



WIRELESS SMART WHEELCHAIR

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Abstract: Every wheel chair is manually operated to move in and around. However a smart wheel chair bring independence and effortlessness to a person. A Smart Wheel Chair is mechanically controlled devices designed to have self-mobility with the help of the user command using head/hand effortlessly. This reduces the user's effort to drive the wheels of the wheelchair. Furthermore this provides an opportunity for visually or physically impaired persons to move from one place to another. Even though a persons' body is fully or partially paralyzed only his head/hand movement will help the wheel chair to move front, back, left, right. There is a wireless communication between the human and the wheel chair. The equipment is kept on his head/ in his hand which detects the movement of the person. If the device finds the swing of head front then the chair moves forward automatically. The procedure is similar to the other directions such as left, right, backward. If the head is still without any swing then it is considered as stop. The operation of the experimental model of our device is based on pairing the Bluetooth of the mobile to the Bluetooth module placed in the wheel chair. The Arduino blue control app acts as an intermediate to find movement of the human and the Arduino uno helps in assisting the Bluetooth and wheels movement according to the code. The L-298 in between the Arduino and wheels helps in converting the voltage that is required for wheels movement.

Index Terms - Heartbeat, Movement, Microcontroller, NodeMCU, Arduino, Bluetooth, Paralyzed, PulseSensor, Wheelchair.

INTRODUCTION

This paper is conceived as an idea to ease the lives of those among us who are unfortunate enough to have lost the ability to move their legs due to a significant amount of paralysis, accident or due to old age. Many differently abled people usually depend on others in their daily life especially in moving from one place to another. For the wheelchair users, they need continuously someone to help them in getting the wheelchair moving. Their lives are made difficult by the fact that there is lack of an intuitive control system for their wheelchairs that allows moving independently. Using an electrical wheelchair leads to a large amount of independence for persons with a physical disability who can neither walk nor operate a mechanical wheelchair alone as it requires great effort and help of [1] Deepak Kumar Lodhi et al, International Journal of Computer Science and Mobile Computing, Vol.5 Issue.5, May- 2016, pg. 433-438 © 2016, IJCSMC All Rights Reserved 434 other people. The problem is that in some cases the disability causes someone to lose the ability to use his hands, therefore in this case, the way of controlling a power wheelchair can be done using speech commands for hands-free patients leading to an interesting and promising outcome. But, still the availability of the smart wheelchair solutions is often limited due to the high costs and not-so-friendly operation. By the proposed approach, described in this paper, the low-cost, simple and friendly solution for the voice controlled platform will be presented that is user friendly, fully-customizable according to the language spoken by the user and will help in enhancement of user's independent mobility. Using a Smartphone as the "brain" of a robot is already an active research field with several open opportunities and promising possibilities. Another recent and very successful technology, Bluetooth has changed how people use digital device at home or office, and has transferred traditional wired digital devices into wireless devices. This research is based on Voice-controlled Wheelchair design based on mobile platforms, by means of Bluetooth technology, design and implementation of wireless remote control solutions. The project also incorporates use of ultrasonic sensors to detect obstacles within range of 4 meters and notifies the system and stop the wheelchair till further command. In this work, Smart Wheelchair control using Arduino Uno microcontroller and Bluetooth Module via android application is presented. A disabled person require a wheelchair to perform functions that require him/her to move around .Caretakers not always able to actively monitor disabled person individuals. The disabled person need a way to control their wheelchair that meets their specific needs.

Existing System

Wheelchair is a gadget utilized by crippled and elderly individuals for their transportation reason and sometimes young people unfortunately. A few sorts of smart wheelchairs are available in market which depend close by motion, eye position, voice acknowledgement, and mind waves and so forth. Voice controlled posture change and driving was realized, the hardware circuit and software program are tested and debugged, the recognition rates of voice control of the wheelchair for the same person are acceptable. But it can't be applicable in crowded place due to it recognize numerous number of voices. Disadvantages Of Existing System are:

Eye position : In order to move, the person should concentrate in a particular direction continuously which increases the stress levels of eye. [2]The capturing of eye ball movement is not accurately done by the system. The receiving of ambiguous eyes gestures is a threat to the person in the wheel chair.



Fig 1: A man operating wheel chair using eye movement with a great difficulty.

Voice Based : The system only responds accurately only to the individual who trained the system and the speaker independent is a system trained to respond to a word regardless of who speaks. [3]Some voice based Wheelchairs receive the commands not only from the owner but from the anonymous person who has same voice frequency as the user.[4] Thus, it will create a problem to the person in the wheelchair. [5]It is difficult to use in rush places and noisy places.



Fig 2: A complexly operated voice controlled wheel chair.

Joystick based: The cost of repairing and maintaining power wheelchair can be higher than a normal wheelchair and difficulty to move. The rapid movement given to the joystick will make the joystick weak and broken. High concentration needed and effort to move the joystick.



Fig 3: A person operating a heavy joystick based wheel chair.

Proposed System

In accordance to the era of technology advancement, it is necessary to provide best solution especially for the disabled person. This project can be used for making even a disabled person to reach his needs independently. These people often need a special care done by the community and it results in different difficulties like human power. In some cases, pushing a wheelchair for a long distance can require a huge amount of power for people in charge of a disabled person. Through all these difficulties, we can combine technology and healthcare to produce a new system which works using IoT and BoT called "WIRELESS SMART WHEELCHAIR". [6] Living independently is the most basic wish of every human being. This might be a wish for a disabled person too. [7] Our wheelchair would definitely fulfill this wish in the case of a disabled person. This smart wheelchair helps a disabled person to move with [8] the movement of head/hand using some software's and IOT platforms like Arduino, NodeMCU, Bluetooth. It also has the feature of monitoring the heartbeat of a person and sending the BPM of the patient in the form of a message to his/her family doctor. A pulse sensor is used to recognize the BPM (Beat Per Minute) of a person. A set of layered behaviors were used to control the chair's movement. These were broken into competencies with each small set of rules becoming a toolbox to achieve a particular goal. These groups could be enabled or disabled by means of switches controlled by the operator. It worked as a partnership in which the machine took care of the routine work and the user decided what needed to be done.

Working Of Pulse Sensor Playground

Firstly, we have written a code for generating the accurate pulse from a pulse sensor playground in Arduino IDE software. This code helps in analyzing the pulse of the person who is holding the pulse sensor playground. The pulse of the person is shown in the serial monitor. It takes approximately 1 minute to show the accurate pulse of the person. The most frequently seen reading is the pulse of the person. The output is shown in the figure present in the next slide. The serial plotter helps to view the heart rhythm of the person in terms of a graph.

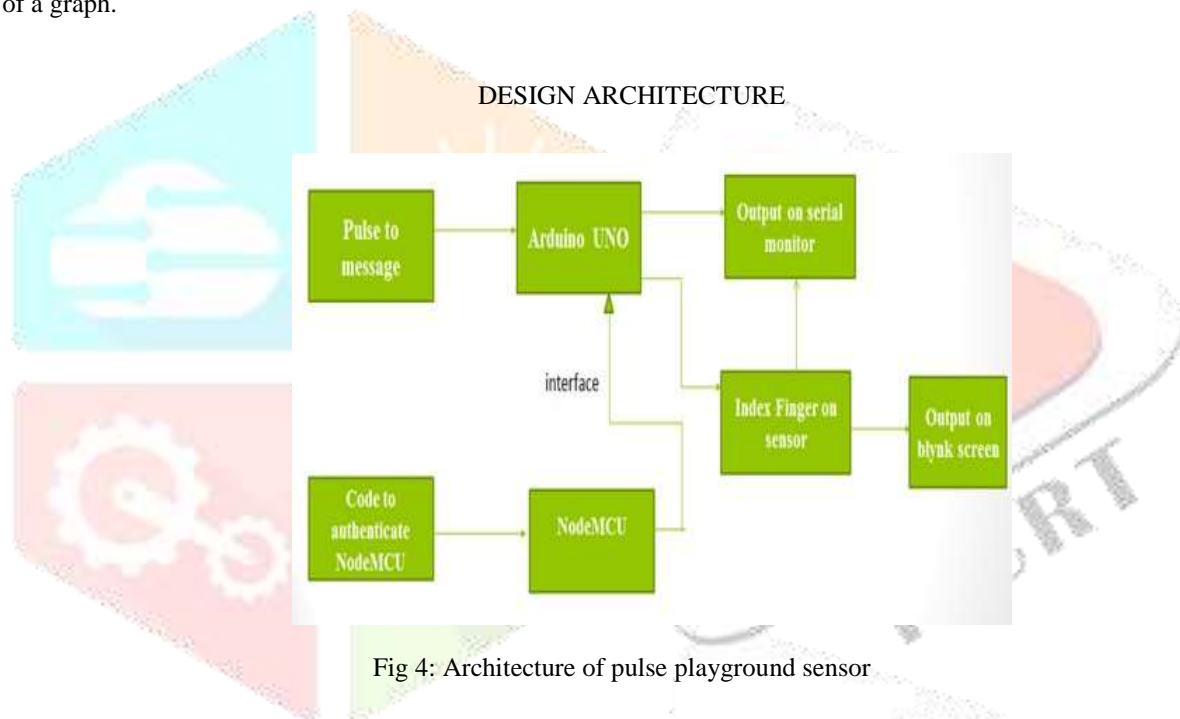


Fig 4: Architecture of pulse playground sensor

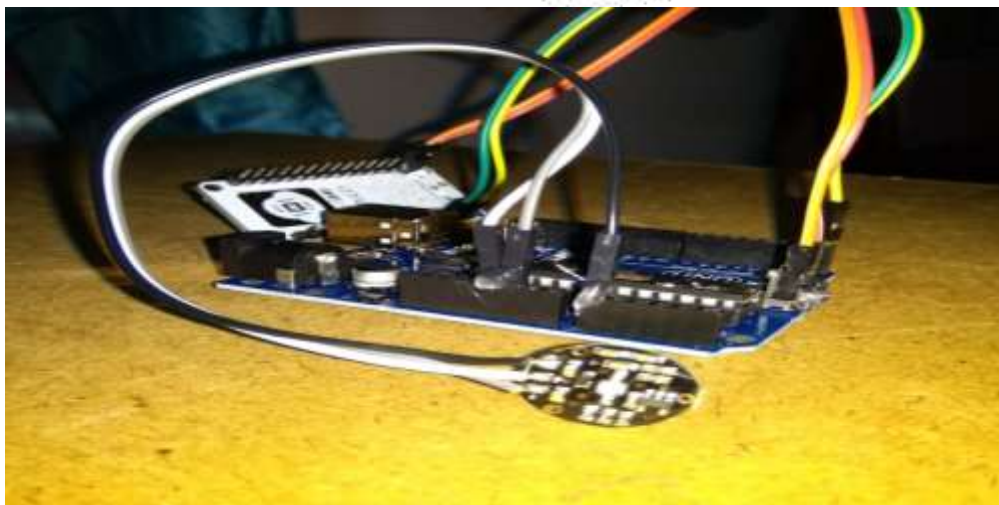


Fig 5: Interfacing of the pulse playground sensor with nodemcu

Working of Wheel Chair along with pulse sensor:

The 8 pins of the Arduino is connected to the 2 motors , Bluetooth module ,L298 motor driver module. The code is loaded into the Arduino for the movement of wheels in the directions front, back, left, right respectively. L1 and R1 makes the wheels move in forward direction. L2 and R2 makes the wheels move in backward direction. The 2 pins of the Arduino is to operate the right wheel and 2 pins of the Arduino is to operate the left wheel. Totally all 4 pins are connected to the L298 motor driver module. The L298 motor driver module helps to convert the power supply of 5volts to 6volts for the movement of motors in different directions. The “Arduino BlueControl” app helps in connecting mobile Bluetooth and Bluetooth(HC05) connected to the Arduino. The gyro accelerometer option present in the Arduino blue control app works according to the code loaded in the Arduino. Bluetooth acts as a interface between the mobile phone and the wheel chair. When the mobile phone is still we will find no movement in the wheelchair. The wheelchair moves according to the movement of gyro in the phone. Thus, the mechanism is completely wireless.

DESIGN ARCHITECTURE

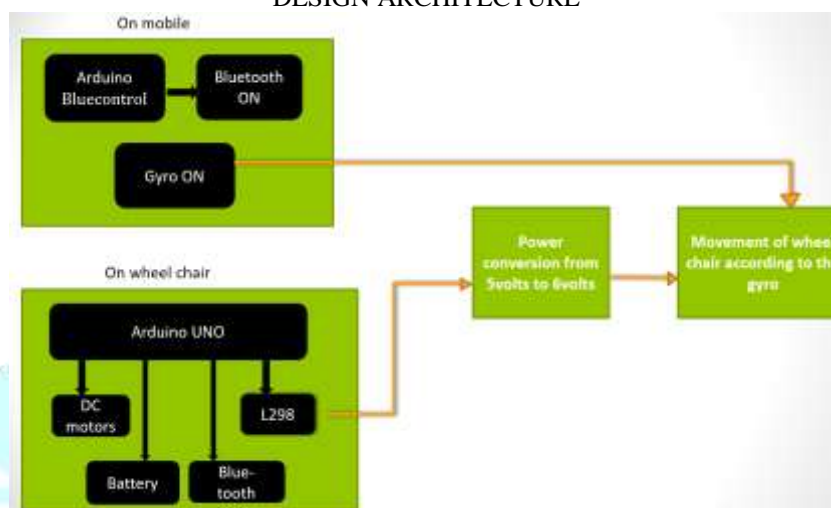


Fig 6: Architecture of Wheel Chair along with Pulse playground sensor



Fig 7: Interfacing of Arduino uno, Bluetooth, L298 and battery

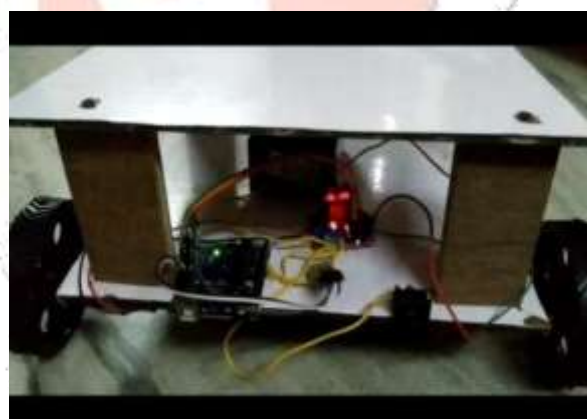


Fig 8: Interfacing of all hardware components

The above figure shows the model of wireless smart wheel chair. This can be used efficiently by a senior citizen, partially or fully disabled person and unlettered person too, simply this wheel chair is completely user friendly because to bring movement in the wheel chair the user need not put any toughest efforts. The inbuilt accelerometer of mobile plays a crucial role in moving the wheel chair in all four directions. The user movement is grasped by mobile and commands the wheel chair. Just a slight movement of the user will bring the movement in the wheel chair in desired direction. This wheel chair works with simple pairing of Bluetooth. When the mobile is tilted left the chair turns left, when the mobile is tilted right then the chair turns right, when the mobile is tilted front then the wheel chair moves forward direction, when the mobile is tilted left then the wheel chair moves in backward direction. When there is no change in the mobile and it is at rest then the wheel chair will be still corresponding to the mobile phone. Thus, without any much effort of the user(the person in the wheel chair), he can move from one place to another without depending on second person.

HARDWARE REQUIREMENTS:

Arduino uno Board:

Arduino uno is a microcontroller, helps to make the application of interactive objects accessible. The code is pre-programmed into the on-board microcontroller chip is a boot-loader that allows uploading programs into the microcontroller memory without needing a chip /device programmer. Once the code uploaded can be replaced again by loading another code through USB cable.



Fig 9: Arduino UNO board

Node MCU:

The ESP8266 itself is a self-contained with Wi-Fi networking solution acts as a bridge between existing micro controller to Wi-Fi and it is also capable of running self-contained applications. This module comes with a built in USB connector, analog and digital pin-outs. With the help of micro USB cable, you can connect NodeMCU devkit to your laptop and use it, just like Arduino. It is also immediately breadboard friendly.



Fig 10: Node MCU

Bluetooth Module:

The HC-05 is an easy-to-use Bluetooth Serial Port Protocol(SPP) module, designed for transparent wireless serial connection setup. Serial port Bluetooth module is fully qualified Bluetooth with Enhanced Data transfer at the rate of 3Mbps on complete 2.4GHz radio transceiver and baseband.



Fig 11: Bluetooth Module

The HC-05 can operate in Master, Slave or Master/Slave mode. This be easily interfaced with Laptop or Mobile phones with Bluetooth. This module is the best choice to make projecSt wireless. This is reliable because it can be paired to the device only after entering the pin. The other applications are consumer applications, home automation, wireless communication between two microcontrollers etc.

L-298 Motor Driver Module:

The L298 Driver is a high voltage, high current dual full bridge driver designed to accept Transistor-Transistor logic and drive inductive loads such as relays, solenoids, DC and stepping motors. Two enable inputs are provided to enable or disable the device independently of the input signals.



Fig12: L298 Motor Driver Module

Rechargeable Battery:

A rechargeable battery, also called a storage battery or a secondary cell, is a type of battery that can be recharged over and over again with electrical energy. It helps in avoiding to buy batteries all over again. Rechargeable battery stores electrical energy in form of chemical energy while charging.



Fig 13: Rechargeable Battery

DC Motor:

The “DC” in DC motor stands for “direct current.” A DC motor is any type of rotary electrical machine that adapts this type of electrical energy, direct current, into mechanical energy. It has higher starting torque, quick starting and stopping, reversing, variable speeds with voltage input and they are easier and cheaper to control.



Fig 14: DC Motors

Wheels:

Dragging a load using a wheeled cart is far easier than dragging it on the ground—for two reasons: Wheels reduce friction. Instead of simply sliding over the ground, the **wheels** dig in and rotate, turning around sturdy rods called axles.



Fig 15: Wheels

Software Requirements:

Arduino Software:

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them.

Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension.ino. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom righthand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

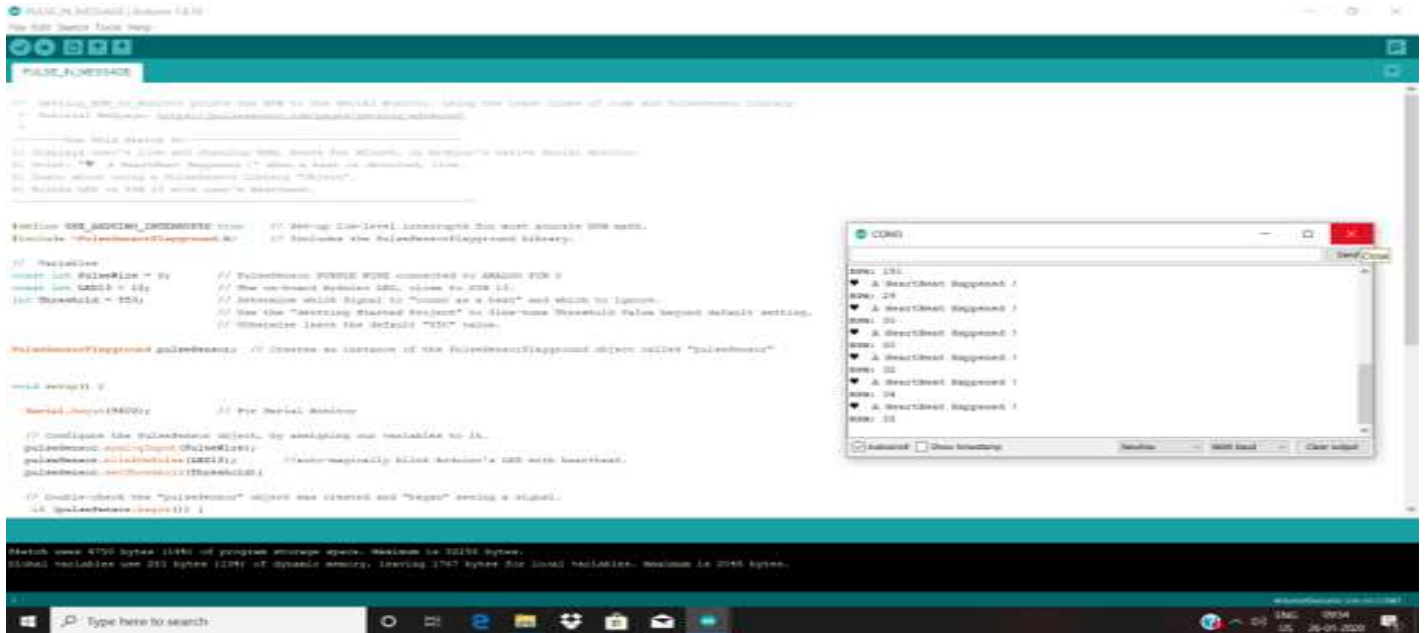


Fig 16: The figure showing the platform of Arduino software and its output on serial monitor

Blynk App:

Blynk is a Platform with IOS and Android apps to control Arduino, Raspberry Pi and the likes over the Internet. It's a digital dashboard where you can build a graphic interface for your project by simply dragging and dropping widgets. The image shows the pulse of the person whose in the wheel chair. The reading continuously monitored by the doctor or care takers.

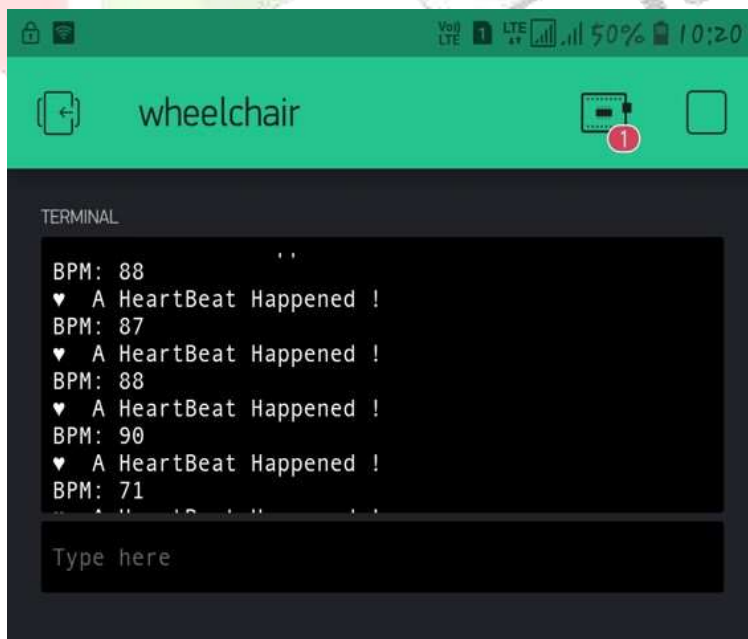


Fig 17: The BPM of the person in the wheel chair is seen on the Blynk app

Arduino Bluecontrol App:

Arduino BlueControl app is an application that allows you to control your arduino board (and similar boards) via Bluetooth, and so to create awesome and fully customized projects, with the new features available within the app. The settings section allows you to adapt the application to your needs, through a very simple and intuitive interface.

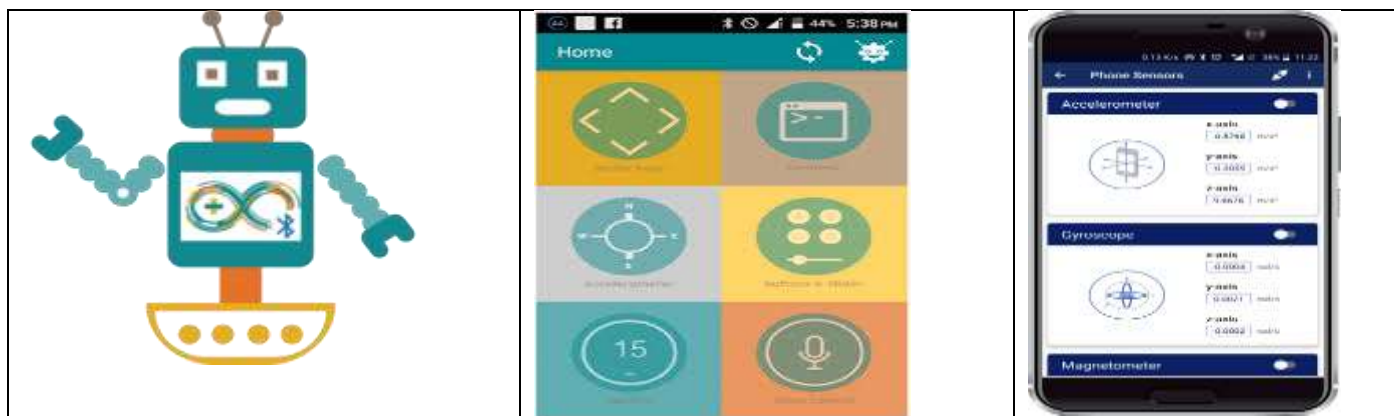


Fig 18: The app icon of Arduino Bluecontrol app with home and Sensor options

CONCLUSION

The main aim of this project implementation is to help all the people who are dependent on wheelchair for their mobility. Wheelchair is simple to operate and does not need any external help. The objectives of this project have been achieved successfully. This project was able to develop an android system that can control the movement of the wheelchair. The application built can be useful for many android phones. This is an design of android application that can direct the movement of a wheelchair, to develop the movement mode which help the elder lies and physically disabled people to move their wheelchairs independently and to provide the elder lies and physically disabled people with the ability to control the movement of the wheelchairs by using android smart phones. The system designed has undergone a few tests and successfully completed the basic performance. The objectives were achieved as the software and hardware implementation work well as expected. This system will helps the elderlies and physically disabled people to control wheelchairs by themselves; therefore this success is to serve many people with disabilities. From the conducted research, it can be seen clearly that a mobile controlled wheelchair will have a bright future. It should be continued and developed in the future as it has a huge potential to improve its performance, reliability and safety.

SCOPE FOR FUTURE WORK

For future work, it is suggested to use a more powerful and lighter weight motor to support various weights of users. This project elaborates the design and construction of Smart Electronic Wheelchair with the help of Bluetooth Module. The wheelchair works properly to move as the command given by the user. After this design the physically disabled to control their wheel using an android application in their smartphones and it also reduces human effort. The detection of any obstacle may be the future scope. As the person switches on it starts moving in all the four directions which also helps the disabled person to do their works independently.

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