Design and Implementation Mobile Control Robot

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Abstract: The project aims in designing a robot that can be operated using Android App. The controlling of the Robot is done wirelessly through an Android smartphone one using the Bluetooth module feature. Here in the project, the android smartphone is used as a remote control for the Robot and have key applications. Bluetooth is an open standard specification for a radio frequency (RF)-based and have a short-range connectivity technology that promises to change the face of computing and wireless communication. The controlling device of the whole system is a Arduino. Bluetooth module, DC motors are interacted to the Arduino. The data received by the Bluetooth module from the Android smartphone is fed as input to the controller. The micro-controller acts accordingly on the DC motors of the Robot. The robot in the project can be made to move in all four directions using the Android phone. The direction of the robot is indicated using LED indicators of the Robot system. Robot is also controlled with gesture control. In achieving the task the controller is loaded with a program written using Embedded 'C' language.
Keywords: Mobile application; Android; Gesture; HC-05; L298N

I. INTRODUCTION

Mobile-controlled robot projects make use of an Android mobile phone for robotic control with the help of Bluetooth technology. This is a simple robotics project using Arduino and run with the help of gesture mode also. We have already seen Mobile Controlled Robots using Bluetooth technology, which uses call, base methods to control the robot. It also have many wireless-controlled robots use RF modules. Today, a Bluetooth-powered robotic robot is a relatively inexpensive, easy-to-use and efficient way to go. The aim of the project is to design an Arduino bot system and write a program on Arduino Microprocessor. The Arduino robot contains an Arduino with basic navigation features. Arduino apps contain mediation instructions between the Android controller and the Arduino robot. Android mobile controller uses various mobile sensors to monitor movement. An appropriate program in the Arduino microprocessor to interact with the android controller. Metal detector is also implemented for detection of metal. It is a device that can detect metal, the basics can make a sound when it is near some metal, and the more advanced can tell what kind of metal and how deep it is down, they are using different detecting principles.

II. MOBILE APPLICATION DEVELOPMENT

Mobile app development is the process of creating software application which can be run on mobile devices. It is easy to maintain and we can also secure our app data. Usually most of the applications need the internet connectivity or Bluetooth connectivity. Android applications are usually developed in the Java programming language.

III. BUILDING COMPONENTS (SOFTWARE AND HARDWARE)

For controlling a robot with mobile smartphone which runs in android software system with having a Bluetooth connectivity and also run by using gesture mode. Robotic parts for the model consists of robot chassis, the Arduino Uno Board, Bluetooth module, electric motors, motor driver module, battery pack, jumper wires and wheels. The Bluetooth module is connected with the Arduino UNO board for the connection with the user. Through the Bluetooth module for monitoring and controlling the particular motor reaches the board and process accordingly, the output of the Arduino goes to the motor driver IC, and it controls the particular motor.

A. Robot Chassis

Chassis is a load bearing framework for any object. It is also used to assemble all the components that we are using in robot. In robotic design we are using acrylic transparent car chassis, high-Quality 65-mm Plastic wheels with Rubber and having 16 x M3 Nut.

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B. Arduino Uno Board

Arduino Uno is a microcontroller based on a board on a microchip ATmega328P. ATmega328 has 28 pins in total which has 14 digital total input / output pins, in which 6 pins are providing PWM output and 6 pins are providing analog inputs. The microcontroller operates at 5V. Arduino Uno needs crystal oscillator for 16MHz frequency.

C. Bluetooth Module (HC-05)

HC-05 Bluetooth Module is acts as a communication bridge between the electronics devices. HC-05 generally connects with small devices like mobile phone for a short range. It is designed for wireless connectivity. HC-05 uses the frequency of 2.45GHz. It operates at a voltage of 5V of power supply and operating current has 30mA. The range of transferring data 10 meter.

D. DC Motor and Motor Driver Module (L298N)

DC motors are operated on direct currents they ate come from small motor to huge ones, it can also use in robotic basis. Here we are using 12V 1.5A dc motor to operate the robot. In robot we also implement the L298N H-bridge motor driver.

L298N motor driver module is high power motor driver and perfect to drive the dc motor, it is capable to drive two dc motor simultaneously. L298N is a 16 pin IC. A Motor driver is connected to Arduino to run the robot. Motor driver's input pins 1, 2, 3 and 4 are connected to Arduino's digital pin number 5, 6, 10 and 11 respectively. Here we have used DC motors to driver robot.

E. Battery Pack, Jumper wires and wheels

Battery is the source of electrical energy in stored form Lithium-ion Battery is a rechargeable battery, supply of 14V.Jumper wires are used for connection in robot and wheels are providing motion to the robot.

F. H. Android Bluetooth Controlled Application and Arduino Software code

Android Bluetooth controlled application is nothing but the application that we are using in our android mobile to give a command to the robot for the movement in it. The application is first design in c language. The Bluetooth HC-05 interfaced with Arduino UNO for connectivity with android mobile to Bluetooth HC-05.

Arduino UNO is programmed by using Arduino Software, it is integrated development program environment (IDE) which makes easy to write code and upload it to the board. For Arduino IDE C/C++ languages are used for programming.
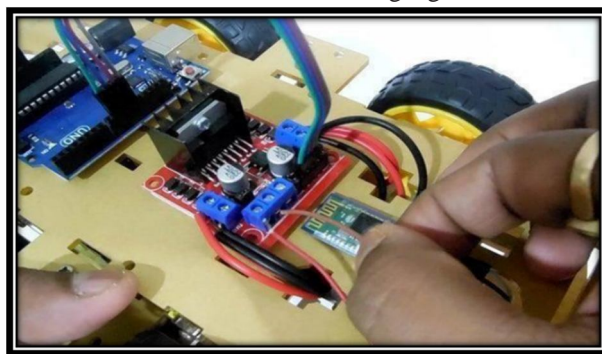

Fig no. 1 Implementation of Mobile Controlled Robot.
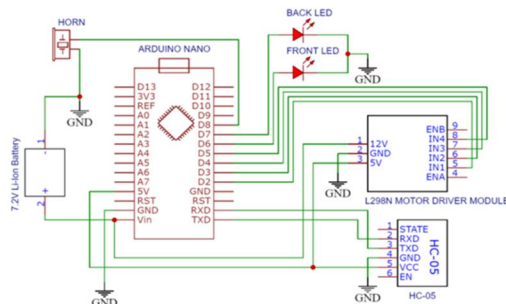
IV.   CIRCUIT DIAGRAM

Fig no.2 Circuit Diagram of Mobile Controlled Robot.

Going to build this Bluetooth controlled robot, at first we should look for the HC-05 Bluetooth module where the +5V supply and GND pins are directly connected to the 5V power supply or Arduino 5V supply.

After that, we need to connect the TX pin of the Bluetooth module to the RX pin of the Arduino as we know that we should only transmit data from the smartphone to the Bluetooth module of the Bluetooth controlled robot and don't need to receive any kind of information from Arduino. This RX pin of the Arduino depends on the Software Serial library (Pin 0 and Pin 1 are arranged as RX and TX pin of the Arduino.)

Presently, the L298N motor driver module's digital I/O pin 2 to pin 5 of Arduino are designed as to output pins of the motor driver and are associated with IN1 through IN4 to the L298N motor driver.

V.   WORKING OF THE CIRCUIT

As we give the command to the robot then the command is then processed by the phone. Command is then sent to the receiver side via Bluetooth Module HC-05. Command received via Bluetooth Module HC-05 is then forwarded to Arduino Uno board using UART serial communication protocol. Arduino code checks the commands that is received. Whenever the command is a matching to string, Arduino controls the movements of the robot accordingly in forward direction, backward direction, turning right direction, turning left direction & stop. Signal logic levels at the different stages of the circuits for proper controlling of the robot are given below;

User Command	Arduino O/P Digital Pins (2,3,4,5)	L293D Input Pins (2,7,10,15)	L293D output Pins (3,6,11,14)
Forward	HLHL	HLHL	HLHL
Backward	LHLH	LHLH	LHLH
Left	-HLLL for 1s, then HLHL if previous Command was Forward -HLLL for 1s, then LHLH if previous Command was Backward		
Stop	LLLL	LLLL	LLLL

Fig no.3 Key Mapping Chart of Mobile Controlled Robot.

To begin with, for this Bluetooth, Mobile controlled Robot, 7 keys as utilized for different direction and different work performance i.e., forward, backward, left, right, light ON/OFF and speed. At the point when a key is pressed by the user, the comparing information is transmitted or exchanging between the HC-05 Bluetooth Module and android smartphone. In the Arduino code, the Arduino gets any of the command from the Bluetooth module (according to the key mapping) and plays out a simple switch case activity, where each case is related with suitable directions to the motor driver input pins. As an example, if the forward key is pressed in the smartphone app, then the Arduino will activate IN1 and IN3 from the motor driver module to move the robot in the forward direction while IN2 and IN4 are in deactivation model.

While giving commands to robot by pressing left, right, upward downward button rather than doing this we can also implement the gesture mode. Simply we have to put the android smartphone in our hand and giving the movement to the smartphone. As we give movement to smartphone the movements also take place in a Robot.

VI.   ADVANTAGES AND LIMITATIONS

1) It is feasible to implement Bluetooth communication between smart phone and Microcontroller. The development of apps for Android in Android SDK is easy and free of cost. It is also used for surveillance. The Bluetooth RC Controller application is friendly to use.

2) As we know the connectivity range of Bluetooth communication is approximately 10 meters, so the controlling range of this robot is also limited. If the power is not sufficient for all the modules especially the Bluetooth module, then the whole process will not work. Also, we can't attach more than 3 batteries to the small chassis. So we need powerful batteries.

3) Through the mobile application we can operate a robot by using command buttons and gesture mode also. Gesture mode is easy to use and it can be used in wheelchair for handicap person, for such a person the gesture mode more friendly to use and easy to operate.

VII.   APPLICATIONS

Low range Mobile Surveillance. Devices Military Applications (no human intervention). Assistive devices like wheelchairs, Home automation can be used The robot is small in size so can be used for spying also. With few additions and modifications, this robot can be used in the borders for detecting and disposing of hidden land mines. The robot can be used for reconnaissance or surveillance.

VIII.   CONCLUSION

The project titled Bluetooth Robot using Arduino is an application based on popular open source technology - Android and Arduino. The aim of the project was to create an Arduino integrated robot that has to be controlled through an application that runs on the android operating system. The project has been completed with success with the maximum satisfaction.

Provisions are created to upgrade the code. The applying has been tested with live information and has provided a health result. Hence the code has proven to figure hasty. The system created met its objectives, by being straightforward to use, implement. Further modules may be simply other once necessary. The code is developed with standard approach. All modules within the system are tested with all the valid information for everything work with success.

IX.   FUTURE SCOPE

Multiple sensor can be added in the robot. Size and shape of the Robot can be modified according to the requirement. We can also mount the web camera in our robot, which can be used in various field such as spying, or for military uses. It is rapidly growing field, as continue to research design and build new robots that serve various practical purposes, whether domestically, commercially, militarily. However there's still lots of scope for future improvement and add-ons in practicality.

REFERENCES

[1] Design of a Bluetooth Enabled Android Application for a Microcontroller Driven Robot By Vito M. Guardi (May 2014).

[2] Introduction to Arduino A piece of cake! by Alan G. Smith September 30, 2011.

[3] 30 Arduino Projects for the Evil Genius™ Simon Monk, McGraw-Hill Companies Inc

[4] A. Sharma, J. Mondal, C. Pandey, R. Kumar and A. Bhattacharya, "IoT Based Home Automation System"; Advances in Applied Science; Volume 2017; Article ID 100005, pp. 01-06; Feb. 2017.

[5] Arpit Sharma, Reetesh Verma, Saurabh Gupta and Sukhdeep Kaur Bhatia, "Android Phone Controlled Robot Using Bluetooth", International Journal of Electronic and Electrical Engineering. Volume 7, Number 5 (2014), pp. 443-448.

[6] P. D. Minns, Atmega32 for Arduino Microcontroller System. Author House, 2013.

[7] https://www.arduino.cc/en/Tutorial/Foundations/AnalogInputPins

[8] S. K. Saha, Introduction to Robotics, Tata McGraw-Hill Publishing Company (30 April 2008) John J Craig, Introduction to robotics, Pearson Education; Third edition (2010)

[9] Roland Siegwart, Illah Nourbakhsh, Davide Scaramuzza. Introduction to Autonomous Mobile Robots, Second Edition, pp. 13-423. Massachusetts: The MIT Press, 2011.

[10] Arvin Agah, Mobile Robotics, EECS 747 Lectures (http:// people.ku.edu/~agah/courses.html), 2011.

[11] IEEE sample paper template for IEEE Transactions, Preparation of Papers for IEEE TRANSACTIONS and JOURNALS (May2007).

[12] http://www.ieee.org/publications_standards/publications/authors/autho rs_journals.html#sect2 Prashant Tripathi, Wi-Fi Robots, The Academia edu.

[13] Kunal Borker1, Rohan Gaikwad2, Ajay Singh Rajput3. WIRELESS SURVEILLANCE ROBOT International Journal of Advance Research in Computer Science and Management Studies ISSN: 2321 7782, Volume-II, Issue-II, February 2014.

[14] Dheepak Mohanraj, MICROCONTROLLER BASED AN AUTONOMOUS WIRELESS LINE TRACKING ROBOT, International Journal of Advanced Engineering Research and Studies E-ISSN22498974.

[15] Mester, G. Wireless sensor-based control of mobile robots motion, Intelligent Systems and Informatics, 2009. SISY '09.7th International Symposium on.

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