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Multi-Parameter Thyroid Detection

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Abstract:

Background/Objectives: A prototype is presented for the ease of thyroid diagnosis in medical field. The model incorporates three inputs from the patient such as blood pressure, body temperature and image of the thyroid gland. Unlike the present technique where ultra-sound images and CT scan being the sole method of monitoring thyroid disorders, which can even contain speckle noises we ensure that our prototype is accurate in results.

Methods/Statistical analysis: Using the above three inputs, we give these analog signals to the PIC controller simultaneously and using the controller A/D ports, these body signals are digitized. The inputs given to the controller are then compared with a pre-defined set of datasheets which are universally accepted based on the studies conducted. For instance, the image of the thyroid gland is compared with an image which has the geometric features of that a thyroid disorder, using MATLAB tools such as GLCM, SVM etc. we are capable of concluding the presence of thyroid. Similarly for body temperature and BP measurement we have a set of defined ranges in which these inputs fluctuate, as seen in a patient suffering from thyroid disorders.

Findings: With the usage and proceedings done so far, it can be realized that Thyroid disorders have minimal symptoms and so the patients may suffer different set of bodily effects. Image processing, CT scans are the most common techniques being used since years for thyroid detection but yet it is not a guaranteed option of knowing the severity of disorder as it contains speckle noises and blur in images. The prototype includes basal body temperature and blood pressure measurement as well since it is been found that among the different body metabolism rates fluctuated frequently under thyroid disorders, these two are the most varied. The purpose of inclusion of these signals hence prove successful, when the accurate results are generated by making the prototype capable of detecting thyroid even in the absence of the positive image results.

Improvements/Applications: The prototype can be more sophisticatedly assembled by using a high image clarity lens, hence we make use of Webcam here. Also various other temperature sensors can be used from the market, keeping the range in mind. The prototype can be further extended to more body rates such as glucose sensors etc. based on further advanced studies. The addition of the IoT module makes it possible for the experts as well as for the patients to access the reports from anywhere, anytime.

***Keywords*:** IoT Module, GLCM (grayscale level co-occurrence matrix), SVM (support vector matrix), Image processing.

1. INTRODUCTION

Thyroid is often an unidentified disorder in human body with minimal symptoms. The function of thyroid is to secrete necessary hormones in the body so as to maintain the metabolism rate for determining fast or slow for heart, brain, lungs etc. The stages of thyroid severity are goiter and tumors which can be benign or malignant. Proper interpretation of the thyroid data besides clinical examination and complementary investigation is an important issue on the diagnosis of thyroid disease. Here we have made use of the three most visible symptoms showing thyroid disorders such as Basal body temperature, Blood pressure and image of the thyroid gland. Unlike the recent trends of limiting the diagnosis to image interpretation, here the aim is to further improvise upon, not only over the clarity and better feature extraction of the image, but also to increase the number of parameters which show a considerate amount of variation in a patient's body when under thyroid disorder. The secretion of hormones from thyroid gland maintains the metabolism rate of the body. The correct amount of hormones secreted in blood vessels result in orderly function of the body. When the hormones are either secreted in less or more amount it results into Hypothyroidism or Hyperthyroidism respectively.

When the hormonal secretion is lesser in the blood vessels, the blood pressure developed is lower than expected and so the vessels are shunted, hence the person suffers from low blood pressure and the disorder is called hypothyroidism. Also since the heat is not escaping the body, the body temperature is increased.

Whereas when the secretion is more than required, blood vessels have high blood pressure and hence are dilated. This leads to Hyperthyroidism. The dilated blood vessels lead to escape of all the body heat and hence lower body temperature.

2. MATERIALS AND METHODS

The process starts with the giving of an input image to the system (laptop) which can be either a realtime image or can also be already present. With the use of MATLAB and its feature extraction tools we are capable of extracting features relevant for underlining thyroid symptoms. The next step is to measure the basal body temperature for which LM35 is being used as temperature sensor. Further we use the Blood Pressure machine so as to measure the diastolic and systolic pressure. The PIC controller then consolidates the above three data and hence conclude thyroid detected or not.

A. Measuring the Blood Pressure

Since we realize that thyroid disorders include blood pressure fluctuations, measuring blood pressure is necessary. Different studies conducted have proven that a person suffering from thyroid disorders undergoes a specific range of blood pressure fluctuation. Hence we make use of the blood pressure machine interfaced with PIC controller which further collects data into an IoT module. The cuff is placed around the patient, giving a pump every sec, as soon as the pressure is dropped realizing the stiffness in the arm of the patient, the blood pressure is then amplified and displayed on the LCD screen. [Figure 1]

B. Measurement of Body Temperature

The early symptoms of thyroid disorders include temperature fluctuations in specific range. Heat escaping from the human body indicates the thyroid abnormality in the person. As the different stages of metabolism occur at specific temperature, body temperature must be taken into account, we use LM35 as a temperature sensor. Similarly this is interfaced with PIC controller and IoT module. The sensor is placed near to the patient and the approximate body temperature is displayed. [Figure 2]

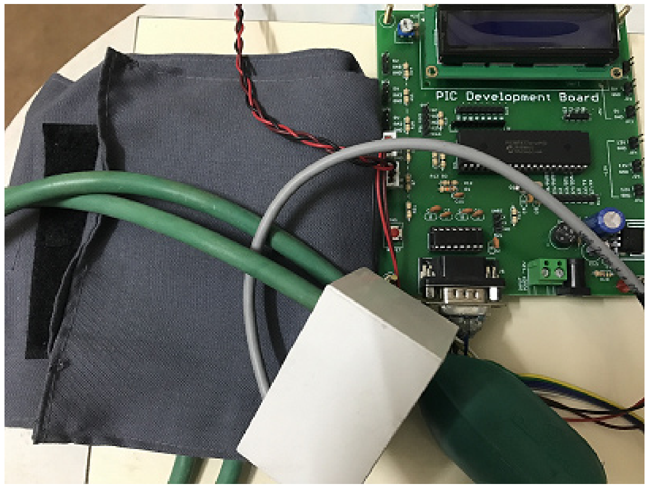

Figure 1: The blood pressure machine with cuff and amplifier are connected with pic controller

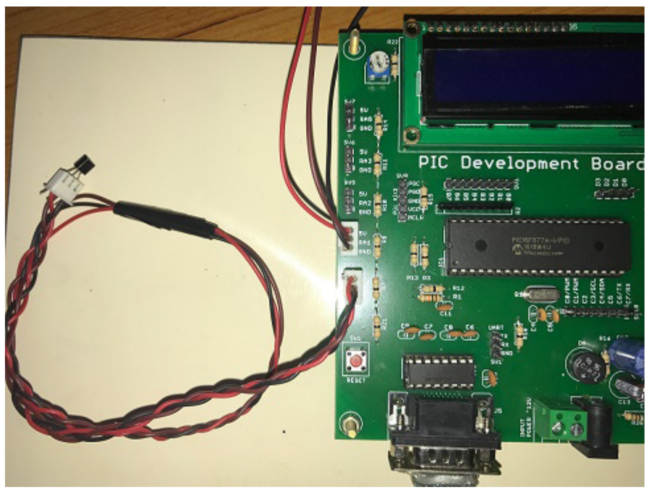

Figure 2: The LM35 is displayed as below, with connections to the PIC controller

C. Acquiring the Image of Thyroid Gland

The main analysis part includes an image of the gland which gives us the length, breadth and height (dimensions) [1][2] of the gland. This helps in extracting the features using MATLAB and using its tools SVM, GLCM etc.[1] Most image processing algorithms consist of a few typical steps viz. image preprocessing, segmentation, feature extraction, feature selection and classification. The first step in image processing is the preprocessing step. It has to be done on digitized images to reduce the noise and improve the quality of the image. Further we have feature extraction which usually includes texture qualities. On the basis of the features then we classify the images into categories and so the images conclude whether thyroid is detected or not. [Figure 3 and Figure 4]

D. Final Interpretations

After all the three inputs are taken and interfaced with the PIC controller, these are then compared with the pre-defined set of datas which are acquired from different studies. On the basis of these datasheets we finally conclude the severity of thyroid disorder and finally collect and interface as IoT[3] module. The IoT saves the data for only those patients, detected with thyroid. (This is done so as to minimise space taken in a server). A URL is used to access securely data log securely, anytime and anywhere. [Figure 4]

Figure 3: For the image of the thyroid gland we have captured a neckline photo of a patient

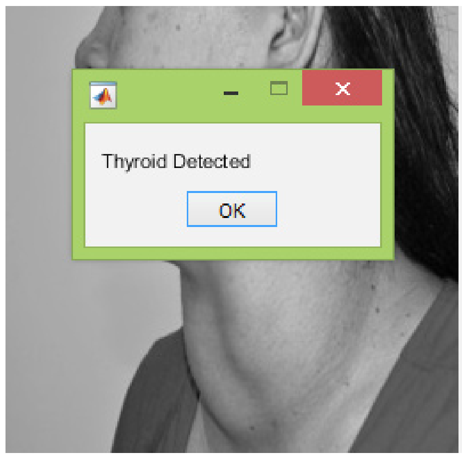

Figure 4: Then we pre-process the image using MatLab tools and extract the features where it concludes the result

3. RESULTS AND DISCUSSION

The older techniques for thyroid disorder are time consuming and complex at the same time. There are certain processing methods which are subsequently used to filter out noises from the images obtained. Also, one of the highlight of this prototype is that it can incorporate three inputs for the accurate result. Other models or diagnosing methods are not sufficient enough to conclude the thyroid disorders. The latest expansion of IoT module will help in the collection of the datasheets of the patients and the unique URL generated for specific database helps in worldwide accessibility.

With the next level of advancement in sensors and controllers used in prototype, accuracy, monitoring, space constraints are removed. This is an attempt to incorporate more than single criteria which are often given importance and letting go the other symptoms. This consideration not only helps in exploring the symptoms but also in finding alternate medications. [Figure 5]

4. CONCLUSION

Through this work we have been able to develop a prototype that successfully gives an accumulative thyroid detection. This incorporates multiple parameters from the human body to give the result. The time consuming process of examining protein levels in the blood for the detection of thyroid is eliminated and makes the process much less tedious. Further the IoT technology gives the medical professionals history of the patient by just logging into a URL, which is secured using credentials such as username and password.

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4	TEMP_NORMAL	03/02/2017	17:36:00
5	TEMP_NORMAL	03/02/2017	17:36:36
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Figure 5: The final interpretation of results from all3 inputs is shown in IoT page:

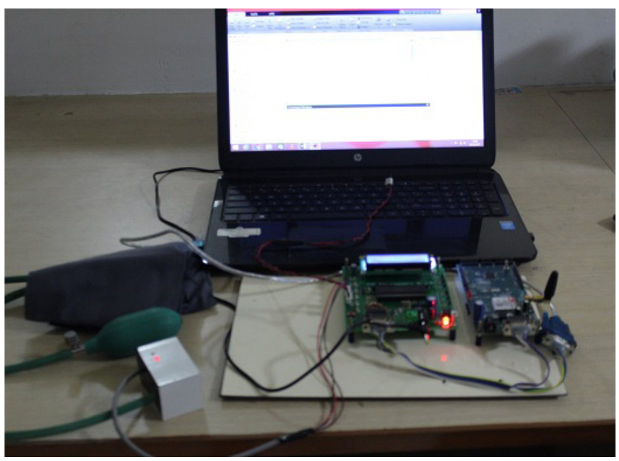

Figure 6: The final prototype body is compact as shown:

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