Interfacing of Robot with Android App for To and Fro Communication

SHIVAM AGARWAL
U.G. Student, Department of CSE
Meerut Institute of Engineering & Technology, Meerut
e-mail : shivam.ag123@gmail.com

NIDHI AGARWAL
ME Scholar, Department of Electrical Engineering
NITTTTR, Chandigarh
e-mail : nidhi.ee@rediffmail,com

***Abstract*— This paper involves fabrication of an android controlled system which can support movement of robot. The objective is to develop a platform that is a combination of hardware and software for human machine interaction. The design provides an approachable system for robot to communicate with android application via Bluetooth mounted on it. Two segments are used as hardware implementation in this robot to perform various tasks with efficiency. The first segment uses an embedded system which is Arduino Board 2560. In the second segment a Bluetooth module is integrated for communication with android application (to and fro). Android application is designed to control the hardware as desired and display the received real time data from the hardware on android device.**

Keywords—android; interactive system; Arduino; robotic platform; bluetooth; real time monitoring

I. INTRODUCTION

A robot is a device to perform the task with accuracy and precision. This can be done by programming for decision making to process the conditional performance by the robots. With advancement of robotic technology and mechatronics principles, total performances are detected for different operations at a time and reported to the user. This system consists of the following modes:

(a) Transmitter mode:
In this mode signals are processed by transmitting end device, to send to receiver.

(b) Receiver Mode:
In this mode received signals are processed by receiving end device and processed accordingly.

Both android device and robot work in transmitter and receiver mode.

The objective is elaborated as, to provide mechanism for controlling an Arduino based robot for desired output and sending real time sensor or monitoring data to android application. The more efficient algorithm is applied for robot in the given environment. It activates particular motor with relevant direction. Bluetooth is used to communicate between microcontroller (ATmega 2560) and android application, to control the kinetics of robot [1].

II. PROBLEM STATEMENT

Earlier methods used were:

- First, the use of an onboard control system, which requires a human to control the robot/ machine by using onboard commands/buttons.
- Second, wired control system, which requires handling of bulky wires and limits the control length.
- Third, wireless dedicates remote system, require different remotes for various machines, prone to disturbance and can be hacked easily as there is not protected transmission of signals, anyone with the frequency can send commands.

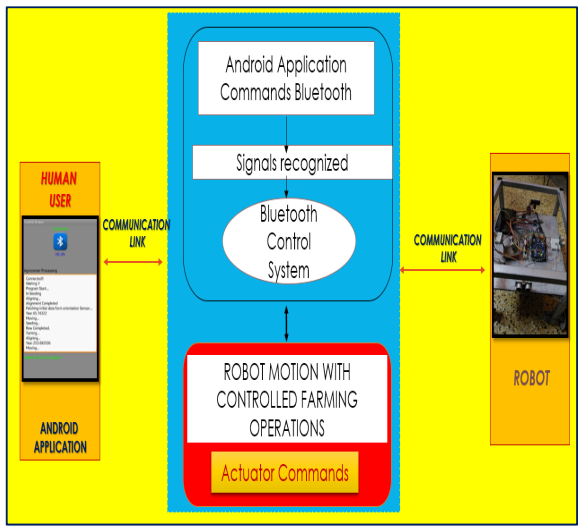

Fig 1-Overview of an Android-controlled Autonomous Robot

III. PROPOSED SOLUTION

Android application with robotics is an exciting area for human computer interface that is used to assist humans to control the mechanical system via software. Here, we designed an android application to control robot/ machines wirelessly using a secured connection over Bluetooth.

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The basic considerations for proposed segments are:

- Interfacing the robot system with communication module Bluetooth (Embedded Hardware Model)
- Bluetooth Module with android application (Software Model).

The input from android application is processed using command and understanding algorithms to parse into controller that will control the robot. A communication protocol that effectively translate the selected command into maneuverable tasks to any control board.

IV. Interfacing The Robot System With Communication Module Bluetooth

This module is the embedded hardware approach which is used for Design – Hardware (Transducers & Actuators)

The first module is the embedded hardware model which uses an embedded system that is interfaced with an Arduino-based hardware platform as shown in fig 2.

1. *Driving Motors*
   A combination of four 100RPM motors (12V, 1A) with spur gearbox system are used to drive four wheels of the robot.

2. *Arduino Mega*
   Arduino Mega 2560 based on ATmega 2560 is used as main brain of the hardware. It takes input from the sensors mounted on chassis. Suitable decision is made by Arduino and actuators are governed accordingly for motion and implementing different selected operations.

3. *Voltage Divider*
   Voltage divider used here provides two voltage distribution one is 5V (for logic operations) and other is 12V (for motors).

4. *Tyres*
   Tread block tyres are used with 4.5" diameter for better gripping and push on land applications.

5. *Bluetooth*
   Bluetooth gives connectivity between two devices using particular MAC address.

6. *Motor Driver (L298N based)*
   Motor driver board based on L298N is used to drive the motors for motion.

V. Interfacing The Bluetooth Module With Android Application

This approach is the software approach which is used for Design – Software Model

The second design involves a programming solution. A Bluetoot

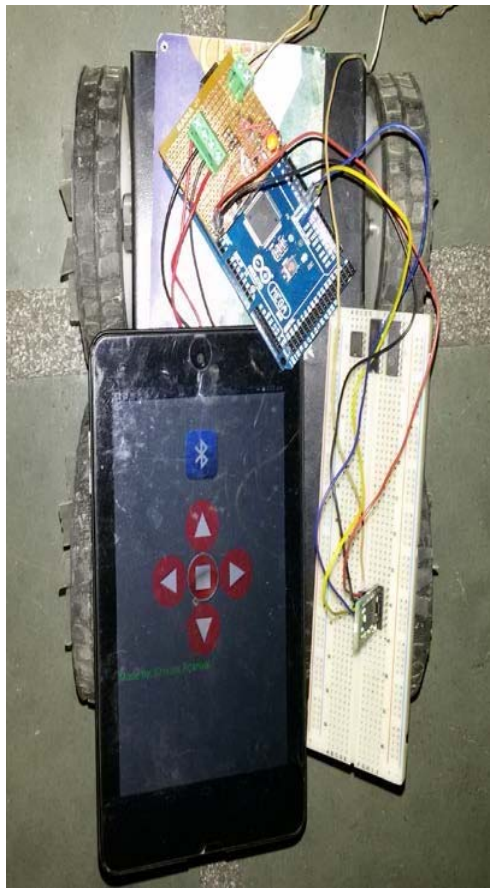

Fig. 2 Assembled Circuit of Bluetooth Control Robot

h module is implemented on board with Arduino and sensors. The module produces signal which can be combined to create commands. This algorithm is developed with accuracy in the Arduino platform. The Arduino is programmed using the IDE called Arduino IDE. The Arduino IDE consists of different algorithms for operations which are dedicated to perform actions. The processing of data taken from sensors is done to generate the desired output signals (commands) which in turn helps in controlling of actuators. The flow of data is shown in fig. 3.c

For sending command to hardware section transmitter is used. The transmitter consists of Bluetooth device controlled by Android commanded application with controlled actions. The receiver consists of Bluetooth connected with Arduino microcontroller which activates H-Bridge to drive motors. The robot contains one chassis with four D.C. motors. It rotates Left, Right and does Forward and Backward movement. Fig 4 shows several types of motion of robot in different directions as selected by user. Fig. 5 shows the motion of robot in forward motion,. So, the button for forward is green and all other are in red color.

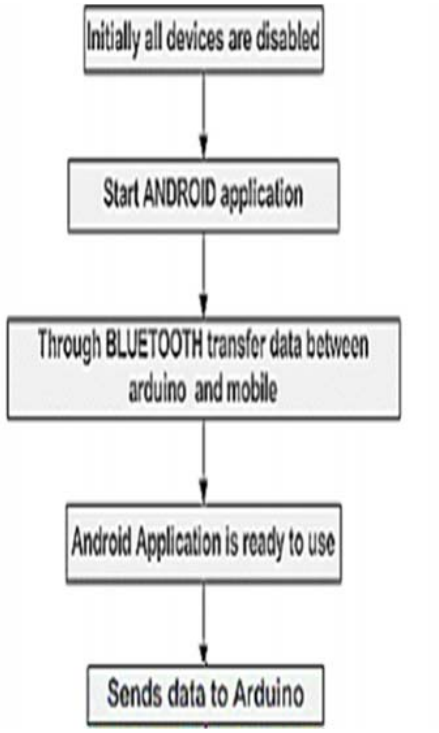

Fig. 3 Flow Chart for robot performance

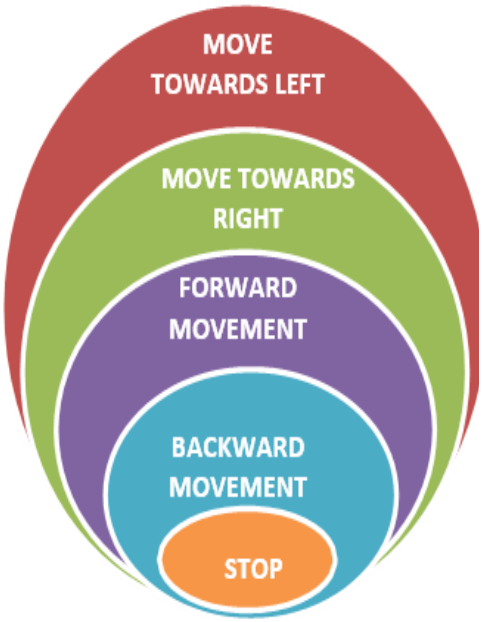

Fig. 4 Illustration of several performance

Fig.6 shows the motion of robot in Backward motion,. So, the button for Backward is green and all other are in red color.

Fig.7 shows the motion of robot in motion towards towards right.. So, the button for right side is green and all other are in red color.

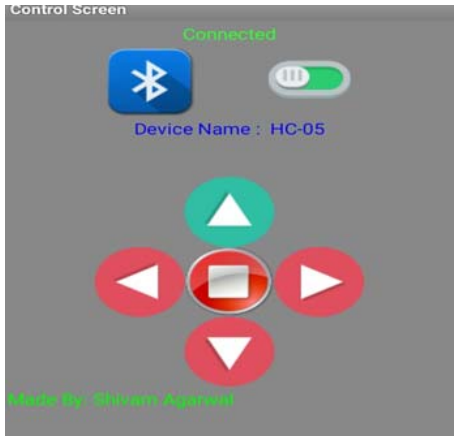

Fig. 5 Forward Motion

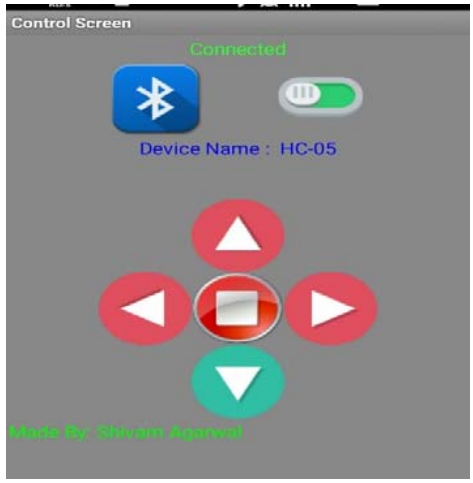

Fig. 6 Backward Motion

Fig. 8 Motion Towards Right

Fig. 8 shows the motion of robot in motion towards left direction. So, the button for left side is green and all other are in red color.

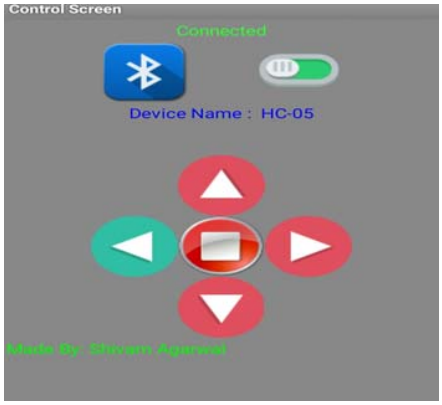

Fig. 8 Motion Towards Left

VI. Receving Data At User End

Android Application

Android application supports real time monitoring of the status of robot. The data from Arduino is send via Bluetooth to mobile which is translated by application for user-view. This help user in real time monitoring of the functions performed on field.

The android application consists of various screens. It includes the connection setup, control screen and Real-Time data monitor. In fig.9 the Connection Setup Screen is shown. When the android application is started, firstly it is connected to robot via Bluetooth, and otherwise all other functionalities remain disabled.

When the application is successfully connected all controls became active, ready to use. Otherwise all other functionalities remain disabled. When the application is successfully connected all controls became active, ready to use.

In robot many different sensors such as infrared sensor, ultrasonic sensors, LDR, NTC Thermistor are mounted on chassis and wheels are connected through geared D.C. motors. LEDs are connected with Arduino showing the motor operations. The glowing sequence of LEDs is mentioned in the Table 1.

The reading from the different sensors are send to android application from Arduino. The data is then displayed on the application with corresponding sensor name as shown in Fig10.

Fig 9 Connection Setup Screen

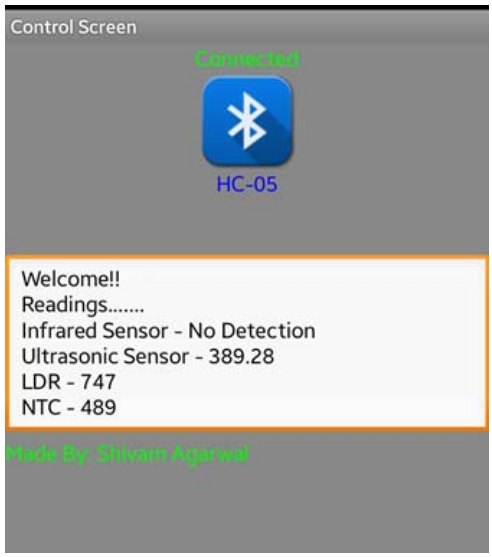

Fig 10 Real Time Data

Table 1: Connection Table of Robot with Arduino Microcontroller

CONDITION	***ARDUINO PINS***	***LEDS***
STOP	PIN 13,12,11,10 HIGH	LEDs L1,L2,L3,L4 GLOW
FORWARD	PIN 13,11-LOW PIN 12,10-HIGH	LEDs L2, L4 GLOW
BACKWARD	PIN 13,10-LOW PIN 12,11-HIGH	LEDs L2, L3 GLOW
MOVE TOWARDS LEFT	PIN10,13 -LOW PIN 12,11 -HIGH	LEDs L2, L3 GLOW
MOVE TOWARDS RIGHT	PIN 11,12-LOW PIN 10,13-HIGH	LEDs L1, L4 GLOW

VII. Testing Of Robot Software Development Of The Arduino

- The Arduino code is basically for testing the motion where android application is linked to robot via Bluetooth and control motion of motors in the field is tested.
- The inconsistencies are improved by taking multiple actions by optimizing them to accurate direction.

VIII. Conclusion

This paper presents the robotic system for android supported device which can be modelled by various purposes using algorithm for comfort to people and can be interfaced by using Arduino board and various types of sensors. Various aspects show it serves better result than manual system. To install smart android application for smooth movement of robot. Implementation of this robot has significant saving in terms of time, efficiency and saving the wastage of resources and reduced utilization of manpower should pay the cost once the system is activated.

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