

# SUDDEN INFANT DEATH SYNDROME DETECTION AND PREVENTION USING GRID EYE SENSOR

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**Abstract** - SIDS (Sudden Infant Death Syndrome) is a mysterious disease that could cause death of a healthy infant over night. It is also called crib or cot death since the infants die in their crib. SIDS is usually seen at a higher rate in children under 1-year age. This disease is caused due to lack of oxygen, increased body and room temperature, maternal smoking and sharing a common sleeping area. However, sleeping in prone position is the most important cause. This causes shrinkage of the respiratory system causing less inhalation of oxygen to the child resulting in sudden infant death. Thus, this project deals with finding the position of the infant viz., prone or normal, detecting the temperature by using GRID EYE sensor and intimating positional changes to the supervisor.

**Key Words:** SIDS, Bi-cubic Interpolation, Temperature Mapping, thermopile elements.

## 1. INTRODUCTION

Children over the world suffer from a mysterious disease called SIDS (Sudden Infant Death Syndrome) which causes unexpected death in infants. The main reason behind this is sleeping in prone position or side position because of which oxygen intake gets reduced and causes sudden infant death. Other reasons include exposure to cigarette smoke while in womb, sharing a common sleeping area and exposure to overheated incubators. Sudden deaths are noticed at a rate of 85% between 2 to 3 months and 95% death is noticed below 6 months. Out of 1000 new-born infants, approximately 10 infants die due to this syndrome. Carelessness of the caretaker is also considered as a major cause. This paper mainly focuses on reducing the death rate of an infant by continuously monitoring the thermal change, position of the baby and oxygen level of the surroundings. Here, the thermal change and position of the baby are monitored by using Grid eye sensor which is an 8\*8 pixel infrared array sensor. The entire movable setup is placed above the crib. The temperature differences are monitored and using image processing, the positions are fixed so that any positional changes could be identified. Surrounding oxygen level is monitored by a gas sensor. These three parameters are continuously monitored and if any abnormalities are detected, it is intimated to the caretakers.

After which, the respected person could take care of the child easily. This device could be used in hospitals as well as residential places.

## 2. EXISTING SYSTEM

Low Resolution Thermal Array Sensors are now providing low-resolution thermal images and could detect the human body heat emission even in dark places. The obtained results are used to monitor the health conditions to prevent extreme emergency situations. But, thermal image detection requires motion/ movement of human in front of the sensor. It also involves adaptive background estimation and a noise removal technique using Kalman filter. This system also requires different sensors for different actions like PIR for motion detection, temperature sensors for temperature detection, thereby increasing complexity and overall cost. It has low accuracy rates, making it highly difficult to be used for the infant monitoring system. This system is also enhanced with ZigBee technology, which could not cover long distance, again causing difficulty to receive information about the infant from distant places. Since infant monitoring is a tedious process, it requires 24/7 monitoring and information exchange. Since time delay could lead to death in this monitoring process, careful and precious monitoring could not be obtained from this system.

## 3. PROPOSED SYSTEM

The proposed system consists of Grid-Eye sensor, a multipurpose sensor which is used instead of PIR sensor (this could detect human only if there is movement change) and temperature sensor. Grid-Eye sensor overcomes this inability of the PIR sensor by detecting the human in movement as well as in stationary position. Grid-Eye sensor detects presence of the human by the infrared rays radiated from the human body. Normally, human body radiates infrared rays of specific wavelength (12 micron) which is used by the sensor to provide thermal images. A Grid-Eye sensor is a thermal infrared detector with 8\*8(64) thermopile elements arranged in an organized grid. It is capable of detecting human at rest, motion, and also the direction of movement along with the temperature range. Thus, human detection using Grid-Eye is deployed in our

project. This system involves image processing for determining the position of the infant. It also includes GPS technology to transfer information, since it could be used for distant places.

#### 4. BLOCK DIAGRAM

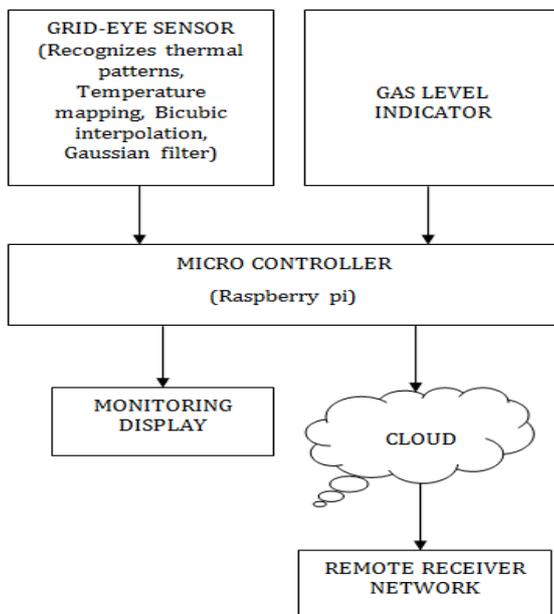


Fig-1 Block Diagram

#### 5. WORKING PRINCIPLE

Grid-Eye sensor is a 64-pixel infrared ray camera which will provide thermal image of an infant. It uses an I<sup>2</sup>C interface as a prototype. There are some major processes which takes place within the Grid-Eye sensor such as Temperature mapping, Bicubic interpolation and Gaussian Filter. Bicubic interpolation is an algorithm, which determines the presence of an infant. Gaussian Filter will sense and display the output without any delay. Gas sensor is used for measuring the air quality inside the incubator. It could be used up to a temperature of about 316°C. Raspberry pi, a single controller with multiple functions analyses the data given by the Grid-Eye sensor and Gas sensor. Finally, it updates the real time data each time the position of the baby is changed. It is sent as a notification to the push bullet application. Then through this application an alert message will be sent to the supervisor and the parent’s mobile. Therefore, the respected person could take care of the infant easily.

#### 6. HARDWARE DESCRIPTION

##### 6.1 RASPBERRY PI 3

It is an integrated ARM processor with System on Chip (SoC) and on-chip Graphics Processing Unit (GPU). SoC used here is Broadcom BCM283780 with 1.4 GHz speed and 64-bit quad core ARM Cortex-A53 processor. ARM Cortex A53 processor works ten-times much faster than the Pentium processors provided in Raspberry Pi 1. This high-speed performance directly depends upon the task threading and instruction set usage. It has a shared L2 cache of 512 KB. Theories show that Raspberry Pi 3 is 80% faster in performance when compared to the previous versions during the parallelized tasks. Raspberry Pi could be over clocked to 800 to 1000 MHz. It operates at a temperature range of about -20 °C to 85 °C. The temperature on chip could also be controlled by adjusting the clock speed and core voltage. CPU operates at a speed of 1200 MHz and while idling, it operates at 600 MHz. Raspberry Pi 3 generates more heat when over clocked, so it should be maintained within permissible values. It has a RAM of 1GB and is provided with 2.4 GHz Wi-Fi 802.11n and Bluetooth 4.1 with no direct support for monitor mode, but could be indirectly patched. It also has 10/100 Mbits Ethernet port. It could be booted from the USB like a flash drive and be operated from any computer keyboards or mouses. It could be connected to any device/component for sharing data using the USB cable and port. It could provide videos of HD and full HD resolutions. It also generates 576i and 480i composite video signals that could be used on CRT TV. The GPU runs at a clock frequency of 300 to 400 MHz. It operates on Linux distribution for downloading, Windows 10 IoT Core and RISC OS. The programming languages supported are python and scratch.

##### 6.2 GRID EYE SENSOR

Grid-Eye Sensor is an infrared thermal sensing and image mapping device. It detects temperature in two-dimensional area including 8\*8 (64) pixel. It could be patched to other devices easily using its digital output and its compact SMD package. It operates at a temperature range of -20 °C to 80 °C. Since it has 64 thermopile elements, it could detect human presence and temperature without physical contact. It uses silicon lenses etched from silicon wafer that provides 60° viewing angle. With all these techniques the Grid-Eye Sensor is available at a reduced package size 11.6mm x 8mm x 4.3mm. Grid-Eye Sensor not only detects human at motion but also at rest. It has an inbuilt Bluetooth module, MEMS sensor, lens and I<sup>2</sup>C interface. It detects over a range of 5m to 7m. It operates at a temperature range of about 3.3V to 5V. It could be interfaced using GPIO or I<sup>2</sup>C. The code snippet converts the grid eye sensor’s data to temperature and fills the display with appropriate color according to the temperature value.

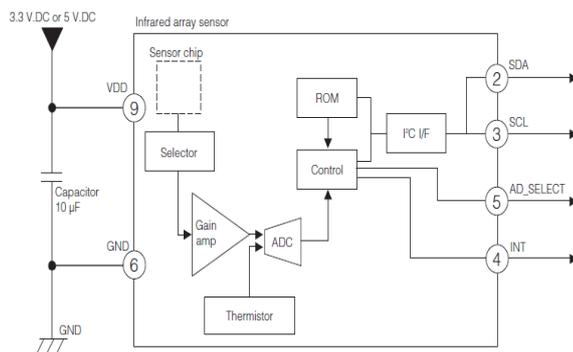


Fig 2- Grid eye sensor

## 7. SOFTWARE DESCRIPTION

### 7.1 PUSHBULLET APPLICATION

Push bullet is an application that brings together or synchronizes multiple devices such as desktop and smartphones. It manages mobile device notification, text messages from any device sending them all, to computers.

## 8. CONCLUSION

Thus comprehensive SIDS detection and prevention system, incorporated with Grid Eye sensor for monitoring the maternal-child units and sending alert messages to the parents is done by using raspberry pi microcontroller. If neonatal units across the globe use this model-SIDS detection and prevention system, they can monitor the neonatal in a much effective way. Globally, we can improve care and drop the SIDS rate in this high-risk group of infants.

## 9. REFERENCES

- [1] Forkan, A.R.M.; Khalil, I.; Tari, Z.; Foufou, S.; Bouras, A. A context-aware approach for long-term behavioral change detection and abnormality prediction in ambient assisted living. *Pattern Recognit.*2015, 48, 628–641.
- [2] Huang, C.; Wang, X.; Liu, W.; Cai, J.; Shen, L.; Zou, Z.; Lu, R.; Chang, J.; Wei, X.; Sun, C.; et al. House hold indoor air quality and its associations with childhood asthma in Shanghai, China: On-site inspected methods and preliminary results. *Environ. Res.*2016, 151, 154–167.
- [3] Zhang, K.; Wang, X. Maternal smoking and increased risk of sudden infant death syndrome: A meta-analysis. *Leg. Med.*2013, 15, 115–121.
- [4] Fowler, A.J.; Evans, P.W.; Etchegaray, J.M.; Ottenbacher, A.; Arnold, C. Safe Sleep Practices and Sudden Infant Death Syndrome Risk Reduction: NICU and Well-Baby Nursery Graduates. *Clin. Pediatr.*2013, 52, 1044–1053.