Remote Monitoring System for Autonomic Nervous System Disorders

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Abstract

The implementation of remote monitoring system for Autonomic Nervous system disorders is focused. Now a days people are suffering from sveral Neurological disorders due to high stress in their life style. So many remote monitoring devices are available but lack of concentration on the disease detection. In this work the main focus is to investigate which vital signs of the patients will effect the Autonomic Nervous System (ANS) disorders. The another aspect is, the physiological parameters threshold values are going to be decided by considering the real time data from hospital. Here the main focus is on detection of ANS disorders but not on communication part. Remote detection methodology is achieved using wireless sensor networks.

Keywords

Autonomic Nervous System Disorders, Physiological Parameters, Wireless Sensor Networks.

I. Introduction

Now a days a very problematic situation is life style of each individual. The life style influences the people by causing so much stress there by everyone is going to suffering from many diseases such as Neurological diseases, Cardio diseases, Psychological diseases etc.,. The emerging science and technology provides many more services to give support who are suffering from these diseases. A remote monitoring system is essential to detect the occurrence of seizure before onset.

The autonomic nervous system regulates the function of the patient's internal organs (ex: heart rate, blood pressure, digestion, and body temperature). People with an autonomic disorder have trouble regulating one or more of these systems, which can result in fainting, lightheadedness, fluctuating blood pressure, and other symptoms. Autonomic nervous system disorders can occur alone or as the result of another disease, such as Parkinson's disease, cancer, autoimmune diseases, alcohol abuse, or diabetes.

II. Types of Autonomic Disorders

There are different kind of ANS disorders such as Orthostatic Hypotension, Postprandial Hypotension, Multiple System Atrophy, Pure Autonomic Failure, Afferent Baroreflex Failure and Familial Dysautonomia [1].

A. Orthostatic Hypotension

Orthostatic hypotension is a sudden drop in blood pressure that occurs when a person stands up, causing low blood pressure in the upright position. This leads to a decrease in blood supply to the brain. The condition usually causes a person to feel dizzy or lightheaded. Sometimes, orthostatic hypotension can cause aperson to faint.

B. Postprandial Hypotension

Postprandial hypotension is a sudden drop in blood pressure after a meal, caused by blood pressure changes while you're digesting food. Symptoms include dizziness, lightheadedness, or fainting about 15 to 90 minutes after eating. The condition is common in adults over the age of 60 and people with other disorders of the autonomic nervous system.However, in people with postprandial hypotension, the heart rate doesn't beat as fast as needed and the blood vessels don't constrict as they should, so blood pressure drops.

C. Multiple System Atrophy

Multiple system atrophy is a rare autonomic disorder that typically affects men and women in their 50s and advances rapidly over the course of 5 to 10 years. The condition causes a progressive loss of motor function and, eventually, the need to use a wheelchair.

D. Pure Autonomic Failure

Pure autonomic failure is a rare degenerative disorder that causes orthostatic hypotension, sexual dysfunction, a decreased ability to sweat, elevated blood pressure when lying down, and changes in gastrointestinal and urinary habits. The condition affects men slightly more often than women, and is often found in middle-aged to older adults.

E. Afferent Baroreflex Failure

Afferent baroreflex failure is an autonomic disorder that causesfluctuations in blood pressure due to a failure of the blood pressure-sensing nerves that relay information to the brain. As a result, blood pressure alternates between being too high and too low. Symptoms include dizziness and fainting as well as headaches, sweating, and skin flushing.

F. Familial Dysautonomia

Familial dysautonomia is a rare inherited condition that affects the development of the autonomic and sensory nervous systems. People with this condition have unstable blood pressure that alternates between being too high and too low.They may also have reduced sensitivity to pain and temperature and an absence of tears when crying.

G. Focal autonomic seizures are characterized by alterations in systems controlled by the autonomic nervous system at seizure onset [2].

These may occur with or without objective clinical signs of a seizure evident to the observer. Focal autonomic seizures can be further described using the following descriptors:
1. Focal autonomic seizure with palpitations/tachycardia/bradycardia/asystole
2. Focal autonomic seizure with epigastric sensation (upper abdominal discomfort, emptiness, tightness, churning, hunger - the feeling may rise up to the chest or throat) or with nausea / vomiting (or other gastrointestinal phenomena) - seizures with these features typically arise in the mesial temporal lobe.

III. Diagnosis Methodology

The Diagnosis of Focal Autonomic Seizures can be performed using wireless sensors. To identify the patient vital signs that is temperature, blood pressure and body movements, require respective sensors. The diagnosis methodology mainly focus on defining the threshold values for each sensor to detect Autonomic Nervous System disorders.
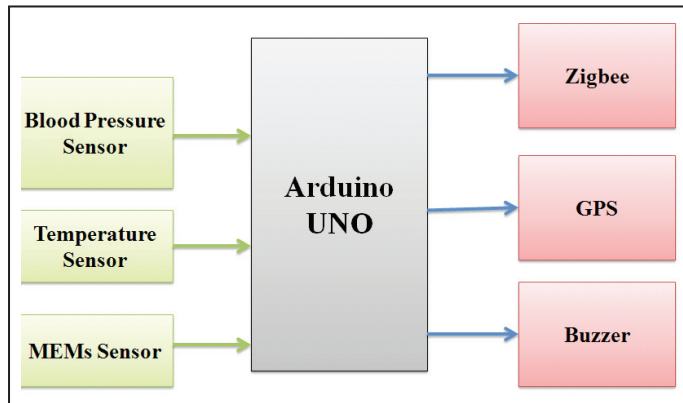

Fig. 1: Block Diagram (RMS-ANS)

The patient's vital signs are read using sensors. The Autonomic nervous system disorders are of different types. In this work, the Focal Autonomic Seizures are perceived. Actually seizures will occur due to the abnormality in heart rate, blood pressure and temperature of the patient. The neurological disordered patient will have a quiet different normal readings in vital signs. For example 98.40F is the normal temperature of human body. If is there any low temperature then also he is in normal condition, there is no worth mentioning problems or symptoms that he observe. Suppose if temperature is less than 980F for the neurological disordered patient then there is a chance of focal autonomic disorder for him definitely. This is what the study that I observe and accordingly designed a Remote Monitoring System for Autonomic Nervous System disorders (RMS-ANS) algorithm.

Algorithm -RMS-ANS:

1. Declare s1<--- Temperature Sensor , S2<--- Blood pressure Sensor ,
S3<--- MEMS and flag.
2. Set threshold values for each sensor as MinS1=98 ; MinS2=60 ;
 MaxS3=300;
3. L1: Read data from S1, S2, and S3
4. if(S1 <= MinnS1) then
begin
5.   flag=1;
6.   if(S2 <=MinS2) then
          begin
7.   flag=2;
8.   if(S3 <=MinS3) then
              begin
9.   flag=3;
10.   end;
11.   end;
12.end;
13. else
14.   GOTO L1;
15. if (flag==3 || flag==2)
begin

16.   Printf(" Declare Seizure alert ");
17.   Get GPS data and locate the patient;
      end;
18. else
19.   GOTO L1

The parameters and their threshold values are identified by investigating 150 patients' case sheets from many hospitals. According to the region the heartbeat, blood pressure and temperature will change. The patient'sLife style is also plays a vital role in setting the threshold values of the parameters. Here 98, 60 and 300 values are used to detect theoccurrence of focal autonomic seizure.

IV. Results and Discussion

The work is verified and implemented in hospital for 10 patients. It recognizes the seizure occurrence in prior with 92% sensitivity. The wok is validated by discussing with so many Neurologists and the accuracy is identified. The expected result is observed and definitely this will show better results than existing.

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