HEAD MOTION CONTROL WHEELCHAIR

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Abstract: Today many of the peoples were physically challenged because of accident, stroke as well as many medical issues. Among them, the people who have paralysed body below the neck portion are difficult to live as well as to move. To help this kind of persons we are planned to introduce the Automated Robotic Safety wheelchair with additional techniques. The processing of Robochair is based on the recognition of head gesture. The head gesture measurement is based on the angle of head movement. We assume and design a program for respective values to initiate the process of robochair. Most of the previous Robochair are designed with EEG, eye blinking sensors and the controllers are Arduino were mainly used. Among them various disadvantages were occurred like cost issues, efficiency, accuracy .Hence we designed with additional techniques to make a prototype for get an useful and efficient wheel-chair. We assume with head motion parameters as A,B,C,D and ultrasonic sensor values were recorded for the obstacles findings to avoid the accident actions .This makes the people to move one place to one easy manner.

Keywords: Accelerometer sensor-head motion, Ultrasonic sensor-finding obstacles, Menu keypad, Voice board, IOT.

I. INTRODUCTION

Main role of engineers is to rehabilitate the peoples who have the disabilities with their bodies. The reason for disabilities mainly due to stroke arthritis, high blood pressure, de-gerative of bones and joints and also destruction of bones in accidents. These kind of peoples now can be migrate from one place to another by using this head motion controlling robotic wheelchair. Mainly this will help the peoples who are fully paralysed below the neck.

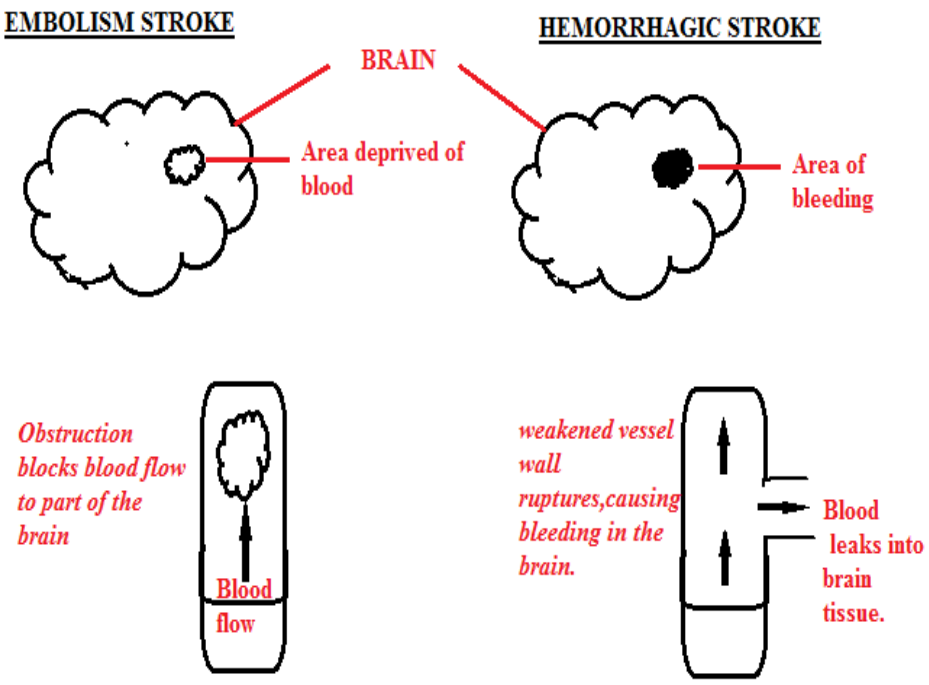

Fig 1. DIFFERENT TYPES OF STROKE

A. *STATISTICAL DATA* According to the study, there are nearly 1in 40 people living with paralysis-approximately 5.4 million people. That's the same number of people as the combined population of Los-Angeles, Philadelphia, and Washington D. C. And that number is nearly 39 percent higher than previous estimates showed. In 2018 2,90,000 peoples were affected by this.

- Paraplegic 34.4%
- Quadriplegic 24.3%
- Survival and Cause of Death

The most often caused by damage in the nervous system, especially the spinal cord. Other major causes are stroke, trauma with nerve injury, poliomyelitis.

B. REHABILITATION ENGINEERING Rehabilitation engineering is the function of engineering principles and technology in the field to uplift the people with disabilities. Quadriplegics are the persons who are not able to use any of their extremities. The reason for such decreased motion possibilities can be due to stroke, arthritis, high blood pressure, degenerative diseases of bones & joints, cases of paralysis and also quadriplegia appears as consequences of accidents or age. The robotic wheelchair supports through the movement of head. This control is particularly useful for severely handicapped people who have spinal card injury or quadriplegic patient who cannot access their hands to control the wheelchair. Thus some other possible inputs are discussed**.**

C.PARALYSIS Paralysis is when you can't move certain parts of your body after something goes wrong with their connection to your brain. It comes in many different forms and can be temporary or permanent or even come and go.

D.CAUSES FOR PARALYSIS: Paralysis can cause problems with blood flow, breathing, how well your organs work, speaking or swallowing, sexual responses, depending on where you're paralyzed and how bad it is.

E. TYPES OF PARALYSIS

- Complete paralysis
- Incomplete paralysis or Partial paralysis
- Localized paralysis
- Generalized paralysis

Complete paralysis is when you can't move or control your paralyzed muscles at all. You also may not be able to feel anything in those muscles.

Partial or incomplete paralysis is when you still have some feeling in, and possibly control over, your paralyzed muscles. This is sometimes called paresis**.**

Localized paralysis affects just one specific area, like your face, hands, feet, or vocal cords.

Generalized paralysis is more widespread in your body and is grouped by how much of your body is affected. The type usually depends on where your brain or spinal cord is injured.

F. TYPES OF WHEEL CHAIR

G. PHYSICALLY OPERATING WHEELCHAIR Manual wheel chairs are driven with the help of man power as source of energy for moving the chair, these are self-propelled. The self-propelled wheel chairs are driven by the user by using the rear wheels (diameter of 20-26") which resembles to that of bicycle but has an additional rims know as hand rims are for the movement of the chairs by means of pushing forward or backward. The hand rims are of diameter lesser than the rear wheels. Use of two hand rims at a time gives straight movement of the chair, use of one of the rim gives the turning movement to the chair towards left or right.




FIG 1.2 Self-propelled 1.3 Attendant propelled 1.4 Rigid 1.5 Foldable

H. WHEELCHAIR OPERATING BY ROBOTIC OPERATION Our robotic wheelchair observes the user and the environment can understand the intentions from behaviour and the environmental information and observes the user when he/she is off the wheelchair. However for the safety reason the user usually does not want to turn in those direction. When users moves in a narrow space, such as a corridor, they usually want to move along it. In addition it might be dangerous if the wheelchair would unexpectedly turn due to the failure of user's intention recognition.

II. **PROPOSED SYSTEM**

As per study, Auto Calibrated Head Orientation Controller for Robotic-Wheelchair Using MEMS Sensors and Embedded Technologies, we have acquired only the theme of Head motion

control. The term ADDENDUM is used, since we include added features like EEG, emergency voice messages etc to the existing system, in order to overcome the technical irregularities faced by the patients. We have use an accelerometer sensor to detect the user head motion and with the help of pic microcontroller which is a industrial standard. And we have added some features than other inventions like we have obstacle detecting sensor as well as including the voice board which intimate the recorded voice notes for respective actions. We attach one more features to identify the status of wheelchair by the use of IOT.

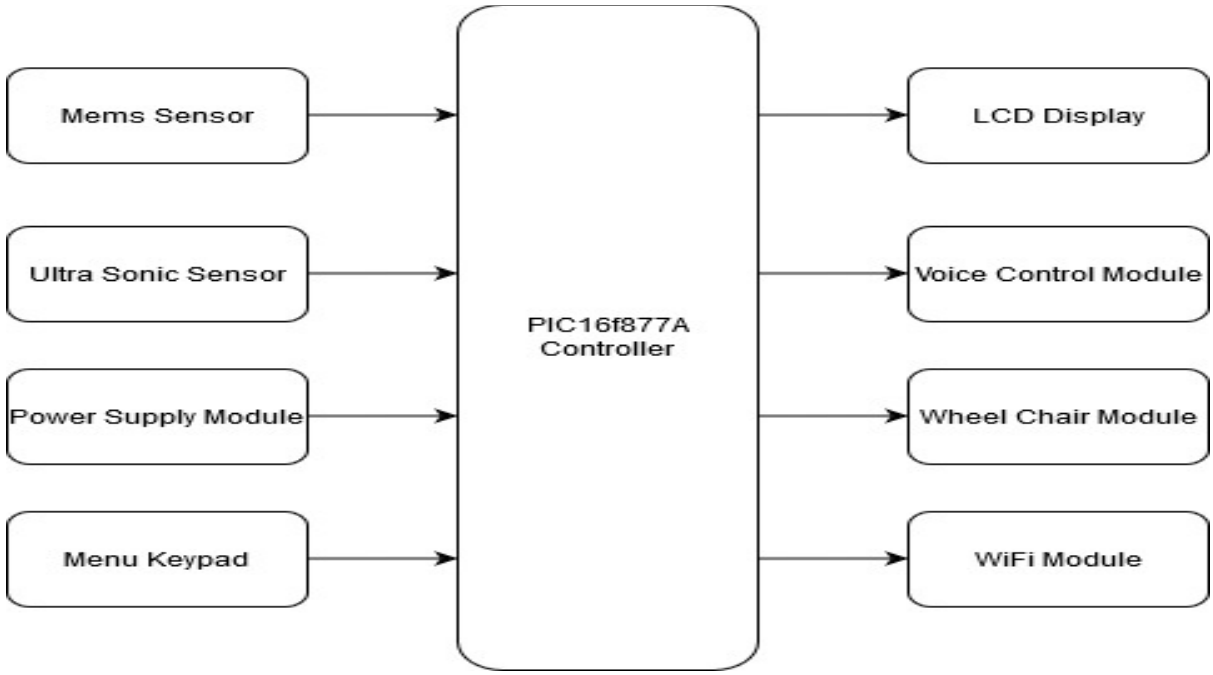

FIG2. Block diagram of proposed system

A. INITIAL PROCESS First and foremost, we started to gather the information about the patients, who are affected with quadriplegia, but unfortunately we got the information only about paraplegic patient from Dr.Dhanaraj M.S ortho, SRM hospital and research institute, Trichy.

B.TECHNICAL MODIFICATIONS The following modifications are taken to resolve the successive problems faced during each testing and analysis.

- In our initial system, we chose only ultrasonic and MEMS as an input source. In order to implement the safety measures and to identify the state of the patient like sleep and awake condition of the user. We have introduced EEG electrode to capture the brain wave signals.
- Now taking ultrasonic sensor into consideration, initially we took only one sensor for sensing obstacle that covers the area only up to 15 degrees, which is insufficient.
- In existing system, only single nod is basically used for controlling the motion of the system, in order to differentiate normal nodding like sneeze, hick ups, etc. thus we have introduced double nodding in forward and backward directions.

Table I. Explanation of the direction of the wheelchair motion

COMMAND	DEFINITION
Single nod forward	Both motors rotate forward
Single nod backward	Both motors rotate backward
To turn Left	Right motor rotates forward and left motor rotates backward
To turn Right	Left motor rotates forward and right motor rotates backward
Normal position to stop	Both motors stops

- In order to make the situation better in outdoor crowded environment, different modes of messages have been introduced, like excuse me, make a way, etc.
- During critical situation, the buzzer sound was used as an indication. This parameter is later replaced by voice message, which will be let out through speaker. These voices are readily pre-recorded in audio recorder board.
- Under uncontrolled situation there is no recovery actions are taken initially, later emergency stop button concept was included.

This robotic wheelchair operate using the recognition of the head motion. A MEMS sensor is used to track the movements. The head gesture recognise by the sensor according to head movement are trapped and send as input to the controller. Based on the inputs provided and microcontroller controls the robotic wheel chair. The decisions made by microcontroller are:

- When person tilt twice his head in forward direction, chair will move in forward direction.
- If person tilt twice his head in backward direction above, chair will move in backward direction.
- If person tilt his head in left direction above, chair will move in left direction.
- If person tilt his head in right direction above, chair will move in right direction.

C.ULTRASONIC SENSOR Ultrasonic sensor emits ultrasonic pulses, and by measuring the time of ultrasonic pulse reaches the object and back to the transducer. The waves which are emitted from the ultrasonic sensor and those waves are hit on an object and received back to the transducer. After having emitted the sound waves, the ultrasonic sensor will switch to receiver mode. We use three electrodes, Difference in voltage between two arms is taken, and right leg electrode serves as the reference. The ultrasonic sensor which we have tested initially could detect at the range of 0-20, which is highly inefficient. Later we have chosen a sensors that could detect at two ranges, short range at 0-300 and long range at 0-500, which is also inefficient in both out-door and in-door environment. Finally, we have included the sensor that could sense at the suitable distance of 0-1500. The full coverage area of ultrasonic sensor is 30-40cm.

D. MEMS SENSOR In our project wheelchair is operated by using the head motion and to sense the head motion MEMS accelerometer is being used. Micro Electro Mechanical Systems (MEMS) is the integration of mechanical elements, sensors, actuators, and electronics on a common silicon substrate through micro fabrication technology. It is one of the most promising technologies of 21St century. It consists of mechanical micro structures, micro sensors, micro actuators integrated on to the same silicon chip. It changes in the system's environment are detected by the micro sensor and corresponding electrical signal is produced, micro actuators react to the signal. In the proposed system, MEMS sensor measure the tilt angles produced by the patients. In the value testing of MEMS sensor we got approximate values, since it has two ways motion we have denoted as X Y parameters and we eliminated the motion in Z direction, hence Z parameter is not considered. Due to their small size, MEMS devices can be integrated into a single chip thus, data reception, storing, interfacing, etc., can be carried out with a single chip. The values of the x and y are,

Table II. MEMS sensor testing

PARAMETER	SETPOINT	MOTION
X	0	Forward
X	>10	Reverse
Y	>10	Left
Z	>2	Right

E. IOT MODULE It is a system which is used to maintain and viewing the detailed data report without any physical contact. It is ability to transfer data over a network without requiring human to human. We are using this IOT is to check the status of the wheelchair. It can be used for doctor because they can monitor the patient and they can easy the monthly report. And then it can be used to check whether the patient is ill or not. We are adding our IOT module and then we are created own webpage

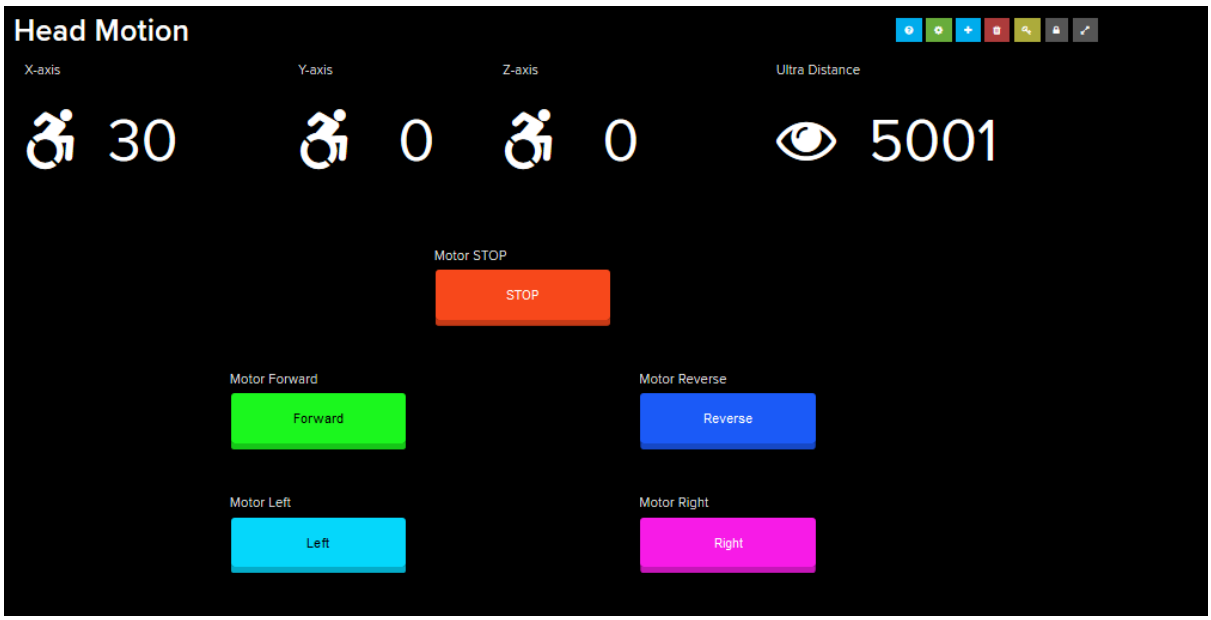

FIG 3.IOT Webpage

F. PIC16F877A MICROCONTROLLER PIC microcontroller board is used as a basic controller in industries.The PIC16F877A microcontroller includes . An 8-channel 10bit A/D converter is also included within the microcontroller,making it ideal for real-time systems and monitoring applications. All port connectors are brought out to standard headers for easy connect and disconnect.The PIC16F877A is one of the most popular PIC microcontrollers and it's easy to see it comes in a 40 pin and it has many internal peripherals. The 40pin makes it easier to use the peripherals as the function are spread out over the pin. This makes it easier to decide what external devices to attach without worrying too much if their enough pins to do the job. The major advantage is that each pin is only shared between two or three functions so it's easier to decide what the pin function (other devices have upto 5 function).

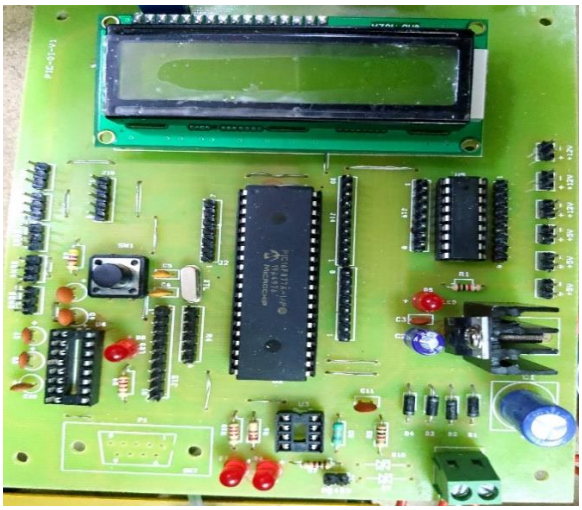

FIG 4. PIC (16F877A) Microcontroller Board

G.AUDIO MODULE The configuration of audio playback module used in our proposed system is ISD18B20. It is mainly used to play back the audio which has been recorded by the users. The terminals of audio module are play, delete, record, A0-A4 are the pins used to store the recorded voice. In this module we fed five messages for indication purpose. The first voice is fed into channel 0, which is announced when the system is started. The second command is fed into channel 1, that is indicated where the MEMS sensor detects the head motion. The third and fourth command is fed into channel 2 and channel 3, which indicates the activation of ultrasonic sensor at out-door and in-door environment. The fifth command is fed into channel 4, that is used to indicate the crowd for making a way, when the ultrasonic sensor detects the crowded environment. It has a single playback and message. Recordings are stored into on-chip non - volatile memory, providing zero-power message storage. This is a small handheld devices used primarily for recording dictation and lectures for later playback.

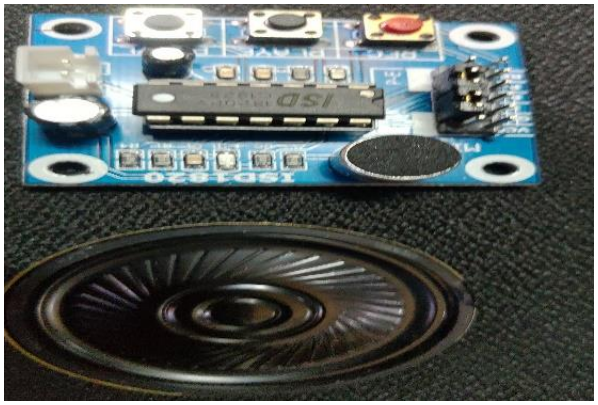

FIG 5. Voice Board with Speaker

H. MENUKEYPAD By combining zeros and ones on the output pins, it is determined which button is pressed. It does not require separate power supply for switching. The keypad is used for a multi input switching.It is using for the changing the axis values

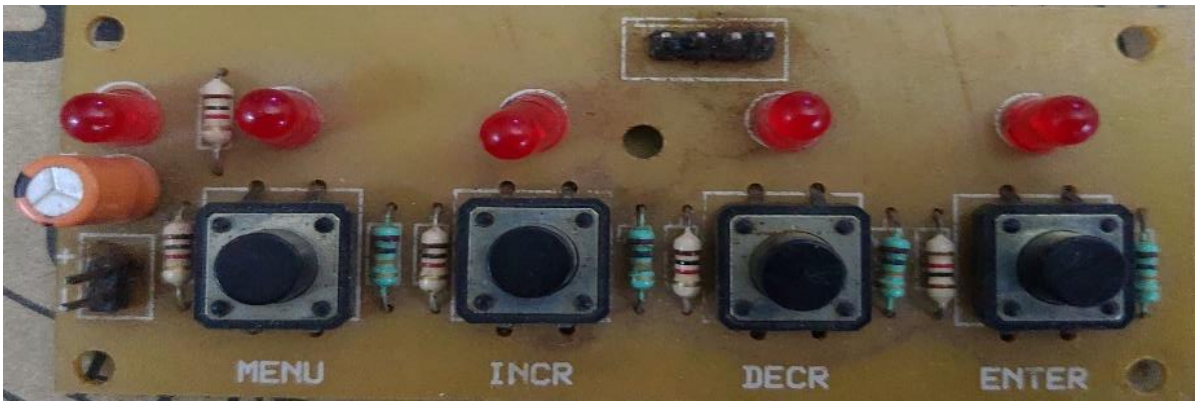

FIG 6. Menu keypad Board

III. *RESULT*

The Flowchart representation of our proposed system are listed below

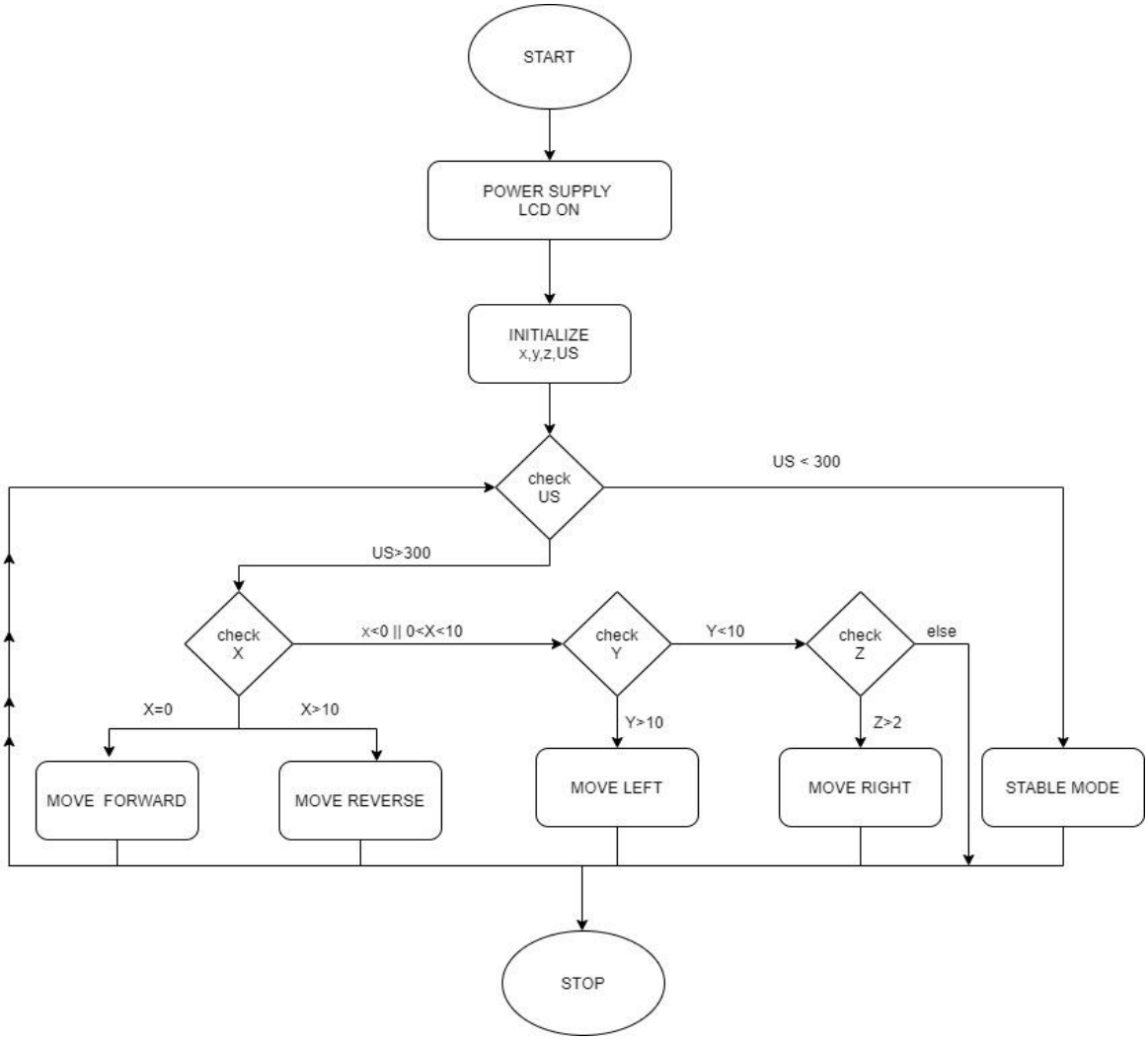

TABLE III. Result of Proposed System

PARAMETER	DESCRIPTION	STABLE VALUE	RECORDED VALUE	MOTOR ACTIVATING VALUE	ACTUAL MOTOR ACTIVATING VALUE
x	Head upward value	X<0	X=0	X=0	X=0
x	Head downward value	X<10	X=9	X>10	X=11
y	Head Left moving value	Y<10	Y=10	Y>10	Y=11
z	Head Right moving value	Z<2	Z=2	Z>2	Z=3

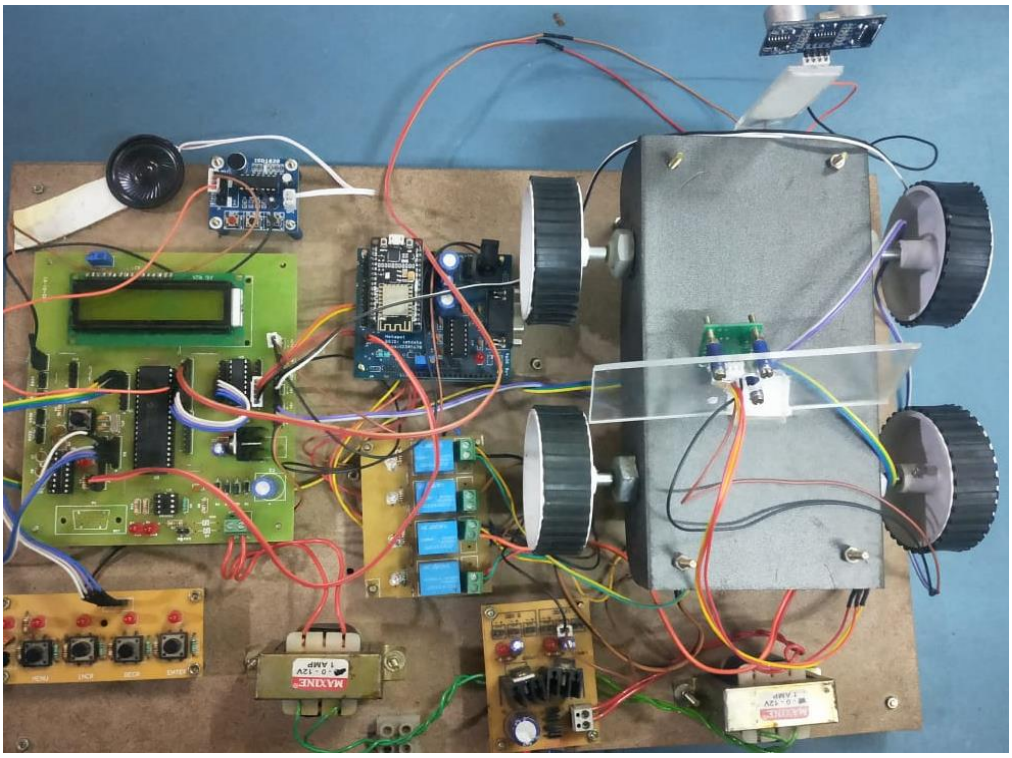

FIG 8. PROPOSED SYSTEM'S WORKING MINIATURE MODEL

IV. CONCLUSION

The proposed system is intended to create a cost effective wheel chair to help paralysed people who find it difficult to move independently. This system is customized one i.e. a pre-trained single user only can able to handle it. So the patient has to be trained as per the command system which has been coded. Errors can appear when the user makes free head motions or it can be reduced to a certain extent using an enable switch. It is designed to be characterized by low price and higher reliability. Future works can be enhanced using serial communication port rs232 of PIC for monitoring the patient and also increment in the accuracy by implementing in the effective manner.

REFERENCES

[1] J.Liu, H. Zhang, B. Fan, G. Wang, and J. Wu, "A novel economical embedded multi-mode intelligent control system for powered wheelchair," International Conference on Computing, Control and Industrial Engineering, pp. 156 – 159, 2010.

[2] H. Tanaka, Y. Sumi, and Y. Matsumoto, "A High-Accuracy Visual Marker Based on a Micro lens Array," in Proc. 2012 IEEE/RSJ Int. Conf. Intelligent Robots and Systems, pp. 4192-4197, 2012.

[3] Yoichi Morales, Nagasrikanth Kallakuri, Kazuhiro Shinozawa, Takahiro Miyashita, and Norihiro Hagita, "Human-Comfortable Navigation for an Autonomous Robotic Wheelchair," in Proc. IEEE/RSJ Int. Conf. Intelligent Robots and Systems, pp. 2737-2743, 2013.

[4] Bong Keun Kim1, Hideyuki Tanaka2, and Yasushi Sumi3 , "Robotic Wheelchair Using a High Accuracy Visual Marker Lenti Bar and Its Application to Door Crossing Navigation", 2015 IEEE International Conference on Robotics and Automation (ICRA) Washington State Convention Center Seattle, Washington, May 26-30, 2015.

[5] Mohammed Faeik Ruzaij, Sebastian Neubert, Norbert Stoll, Kerstin Thurow, "Auto Calibrated Head Orientation Controller for Robotic Wheelchair Using MEMS Sensors and Embedded Technologies", in Proc. 2016 IEEE Sensors Applications Symposium (SAS 2016), Catania, Italy, 20-22 April, 2016, pp. 433-438.

[6] Krishnamoorthy, V.Vijayarajan, R. Kannadasan, Shikhar Johari, "Robotic-Wheelchair Control Head Orientation and Eye Ball Movement Control with Health Monitor System", International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277-3878, Volume-7, Issue-5S3, February 2019.