IoT Based Android Controlled Robot System: Design and Implementation

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Abstract: *Android-controlled robot cars can be used in multiple applications and life areas. It would certainly be amazing if the robot car had an ultrasonic sensor with a Bluetooth connection. Robot cars equipped with Android phones are manufactured here with the following ultrasonic sensors, Bluetooth modules, motor driver shields, and Arduino boards. The main connection depends on the Bluetooth module. An Android app called Bluetooth RC car, is installed on Android smartphone, and all navigation is performed at the push of a button on the app's interface. When the car receives a driving command, it drives back and forth according to the command and uses ultrasonic sensors to avoid collisions along the way. The Arduino module is coded according to the need to drive this car. After successfully running the device on the Arduino Uno and programming, the app works properly and thus finally achieved its goal.*

Keywords: *Bluetooth Device, Android OS, Smartphone, Microcontroller.*

1. Introduction

Today, automated control equipment plays an important role in all industrial systems [1]. Control engineers typically deal with important industrial processes in equipment design, installation and maintenance to ensure that system operations and processes are intelligent and secure. An Android Controlled Robot Project uses Bluetooth technology to operate the robot with an Android phone [2]. Here, a simple microcontroller-based robot App is implemented with a Bluetooth connectivity. To do this, Android mobile users have to install the App on their portable. After that, the user must put on Bluetooth on their phone. As we know, Bluetooth is a wireless communication technology accustomed to control the robot. Forward, backward, left and right left etc. commands are available for users.These commands are transmitted to the Bluetooth receiver from Android phone. A Bluetooth receiver device is deployed in Android-based robots to receive commands and pass them to a microcontroller circuit that controls the motor. To run the motor, the microcontroller sends a sign to the motor driver IC[3].

2. Literature Review

The Internet of Things (IoT) [4] is a network of physical objects ("things") that contain sensors, software and other technologies to connect and exchange data with other devices and systems via the Internet. These devices range from ordinary household items to complex industrial tools. Inexpensive computing, big data, cloud, mobile technologies and analytics allow the physical to exchange and collect data from a study with minimal human intervention. Digital systems can record, monitor, and coordinate all interactions between connected entities in today's hyper-connected environment. By enabling connected cars, the Internet of Things reinvents the automobile. Car owners can use IoT to remotely operate their vehicles, such as preheating the vehicle before the driver gets in or making a phone call to the vehicle.The term "Internet of Robotic Things" was coined to represent the concept of combining sensor data from various slices, processing it with local and distributed intelligence, and employing it to govern and run physical objects [5].

3. Methodology and Architecture

A robot can be controlled using Bluetooth module HC-05 [6] and ATMEGA328P-PU [7] microcontroller with android Smartphone device. The controlling devices of the whole system are a microcontroller. Bluetooth module, DC motors [8] are interfaced to the microcontroller. The data receive by the Bluetooth module from android smart phone is fed input to the controller. The controller acts accordingly on the DC motor of the robot. The robot can move to move in all the four directions using the android phone. The direction of the robot is indicators using LED [9] indicators of the Robot system. In achieving the task, the controller can be loaded with program written using Embedded 'C' Languages [10].

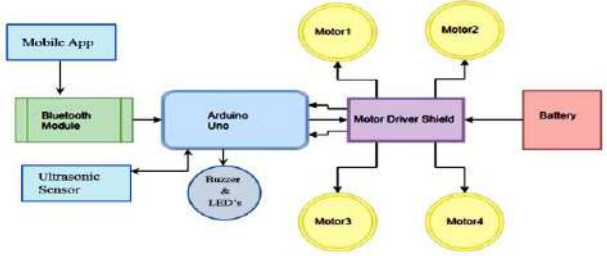

Figure 1: Methodology and architecture

4. System Circuit Design

Necessary components as mentioned above (figure 1) are needed to build the project circuit. According to the proposed architecture, stepped forward to build connections among all the components.

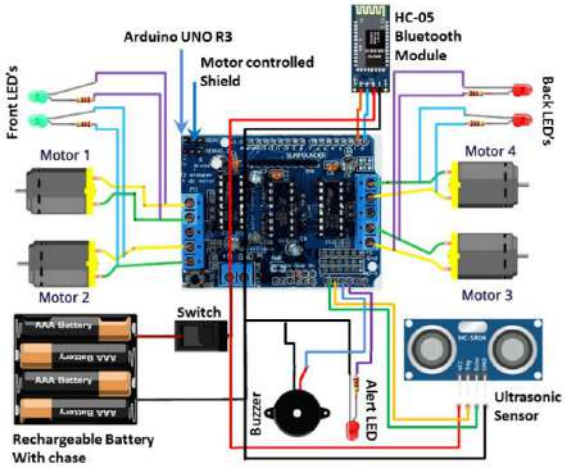

Figure 2: System circuit design.

4.1 Robot Car Functioning

Centering the Arduino module, the motor driver shield, ultrasonic sensor, Bluetooth module etc. are connected. Also connected the LEDs for every wheel. Then the full circuit was connected to a power supply through a switch.

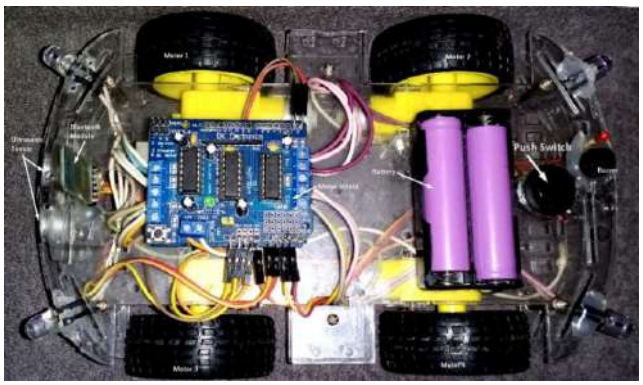

Figure 3: Designed for a car with components.

4.2 Android App Functioning

Created a Bluetooth connectivity testing app using MIT app inventor website which is an open platform where it can createsits own app. After being successful tested connection, has to download an android app named "Bluetooth RC Controller" [18] from google play store to operate the robot car remotely from Android phone. After connecting the app to the robot, all necessary commands are applied and it worked properly.

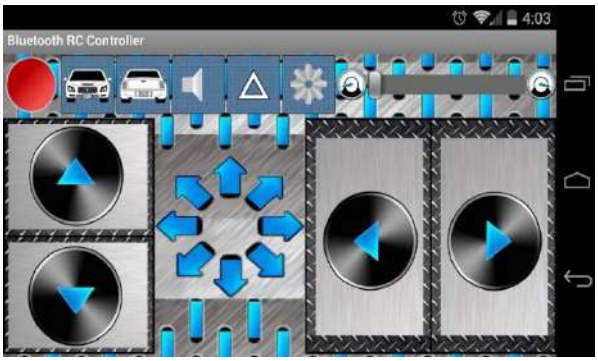

Figure 4: Car control App interface.

5. Simulation and Result

To build this project, used some familiar tools and components such as: Arduino Uno Board [11], Bluetooth Module, Motor Driver Shield [12], Four-wheeler robot car set [13], battery, LEDs, Push button, Buzzer, Switch and Ultrasonic sensor [14].The first step in putting together the endeavor was to get the hardware ready and test it.Tested three simulation processes with proteus [15]and Arduino IDE [16]. The first one is the motor simulation.

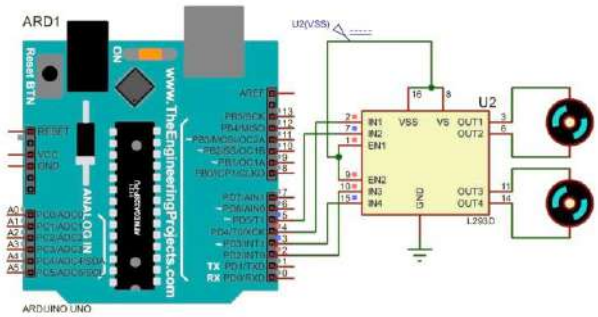

Figure 5: Motor simulation

With correct connection and properly coded HEX file for L293 motor driver, firstly simulation was successful and has been found two rotating motors on simulation screen. Secondly, ran Bluetooth simulation and that was also performed successfully. In case of Bluetooth simulation, it is needed to create a custom app from MIT App Inventor website [17]. Connecting the app with computer through Bluetooth, ran the motor in proteus pressing ON button in the app.

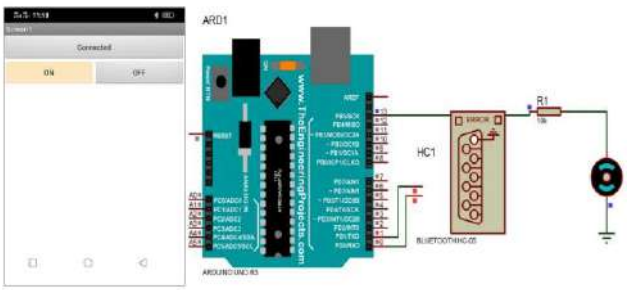

Figure 6: Bluetooth simulation

Thirdly, it is tested the ultrasonic sensor with Arduino and the simulation process found successful. At the point when vehicle model was prepared, all the physical components were assembled to build this prototype robot car. After all the successful simulations, it was confirmed that the proposed project functioned properly. Finally, burnt the program code for the robot car in Arduino Uno R3 module using Laptop and Arduino IDE software.

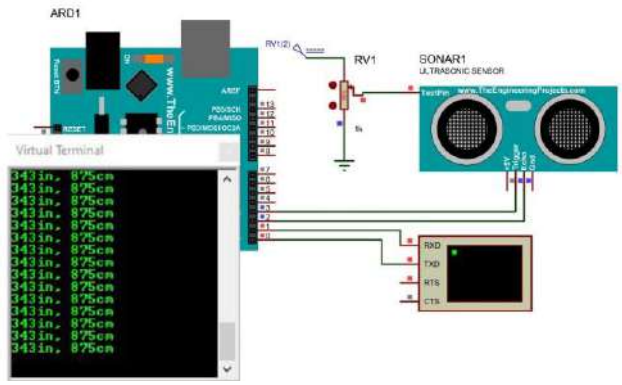

Figure 7: Ultrasonic sensor simulation

Here's the picture for the prototype car. After a successful connection and coding inside microcontroller, it is demonstrated the prototype car and it is found satisfactory watching car's movement according to android app command.

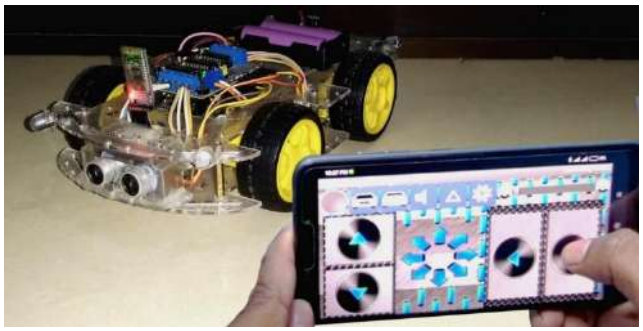

Figure 8: Live demonstration.

5.2 Implication and Future Scopes

Communication between the robot and mobile device is established through a Bluetooth device and some implication are describe as follows:

i. In Domestic Use: This project can be used at homes for many purposes like picking up and placing some objects from one to other.

ii. In Spying Operations: This robot can help in spying operations. The object recognition and android control makes it Hi-Fi.

iii. For Handicapped People: This project can help the handicapped people especially those who had lost their feet unfortunately.

iv. Robo Races: The tilt control of robots can be used in robot-races which will be revolutionary.

v. Military Application and Hostage Rescue.

A wireless camera [19] is mounted on the robot vehicle for spying and observation reason indeed in night time by utilizing infrared lighting. Future alterations can be made to perform diverse assignments with exact control such as:

i. A Robot Mounted with camera

ii. A headset, with a full-color display

iii. A mission control center

7. Conclusion

Now-a-days in every sector are developing with IoT, Apps etc. day by day. New product is coming with new feature. In Bangladesh,basically, this type of goods is imported, and it is quite expensive because of vat, transportation, and other factors. This system will play an important role in the modern world. Considering that if we have the right tools, we can design and implement this type of products, as well as to develop and export those. New job sector also be created by engaging peoples and thus it will help to decrease unemployment rate of Bangladesh.

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