

SMART PHONE BASED ROBOTIC CONTROL FOR SURVEILLANCE APPLICATIONS

M.Selvam¹

¹M.E. Embedded Systems, Dept. of ECE, Karpagam University, Coimbatore, Tamilnadu, India-641021

Abstract

The robotics and automation industry which is ruled the sectors from manufacturing to household entertainments. It is widely used because of its simplicity and ability to modify to meet changes of needs. The project is designed to develop a robotic vehicle using android application for remote operation attached with wireless camera for monitoring purpose. The robot along with camera can wirelessly transmit real time video with night vision capabilities. This is kind of robot can be helpful for spying purpose in war fields.

Keywords: Android, Robot, Bluetooth, Robotic control

1. INTRODUCTION

The advent of new high-speed technology and the growing computer Capacity provided realistic opportunity for new robot controls and realization of new methods of control theory. This technical improvement together with the need for high performance robots created faster, more accurate and more intelligent robots using new robots control devices, new drivers and advanced control algorithms. This project describes a new economical solution of robot control systems .In general; the robots are controlled through wired network.

The programming of the robot takes time if there is any change in the project the reprogramming has to be done. Thus they are not user friendly and worked along with the user preferences. To make a robot user-friendly and to get the multimedia tone in the control of the robot, they are designed to make user commanded work. The modern technology has to be implemented to do this. For implementing the modern technology it should be known by all the users to make use of it. To reach and to full-fill all these needs we are using android mobile as a multimedia, user friendly device to control the robot. This idea is the motivation for this project and the main theme of the project.

In this modern environment everybody uses smart phones which are a part of their day-to-day life. They use all their daily uses like newspaper reading, daily updates, social networking, and all the apps like home automation control, vehicle security, human body anatomy, health maintenance, etc has been designed in the form of applications which can be easily installed in their hand held smart phones. This project approached a robotic movement control through the smart phones.

Hence a dedicated application is created to control an embedded robotic hardware. The application controls the

movement of the robot. The embedded hardware is developed on 8051 microcontroller and to be controlled by a Smartphone on the basis of Android platform. 8051 controller is to receive the AT commands from the Smartphone and takes the data and controls the motors of the robot by the motor driver L293D. The robot can able to move forward, reverse, left and right movements. The Smartphone is been interfaced to the device by using Bluetooth. A Bluetooth device HC-05 module is going to be added to 8051 microcontroller to receive commands from smart phone. A wireless camera is mounted on the robot body for spying purpose even in complete darkness by using infrared lighting.

2. RELATED WORK

2.1 A Bluetooth-based Architecture for Android Communication with an Articulated Robot

An Articulated Robotic Arm which is used in Industry was proposed by Sebastian van Delden and Andrew Whigham. It can be controlled by an android device in an industrial fixed setup. It can pick and place, and do some welding works which human can't do. By using the device control we no need to reprogram for every time we use the robot for different works. It can connect various types of other robot too for controlling them.

In industrial robotic environments there are many different robots performing a variety of tasks. Each robot is controlled by its own teach pendant or via a networked socket application. However, to monitor the status or make minor changes to the programming of the robot, the user must obtain access to the pendant or terminal. In an effort to eliminate this need, this paper introduces an android platform that communicates with robots over a Bluetooth connection.

Practical applications: To demonstrate one of the practical uses of this application, a typical manufacturing floor environment was simulated. Two Robotic systems were set up with looping programs. The first simulated a spot welding line by visiting a starting point just above an apparatus containing a model vehicle and then quickly visiting six points around the model. The second simulated a palletizing line where the robot was programmed to pick and place a cylinder up from a pallet and place it into another pallet and vice versa. Each system was equipped with the typical “stop emergency” and “stop normal” commands that are commonplace in factories.

The stop emergency command breaks the robot immediately while the stop normal command allowed the robot to finish its current cycle in the program.

The robots were then connected to the Bluetooth server application and the Android application was started. This demonstration showed the case in which a user could switch between robots running different programs quickly and send those robot commands. Both commands executed very well on both simulations. [4]

2.2 Development of A Wireless Device Control Based Mobile Robot Navigation System.

The system is proposed by PheySiaKwek, Zhan Wei Siew, Chen How Wong., BihLiiChua, Kenneth Tze Kin Teo. The general computer with well-designed software Centralized software can control the moveable mobile robot. The commands send through the mobile device they used Wi-Fi as a transmission protocol. The robot is set on a moveable platform and can be assisted with an IR reflective terminal to avoid collision of the robot. The IR signals help the robot to find the correct path with no obstacles. The mobile controller is a Tablet.

Tablets are highly functional and flexible platform to pair with robotic autonomy and navigation control. The advantage of remotely controlling robots using mobile devices is location independence. New research is merging towards more applications for mobile devices with robots. In this paper, the design and development of a mobile robot system with tablet is presented in detail. The wireless communication interfaced between the microcontroller and tablet is described. [3]

2.3 Range based Navigation System for a Mobile Robot.

Range detector navigation system is proposed by Neil MacMillan, River Allen, Dimitri Marinakis, Sue Whitesides. They have designed the system to detect an obstacle free path by using the mobile robot. The robot senses the obstacle by using ultrasonic sensor. The path obstacles are found by the sensor and are transmitted to the controlling device. It uses

general RF communication. The range of the device is higher than the other projects but it is old type of communication technique. The range of the path is identified and are easily selected the good path. [1]

2.4 Mobile Robot Temperature Monitoring System Controlled by Android Application via Bluetooth

T. Maria Jenifer, T. S. Vasumathi Priyadharshini, Raja Lavanya & S. Raj Pandian were proposed a autonomous robot system which can sense the environment temperature and transfer the value to a php server via Bluetooth android application. [5]

3. PROPOSED SYSTEM

In existing systems were used the DTMF based and GSM based Robotic Control has a reasonable drawbacks such as the system requires more energy, The controlling unit and robot unit are must be in Line of Sight, For different mobile phone the controlling unit must be reprogrammed, so thus the operation of the system is Mobile phone Dependant. In DTMF Standard, and the Cable Standards are the main constraints of the system

To overcome these problems a new system is proposed to perform the robotic control by a smart phone. Which acts as a transmitter unit and it is interfaced with robot by Bluetooth module. AT commands for robotic controlling and turn on and off of the night vision camera is carried by the android application Thus a motion video is captured by the camera will transmitted to a TV unit through RF signal.

Our proposed system is dividing into 2 parts as RF transmitter and Receiver, the block diagram of these two parts are shown in fig

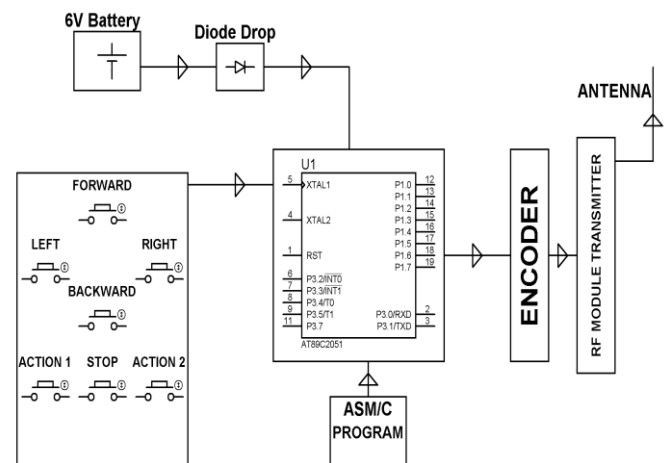


Fig1: Transmitter

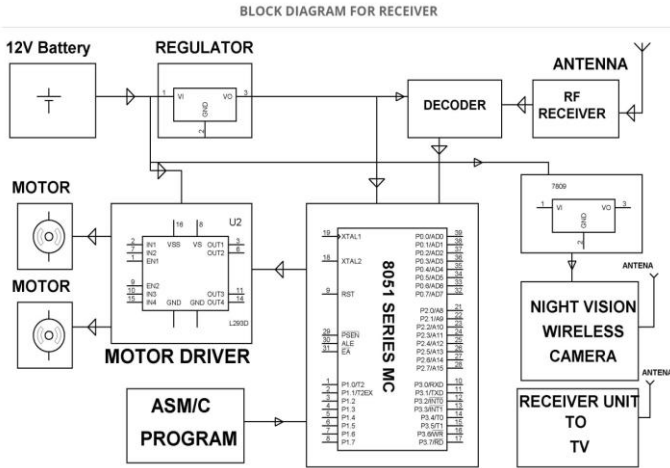


Fig 2: Receiver

In the Transmitting end we have RF Encoder capable to cover 100meters distance and unidirectional nature is used which operates the frequency on 433MHZ. To control the RF encoder and Transmitter Atmel 89c2051 is used which is 20pin version of 8051 microcontroller.

In Receiver section Atmel 89c51 microcontroller was used to perform the motor control according to the Bluetooth commands .Here HC-06 Bluetooth receiver module is used in slave configuration which interfaced with UART module of the 8051 microcontroller. The Bluetooth characters and received by RXD pin of 8051 microcontroller. For Receiving RF signal the HT 12D RF decoder and Receiver is used. A Wireless camera was mounted on the Robot chassis to capture the video up to 50metres distance without loss which can operate video frequencies, usually somewhere between 50 MHz and 30 GHz, within a certain radius. To control the Robot L293D motor driver controller is used in this system. It is used to make the rotation on the DC motor which is used as the Robot wheel according to the commands such as forward, backward, left and Right.

4. ANDROID APPLICATION

Android is a very familiar word in the world today. Millions of devices are running the Google Android OS and millions are being developed daily. Google has made the Android development platform open to everyone around the world, so there are millions of developers. Although some developers just focus on building the apps or games for the android devices, there are numerous possibilities as well.

App Inventor for Android is an application originally provided by Google, and now maintained by the Massachusetts Institute of Technology (MIT).It allows anyone familiar with computer programming to create software applications for the Android operating system (OS). It uses a graphical interface, very similar to Scratch and the Star Logo TNG user

interface, that allows users to drag-and-drop visual objects to create an application that can run on the Android system, which runs on many mobile devices.

The first phase of application design goes through App Inventor Designer. Designer is accessible through the web page and all the ingredients for the app are available on the left side of the window. The ingredients include elements like a screen for the app, buttons for tapping, text boxes, images, labels, animations and many more. The right side of the designer allows users to view the screen and components added to the screen. Additionally, the properties section of the window allows users to modify the properties of components.

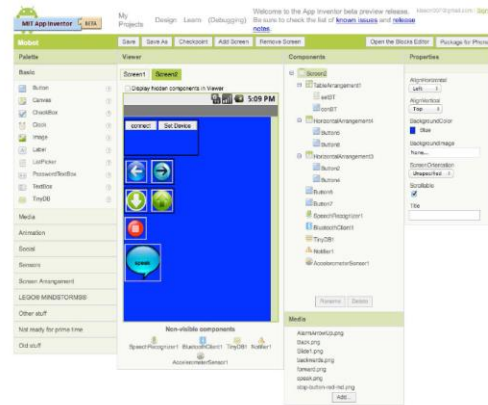


Fig 3: App Inventor Designer

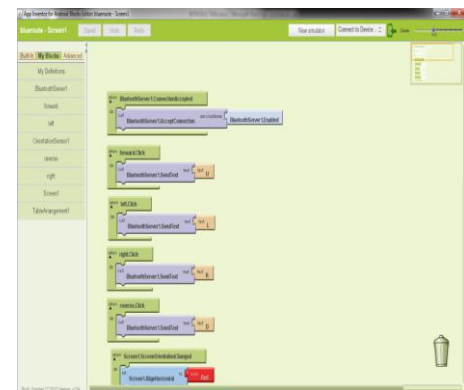


Fig 4 Apps Inventor Block Editor

In this apps development the App Inventor provides a versatile opportunity to develop a customized application starts with establish a Bluetooth connection by searching the available Bluetooth devices and make pair with them. For Robotic Movement assign a Character for each operation such as Forward –‘U’, Backward –‘D’, Left –‘L’ and Right –‘R’. These characters were transmitted to 8051 microcontrollers UART module via Bluetooth Device HC-06 which can transmits the character in 9600baud. The App Inventor has a feature to test the operation using Emulator

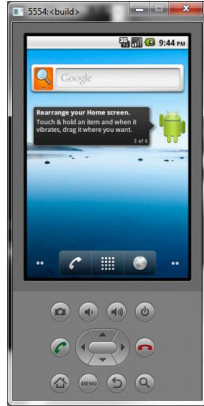


Fig 5: Android Apps Emulator

5. OPERATION OF THE SYSTEM

The project is designed to control a robotic vehicle using an android application. Bluetooth device is interfaced to the control unit on the robot for sensing the signals transmitted by the android application. This data is conveyed to the control unit which moves the robot as desired. An Atmel 89C51 microcontroller is used in this project as control device.

Remote operation is achieved by any smart-phone/Tablet etc., with Android OS, upon a GUI (Graphical User Interface) based touch screen operation. Transmitting end uses an android application device remote through which commands are transmitted. At the receiver end, these commands are used for controlling the robot in all directions such as forward, backward and left or right and captures the video and transmits to TV through RF signal

At the receiving end the movement is achieved by two motors that are interfaced to the microcontroller. Serial communication data sent from the android application is received by a Bluetooth receiver interfaced to the microcontroller. The program on the microcontroller refers to the serial data to generate respective output based on the input data to operate the motors through a motor driver IC. The motors are interfaced to the control unit through motor driver IC.

6. CONCLUSIONS

In this project, we achieved control both wireless communication between the mobile Robot Android GUI Application. The main task of this project make a surveillance robot which can be control by emerging android technology .It gives versatile operation of robot controller which need not modify the hardware

This system can further be developed by enhancing the performance and by adding more features. Further development of this system depends on the application we are using an area of work. The system can be added features like gas sensor, thermal image sensing, connecting robotic arms

and can be used in pick and place purposes etc... can be done. The development of this system has wide area of applications such as in Military and Law enforcement and Industrial and in Disaster management and so on.

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BIOGRAPHIE



The Author is a PG scholar in embedded systems at Karpagam University. He had a Teaching Experience of 4 years .He has completed his Master of Science Degree in Electronics and communication systems at Bharathiar university in 2009 and his M.Phil degree in Electronics at Bharathiar university in 2012.