Smart Healthcare System Using Artificial Intelligence

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ABSTRACT: In order to resolve complex issues, we used Artificial Intelligence which will be discussed in this paper, the adoption of artificial intelligence in healthcare is growing while radically changing the face of healthcare delivery. Our aim is to provide emergency services to the patients in need and to predict their health details with the help of a smart watch and web application. The data obtained from device using sensors will be stored in server, one set per day at least to keep track of patient's health details. Medicines for patients will be updated by hospital staff and will be alerted at the time of consumption along with medicine names through device to the patient.
KEYWORDS:AI (Artificial Intelligence), KNN (k-neighbours nearest algorithm), Node MCU.

I.   INTRODUCTION

In Artificial Intelligencemeans objects that are made or produced by human beings rather than taking place naturally those having the capability to form tactics to achieve goals by interacting with surroundings that are information-rich therefore Artificial Intelligence simply represent the intelligence of machines and the separation of computer science that targets to generate it. Important goal of AI is to determine patient condition and provide efficient solution. Different AI algorithms have been created for different applications, in this modern days AI can also be used in smart health services, such as robotics surgery, cardiology, cancer treatment and also neurology. In this project we provide an architecture for an AI-based smart healthcare system by using smart watch, where patient will get complete support throughout their lifetime. This AI-based support will come from all department including Emergency medical service (EMS), Nurses, doctors and so on.

Healthcare means taking care of health via the prevention, diagnosis, and treatment of disease, illness, injury, and other physical and mental problem. Healthcare is facilitated by health professionals in various health professions such as, physicians, physician associates, dentistry, midwifery, nursing, medicine, optometry, audiology, pharmacy, psychology, and other health professions. It involves providing primary care, secondary care, and tertiary care, as well as in public health. The main disadvantage in hospital treatment is that reducing the rate of hospital admission and increasing employee's workload and dissatisfaction. Even though existing smart watchbased systems are useful in our life but some time data may be inaccurate thus our system focuses on patient's safety and will have the patients details from a long time and eventually identifies the problem and alerts the hospital in case of emergency situation and ambulance with doctor will be sent to patient immediately. The system contains patient's health records and data about his medication which helps the patient to know his health in detail using mobile application.

II.   LITERATURE SURVEY

The study by M.M.Kamruzzaman [1] suggests the establishment of a smart healthcare system that uses artificial intelligence to solve problems in the healthcare business and to optimise patient care plans.The suggested AI-assisted system demonstrates that it can aid a patient who is admitted to the hospital via emergency medical services, process the patient's data quickly, and detect critical diseases early. The proposed architecture is capable of dealing with a wide range of complex healthcare issues and can be

implemented in any modern hospital to save time and money

The work by Alison J Cawsey, Kim A Binsted, and Ray B Jones [2] presents a system that uses a "knowledge base" to assist users in learning about their own health conditions. In this system will be operating through text method and this includes the reasons of the condition, as well as an explanation of the symptoms, a prescription for a medicine, and a glossary of medical jargon The study by Fei Jiang, Yong Jiang, Hui Zhi, Yi Dong, Hao Li, [3] describes the survey on the modern healthcare system and its uses in detail. It goes over the AI applications in stroke in greater depth, focusing onthe three primary areas of early detection and diagnosis, therapy, and outcome prediction and prognosis evaluation.

III. METHODOLOGY

Fig 1. Methodology of Smart Healthcare System

Project entitled as smart healthcare system using AI, mainly Used artificial intelligence and machine learning algorithms to develop the system. The user will be alerted every day for a heartbeat check-up by the systemapp or a smart watch. In case of emergency situation, the application alerts the hospital system about the emergency condition and the hospital will send an ambulance with first aid team to the location and it notifies to a relative also about the situation. The system will have a detailed patient's information such as his sleep record, exercise habits and heartbeat details along with the basic (if new) and updated health record details of patient, these details will be used by doctor/nurse for providing better treatment by saving time and money. Prescription about patient's medicine routine and health condition will be updated to the system such that patient will be reminded about it. Users can contact hospital or request for the disease details through the app.

In this project for the purpose of disease prediction using available data collected from patients we used machine learning algorithm that is K Nearest Neighbour. We have trained the data and then ed the data against the algorithm so that we get more accurate results.

DATASET USED IN KNN ALGORITHM IS:

The dataset has 303 individual's data. There exist 14 columns in the dataset, they are:

1. Age: displays the age of the individual.
2. Sex: displays the gender of the individual in the following way:
   1 = male
   0 = female
3. Chest-pain type: determines and shows the type of chest-pain experienced by the individual considering following format:
   1 = typical angina
   2 = atypical angina
   3 = non — anginal pain
   4 = asymptotic
4. Resting Blood Pressure: shows the resting blood pressure value of a person in mmHg (unit)
5. Serum Cholesterol: determines the serum cholesterol and displays in mg/dl (unit)
6. Fasting Blood Sugar: compares the fasting blood sugar level of an individual with 120mg/dl. If it is greater than 120mg/dl then: 1 (true) else: 0 (false)
7. Resting ECG: shows the resting electrocardiographic results as
   0 = normal
   1 = having ST-T wave abnormality
   2 = left ventricular hypertrophy
8. Max heart rate achieved: displays the maximum heart rate occurredin an individual.
9. Exercise induced angina: this shows as follows:
   1 = yes
   0 = no
10. ST depression induced by exercise relative to rest: shows the value which is an integer or float.
11.Peak exercise ST segment: the values are assigned as follows:

1 = upsloping

2 = flat

3 = down sloping

12. Number of major vessels coloured by fluoroscopy: it determines the value as integer or float.

13.Thal: shows the thalassemia: 3 = normal, 6 = fixed defect and 7 = reversible defect

14. Diagnosis of heart disease: Determines whether the individual is suffering from heart disease or not:

0 = absence

1, 2, 3, 4 = present.

In actual dataset, we had 76 features but for our study, we have chosen only the below 14 because:

1.   Age: Age is the most important factor for the cause of heart diseases, with approximately a tripling of risk with each decade of life. Coronary fatty streaks couldstart to form in adolescence. It is estimated that 82 percent of people who die of heart disease are 65 and above. Simultaneously, after age 55the risk of stroke doubles every decade.

2.   Sex: Men are at greater risk of heart disease than that of women. Once past menopause, it has been argued that a woman's risk is similar to a man's although more recent data from the WHO and Unare against this. If a female has diabetes, she is more likely to develop heart problem than a male with diabetes.

3.   Angina (Chest Pain): Angina is chest pain or uncomfortableness caused when the heart muscle doesn't get enough oxygen-rich blood. It mostly feels like the pressure or squeezing in the chest. The discomfort also can occur in human shoulders, arms, neck, jaw, or back. This pain may even feel like indigestion.

4.   Resting Blood Pressure: Over time, arteries c that feed the heart can be damaged by high blood pressure. High blood pressure willoccur with other conditions, such as obesity, high cholesterol or diabetes, increases the risk even more.

5.   Serum Cholesterol: Narrow arteries is mostly caused by high level of low-density lipoprotein (LDL) cholesterol. A high level of triglycerides, a type of blood fat related to your diet, also increases the risk of a heart attack. However, a high level of high-density lipoprotein (HDL) cholesterol reduces the risk of a heart attack.

6.   Fasting Blood Sugar: Not producing enough of a hormone secreted by your pancreas (insulin) or not responding to insulin properly causes the body's blood sugar levels to increase, which further increases the risk of a heart attack.

7.   Resting ECG: For people with low risk of heart disease, the USPSTF summarises as moderate certainty that the potential harms of screening with resting or exercise ECG exceed or maintains the potential benefits. For people with normal to high risk, current resourcesare insufficient to assess the balance of benefits and harms of screening.

8.   Max heart rate achieved: With high blood pressure the increase in cardiovascular risk, associated with the acceleration of heart rate, was comparable to the increase in risk observed. It has been observed that an increase in heart rate by 10 beats per minute is associated with increase in the risk of heart attack by at least 20%, and this increase in the risk is similar to the one observed with an increase in the systolic blood pressure by 10 mm Hg.

9.   Exercise induced angina: The discomfort or pain with angina usually feels tight, gripping or squeezing, and can vary from low to high. Angina is usually felt in the centre of your chest but may spread to either or both of the shoulders, or back, neck, jaw or arm. It can even be felt in the hands.

10.   Peak exercise ST segment: If there is a horizontal or down sloping ST-segment depression ≥ 1 mm at 60–80 ms after the J pointthe treadmill ECG stress test is considered abnormal . The duration of ST-segment depression is important, as prolonged recovery after peak stress is consistent with a positive treadmill ECG stress test. Another finding that is highly indicative of significant CAD is the occurrence of ST segment elevation > 1 mm these patients are frequently referred urgently for coronary angiography.

The mobile application shows the basic details required by the user.
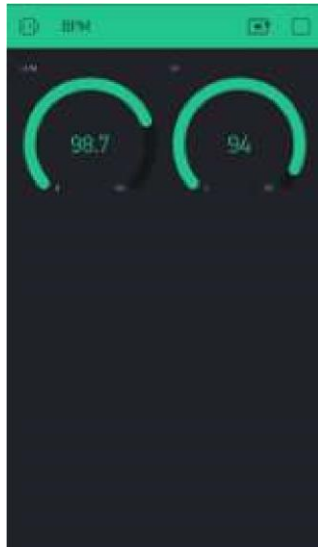
IV. SYSTEM REQUIREMENT ANALYSIS AND SPECIFICATION

Software requirements and hardware requirements are given as follows:

• Software Requirements
  Operating system   : windows 10
  Software   : Telegram, PyCharm
  Languages   : Python

• Hardware Requirement
➢ Node MCU:Forthisopen-source prototyping board designs are available as it is an opensource software. The name is a combination of node and microcontroller. The term "NodeMCU" rather than referring to associated development kits it strictly speaking refers to the firmware.
➢ LM 35: A precession Integrated circuit Temperature sensor is LM35, in which the output voltage varies depending on the temperature around it. It is an IC which is used to measure temperature between -55°C to 150°C. It can easily be interfaced with any Microcontroller that has ADC function or any development platform like Arduino. Power the IC by applying a regulated voltage like +5V (V_S) to the input pin and connected the ground pin to the ground of the circuit.
➢ Pulse sensor: The change in the volume of a blood vessel that occurs when the heart pumps blood is called pulse wave, and a detector which monitors this change in volume is called a pulsesensor. Electrocardiogram, photoelectric pulse wave, blood pressure measurement, and phonocardiography are fourways to measure heart rate.
➢ ESP-01:ESP-01 is a less expensive Wi-Fi module which is of small size and consists of TCP/IP stack with a built-in microcontroller. thus, we can bring Wi-Fi capability in our Embedded projects by programming directly in this small chip. It assimilates the antenna switches, Radiofrequency balun, power amplifier, low noise receiver amplifier, and power executive elements and acts as one of the primarily incorporated Wi-Fi chip in the industry. This module allows the microcontroller to connect with a Wi-Fi available.
➢ Jumper Wires :A jumper is a small metal connector which is used to close or open part of an electrical circuit. It can be used as an alternative to a dual in-line package (DIP) switch. A jumper regulates an electrical circuit boardthat has two or more connecting points. Jumpers are electrically conducting; these are usually encased in a non-conductive block of plastic . It also avoids the risk that an unshielded jumper will accidentally short out something critical

V. CONCLUSION

The main disadvantage in hospital treatment is that reducing the rate of hospital admission and increasing employee's workload and dissatisfaction. Even though existing smart watchbased systems are useful in our life but some time data may be inaccurate thus our system focuses on patient's safety and will have the patients details from a long time and eventually identifies the problem and alerts the hospital in case of emergency situation and ambulance with doctor will be sent to patient immediately. The system contains patient's health records and data about his medication which helps the patient to know his health in detail using mobile application

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