

Wheeled Mobility with Health Monitoring System

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Abstract:- We all know that independence refers to the state of a person wanting or being able to do things for oneself and make their own decisions, without the help or influence from other people. According to the report from WHO, every year, about 5,00,000 people worldwide suffer from a spinal cord injury. This has increased the number of wheelchair users substantially. So, the ease of use will make it reliable. The mortality rate of wheelchair bound increases if timely and quality medical care is not provided when needed. So, providing a quality medical care at the right time plays a vital role in saving lives of wheelchair ridden patients. The health of the patient is monitored by the combined usage of three different sensors like the pulse sensor, temperature sensor and the respiratory sensor. The multivariant data set is fed into the Arduino UNO, where it is processed, and the output can be retrieved. Several health parameters are monitored and measured using this device. This smart wheelchair will help the family members track the patient's health by using a mobile app. If any emergency occurs, the users can be immediately taken to the hospital and get treated. This will increase the chances of saving people's life by a great number.

Keywords:- emergency, independence, mortality, multivariant, smart wheelchair.

I. INTRODUCTION

The spinal cord itself or the adjacent tissues and bones can be harmed by a spinal cord injury. The person may lose function or mobility in various body parts depending on the severity of the damage. The abrupt shock of a strike to the vertebrae is the main cause of spinal cord injury. The spinal cord and its nerves are harmed by the broken bones. The spinal cord can occasionally be totally severed or split by trauma.

The body is impacted by spinal cord damage in numerous ways. Communication with the brain is hampered if the nerves are injured. Breathing, heart rate, metabolism, muscle movement, reflexes, senses, bladder, and bowel functions can all be impacted by spinal cord injuries.

Automobile accidents, slips and falls, gunshot wounds, sports injuries, and surgical complications are the main causes of spinal cord injury. Physical therapy or rehabilitation is necessary for those who have suffered spinal cord injuries. People with such injuries will have to be dependent on helping aids like walkers or wheelchairs.

Many different disabilities require the use of wheelchairs for mobility. For example, Paralysis, Cerebral Palsy, Multiple Sclerosis, Muscular Dystrophy, and more. Whereas the major cause for wheelchair usage is paralysis.

The inability to move all or a portion of the body is known as paralysis. The inability to move a bodily part or not being able to move at all is the primary symptom of paralysis.

Any facial feature, including the hands, arms, legs, and face, can become paralysed. There are four primary types of paralysis: hemiplegia, which affects one side of the body, paraplegia, which affects both legs, and tetraplegia or quadriplegia, which affects both legs (affects both arms and legs).

There are a variety of paralysis symptoms, such as sudden weakness on one side of the face, with arm weakness or slurred speech – stroke; temporary paralysis when waking up or falling asleep – sleep paralysis; sudden weakness on one side of the face with earache or face pain – Bell's palsy; paralysis following a serious accident or injury – severe head injury or spinal cord injury; and weakness in the face, arms, or legs that comes and goes – multiple sclerosis or myasthenia gravis

So, people suffering from paralysis tend to use wheelchairs for mobility. Wheelchairs are available in a broad range of formats to fulfil the unique demands of the users. These formats may include specialised seating adaptations, individualised controls, and wheelchairs that are tailored to particular activities, including beach wheelchairs and sports wheelchairs.

There are several different types of wheelchairs, each with a unique propulsion system, control system, and technology. Wheelchairs can be made for general usage, specialised tasks, or special access requirements. There are different types of wheelchairs which includes Powered wheelchairs, mobility scooters, single-arm drive wheelchairs, manual self-propelled wheelchairs, manual attendant-propelled wheelchairs. There are several technological advancements in wheelchairs today, including tilting and reclining wheelchairs, standing wheelchairs, sports wheelchairs, wheelchair stretchers, all-terrain wheelchairs, smart wheelchairs, and more.

According to statistics, 650 million individuals, or 10% of the world's population, have a disability, and of these, 10% need a wheelchair. Thus, it is estimated that over 65 million people worldwide—or about 1 percent of the world's population, or 10 percent of those with disabilities—need a wheelchair.

When a wheelchair fits the user's requirements, provides suitable fit and postural support based on biomechanical principles, is safe and durable, available, accessible, and maintained in the nation at the most reasonable and affordable price, it is said to be appropriate.

A suitable wheelchair can help the user enter a new world, go from exclusion to inclusion, participate in all societal activities, sports, and recreation, and gain independence as well as better health and a higher quality of life.

The goal of wheelchair supply is to make it possible for people with disabilities to become mobility, stay healthy, and actively engage in society. Studies have shown that assistive technologies, such as wheelchairs, have a significant impact on the level of participation that people with disabilities are able to achieve when they are appropriate to the user and the user's environment. When provided through a supportive service, wheelchairs have also been reported to reduce time and physical burden for caregivers.

The person who becomes wheelchair dependent will need continuous monitoring of their health. This means that doctor visits will become an inevitable part of the patient's daily life. This routine visits to the doctor's office are a very time-consuming process and could be uncomfortable to the patient.

II. OBJECTIVES

The main objective of the project is to provide a system which will help in detecting and in keeping a continuous watch over the patient's various health parameters. The health monitoring system can be mounted on any wheelchair, and three different sensors are used to measure various parameters of the patient's health like pulse rate, temperature, respiration flow velocity, blood sugar level, blood O₂ concentration, blood CO₂ concentration, hyperthermia, and stress. The above-mentioned parameters can be viewed in a smartphone app which comes in handy, and the health of the patient can be kept under constant check.

The pulse rate, temperature, and respiration flow rate are continuously displayed in the LCD display. The buzzer buzzes every one minute indicating that the health status of the patient has been updated in the app. People on wheelchair will need their health to be continuously monitored. If anything goes abnormal, timely medical care can be provided and their lives can be saved.

III. EXISTING SYSTEM

According to the report from WHO, about 1% of the total population need wheelchairs. This makes them dependent on others to be taken care of. Since the first commercially produced wheelchairs, there have been several different wheelchairs designed and manufactured over the last half-century.

The Manual wheelchairs marked the invention of wheelchairs, which was powered using the user's hands. To emphasis different uses, lightweight and foldable wheelchairs for travel and heavy-duty chairs for holding more weight were designed. Powered wheelchairs were designed to eliminate manual work by using batteries for their operation.

Paediatric wheelchairs were designed for kid-sized users. Positioning wheelchairs were able to recline backwards, or raise and lower user's feet and legs, some chairs offer every kind of movement capabilities. Sports wheelchairs were specifically designed for wheelchair bound athletes. They are available for sports like basketball, tennis, racing, and even rugby.

All-terrain wheelchairs use technologies like large wheels and extended designs which helps in maintaining balance while traversing uneven ground. As far as ease of mobility is concerned, there are many advancements made in the wheelchair to make the user independent. There are self-driving wheelchairs available in the market. Apart from this, advancements are made such that paralysis patients can control their own mobility by different means. Wheelchair mobility has hence been enhanced in several ways possible like voice-controlled wheelchairs, gesture-controlled wheelchairs, eyeball movement-controlled wheelchairs, etc. Advancements in mobility has had its own leaps and bounds in the recent years. As for health monitoring, only the pulse rate of the patient can be monitored and kept track of. We have designed our system to make things easier in the health monitoring sector for the wheelchair users.

IV. PROPOSED SYSTEM

A. Description

The Health Monitoring System is a device which can be used to continuously monitor and keep track of the user's health status. Several parameters like the pulse rate, respiration flow velocity, body temperature, blood sugar level, stress, blood O₂ concentration, blood CO₂ concentration, and hyperthermia can be monitored using this system. It consists of three different sensors namely pulse sensor, respiratory sensor, and temperature sensor. The sensors are connected to an Arduino UNO. The output from the Arduino UNO is viewed or displayed in the 2x16 LCD display. This system also employs a Wi-Fi module. So, an app is used which works on Wi-Fi where the accurate measurements of the various health parameters can be viewed from time to time. The parameters are updated every minute which is indicated by a buzzer which buzzes each minute. As for the power supply, a 230V/15V step down transformer is used. A bridge rectifier, filter and regulators are also used to obtain the required voltage level.

B. Block Diagram

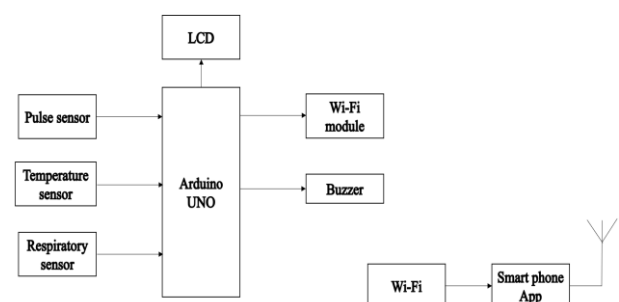


Fig. 1

C. Working

The monitoring and measurement of the wheelchair user’s health parameters is important as it enables us to provide timely and quality medical care to the user if any abnormality is detected. The Health Monitoring System enables us to keep track of the user’s health using an app that works in Wi-Fi.

The 230V supply is given to the system. The 230V/15V step down transforms, steps down the voltage to 15V. A bridge rectifier is used to convert the AC voltage to DC voltage. A capacitor filter is used to remove the ripples in the DC voltage. Three voltage regulators of 12V, 5V and 3.3V are used. The 5V regulator provides supply to the sensors, Arduino UNO, buzzer, and the 2x16 LCD display. The 3.3V regulators provides supply to the Wi-Fi module ESP8266.

The pulse sensor, temperature sensor, and respiratory sensor are placed on the user’s body. The output from these sensors is fed into the Arduino UNO where the data is processed. An LCD display, buzzer and a Wi-Fi module are connected to the Arduino UNO. The LCD displays the pulse rate, temperature, and the respiration flow velocity value. The ESP8266 Wi-Fi module is programmed to connect to a single data, as multiple devices can use the same data to view the various parameters of the user.

An app is used, which displays graphical representations of pulse rate, temperature, respiration flow velocity, blood sugar level, stress, blood O₂ concentration, blood CO₂ concentration, and hyperthermia recorded at different days. The base of the graph also shows the overall maximum and minimum value of the parameter measured from beginning till date. The parameters are updated every minute which is indicated by a buzzer that goes off every minute.

The system is also programmed to send an alert message to the mobile phone when the pulse rate and the sugar level exceeds or falls behind the nominal value. This can alert the person whose device is connected to the system, that the user’s health is abnormal and that he/she must be taken to the hospital immediately.

D. Advantages

- Ease of handling
- It can be used at home, public areas and in rural and urban areas wherever network is available
- People who use wheelchairs require frequent doctor visits for regular check-ups. This device will help in reducing the visits to the doctor’s office
- Vital parameters can be constantly monitored and kept under check
- Better access to healthcare
- The system is user friendly
- Improved quality of healthcare
- Cost of this device is affordable
- Since we use Wi-Fi module, it can be used anywhere and everywhere
- Helps patient improve self-care
- An alert message will be sent to the mobile phone if any abnormality is detected in the user’s pulse rate and

blood sugar level. This helps in providing timely and quality medical care to the user

- It helps in reducing the mortality rate of the wheelchair dependent patients by a large number

E. Disadvantages

- Requires continuous power supply. If battery is used, discharging of battery will be very quick
- Only limited number of parameters can be monitored
- Susceptible to network hackers
- The cost of the system will increase if the health monitoring sensors and parameters are increased.

F. Application

- It is universal. That is, it can be used wherever Wi-Fi or mobile data is available
- This device is beneficial to the society as it can be used by anyone
- It can be used at home, in public areas, rural, and in urban areas
- It provides quality and basic health check-up to the paralyzed patients who become wheelchair ridden

V. DATA COLLECTION

A. Heart pulse rate:

The number of times our heart beats in a minute is called the pulse (BPM). By deducting your age from 220, you may determine your maximum heart rate. For instance, a person’s maximal heart rate is 185 if they are 35 years old ($220 - 35 = 185$).

Age range	Heart Rate (beats per minute, or BPM)
Newborn	100-16
0-5 months	90-150
6-12 months	80-140
1-3 years	80-130
3-5 years	80-120
6-10 years	70-110
11-14 years	60-105
15 years and older	60-100

Table 1

Tachycardia is the condition when the heart rate is too fast. For adults, a fast heart rate is above 100 bpm. Bradycardia is the condition when the heart rate is too slow i.e., less than 60 bpm. Medical attention is needed when sudden change in heartbeat is accompanied by shortness of breath, chest pain, dizziness, fainting, and/or an inability to exercise

The normal heart rates at rest are:

- Children (age 6 to 15) 70 – 100 bpm
- Adults (age 18 and over) 60 – 100 bpm

B. Blood sugar level:

The normal sugar level in a healthy body is between 90 and 100 mg/dL. Whereas the normal blood sugar range for a healthy adult after 8 hours of fasting is between 70 and 100 mg/dL.

Age	Healthy blood sugar level
6	80 - 200 mg/dL
06 to 12	80 - 180 mg/dL
Teens	70 - 150 mg/dL

Table 2

Alarming blood sugar levels in children that requires medical attention is when it falls below 70 mg/dL or goes beyond 180 mg/dL. Blood glucose level of 180 – 250 mg/dL is considered high and >250 mg/dL is very high and requires immediate medical attention. Blood glucose level of 71 – 90 mg/dL is a low sugar level and <70 mg/dL or <50 mg/dL is a critical situation and requires emergency treatment.

Common symptoms of low sugar conditions are dizziness, shakiness or tingling sensation in body or hands or limbs, light-headedness, nervousness, anxiety or stress, chills and sweating, fast heart rates, and fainting.

VI. CONCLUSION

The main motive of our project is to help the people who are bound to use wheelchair. Our project makes them more independent and conscious of their own health. The system helps them measure and monitor several vital parameters like the pulse rate, temperature, respiration velocity, stress, blood sugar, blood O₂, CO₂ concentration. The health monitoring system comes in handy as it can be used by anyone who has access to Wi-Fi. Apart from monitoring, alert message can also be sent to the mobile phones connected to the device using Wi-Fi.

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