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STROKE PREDICTION SYSTEM USING IOT

Based on real time monitoring data sources

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ABSTRACT— **Over the last few decades, the most common death in worldwide because of cardiovascular disease. It is the unpredictability and random time of the occurrence that makes the disease more dangerous. The death rate will be reduced by regular supervision of clinicians and early detection of cardiac diseases. Unfortunately, people suffering from sudden cardiac arrests have low survival rates. During the COVID-19 pandemic, the personalized patient care is modernized and wearable devices are mostly incorporated in cardiovascular community and clinical applications to achieve medical breakthroughs. The wearable devices such as sensors built in textiles, wrist watches, ECG patch recorders and vests patches are targeted at the healthcare professions for the early detection of acute decompensation and improved prognostication. We proposed the wearable device which is used for adaptive fall detection for paralyzed patients/elders and heart stroke prediction. A real-time data of the patient such as blood pressure, body temperature, heart rate and humidity can be monitored and analyzed by System. Our proposed wearable device saves the lives of patient and reduces the death rate by taking immediate care.**

Keywords— COVID-19 pandemic, Cardiovascular disease, Heart stroke prediction

I. INTRODUCTION (*HEADING 1*)

The heart is the capital part of the cardiovascular system. It also comprises the lungs and muscular organ that used to plumb the blood into the body network. The cardiovascular system incorporates of blood vessels like arteries, veins, capillaries and these blood vessels form a network to transport blood in through the body. Cardiovascular diseases (CVD) are a group of heart diseases caused due to irregularities in usual blood flow from the heart. [Shadman Nashif]. Also, 80% of the deaths might occurred in account of CVDs owing to stroke and heart attack. The 0.54 degrees increase in the average global land-ocean surface temperature compared to the past 10 years advisable that the universal temperature is increasing significantly in recent decades. These high temperatures accelerate to increase heart strokes and which in turn can lead to cardiovascular diseases.

Stroke occurs when the blood flow is restricted veins to the brain. When brain cells don't get enough oxygen and nutrients they eventually die within minutes. Stroke ranks as one of the major causes of death everyday globally. The trauma of stroke can be overwhelming to individuals and their families, stealing them of their freedom. It causes disabilities in adults and may even lead to demise of individuals who are not treated at early stages. Stroke disease may lead to other complications like cardiac arrest, loss of vision, inability to walk and loss of speech, etc.,

Most of the elder population is unable to get up without any help when they fall, even if they are not injured. Also, lying on the floor for a long time leads to muscle damage, dehydration and fear of falls. Fall detection approaches are of three types. They are vision-based, ambient-based and wearable based. Although vision-based and ambient-based approaches provide better accuracy compared to wearable-based approaches, wearable-based approaches are advantageous in terms of cost, computational cost, setup and space restriction. Accelerometers, gyroscopes, heart rate sensors or a combination of these are typically used in wearable-based fall detection systems. The heart rate sensor is chosen as it achieved higher accuracy levels using a multidimensional fusion of physiological and kinematic parameters. Also, a heart rate sensor is better in terms of size and cost compared with other physiological sensors, and it is generally used in smartwatches and hospitals. The sensors networks that are collecting, analyzing and passing data between multiple nodes are currently using Internet of Things (IoT) technology.

Using IoT, the data collected from multiple sensors and pass the data and communicate over the Internet Protocols or public networks. The sensors' collected data are analyzed are it is used to begin the essential action for planning.

The best part of this project is that it can be used by everyone and make our health management easier than available systems. It provides a solution for measurement of body parameters like, Temperature Sensor and Heartbeat, Blood Pressure. This system also generates an alert when it required that means at the time of any critical conditions.

II. RELATED WORK

A. *Development and Clinical Evaluation of a Home Healthcare System Measuring in Toilet, Bathtub and Bed without Attachment of Any Biological Sensors*

Daily monitoring of health condition at home is important for an effective scheme for early diagnosis, treatment, and prevention of lifestyle-related diseases such as adiposis, diabetes and cardiovascular diseases. While many commercially available devices for home health care monitoring are widely used, those are cumbersome in terms of self-attachment of biological sensors and self-operation of them. From this viewpoint, we have been developing a non-conscious physiological monitoring system without attachment of any sensors to the human body as well as any operations for the measurement. We developed some devices installed in a toilet, a bath, and a bed and showed their high measurement precision by comparison with simultaneous recordings of ordinary biological sensors directly attached to the body. To investigate that applicability to the health condition monitoring, we developed a monitoring system in combination with all the monitoring devices at hospital rooms and previously carried out the measurements of patients' health condition. Further, in this study, the health conditions were measured in 10 patients with cardiovascular disease or sleep disorder. From these results, the patients' health conditions such as the body and excretion weight in the toilet, the ECG during taking the bath and the pulse and respiration rate during sleeping were successfully monitored in the hospital room, demonstrating its usefulness for monitoring the health condition of the subjects with cardiovascular disease or sleep disorder.

B. *The real-time monitoring system for in-patient based on ZigBee*

The system is made up of two sub-systems: patient physical states data acquisition and communication system based on ZigBee technology, and hospital monitoring and control centre. The patient physical states data acquisition and communication system monitors the main physical parameters and movement status continuously. The information from data acquisition system is sent to hospital monitoring centre by ZigBee wireless communication module. The monitoring centre receives the information from each patient and save them to the database, and then judges the states of the patient by fuzzy reasoning. The data from the patient can be displayed as a graph or numeric on the monitor if it is necessary, and then the doctor can diagnose the patient according to the recorded continuous data. Wireless sensor network is made up of a lot of wireless sensors based on ZigBee technology. The ZigBee technology provides a resolution for transmitting sensors' data by wireless communication. ZigBee technology can transmit data with a rate of 250kbps, and then it is enough for the physical parameters of the patient. ZigBee technology owns many virtues, such as low power consumption, low cost, small size, free frequency, etc. To know the physical states of in-patient, the physical parameters need to be monitored real-time. The traditional medical test instrument is a large size and connected by wire often, and the patient is required to be quiet during the test. In most of the hospital, the medical instruments need to be read by doctor or nurse, and the physical parameters are tested and recorded one or two times each day, the real-time monitoring is expensive for most of the patients, and can be only acquirable for ICU by a nurse. For this reason, the worsening of patient can't be found in time, and then the patient can't be helped in time. For most of the patients can be monitored real-time in hospital, we should find a new method. Consider that the movement of the patient is limited in hospital, we adopted the ZigBee and wireless sensors network to acquire the physical parameters of the patient.

III. PROPOSED SYSTEM

For developing the model, we focus on technologies to automate the stroke prediction system. This is achieved by building the application using Machine Learning algorithm.

We make use of approximately 5000 datasets obtained from UCI Machine Learning website.

Around 18 to 19 parameters like, alcohol consumption, family history, lifestyle, red blood cells count, smoking history, work type and other health related data are being used as input to the system to predict the different types of strokes.

Based on these inputs, the model predicts three different types of strokes, which are Ischemic stroke, Hemorrhagic stroke and Transient Ischemic stroke.

The model is designed for four types of users namely; Administrator, Receptionist, Doctor and Patients. The main goal of this proposed model is to eliminate the complexities for doctors in stroke prediction. This application can be used in real time to treat patients in early stages without the necessity of any sophisticated medical equipment

IV. SYSTEM ARCHITECTURE

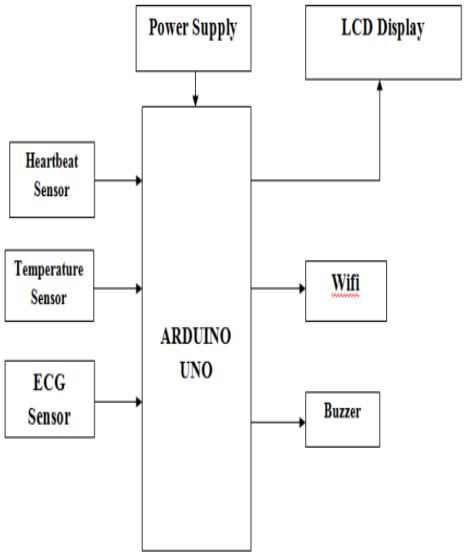
Hardware and Software requirement are Arduino uno, power supply, lcd display, heartbeat sensor, temperature sensor, ECG sensor, wi-fi module and Operating System etc.

Arduino/Genuine Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

Power supply consists of transformer, rectifier, filter, regulator. A transformer is a device that transfers electrical energy from one circuit to another through inductively coupled conductors without changing its frequency.

A rectifier is an electrical device that converts alternating current (AC) to direct current (DC), a process known as rectification. Rectifiers have many uses including as components of power supplies and as detectors of radio signals. The process of converting a pulsating direct current to a pure direct current using filters is called as filtration. Electronic

filters are electronic circuits, which perform signal-processing functions, specifically to remove unwanted frequency components from the signal, to enhance wanted ones.
A voltage regulator (also called a _regulator ‘) with only three terminals appears to be a simple device, but it is in fact a very complex integrated circuit. It converts a varying input voltage into a constant _regulated ‘output voltage.
Liquid crystal display is very important device, in embedded system, it offers high flexibility to user as he can display the required data on it. But due to lack of proper approach to LCD interfacing many of them fail.



Liquid crystal display is very important device, In embedded system, it offers high flexibility to user as he can display the required data on it. But due to lack of proper approach to LCD interfacing many of them fail. Many people consider LCD interfacing a complex job but according to me LCD interfacing is very easy task, you just need to have a logical approach. This page is to help the enthusiast who wants to interface LCD with through understanding.

ECG records the electrical activity generated by heart muscle depolarizations, which propagate in pulsating electrical waves towards the skin. Although the electricity amount is in fact very small, it can be picked up reliably with ECG electrodes attached to the skin. The full ECG setup comprises at least four electrodes which are placed on the chest or at the four extremities according to standard nomenclature (RA = right arm; LA = left arm; RL = right leg; LL = left leg).

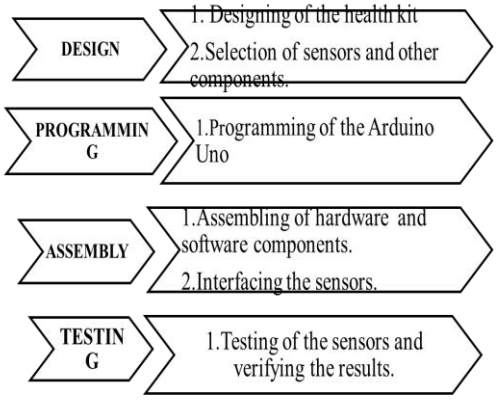
Temperature sensor is a device which is designed specifically to measure the hotness or coldness of an object. LM35 is a precision IC temperature sensor with its output proportional to the temperature (in °C). With LM35, the temperature can be measured more accurately than with a thermistor. It also possesses low self-heating and does not cause more than 0.1 °C temperature rise in still air.

Heartbeat sensor provides a simple way to study the function of the heart which can be measured based on the principle of psycho-physiological signal used as a stimulus for the virtual-reality system. The amount of the blood in the finger changes with respect to time.

Wi-Fi enabled system on chip (SoC) module developed by Express if system. It is mostly used for development of IoT (Internet of Things) embedded applications.

v. METHODOLOGY

The usage of wireless communication is the strength of our system to have highest liberation of movement to users in their physical activities. Also, we have used user friendly, thin, small, smart IoT devices like wristbands and smartphones. Embedded sensors were worn by the subjects, and smartphones are carried in the pockets or held in hands by their caretakers.

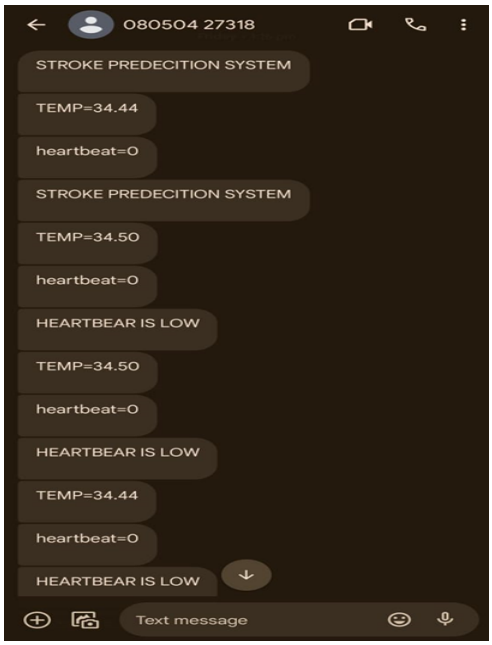


While the patient is living in a usual life, the heart parameters are constantly collected by the embedded Pulse Sensor, Accelerometers, and temperature sensors. After receiving the data to the cloud through a Wi-fi. A premature warning system is designed to observe those parameters for detecting the symptoms of cardiac arrest during any activity. When the body temperature and Pulse sensor patterns reach a certain threshold level, the planned design triggers a warning, where the subject might feel the potential heart stroke.

A warning to the subject in the form of a alert or notification or call is transmitted by the system at that moment. The IoT device continuously receives data from the user and sends it to a smartphone via a Thing speak cloud. All the operations and data examination take place in the cloud (Thing Speak).

RESULT

Continuous monitoring of health conditions. In case of In case of variation in the sensor intimation message to the family members, Early warnings or alerts for potential stroke cases. Development of risk stratification system to categorize individuals into low, medium and high-risk groups for stroke occurrence. Healthcare monitoring and



management system using IOT implemented. This system offers the doctors to take advantage of the massive amount of healthcare data and provide right intervention to the right patient at the right time. Hence personalized care could be given to the patient. This remote monitoring system allows the doctor to monitor the health status of the patient remotely. This is efficient system which alerts about the patient health condition to his or her family members. Since the response time of the proposed system is less, it is suitable or real time alerting.

Stroke is a serious condition that needs to be treated before it gets worse. Building machine learning models can help you predict stroke early and mitigate serious future impacts. This paper demonstrates the performance of various machine learning algorithms in successfully predicting stroke based on multiple physiological attributes.

SMS/Email Module – In the proposed system, the admin creates ID and password credentials for doctors and receptionists. For enhancing the application in the future days, we can turn this manual process into an automated process by buying email hosting services or deploying on cloud platforms using its integrated SNS services.

Query Interaction Module - we can add the interactive query module in the days ahead into the application by using Chabot's or form filling where doctors, receptionists, and admin of the application can interact one to one.

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