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Head Gesture Driven Wheel Chair for the Disabled

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ABSTRACT

The paper aims to design and develop a gesture control system for a wheelchair using RF (Radio Frequency) technology and Arduino. The system allows individuals with physical disabilities to control the wheelchair's movement through simple head gestures, providing them with increased mobility and independence. The project utilizes RF communication for transmitting gesture commands from a wearable device to the wheelchair, where an Arduino board interprets these commands and controls the wheelchair's motors accordingly. This system offers a user-friendly and efficient solution for individuals with limited mobility to navigate their surroundings with ease..in addition to these we are adding panic button or the emergency purpose whenever the person presses the automatically an alert will be sent to the respective people.

Keywords — RF communication, head gestures, panic button, Arduino board.

I. INTRODUCTION

As in 21st century the human life is becoming fast and advance. So, everyone is running behind the technology and its innovation. With such pace of life normal human being can easily run behind the technology, but what about the especially abled / disabled people of our society? In the world, people are busy in their own work but disabled & older age people are dependent on other person for mobility. So, there are few people who take care of these people properly. In order to give them the independence we thought to design an automated wheelchair in terms of increasing their mobility and their requirements. To drive wheelchair in our environment is a challenge for people using their arm or hands. The wheelchair is developed to overcome such problems. The automated wheelchair is an easy transportation for the physically disabled persons. The work represents a head gesture controlled wheelchair using gesture control technique. Wheelchairs are used by the senior aging group and people facing some kind of disability and injuries. The main aspect to develop this project is to make senior aging group and physically disabled person independent. The user can control the wheelchair using his/her head gesture. In this wheelchair the automation is not isolated as the luxurious thing. It is to be beneficial for all common people. So, how to reduce the physical strength used by old age people & handicapped people to operate the wheelchair is paramount aim. As many such people has their own wheelchair but they can't afford automation in it. In current scenario the automatic wheelchairs are available in market, but it is costlier than the wheelchair that we have designed.

II. LITERATURE REVIEW

Some research has been done in this field of control using Human/Head Gesture: Chowdhury, SM Mazharul

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Hoque. (2019) Diss. JAHANGIRNAGAR UNIVERSITY. Smart wheel chair for disable people. In this Prior art they have constructed Smart wheelchair for disable people in which thewheelchair will be controlled using certain commands. Claims which they have made are if user faces any critical situation an emergency message will deliver to them. Shruti Warad, Vijayalakshmi Hiremath, Preeti Dhandargi, Vishwanath Bharath, P.B.Bhagavati (2015) Speech and flex sensor controlled wheelchair for physically disabled people. Paper describes an intelligent motorized wheelchair for physically handicap person using dependent user speech controlled and flexes sensor technology. In this project, to drive the wheelchair they are using speech commands "forward, backward, maximum, medium, minimum and stop". Direction of the wheelchair is controlled by flex sensorapplication. The wireless link between the glove & wheel chair enables any person to operate. Shayban Nasif & Muhammad Abdul Goffar Khan (2017) (EEE department Rajshahi University) "Wireless Head Gesture Controlled Wheelchair for Disable Persons". In this project they have developed hands-free wheelchair for physically disabled persons. It works based on the Head Gesture Recognition Technique using Acceleration sensor. Acceleration sensor isused for the gesture recognition RF module is used for the smart wireless controlling.

III. EXISTING METHODS

The existing systems are :

A) Eye movement based wheel chair : Eye movement wheel chair is sensed by eye ball. The main disadvantage is itchingand irritation.

B) Tongue controlled Wheel chair : In tongue controlled wheel chair, the tongue is used as medium. The main disadvantage is that tongue needs to be pierced.***Voice recognition based system :*** Proposed and implemented by a researcher. For this system the human voicecan be used to control the wheel chair. The main disadvantageis it is not suitable in noisy environment and individuals mustbe trained.

C) Brain controlled Wheel chair : In brain controlled wheel chair, brain controls the mechanical device. The main disadvantage is Brain impulse varies from person to person.

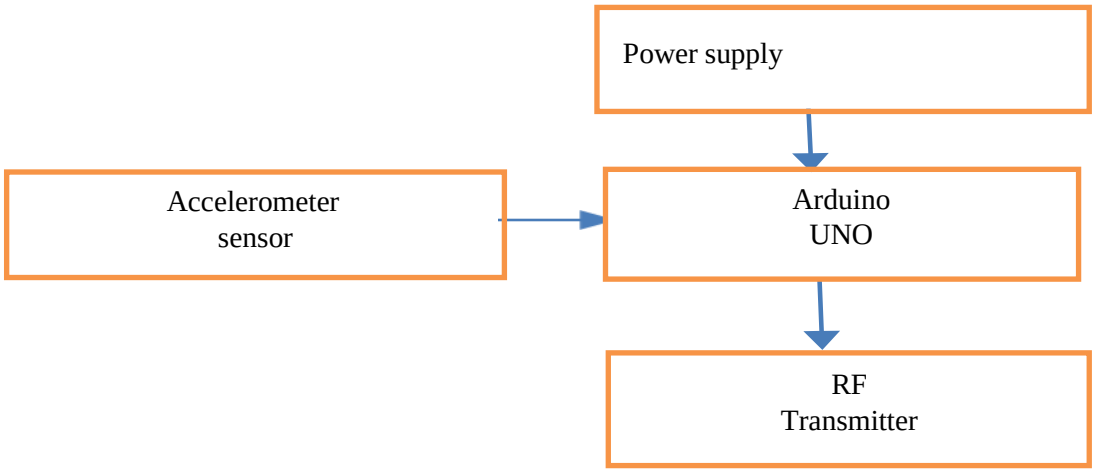
IV. METHODOLOGY

This implemented structure of wheelchair is so designed that a physically unable person can do their daily activities and move around their house without any others help . The basic methodology of this invention is two DC motors are fixed in the wheel to control the movement of the chair . The most attractive feature of this wheelchair is that it can be wirelessly controlled as we have done in this module using the RF receiver transmitter module. The controlling technique of thisdevice is performed by microcontroller.

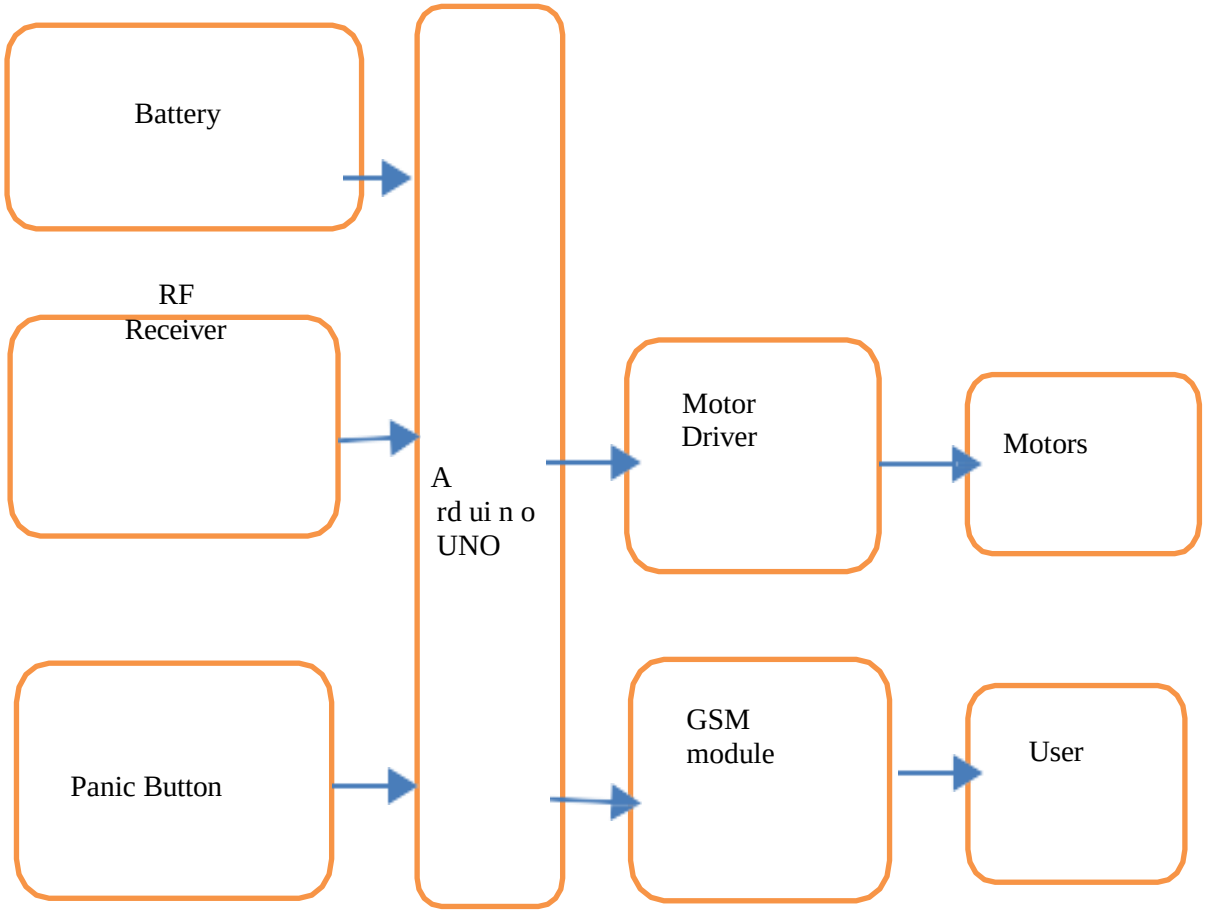
BLOCK DIAGRAM

The block diagram is classified into two, one is transmitter system and other is receiver system.

a) Transmitter Block Diagram



b) Receiver Block Diagram



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C) Flow chart

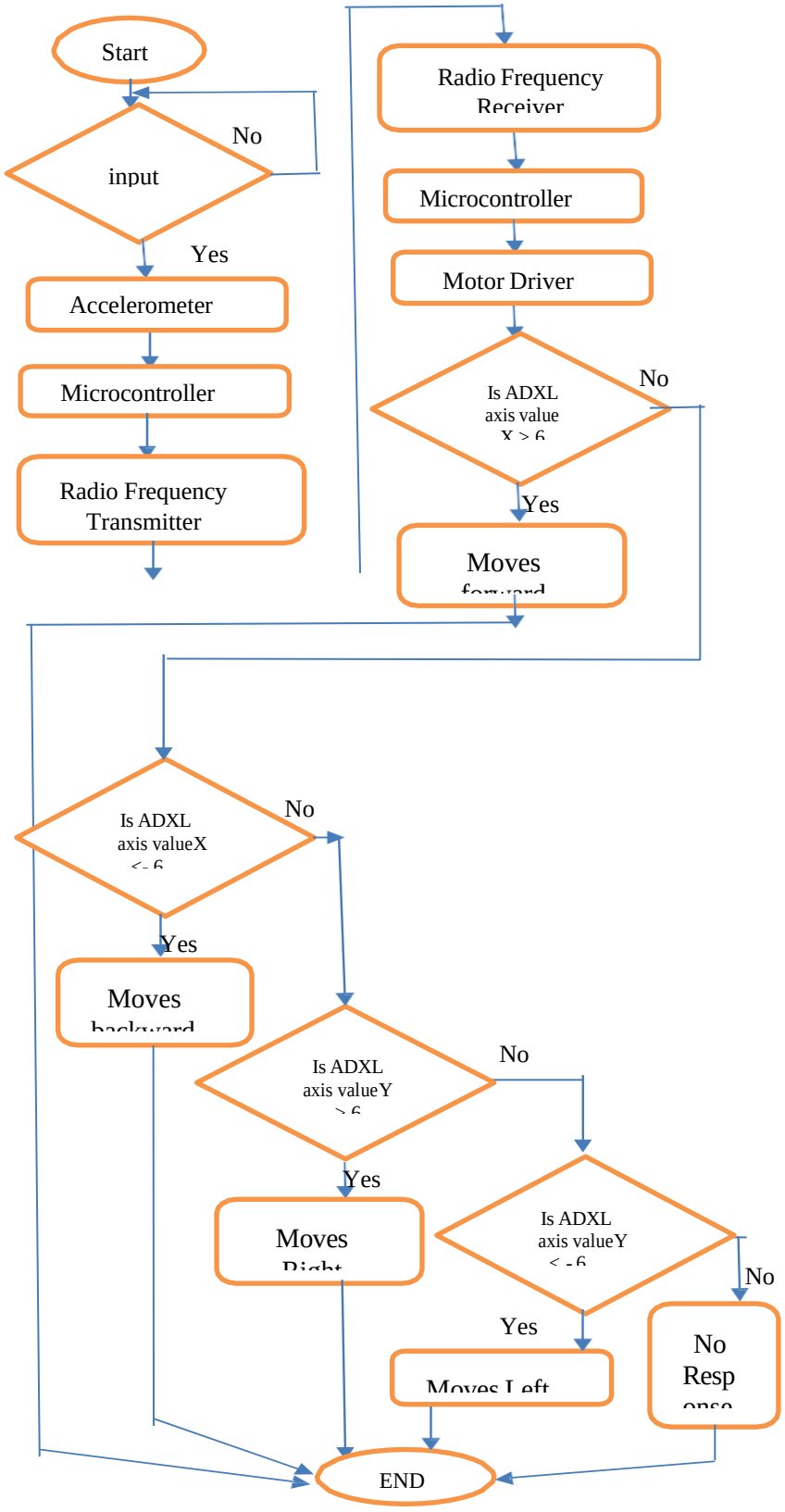

Fig 2: Receiver block diagram

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d) Complete Structure

The transmitter and the receiver circuit is fabricated in the lab. All the required components are available in the local market. The complete Transmitter and Receiver structure is shown below:

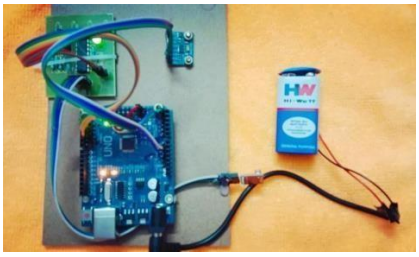

Fig 3 : Transmitter

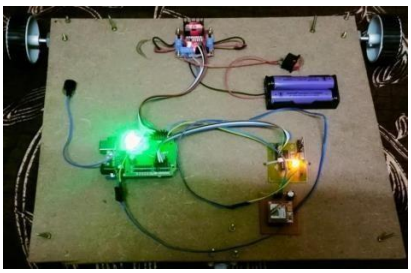

Fig 4 : Receiver

e) Component description

i . Head gesture module : The ADXL345 is a small, thin, low power, 3-axis accelerometer with high resolution (13-bit) measurement at up to ±16*g*. Digital output data is formatted as 16-bit twos complement and is accessible through either a SPI (3- or 4-wire) or I^2C digital interface.

Fig 5 : Accelerometer Sensor

ii . Radio frequency module : It is the combination of Transmitter and Receiver of radio frequency. The corresponding frequency range varies between 30 kHz & 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave. The below figures represents Tx and Rx.

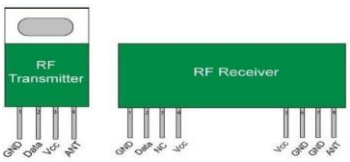

Fig 6 : RF Transmitter Fig 7 : RF Receiver

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Table 1 : RF Transmitter Pin Description

Pin No	Function	Name
1	Ground (0V)	Ground
2	Serial data input pin	Data
3	Supply voltage; 5V	Vcc
4	Antenna output pin	ANT

Table 2 : RF Receiver Pin Descriptions

Pin No	Function	Name
1	Ground (0V)	Ground
2	Serial data output pin	Data
3	Linear output pin; not connected	NC
4	Supply voltage; 5V	Vcc
5	Supply voltage; 5V	Vcc
6	Ground (0V)	Ground
7	Ground (0V)	Ground
8	Antenna input pin	ANT

iii. Microcontroller (AT Mega 328) : ATmega328 is commonly used in many projects and autonomous systems where a simple, low-powered, low-cost micro-controller is needed. Perhaps the most common implementation of this chip is on the popular Arduino development platform, namelythe Arduino Uno, Arduino Pro Mini and Arduino Nano models. ATmega328P is a high performance yet low power consumption 8-bit AVR microcontroller that's able to achievethe most single clock cycle execution of 131 powerful instructions thanks to its advanced RISC architecture. It can commonly be found as a processor in Arduino boards such as Arduino Fio and Arduino Uno.

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f) Advantages

They can provide greater independence for people with disabilities, as they allow them to control their mobility without the need for physical assistance. Hand gesture wheelchairs can also be more comfortable and easier to use than traditional wheelchairs.

g) Applications

This automated wheelchair is valuable for the people whocould not move independently like:

- Amputees – Missing legs and / or arms.
- People with weak or no upper body movements.
- Paralyzed children.

V . RESULTS

Every electronic component , as discussed above has been tested in the lab for proper functioning. Then all the components are connected together and a sample of the proposed wheel chair is fabricated. The transmitter is placedin a cap which is placed on the head of the person.

Table 3 :

Accelerometer Response and Wheel Chair movement

Head MovementDirections	**CorrespondingAnalog Value**	**Wheelchair Directions**
	Accelerometeraxis Value X > 6	**Forward Direction**
	Accelerometeraxis Value X< -6	**Backward Direction**
	Accelerometeraxis Value Y > 6	**Right Direction**
	Accelerometeraxis Value Y < -6	**Left Direction**

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VI . CONCLUSION

The wheelchair is fully controllable and reduces the effort and physical strength of the disabled person. It will come in affordable cost or if anyone have his own traditional wheelchair then also automation can be implemented in it using the circuits. It is as foldable as the original wheelchair is,so that we can take it from one place to another place without any difficulty. It is capable of control in multi modes. User can use it by his own or his companion can also operate it under a certain range. The main aspect to design this wheelchair is to make senior age people and handicapped people to be independent.

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