International Journal of Ethics in Engineering & Management Education
Website: www.ijeee.in (ISSN: 2348-4748, Volume 1, Issue 4, April 2014)

Android Based Bluetooth Controlled Robot

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Abstract—Technology becomes more and more advanced in all areas. Smart phones technology and assistant robots can be devoted to help us and improve our life .The Android Mobile Phone Platform by Google becomes more and more popular among software developers ,because of its powerful capabilities and open architecture. As its based on the java programming language. This system makes use of an android application on Bluetooth enabled device, by which remote movement of robot is possible and it comprised of robotic arm to hold and release the hazardous object which are threat to human and detecting the surrounding environment conditions by making use of gas and temperature sensor and has a wireless camera mounted on the robot to monitor the area where robot has been sent. The live video also monitors the robot activity, such as placing of objects to the safer place.

Key Words—Atmega8L Microcontroller, Sensors, Android mobile, Bluetooth, Robotic arm, Wireless camera, AVR-Studio.

1. INTRODUCTION

The main purpose of this system is to develop a remote user interface to control a robot via a wireless technology. Robots have replaced slaves in the assistance of performing those repetitive and dangerous tasks which humans prefer not to do, or are unable to do due to size limitations, or even those such as in outer space or at the bottom of the sea where humans could not survive the extreme environments. There is a need to communicate with the robot remotely in order to control the robot movements and pass critical data both ways. The current IR controls are not good enough because the robot does not have an IR transmitter but only a receiver, meaning that the communication is one way.The IR communication works only in line of direct sight and any objects in the way will obstruct the communication. Bluetooth communication will enable us to control the robot up to 10 meters without the need for direct sight which means that the robot could be located behind a wall or some other object and the communication would not be lost.

Android is open source and Google releases the code under the Apache License. This open source code and permissive licensing allows the software to be freely modified and distributed by device manufacturers, wireless carriers and enthusiast developers. Additionally, Android has a large community of developers writing applications (apps) that extend the functionality of devices, written primarily in a customized version of the Java programming language. Android had a worldwide Smartphone market share of 75% during the third quarter of 2012, with 500 million devices activated in total and 1.3 million activations per day, Applications are developed in the Java language using the Android software development kit (SDK).The officially supported integrated development environment (IDE) is Eclipse using the Android Development Tools (ADT) plug-in . In Android recently there have been a number of reports that assert iOS (iPhone, iPads) are generating the majority of mobile web traffic (and mobile transactions). This is somewhat strange because of the dominance and proliferation of Android handsets on the market. Below in Table1 and figure1 are comScore's[1] most recent US Smartphone operating system share data. Android has essentially 54 percent of the market to Apple's 34 percent.

Top Smartphone Platforms
3 Month Avg. Ending Oct. 2012 vs. 3 Month Avg. Ending Jul. 2012
Total U.S. Smartphone Subscribers Ages 13+
Source: comScore MobiLens

	Share (%) of Smartphone Subscribers		
	Jul-12	Oct-12	Point Change
Total Smartphone Subscribers	*100.0%*	*100.0%*	*N/A*
Google	52.2%	53.6%	1.4
Apple	33.4%	34.3%	0.9
RIM	9.5%	7.8%	-1.7
Microsoft	3.6%	3.2%	-0.4
Symbian	0.8%	0.6%	-0.2

Table 1 Top smart phone platforms.

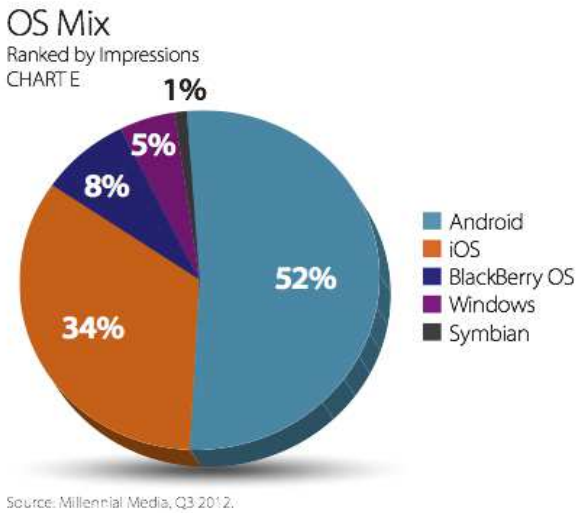

Figure 1:Most preferred Operating system for mobiles

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Most wireless technologies such as Bluetooth and IrDA standard provide the ability to strengthen the local wireless network. Bluetooth technology was created by Ericsson[2] in 1994.Bluetooth module AUBTM-20 is Bluetooth Core V2.0 compliant module with SPP. The module is designed to be embedded in a host system which requires cable replacement function. Typically the module could interface with a host through the UART port.

ATmega8L microcontroller is the AVR core that combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers.

WinAvR20100110[4] is a suite of executable, open source software development tools for the Atmel AVR series of RISC microprocessors hosted on the Windows platform. It includes the GNU GCC compiler for C and C++.
Atmel AVR Studio 4 is great tool to write code for Atmel microcontrollers. It has some great features. There Integrated assembler and simulator in the software and it is easy to use as compared to other tools.

2. HARDWARE AND SOFTWARE DESIGN.

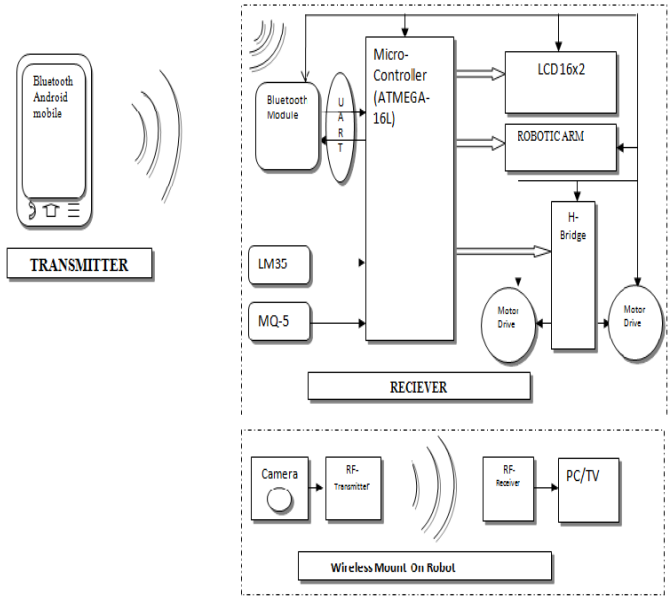

Figure 2:System Architecture

We use an android mobile phone with a built-in Bluetooth adapter as the remote controller for robot. Android phone does not come with a mobile application to control the robot, the android app has to be developed and it helps to transmit the data to the robot through the Bluetooth protocol.
The data transmitted through the mobile are the ASCII values which are received by the Bluetooth module connected to the microcontroller ATMEGA 8L through the serial communication mode. The Bluetooth module is the full duplex communication which could receive and transmit the data.The received data from the Bluetooth module is transmitted to the ATMEGA 8L through the Tx port where the ASCII values are received and are used for robotic movements. The microcontroller program makes the decision for the robotic movements which instructs the Robotic Arm or the H-bridge motor driver circuits for the forward, reverse or direction of the Robot.The sensors on the robot LM35 and MQ-6, temperature and gas sensor respectively are used to note the temperature of the remote area and any gas leakage intensity. These sensor values are obtained by the microcontroller transmits to the mobile phone through the Bluetooth module. By which remote temperature and gas leakage can be noted. A wireless surveillance camera is mounted on the robot to monitor the materials or hazardous chemicals where the robotic arm is used. The wireless camera uses a RF transmitter and receiver to transmit the images to the PC or TV.

Android application is developed such to receive the signals from the Bluetooth module on robot to the mobile phone and to get the temperature and gas information of the remote place. After turning on the hardware, lcd display initializes with a scroll message displaying the name of the robot “andiRATH” and waits for the instructions from the Bluetooth which is interfaced serially with txd and rxd pins of the controller. PORTB is initialized as output and connected for the movement of robot by dc motors through l293d driver. PB7 – PB4 are connected for the robot’s motion such as forward and backward movement. PB3 – PB0 are connected for the arm movement, wherein PB3-PB2 are configured for up-down movements of arm, and PB1-PB0 are configured for hold and drop of the arm gripper. Lcd is interfaced with controller through PORTD wherein PD4-PD7 are configured as 4-bit input to the lcd with rs and enable pin connected to PD2-PD1 respectively. It displays live robotic movement and sensor updates.

Gas sensor module detects the gas leakage and the output pin sends logic high(5v) or logic low(0v) to the PC0 pin of the controller, Where logic low stands for no gas detection and logic high stands for presence of gas.
Temperature sensor LM35 senses the surrounding temperature around the robot and transmits analog value. It is connected to the ADC Channel1 (PC1 PIN) of the controller. The built in ADC converts analog input to digital value and display it on the LCD screen..

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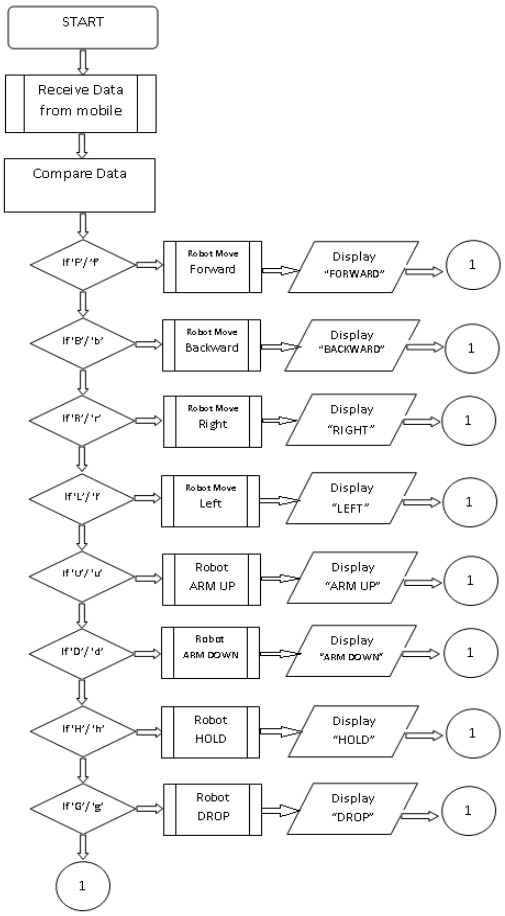
Flowchart for microcontroller



\ Figure 3.1 Flowchart 1A

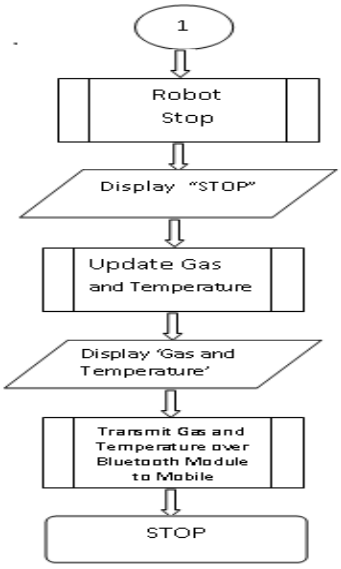


Figure 3.2 Flow chart 1B

In the Figure3.1 and Figure3.2 shows the typical sequence of events when a user runs the application. This sequence diagram assumes the user already has the software on his phone and the robot and it represents an abstract level of the interaction between the system components (mobile application and the robot).

Algorithm for Android Code

- Start
- Pair with Bluetooth module of robot
- Send ASCII code over Bluetooth
  - F: Forward movement
  - B: Backward movement
  - R: Right turn
  - L: Left turn
  - U: Arm up
  - D: Arm down
  - H: To hold
  - G: To drop

  Any other key: Stop or still
- Receive temperature and gas update from module
- Display temperature and gas update on mobile screen
- End

.

At initial, it scans for the available Bluetooth device and pairs with the available device. The input character from the android app is transmitted by Bluetooth adaptor present in the phone to the Bluetooth module on the robot. The above keys mentioned in the algorithm are prescribed for the corresponding robotic movement. For any other key pressed it remains still. Similarly from Bluetooth module remote temperature and gas update are transmitted to the phone and is displayed on the screen.

4. RESULT.

From the system evaluation the following conditions are analyzed**.** When 'f' key pressed in android application the robot moves forward and "forward" is displayed on the lcd display on the robot. As shown in below figure4.1. Similarly 'b' for backward , 'l' for turning left, 'r' for turning right and any other key to stop.

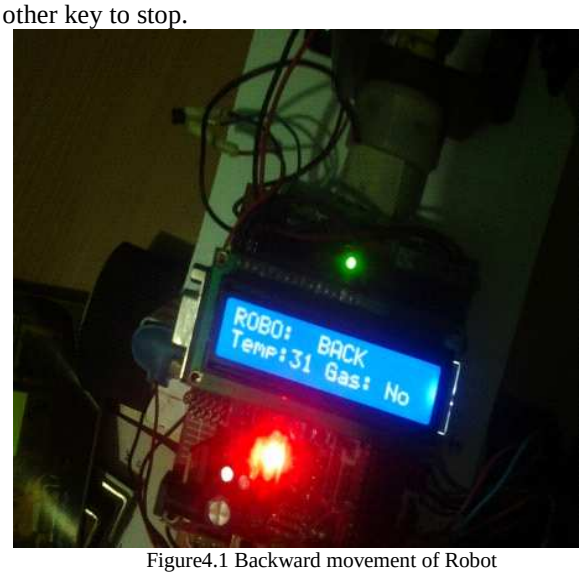


Figure4.1 Backward movement of Robot

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For arm movement, 'u' key is assigned for upward movement and 'd' key is assigned for downward movement and corresponding "arm up" and "arm down" messages are displayed on the lcd present on the robot as shown in below figure4.2

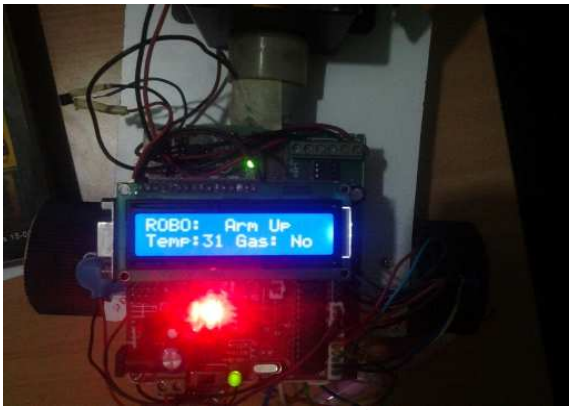

Figure 4.2 Arm up movement of Robot

For the gripper movement, 'h' key is assigned for holding the object and 'g' key is assigned for dropping of object and corresponding "hold" and "drop" message are displayed on the lcd as shown in below figure4.3.

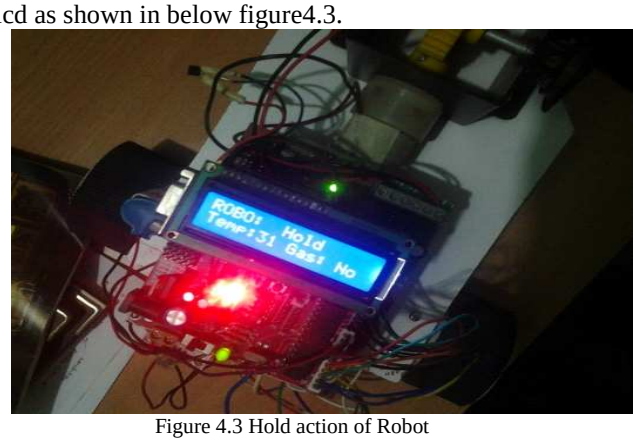

Figure 4.3 Hold action of Robot

When any key pressed the temperature and gas sensed by the corresponding sensors are sent to the mobile phone by the Bluetooth module on the robot and is displayed on the screen of the phone.

Figure 4.4 Displaying of temperature and gas parameters on mobile.

The live video from the wireless camera mounted on the robot is viewed on the tv or pc.

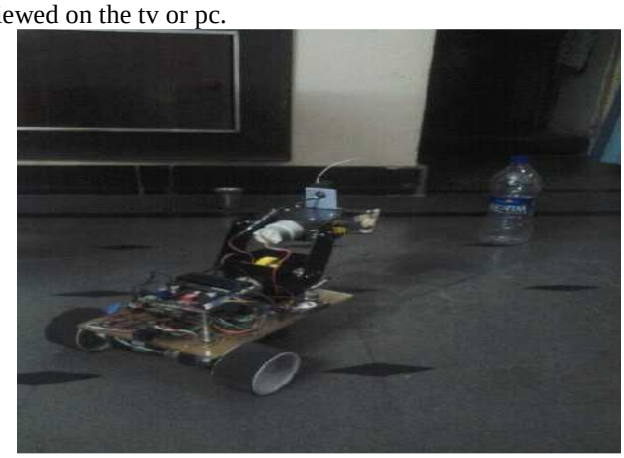

Figure 4.5 Wireless camera mounted on Robot

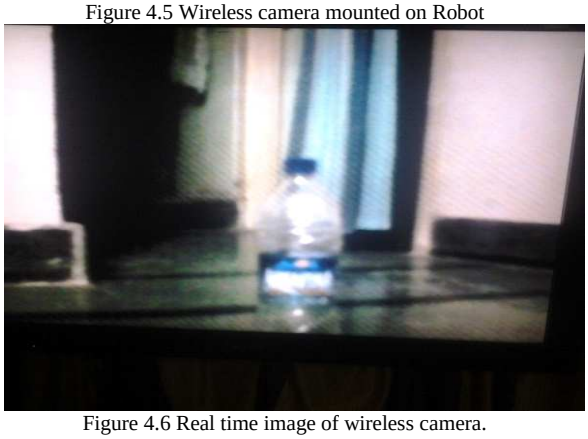

Figure 4.6 Real time image of wireless camera.

5. CONCLUSION AND FUTURE SCOPE

The system use can be extended and exploited by few modifications to do even difficult and hazardous tasks for nuclear applications. It can be used to do work effectively due to its great-added accuracy which wills results the quality improvement in the work. Thus ROBOT is an elite approach in saving the most important human lives. This system tries to automate the entire process and hence address the above mentioned issues.

In the future we have intention to test the system

Instead of the sense of touch or press of key on android phone the tilt of device can be used for the propagation of the Robot

- Wireless surveillance camera mounted on the Robot which streams video can be captured through WIFI onto Android mobile screen.
- The robot can be controlled by any mobile using gps and gsm kit on the robot.
- Using pressure sensor on the robotic arm, precise grip of the object can be controlled.

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