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Non-Contact Infant Sleep Apnea Detection

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ABSTRACT: Infants with sleep apnea, a breathing disorder, repeatedly cease breathing while they are asleep. For new-borns, early detection is essential because it may result in long-term difficulties. The current reliable detection method is skin contact (pulse oximetry). Acoustics and visual processing are currently used non-contact techniques, however they are not precise enough. For the detection of sleep apnea using video processing in this case, we use the CV2 library. The answer is precise and non-contact.

KEYWORDS: CV2 library, sleep apnea, infant

I. INTRODUCTION

The disruption of breathing while you sleep results in the sleeping problem known as sleep apnea. An affected person can briefly stop breathing. Low blood oxygen levels caused by not breathing may cause additional problems. Although it can affect adults of any age, it can have particularly negative effects on infants. The infant may suffer long-term negative effects if untreated. Thus, early detection is essential. Obstructive and central sleep apnea are the two different types of sleep apnea. Physical interference with the nasal passage is the cause of obstructive sleep apnea. A neurological condition causes central sleep apnea to happen. Overweight individuals, guys with long necks, and those with anomalies in the neck are the basic risk groups for the condition of sleep apnea.

Sleep apnea is associated with Down syndrome in both adults and children. Children at risk also tend to have big tonsils. Because premature infants are more likely to develop sleep apnea, this article suggests a treatment for them. Effects of sleep apnea include fluctuations in blood oxygen levels, higher heart rates, blood pressure, and an increased risk of stroke. Those who suffer from sleep apnea may have mood swings and difficulty concentrating. The effects of sleep apnea in infants, particularly the drop in blood oxygen levels, can have long-term negative effects on brain development.

II. RELATED WORK

1. Pulse Oximetry Recorded from the Phone Oximeter for Detection of Obstructive Sleep Apnea Events With and Without Oxygen Desaturation in Children

If left untreated, children with obstructive sleep apnea (OSA) may experience major health issues. OSA interferes with normal breathing while sleeping. The gold standard for diagnosing OSA, polysomnography, uses a lot of resources and calls for a specialist facility. Because of this, we suggested using the Phone Oximeter T, a portable gadget that combines pulse oximetry with a smartphone, to identify OSA occurrences. We advise combining SpO2 and pulse rate variability (PRV) analysis to identify all OSA events and give a more accurate sleep study.

2. Obstructive Sleep Apnea in Infants

When compared to obstructive sleep apnea in older children and adults, infants have a unique pathophysiology, natural history, and treatment. Babies are more likely to experience airway blockage and aberrant gas exchange due to their morphological and physiological predispositions, which include a superiorly positioned larynx, higher chest wall compliance, ventilation-perfusion mismatch, and ventilatory control instability. Airway patency may

also be negatively impacted by congenital anomalies of the airway, such as laryngomalacia, hemangiomas, pyriform aperture stenosis, choanal atresia, and laryngeal webs.

3.Diagnostic techniques for obstructive sleep apnea: is polysomnography necessary?

The gold standard for evaluating breathing during sleep in adults and children continues to be attended, in-laboratory nocturnal polysomnography. However, the limited availability and high cost of this test have prompted a search for a more straightforward replacement, preferably one that can be carried out at home.

4.Obstructive sleep apnea syndrome in infants and children: established facts and unsettled issues

Pediatricians can now identify the presence of elevated upper airway resistive loads during sleep. To accurately identify episodes of partial airway blockage, however, diagnostic criteria must be further established. The clinical utility of ambulatory sleep testing will be determined by new technical developments, which will also establish the indications for laboratory polysomnographic investigations. The best treatment must be chosen after a thorough analysis of the anatomical anomalies that lead to airway blockage. It's still not obvious, though, what order these investigations should be conducted in. For multicentre research, the diagnostic instruments, such as questionnaires and sleep tests, and procedures for examining pathophysiological pathways should be standardised. Be sure to consider any familial influences.

III. EXISTING SYSTEM

Respiratory monitoring is the common method used in Existing System to identify sleep apnea in infant. In order to identify both central and obstructive apnea episodes in infants and children, a small microphone device has been employed to detect breath sounds across the trachea. The current reliable detection method is skin contact (pulse oximetry). So, it is challenging to wear the gadget on a baby. A method for determining the blood's oxygen content is pulse oximetry. A child with OSA experiences a dramatic reduction in blood oxygen levels. Sometimes, there may be additional issues contributing to the decline in blood oxygen levels. The loss in brain oxygenation caused by OSA is the main issue. The presence of underlying veins is required for the connection of pulse oximeters to the skin. In adulthood, they typically attach to the fingers. Yet, because they are attached to the earlobes in neonates, they are uncomfortable.

IV. PROPOSED SYSTEM

In the proposed system, we employ a sufficiently accurate non-contact method (video processing). The identification of sleep apnea with video processing is done using the CV2 library. The solution is precise and non-contact. This Non-Contact technique makes use of frames to precisely evaluate the breathing cycle. It utilizes the movement of the stomach to determine the breathing pattern (Region of interest). It generates thorough information.

V. BLOCK DIAGRAM

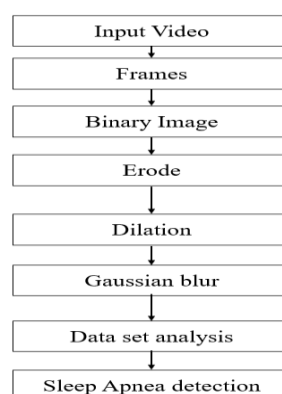


Fig.1. Block diagram

VI. WORKING METHODOLOGY

The infant's sleeping video is given as input and frames are extracted shown in Fig.2. RGB frame is converted into HSV frame format as shown in Fig.3. HSV frame is converted into binary image format as shown in Fig.4. As shown in Fig.5 the noises are removed from Binary image by erode method. While removing the noise a portion of ROI is lost to regenerate this portion Dilation method is used as shown in Fig.6. Further the frame's region of Interest is smoothened by Gaussian blur as shown in Fig.7. The region of interest regains its RGB format by comparing with extracted images as shown in Fig.8. The number of ROI areas are counted and its size is calculated which is shown in Fig.9.

Further each frame is plotted against the region of interest which provides a graph. A threshold is used to identify abnormalities when there are greater pauses between breaths. For disciplinary purpose when the position of the infant is changed the position-Alert is displayed When sleep apnea is detected RED-Alert is displayed.



Fig.2. RGB frame

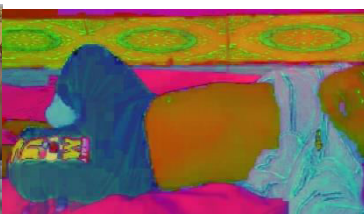


Fig.3. HSV frame format



Fig.4. Binary image format



Fig.5. Binary image after removing noise



Fig.6. Image after dilation method



Fig.7. Image after Gaussian blur method



Fig.8. Regenerated RGB Image

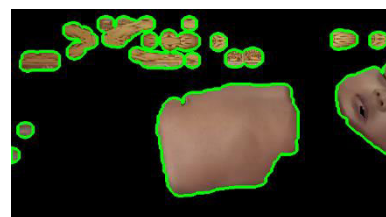


Fig.9. Area of region of interest

VII. EXPERIMENTAL RESULT

The output is shown in the form of graph which produces the result as normal as shown in Fig.10 or abnormal as shown in Fig.11. Thus, by utilizing graph sleep apnea can be detected.

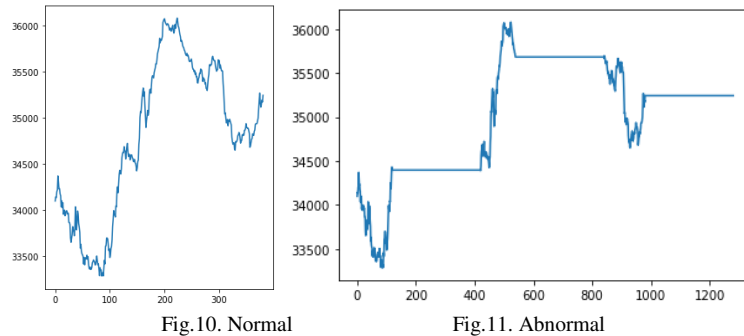


Fig.10. Normal

Fig.11. Abnormal

VIII. CONCLUSION

This proposed solution is non-intrusive and non-contact. It makes it convenient for the patient as well as the medical staff. Throughout the project the process is carried out using Video processing in which each frame gets processed. For disciplinary purpose when the position of the infant is changed the position-Alert is displayed. When sleep apnea is detected RED-Alert is displayed.

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