Infant Incubator System

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1) System Requirements:

Input Requirements-

1. The Infant Incubator System shall receive a temperature of about 95 F to 98.6 F suitable to the environment to keep the baby warm into the system everyday.
2. The Infant Incubator System shall receive updates about the baby's records like prewarmed temperature,age,size and condition.
3. The Infant Incubator System shall receive a periodic schedule from the pediatrician about the temperature adjustments.

Output Requirements-

1. The Infant Incubators System shall provide neonatal nurse the present and the correct temperature indicated on the temperature sensor everyday.
2. The Infant Incubator System shall provide the neonatal nurse an alarm if the temperature is not within the 95 F to 98.6 F.

Functional Requirements-

1. The system shall provide the doctors with a reliable method of an air sensor which regulates the temperature of the environment inside the system making it to remain stable at 95 F.
2. The system shall provide an alarm state by sending alarms to the NICU staff when the temperature is not in the required range of 95 F to 98.6 F.

Non Functional Requirements-

1. The Infant Incubator System operational cost shall be $2,00,000 per month or less.The design goal is $1,80,000 per month.
2. The infant incubator system shall have a weight of more than 50 pounds.The design goal is 40 pounds.Failure is defined as the inability to move the incubator from one place to another.
3. The infant incubator system shall be bigger than 3 feet in any dimension.The design goal is less than or equal to 3 feet.
4. The infant incubator system shall have its temperature adjusted by no more or less than 0.5 of a degree at a time.

2) Support Concept: The Infant Incubator System will have a temperature indicator that will be able to take upto 95 F to 98.6 F of heat and produce enough heat to maintain the body temperature of the baby.The incubator can have a preterm infant of 5 pounds or less while maintaining an optimal temperature of 98 F.

Reliability: The Infant Incubator System shall accept upto an optimal temperature of 95 F to 98.6 F, recheck the incubator every half an hour without damaging the incubator.

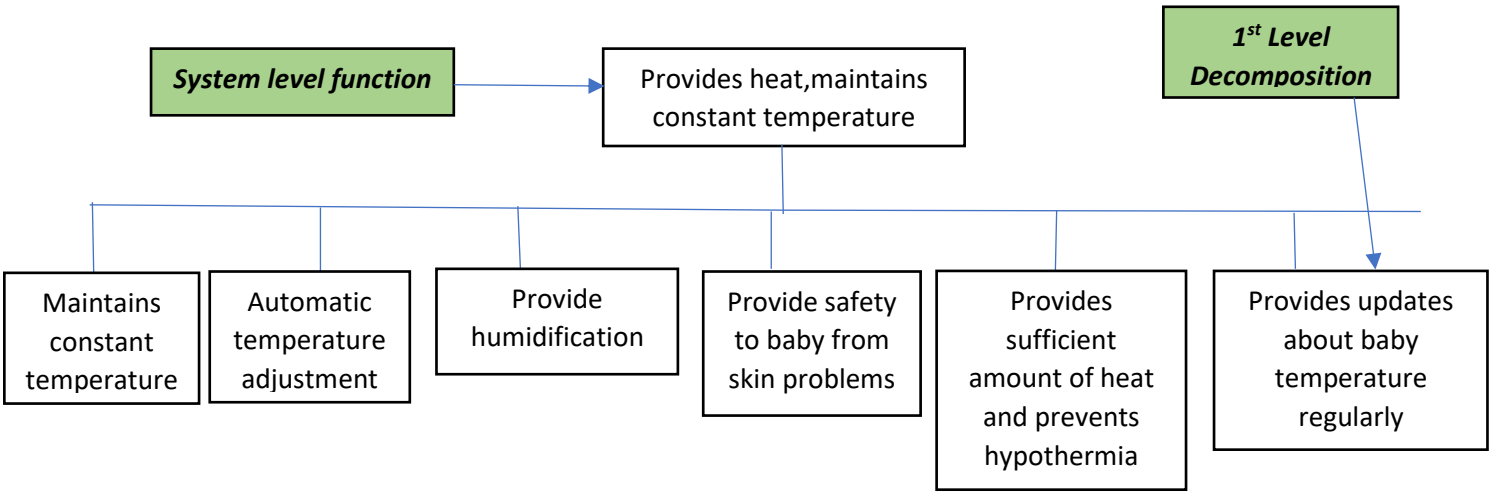
Maintainability:

1. The mean time to replace an alarm or a component following a failure in providing necessary temperature shall be less than 10 mins.
2. The system shall be under the maintenance for upto 6 hours if the system which had to get enough temperature required for the baby breaks down.
3. The mean time taken by the incubator to bring up the temperature level when the temperature level falls down shall be less than 5 mins.

Supportability:

1. The mean time for the maintenance staff like doctors and nurses to arrive when the incubator breaks down shall be less than 5 mins.
2. The mean time taken by the maintenance NICU staff to arrive near the system when the system goes into alarm state shall be less than 5 mins.
3. The system shall be notified by the neonatal nurse within 24 hours when the baby is out of danger.

3) First-Level Functional Architecture: Functional Decomposition and Rationale



- The system maintains with the help of a Pediatrician a constant set temperature of 95 F to 98.6 F.
- The above maintained temperature is used by the Pediatrician to create interfaces about baby's body temperature in future.
- The temperature gained exposes the baby to humidification which can help the baby to have a constant temperature from birth and reduces skin water loss.
- The neonatal nurses are provided instructions from the pediatrician to maintain an optimal body temperature to prevent skin problems in the baby.
- These optimal temperatures prevent hypothermia in babies.
- The neonatal nurse makes a note of the baby's temperature constantly for every ½ hour.

4) Primary technical risks and potential design mitigations

1. Risk: - The biggest risk of our system is the dropping of the temperature inside the incubator causing hypothermia to the baby.

Mitigation Plan:- The delivery room shall be kept warm at a minimum temperature of 95 F to 98.6 F.Also, when the temperature in the delivery room is not set at a constant temperature,the audible alarms are triggered to alert the laboratory staff that the incubator conditions should be checked.The alarm designed shall be of 30 decibal to make sure the alarm is heard when the NICU staff is not present in the room.The newborn infant shall be wrapped in a prewarmed blanket immediately after birth.

2. The system shall cause the baby to heat up to a very high temperature

   Mitigation Plan:- The system shall be designed with multiple sensors and alarms which are in proper working condition.Also, the system shall be designed with five different temperature sensors positioned at points A,B,C,D and E and a humidity sensor positioned at the central point A.Even though the necessary preventive measures like installing a sensor and an alarm have been taken to keep the baby away from having high temperatures the baby dies when there is a temperature rise and the installed sensors and alarms have become inessential.

3. Crash of an incubator due to power outage causing the baby's temperature to have fallen below the normal temperature.

   Mitigation Plan:- Hire a highly efficient team of skilled technicians who conduct repetitive checks to find faults and replace the damaged parts to prevent further complications in the incubator.Regular preventive maintenance shall include checking plugins,replacement of the equipment after being used several times,changing the damaged parts of the incubator immedietely.