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# NON-INVASIVE THYROID DETECTION

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**Abstract:** Thyroid gland's ability to perform its functions is impacted by thyroid illness. Thyroid disease often comes in one of two forms: i) Hypothyroidism, which is characterised by (low function) and is brought on by insufficient thyroid hormones. ii) Overproduction of thyroid hormones, which results in hyperthyroidism (high function). Hypothyroidism can causeconstipation, dry skin, slow heartbeat, low energy, weight gain, inability to withstand the cold, and weariness. The signs of hyperthyroidism include irritability, weight loss, a rapid heartbeat, heat sensitivity, diarrhoea, and thyroid enlargement. A portion of the neck may bulge, a condition known as a goiter , in both hypothyroidism and hyperthyroidism.

The objective of this work is to create a low-cost smart sensing device that can measure the relative skin temperature, heart rate, and pulse of a human using a non-invasive technique for thyroid detection. It makes use of two separate sensors, one of which measures the patient's heartbeat, pulse rate and the other of which measures the relative difference in skin temperature. The variance detected by the sensors will be processed by the microcontroller. In this work, a heartbeat and pulse rate monitor built on an Arduino ide is used to count heartbeats per minute. Here, a Max30100 sensor is being operated, and when a finger is placed on it, it detects the heartbeat and pulse. This thyroid-detection method uses no pain or force.

**Keywords:** Relative skin temperature variation, Heartbeat monitor, pulse

## I. INTRODUCTION

According to a projection from various studies on thyroid disease, it has been estimated that about 42 million people in India suffer from thyroid diseases. The radioactive approach is used in thyroid detection to find out how well the thyroid gland is working. For example, receiving a thyroid diagnosis while pregnant puts the patient at risk for radiation exposure, which also has an impact on the foetus. According to a clinically established fact, a person with a healthy thyroid gland will absorb 65% of the energy that is there and emit 35% of it as heat. According to how the thyroid gland functions, being too cold or too hot are the typical symptoms of poor and high thyroidism, respectively. Thermal imaging is an illustration of a non- invasive technique. This hormone's release is diminished in hypothyroidism. This hormone is secreted more often as a result of hyperthyroidism. In women, hypothyroidism is typical. A congenital abnormality causes hypothyroidism in one in every 4000 new-born. Peripheral temperature rises as a result of hyperthyroidism. Reduced peripheral temperature is a side effect of hypothyroidism. The thyroid is diagnosed in this work using a non-invasive, non- contact smart sensor. To determine the relative skin temperature is the first step in this process. The relative change in skin temperature is detected using an LM35 sensor. This sensor measures the thermal coefficient, and the Arduino microcontroller assists in displaying the temperature reading. The non-contact LM35 sensor can detect changes in both the ambient and skin temperatures, as well as display those changes in both Celsius and Fahrenheit. The MAX30100 sensor is employed in the second portion of this work to detect the thyroid by placing a finger on the sensor and measuring the heartbeat and pulse rates. The heart rate and number of beats per minute are counted and displayed using an Arduino-based heartbeat monitor.

## II. LITERATURE SURVEY

The thyroid disease can be diagnosed by measuring body temperature and pulse rate. The cost of this method is low when compared to previous methods. The temperature and the pulse rate detection is an alternative diagnostic method to monitor the thyroid function. The proposed method has advantages of low cost, simple and non invasive. A low cost smart sensing system to sense the human relative skin temperature through non-contact and non-invasive method for detecting thyroid. This method canbe used by the person to find whether one has any thyroid problem or not. This is one of the simple method for thyroid diagnosis. Developed method tests the medical data that is collected and gives the risk value of the individual. Twelve normal subject and eight abnormal subjects were tested. In case of abnormal subject all parameter range exceeds the normal range. So the subject is considered to bea patient with thyroid disease. The averageaccuracy of this method is 83.33%.[1]

Multiple short-wave spectroscopy techniques based non- invasive blood glucose monitoring device is proposed and

  

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validated for real-life application. The combination of absorption and reflection of light at specific wavelengths using MPR based calibration is optimized for non-invasive measurement. The proposed device is an innovative approach in the form of a combination of spectroscopy techniques for precise detection. During statistical analysis using the proposed computation device, 0.81 correlation coefficient is calculated using MPR based calibration with polynomial degree 3. The AvgE and mARD using the proposed calibration method are improved as compared to other noninvasive glucose measurement device. After analysis of predicted blood glucose values, 100% samples come in the zone A and B. During statistical analysis of possible combinations of techniques with proposed combination, it is concluded that the device with the combination of three channels is more optimized as compared to other possible combinations and precision measurement hasbeen observed between the range of 70- 450 mg/dl. In future research, we will add more features of Internet-of-Medical- Things (IoMT) integration of the iGLU. For example, integration of stress measurement along with blood-glucose level. Integration of control methods of stress and blood- glucose along with monitoring will be considered.[2]

In this research work, we have developed a hardware prototype from which the Photoplethy smograph (PPG) signalis acquired. The Integrated circuits used in this hardware design is of low cost and has considerable advantages when compared with the existing design used in the literature and other existing devices. The signals that are acquired will be analysed in software platforms foradditional signal processing methodologies and feature extraction will be performed for both normal and diabetic subjects. The software analysis highlights the feasibility of developing a low-cost non-invasive glucose monitoring using machine learning. The future work of this work will be focused on estimating the correlation of the feature sets with various machine learning techniques.[3]

We have designed and implemented the idea using reflection spectroscopic method for non- invasive measurementof blood glucose level which offers several advantages, such asabsence of pain and exposure to sharp objects, the potential for increased frequency of testing and tighter control of the glucose concentration and lower cost. We have been able to determine cardiac related pulsatile voltage changes, using regression analysis for glucose and subsequently been able to predict the blood estimates non - invasively. In this prototype of device developed, wavelength of 950 nm obtained using NIR sensor and finger as a body site is used for predicting blood glucose level for the healthy adults. A low cost framework for noninvasive blood glucose measurement has been designed and implemented on printed circuit board and results are validated using different statistical methods. This statistical result analysis of the designed system with the prick method gives less than 10 % of percentage error and is within acceptable accuracy.[4]

We surveyed the recent advances in BP monitoring and underlying principles behind them. Most efforts have been directed in developing continuous and cuff-less monitors, miniaturization of the cuff-based devices and finding new algorithms to improve the robustness and accuracy. BP monitoring devices are being developed towards a more wearable form factor that could be worn over long time periods and, hence, geared towards better continuous measurements. Cuffless BP monitoring solutions rely mostly on time delay between pulse waveforms measured at different locations and pulse morphology analysis combined with machine learning techniques. Several studies have attempted to improve continuous BP monitoring accuracy with the use of models and machine learning techniques. Although good progress has been made, most studies have limited number of subjects and narrow BP distribution and do not use unified study protocols to allow direct comparison with obtained results. With the hope of new extensive public databases becoming available, more rapid progress could bemade. Some concerns have been raised on the rigor of the validation of cuffless device and although a standard has been proposed it has not gained widespread use.[5]

A non invasive technique to detect thyroid using infrared sensors(2019). The major benefits of this system come from a multitask cascade architecture, two layers of meticulously built deep convolution networks to identify and recognise thyroid nodules in a pyramidal approach, and capturing numerous intrinsic properties in a global-to-local manner and limited data has been set into the system. In our methodology, following initial detection, the prospective regions of interest are then supplied to the spatial pyramid augmented CNNs to embed multiscale discriminative information for fine-grained thyroid recognition.[6]

Thyroid Module Detection using Artificial Neural Network (2021). This study suggests a computer-based system for identifying diagnostic value in ultrasound pictures as benign or cancerous depending on the attributes collected. Both Region of Interest (ROI) blocks are used to determine the texture-related information. The image is enhanced, and then segmented using an active contour without an edge (ACWE). The Multi-layer Perceptron (Proposed method) diagnoses the lump as benign or malign using the features that were retrieved.[7]

The objective of this project is to develop a device for the detection of thyroid dysfunctions using non-invasivemethod. It is found that there is a increase in voltage due to hyperthyroidism, decreased in voltage due to hypothyroidism when

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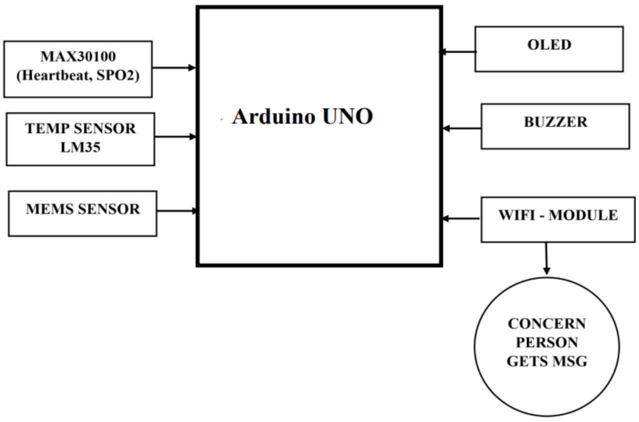
compared to the euthyroid. This is a basic device developed to detect thyroid dysfunctions in an endemic area at a very low cost. Further development of this instrument in my future research program may throw more information regarding the accuracy and precision of this device .[8]

In this research work, we have developed a hardware prototype from which the Photoplethysmography (PPG) signal is acquired. The Integrated circuits used in this hardware design is of low cost and has considerable advantages when compared with the existing design used inthe literature and other existing devices. The signals that areacquired will be analyzed in software platforms foradditional signal processing methodologies and feature extraction will be performed for both normal and diabetic subjects. The software analysis highlights the feasibility of developing a low-cost non-invasive glucose monitoring using machine learning. The future work of this work will be focused on estimating the correlation of the feature set with various machine learning techniques.[9]

## III. METHODOLOGY




**3.1.1 System Block Diagram**

This IR LED approach is a non-invasive way to differentiate between hyperthyroidism and hypothyroidism in the thyroid level. The basis for the IR LED approach is the way that blood absorbs light. On a narrow area of the patient's body, often the tip of a finger, an array of IR LED and photo diodes are positioned. With the aid of a photo detector, IR LED wavelengths of 1000, 800, and 750 nm are transmitted through the patient. It is possible to measure the thyroid level in blood by measuring the change in absorbance level, which enables determination of the absorbance. The result appears as normal/hyper or hypothyroidism on the OLED.

### 3.1.2 Glucose Level Detection

The main optical principle used in Non-invasive method of NIR Spectroscopy is Light Transport Theory or Beer-Lamberts Law. The incident light on the body is partially absorbed and partially scattered, due to its interaction with the chemical components within the tissue. The light Absorption is proportional to the concentration of the medium. In human tissue, light interacts with tissue and attenuation occurs. Light of wavelength between 800 nm to 1200 nm are absorbed by patient fingertip from max 30100 sensor which detects the temp, heartbeat, spo2. By this we will be using standard formula to calculate glucose molecules present in blood. Then based on the Glucose level , we predict Low ,Normal ,High glucose concentration along with the values and print it on OLED Display.

### 3.1.3 Thyroid Level Detection

The main objective is to measure the body temperature and the pulse rate to detect the type of thyroid. The IR LED technique is a non-invasive method of classifying the thyroid level as hyperthyroidism and hypothyroidism. An array of IR LED and photo diode is placed on a thin part of the patient's body, usually on a fingertip. IR LED wavelengths of 1000, 800 and 750 nm is passed through the patient and detected with the help of photo detector. That will be detecting temp, heartbeat, spo2, glucose if these 4 values are greater than normal conditions then it will display hyperthyroidism or if these 4 values are less than normal conditions then it will display hypothyroidism and if it fails with one condition also then it will be displaying normal. The output is displaced in the OLED as normal/hyper or hypothyroidism.

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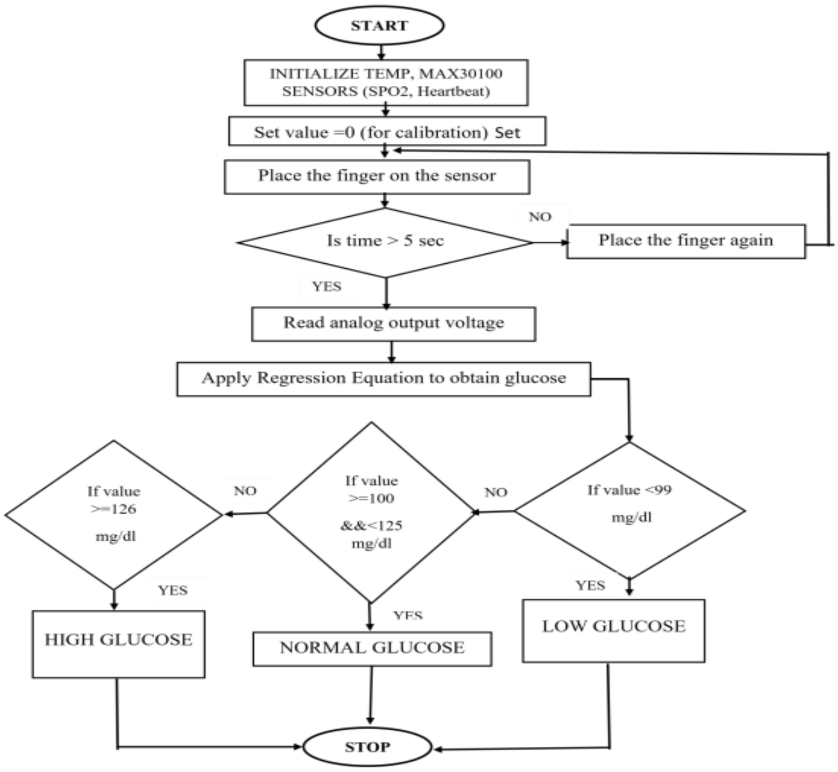
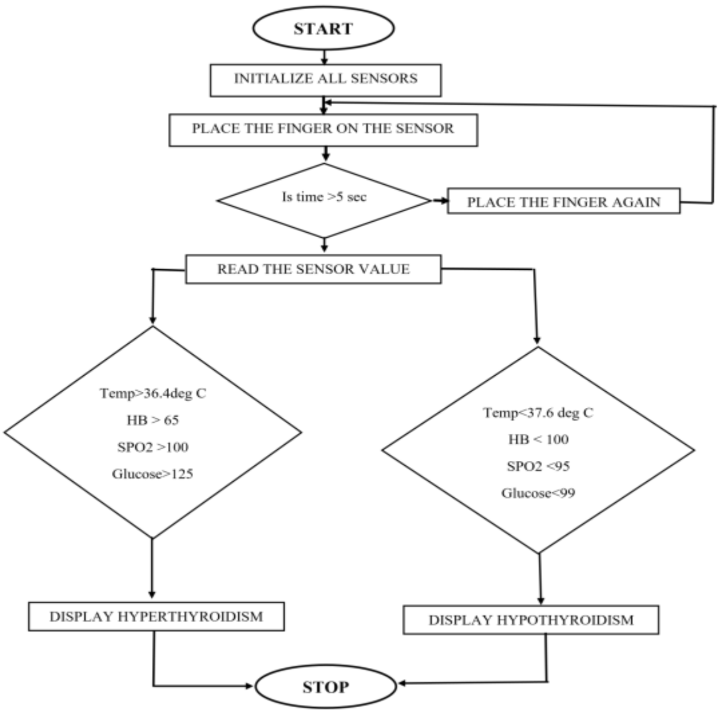



**3.1.2 Flow chart of Glucose level detection**




**3.1.3 Flow chart of Thyroid level detection**

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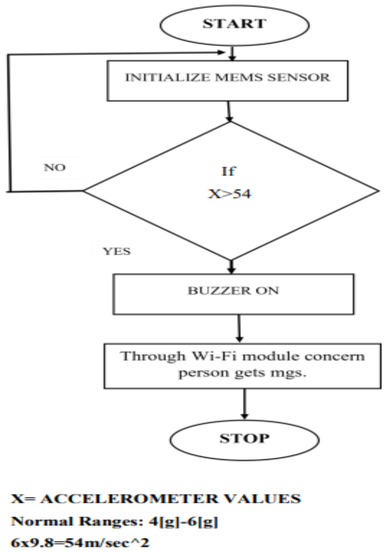
### 3.1.4 Fall detection

MEMS sensor is used to detect the position and speed of the person. These values are compared with normal values. Under variations, a buzzer is on and the concerned person will receive a message through the WIFI module.




**3.1.4 Flow chart of fall detection**

## IV. RESULT & CONCLUSION

Non-invasive glucose, thyroid levels we will be implemented on wrist band. That shows the Values of glucose and thyroid levels in OLED.
Non-invasive thyroid detection techniques have become increasingly important in recent years due to their potential to accurately diagnose thyroid diseases without causing discomfort or risk to patients. Several non-invasive techniques have been developed, including ultrasound, scintigraphy, and optical coherence tomography (OCT), among others.
The conclusion from studies on non-invasive thyroid detection is that these methods can be effective in diagnosing thyroid diseases, including thyroid nodules, goiter, and thyroid cancer, with a high degree of accuracy. Furthermore, non-invasive methods offer several advantages over invasive methods, such as avoiding the need for biopsy or surgery, reducing patient discomfort, and being more cost-effective.

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