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Healthcare Monitoring for Physically Challenged People in Wheelchair using IOT

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Abstract

IOT has changed the evolution today by connecting things over the Internet, which makes remote accessing very much easier. IOT, being one of the trending technologies can also be implemented in health care monitoring systems especially for the requirements of physically challenged people. The wheelchair can be moved using a joystick which is based on reinforcement learning. This system allows machines and software agents to automatically determine the ideal behavior within a specific context, for better performance. This wheelchair is aimed to be designed at a lower cost as compared to the other versions available in the market. The head motion controlled wheelchair designed using tilt communicator system turns out to be a great use for quadriplegic patients and disabled people having more than 45% or more disability as this could be operated easily through head gestures. Our proposed work is to design a wheelchair which operates on head gesture for its movement and as well as to enhance real time healthcare monitoring, the system has various sensors which works on IOT basis. By using IOT, status of the patient is recorded and the database can be sent to the Doctor in case of emergency.
Keywords: Gesture based control, Wireless control, Internet of Things (IOT), Tilt sensor, Healthcare monitoring

I. INTRODUCTION

In recent days, wheelchairs with advanced features have been designed for physically challenged people to move around independently without any assistance. Our project is to reduces manual work and enhance real-time healthcare monitoring system. The aim of the project is to design a wheelchair tilt communicator system that could operate the wheelchair of the handicapped person with the help of tilt of head movements. This system could be used by physically disable persons who cannot move their hands or legs but make head and eye motions.

This wheelchair could be operated in any direction using head tilt movements by the handicapped person. Design and development of Head motion controlled wheelchair has been achieved using tilt sensors and wireless modules. In order to enhance real time healthcare monitoring, the system has various sensors like MEMS sensor, IR sensor, Heart beat sensor and Moisture sensor which works on IOT basis. The MEMS sensor has the Tilt register, which analysis the direction and movement. IR sensor analysis the obstacle. Heart beat sensor measures Beats per minute (BPM) rate. Moisture sensor measures the moisture degree. The PIC microcontroller is used to perform the entire computing functions. By using IOT, status of the patient is recorded in the form of database.

II. EXISTING SYSTEM

The wheelchair can be moved using a joystick based on reinforcement learning technique. The system allows machines and software agents to automatically determine the ideal behavior. The existing model works on technologies of Robotic Wheelchair, Neuro-adaptive control and Reinforcement learning. A standard motorized wheelchair aids the mobility of the disabled people who cannot walk, allows them to control the joystick safely. Persons with a serious of disability or handicap, however, may find it difficult or impossible to use them because it requires fine control. However, there are tasks that are less structured and too complex to fully automate and thus cannot be totally performed. Therefore, wheelchair with MEMS sensor is designed which reduces the manual work.

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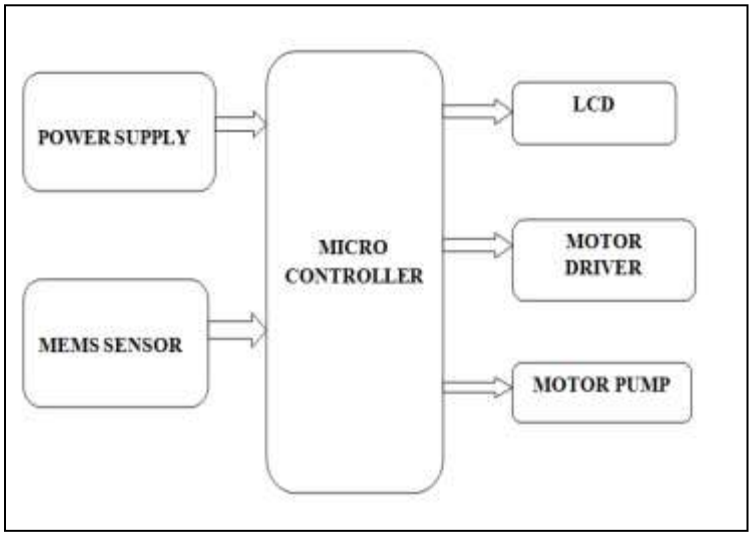

Fig. 1: Block diagram of the Existing System

III. PROPOSED MODEL

Design and development of Head motion controlled wheelchair has been achieved using tilt sensors and wireless modules. In order to enhance real time healthcare monitoring, the system has various sensors like MEMS sensor, IR sensor, Heart beat sensor and Moisture sensor which works on IOT basis. The MEMS sensor has the Tilt register, which analysis the direction and movement. IR sensor is used to detect the obstacles. Heart beat sensor measures Beats per minute (BPM) rate. Moisture sensor measures the moisture degree. The PIC microcontroller is used to perform the entire controlling functions. For the enhancement of real time healthcare monitoring, the system has various sensors which works on IOT basis. By using IOT, status of the patient is recorded and the database can be sent to the Doctor in case of emergency.

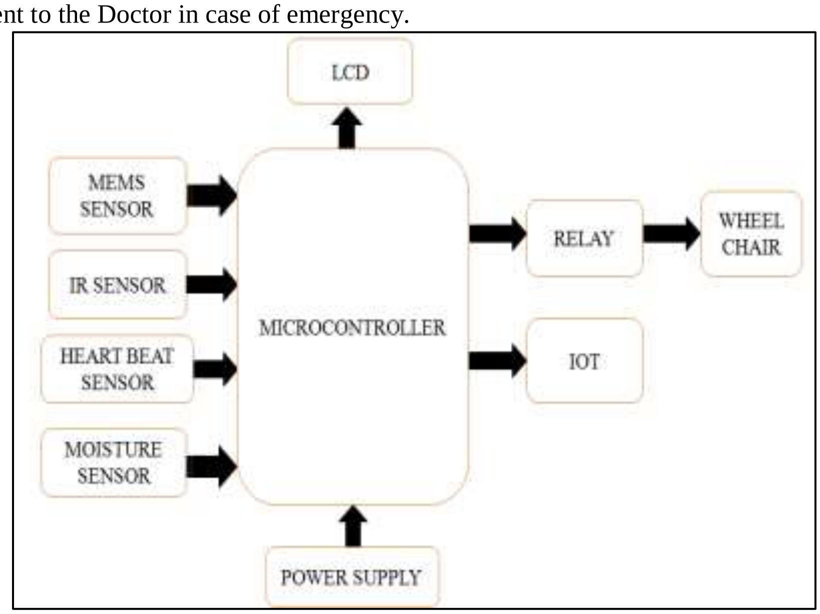

Fig. 2: Block Diagram of Proposed System

A. *Working of MEMS Sensor*

The wheelchair operates with head movement taking motion as an input signal for the movement the wheelchair in a particular direction. An accelerometer (motion sensor) is used to track this motion. This sensor is fitted to the cap on head. The variations of the sensor are trapped and those signals are fed as input to the micro-controller.

Now based on these variations, the micro-controller is programmed to take decision which in turn controls the movement of wheelchair.

- When person tilt his head in forward direction, chair will move in forward direction.
- If person tilt 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.

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Table – 1
Truth table representing the direction of the rotation of motor

POSITION	*MOTOR 1*	*MOTOR 2*
Forward	*Clock wise*	*Clock wise*
Reverse	*Anti-clock wise*	*Anti-clock wise*
Right	*Clock wise*	*Anti-clock wise*
Left	*Anti-clock wise*	*Clock wise*

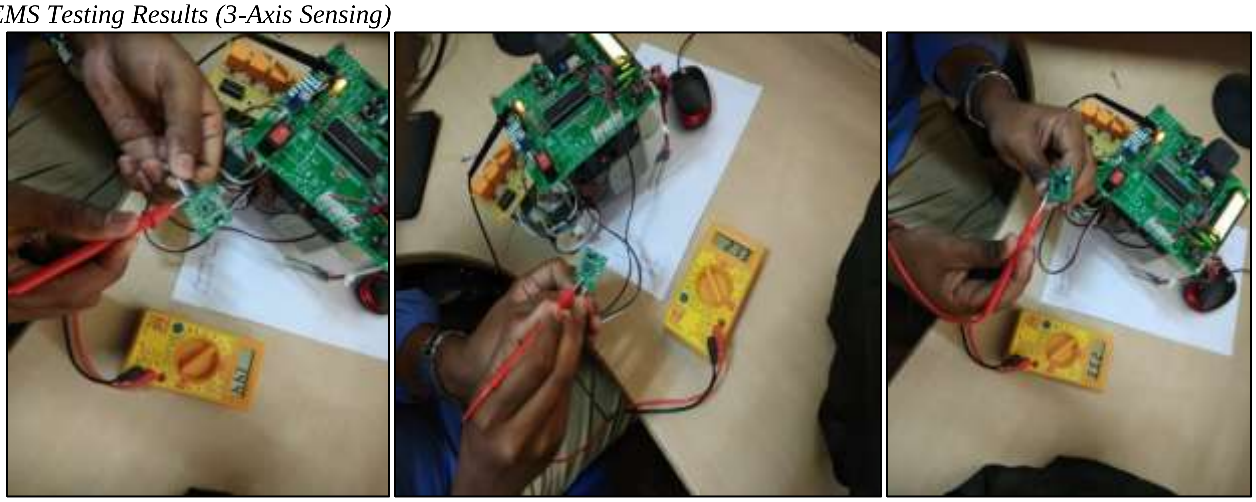

Fig. 3: Hands-free control of an intelligent wheelchair.

B. *Sensor Descriptions with its Testing Results*

1) *MEMS Sensor:*
- MEMS stand for Micro-Electro-Mechanical Systems.
- 3-axis sensing
- Small, low profile package
- Single-supply operation

2) *Application:*
- Mobile Devices
- Gaming system

3) *MEMS Testing Results (3-Axis Sensing)*


X-axis Y-axis Z-axis
Fig. 4: MEMS Testing Results (3-Axis Sensing)

4) *IR Sensor:*
- Operating voltage- 4.5v to 6v
- Type- Analog and/or digital
- Range- 0.5 cm-5 cm

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5) Application:
- Obstacle avoidance
- Line follower

6) IR Testing Results:

Detection of Obstacle

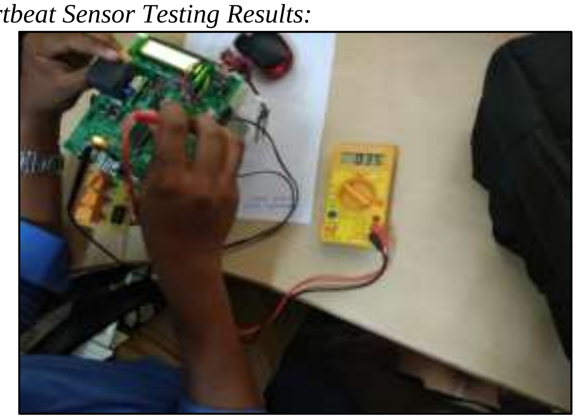
System Movement- STOP

Fig. 5: IR Testing Results

7) Heartbeat Sensor:
- Operating voltage-+5v dc regulated
- Operating current-100mA
- Indicated by LED and Output High Pulse

8) Application:
- Digital Heart Rate Monitor
- Patient monitoring system

9) Heartbeat Sensor Testing Results:



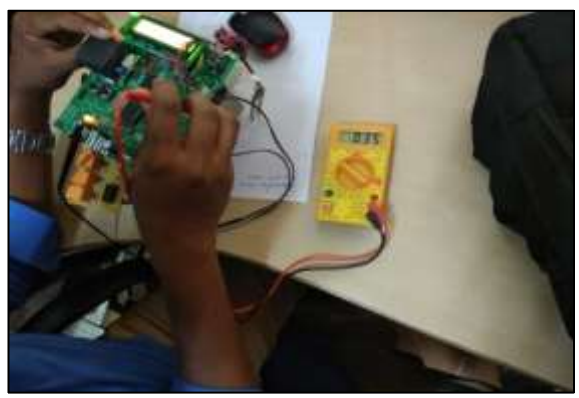


Fig. 6: Heartbeat Sensor Testing Results

10) Moisture Sensor:
- Range-700ft(210m) line of sight
- Moisture-0~100%,8-bit
- Operating range—40c to 85 c

11) Application:
- Agriculture
- Landscape irrigation

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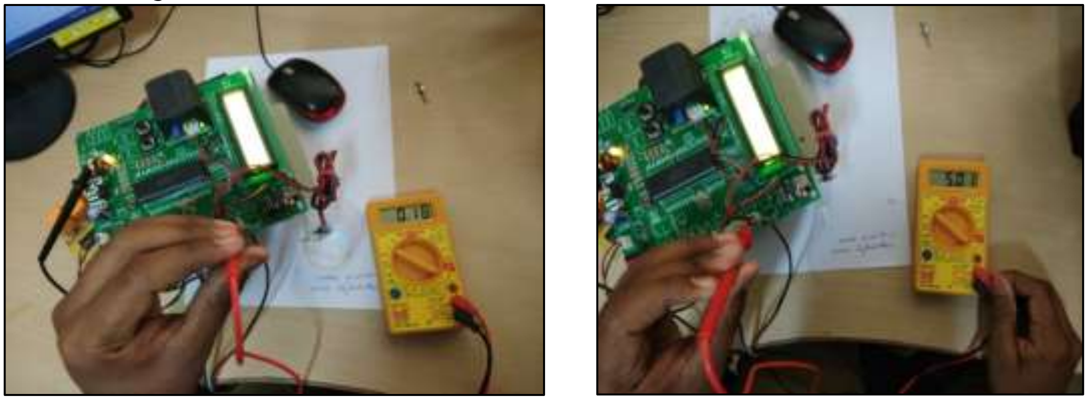
12) Moisture Sensor Testing Result



With moisture without moisture

Fig. 7: Moisture Sensor Testing Result

IV. TECHNOLOGY

A. Wireless Transmission in IOT

Wireless communication system is essential part for iot infrastructure, which acts as bridge for dual directional communication for data collection and control message delivery. It can be applied to various iot applications including healthcare monitoring system in fields of medicine. The concept of connecting devices to internet and to each other is gaining a lot of attention.

B. Device-To-Cloud Communication

In a device-to-cloud communication model, the IoT device connects directly to an Internet cloud service like an application service provider to exchange data and control message traffic. This approach frequently takes advantage of existing communications mechanisms like traditional wired Ethernet or Wi-Fi connections to establish a connection between the device and the IP network, which ultimately connects to the cloud service.

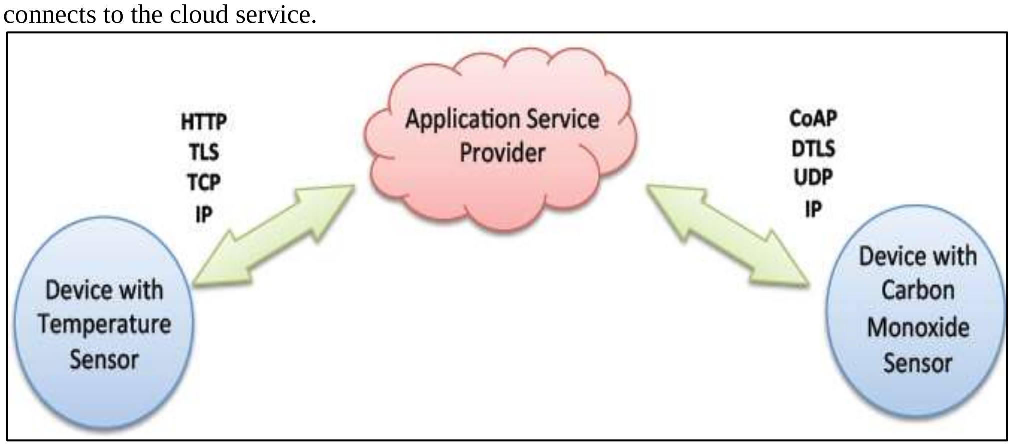


Fig. 8: Device-to-cloud communication model diagram.

This communication model is employed by some popular consumer IOT devices like the nest labs learning Thermostat and the Samsung SmartTv. In the case of the Nest Learning Thermostat, the devices transmits data to a cloud database where the data can be used to analyze home energy consumption. Further, this cloud connection enables the user to obtain remote access to their thermostat via a Smartphone or web interface, and it also supports software updates to the thermostat. Similarly with the Samsung SmartTV technology, the television uses an Internet connection to transmit user viewing information to Samsung for analysis and to enable the interactive voice recognition features of the TV. In these cases, the device-cloud module adds value to the end user by extending the capabilities of the device beyond its native features. However, interoperability challenges challenges can arise when attempting to integrate devices made by different manufacturers. Frequently, the device and cloud service are from the same vendor. If proprietary data protocols are used between the device and the cloud services, the device owner or user may be tied to a specific cloud service, limiting or preventing the use of alternative service providers. This is commonly referred to as “vendor lock-in”, a term the compasses other facts of the relationship with the provider such as ownership of and access to the data. At the same time, users can generally have confidence that devices designed for the specific platform can be integrated.

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V. Implementation

Pic-microcontroller controls the functionality of the above mentioned sensors. MPlab software is being used for programming part in Embedded-C. After completion of the entire program, debugging is carried out. Finally, the program is dumped to the controller. Then, the working mechanism is verified.

IOT plays a major role in collection of database, from the user. Each user has different login and password to reach the server. This is achieved by means of mobile-to-cloud communication. When the user access the server, any variation in sensor detection is updated in form of database with the date and time. Therefore, real time healthcare monitoring is achieved by the implementation of IOT.

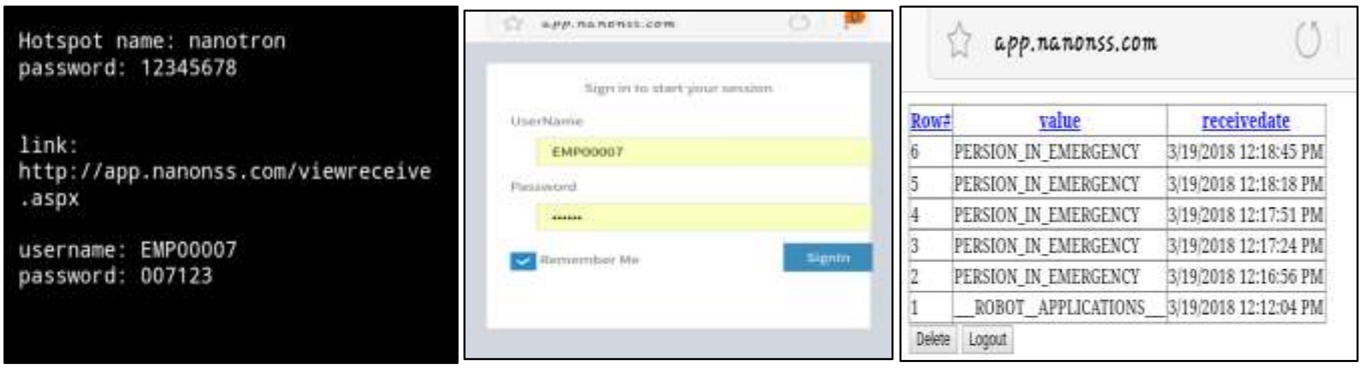

Fig 9: IOT Module output

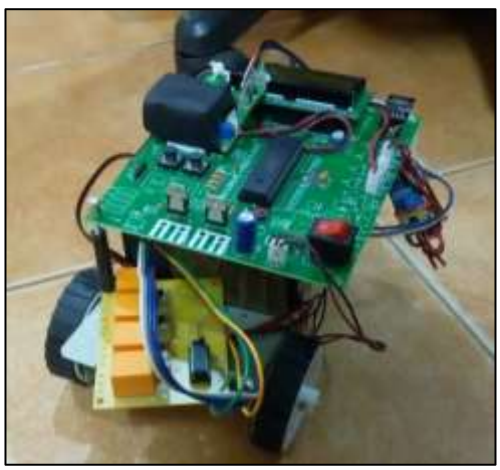

Fig. 10: Hardware (Wheelchair) implementation

VI. Conclusion

This proposed system with advanced features reduces manual work and allows physically challenged people to move around independently without any assistance. The IOT technology used in this system helps in treating the physically challenged people instantly in case of any emergencies.

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