

# A Smart and Sensitive Wheel Chair for Physically Challenged

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**Abstract**—Automation is one of the developing fields especially in the country like India. It is acquiring one of the most essential parts of our life. To make a faster move in today's world, automation has become an essential part. With respect to automation a simple and effective idea is developed towards the handicapped people which thus help the handicapped/physically challenged to effectively utilize and taste the experience of automation. Especially for whom walking is difficult or impossible due to illness (physiological or physical), injury, or disability a wheel chair is often needed. A wheelchair is a wheeled mobility device in which the user sits. The device is propelled either manually (by turning the wheels by the hand) or through various automated systems. Here an automated wheel chair is proposed where the proposed system uses a novel INFRA RED Movement Detector suitable for detecting any moving objects within the range between 25 cm and about 6 meters. The detected action is intimated by alarm sound. There are many uses for this movement detector. It is built around a matched pair of ceramic transducers, which convert movement energy to electrical energy and vice versa. The operating frequency of the pair is 40 kHz. Any movement in the area scanned by the pair of transducers will be detected and a 6V pulse produced. In this INFRA RED Movement Detector system the pulse turns on a LED. Pads are provided to take this pulse to add on circuits where it may be used to switch between an automatic reset after the detector has been triggered or to stay triggered. The unit will work reliably up to three meters after calibration. As a display device and a controller, microcontrollers are used.

**Keywords**— Automation, Infrared movement detector, LED, electromagnetic spectrum, microcontroller

## I. INTRODUCTION

Until the middle of the 20<sup>th</sup> century, it was used to give this category of people different kinds of naming like "disabled", "crippled", or "people with deformities". These are respectable names in comparing with others that are so far from humanity. This happened when the point of view towards the handicapped people changed after starting to say that these categories are not handicapped, but the society failed to understand or absorb them, or make use of their capabilities, talents, and capacities, and train them in order to adapt them in the society and prepare them to benefit from the development programmes, which will enable them to fit in the society.

### A. The Reasons Of Handicapping

The main reasons are

1) *Hereditary reasons.*

The hereditary reasons: The people under this category took the disability from their parents, who are (with the society) the main reasons for their disabilities, which could be avoided by early examination before the marriage or even during the pregnancy period.

### 2) *The environmental reasons*

These are the result of the external effects, which play a role since the pregnancy period until the death of the person. They include the effects before, during and after the delivery, in addition to all kind of Disabilities that happened due the wars, accidents, and disasters. The conclusion here is that any person in this world could have disability.

A wheelchair is a wheeled mobility device in which the user sits. The device is propelled either manually (by turning the wheels by the hand) or via various automated systems. Wheelchairs are used by people for whom walking is difficult or impossible due to illness (physiological or physical), injury, or disability. People with both sitting and walking disability often need to use a wheel bench.

Types of basic standard manual wheelchair incorporates a seat and back, two small front (caster) wheels and two large wheels, one on each side, and a foot rest.

Wheelchairs are often variations on this basic design, but there are many types of wheelchairs, and they are often highly customized for the user's needs. The seat size (width and depth), seat-to-floor height, seat angle (also called seat dump or squeeze) relative to the horizontal plane, footrests/leg rests, front caster outriggers, adjustable backrests, controls, and many other features can be customized on, or added to, many basic models, while some users, often those with specialized needs, may have wheelchairs custom-built.

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. This reduces the energy required to push the chair by eliminating many points where the chair would flex as it moves. Welding the joints also reduces the overall weight of the chair. Rigid chairs typically feature instant-release rear wheels and backrests that fold down flat, allowing the user to dismantle the chair quickly for storage in a car.



Fig. 1. Manual Wheel Chair

The wheelchair shown on the right is fitted with which give it complete freedom of movement. It can be driven forwards, backwards, sideways, and diagonally, and also turned round on the spot or turned around while moving, all operated from a simple joystick. However automated wheel chairs are now in the market with many other advantages.

An automatic Wheel Chair is mechanically controlled devices designed to have selfmobility with the help of the user command. This reduces the user's human effort and force to drive the wheels for wheelchair .Furthermore it also provides an opportunity for visually or physically impaired persons to move from one place to another. The wheelchair is also provided with obstacle detection system which reduces the chance of collision while on the journey. Smart wheelchair has gained a lot of interests in the recent times. These devices are useful especially in transportation from one place to another. The machines can also be used in old age homes where the old age persons have difficulty in their movements. The devices serve as a boon for those who have lost their mobility. Different types of smart wheelchair have been developed in the past but the new generations of wheelchairs are being developed and used which features the use of artificial intelligence and hence leaves a little to tinker about to the user who uses the wheel chair. The project also aims to build a similar wheel chair which would have a sort of intelligence and hence helps the user on his/her movement.



Fig. 2. A model of automatic wheel chair

## II. BLOCK DIAGRAM AND METHODOLOGY

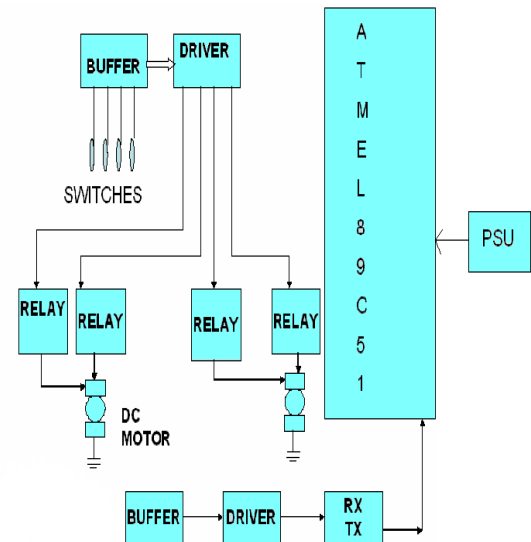


Fig. 3. Block diagram of an electric wheel chair

The figure shows the block diagram of an electric wheel chair. It has an 89C51 microcontroller with an LCD display system. The data is to be sent to the 89C51Micro-controller chip by pressing keys on Key Pad as Input Data. The 89C51 Micro-controller chip receives this data at its Input port and manipulates it with the help of software and send the final output to Output Port. The LCD Display board connected to this Output Board displays that data as visual representation of the key press action.

This '89C51 WITH LCD DISPLAY' project is constructed around the smart and self-efficient Micro-controller chip. In Brief: The user enters his data through a keypad. This User Data enters the Micro-controller and processed there. As user wants to know what data he has entered, as soon he enters it is displayed on 7 Segment display for visual information.

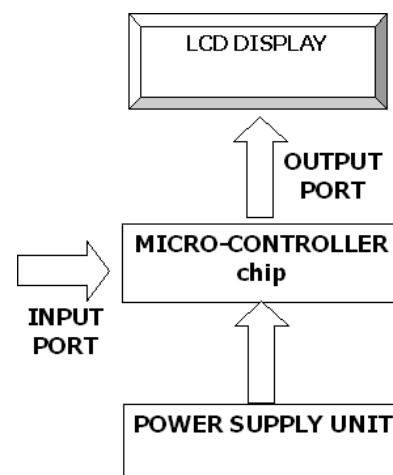


Fig. 4. Interfacing 89C51 With LCD Display And PSU

This 89C51 WITH LCD DISPLAY system is just a starting point for exploration of Micro-controller chips. Hence it has totally very few hardware parts with supporting software, which is inherited inside the memory of Micro-

controller chip. One Key Pad is connected to Input Port of Mother Board, which contains Micro-controller chip, and output is taken across Output Port and connected to LCD Display.

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The keypad helps user to set the data [i.e., User Data] for display purpose. There are 0 to 9 numbered keys, which are used to set the User Data. The keypad might involve flipping a switch beign an operation, pressing a key to select an option, or entering a number for the program to use in its operations. For simple tasks, one can use toggle, slide, or pushbutton switches. Other project might call for a keypad with an array of switches, with each labeled with a number, letter, or other description.

89C51 micro-controller processes the User Data and executes the same. The software inherited in this chip manipulates the User Data and gives out the respective result to Display Unit. The general definition of a microcontroller is a single chip computer, which refers to the fact that they contain all of the functional sections (CPU, RAM, ROM, I/O, ports and timers) of a traditionally defined computer on a single integrated circuit. Some experts even describe them as special purpose computers with several qualifying distinctions that separate them from other computers.

The power supply provides the clean and harmonic free power to IC to function properly. The output of the full wave rectifier section, which is built using two rectifier diodes, is given to filter capacitor. The electrolytic capacitor C1 filters the pulsating dc into pure dc and given to Vin pin-1 of regulator IC 7805. This three terminal IC regulates the rectified pulsating dc to constant +5 volts. C2 & C3 provides ground path to harmonic signals present in the inputted voltage. The Out pin-3 gives constant, regulated and spikes free +5 volts to the mother board.

LCD display provides the visual presentation of the entered User Data for the user benefit. This module receives its information from Micro-controller, and not from the Keypad. LCDs can add a lot to any application in terms of providing a useful interface for the user, debugging an application or just giving it a "professional" look.

Relay is the traditional method of switching current through a load, which requires isolation from the controlling circuit, involves the use of an electromechanical relay. Such devices offer a simple, low-cost solution to the problem of maintaining adequate isolation between the controlling circuit and the potentially lethal voltages associated with an a.c. main supply.

Buffer isolates IR Receiver section from the rest of the circuit. This is necessary as Buzzer is used to give audible indication, and thus leads to loading effect on entire circuit while buzzing. The reference signal passes through this block and is fed to Driver block.

Driver This block drives the Buzzer, which needs extra current while buzzing the alarm. As all the blocks deal with low voltage leveled reference signal, this Buzzer acts as strong current driving load to the system. So to avoid that loading effect, Driver block is created. This block drives the Buzzer, as soon it receives the reference signal from the IR Receiver Block.

The wheel chair uses an INFRA RED Movement Detector suitable for detecting any moving objects within the range between 25 cm and about 6 meters. The detected action in intimated by alarm sound.

The IR detector is built around a matched pair of ceramic transducers, which convert movement energy to electrical energy and vice versa. The operating frequency of the pair is 40 kHz. Any movement in the area scanned by the pair of transducers will be detected and a 6V pulse produced. In this INFRA RED Movement Detector system the pulse turns on a LED. Pads are provided to take this pulse to add on circuits where it may be used to switch between an automatic reset after the detector has been triggered or to stay triggered. The unit will work reliably up to three meters after calibration.

IR detector is a modern, simple electronic remote controlling system, which can be used to control the required electronic or electrical device in any industry or home. An IR transmitter and Receiver is used here. This IR Transmitter is fitted in front of the wheel chair, besides the IR Receiver. Its job is to transmit the IR Wavelength Signals in opposite direction continuously. An IR Receiver is a module, which is encapsulated with Photo Transistor whose semiconductor junction is mounted beneath an optical lens. It is normally used in its open base configuration and act as a light-to-voltage converter.

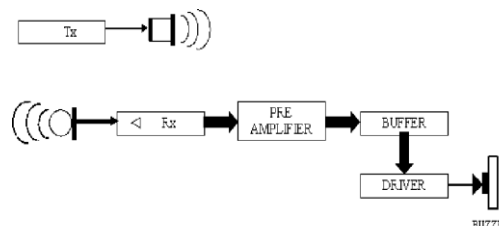


Fig. 5. Block diagram of IR movement detector

#### A. Advantages and Applications

The above work has several advantages and applications:

- Cost effective and time efficient
- Provides better Security.
- Easy to construct and install
- Efficiency of the system is high.
- Consumes less energy and automatic motion control.

The applications include:

- Automatic wheel chair control is extremely helpful for physically disabled patients and fed in hospitals.



- In factory automation, Surveillance equipment.
- Stage lighting, vending machines, machine tools
- pumps labelling and folding machines, lab analyzer
- Copier, printer, plotter and scanner and medical equipment.

### III. TESTS AND RESULTS



Fig. 6. The circuit diagram



Fig. 7. Microcontroller with LCD display



Fig. 8. Result showing the detection of obstacle

The novel Infrared Movement Detector presented here is suitable for detecting any moving objects within the range between 25 cm and about 6 meters. The detected object is sent as a message to emergency care unit and the output is displayed in the LCD as shown in the fig 4.4.



Fig. 9. Indicating an emergency call

### IV. CONCLUSIONS

With respect to automation a simple and effective idea is developed for the handicapped where even they can effectively taste the experience of automation. The system implemented here is can control the motion of the wheel chair. The INFRA RED detector used here will detect the object and it is indicated by a buzzer. If the person falls from the wheel chair the message is sent to the emergency care unit.

Another major advantage of this implementation is that wheel chair can be automatically controlled. The action of the wheel chair is automatically stopped if it finds any obstacle ahead in the movement.

### V. FUTURE DEVELOPMENTS

The following modifications can be made to the present circuit, which leads to still smarter project building task. This system can be used as an add-on module with any instrument, gadget or equipment's and get the following advantages over conventional one:

- Micro-controller based control and speed position
- Open-loop system with no position feedback required
- Excellent response to acceleration, deceleration and step commands.
- Excellent low speed/high torque characteristic without gear reduction
- An excellent energy choice for positioning application.

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