



# SPY SURVEILLANCE ROBOT SYSTEM USING ARDUINO

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## ABSTRACT

Surveillance is the process of monitoring a situation, an area or a person. This generally occurs in a military scenario where surveillance of borderlines and enemy territory is essential to a country's safety. Human surveillance is achieved by deploying personnel near sensitive areas in order to constantly monitor for changes. But humans do have their limitations, and deployment in inaccessible places is not always possible. Thus, in recent times, surveillance technology has become an area of great research interest. However, building a small robot for testing and research purposes proves to be extremely expensive. Primarily because a security robot would require certain components such as a GPS module (Global Positioning System), High resolution cameras, radios for satellite connectivity, etc. Each of these components are quite expensive and piecing them together for the purpose of a robot is a very costly and time consuming affair.

We propose a cost-effective four-wheeled surveillance robot using an Arduino UNO microcontroller and a smart phone running the Android Operating System. Surveillance robots typically consist of a video camera, a GPS module, and GSM radios. Android smart phones come with excellent hardware satisfying the above needs. This can be leveraged and used to advantage through APIs (Application Programming Interfaces) provided for the Android operating system. Moreover, the cost for building said robot using a smart phone is mitigated to a great extent. The robot can be controlled remotely from a PC using the internet and a microcontroller-smart phone interface residing on the robot.

To capture and archive the real time video from the robot, the inbuilt camera input of the phone is utilized. The robot can be controlled based on visual feedback from the same smart phone. Four motors help achieve a zero turning radius. The camera is attached to a stepper motor which makes it feasible to capture the scene or object of interest. The captured video can be enhanced and made intelligible using further image processing on the remote PC thereby eliminating the need for extra DSP hardware on the robot. Thus, it is our aim to build a fully-featured surveillance robot using an easily available Android phone, which can be remotely controlled over the internet.

Keywords: Arduino uno, Android phone, mobile application,Bluetooth,Wifi

## 1. INTRODUCTION

A robot is an electromechanical machine that is controlled by computer program to perform various operations. Industrial robots have designed to reduce human effort and time to improve productivity and to reduce manufacturing cost. Today human-machine interaction is moving away from mouse and pen and becoming much more pervasive and much more compatible with the physical world. Android app can control the robot motion from a long distance using Bluetooth communication to interface controller and android. ANDROID UNO can be interfaced to the Bluetooth module through UART protocol and code is written in embedded C language. As per the commands received from android app the robot motion can be controlled. The output motion of a robotic vehicle is accurate and repeatable. Pick and Place robots can be reprogrammable and tool can be interchanged to provide for multiple applications. The purpose of this work is to

design and implement an Android Controlled Bluetooth Robot which is used for Surveillance, home automation, wheelchairs, military and hostages Rescue applications.

**II. SYSTEM DESIGN AND ARCHITECTURE**

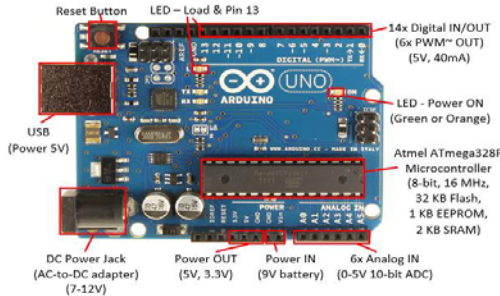


Fig.-1: Arduino Uno Board

Arduino Uno R3 This is the brain of robot loaded by a program written in embedded c language to do the required functioning and is interfaced with bluetooth module. The motor driver are used to make the system work as required.

**1.1 DC Motor**

DC Motor HC -05 Bluetooth module. D.C. motor is controlled by DC voltages and moves in forward, backward, left and right, direction according to the polarity of voltage applied. Mostly all mechanical movement which robot performs is accomplished by an electric motor. Electric machines are means of converting energy into mechanical energy. Electric motor is used to power devices. An example of small motor applications such as motors used in automobiles, robot, hand power tools and food blenders. Micro-machines are electric machines with parts the size of red blood cells and find many applications in medicine.

**III. SYSTEM ARCHITECTURE**

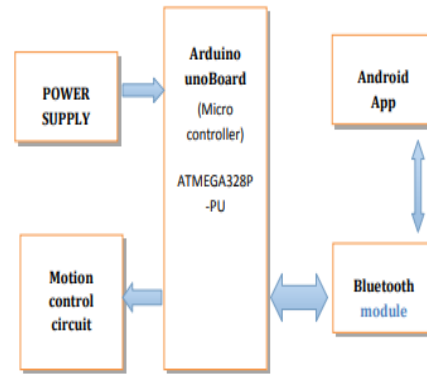


Fig -2 System Architecture

A robot can be controlled using Bluetooth module HC-05 and ATMEGA328P-PU microcontroller with android Smartphone device. The controlling devices of the whole system are a microcontroller. Bluetooth module, DC motors 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 indicators of the Robot system. In achieving the task the controller is loaded with program written using Embedded 'C' Languages. Android smart phone controller Bluetooth

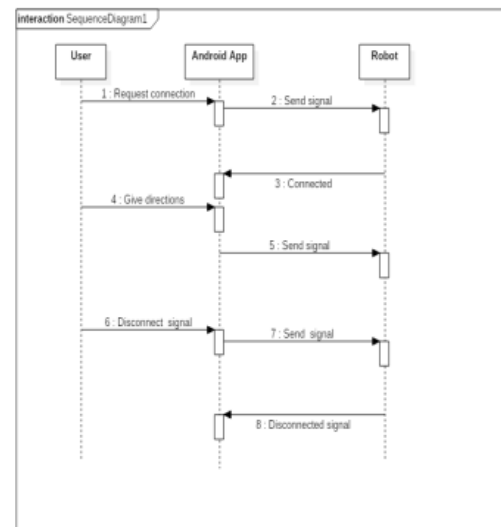
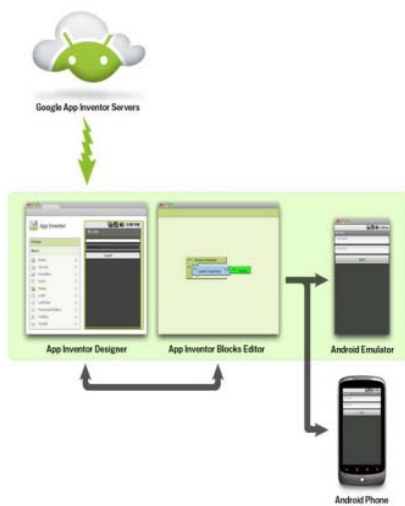


Fig -3 Sequence Diagram

**IV. SOFTWARE IMPLEMENTATION**

**4.1 MIT App Inventor**

(to build GUI for Android application) App Inventor for Android is an open-source web application provided by Google and now maintained by the Massachusetts Institute of Technology (MIT). It allows computer program to create software applications for the Android operating system (OS). MIT App Inventor is an innovative beginner's introduction to programming and app creation that transforms the complex language of text-based coding into visual, drag-and-drop building blocks. The simple graphical interface grants even an inexperienced person to create a basic, fully functional app within an hour or less.



**Fig -4. App Inventor**

App Inventor involves three aspects: (i) App inventor designer,  
 (ii) App Inventor Blocks editor, and  
 (iii) An emulator or Android Phone.

The set-up process for the software is very easy and system requirements are very basic. It is compatible with Mac OSX, Windows and Linux Operating systems. Browsers required for the software are Mozilla Firefox 3.6 or higher, Apple Safari 5.0 or higher, Google Chrome 4.0 or higher and Microsoft Internet Explorer 7.0 or higher. (App Inventor 2012) 4.2 App Inventor Designer The first phase of application design passes 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 contains 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.



Adding the components to the screen is a simple drag-and-drop process. The alignment of the components can be managed through alignment options. Several non-visible components are also added to the screen, which are explored later in the blocks editor. On the left of the screen is a list of the components which can be dragged and dropped onto the Android screen. To the immediate right of the Android screen is a list of the current screen components: a ListPicker, two Buttons in a Horizontal Arrangement and a "hidden" Label, hidden because it is initially blank. There is also a non-visible bluetooth client at the bottom of the screen. To the far right of the Android screen are the properties of the currently selected component - in this case the Label, Label1 is selected. If we click on the Blocks Tab and then click on the ListPicker1 component on the left hand side of the screen. A scrollable list of code blocks relevant to theListPicker1 appears. Click on "When ListPicker1 BeforePic king" and it will be placed onto the Blocks screen area.

## V. ANDROID APPLICATION

Spy Robot is the name of the android application designed for this project. It was designed through App Inventor. The basic function of the application is to control the robot (created with Arduino and Chassis). It has

different buttons integrated to it and each button has different functions.



**Fig -5 Android Application**

### 5.1 Buttons

There is a total of six buttons in the application. One of them are for preparing the device to communicate with the robot. Four of them are for commanding the directions. One is for stopping the motion of robot

#### Set Device and Connect Buttons

The first button is the set device button. When the button is tapped the application takes the user to a window with the list of Bluetooth devices available. Tapping the right device allows the user to come back to the main window which awaits the user with the activated connect button which when clicked connects the application to the robot allowing the user to use other buttons available.

#### Software Tools:

Arduio For writing code in assembly and simulation of code, Arduino software plug-in to write code in C. Compilers: IAR, Image Craft. Code Vision Arduino Program type: Application Clock frequency: 7.372800 MHz Memory model: Small Programming Digital I/O pins of Arduino UNO board: • Each pin is controlled by three commands associated with it which are designated as: pinMode() digitalWrite() digitalRead() • pinMode() This configures the specified pin to behave either as an input or an output.

Syntax

pinMode(pin, mode)

digitalRead() Reads the value from a specified digital pin, either HIGH or LOW.

Syntax

digitalRead(pin)

Parameters pin: the number of the digital pin you want to read (int) Returns HIGH or LOW

## VI. EXPERIMENTAL RESULTS:



## VII. CONCLUSIONS

The operating system of smart phone is android which can develop effective remote control program. At the same time , this program uses blue-tooth connection to communicate with robot. It has proven to allow for meaningful two-way communication between the Android phone and the robot which would allow a non-expert to interact with and adjust the functionality of a system which uses ATmega328 controller, a single board micro-controller intended to make the application of interactive objects or environments more accessible. The surveillance is always has been a quite sensitive task. And it includes so many risks. So it's better to use robot for this job instead of people. And if you are able to control the robots with efficiency and accuracy then you can guarantee yourself with good results and success. This system is a good step for secure surveillance using robots. Wireless control is one of the most important basic needs for all the people all over the world. But unfortunately the technology is not fully utilized due to a huge amount of data and communication overheads. Generally many of the wireless-controlled robots use RF modules. But our project for robotic control make use of

Android mobile phone which is very cheap and easily available. The available control commands are more than RF modules. For this purpose the android mobile user has to install a designed application on her/his mobile.

### **VIII. FUTURE SCOPE**

A wireless camera is mounted on the robot vehicle for spying and surveillance purpose even in night time by using infrared lighting. Future modifications can be made to perform different tasks with precise control such as: A Robot Mounted with camera→ A headset, with a full-color display→ A mission control centre→

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