11, the IP address of the NodeMCU must be entered to control the mobile vehicle. The IP address of NodeMCU is 192.168.43.253. The test of the mobile robot vehicle is as shown in Figure 12.

The Figure 10. The mobile robot vehicle

Figure11. The Android application of the system

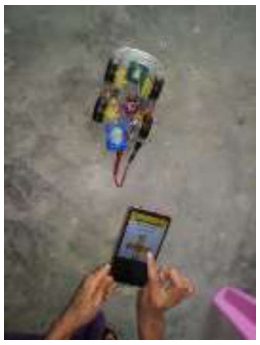

Figure12. The testing of the mobile robot vehicle

6. CONCLUSION

The work carried out by using the NodeMCU and motor drive in the field of control system. The hardware components are successfully assembled and interfacing the NodeMCU with robot vehicle is achieved. The proposed system shows how the android Smartphone can be used as remote controller for robot and various embedded technologies with the help of the Wi-Fi technology. At the same time, this program uses Wi-Fi connection to communicate with mobile robot vehicle. Controlling the movement of robot via Wi-Fi as well as from android applet is successfully obtained. This system also shows that how a robot can be used for travelling purpose. The operating system of Smartphone is Android, and it can develop effective remote-control program and by using Wi-Fi wireless network, the communication between Smartphone and robot can be realized, which makes it simple and convenient to control robot. Hence the modules of

controlling the robot is successfully tested and demonstrated. Though controlling using Wi-Fi limits the range of distance for communication, a smart and easy means to guide a mobile robot vehicle is achieved. This system can be used in defiance applications for detecting landmines in war field and for bomb detections by mounting a metal detector sensor on it.

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