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IOT based a Smart Wearable System for Sudden Infant Death Syndrome

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Abstract: ***Sudden infant death syndrome (SIDS), this may occur when a baby is younger than one-year-old who dies usually during sleeps with no warning signs or any clear reasons. And it's also one of the most important causes of death among infants during their sleep. For the security and safety of the infants, we can also match different emergent research fields for the development of Baby Night Watch. This Wearable IOT Device is a wireless sensor node which is integrated in a Chest Belt, and also has the capacity to monitor few parameters like: body temperature, heart and breathing rates and body position. After performing a minimal information processing, this set of data is sent to the Gateway, and it's accessible to the user. When critical event occurs, the device will trigger an alarm which is audible within the nearness, and sends a danger message to an android application. The Baby Night Watch is a main tool for medical studies, since it allows the envision of previous physiological data and export it to different types of datasets.***

Keywords: IOT Device, Chest Belt, Gateway.

I. INTRODUCTION

Sudden Infant Death Syndrome (SIDS) is one of the major plague among infants, and it was the main motivating source to design a Smart Wearable System (SWS) capable of increasing the safety of the infant. This project is an amalgam of arising technologies, such as: wearable devices; smart textiles; embedded systems; wireless communications; web interfaces; and mobile applications, aiming to monitor the infants during their sleep. This SWS is composed by a Wearable IOT device, a Gateway, and an H Medical Interface. The Wearable IOT Device is the sensing unit, in the form of a Chest Belt, and is responsible for monitoring the body temperature, the heart and breathing rates and the body position. This set of parameters is vital for the identification of SIDS scenarios and for the evaluation of the quality of the sleep during sleep, doctors state that the infants should sleep on their back and they must not sleep on their stomach, as the infants are particularly vulnerable to SIDS due the risk of asphyxiation. The data retrieved from an accelerometer and it is able to identify all four possible positions of the infant during the sleep: lying on his back; lying on his side; lying on his stomach. Moreover, the two of the major signs that SIDS may be about to happen is abnormal breathing pattern and heart rate. For the new born the typically breathing rate is between 30 to 60 breaths per minute, 40 breaths per minute for infants, and it decreases to 24 to 30 breaths per minute after the first year. For the detection of the breathing rate, we used the same 3D accelerometer, and we have developed a low complexity algorithm with low overhead. Through the use of textile electrodes, knitted in the chest belt and with dedicated electronic, the heart rate is measured by our system. The textiles revealed to be an excellent interface for bio-signal sensing, as they are flexible, stretchable and conform to the body (increasing the physical comfort of the infant), rendering them an interesting solution for ubiquitous, continuous health monitoring. For the infants the normal heart rate is above 100 beats per minute. For the body temperature monitoring we use a small contactless infrared temperature sensor.

II. PROBLEM STATEMENT

To Design and Develop Smart Wearable System for Sudden Infant Death Syndrome Monitoring.

III. RELATED WORK

1) *Sleep Position:* Why Back is Best (DOP: 28/2/2012) Authors: K. Prabaakaran1 B. Sai Dixit2 A. Sakthiraja3 J. Sheik Mohammed Although the total death rate of SIDS(Sudden Infant Death Syndrome) has been reduced with the 'Back to Sleep' campaign but SIDS still remains a common reason for deaths in infants. A wide range of environmental facts may interact to contribute to adverse health conditions conducive to SIDS. with the advanced technology in medicine and specialization of the monitoring it's been a gradual advancement especially in the case of new born babies and infants. So, monitoring needs sensing units to show the parameters required to indicate the condition of infants, thus it's proposed that wearable sensing units with all-time monitoring will be responsible for development in this field. A unique technology is provided for efficient and accurate calculation of parameters like heart beat, temperature and the breathing level of the infant. A legal authorization should be provided for the systems introduced within the field of hospitality which has embedded based technology as a working media.

2) MARRSIDS: Monitoring Assistant to Reduce the Risk of Sudden Infant Death Syndrome (DOP: 27/07/2017)
Authors: Xavier López Gallo; Santiago Lechón; Stalin Mora; Diego Vallejo-Huanga
One of the main plague in children, during the first year of life, is Sudden Infant Death Syndrome (SIDS) due to the poor position of the infant during their sleep. Unexplained death of an infant younger than one-year-old even after thorough investigation, autopsy and clinical history are classified as SIDS. In this work a paradigm is proposed, called MARRSIDS, based on elements of accessible hardware, free software and artificial vision that allows to observe the infant, while their sleeps. The monitoring assistant implements a sound alarm if it identifies that the child is at incorrect position. To verify the reliability of the device, experiments are conducted on sample data, which has different characteristics, have been monitored during a certain period of time in which the behaviour of the device has proven to be effective.

3) Infant monitoring system for SIDS (DOP:06/06/2014) Authors: E. Abirami; S. Karthika; H. Staff
Sudden Infant Death Syndrome (SIDS) is identified by sudden death of an infant, unanticipated history and incomprehensible by a post mortem exam. The rate of SIDS had been decreased noticeably since the launch of 'Back to Sleep' campaign and other public health initiatives. Despite these attempts, SIDS remains third leading cause of infant death and the leading cause of post neonatal in the United States. Cause of SIDS is unknown but autopsies have suggested the asphyxia and central nervous system abnormalities among other findings, may play a vital role. Environmental risk factors, such as infant sleep position and air pollution is documented throughout the medical literature. The impact of genetics on SIDS risk is not well recognized at this time, but recent data have indicated associations between specific polymorphism and SIDS, suggesting that interaction among environment and genetic factor contribute to SIDS susceptibility.

IV. IMPLEMENTATION DETAILS

A. Major Modules

1) Infant Monitoring Module: This module consists of raspberry pi, MCP3008, buzzer, LCD display. It is the computing module of the equipment. MCP3008 converts from analogue to digital signal. The readings from sensors are converted and sent to the android application. Whenever the temperature and heart beat is abnormal then the buzzer is ON and Raspberry Pi sends the notification even to android application.

2) Processing Module: The analogue output from the Sensors is sent to MCP3008 to convert it into digital data. This Digital data from MCP3008 is fed to Raspberry Pi. Then Raspberry Pi will perform comparisons for the threshold values. If the values are above the threshold, then it will send notification to the android application.

3) Notify Module: The output is in the form of alert messages to the authorized users. There is an alternative form of notifying through Buzzer if the Android service fails. Through android application, we can get the health report history of the infant. Whenever the baby is in abnormal health condition the guardians get the notification and alert message.

4) Display Module: This module mainly displays the resulting BPM (Beat per Minute) on an LCD screen, since it is the most flexible way of displaying the output. This module consists of a LCD display board, that displays the heart rate of the infant. The continuous monitoring of the heart rate is possible with this module.

V. ARCHITECTURE & UML DIAGRAM

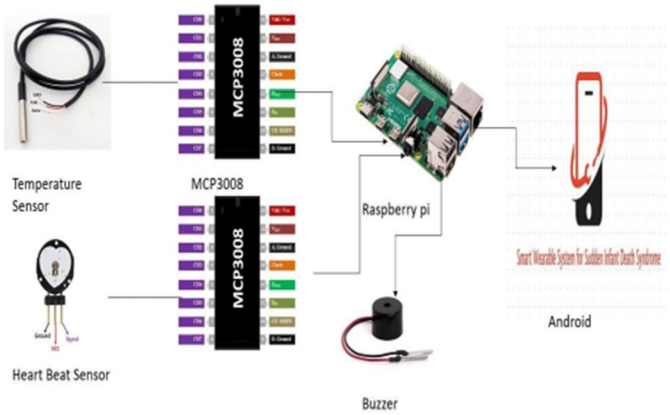

Fig 1: Architecture of SIDS

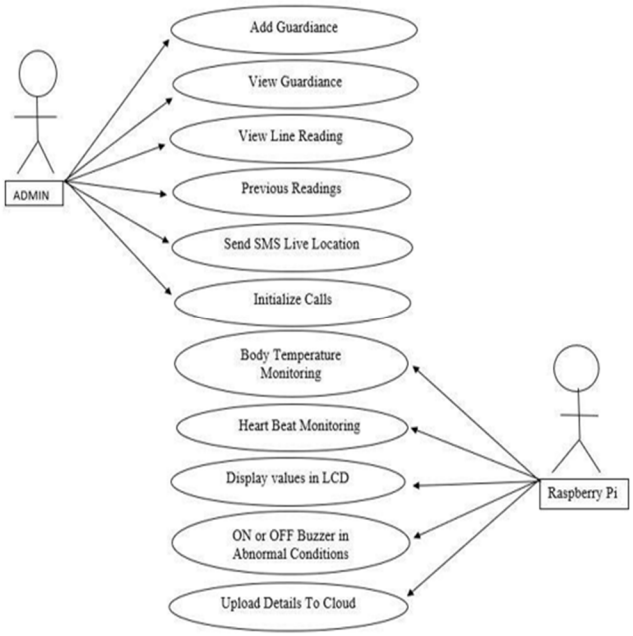

Fig 2: UML Diagram for SIDS

VI. CONCLUSION & FUTURE WORK

This paper presents an approach for Smart Wearable System which will be capable of detecting unpredicted risks of infant's health like irregular Heartbeats and temperature above the threshold and other parameters, which will make it a powerful medical tool to understand SIDS (Sudden Infant Death Syndrome) and a reliable real-time monitoring of infant's health. In future, the scope can be developed from infants to the old age people for detecting the cause of risk in indoor atmosphere which causes functional impairment by sensing the fall of the elderly people & a huge number of parameters can be measured which will improve the Medical Monitoring of Infant's & old age people health.

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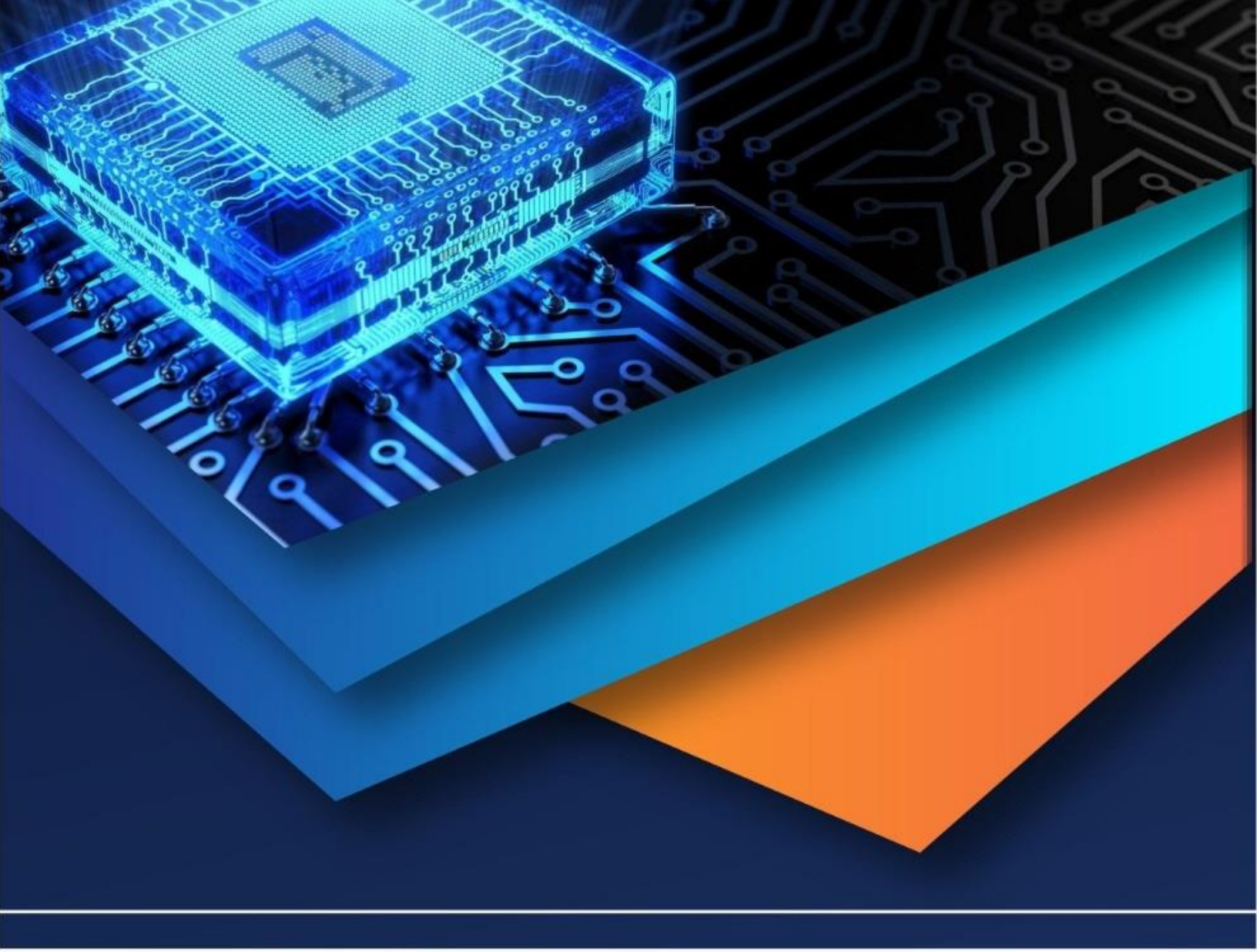

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