SUDDEN INFANT DEATH SYNDROME MONITORING

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Abstract : Sudden Infant Death Syndrome is one of the major causes of death among infants. We propose to develop an analytical model for reducing the Sudden Infant Death Syndrome (SIDS) using infant heart rate, detection of toxic gas, body vibration, temperature to develop a prototype model. The proposed system for infants can be used at home or hospital nursery room. It consists of LM35 sensor, accelerometer sensor, heart beat sensor, MQ5 sensor ,relay device and Global System for Mobile Communication (GSM) application. Heartbeat sensor is used to measure the heart rate of an infant. Heart rate during awake 100-160 BPM and sleep condition 90-160 BPM (Infant 1 month to 1 year). MQ5 sensor is used to detect the presence of gas in air to measure its concentration which ranges from 100ppm to 3000ppm. Vibration sensor is used to sense the abnormal vibration which infant may experience during panic condition during their sleep. Similarly LM35 sensor that can be used to measure temperature with an electrical o/p comparative to the temperature (in °C).Using these four sensor measurements and an analytical model is developed to detect the cause of SIDS. Based on the predictive value β, the alarm signal regarding the cause of SIDS will be given to the concerned person like a parent,medical adviser and ambulatory service.The prototype will be developed for an analytical model using a heart beat sensor, MQ5 sensor, LM35 sensor, accelerometer and GSM for wireless communication.

IndexTerms - **GSM, Heart beat Sensor, MQ5 sensor, LM35 sensor, accelerometer , relay device.**

I. INTRODUCTION

Sudden infant death syndrome (SIDS) is when a healthy baby dies unexpectedly and suddenly, and there is no explanation for the cause of their death. Even after a thorough study, an explanation for cause of death may not be found .SIDS, also known as crib death, usually occurs while a baby is asleep. SIDS is rare and the most common cause of death for children under the age of 1 in the United States. It most often happens between the ages of 2 and 4 months.In 2015, approximately 1,600 babies died of SIDS in the United States. SIDS doesn't have any noticeable symptoms. It happens suddenly and unexpectedly to infants who are in healthy condition.

The cause of SIDS is unknown, but there are some potential causes. Some of these possible causes are being : a form of apnea (periods of stopped breathing while sleeping).brain abnormality in the area that controls breathing.the cause are known but SIDS does have several risk factors. Many of these risk factors can be avoided, so it's important to be aware of them.

Some risk factors for SIDS include: laying your baby to sleep on their stomach or side before the age of one, brain defects (many times these are not even detected in autopsy),Respiratory infection ,low weight while birth ,premature birth,birth of multiples, family history of SIDS ,secondhand smoke or mother smoking during pregnancy ,race (African-American and Native American babies are two times more likely to die of SIDS than other races),sex (males have a slightly higher risk than females),young mother (under the age of 20),more common during winter ,cold weather, overheating ,co-sleeping (sharing a bed with a

parent or caregiver),unsafe or old crib, bedding or mattress that's too soft, crib that contains soft objects, not using a pacifier during sleep ,not breastfeeding. Avoiding as many of these risk factors as possible will reduce infants risk of SIDS.

II. METHODOLOGY

SIDS is a condition which occurs to infant due to : premature birth, respiratory infections,

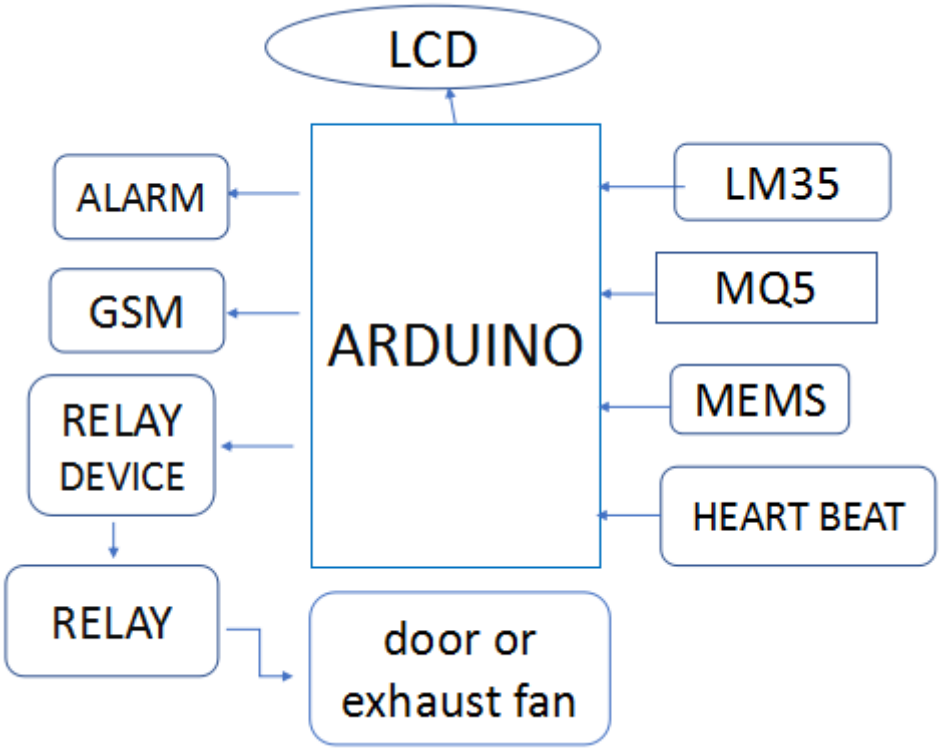
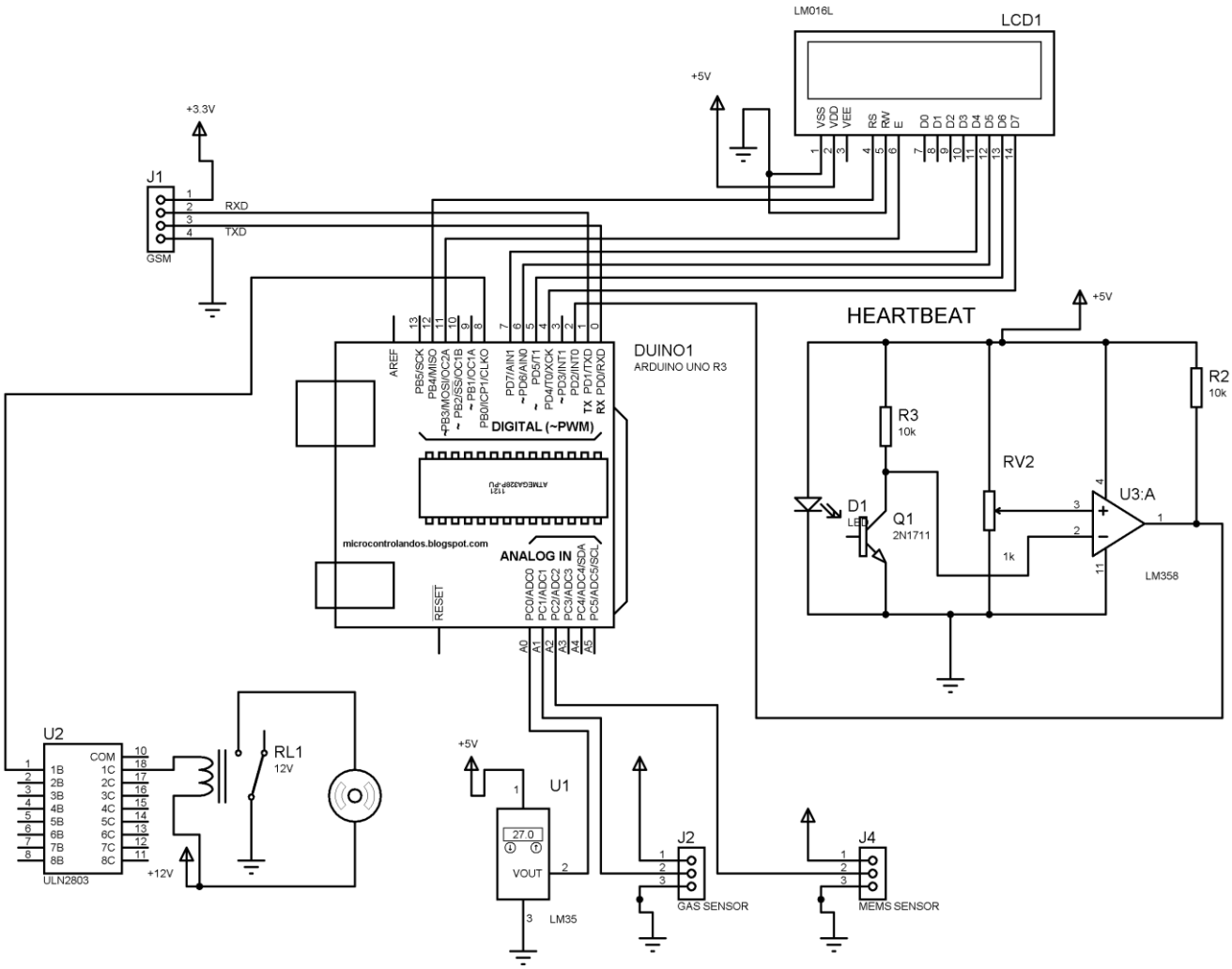


Fig.1: Block Diagram of the Proposed System

Sensor is used to sense the physical activity of an infant. And the signal is transmit to the ADC to convert the analog into a digital signal . A signal is pass to the embedded system of the microcontroller for the hardware. LCD is used to display the output of the sensor . It gives alert to the parents by sending message to the mobile and alarm. Here relay device is used which is the electrically operated switch to open door and on exhaust fan.



Schematic Diagram of the Proposed System

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3.1 HEART BEAT SENSOR

When the infant finger is placed on it, the LED blinks for every heart beat of individual infant. Whenever the blood flows through the finger, it works based on the principle of light modulation. In order to measure Beats Per Minute (BPM) of an infant, the digital output directly connected to the microcontroller. Heart beat sensor detects the digital output of heart beat. As for the cardiac activity of the new born, heart rate sensor is connected to the finger of the newborn and it can register the number of heart beats per minute. The designed circuitry can also indicate whether the heart signal is normal or abnormal depending on the P, Q, R, S and T points as well as on the time frame between them.

3.2 VIBRATION SENSOR

The measurement of vibration is a complex subject. The normal range of infant's vibration is 1 – 25Hz. Working voltage is 3.3 to 5V.The operating current is greater than 15 m A .This sensor is very important to avoid death, which happens very quickly in this case, death by suffocation, which is the failure of systemic oxygenation. Many parents throw their children on the left or right sides or stomach, because they have feared that when baby sleeping on their backs die from choking . But no one knows the most correct baby sleep position because every position may cause problems. If baby is face down in a short time position the baby can die by suffocation and the same happens if baby sleeps on left and rights sides, because it can turn around. So to avoid this complicated issue, this sensor may prevent the death by suffocation, because once the baby change position spontaneously the application automatically detect the position and sends an alert to a mobile device for control. The sensor is a three-axial accelerometer where one of the axes gives us the position of the baby (face up, face down or are lying to left or right sides).

3.3 BODY TEMPRATURE SENSOR

Concerning the monitoring of the room temperature, the LM35 sensor was used. It is a low cost sensor with accurate results. The error percentage is acceptable (below 1°C) and the measurement ranges are within the margins .The temperature sensor collects the baby body temperature in real-time, but it is also important the surrounding environment. This sensor is important if the baby is not in a warm environment. This problem is another possible cause of sudden death because babies need good thermal conditions since an extremely hot or cold environment may cause unexpected issues. To avoid this problem, the sensor sends real-time data collected and checks whether the values are within the defined thresholds. If the values are not within the threshold levels, an alert to the nannies mobile device is delivered.

3.4 GAS SENSOR

They function through electrodes signals when a gas is detected. Generally, these types of detectors are highly sensitive and give off warning signals via electrical currents. Due to its high sensitivity and fast response time, measurements can be taken as soon as possible. The sensitivity of the sensor can be adjusted by using the potentiometer.MQ5 ranges form 100ppm to 3000ppm.

3.5 ARDUINO

The sharp proximity sensors can detect objects as close as 10cm and as far away as 80 cm .It emits a pulse of infrared light and then detects the angle at which that light is reflected. The farther away an object is the lower the output voltage. The sensor's out is connected to an arduino analog input.

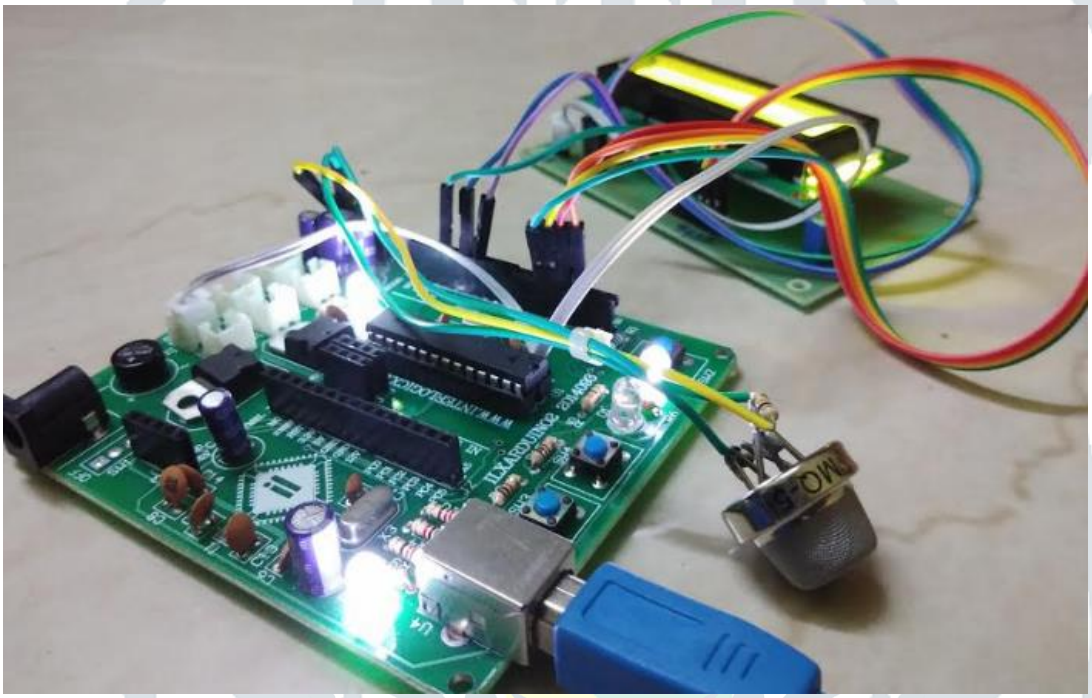
3.6 RELAY DEVICE

The other side has three low voltage pins (Ground, VCC, and Signal) which connect to the arduino. Inside the relay is a 120-240V switch that's connected to an electromagnet. When the relay receives a HIGH signal at the signal pin, the electromagnet becomes charged and moves the contacts of the switch open or closed.

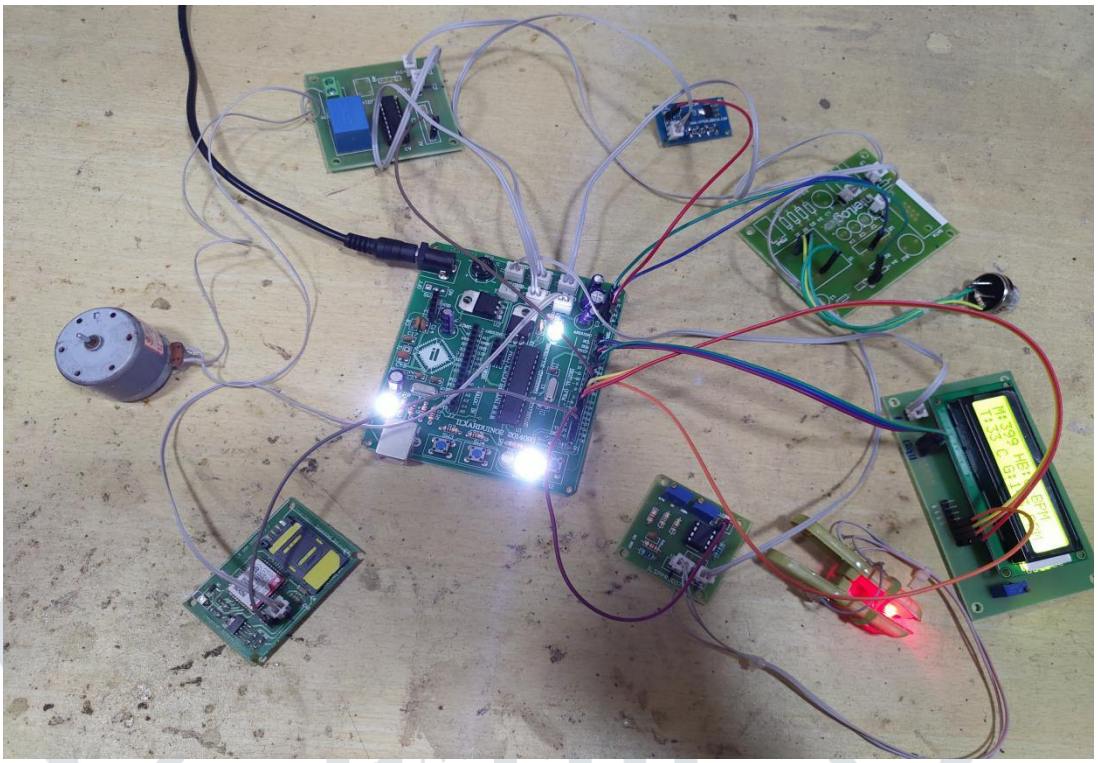
III. CONCLUSION AND FUTUREWORK

Our project could be a life saving device for infants , parents will find it so useful to keep an eye on their children . It is a low cost project and harmless system .It was designed with precaution in order not to take any risk on the infant health while monitoring its vital signs.An Infant Monitoring system is used to reduce the risk factor for SIDS. It helps to monitor the heart beat, temperature level, gas level and motion level within the predefined range.

Any abnormal situation happens to individual infant, an alert is given or GSM is sending message to Ambulatory service or concerned person. The main aim of this proposed system to develop an analytical model for reducing SIDS and based on predicted value of heartbeat,gas, motion, temperature of infants, created a prototype model.



LCD is connected to the arduino board to display the output in LCD screen.Above figure display the gas sensor range in LCD screen.



Final output

Above figure shows that all the sensors are connected (HEART BEAT SENSOR, MEMS SENSOR, TEMPERATURE SENSOR, GAS SENSOR) in addition too GSM and RELAY DEVICE where connected..

References

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