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DESIGN OF GARBAGE COLLECTION ROBOT USING WIRELESS TECHNOLOGY

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ABSTRACT

This paper presents the design of garbage collection robot on using wireless Technology such as WI-FI application. The robot connected to solar panel. The user can control a robot via a program developed from web application based on MVC framework. The commands from user are sent via Wi-Fi router to ESP8266 for processing. By via wireless communication and collect the garbage for example like glass, bottles, papers and plastic, etc. From the experimental, it can clearly indicate that the proposed robot is superior to handle tasking conveniently, control capability, and operate environmentally friendly.

Keywords: robot, wireless, MVC network, garbage collecting robot, solar energy, Wi-Fi, Ultrasonic Sensor

1. INTRODUCTION

In modern times, the world has become a very busy place. This is mainly due to the rapid increase in population as well as physical resources. Along with these two factors, there is another factor which has, in turn , increased at an alarmingly high rate, which is the amount of garbage being disposed. As anyone would expect, this has become one of the major problems that not just our country, but the whole world, has come to face today. This dilemma is not limited to the towns and cities, but even in small villages, the collecting and disposing of garbage has become quite a head ache for the community. With respect to human health and hygiene, as well as the cleanliness of the environment, the effectiveness of garbage disposal is very important. Although the most common ways of disposing garbage are bins and bags, both these methods are implemented manually. This means that garbage disposal becomes a highly time-consuming and difficult process, and places such as schools, restaurants, hotels, offices, production plants are adversely affected. To overcome this possible catastrophe, an automated system, implemented with the use of electronics, introduced in such places, would prove to be highly efficient. It would get the job done easily, with minimal labour and hazards to health, as well as time and money being saved in the process. This idea was the base background for us to undertake this project. The thought of easing the task of collecting and disposing garbage was highly motivating, because we, as university students, are very much familiar with this unpleasant job. So that is where the foundation of our project was laid.

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2. EXISTING SYSTEM

The complete system of garbage collection robot an be shown in Fig. 1 and Fig. 2.

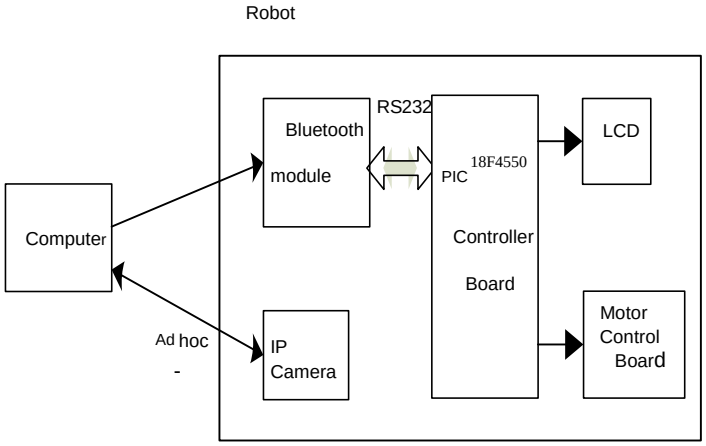

Fig 1: Hardware architecture of garbage collection robot

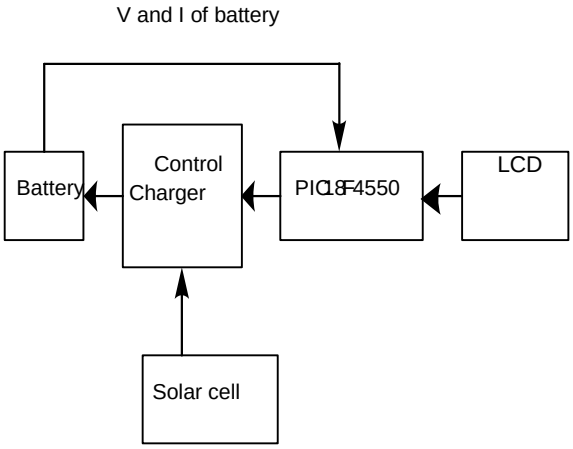

Fig 2: Hardware architecture of power supply

3. PROPOSED SYSTEM

The complete system of garbage collection robot is divided into 8 major parts: (1) power consumption, (2) structure and configuration of the robot, (3)Arduino UNO and LCD (4)Wireless Wi-Fi ESP8266 module, and (5)Ultrasonic Sensor, (6) Half H Driver, (7)Dc Motor, (8)Servo Motor.

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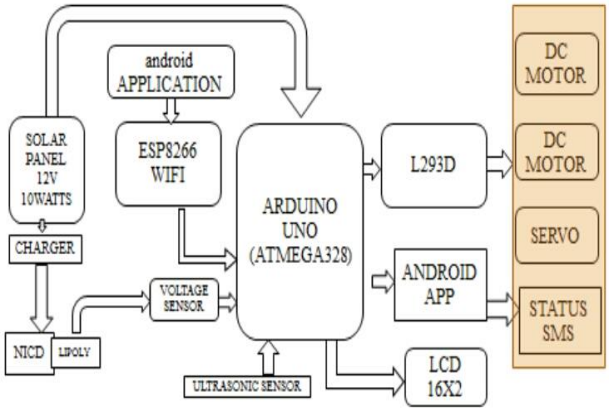

Fig 3: Block Diagram

3.1.1 Power consumption

The primary source of power for the robot is the sealed Lithium Polymer battery (12V 30Ah). The voltage regulator (LM7805) is used to reduce the 12 V dc from battery to 5 V dc for supplying the Arduino and Ultrasonic Sensor. Forty watts of solar cell is used to charge the battery.

3.1.2. Structure and configuration of the robot

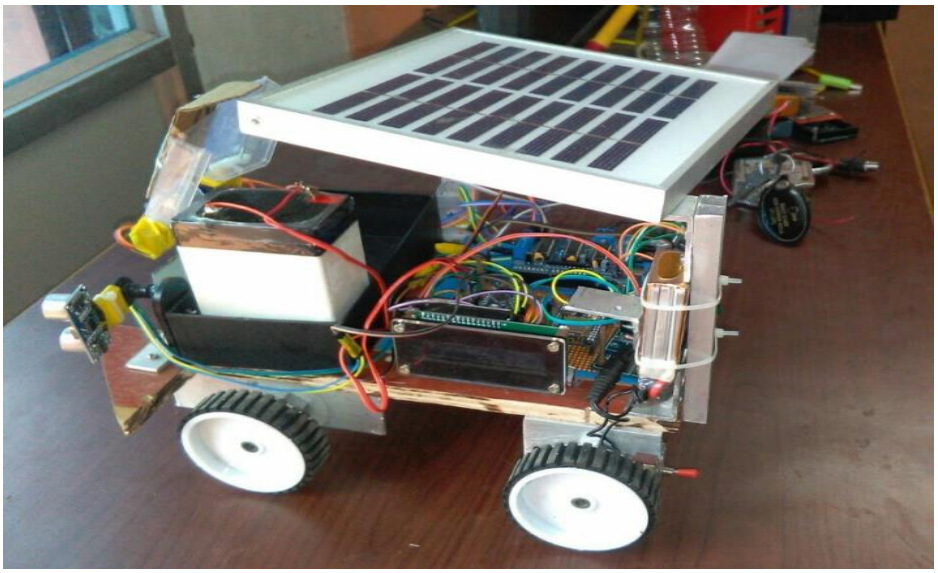

Fig 4: Hardware Implementation of Garbage Collection Robot

The structure of the robot is made of aluminums sizes 52x74x17 centimeters. The shovel of the robot width is 49 centimeters and the trash box in the robot sizes 35x36x40 centimeters. The prototype of the robot can be shown in Fig.

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3.1.3. Arduino UNO

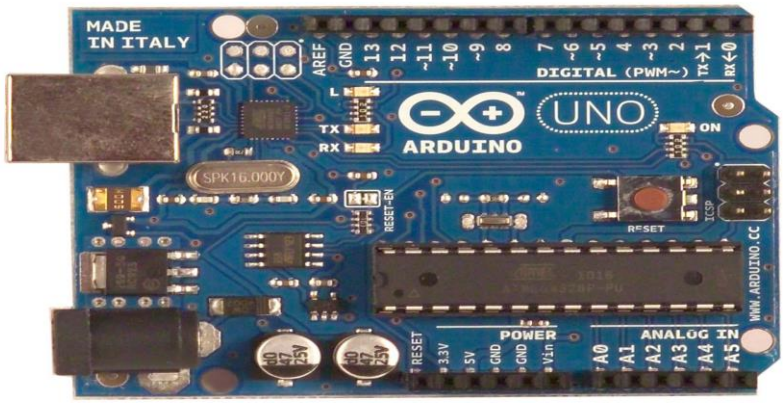

Fig 5: Arduino UNO

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input and output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, aUSB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to supportthe microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapteror battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.

3.1.4. LCD

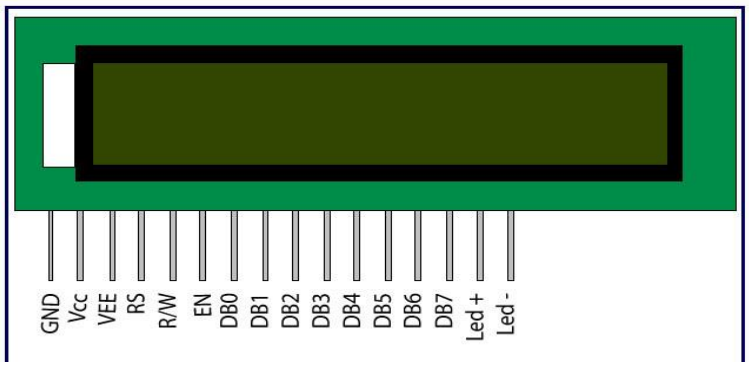

Fig 6: LCD display

The 16x2 LCD is used for displaying the user output command and status of the charging battery on the robot.

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3.1.5. Wi-Fi ESP8266 MODULE

ESP8266 is an impressive, low cost WIFI module suitable for adding WIFI functionality to an existing microcontroller project via a UART serial connection. The module can even be reprogrammed to act as a standalone WIFI connected device–just add power! The feature list is impressive and includes: 802.11 b/g/n protocol Wi-Fi Direct (P2P), soft-AP Integrated TCP/IP protocol stack. This guide is designed to help you get started with your new WIFI module so let's start! The hardware connections required to connect to the ESP8266 module are fairly straight-forward but there are a couple of important items to note related to power: The ESP8266 requires 3.3V power–do not power it with 5 volts. The ESP8266 needs to communicate via serial at 3.3V and does not have 5V tolerant inputs. ESP8266 on-board processing and storage capabilities allow it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. With its high degree of on-chip integration, which includes the antenna switch balun, power management converters, it requires minimal external circuitry, and the entire solution, including front-end module, is designed to occupy minimal PCB area.

ESP8266 PIN DESCRIPTION

ESP8266 has 8 pins, 4 in the row of 2. The first pin on the top left is GND. The two pins right from the GND are GPIO 2 and 0. The pin on the top right side is the RX pin and the pin on the lower left is TX. These are the pins for communication. The middle pins on the bottom are CH_PD (chip power-down) and RST (reset).**The main thing to remember is, that this device works with 3.3V; Even the RX and TX pins. Controller or many USB to serial converters work with 5V.**

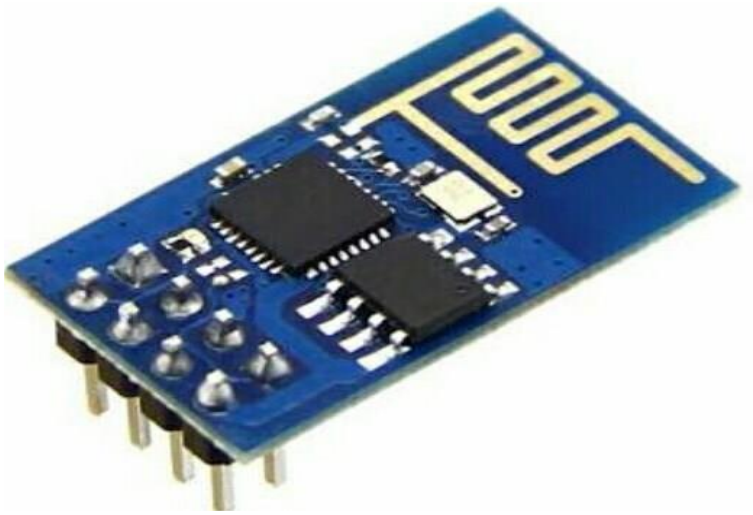

Fig 8: ESP8266 Wi-Fi module

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3.1.6. Ultrasonic Sensor

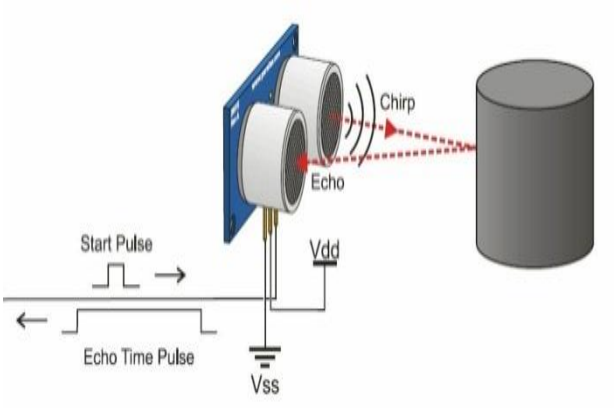

Fig 9: Ultrasonic Sensor

An Ultrasonic Sensor transmit ultrasonic waves into the air and detects reflected waves from an object. There are many applications for ultrasonic sensors, such as in alarm systems, automatic door openers and backup sensors for automobiles. Accompanied by the rapid development of information processing technology, new fields of application, such as factory automation equipment and car electronics, are increasing and should continue to do so. Using its unique piezoelectric ceramics manufacturing technology developed over many years, Murata has developed various types of ultrasonic sensors which are yet have very high performance. The information contained in this catalog will help you to make effective use of our ultrasonic sensors.

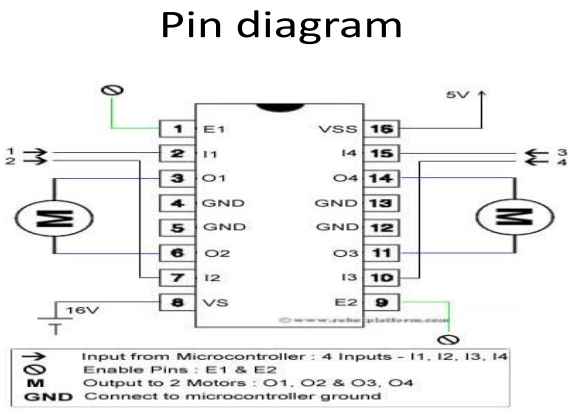

Fig 10: Motor Driver Pin Diagram

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Features of Ultrasonic Sensor

(1) Compact and light-weight
(2) High sensitivity and high sound pressure
(3) High reliability

3.1.7 Half H Driver

The Motor Driver will act like a Current Amplifier. Since they L293D is a dual-H-type Bridge motor driver. The pin diagram is given below: Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors. L293D contains two inbuilt H-bridge driver circuits. In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction. Enable pins 1 and 9 (corresponding to the two motors) must be high for motors to start operating. When an enable input is high, the associated driver gets enabled. As a result, the outputs become active and work in phase with their inputs. Similarly, when the enable input is low, that driver is disabled, and their outputs are off and in the high-impedance state.

3.1.8 Dc Motor

When the first start up, they draw a lot more current, up to 30x more. If you "stall" them (make it so they can't turn), they also draw a lot of current. They can operate in either direction, by switching voltage polarity. Usually spin very fast: >3000 RPM. To get slower spinning, need gearing.

3.1.9 Servo Motor

Fig 9: Servo Motor

The Addicore SG90 mini servo is a light weight servo ideal for small garbage collection robot, plane, and pick application, car use, as well as other circuit-board projects using microcontrollers like Arduino.

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4. SOFTWARE DETAILS

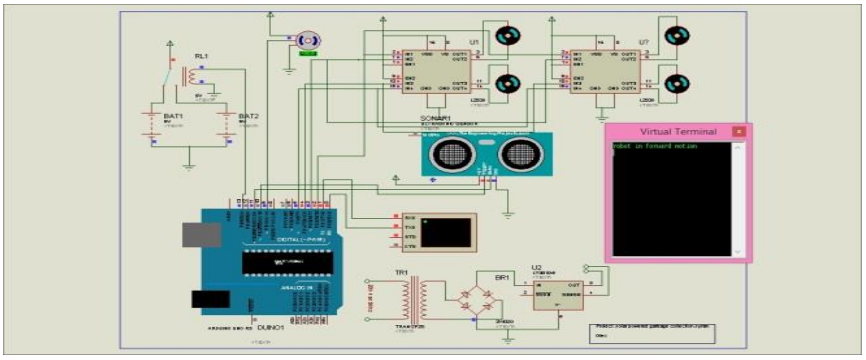
4.1. PROTEUS 7.10 SIMULATION

Proteus 7.10 is a Virtual System Modeling (VSM) that combines circuit simulation, animated components and microprocessor models to co-simulate the complete microcontroller based designs. This is the perfect tool for engineers to test their microcontroller designs before constructing a physical prototype in real time.

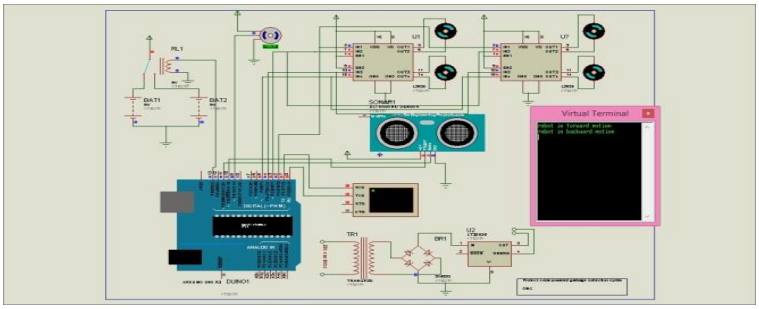
This program allows users to interact with the design using on-screen indicators and/or LED and LCD displays and, if attached to the PC, switches and buttons. One of the main components of Proteus 7.10 is the Circuit Simulation -- a product that uses a SPICE3f5 analogue simulator kernel combined with an event-driven digital simulator that allow users to utilize any SPICE model by any manufacturer. Proteus VSM comes with extensive debugging features, including breakpoints, single stepping and variable display for a neat design prior to hardware prototyping. In summary, Proteus 7.10 is the program to use when we want to simulate the interaction between software running on a microcontroller and any analog or digital electronic device connected to it.

5. RESULTS

5.1 Simulation Test



(a) Forward Direction of Dc Motor



(b) Backward Direction of Dc Motor

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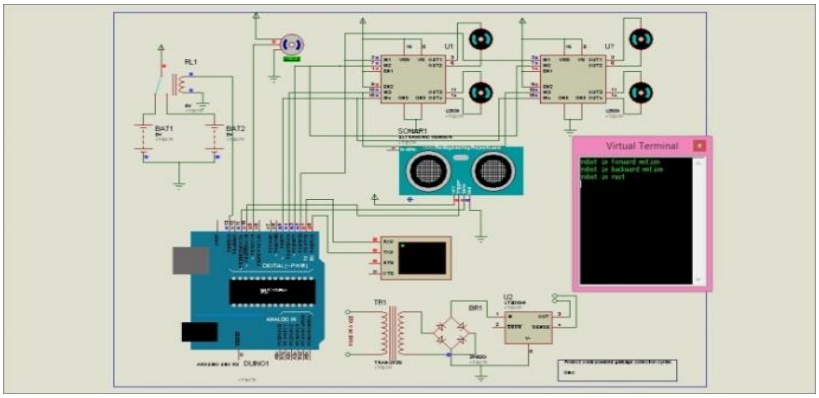

(c) Rest Condition for Dc Motor

Fig 11: Image from the Wheel Rotational of Robot

The wheel structure Robot is completed interface to Dc Motor. To control Dc Motor like Forward, Reverse and Rest Conditions. The Ultrasonic sensors are attached with the Robot for sensing completely interfacing factors such as light, dust, smoke, mist, vapor, lint, oily air, etc. The output of our project is given below:

a).	Robot move towards Front	Motor as Forward Direction
b).	Robot move towards Back	Motor as Backward Direction
c).	Robot Still Stop	Motor will Rest

The Ultrasonic Sensor which is installed on the robot is tested by measuring the delay time of transmitted image. From the results, it was found that the delay time of transmitted image and the sharpness of the image are depended on the distance between the robot and the user. The delay time of the long path will be more than on the short path. The distance that the sensor can transmit the clearly image is the range 0 – 15 meters. The delay time of transmitted image is 0.5 and 2 seconds in the range of 15 and 25 meters respectively.

5.2. Robot Control Test via Wi-Fi

In this test, the robot is tested by the user controlling via Wi-Fi. All the movement of the robot can be controlled from through the image from Ultrasonic Sensor. The robot can be controlled within 20 meters(66 feet) that is the limited of Wi-Fi. The robot can move at a constant speed of 0.5m/s and the delay time are the maximum of 2 seconds.

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(a) The large garbage

(b) The medium garbage

Fig 12: The garbage collection test

CONCLUSION

This project developed the robot for collecting the garbage. A continuing rise in the rate of waste production is no longer acceptable – hazardous waste affects the health of millions of people and poisons large areas of our planet. In many places people live surrounded by garbage and landfills. It is essential that governments and corporations face up to waste, using what we know about reduction, recycling and reuse, but also developing new technologies that eliminate waste. The robot can move with an average speed of 0.5 m/s on the sand via wireless communication and collect the large garbage with side 12.5 x 49 cm. This robot is expected to overcome the garbage problem. However, this robot still be improved to operate automatically and control from the more distance.

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REFERENCES

[1] Available:http://www.oceanconservancy.org/who-weare/newsroom/2013/ocean-conservancys-internationalcoastal-cleanup-announced-for-september-21.html. (1-2014)

[2] Available : http://www.manager.co.th/Local/ViewNews.aspx?NewsID=9510000065096 (1-2014)

[3] Available: http://www.newswit.com/news/2009-09-02/e61a2d27edb74447bd81fce8d042cfcb/ (1-2014)

[4] Y. Fu-cai et al. Design of Cleaning Robot for Swimming Pools. International Conference on Management Science and Industrial Engineering (MSIE). 2011, pp. 1175-1178.

[4] T. Takeshita, T. Tomizawa and A. Ohya. A House Cleaning Robot System-Path indication and Position estimation using ceiling camera. International Joint Conference SICE-ICASE. 2006, pp. 2653-2656.

[5] X. Gao and K. Kikuchi. Study on a Kind of Wall Cleaning Robot. Proc. The 2004 IEEE International Conference on Robotics and Biomimetics. 2004, pp. 391-394.

[6] C.-C. Liu, Y.-P. Kang and S.-N. Yu. Hardware and Software Integration for Domestic Stairs Cleaning Robot. Proc.

[8] Song, M., Kim, B., Ryu, Y., Kim, Y., and Kim, S., "Control Robot System Using Android Smartphone", The 7th International Conference on Ubiquitous Robots and Ambient Intelligence (URAI), Busan-Korea, 2010

[9] Krofitsch C., Grabler R., "Android-Based LowCost Robot Controller", Practical Robotics Institute Austria (PRIA)

[10] Namratha S.N, Anjanaparua, Kumuda. S, Self Balancing Robot Using Android Phone, BMS college of Engineering, IT Department, Bangalore

[11] Pradeep N., Sharief M., Siddappa M., Building Vision And Voice Based Robots Using Android, 1st Annual International Interdisciplinary Conference, 2013

[12] M. Klingmann, "Accelerometer-Based Gesture Recognition with the iPhone", Goldsmiths University, MSc in Cognitive Computing, London,September 2009

[13] T.A. Baede., Motion Control of an Mobile Robot, National University of Singapore, Faculty of Engineering,Departement of Mechanical Engineering, 2006.