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Smartphone Controlled Robot Car

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ABSTRACT: **In recent months, Bluetooth technology has seen rapid growth, driven by the widespread use of Bluetooth-enabled phones and other electronic devices in everyday life. To meet evolving demands, advancements have been made, including the development of remote-controlled robotic cars using Bluetooth. In this project, open-source hardware is utilized to design and build a Bluetooth-controlled robotic car based on a simple architecture. The movement of the car in specific directions is achieved through pre-programmed commands. An Android application, developed for smartphones, enables the user to control the car remotely. This design offers an efficient and practical way to operate the vehicle via Bluetooth. In the system, Arduino serves as the central controller, communicating with the smartphone through Bluetooth technology, which acts as the main link between the controllers and the smartphone using established communication protocols.**

Keywords: Bluetooth, Arduino, DC Motor

I . INTRODUCTION

In recent times, technological development has accelerated significantly, especially in the field of communication technologies such as Bluetooth and other remote-controlled cars and robots. Across the world, including India, technology is advancing rapidly, with a growing number of users operating a variety of smartphones running different operating systems. In the past, communication between devices relied on wired connections, which were often risky and inconvenient. However, today, wireless communication has become more efficient, faster, and safer, greatly simplifying interactions between devices. The Android operating system plays a crucial role in enabling communication between smartphone hardware and various mobile applications. In this project, a robotic car model is designed to be controlled via Bluetooth using a smartphone. The robot has a car-like structure with four wheels and can be used in a variety of industries for tasks such as transporting goods or moving small particles quickly from one location to another.

An Arduino Uno board acts as the main controller, managing the DC motors to navigate the robot in different directions. The model can be operated through two primary devices: a computer or a smartphone. In many countries, the use of wheeled robot cars is expanding, contributing to increased industrial efficiency and profitability. To enhance the performance of these robots, continuous developments are being made across various fields. Researchers have been extensively studying and testing this type of remote-controlled design to further optimize its capabilities.

II. LITERATURE SURVEY

Today, most mobile phones available in the market are Android-based and are easily accessible at little to no cost. Many developers and students are already familiar with smartphones and their

functionalities, largely because these devices use the Java programming language. Developers can conveniently interact with numerous functions and Android hardware components, as they are not heavily restricted [1]. Bluetooth technology operates on the principle of radio frequency (RF) communication. It generates radio signals to control various devices wirelessly. However, a robot car controlled via Bluetooth does not act independently; instead, it relies entirely on human operators for wireless control, ensuring operation without risks or interruptions [2]. Bluetooth functions within a personal area network, typically allowing wireless communication over a range of 5–10 meters. This technology has been increasingly adopted in electronic devices like MacBooks, printers, laptops, notebooks, and more [3]. Today, Android operating systems continue to evolve rapidly, offering new features and meeting modern user demands. Android smartphones are built on the Linux operating system [4]. Linux, known for being an open-source software stack and software development kit (SDK), allows developers to easily customize and add features according to customer needs in a flexible manner [5].

In the past, people faced difficulties and hesitations in communicating with each other and the outside world. However, with the rise of IoT devices such as smartphones, laptops, and other gadgets, communication has become simple, seamless, and independent [6]. Bluetooth technology was initially introduced by Jaap Hearten in the 1990s and further developed by Ericsson in 1994. Jaap successfully transformed his office setup from wired to wireless without external assistance [7].

III. PROJECT OVERVIEW

This device is built around an Arduino board, which functions as the brain, managing the operation of the entire system. The Arduino IDE software is used for easy and free programming of the Arduino board. Motor drivers and DC motors are incorporated to control movement in all directions smoothly, using a smartphone for command inputs. The robot car is capable of moving at good speeds and can carry items weighing between 150 to 200 grams, powered by high-capacity batteries.

The design features a single remote system to control all movements and rotations. Two 9V batteries are used: one powers the Arduino board, while the other supplies energy to the rest of the system, activating the motor drivers and DC motors. The Bluetooth RC Car mobile application enables the user to control the robot's movements and rotations wirelessly via the smartphone's Bluetooth connection. A single motor driver is used to manage all four motors efficiently.

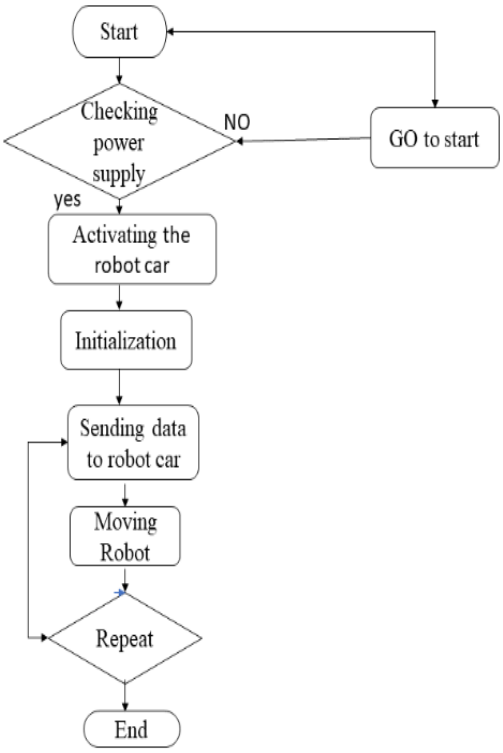

Fig. 1 Flow Chart

In the above figure represents flow chart of the designed model. There are many steps of the flow chart I have been mentioned below.

Step1: Before starting the process the designed model it has the feasibility of a primary checking of the power supply. If there is any power supply "available" then it activates the robot car to start the initialization of the several codes which is given by instructor. If in case the power supply is not supplied to the designed model then it will move to starting process and again repeat the initial checking of the power supply.

Step2: After the step 1 process completed, my designed robot car is moves to initialization of the coding which is given by instructor. If in case coding has several errors while initialization and

stop the process of step 2 and again repeat the process of

Step 3: After the step 2 process completed, then it sends the data to robot car then my designed model starts moving the robot car in several directions which is given by instructor.

Step4: Now then repeat the entire process to send the data and move several directions. Suppose the instructor giving the several commands to the robot car then it sending the data and repeat the process.

Step5: After successfully completed all steps then the entire process will come to end.

IV. BLOCK DIAGRAM OF BLUETOOTH CONTROLLED ROBOT CAR:

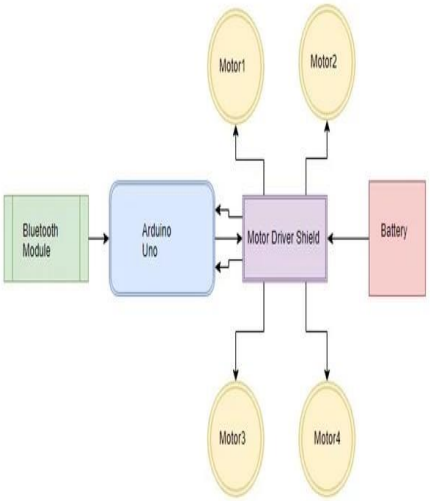

Fig.2 Proposed block diagram of Bluetooth Robot car

V. WORKING PRINCIPLE

The operation of the Bluetooth-controlled robot car is very simple and can be accessed globally. To power the motors and motor drivers, two 9V batteries (providing a total of 18V) are used. A Bluetooth RC Car application installed on a smartphone is utilized to control the movement of the robot car, motors, and motor drivers, allowing it to navigate in various directions. The app features several basic control keys that help steer the car through the smartphone interface. The Bluetooth RC Car app is responsible for sending and receiving signals between the smartphone and the Arduino hardware. In this system, the Arduino serves as the main controller, receiving commands from the smartphone and directing the motors and motor driver to carry out specific actions.

The robot car is constructed with two DC motors and a single motor driver, enabling it to move in four directions. The Arduino manages the entire operation, and all components are mounted onto a robot chassis. To program the Arduino, the Arduino IDE software is used. Initially, the Arduino board is connected to a computer or laptop via a data cable for code uploading. Once the coding is complete and uploaded, the cable is removed, and the Arduino can independently receive instructions from the smartphone through the Bluetooth connection.

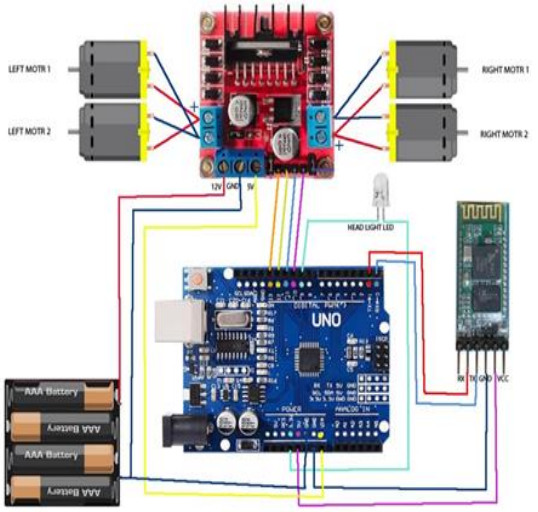

Fig.3 Proposed Bluetooth RC Car app

VI. COMPONENTS REQUIRED:

ARDUINO UNO:

The name "Arduino" originates from a bar located in Ivrea, Italy. In Italian, "Uno" translates to the number one. Arduino Uno was created by Massimo Banzi, while Hernando Barragán contributed by developing support for the microcontroller (ATmega16) through the Wiring platform in 2003. Arduino Uno is known for being user-friendly, easily accessible, and affordable. It is designed to allow users to develop projects without significant difficulty.

The Arduino IDE software is used to program and manage the Arduino board in a simple and flexible way. Originally introduced in 2008, Arduino was

developed specifically for engineering and educational projects. The board features a microcontroller (ATmega328P) that can be programmed through the Arduino IDE.

Arduino Uno can output voltages between 3.3V and 5V without disruptions and accepts input voltages ranging from 7V to 20V. It is equipped with 6 analog pins (which support pulse width modulation) and 14 digital pins for reading and writing functions. To handle serial communication, the Tx (transmit) pin sends data from the Arduino board to other components, while the Rx (receive) pin receives data back into the board. In this project, the Arduino Uno serves as the main controller, managing the operation of all components and overall system functionality.

MOTOR DRIVER L293D:

To control two DC motors simultaneously, two H-bridge circuits are used, providing the necessary control to the motors. The L293D motor driver contains an H-bridge configuration that enables control over both the direction and speed of the DC motors. An enable line is included to turn the motors on or off and to regulate their speed.

The L293D driver features four input pins and four output pins, allowing for independent and smooth motor control without any interruptions. Designed using TTL (Transistor-Transistor Logic) levels, the driver can manage heavier loads efficiently. It can handle input voltages ranging from 5V to 35V with ease. Additionally, the motor driver helps adjust the voltage supplied to the motors, ensuring that even when low input voltages are provided, the motors can operate effectively without any performance issues.

Fig.4 Proposed the motor driver(l293d)

BLUETOOTH RC CAR/ARDUINO IDE

This application is specifically designed to easily control small robotic cars as well as compact IoT devices in an eco-friendly manner. It is used to store data and execute multiple tasks efficiently while maintaining an environmentally friendly approach. The Bluetooth RC Car application can be downloaded for free from the Google Play Store and Apple App Store.

The app offers a user-friendly interface, making communication with the designed model simple and accessible for all users. Compared to other similar applications, this app provides faster and more efficient communication with the robot car, supporting quicker development and smoother operation of the designed model.

ARDUINO SOFTWARE

A microcontroller is embedded within the Arduino PCB board, allowing easy communication with the designed model and providing flexible control over the entire Arduino system. The Arduino IDE software is used to upload (or "burn") the code into the microcontroller. These programmed instructions are then stored in the microcontroller's EEPROM memory with the help of the Arduino IDE.

HC-05 BLUETOOTH MODULE:

The development and design of this board began in 1994 and continued until 1997, leading to a workable solution. Nils Rydbeck initially developed radio communication technology in 1989, which was later named Bluetooth at Ericsson Mobile in Lund, Sweden. The first Bluetooth version was officially launched in the market in 1999. Bluetooth is a low-cost, widely available technology primarily used for short-range communication between devices via bandwidth.

Its main purpose is to replace traditional wired connections with wireless communication for various projects. The Bluetooth module features six pins: the Tx pin for transmitting data, the Rx pin for receiving data, a GND (ground) pin, a Vcc (power supply) pin, and two additional pins for Key and State functions. It can operate over a distance of up to 100 meters.

Bluetooth utilizes low-power radio waves and functions within a frequency range of 2.400 GHz to 2.483.5 GHz for device communication. It is also referred to as a 2-slave Bluetooth module when used for serial communication purposes.

VII. CONCLUSION:

This Model successfully designed and completed without any major difficulties by carefully analysing the connection. As a result, the robot car is capable of moving in multiple directions and traveling from one location to another as intended. This model tested multiple times and in various environments, and it consistently performed tasks according to the set requirements without any issues. This model was specifically designed to allow users to control it over long distances using Bluetooth technology.

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