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Touch-Screen Based Wheelchair System

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ABSTRACT

In the technologically developing world patients with some cognitive disabilities and impairment must be provided with smart wheelchair systems for their easy navigation and safety. This paper describes the wheelchair system with user friendly touch screen interface. This device helps the disables to have automatic advancement to their destination through predefined paths in the indoor system. Use of touch-screen enables less muscle movement and less muscular pressure than the self propelled wheelchairs which are being used from ages. The ability to choose between manual operating mode and predefined operating mode uniquely presents capacity of the wheelchair to operate in multiple environments. Obstacle avoidance facility enables to drive safely in unknown as well as dynamic environments.

Keywords-**Easy navigation, Obstacle avoidance, Touch screen, Wheelchairs**

I. INTRODUCTION

With the increase of elderly and disabled people, a wide range of support devices and modern equipment has been developed to help improve their quality of life. Some patients which cannot manipulate the wheelchair with their arms due to a lack of force face major problems such as orientation, mobility, safety [5] .There are various kinds of wheelchair which are being manufactured such as

(1) Manual or self propelled wheelchair-It is normal chair arrangement having wheels which are present on both sides of chair which are dragged by patients manually and Joy-stick operated wheelchair in which joystick is used for operating.

2) Speech Recognition-It recognizes the verbal command given by patient and according to that wheelchair moves.

3) Image acquisition-It uses camera to detect hand movement and according to it movement occurs.

4) Sensor controlled- In this sensors like accelerometer sensor and flex sensor. As a stability point of view it is quite good but it require high accuracy while designing and programming.

Taking all in this in consideration we have decided to do a touch-screen operated wheelchair 1) It is user friendly technology that operates on touch screen 2) less force is required for operation i.e. single finger is enough to operate a wheelchair. As touch screen technology is acquiring highest peek in various scientific as well as commercially developing products, its use in patient friendly devices like wheelchairs may result in improved quality of service.

II. WHEELCHAIR SYSTEM

This system includes two modes of operation viz. manual and autonomous mode using arm microcontroller. In manual mode touch screen is used which enables patient a user friendly inter-facing of the wheelchair. An autonomous mode enables the patients to navigate indoors at predefined paths. It also contains obstacle detection techniques with the help of IR sensor. This allows the use of wheelchair for disabled person to lower the cost and improve effectiveness.

The wheelchair users are also facilitated with wireless communication for emergency situation. The Intelligent wheelchair is developed as a very low cost product. It is designed as an embedded system and is directly usable; it does not require a laptop or other heavy devices as compared to the sophisticated wheelchair products available today. Hence it proves to be ideal solution for physically disabled and elderly people. In the situation where no of disabled and handicapped are aggravating with war and aging, this product has great timely value.

III. RELATED REASEARCH

Referring to table 1 below, these are the recent advancement in development of smart wheelchair system. The majority of smart wheelchairs that have been developed to date have been tightly integrated with the underlying power wheelchair, requiring significant modifications to function properly. There are various types of smart wheelchairs which are being recently researched and developed. Some of them are yet to be implemented at manufacturing level for customers.

To accommodate this population, several researchers have used technologies originally developed for mobile robots to create "smart wheelchairs." A smart wheelchair typically consists of either a standard power wheelchair base to which a computer and a collection of sensors have been added or a mobile robot base to which a seat has been attached [7]. It is worthy to recall that the aim of this study was to develop an intelligent robotic wheelchair to provide independent mobility to cognitively and motor disabled people [2].

As described in the table below multiple wheelchair designs shows the adaptability of the system to dynamically changing environment which includes the curved path, narrow passageways as well as dynamically changing obstacles. The majority of smart wheelchairs that have been developed to date have been tightly integrated with the underlying power wheelchair, requiring significant modifications to function properly [7]. As this system is using 4 wired resistive touch screen, its compact size and higher resolution makes the system more user friendly.

This system is implemented using ARM microcontroller which has on chip memory of 512 KB in which predetermined paths can be stored without interfacing any external memory. This system can also be modified for the patients other than patients with cerebral palsy by adding various advanced and newly developed interfacing devices.

System	Description
Multi-mode control powered Wheelchair [1]	Provides Manual, Speech, Vision and Autonomous modes that can be used in accordance with needs and situation.
Intelligent wheelchair System [2]	Automatic navigation system that drives the vehicle, avoiding obstacles even in unknown and dynamic scenarios.
Motion Control for powered Wheelchair [3]	Straight and curved motion mode of wheelchair based on joystick to calculate synchronized motion ratio for safe navigation on roads with uneven ground or obstacles.
Electric power wheelchair [4]	Provides manual operation based on joystick and autonomous Operation relies on a computer vision for navigation.
Hand Gesture wheelchair System [5]	User provides input to system through facial gestures, which are are Interpreted through computer vision techniques. Response to user input (facial gestures) adapts based on wheelchairs surrounding.
Intelligent Wheelchair Platform [6]	Provides automatic navigation by outfitting the wheelchair with cameras, a laser range finder and on board processing.

Table1.
Current and recent smart wheelchair research projects

IV. INTERFACES FOR SYSTEM

As shown in Fig.1, the main components of the system contain hardware, software as well as interfacing devices. The touch-screen is used as input device while LCD is used for display. C language is used for designing the software. Due to some indoor or outdoor hurdles, there is a possibility of collision as a result of misjudgment. To avoid this situation this system uses IR sensors which senses the obstacle in the way and system will immediately respond to it. 4 wire touch screen is used as touch screen interface. The use of resistive touch screen enables low power consumption and millions of touch life.

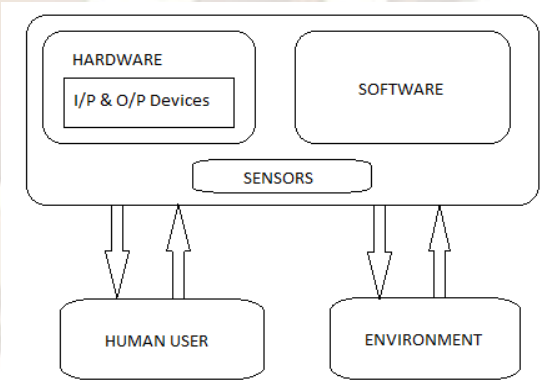
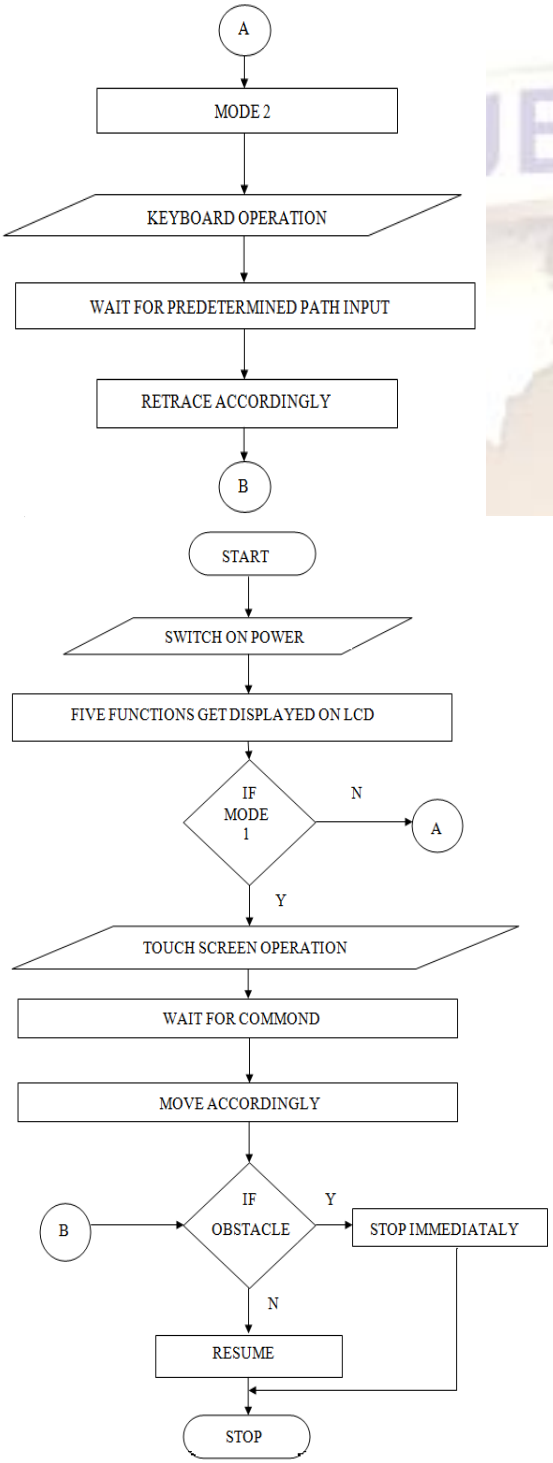


Fig.1. Architecture and main components of the system

Two modes of operation such as manual and autonomous will enable the patient a choice of navigation. Predefined paths can be chosen from touch screen panel which can trace the paths which are stored in the memory.ARM microcontroller is used for processing of the touch screen input as well as the sensor input.

V. SOFTWARE DESIGN



5. (A) Flowchart of wheelchair system software

V. [1] ALGORITHM

1) start
2) Turn on power
3) Give command on touch screen panel
4) Choose navigation option as per indoor or outdoor environment
5) Avoiding obstacles automatically through sensors
6) Reach destination
7) Stop

Software design enables the adaptive changes in the system without changing the hardware as per patient's requirement. Some additional facilities can be added with the help of software. Patients with cognitive disorder require different arrangement than elderly patients.

VI. FUTURE WORK

Much future work is to be completed before commercialization of this project. This includes further development of hardware and software. It also includes the full testing of the system. The system can be redesigned and rebuild as per the patients requirement. We have planned wide range of activities that will be useful to evaluate system.

VII. CONCUSION

We have described the system which is driven by the sensors and advanced algorithm. Though we are mainly focusing on touch screen based system interface, further advancements can be done through more research. The interface and software can be modified and redeveloped according to the level of disability of the patient.

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