JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

MEMS BASED INFANT MONITORING SYSTEM TO PREVENT SUDDEN INFANT DEATH

S.Jone Rosy[1],P.Kalima Benazir[2]

[1]Assistant professor, Aalim Muhammed Salegh college of Engineering,

[1]s.jonerosy@aalimec.ac.in

[2]Assistant professor, Aalim Muhammed Salegh college of Engineering,

[2]Kalimabenazir.p@aalimec.ac.in

ABSTRACT:

MEMS based Infant Monitoring device provides solution for sudden infant death due to anticipated changes in temperature, respiration rate, heart beat and sleeping position. The wireless monitoring device measures the Heart beat, respiratory rate and body temperature of an infant as well as its surrounding carbon monoxide concentration. These are considered as the risk factors of the sudden infant death syndrome. They are analyzed and results are transmitted to a remote server via Zigbee. Buzzer will produce alarm indication if one the parameters is not in the acceptable level. It can reliably measure the respiratory rate from high to the low respiratory pressure of Hg peak to peak in addition to the infant position, temperature and carbon monoxide concentration. The proposed protype system monitors temperature,heart beat,blood pressure. These information will be displayed in LCD. Doctor can easily monitor these parameters and start the treatment immediately.

INTRODUCTION:

Sudden infant death syndrome (SIDS), also known as cot death or crib death, is the sudden unexplained death of a child less than one year of age [1].Sudden infant death syndrome (SIDS) is the sudden death of an infant without any previous perceivable medical conditions. However, the cause of SIDS is unknown or unexplained even after the autopsy and examination of the medical records. SIDS was the third leading cause of death of infant mortality in the U.S. in 2011. According to the Centers for Disease Control and Prevention, SIDS deaths have been declining since 1988 [2]. The mechanism(s) of the sudden infant death syndrome (SIDS) remains controversial. Impaired cardio respiratory controls, hyperthermia, lethal rebreathing of carbon dioxide trapped in bedding, and arousal deficiency are among

the postulated mechanisms that are currently the focus of much interest and debate[3]&[4]. That arousal deficiency could be important stems from the notion that arousal can be a protective response to dangerous conditions or events in sleep. Observations in victims of SIDS support a role of arousal deficiency in SIDS. Infants who subsequently died of SIDS were found to move less in sleep,3 and parents of SIDS victims reported retrospectively greater difficulty awakening their infants and fewer infant body movements than reported by the parents of healthy infants.

VENTURE ANALYSIS-SIDS

The items in a baby's crib and his or her sleeping position can combine with a baby's physical problems to increase the risk of **SIDS[5]**. Examples include: Sleeping on the stomach or side. Babies who are placed on their stomachs or sides to sleep may have more difficulty breathing than those placed on their backs.Premature birth or being part of a multiple birth increases the likelihood that a baby's brain hasn't matured completely, so he or she has less control over such automatic processes as breathing and heart rate. Many infants who died of SIDS had recently had a cold, which may contribute to breathing problems.

While on re breathing, the supine, face-up scenario the suffocation when the nose and mouth are covered by bedding[6]. Therefore the deaths pertinent to rebreathing had occurred face straight down or nearly so, with the nose and mouth into bedding, and with the mass of the infants head acting to force the nose and mouth into the underlying microenvironment

The reports down to the year 1940s reveals that from 20% to 52% of infants die suddenly with nose and mouth down into bedding(7-9). The face-down posture significantly increased risk of sudden death ($p < 0.01$). A recent case-comparison study of 206 deaths in the U.S.A. occurring between 1991 and 1996 showed that 28.6% of SIDS infants died prone with their airways covered by bedding (8).

INFANT MONITORING SYSTEM

The proposed System tracks the natural activity of the child like Heart beat, temperature and respiratory changes with the help of sensors. The status of the above parameters will be displayed in the LCD. If there is any deviation it will be intimated through buzzer. With the help of this module sudden infant death can be avoided. The Infant death monitoring system is shown in Fig 1.

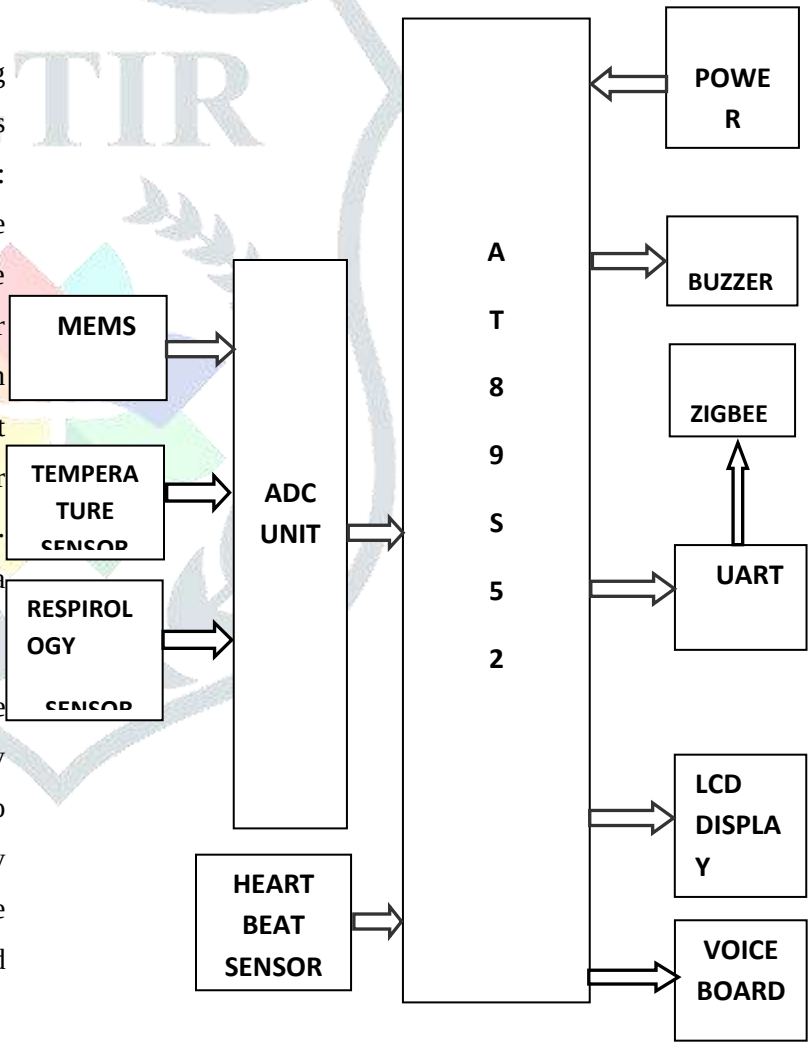

FIG1 INFANT MONITORING SYSTEM

The basic functional units of the system are Microcontroller, Temperature Sensor, Heart Beat

sensor, Respirology Sensor, and Position Monitoring Sensor.

MICROCONTROLLER(AT89S52):

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory., the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications. The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving mode. The Power-down mode saves the RAM con-tents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset.

MEMS:

Micro machined Accelerometer is used to measure proper acceleration of the devices. A MEMS based gyroscope shown in Fig 2 is a device for measuring or maintaining orientation, based on the principles of angular momentum. In essence, a mechanical gyroscope is a spinning wheel or disk whose axle is free to take any orientation. Gyroscopes in consumer electronics are frequently combined with accelerometers (acceleration sensors) for more robust direction- and motion-sensingThe infant position in X,Y,Z positions can be monitored with Mechanical gyroscope.When the infant sleeping position is not on his back, its current position is alerted to remote server through zigbee.

SENSORS:

The sensor consists of a super bright red LED and light detector. The LED needs to be super bright as the maximum light must pass spread in finger and detected by detector. Now, when the heart pumps a pulse of blood through the blood vessels, the finger becomes slightly more opaque and so less light reached the detector.

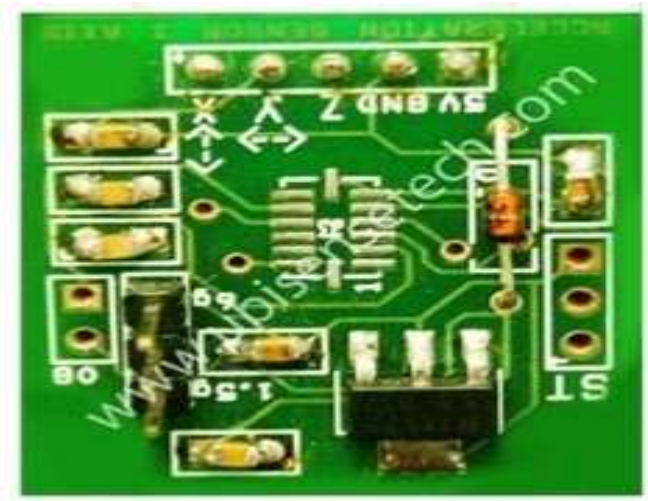

FIG 2 MEMS BASED GYROSCOPE

With each heart pulse the detector signal varies. This variation is converted to electrical pulse. This signal is amplified and triggered through an amplifier which outputs +5V logic level signal.The output signal is also indicated by a LED which blinks on each heart beat. Heart beat sensor shown in Fig 3 is designed to give digital output of heat beat when a finger is placed on it. When the heart beat detector is working, the beat LED flashes in unison with each heart beat. This digital output can be connected to microcontroller directly to measure the Beats Per Minute (BPM) rate. It works on the principle of light modulation by blood flow through finger at each pulse.

The measurement of temperature is one of the fundamental requirements for environmental control, as well as certain chemical, electrical and mechanical controls. Many different types of sensors are commercially available and the type of temperature

FIG 3 HEART BEAT SENSOR

sensor that will be used in any particular application will depend on several factors. For example, cost, space constraints, durability, and accuracy of the temperature sensor are all considerations that typically need to be taken into account.

Depending upon the temperature to be measured, the required accuracy of the measurement, and other factors such as durability or cost, one type of temperature sensor may be preferable over another. Some temperature sensors provide a wide range of temperature measurement, whereas other temperature sensors may only provide temperature information for a small temperature range. Infrared thermometer is a non-contact one with a measurement range from -70 to +380 degree Celsius. Just connect the four leads to your Arduino and you will have a accurate thermometer with a resolution of 0.01 and a accuracy of 0.5 degrees. The code below reads the object temperature which is emitted from the objects surface and the ambient temperature from the sensor itself.

Breathing is the process that moves air in and out of the lungs or oxygen through other breathing organs such as gills. It is one part of physiological respiration. Breathing is only one process that delivers oxygen to where it is needed in the body and removes carbon dioxide. Another important process involves the movement of blood by the circulatory system exchange occurs in the pulmonary alveoli by passive diffusion of gases between the alveolar gas and the blood in lung capillaries. Once these dissolved gases are in the blood, the heart powers their flow around the body

The respiration rate is the number of breaths a person takes per minute. The rate is usually measured when a person is at rest and simply involves counting the number of breaths for one minute by counting how many times the chest rises. Respiration rates may increase with fever, illness, and with other medical conditions. When checking respiration, it is important to also note whether a person has any difficulty breathing. Normal respiration rates for an adult person at rest range from 15 to 20 breaths per minute. Respiration rates over 25 breaths per minute or fewer than 12 breaths per minute (when at rest) may be considered abnormal. Here respiration rate is measured with the help of TMP100 temperature sensor.

Communication between a mobile phone client and a server unit is achieved through programming the client using attention commands (AT commands). The experimental setup can be operated for monitoring from anywhere covered by the Cellular (GSM) service by exchanging SMS messages with the remote mobile device. At the consultation unit, dedicated application software is required to manage the follow of SMS messages from the Mobile and display the, respiration rate, of the patient .The device which can be widely used for medical equipment in diagnosis at hospital and clinics. The special of this device is it will display the measured respiration rate per minute.

UART

universal asynchronous receiver/transmitter is a type of "asynchronous receiver/transmitter", a piece of computer hardware that translates data between parallel and serial forms. UARTs are commonly used in conjunction with other communication standards such as EIA RS-232.

UART is usually an individual (or part of an) integrated circuit used for serial communications over a computer or peripheral device serial port. UARTs are now commonly included in microcontrollers. A dual UART or DUART combines two UARTs into a single chip. Many modern ICs now come with a UART that can also communicate synchronously these devices are called USARTs.

The Universal Asynchronous Receiver/Transmitter (UART) controller is the key component of the serial communications subsystem of a computer. The UART takes bytes of data and transmits the individual bit in a sequential fashion. At the destination, a second UART re-assembles the bits into complete bytes. Serial transmission of digital information (bits) through a single wire or other medium is much more cost effective than parallel transmission through multiple wires. A UART is used to convert the transmitted information between its sequential and parallel form at each end of the link. Each UART contains a shift register which is the fundamental method of conversion between serial and parallel forms.

A buzzer or beeper (BUZZERS)is a signaling device, usually electronic, typically used in automobiles, household appliances such as a microwave oven, or game shows. It consists of switches or sensors connected to a control unit that determines if and which button was pushed or a preset time has lapsed, and usually illuminates a light on the appropriate button or control panel, and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound.

ZIGBEE

The ZigBee technology is designed to carry small amounts of data over a short distance while consuming very little power. As opposed to WiFi, it's a mesh networking standard, meaning each node in the network is connected to each other. This means you don't have to rely solely on the router and the endpoint. There are a few common household products that use ZigBee chips, like the Nest thermostat we talked about in our smart meter blog post.

The ZigBee mesh network has interoperability problems, though it can interfere with one another. So unlike WiFi, if you have two devices with ZigBee chips, it's possible that they won't be able to operate with each other.This technology also has a low-channel bandwidth of 1MHz. It's restricted to wireless personal area networks (WPAN) and reaches an average 10 to 30 meters for usual applications. ZigBee's data transfer speed is lower than WiFi's, too. It's maximum speed is just 250kbps, much lower than the lowest speed WiFi offers.

RESULT:

The infant sleep position shown in Fig 4 was determined from the three dimensional accelerations and catagorized as face up, face right, face left and face down . It is well accepted that infants who sleep on the back has much less risk of SIDS than other positions. Therefore, alert message was generated when the infant was sleeping sideways or in prone position.

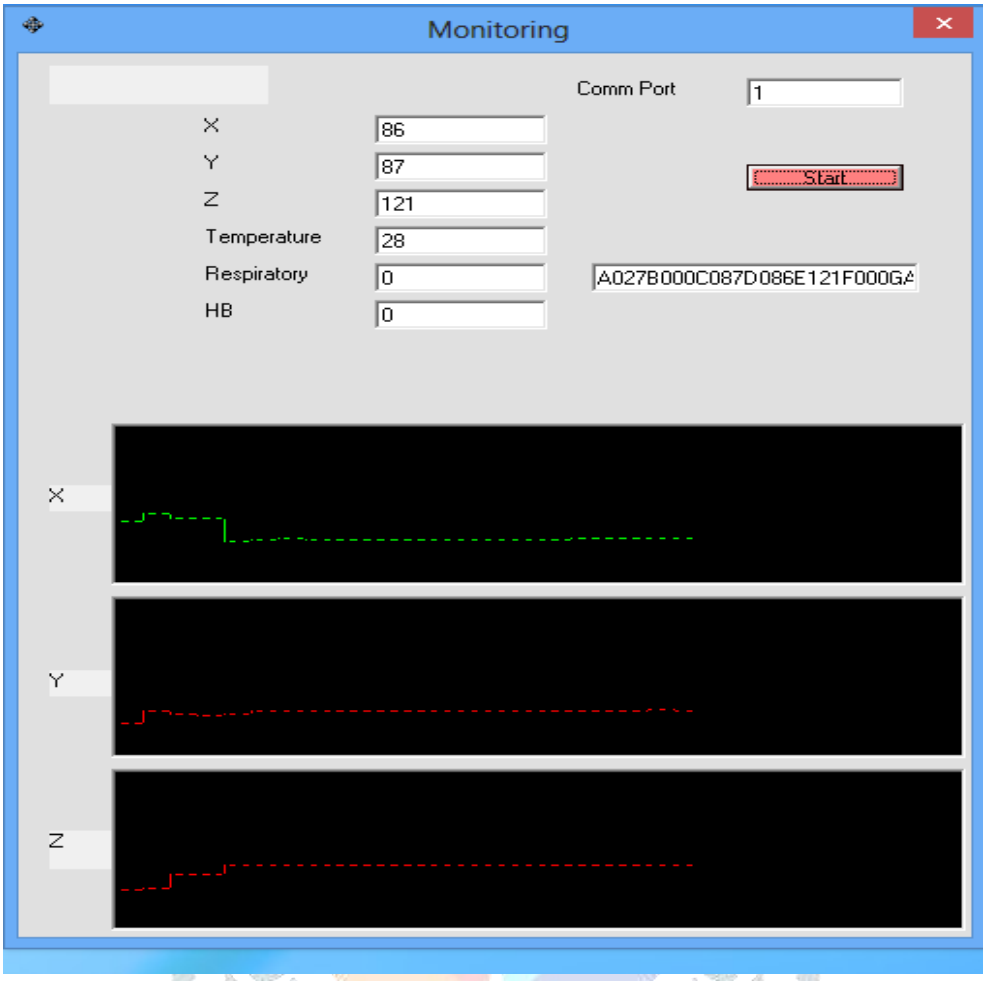

FIG 4 PARAMETER ANALYSIS GRAPH

FIG 5 SNAPSHOT OF THE PROPOSED SYSTEM

CONCLUSION

The MEMS based Infant Monitoring Device is an effective tool for the prevention of SIDS as it can effectively detect the risk factors and issue warnings if the monitored parameters are beyond preset limits. Treatment becomes easy during emergency situations and the number of deaths can be reduced. The proposed system imparts a solution to upgrade existing health monitoring system in hospitals by providing remote monitoring capability. The parameters to be analysed in future is blood pressure. The future work include analysing blood pressure and to design a compatible device with wi-max.

REFERRENCE:

[1]."Sudden Infant Death Syndrome (SIDS): Overview". *National Institute of Child Health and Human Development. 27 June 2013*. Retrieved 9 March 2015.

[2]. Centers for Disease Control and Prevention, "Sudden Infant Death", Available at http://www.cdc.gov/sids/, 2013.

[3]. Rognum TO. Sudden Infant Death Syndrome: New Trends in the Nineties.Oslo, Norway: Scandinavian University Press; 1995

[4]. Guntheroth WG. Crib Death: The Sudden Infant Death Syndrome. Armonk,NY: Futura Publishing; 1995

[5] http://www.mayoclinic.org/diseases-condition/ Sudden-infant-death-syndrome/basics/causes/con-200 20269.

[6]. Galland BC, Peebles CM, Bolton DPG, Taylor BJ. "The microenvironment of the sleeping newborn piglet covered by bedclothes: gas exchange and temperature". J Paediatr Child Health 1994;30:144-50.

[7]. Abramson H." Accidental mechanical suffocation in infants. J Paediatr" 1994;25:404-13.

[8]. Adelson L, Kinney ER. "Sudden and unexpected death in infancy &childhood. Pediatrics 1965;17:663-97.

[9].Carpenter RG, Shaddick CW. "Role of infection, suffocation, and bottle feeding in cot death: an analysis of some factors in the histories of 110 cases and their controls" Br J Prev Soc Med 1965;19:1-7 Bergman AB, Ray CG, Pomeroy MA, Wahl PW, Beckwith JB. Studies of the sudden infant death syndrome in King County, Washinton. III. Epidemiology. Pediatrics 1972;49:860-70.

[10].Taylor BJ. "A review of epidemiological studies of sudden infant death syndrome in southern New Zealand" J Paediatr Child Health 1991;27:344-8.

[11].Wein lin,Ruikai Zhang,John Brittelli,Craig Lehmann,"Wireless Infant Monitoring Device for the prevention of Sudden infant Death syndrome"IEEE Transaction Journal on March 2015.