

Android Based Beaglebone Spybot

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Abstract— This paper explains the basic concept of a spybot, which is robot used for spying purpose. We are controlling beaglebone black based robot wirelessly. Process of initializing beaglebone black using debian. Android operating system based robot platform and smart phone operated control and monitoring system are introduced. In this work, concept of Beaglebone black and Android operating system are correlated. Review of different kind of android controlled robots which uses voice controlled android application to control robot.

Index Terms— spybot; android; smart phone; beaglebone black

I. INTRODUCTION

Technically a Robot is a machine which includes different field of engineering and in general it is the working partner of us in the field in the entire situation like in our house, in industries, in laboratory, in space and even for playing children. In recent time, information technology tends to be more smart and human-friendly. The main theme is the appearance of smart phone. Spybot is basically a robot which is used for spying purpose. This can use in military and many more fields. A Robot for a spying purpose means which can saw us the real time video of the particular place. Spybot is a robot which is having camera, connected to robot body. Camera provides live video streaming of place where ever it travels [1].

Mostly robots are controlled based on remote control but the problem is range if controlling for increasing range of controlling it better to use a Wi-Fi module which can access by a smart phone.



Fig 1: Communication using wifi

Here, we are using beaglebone black because it is having less cost and higher performance than other controllers. Beaglebone black is having Cortex A8 series 1 GHz processor in it [4].

It also has incredible number of GPIO pins 65 pins which is good for external sensors. We can add multiple external sensors in robot using GPIO [7].

II. INITIALIZE BEAGLEBONE BLACK

Beaglebone black is running on 5V DC power supply. Wired connection of the beaglebone black is by connecting a charger which gives 5V DC output. For power up beaglebone black wireless there are few ways which works with using a LTC3529 which is controlling the voltage of Li-ion battery. Another easy way of power up beaglebone black is using power bank. It is better use power bank which is having inbuilt control over voltage. Using power bank beaglebone can easily power up by just connecting usb with it [7].

Beaglebone black is having in built cloud9 IDE. Cloud9IDE provides an open source integrated development environment in the cloud. Once if beaglebone connected to computer it will provide an IP address. By entering that IP address in browser we can access particular Cloud9 IDE for that beaglebone black [8]. Beaglebone black it can be run using different types of operating system. Debian is one of the operating system which is used for programming in beaglebone black. After connecting beaglebone black to the computer via Ethernet cable, there is software named "PUTTY" which is used to access debian OS on beaglebone black. Beaglebone black can access by putty using IP address of Ethernet connection. After connecting the IP address it will show a command window.

By entering username "root" we can have a baud rate of the board which is 5900. Then software called TightVNC viewer will ask for recommended IP and baud rate for Beaglebone black. After entering that viewer will show the Debian running over Beaglebone black [8].

III. LITERATURE SURVEY

The following papers are useful for the study of smartphone controlled robot.

(a) Wi-Fi connection with smartphone and application of robot:

This system consists of two parts, one is smartphone, and the other is the robot host. The former is equipped with Android system and WIFI function, and the effective coverage of the radio waves is 100 meters, so we can develop effective remote control program. And the latter is equipped with wireless network card which is compatible with 802.11 N standards. In addition, the smartphone makes network with the robot through its own WIFI network function, and it can help robot to accomplish the various functions via some auxiliary commands that can be realized by some applications during their courses. In this system, the networking mode is Ad - hoc without wireless router [3].

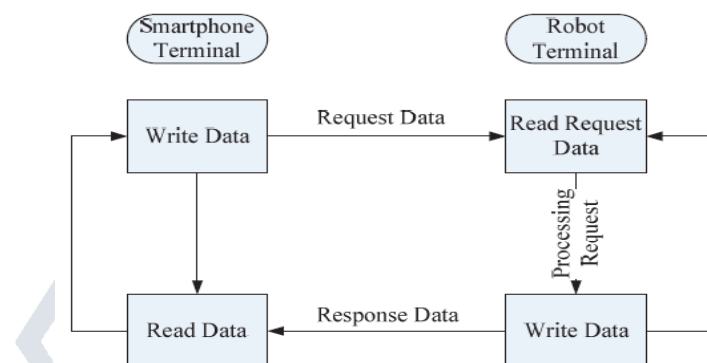


Fig 2: Communication is in progress between smartphone and robot [3].

The operating system of smartphone is Android, and it can develop effective remote control program. At the same time, this program uses double threads and synchronous network sockets to communicate with robot.

At present, the functions can be realized such as stopping robot to speak, closing a thread, updating face feature library, supplementing grammar, and so on.

On the one hand, the smartphone supports IFLYTEK voice input and handwritten input, so it is agile, convenient, practical to be used and can ensure the reliability of the whole system, on the other hand, by using WiFi wireless network, the communication between smartphone and robot can be realized, which makes it simple and convenient to control robot to sing and dance in accordance with the commands [4].

(b) Robot which works using NXT intelligence brick:

A robot is controlled by smartphone using Bluetooth technology. The robot has to be built before to be controlled while the Bluetooth module has to be included in the project. It is not enough to have an Android device and a robot. These two devices have to be connected and programmed to share information. The Mind storms Robotics Invention System kit contained three servo motors and one light, sound and distance as well as 2 touch sensors and support for 4 without using a sensor multiplexer. NXT-G is a graphical programming environment that comes bundled with the NXT [2].

The main component in the construction kit is brick shaped computer with a 32-bit microcontroller, Bluetooth communications and USB port. It can take input from up to four sensors and control up to three motors. The brick has a 100×60 pixel monochrome LCD display, speaker and can play sound files at sampling rates up to 8 kHz and four buttons that can be used to navigate a user interface using hierarchical menus [2].

The flash memory is used not only for firmware, but also for saving programs, pictures and sounds. The flash memory is rewritable. The firmware for the NXT intelligent brick provides the control program for the device and has been released as open source, along with schematics for all hardware components. One of the tasks of the firmware is to cooperate with the programming language. Different firmware can be flashed to the NXT Intelligent Brick [2].

For communication between the model and the mobile device, we can use Bluetooth or Wi-Fi. Regarding the transmission speed, communication via Bluetooth, which in asynchronous mode can handle 720 kbps, is compared to Wi-Fi with 11Mbps several orders slower. Wi-Fi has also a greater reach, but for the purpose of this work it was not important. On the other hand, because Bluetooth has lower power requirements than Wi-Fi, for this reason is much smaller and is thus part of NXT cube.

But the NXT intelligence brick is very costly as compared to Beaglebone black. This is drawback of NXT intelligence Brick. Beaglebone black is having more GPIO pins then NXT intelligence brick so it is possible to connect more than 4 sensor n a robot. NXT intelligence brick don't allow more than 4 external sensors.



Fig 3: NXT intelligence brick [2]

(c) Web based robot controlling:

The main contribution of this paper is a robot programming architecture based on the web Which allow users to directly edit, run and control robots' programs remotely using web browsers [5].

Smartphone is connected to robot hardware which gives access of Smartphone's camera, sensors, display, etc. This robot is using all the basic need for performing task is used from smart phone where it is creating ad-hoc Wi-Fi network using Smartphone. Ad-hoc Wi-Fi network can created by enabling hotspot on smart phone which can access by Wi-Fi module of the robot. Cost of the robot will be high which uses smart phone for implement as hardware [5].

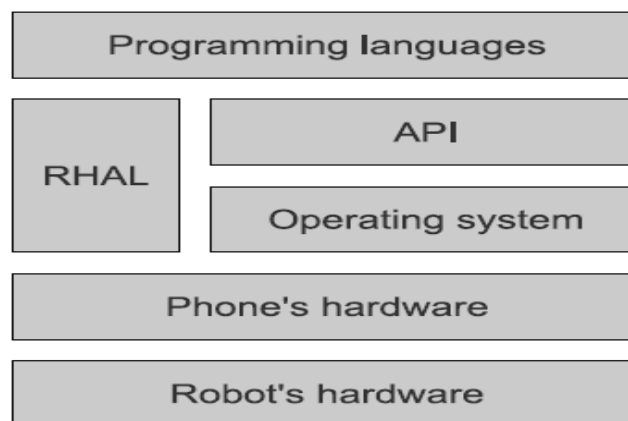


Fig 4: Basic block diagram of smartphone controlled robot [5]

The main actions that the users can do after accessing the embedded web server from a web browser are:

- 1) Source code management
 - a) List programs
 - b) Edit a program
 - c) Start the execution of a program
 - d) Save or "Save as" a program
 - e) Share a program with another person or robot using Bluetooth or email
- 2) Running processes
 - a) List running programs
 - b) View the output of running programs
 - c) Stop a running program
- 3) Monitor and manual control
 - a) Live view from robot's camera
 - b) Execution of manual commands (E.g.: move forward, Stop)
 - c) Exhibition of output dynamically generated by user's programs

All the development is done by accessing a webpage embedded on the robot that has all the editing and execution functions. As it uses only standard HTML, it can be accessed from any browser in any device, even the ones with low hardware resources.

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IV. SUMMARY AND FUTURE WORK PLAN

For a fast and stable performance of spybot it is required better hardware. Using beaglebone black for robotics is very reliable in cost, performance, and for future expansions of the project because Beaglebone black is having higher number of GPIO pins. By cloud9 IDE of beagle bone black, it is easy to code for any task.

For controlling beaglebone wirelessly, power bank is best option over other bulky circuits which may have problems of reverse current and it may be damage the board. By This feature of spybot, it can work for more time as in it has enough power sources. Our work is to improve performance of spybot with lower cost can be done by using beaglebone black. In future planning of the project we will implement a camera with beaglebone black and making an application for the android smart phone which will control spybot.

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