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Design and Development of Electric Wheelchair Control Based on Mobile Application

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ABSTRACT: The wide spread prevailing loss of limbs in day-to-day scenario due to wars, accidents age and health problems. A wheelchair monitored with the android mobile application is developed to help the inactivated patients by using application to control the movement of wheelchair in different directions. Many wheelchairs are available with various running technologies, but the cost is very high and it is not much operative. The purpose of selecting the android platform is that nowadays android mobile phones are commonly used. The user has to first get connected with the wheelchair with the help of application. The user has the WIFI module to control the wheelchair. This system allows the user to forcefully interact with the wheelchair at different levels of the control (left, right, forward, backward and stop) and sensing. The proposed system will be operative in terms of cost and response time also.

KEYWORDS: Relays, ESP8266 microcontroller with WIFI module, android mobile phone, dc motor, sensor, alarm buzzer.

I. INTRODUCTION

This population needs a support that is provided by wheelchair. The normal pushing wheelchair is the primitive one in which the user has to push the chairwith the hands it has a stress on the user when travelling for a long distance. So with the help of technology and human intelligence the idea of automotive wheelchair was evolved. An automated wheelchair is based on some input interface in machine which provides input to the motor. The motor process the input delivered and takes the corresponding action (In terms of movement-move left, front, back, right). With the overview of android smartphone in the system, the working becomes less complex. The system becomes quite user friendly to the user.This paper enables an economy assembly in any existing wheelchair that enable a smart system for automated motion which can be controlled by any smartphone the main concept involved is ‘smartphone’ which has an operative system as android which have in build WIFI technology. The main second part of our system architecture has a most advanced microcontroller ESP8266 with combination of WIFI module which drives the various directions of the DC motor for directional movement of wheelchair and powers the DC motor for linear motion of wheelchair. The dc motor controls the front wheel for rotating the wheelchair while the pair of DC motor connected to the rear wheels enables linear motion.

By referring to a study conducted by World Health Organization, nearly every one person in fifty is suffering from paralysis are mainly due to spinal cord injury, strokes and cerebral palsy. The graph titled “PROPOTION OF DISABLED POPULATION BY RESIDENCE INDIA 2001-11” describe the percentage of disabled persons in India has increased both in rural and urban areas during last decade.Many project related to wheelchair have been developed. Some of the existing systems are based on the input delivered by joysticks, eye-ball movements, gesture-based, patterns made by hand. In last few years, many project related to wheelchair and brain signal (neutral) based etc..,

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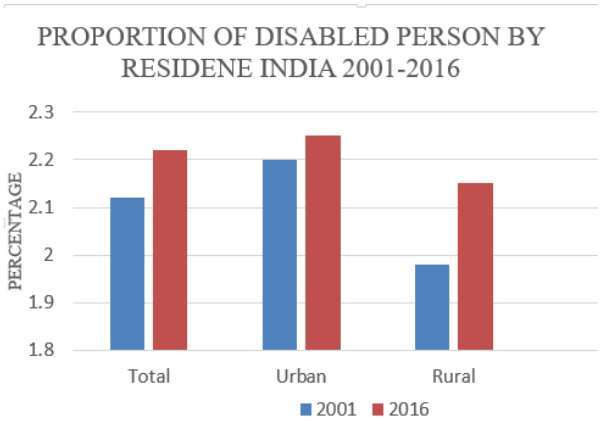

Figure1: Graphical Diagram For the Survey of Physically Challenged People.

In joystick based wheelchair within different disabilities may find it difficult to move joystick as it requires considerable amount of force moreover it may affect the reaction time of the wheelchair which may be dangerous.

In the eye-ball movementorganised wheelchair and head/neck movement control wheelchair, the user has more stress on the eye/head/neck. In this case, the user has restricted sight as the motion of eye-ball/head/neck is taken as an input by system that can give wrong output for that instance.

Voice controlled system can provide imprecise response in noisy environment and it can become difficult for the user to locomotive in such environment.

In accelerometer-based controlled system the tipping direction of the mobile phone should be precise to receive accurate result. And moreover it will be complex for people with disabilities in wrist movements and pattern recognization based system will require exercise of the user as well as the system. The training of the system will vary for different user. In brain signal controlled system acquires and controls the brain signal to give direction signals.
This signal are generated due to electrical activity that is simulated by brain. But brain signals cannot be relied on for motion of wheelchair as in some external electric field the device may not able to capture the accurate signal.

1.1 Block Diagram

In this project, the program of the wheelchair are controlled with the help of android application. The proposed system uses android mobile to control the wheelchair. An android application is to be developed for this purpose. The android mobile is connected to the microcontroller privileged wheelchair via WIFI module inbuilt in the controller. And the controller passes the signal in accordance with the signal passed from application.The controller actuates the relay and the DC motor which has been used will work according the command. The power supply is given to the entire unit. Android-based wheelchair controller that consists of android device and a control box that can be attached to standard wheelchairs to control the movement by using a DC motor. This project also provided a controller to the electrical appliance by using radio frequency as a wireless connection between control box and electrical appliance.

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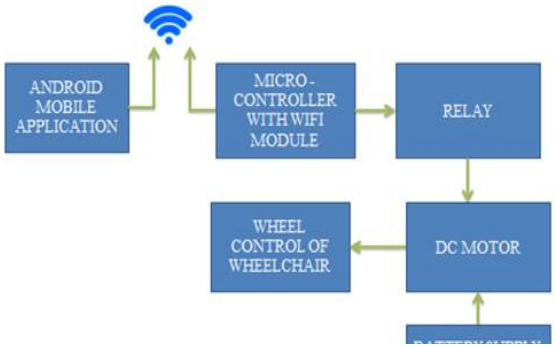

Figure2: Block Diagram of Electric Wheelchair Control

1.2 Basic Circuit Diagram:

The control within the system architecture had choices varying from designing a mechanical hand, inputting an equivalent signal, decoding the input signal and/or designing a new control circuit. The wireless communication between the Android phone and the wheelchair was realized by the previous groups using the wireless module which is inbuilt in the microcontroller that had been used. This module was a serial communication module that created a wireless network. It was already packaged with an attached microcontroller. The same single chip was used by the relay circuit such that the single chip was powered from the same battery source as the motors, i.e., 12V but reduced to 5V, once again using the electric relays, for the logic circuit. However, the different speed levels of the original wheelchair was not reached by this circuit as it lacked a bidirectional dual motor controller to handle the 12V, 7.5A dual DC motor requirements. Hence, the motors ran at full speed at all times and lacked a smooth deceleration when coming to a stop. Overall, an integration of a speed regulation system was necessitated to ensure the safe operation of the wheelchair.By default, Android phones do not natively support connections to wireless networks unless the internal settings of the phone are changed. This requires rooting the device, however different devices require different changes to the settings for enabling connections, both of which are inconvenient in the long run. The signal passed through the WIFI inbuilted controller. The microcontroller will produce an output signal in according to the control passed from the application. The controller will control the turn ON and OFF process of relay. The transistor used in this circuit is for switch on and off the relay. A 2W resistor and a polished capacitor will avoid the reverse voltage from the dual DC motor to the controller circuit.

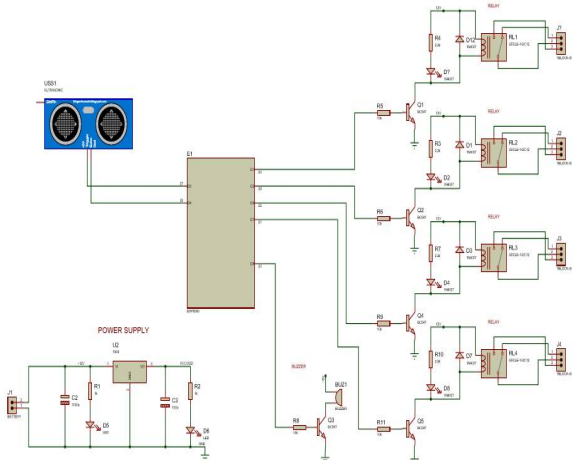

Figure3: Basic circuit for the entire contol system.

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II. THE WHEELCHAIR

The base of this project is the wheelchair. The wheelchair itself has no complexity except for its specific design and material used in manufacturing. Different types of wheelchairs are available in the market, including electric wheelchairs and manual wheelchairs. One of the main disadvantages of using manual wheelchairs has to do with the upper body. Though the exercise is good for those who push themselves. However, over time, this same motion can lead to injury—something that wheelchair users try to avoid whenever possible. Everyday manual wheelchairs come in two major designs: folding or rigid. The rigid chairs, which are increasingly preferred by active users, have permanently welded joints and many fewer moving parts.

III. ESP8266 MICROCONTROLLER

The ESP8266 WIFI Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WIFI network.

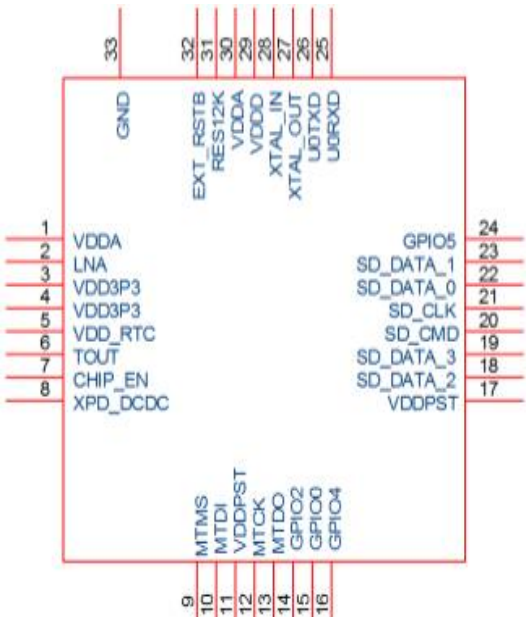

Figure4: Pin Diagram of ESP8266 Microcontroller.

The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much WIFI-ability as a WIFI Shield offers (and that's just out of the box)! The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community.

Features of ESP8266 Microcontroller:

- 802.11 b/g/n/d/e/i/k/r support
- WiFi Direct (P2P) support
- P2P Discovery, P2P Group Owner mode, P2P Power Management
- Infrastructure BSS Station mode / P2P mode / softAP mode support;
- Hardware accelerators for CCMP (CBC-MAC, counter mode), TKIP (MIC, RC4), WAPI (SMS4), WEP (RC4), CRC

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- WPA/WPA2 PSK, and WPS driver
- Additional 802.11i security features such as pre-authentication, and TSN
- Open Interface for various upper layer authentication schemes over EAP such as TLS, PEAP, LEAP, SIM, AKA, or customer specific
- 802.11n support (2.4GHz)
- Supports MIMO 1×1 and 2×1, STBC, A-MPDU and A-MSDU aggregation and 0.4μs guard interval
- WMM power save U-APSD
- Multiple queue management to fully utilize tra□c prioritization defined by 802.11e standard
- UMA compliant and certified
- 802.1h/RFC1042 frame encapsulation
- Scattered DMA for optimal CPU o□ load on Zero Copy data transfer operations
- Antenna diversity and selection (software managed hardware)
- Clock/power gating combined with 802.11-compliant power management dynamically adapted to current connection condition providing minimal power consumption
- Adaptive rate fallback algorithm sets the optimum transmission rate and Tx power based on actual SNR and packet loss information
- Automatic retransmission and response on MAC to avoid packet discarding on slow host environment
- Seamless roaming support
- Configurable packet tra□c arbitration (PTA) with dedicated slave processor based design provides flexible and exact timing Bluetooth co-existence support for a wide range of Bluetooth Chip vendors
- Dual and single antenna Bluetooth co-existence support with optional simultaneous receive (WiFi/Bluetooth) capability.

IV. ANDROID APPLICATION AND CONTROL

An most important part in this project is the wheelchair auto movement. The aim of this part is to let the user choose a source and destination and to save the path for the wheelchair to go through when a pre-saved path is clicked. For the first use, the user must measure the time needed for the wheelchair to move through the desired destination and to specify the turns (left or right) the wheelchair must do.

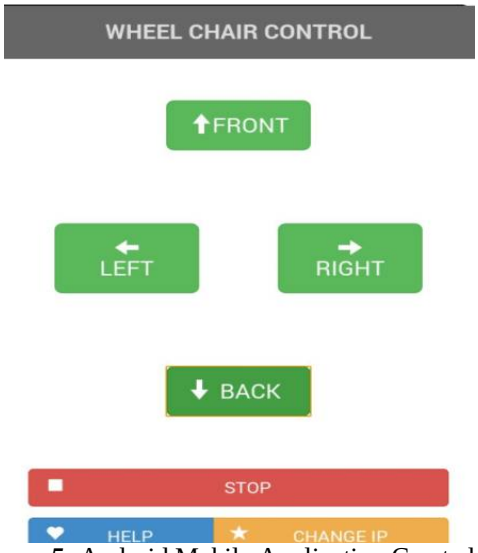

***Figure5*: Android Mobile Application Created.**

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A significant issue the user must look for in this section is the battery effectiveness revealed in the android computer program. This part was invented to notify the user if the wheelchair is capable of moving in the pre-saved path for detailed reasons. To avoid any errors, wheelchair's electrical device storage percentage must always be above 80%, and the user is to be notified to charge the electrical storage device in case it is dropped below the desired percentage.

The android application design is user friendly. Saving the path is not that hard; all what the user has to do is to enter the settings and choose the first source and the first destination. Then, the user must specify both the time and the direction the wheelchair must pass through. Finally, he/she must click on "save" button to save the desired path.

Table: Declaration of movement of wheelchair and input

S1	*S2*	*S3*	*S4*	*RESULT*
0	0	0	0	Stop
0	1	0	1	Move forward
0	1	1	0	Move left
1	0	0	1	Move right
1	0	1	0	Move backward

To test this, the user must open the computer program main screen and choose the source and the destination he/she has already saved and click on the go arrow for the wheelchair to take an order. Figure 5 shows a snapshot from the main screen of the Mobile Controlled Wheelchair android application. In the snapshot, the source, destination, and the rooms path management (where the path details are set) are shown clearly. Besides, the electrical storage device percentage shows that the wheelchair is now capable of auto-movement. The four direction arrows and the video screen are so clear**.**

V. RELAY

Relay is an electrically operated switch. Current sinuous through the coil of the relay creates a magnetic field which interests a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and they are doublerug (changeover) switches. Relays agree one circuit to switch a second circuit which can be totally separate from the first. For example a low voltage electrical storage device circuit can use a relay to switch a 230V AC mains circuit. There is no electrical connection inside the relay between the two circuits; the link is magnetic and mechanical.

The coil of a relay passes a moderately large current, normally30mA for a 12V relay, but it can be as much as 100mA for relays intended to operate from lower voltages. Most ICs (chips) cannot provide this current and a transistor

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is usually used to increase the small IC current to the larger value needed for the relay coil.

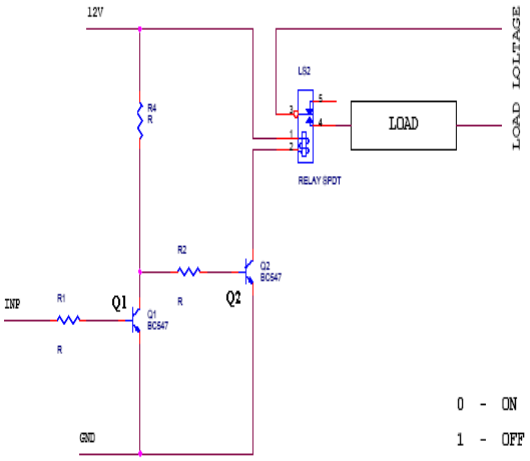

Figure6:Scientific Diagram of Relay Circuit.

This circuit is designed to control the load. The load may be motor or any other load. The load is turned ON and OFF ended relay. The relay ON and OFF is controlled by the pair of switching transistors (BC 547). The relay is connected in the Q2 transistor collector terminal. A Relay is nothing but electromagnetic switching device which consists of three pins. They are Common, Normally close (NC) and Normally open (NO).

The relay common pin is connected to supply voltage. The normally open (NO) pin connected to load. When high (5 Volt)pulse signal is given to base of the Q1 transistors, the transistor is conducting and shorts the collector and emitter terminal and zero (0 Volt)signals is given to base of the Q2 transistor. So the relay is turned OFF state.When low pulse is given to base of transistor Q1 transistor, the transistor is turned OFF. Now 12v is given to base of Q2 transistor so the transistor is conducting and relay is turned ON. Hereafter the common terminal and NO terminal of relay are shorted. Now load gets the supply voltage through relay.

Table: Relay turn ON and OFF.

Voltage Signal from Microcontroller or PC	Transistor Q1	Transistor Q2	Relay
1	On	Off	Off
0	Off	On	On

VI. DC MOTOR

A DC motor is an electrical device that converts direct current electrical power into mechanical power. The most common types of such motors relay on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, electromechanical or electronic, used to periodically change the direction of the current flow in part of the motor. The DC motors that were used in our project is that can operate using 12V DC with the rated current of 7.5A, and rated power output is 0.9~1.4KW and 2750RPM and the polarities are negative it may be operated either in clockwise or counter clockwise direction.These motors had very accurate dimensions that fit wheelchair both in size and weight. In addition to that, the shaft rotation is reversible property by reversing power leads helped in moving the wheels in both directions, backward and forward.

The main features of this motor are permanent magnetic field, epicylic gear train, light weight motor, better cold starting capability. Various pinion forms are available to suit wide range of application. Normal protection against water and oil splash.

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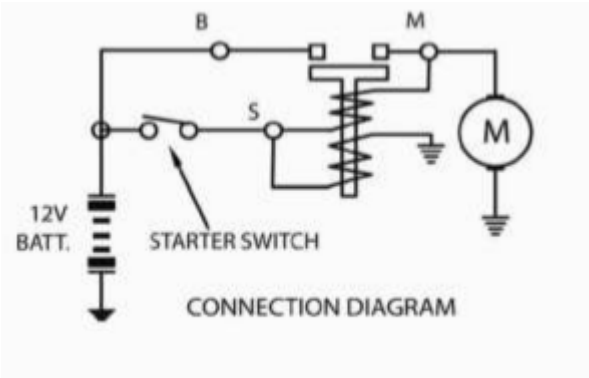

Figure7: Connection diagram of DC motor.

VII. SENSOR

The basic concept of IR obstacle detection is to transmit the IR signal in a direction and a signal is received at the IR receiver when the IR radiation bounces back from a surface of the object. In our project, the obstacle sensor is used to detect the object if any object is cross while the wheelchair is moving.

- Near infrared region — 700 nm to 1400 nm — IR sensors, fiber optic
- Mid infrared region — 1400 nm to 3000 nm — Heat sensing
- Far infrared region — 3000 nm to 1 mm — Thermal imaging

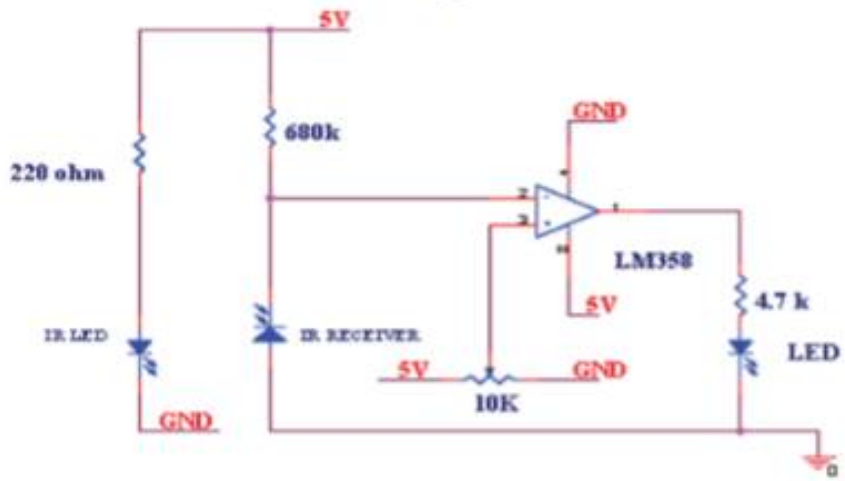

Figure8: IR Sensor Connecting Circuit.

VIII. CONCLUSION

As a conclusion, the objectives of this project have been achieved successfully where this project was able to develop an android system that can control the movement of the wheelchair and to develop an android system that can control two appliance with the android phone. The development of an android-based wheelchair controller was fully functional base on the objective which are targeted before started this project. Finally all the combination circuits and the DC scooter motor were embedded to the wheelchair. This project gives an idea on how to combine all the circuit board, DC scooter motor, and electronics components together in one whole system. As a future improvement, replacement of the DC scooter motor with the DC motor with geared is recommended because to more accurate. The part that has been accomplished is considered a pillar to what it will become in the future. Mobile Controlled

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Wheelchair will have a bright future. This project is to be continued and developed in the future due to its wide ability to grasp new software in addition to hardware to improve performance, reliability and safety procedures.

Our project doesn't provide the user with a capability of moving the wheelchair in an environment full of obstacles. The IP camera only helps to visualize the path, and thus, it provides the user with the ability to locate obstacles near the wheelchair. However, a future work will improve the wheelchair ability to interact with the obstacles that it might face. Health issues might be introduced to our newly designed wheelchair including pulse sensors and heart beat sensors that may provide accurate measurements for the disabled health. This may also help in improving the mobile application, in which a user with rapid heartbeats is not allowed to travel alone using the wheelchair since he may face any heart attack alone, by sending a notification to him. Replacing our batteries with lithium batteries, which are very light in weight and very small in size with higher efficiency than the used ones, will improve the motors functionality and will speed up the process of wheelchair movement. Actually we did not use such batteries because of their high cost that a prototype cannot handle.

When it comes for the safety of the disabled while using the wheelchair, it is, initially, designed for a specific area. The use of the wheelchair on the streets for instance will face some discomfort since it lacks digital signal processing and artificial intelligence to process the movements of vehicles and pedestrians on the street. Besides, the presence of stairs will be a problem. This project is yet to be continued, to help the 15% of the world's population who live with physical disability, since we are limited to our capabilities, materials, and resources

REFERENCES

[1]Jaykesh K.Kokate,A.M.Agarkar, "voice operated wheel chairInternational Journal of research in engineering andtechnology" volume 3,Issue 2,Feb-2014.
[2] M.Anousouya Devi, R.Sharmila, "Hybrid brain computer interface in wheelchair using voice recognition sensors."
[3] Rakhi A.Kalantri, D.K.Chitre, "Automatic wheelchair using gesture recognition", International journal of engineering and innovative Technology.
ISSN: 2277-3754, (IJEIT) Volume 2, Issue 9, March 2013
[4] Hiroo Wakami, K.N.T.M., 1992. "Development of automated wheelchair". Resources and Environment protection Research laboratories, NEC Corporation, Kawasaki, 213 Japan. Seagrave, 2013.
Basic android. United Kingdom: penny press Ltd.
[5] Vasundhara G.posugade, Komal K.Shedge, chaitali S.Tikhe, "Touch screen based wheelchair system", International journal of Engineering Research and applications. Volume 2, Issue 2, Mar-Apr-2012
[6] S.H.Husin, M.Y.N.hassan, N.M.Z.Hashim, Y.Yusop, A.Salleh, "Remote Temperature monitoring and controlling," International Journal for advance research.
[7]] N. M. Z. Hashim, M. R. Anuar, A. Jaafar, M. Z. A. A. Aziz, A. Salleh, A. S. Ja'afar, "Graphical User Interface For Wireless Patient Monitoring System Using Zigbee Communication," Journal of Engineering & Applied Sciences, vol. 9, no. 9, pp. 1554-1558, 2014.
[8] S. A. W. A. S. Mokhtar, N. M. Z. Hashim, N. R. Mohamad, A. Jaafar, A. Salleh, "Vehicle Security System Using ZigBee Technology," International Journal For Advance Research In Engineering And Technology, vol. 2, no. 7, pp. 81-85, 2014.
[9] A. Salleh, N. M. Z. Hashim, N. R. Mohamad, N. A. A. Hadi, M. Z. A. Ab Aziz, "Development of High Performance and Low Cost Automatic Toll Payment System using RFID Technology for Malaysia Environment," International Journal For Advance Research In Engineering And Technology, vol. 2, no. 10, pp. 01-07, 2014.
[10] Hiroo Wakaumi, K. N. T. M., 1992. "Development of an automated wheelchair", BEng, Resources and Environment Protection Research Laboratories, NEC Corporation, Kawasaki, 213 Japan.