UOS SMART E-WHEELCHAIR

(Project Proposal)

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1. Abstract

The aim of introducing Smart E-wheelchairs is to facilitate elderly and paraplegic people. Paraplegic people face problems while going from one place to another place. Wheelchair is one of the most commonly used supporting devices to uphold mobility and enhance quality of life for people who have difficulties in walking. Wheelchair provides the user the freedom to move around, allowing the user to perform day to day physical activity. If a paraplegic person uses simple wheelchair than he/she needs an attendant who helps them to perform the activity. Smart E-wheelchairs is a ride solution to solve the problem faced by disable people. It allows the user to get around and undertake daily activities without assistance. It makes paraplegic person independent. They will simply have to install an application on their cell phones and fill an application to get wheelchairs services. By using android smartphone, the user can select the specified direction displayed within the four quadrants on the screen of the android smartphone to control the wheelchair. An Arduino Mega is basically used to execute all commands. Moreover, MD30C motor driver and HC05 Bluetooth module are used in this system. This system is mainly designed to save time and energy of the user.

2. Background and Justification a. Background

i. The first known wheelchair purposefully designed for disability and mobility was called an “invalid’s chair”. It was originated in 1595 specifically for King Phillip II of Spain. [1]

ii. In 1783, John Dawson of Bath, England invented a wheelchair and named it after his town. The Bath wheelchair had two large wheels in the back and one small one in the front. [2]

iii. In 1869 a patent was taken out on a wheelchair that could be self-propelled and had large wheels at the back. Wheelchairs were starting to get less bulky but still were not easily transportable [2]

iv. In 1932 the folding tubular steel version of wheelchair was made by Harry Jennings[2]

v. Electric-powered wheelchairs were invented by George Klein. It was extremely expensive. [1]

b. Justification

Due to the increased percentage of elderlies and physically disabled people, wheelchairs are the best assistive devices to help them enhance their personal mobility. The conventional wheelchairs have some limitations such as flexibility, bulkiness and restricted functions. There are existing technologies which allow the users to use human gestures such as the movements of hands, movements of leg tongue and head and synchronize them with the movement of the wheelchair. Smart wheelchair App is a better wheelchair controller. A smart wheelchair is developed to help an elderly or physically disabled person (user) to move from one place to another independently. To control Smart wheelchair, you need to install the application in your smartphones.

By using smartphone, the user can easily determine the wheelchair's movement by selecting the desired direction on the android smartphone phone screen. The command given by the user will be forwarded to the Arduino Mega via Bluetooth. The Bluetooth will convert the commands given by the user in a binary format and send them to the Arduino Mega. Arduino Mega used in wheelchair will read and execute the command and finally send the digital values to the motor driver device. The motor driver installed will direct the wheelchair according to the command given. . When the user selects the "Go" arrow, the wheelchair will move in a forward direction, "Back" arrow prompts the wheelchair to move backward, and "Left" arrow causes the wheelchair to turn towards left, and "Right" arrow makes the wheelchair to turn right. An aged or physically challenged person can carry on the direction and movement of the wheelchair with the facility of android smartphone in the following four different directions namely, left, right, forward and reverse. There would also be a stop button to make the wheelchair's movement stop at once. The wheelchair will move according to the command given by the user.

In this paper will discuss, a smart wheelchair is developed to help an elder person or someone who is physically disabled to move from one place to another independently. An

elderly or physically challenged person can direct the direction and movement of the wheelchair with the help of the android smartphone in four different directions, left, right, forward, reverse and stop. The wheelchair will move according to the command given by the user.

3. Project Methodology

The project entitled "UOS SMART E-Wheelchairs" is a combination of **IoT** and **Android** base logic. Our product will consist of wheelchair infrastructure and an android application that work and communicate effectively with each other. By using smartphone, the user can determine the wheelchair's movement by selecting the desired direction on the android smartphone phone screen. The command given by the user will be forwarded to the Arduino mega via Bluetooth. The Bluetooth will convert the commands given by the user in a binary format and send them to the Arduino Mega. Arduino mega will read and execute the command and lastly send the digital values to the motor driver device. The motor driver will direct the wheelchair according to the command given. When the user selects the "Go" arrow, the wheelchair will move in a forward direction, "Back" arrow prompts the wheelchair to move backward, and "Left" arrow causes the wheelchair to turn left, and "Right" arrow makes the wheelchair turn right.

4. Scope and Objectives

The objective of Smart E-wheelchair System is to make physically disabled student independent. Movement of wheelchair can be controlled by using android application. With the help of this functionality user don't need any attendant. The electronics wheelchair presents in marketplace are too much costly. A common person cannot afford to buy that wheelchair. The electric wheelchair we are going to make is affordable by a any person.

The following aspects were considered in the choice of a design solution:

- Installation costs
- Time savings
- Reliability
- Power consumption
- Maintenance
- Expandability

A critical consideration is the installation costs, since costs generally determine the feasibility and viability of a project.

Chapter 2

Feasibility Study

1) Technical Feasibility

The technical feasibility of this project involves the languages and Arduino devices which are being used to develop the project. The project entitled "UOS SMART E-WHEELCHAIR" is a combination of IOT and android base development.

- In IOT base development we use Motor driver (L298N), DC motor, HC-05 Bluetooth module, Arduino Mega, Power supply, capacitor, LM7809 and wheelchair. These components will combine to make electric wheelchair. We use Arduino IDE for coding in chips.
- In the android base development phase, we will develop an application that is used to control a wheelchair. For front end coding we use XML language. For back end coding, we use JAVA language. The developmental phase of the application consists of a graphical user interface and movement functionality of the wheelchair using mobile application. Application would provide a user-friendly display, easy to use and operate.

Functional requirement

- User will provide log in information.
- User must provide valid contact detail.
- User can use application to operate wheelchair.
- User can stop wheelchair by using stop button in application.
- User can move left wheelchair by using left button in application.
- User can move right wheelchair by using right button in application.
- User can move reverse wheelchair by using reverse button in application.
- User can move forward wheelchair by using forward button in application.

Non-Functional requirement

- **Performance Requirements**

The E_Wheelchair application should have a very quick performance capability to make the system efficient enough to act upon the generated command. All devices connected to it will confirm their duties within Nano seconds or within no time after receiving a notification from it.

Talking about performance concerns all devices connected to the system are nicely communicating to each other to send and receive information. All modules are well integrated and process is running in an adequate flow.

- **Availability**

  The system will be available 24/7. By using android smartphone, the user can select the specified direction displayed within the four quadrants on the screen of the android smartphone to control the wheelchair.

- **Security**

The application will provide database security. Only the registered person that has been installed E_Wheelchair would be able to log in and can operate wheelchair at any time. User would be able to set log in passwords of their suitable safety requirement.

- **User Documentation**

  On first startup of website application, there will be a small description or a graphical slider will be shown in order to guide the particular customer so that he could easily navigate through the system and could make changes when or how he feels suitable or when required regarding field necessity. User will be guided through proper guideline. Step wise understanding would be tried to facilitate the users. Any complexity would be avoided that can be cause of worry for an E_Wheelchair user. Also a YouTube tutorial URL will be provided (if possible) that will teach how to use the Electronic Wheelchair.

2) Economic Feasibility:

The following factors are considered in designing the proposed solution:

A. Software cost estimation

We can calculate the cost of software by using Constructive Cost Model. Our project is medium level and have characteristics of organic mode so we take value of organic mode for a, b, c and d. There are approximately 3 KLOC in our project.

Mode	A	B	C	D
Organic	2.4	1.05	2.5	0.38
Semi-Detached	3.0	1.12	2.5	0.35
Embedded	3.6	1.20	2.5	0.32

In this we calculate 4 things

i. Effort

$$Effort = a\ (KLOC)^{b}\ person\text{-}month$$

$$Effort = 2.4\ (3)^{1.05}\ person\text{-}month$$

$$Effort = 7.60\ person\text{-}month$$

$$Effort = 8\ person\text{-}month$$

ii. Development time

$$Development\ time = c\ (Effort)^{d}\ month$$

$$Development\ time = 2.5\ (8)^{0.38}\ month$$

$$Development\ time = 5.49 month$$

$$Development\ time = 5\ month$$

iii. Average staff size

$$Average\ staff\ size = (Effort / Development\ time)\ person$$

Average staff size = (8/ 5) person

Average staff size = 1.6 person

Average staff size = 2 person

iv. **Productivity**

Productivity = (KLOC/ Effort) KLOC/ person-month

Productivity = (3/ 8) KLOC/ person-month

Productivity = 0.375 KLOC/ person-month

Productivity = 0.4 KLOC/ person-month

B. Hardware cost estimation

Table 1: Hardware cost

Sr.no	Component	Price
1	Motor driver (L298N), Arduino mega 2560 R3, hc-05 Bluetooth, , wires	5000
2	Brush gear electric motors	7000
3	welding cost + new wheel cost +25h 68 tooth rear wheel sprocket + 2 DC motors+ Battery with charger + Battery terminal	15000
4	Wheelchair	8500
5	Button+ regulator	500
6	Rent	1500
7	Electrical engineer service fee	10000
	Total	47500 approximately