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DEEP LEARNING APPROACH FOR DENGUE FEVER PREDICTION

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ABSTRACT:

In response to the escalating global health concern posed by dengue fever, this project presents an innovative solution for early detection by leveraging cutting-edge technologies. This research proposes a comprehensive system for early dengue detection by integrating sensors, a K-Nearest Neighbors (KNN) and cloud computing. Utilizing a Max30100 for spo2 levels, PPG sensor for pressure, a pH sensor for sweat analysis, and a DHT sensor for temperature, data is collected by the NodeMCU (ESP8266) and transmitted to the cloud. In the cloud, a pre-trained KNN model processes the sensor data to predict the likelihood of dengue based on historical patterns. The results are then relayed back to the NodeMCU, where they are displayed in real-time.This innovative approach harnesses the power of Internet of Things (IoT), machine learning, and cloud computing to enable efficient and timely dengue detection, fostering potential advancements in early intervention and public health monitoring.

INTRODUCTION

Dengue fever remains a persistent and challenging global health threat, affecting millions of individuals annually and placing significant strains on healthcare systems across the globe. Characterized by its wide-ranging symptoms and potential for severe complications, dengue poses a formidable challenge for both clinicians and public health officials. The absence of specific antiviral treatments underscores the paramount importance of early detection and timely intervention in managing the disease's impact and preventing adverse outcomes. Motivated by the urgent need for effective disease surveillance and management strategies, this project sets out to explore innovative approaches to early dengue detection. Drawing upon recent advancements in sensor technology, machine learning algorithms, and cloud computing infrastructure, the project aims to develop a comprehensive system capable of detecting dengue infections at the earliest possible stage. By integrating a diverse array of sensors, including those for spo2 levels, blood pressure, sweat analysis and temperature, the system seeks to capture a holistic picture of an individual's health status, enabling the identification of potential dengue cases before the onset of severe symptoms. At the heart of the proposed

system lies the utilization of machine learning algorithms, specifically the K-Nearest Neighbors (KNN) algorithm, to analyze sensor data and predict the likelihood of dengue infection. By leveraging historical patterns and real-time sensor readings, the algorithm aims to provide accurate and timely assessments of an individual's risk of dengue, thereby facilitating proactive interventions and treatment strategies.

Keywords: IoT based, Deep Learning, Python, KNN and Real-time monitoring.

RELATED WORK

Mohammad Rustom Al Nasar, Iftikhar Nasir, Tamer Mohamed, Nouh Sabri Elmitwally, Tayba Asgher, proposed detection of dengue disease empowered with fused machine learning.This model utilized in this study to predict dengue fever is fused with machine learning. Artificial Neural Networks (ANN) and Support Vector Machine (SVM) provide the foundation of the conceptual framework. The datasets employed in these models have been collected from a government hospital in Lahore, Pakistan for diagnosing dengue fever (positive or negative). 70% of the statistics in the dataset are training data, whereas 30% are testing data. This fused model's membership functions explain whether a dengue diagnostic is positive or negative, which controls the model's output. A cloud storage system saves the fused model based on patients' real-time information for future use. The proposed model has a 96.19 % accuracy rate, which is much greater than earlier research."

Dhiman Sarma, Sohrab Hossain, Tanni Mittra, Md. Abdul Motaleb Bhuiya, Ishita Saha, Ravina Chakma, proposed dengue prediction using machine learning algorithms. In this paper, they proposed a new machine learning approach to predict dengue fever. A patient dataset, containing information of the patient's diagnosis report, medical history, and symptoms, was constructed through collecting real- time raw data samples of various types of dengue fever patients from the Medicine Department of Chittagong Medical College Hospital and Dhaka Medical College Hospital, Bangladesh. The whole dataset was split into 70:30 ratios using 70% for training and 30% for test purposes. We applied machine learning algorithms, namely decision tree (DT) and random forest (RF) in the proposed classification model. Finally, the decision tree resulted in an average accuracy of 79%, which is higher than the random forest."

Lathesparan Ramachandran, Rm Kapila Tharanga Rathnayaka, Wiraj Udara Wickramaarachchi, proposed artificial neural networks based dengue diagnosis prediction model.This study aims to identify the best performing Dengue diagnosis prediction model using Artificial Neural Network (ANN) to automate the process of Dengue diagnosis. In developing the prediction model, feature selection is a crucial phase as it has been used to identify key attributes that directly impact the accuracy of the Dengue prediction model. In this study two approaches were used for the feature selection; Principal Component Analysis (PCA) and Wrapper

feature selection methods with Nau00efve Bayes, KNN, & J48 as classifiers. The PCA made a huge impact in developing higher accuracy Dengue diagnosis prediction model. Further, with PCA the initial 22-dimensional system was reduced to the 8-dimensional system with a cumulative variance of 59 %. A total of 360 Dengue diagnosis prediction models have developed using four different sets of feature combinations and with different hyperparameters. In conclusion, ANN with PCA, learning rate of 0.01, batch size of 32 and 200 epochs shows the highest accuracy of 73.41% and it is most suitable for the dengue diagnosis prediction based on current dataset."

Purnomo Husnul Khotimah, Andri Fachrur Rozie, Ekasari Nugraheni, Andria Arisal, Wiwin Suwarningsih, Ayu Purwarianti, proposed deep learning for dengue fever event detection using online news.This paper presents dengue fever event detection using online news. A previous study conducted an event detection task from sentences using word frequency burst to detect an ongoing eve news do not only report about the event (i.e., the event of dengue fever case) but also information regarding the disease. This paper focuses on detecting an event of dengue fever from online news. An assessment of different deep learning models is reported in this paper. Using k-fold cross validation, convolutional neural network (CNN) validation, convolutional neural network (CNN) achieved the best performance (in average, test accuracy: 80.019%, precision: 78.561%, recall: 77.747%, and f1-score: 77.234%)."

EXISTING SYSTEM

The system is designed adaptively to alert patients and can be monitored over the Microsoft Windows Interfacing Applications system. The purpose is to alert patients on dengue attacks if they are possibly infected with dengue. Problem identifies that patients are difficult and hard to go for regular medical check-ups especially to the hospital. They face issues like long queues and long waiting times at public hospitals and it takes time to diagnose the dengue attacks. The objective of this system is to design a handy system for dengue detectors and to accurately warn the patients so that, they are being treated properly. The elements designed in this system comprised of a temperature sensor and blood dengue kit which is combined with push buttons as a tool to determine the condition of blood cells. This system used Radio Frequency identification (RFID) access card to detect personal details. The database is directed to Windows application s on the DAS system. Results present the value of the blood level of infected dengue and body temperature in an online graph.

Drawbacks

- ✓ The system relies heavily on technology, including temperature sensors, blood dengue kits, RFID access cards, and Windows applications.
- ✓ May require specialized facilities; results may take time.
- ✓ Relies on user-reported data; limited accuracy

PROPOSED SYSTEM

✓ The proposed system aims to develop an advanced dengue detection framework through the integration of diverse sensors, a machine learning model, and cloud computing.

✓ Leveraging a Max30100 PPG sensor for vital sign monitoring, a pH sensor for sweat analysis, and a DHT sensor for environmental data, the NodeMCU (ESP8266) serves as a data collection hub.

✓ This collected data is transmitted to the cloud, where a pre-trained Artificial Neural Network (ANN) model processes it to predict the likelihood of dengue based on historical patterns.

✓ The incorporation of cloud computing facilitates scalable and efficient data storage and model deployment.

✓ The system's innovative approach not only showcases the potential for real-time disease detection but also signifies a convergence of Internet of Things (IoT), machine learning, and cloud technologies for proactive and data-driven healthcare strategies.

Merits

- ✓ Non-invasive, continuous monitoring; user-friendly.
- ✓ User-friendly; accessible; potential for early symptom detection.
- ✓ Flexibility in choosing sensors; potential for enhanced accuracy.
- ✓ Early detection; community involvement.

MODULE DESCRIPTION

A module is a Hardware and software component or part of a program that contain one or more routines.

ARDUINO DEVELOPMENT ENVIRONMENT

The Arduino development environment contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions, and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them.

PYTHON 3.7:

Python is an easy to learn, powerful programming language. It has efficient high-level data structures and a simple but effective approach to object- oriented programming. Python’s elegant syntax and dynamic typing, together with its interpreted nature, make it an ideal language for scripting and rapid application development in many platforms and may be freely distributed.

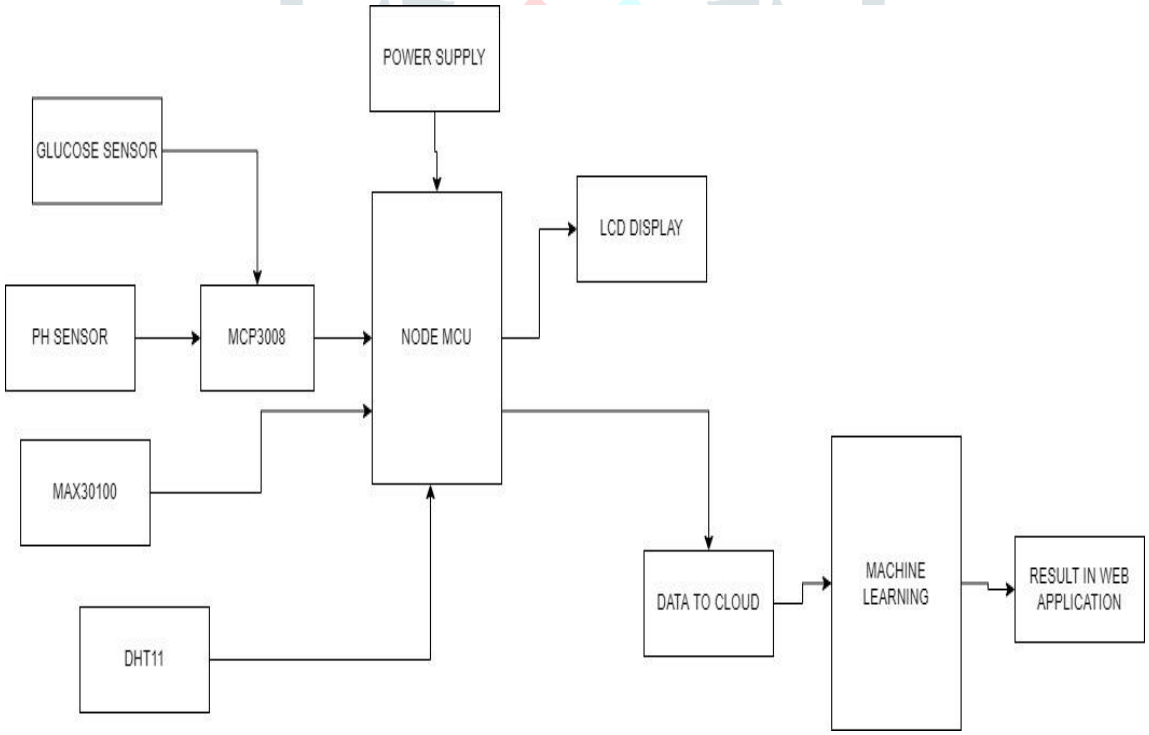
SENSORS

A sensor is a device, module, machine, or subsystem whose purpose is to detect events or changes depends upon transducer in its environment and send the information to other electronics, frequently a

microcontroller. A sensor is always used with other electronics.

ESP8266 WIFI

The ESP8266 arduino compatible module is a low-cost Wi-Fi chip with full TCP/IP capability, and the amazing thing is that this little board has a MCU (Micro Controller Unit) integrated which gives the possibility to control I/O digital pins via simple and almost pseudo-code like programming language. This device is produced by Shanghai-based Chinese manufacturer, Espresso if Systems.



Results and Discussion of LCD Display

A Liquid Crystal Display (LCD) is an electronically-modulated optical device shaped into a thin, flat panel made up of any number of colour or monochrome pixels filled with liquid crystals and arrayed in front of a light source (backlight) or reflector. It is often utilized in battery-powered electronic devices because it uses very

small amounts of electric power. LCD has material, which continues the properties of both liquids and crystals. Rather than having a melting point, they have a temperature range within which the molecules are almost as mobile as they would be in a liquid, but are grouped together in an ordered from similar to a crystal.

MAX30100:

The MAX30100 sensor, which is commonly used for pulse oximetry and heart rate monitoring, can contribute to predicting dengue fever by measuring physiological parameters such as oxygen saturation levels and heart rate variability. In dengue fever, there can be significant changes in these parameters due to factors like dehydration, plasma leakage, and circulatory collapse. By continuously monitoring these vital signs, the MAX30100 sensor can help detect early signs of dengue fever, enabling timely medical intervention and treatment. Additionally, trends in these physiological parameters over time can provide valuable insights into the progression and severity of the diseases.

PPG sensor

A PPG (Photoplethysmography) sensor can play a role in dengue fever prediction by monitoring changes in blood volume in peripheral blood vessels. Dengue fever can cause changes in blood volume and circulation, which can be detected by a PPG sensor. By analyzing these changes, the sensor can potentially contribute to early detection of dengue fever symptoms, allowing for timely medical intervention and treatment.

PH sensor

A pH sensor can potentially help in predicting dengue fever by monitoring changes in the pH levels of bodily fluids such as urine, saliva, or blood. During dengue fever, there can be alterations in the body's acid-base balance due to factors like dehydration, metabolic acidosis, or vascular leakage. These changes can affect the pH levels of bodily fluids. By measuring pH levels, a sensor can provide insights into the body's physiological state and detect early signs of metabolic imbalances associated with dengue fever. However, it's important to note that while pH monitoring can be a useful tool, it is typically not used as a standalone method for diagnosing dengue fever.

DHT11 Sensor

DHT11 sensor consists of a capacitive humidity sensing element and a thermistor for sensing temperature. The humidity sensing capacitor has two electrodes with a moisture holding substrate as a dielectric between them. Change in the capacitance value occurs with the change in humidity levels.

CONCLUSION

In conclusion, the proposed system for early dengue detection represents a significant advancement in the field of public health monitoring and disease surveillance. By leveraging cutting-edge technologies such as sensor technology, machine learning algorithms, and cloud computing infrastructure, the system offers a comprehensive and efficient approach to identifying potential dengue cases at the earliest stages. Through real-time data collection, analysis, and feedback, the system enables timely interventions and decision-making, ultimately enhancing the effectiveness of public health efforts aimed at controlling dengue fever and other infectious diseases. With its potential for scalability and adaptability, the system holds promise for broader applications in global health security and resilience, offering a beacon of hope in the ongoing battle against emerging infectious threats.

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