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IOT-BASED SKIN HEALTH MONITORING SYSTEM

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ABSTRACT

A significant rise in the numeral of skin disease patients, which is cause for concern and needs to be addressed. A doctor's observations and experiences always serve as the basis for the diagnosis process. Following a misdiagnosis, a delayed diagnosis, or no diagnosis at all, a person may experience a number of common symptoms, including side effects, allergies, and even an increased risk of skin cancer. In follow-up, the assessment of skin changes is essential to the accurate diagnosis. Skin conditions can be recognised and predicted, and diagnoses can be made outside of physical boundaries thanks to partnerships and technological advancements. An Internet of Things-based skin surveillance system that makes it easier to keep an eye on skin patients in far-off places was suggested in the article. This system aims to provide a comprehensive and personalized solution for skin health monitoring. It comprises of an IoT-enabled device and a mobile application that allows users to track and monitor their skin health. The device is equipped with advanced sensors and algorithms that enable it to measure skin moisture, temperature, and pH levels. Overall, we think this is an innovative and effective solution for skin health monitoring. It is a great way for people to keep track of their skin health and stay on top of any potential skin issues. It is also a great way for people to take proactive steps to improve their skin health.

Keywords: IoT, Healthcare, Skin, Sensors, IoT System, Temperature, pH sensor, Humidity Sensor

1. INTRODUCTION-

Skin diseases, also known as dermatological conditions, are illnesses [1] that affect the skin. These disorders vary greatly in symptoms and severity, ranging from mild rashes to life-threatening diseases. Common skin diseases include acne, eczema, psoriasis, rosacea, and skin cancer. Acne is the most common skin disease and is caused by clogged pores. It is characterized by red, inflamed bumps, blackheads, and whiteheads. Acne can be treated with topical medications, antibiotics, and in some cases, oral medications. Eczema is a type of skin inflammation that can range from mild to severe. It is usually characterized by red, itchy patches of skin that can become scaly and crusty. Treatment includes keeping the skin moisturized, avoiding triggers (such as fragrances and detergents), and in some cases, medications.

Psoriasis is an autoimmune disease [2] that causes red, scaly patches on the skin. It is usually itchy and can be triggered by stress and infections. Treatment includes topical medications, phototherapy, and in some cases, oral medications [3].

Rosacea is a skin disorder that usually affects the face. It is characterized by redness, visible blood vessels, and in some cases, bumps. Treatment includes topical medications and in some cases, oral antibiotics. Skin cancer is the most serious type of skin disease. It is caused by long-term exposure to ultraviolet (UV) radiation and can manifest in various forms. Treatment includes surgery, radiation therapy, and in some cases, chemotherapy. No matter what type of skin disease you have, it is important to consult a doctor for diagnosis and treatment. With early diagnosis and treatment, many skin diseases can be managed and in some cases, cured.

Skin health monitoring is the process of tracking and monitoring the condition [4, 5] of the skin in order to detect any potential problems or changes in skin health [6, 7, 8]. It is important to monitor the skin for any signs of infection, inflammation, or other changes that may indicate a problem. Skin health monitoring can be done through a variety of methods, ranging from in-person physical examinations to the use of specialized instruments [9, 10, 11].

The skin is biggest tissue of human body and is accountable for providing fortification from the environment, preventing dehydration, and regulating body temperature [12, 13]. For these reasons, it is important to monitor the health of the skin and take steps to ensure its well-being.

Physical examination is one of the most common methods of skin health monitoring. During a physical exam, a doctor [14] will check for any abnormalities, such as skin lesions, rashes, or other changes in the skin. In addition, the doctor will check for signs of infection, such as redness, swelling, or tenderness [15, 16, 17].

Instrument-based skin health monitoring is another option that can be used to monitor the condition of the skin. This type of monitoring typically involves the use of specialized instruments, such as UV light meters, digital microscopes, and infrared cameras [18, 19]. These instruments allow for more accurate measurements of the skin's condition and can help to detect early signs of skin problems. In addition to physical exams and instrument-based monitoring, there are also other methods of skin health monitoring. For instance, people can use skin care products to monitor the condition of their skin. These products can be used to cleanse, moisturize, and protect the skin. They can also be used to detect changes in skin health, such as dryness, redness, and flaking [20, 21, 22].

Finally, people can also take measures to protect the skin from environmental damage. This can include wearing sunscreen, avoiding sun exposure, and avoiding harsh chemicals. Taking these steps can help to reduce the risk of skin damage and help to maintain healthy skin [23].

Overall, skin health monitoring is an important part of maintaining healthy skin. It is important to be aware of the signs of skin problems and take steps to ensure the skin remains healthy and free from damage. By taking the necessary steps, people can ensure that their skin remains healthy and free from any potential problems [24, 25].

2. INTERNET OF THINGS(IoT)-

IoT [26] is a rapidly growing technology trend that is transforming the way we cooperate with the domain nearby us. It is the concept of connecting physical devices, such as home appliances, to the internet to allow for remote monitoring and control. The potential of IoT is huge, and it has the potential to revolutionize the way we live.

IoT technology enables devices to communicate with each other and with the internet without the need for a human being to be involved **(Figure 1)**. This opens up a world of possibilities, as it means that devices can be connected to each other and be monitored [27] remotely. This allows for a more efficient and effective use of resources, and it also allows for the automation of many processes that would otherwise require manual intervention. IoT is made possible through the use of sensors, actuators, and other components that

are associated to internet. Those devices can be used to collect data, such as temperature **[28]**, humidity **[29]**, and other environmental factors, and can also be used to control devices in a home or office. By connecting these devices to the internet, it is possible to monitor and control them from anywhere in the world **[30]**. IoT is already being used in a variety of industries, from smart homes and agriculture to healthcare and automotive **(Figure 2)**. It is being used to improve efficiency, lessen costs, and upturn safety. As the tools endures to

develop, it is likely that more industries will adopt it in order to take advantage of the potential benefits **[31]**.

The IoT revolution is just getting started, but its potential is already being seen. It has the impending to transmute the method we relate thru the realm round us, and it has the potential to revolutionize the way we live. As the technology continues to develop, it is likely that more industries will adopt it to take advantage of the potential benefits **[32, 33]**.
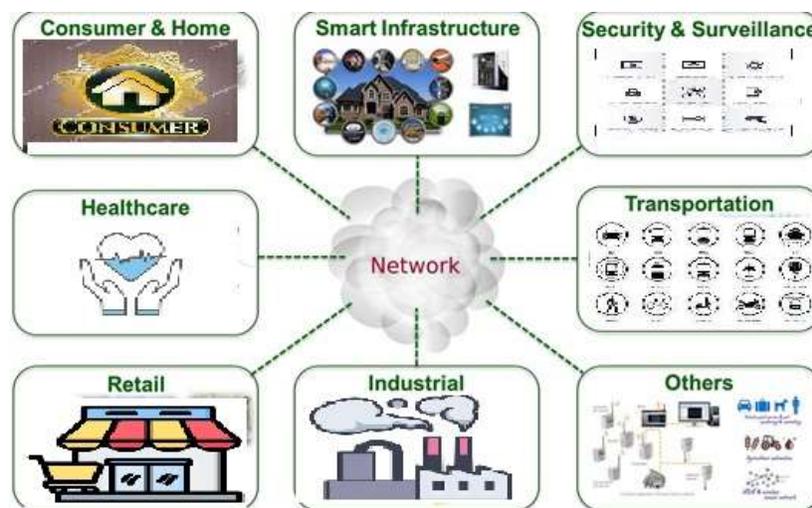

Figure 2: Applications Areas

3. LITERATURE SURVEY-

Applications of IoT technology can be very helpful in the healthcare industry. Medical parameters of the human body can be monitored and assessed using a variety of sensors **[34]**. McGrath *et al*.'s research **[35]** provides a detailed description of the different

wearable sensors used for individual health movement. There are now a lot of wearable sensor devices on the market that can measure a number of different things, including blood pressure-BP, temperature, heart-rate, pulse, respiration rate, and blood suger levels **[36]**.

Skin tracking patches, which resemble tattoos on the skin, are another innovative Internet of Things technology that shows great promise. The patches are inexpensive, extendable, and unrestricted. These can be used by the patient to continuously monitor a vital health parameter for an extended period of time **[37]**. The automated parts are combined into a structure and can use wireless media to send sensor data. Clinicians can receive real-time patient health parameter broadcasts via IoT and cutting-edge wireless technologies **[38, 49]**. The categorization of skin diseases using different machine learning techniques and the comparison of them are covered by Shuchi *et al*. **[40]**.

According to Paradeshi *et al*. (2022) **[41]**, advancements in technology have made it possible for a variety of industries to investigate and make use of wireless sensor networks and IoT in their respective domains. The healthcare sector is one such area that this study will examine. Fault Detection Framework for IoT Sensor-Based Wireless Healthcare Monitoring will be the main focus of this study. When a process or system has flaws, fault detection finds them and separates the convoluted procedure or variable because doing so reveals additional pertinent information about the issues. The findings show the effectiveness of the fault finding

framework for IoT-based healthcare monitoring in a wireless setting.

A machine learning and Internet of Things-based approach for monitoring perishable goods is covered in the article by Dr. Rawale *et al*. (2023) **[42]**. The projected system entails by IoT devices to upload images captured by high-resolution cameras to a cloud server. These pictures are first segmented using K-means clustering algorithm before being uploaded to a cloud server. After principal component analysis is used to extract attributes from the images, trained ML models are applied to classify these images. This suggested method uses machine learning, image processing, and the Internet of Things to monitor perishable food. The agricultural system that Wale *et al*. (2019) **[43]** have proposed is excellent; it measures the soil's moisture content and adjusts the motor's ON/OFF settings accordingly. The user is also provided with information regarding water's level in a water tank via LCD display and IoT. The system provides data on temperature and humidity in the atmosphere. which allows us to take appropriate action. The PIR sensor also detects the entry of animals. Low cost, low power consumption, and reduced analysis time were among the benefits.

Acute data are collected by IoT module in this Pradeepa *et al*. (2022) **[44]** concept, and data assessment is carried out using NN-neural network simulations to analyse the data and defines the likely risks to children's physiological and behavioural modifications. The results of the experiment indicate that the proposed model is a reliable and accurate way to assess the pupils' states. After evaluating the suggested model, SVM-support vector machine achieved a maximum performance of 99.1%, which is satisfactory for our goals. The outcomes also outperformed algorithms for random forests, decision trees, and multilevel perceptron neural systems.

4. PROPOSED METHODOLOGY-

IoT-based skin health care monitoring is an approach to skin health care that uses sensors and other IoT devices to collect data from the skin **(Figure 3) [45, 46]**. This data can include temperature, humidity, moisture, and other environmental factors that can affect skin health. By collecting this data, healthcare providers can get a better understanding of the skin's condition and can make more informed decisions about treatment.

Here are several benefits to using an IoT-based approach to skin health care monitoring. First, it allows for more accurate and timely data collection. This can help healthcare providers diagnose skin conditions more quickly and accurately. Additionally, it can reduce the need for manual data entry, which can be time-consuming and prone to errors. Furthermore, it can provide a better understanding of the skin's environment, which can help healthcare providers make more informed decisions about skin care.

When implementing an IoT-based methodology for skin health care monitoring, there are several key steps that need to be taken. First, the system must be designed with the right sensors and hardware to accurately collect the data needed to monitor skin health. Once the system is in place, the data collected must be analyzed and the results used to inform decisions about skin care. Finally, the results must be communicated to the healthcare provider so that they can make the best possible decisions for the patient's skin health.
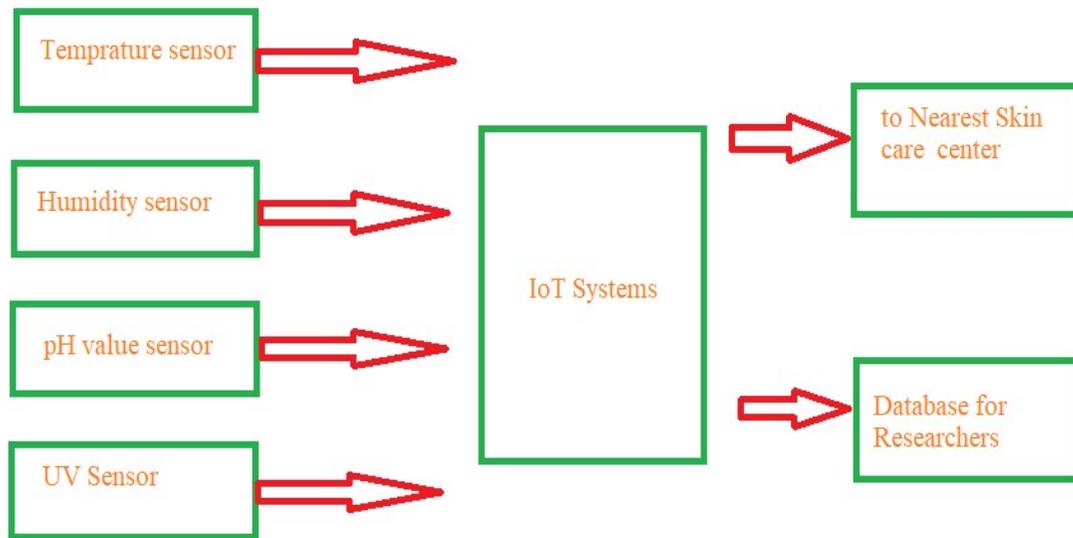
Figure 3: Proposed IoT based Skin Healthcare System

A sensing device is a skincare van equipped with skin-sensors and server. Depending on the unique skin symptoms of the patient, sensors collect data such as high-resolution skin images, hydration, skin pH levels, and trans-epidermal water loss. A server that is compatible with multiple local networks, such as LTE and WiFi, is referred to as a local server. You can use a local server. It is equipped with features like WiFi, GPS, **[27]** and SQLite **[34]** databases. This serves a number of purposes. For more accurate disease inferences and predictive analysis, those skin data may also be enhanced with additional information including age, gender, location, and previous history of skin issues. These parameters can be used to explore how skin disease trends are changing and how preventive interventions can be made in the future. In the event that a patient or doctor requires continuous observation, the patients will admit, and the sensors also collect vital data and send it to the nearby server.

**5.   RESULTS AND DISCUSSIONS-**

The suggested system's automation during the skin Health-monitoring phase would shorten the time needed for diagnosis. Manual labour is replaced by automation, which is less prone to human error. This method offers a reliable path to predicted performance. The system is implemented with the LCD display for display the Skin parameters like temperature, skin Humidity etc. **(Figure 4)**. In contrast to the manual system, the scenario may be resolved quickly in the event of a patient variation or an adverse drug effect. The course of treatment can begin at any time. Early recovery is therefore expected to decrease in average treatment time when information and a on-demand therapy programme are available. We

found that when doctors and patients use the suggested system, diagnosis days are lowered by up to 25%. As indicated in Table in **Figure 5**, we have gathered data on 25 patients with skin diseases, including a days since skincare consultant made the diagnosis.

Figure 4: Temperature and Humidity measurement
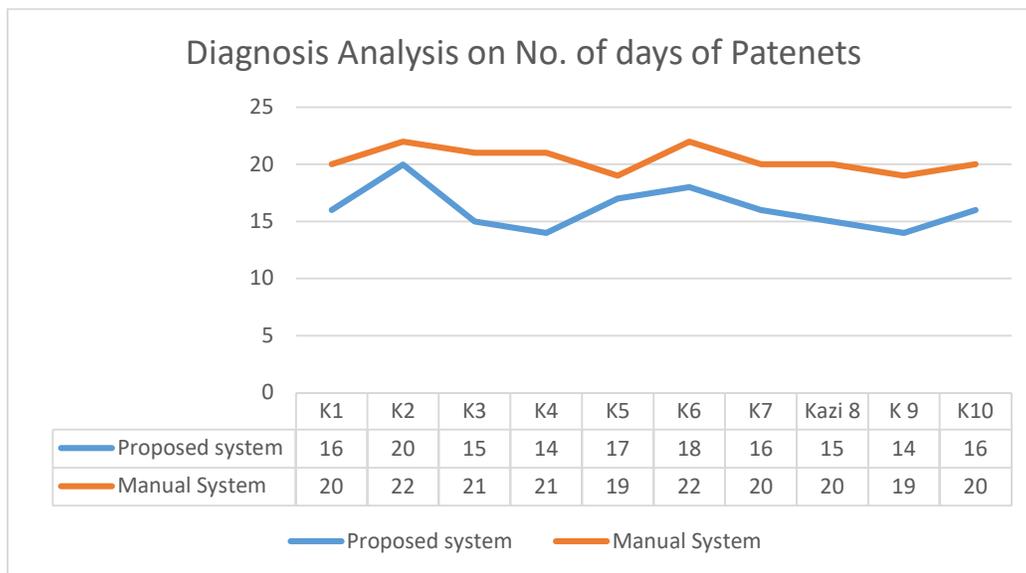
Figure 5: Analysis of Proposed and Manual System with table

We put the suggested system into practise and compared a outcome with manual system that was already in place. I discovered that the suggested system's efficiency surpasses that of the current manual system. I discovered that the reason for this was that the patient's medical history was available in real-time for the doctor to access at data centres in order to diagnose skin conditions. Real-time skin patient images or data are captured by the

sensors, which then transmit them in real-time via local or remote gates to data centres.

Saved time is a crucial factor that would otherwise increase expenses. Our suggested system automates the process of gathering patient data from nearby hospitals through sensor vans, which reduces visiting and waiting times. Additionally, there is no longer a waiting period because the patient can return at any time after giving skin data to obtain the medicament and other information on her/his mobile device. This demonstrates how effective the suggested system architecture is in terms of saving money and time.

6. CONCLUSION –

The study concentrated on an Internet of Things-based skin Health monitoring system that provides real-time skin disease surveillance and diagnosis. We propose an approach and structure for skin health monitoring to enhance the diagnostic cycle and prevent skin diseases. IoT-based skin health care monitoring is a promising new approach to skin care. By using sensors and other hardware to collect data about the skin's environment, healthcare providers can get a better understanding of the skin's condition and can make more informed decisions about treatment. With the right methodology in place, this type of monitoring can be automated and made more efficient, allowing

healthcare providers to better diagnose and treat skin conditions. Saved time, which is a crucial component, prevents additional expenses. Because patient data is retrieved automatically through sensor vans positioned in nearby hospitals, our proposed system reduces visiting and waiting times. Additionally, the patient no longer has to wait because, upon supplying her skin data, she can always return to receive the prescription and additional information on her phone. This demonstrates the low cost and time-saving effectiveness of the suggested system architecture.

DISCLOSURE AND CONFLICTS OF INTEREST-

No Conflict.

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