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Multiparameter Thyroid Measurement (using Image Processing, Blood Pressure, Body Temperature and IoT Module)

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Abstract: 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 aim for the accurate results in measuring thyroid and hence make full use of the image processing techniques (GLCM, SVM) and also make the data securely accessible, using an IoT module.

Keywords: Image procesing; thyroid; GLCM; SVM; IoT

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.

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 hence 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 hence the body temperature is increased.

Whereas when the secretion are 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. DIFFERENT THYROID DISORDERS AND THEIR SYMPTOMS

Thyroid gland produces hormones that are helpful for the body to control metabolism. Broadly classifying the thyroid disorder can be divided into two groups: First group is the one which primarily affects the function of the thyroid and the second one is the one which involves tumours of the thyroid. Both types of disorders are common in the general population. Abnormalities of thyroid function are usually related to production of thyroid hormones.

There are four main types of thyroid diseases hyperthyroidism, hypothyroidism, benign (non-cancerous) thyroid disease and thyroid cancer. The symptoms of hypothyroidism includes tiredness, mental unclarity and anxiety, feeling cold, constipation, skin dryness and stiffness in muscles and joints, prolonged menstrual bleeding, and clinical depression. Hyperthyroidism has a separate set of symptoms. Common symptoms of hyperthyroidism includes unnatural sweating, agitated bowel movements, faint spells, nervousness, rapid heart rate, sudden weight loss, fatigue, decreased concentration and irregular flow of menstruation.

3. METHODOLOGY USED

A. Measuring the Blood Pressure

Since we realize that thyroid disorders include blood pressure fluctuations hence measuring blood pressure is necessary. Different studies conducted have proven that a person suffering from thyroid disorders undergoes a specific range of B.P. fluctuation. Hence we make use of the B.P. 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 BP is then amplified and displayed on the LCD screen. [Figure 1]

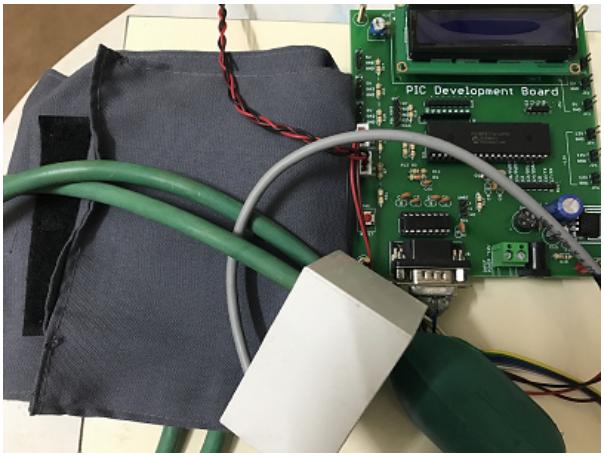


Figure 1: blood pressure cuff connected with PIC controller

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 hence 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 approx. body temp is displayed. [Figure 2]

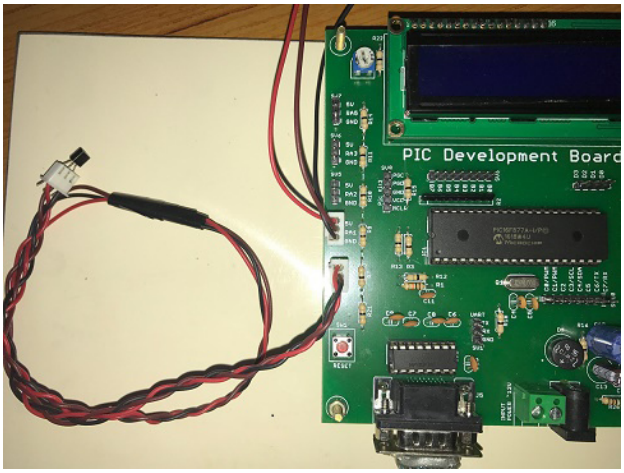


Figure 2: LM35 connected with PIC controller

C. Acquiring the Image of Thyroid gland

The main analysis part includes that an image of the gland which gives us the length, breadth and height (dimensions) of the gland, this helps in extracting 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 concludes whether thyroid is detected or not. [Figure 3]

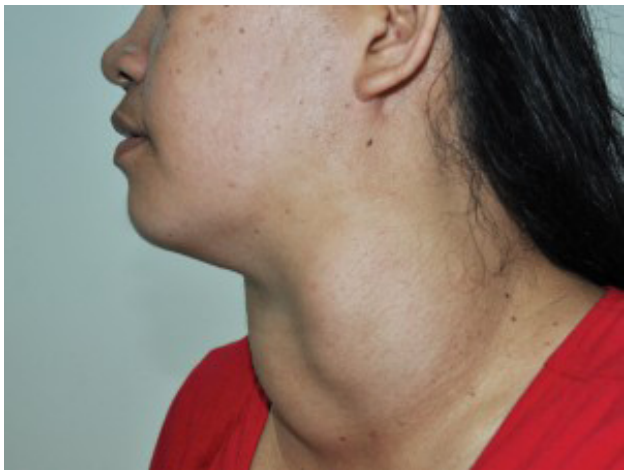


Figure 3: only a relevant part of neckline is captured

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]

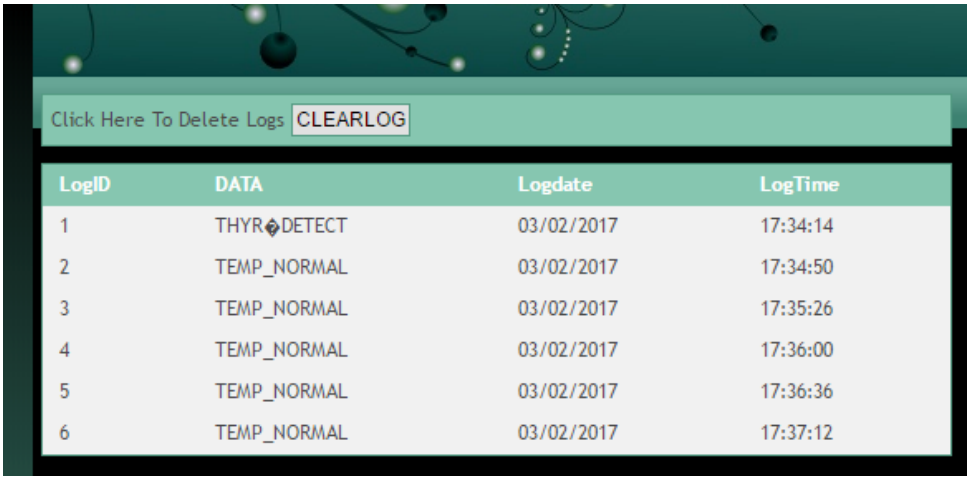


Figure 4: Displayed above is the conclusion of a patient

4. TECHNIQUES USED

We have mainly used the MATlab tools and commands to first extract the minute details of the images and the classified theses details as how these make patients differ from the ones that don't undergo thyroid disorders.

The first technique that we are using is SVM viz. Support Vector Machine. This can be taken as an algorithm in which have sets of examples such that we create a model so as to categories.

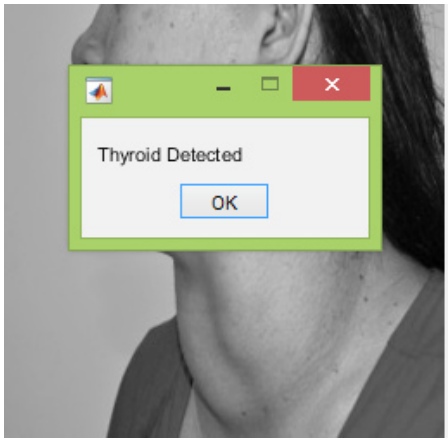
The next tool we are using is the GLCM viz. Gray Level Co-occurrence Matrix. This is basically a texture analysis for gray scale pixels and their occurrence in an image. This is a statistical approach of obtaining the relative position in an image.

The other software used for the prototype is the MPLAB software under which using embedded C the hardware including LM35, BP Machine etc. are interfaced with the PIC controller.

5. SIMULATION OF IMAGE PROCESSING

Using MatLab Software we can simulate the thyroid detection procedure with the stored images. Following are the steps Involved:

1. The stored image is then converted from coloured to grey so as to extract efficiently.
2. The same image of the neck is then pre-processed such as, cropping, contouring ,sharpening etc.
3. After this the MatLab tools and algorithms are applied (GLCM, SVM), to successfully extract the features relevant to Thyroid guidelines.
4. As soon as the extraction is completed, these features are further compared with the pre-defined thyroid disorder suffering image.
5. Finally the conclusion is made as Detected or not. [Figure 5]



6. CONCLUSION

The older techniques for thyroid disorder are time consuming and complex at the same time. There are certain processing methods which are in later on stage processed so as to remove noises from the images obtained. [Figure 6]

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 more alter medications.

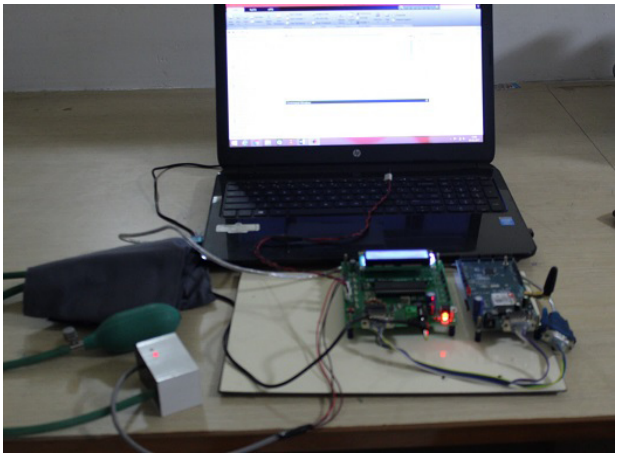


Figure 6: This is the present developed prototype body

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REFERENCES

[1] Ms. Priti Dhaygude, Mrs, S.M. Handore, "Review of thyroid disorder using medical images" *International Journal on Recent and Innovation Trends in Computing and Communication* 4194-4197.

[2] Gouri S. Yende, Krushil Pulwantakar; Thyroid Segmention and Volume Estimation. *International Journal of Scientific and Research Publications*, Volume 2, Issue 12, December 2012.

[3] Gaurav Sharma, Mehmat Aktas; Health monitoring and Managemet using IoT cloud processing.

[4] ….Link: http://pubs.rsna.org/doi/abs/10.1148/rg.342135067