February 21st, 2021

Dr. Craig Scratchley
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Simon Fraser University, School of Engineering Science
Burnaby, British Columbia, V5A 1S6

RE: ENSC 405W/440 Requirements Specification — Tenshi Baby Crib

Dear, Dr. Scratchley,

Enclosed in this letter is the requirements specification for the Tenshi Baby Crib. Our company, Tenshi, crafted this document to inform stakeholders on the research performed, the overall scope and intended features pertaining to the product. The consolidated information also serves as a means for executive management to track progress throughout the project, while also providing their engineers a guideline to produce the design specification. As a result, the requirements specification represents Tenshi's guide to create a high quality product that ensures the safety of children in their earliest days.

The Tenshi Baby Crib is a high-tech crib system that monitors a baby's environment, and their sleeping position. By tracking temperature, noise, and the baby's movements, the system quickly notifies parents when their baby may be vulnerable so they can take action as soon as possible. Furthermore, our product logs and visualizes the data gathered so that parents may analyze environmental and sleeping patterns. With the sensors being seamlessly integrated into the crib, parents can feel at ease that the product reliably watches over their newborn.

The project's design team consists of five engineers: Dexter Bigueta, Izyl Canonicato, Alvin David, Matthew Thomas, and Denyse Tran; all of whom have a variety of experience in the computer engineering field. From full-stack design, testing, and program optimization and efficiency, the team strives to produce quality deliverables throughout the project timeline.

From all of us at Tenshi, we would like to extend a thanks to you, Dr. Scratchley, and the instructional team for your continued guidance. For any questions, you may contact the Chief Executive Officer, Alvin David, by email at alvind@sfu.ca.

All the best,

Chief Executive Officer, Alvin David
Tenshi Company

Enclosed: Tenshi Baby Crib - Requirements Specification

tenshi
baby crib

# BABY CRIB SYSTEM REQUIREMENTS SPECIFICATION


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## Abstract

At the earliest stages of life, infants are especially vulnerable to the environment around them. Parents must monitor their children to avoid suffocation, overheating, and maintain their infant's sleep. It is evident that it requires consistent attention and caretaking to facilitate a healthy environment for an infant. To aid parents in their commitment to raise their children, Tenshi has created their baby crib to offer an ease of use, high-tech solution to monitor an infant's environment and sleep. Engineered together is its three systems: the sensor system, data analysis system, and notification system. Whilst the infant is in the crib it will automatically start monitoring. The sensor system that is seamlessly integrated into the crib allows for a wide range of temperature measurements, noise level detection for crying infants, and positional data of the baby. With those inputs, the data analysis system can log and visualize the information so that it can determine whether the infant has entered a vulnerable state. In that event, the notification system will notify parents and caretakers so that they may intervene and maintain a safe environment for their baby. In order to achieve this, Tenshi has outlined an extensive list of functional requirements, product requirements, and external requirements. Not only that, Tenshi takes to heart Engineers Canada's guidelines for sustainable development and safety requirements. In addition, by adhering to multiple engineering standards, rest assured that the device will be safe for both the parents and infants utilizing the crib. During development, the development team will extensively test the system to ensure full functionality, usability, sustainability, and safety. As a result, Tenshi offers parents a seamlessly integrated system to monitor their children's environment and sleeping habits to facilitate healthy growth and peace of mind.

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## Glossary

**Baby:** A young child between the ages of 0 months old to 48 months old.
**Caregiver(s)/Parent(s):** Primary attendant of the baby and owner of crib system.
**COVID-19**: Highly contagious respiratory disease caused by the coronavirus.
**External Electronic Device:** The interface at which the caregiver(s) can be notified.
**Infant**: A young child under 12 months of age.
**Nap:** Sleeping interval of 15 to 30 minutes.
**Requirements, External:** Derived from factors that are external to the system and its development process such as regulatory requirements.
**Requirements, Functional:** Describe the services provided according to its components and the range of its behaviour according to various inputs, and its outputs.
**Requirements, Non-Functional:** Identifies constraints and requirements regarding the system as a whole.
**Requirements, Performance:** Describes the speed and efficiency at which the system must behave.
**Requirements, Product:** Describes system behaviour such as performance, reliability, security, and usability.
**Requirements, Reliability:** Describes the accuracy and reliability of the system in operation.
**Requirements, Security:** Describes the privacy and security of the data recorded and processed in the system.
**Requirements, Usability:** Describes the interactive specifications that ensure user understandability.
**Room-sharing:** When infants and/or babies sleep in the same room as caregivers/parents.
**SIDS:** Sudden Infant Death Syndrome, sudden unexplained death of infants, usually during sleep.
**Velostat:** Pressure-sensitive material whose resistance changes based on pressure applied to it.

## 1. Introduction

Infants are vulnerable and subject to their environments; prone to suffocating, overheating and choking, and the unexplainable cause of death of Sudden Infant Death Syndrome (SIDS).

The best prevention entails constant supervision and monitoring of the baby and its environment. However, infants require seven to eight hours of sleep during the day and eight to nine hours at night to facilitate the necessary growth and to meet development milestones [1]. Additionally, the COVID-19 pandemic has introduced new challenges in every aspect of life, and raising a child is not an exception. Finding childminding services has become more strenuous with restrictions in place for safety. Parents are not easily as able to employ extended family members or outside help to alleviate the work of raising a newborn. Caregivers must make difficult compromises to constantly attend to their child instead of working, even if the tasks may take place within the same room or home.

Within the requirement elicitation stage of Tenshi's development process, it can be concluded from a series of interviews that parents often buy baby monitors to alleviate the stress of constantly monitoring for dangerous situations. However, these parents did not end up using the baby monitor as it did not provide enough technical reassurance to supervise or detect harm to the same degree that a parent can.

Tenshi's primary goal of the baby crib monitoring system is to keep babies safe and healthy. Tenshi aims to provide parents with a reliable and convenient way to monitor their baby and their environment while lessening the likelihood of dangerous situations and providing preventative safety measures. Alongside this, Tenshi aims to design and create a system to help facilitate better parenting habits and monitor the baby's development.

## 1.1. Background

### 1.1.1. Preventing Dangerous Situations

Health Canada outlines recommendations and standards for an infant's daily active/sleeping environment to lessen the probability of dangerous situations occurring [2]. It is important that parents are proactive in following these recommendations to mitigate the danger of suffocation and overheating, as well as preventing SIDS. Recommendations include definitions to promote safe baby posture/positioning and to set an ideal temperature [3].

Infants are at the highest risk of SIDS between the ages of 2 and 4 months old. Unfortunately, SIDS has an undetermined cause of death. Providing a safe sleeping environment is one precaution parents can easily take to reduce the probability of SIDS [2]. These precautionary measures include ensuring the baby sleeps on their back during both nap times and night times, and providing a firm sleeping surface with no excess pillows or fabrics within a crib. Additionally, overheating heightens the risk of SIDS. To ensure the baby is not uncomfortable or overheating, the ambient temperature must be monitored. Babies are most comfortable between 20 to 23 degrees Celsius [4]. Most importantly, the risk of SIDS is greater when the baby sleeps on their stomach or on their side [3]. Until babies can independently roll onto their fronts, caregivers should promptly return the baby to their back for sleep.

### 1.1.2. Healthy Habits and Infant Development Milestones

Health Canada recommends parents make habits of good parenting practices for their baby's health, safety, and development. Parents must make it a habit to monitor the baby's behaviour and movement, and temperature of the baby's room.

The Table 1.1 describes Health Canada's definition of infant milestones that are important for the parents to monitor for, and for Tenshi to use as a guideline to develop the product.

| **Age** | **Milestone** |
|---|---|
| Newborn | Sleeps for 7 hours at night, 8 hours during the day; wakes up constantly [1] |
| | Naps constantly [1] |
| 2-3 months | Sleeps for 10 hours at night, 5 hours during the day [1] |
| | Naps 2-3 a day [1] |
| | Lifts head and hold erect [5] |
| | Becomes alert with familiar voices [5] |
| 5-6 months | Sleeps continuously throughout the night [1] |
| | Naps twice a day [1] |
| | Sits with support [5] |
| | Turns from back to side [5] |
| | Plays by making sounds [5] |
| 8-10 months | Sleeps through the night [1] |
| | Naps once a day [1] |
| | Sits alone for short periods of time [5] |
| | Rolls from back to stomach [5] |
| | Babbles [5] |

**Table 1.1:** Infant Development Milestones [5]

#### 1.1.2.1. Sleeping

For sleeping, Health Canada recommends caregivers to use a crib for the baby until the age of three while room-sharing until a minimum of six months of age [6]. By doing this, caregivers are able to monitor and keep track of the baby's sleeping habits that may disturb the many required hours of sleep to facilitate the necessary growth and to meet development milestones. Furthermore, parents can help babies develop a habit of sleeping on their back by continuously placing them in that position [6].

#### 1.1.2.2. Awake/Active

While the baby is awake and active, it is important to position them in such a way that they are able to work and strengthen muscle groups. It is recommended to place the baby on their stomach 2-3 times a day soon after they are born to strengthen their neck muscles [6]. Conversely with monitoring sleep, monitoring active time during the day can aid parents plan naps accordingly to allow for a full night's sleep.

### 1.2. Scope

With the aforementioned information, the following requirement specification document outlines functional and non-functional requirements of Tenshi's baby monitoring system throughout the development process (i.e. proof-of-concept (POC), prototype (PT), final product (FP). The following requirements specifications are defined for creation of a useful and safe product and are encoded to be fulfilled in its respective design stage.

Tenshi's baby monitoring system will be designed and built to benefit both the baby and the caregiver(s). The baby monitoring system should be used as a preventative, safety measure for when the baby cannot yet stand within the crib. Tenshi will safely sample and analyze data from the baby's movement and noise, and the ambient temperature to notify the parents of the possibility of a dangerous situation. Given the development milestones and expected behaviours of infants, Tenshi hopes that parents are better able to monitor their baby's development and activity with the visualized data from the system.

### 1.3. Intended Audience

The requirements specification is presented to the Board of Directors and stakeholders to inform on the research, analysis, and features regarding the product. At the same time, this document serves as a means for executive management to track progress throughout the project timeline. Lastly, it outlines details for the engineering team to produce the design specification.

# 2. System Overview

## 2.1. Operation

Tenshi's operations are handled by three processes; namely, its electronic sensors system, and its software-based data analysis and notification system. These three systems must continuously monitor the baby's environment around them and their sleeping position. First, the electronic sensors system must take temperature, noise, and the baby's positional measurements. These measurements must be processed in the data analysis system, where upon crossing certain vulnerable thresholds, must notify the parents through an external electronic device. In addition to Tenshi's ability to notify parents, the data analysis system supports time logged data visualization of the aforementioned temperature, noise, and positional measurements. These three processes make up the system that watches over the baby whilst in their crib. Figure 2.1 below depicts Tenshi utilizing its three systems during operation.

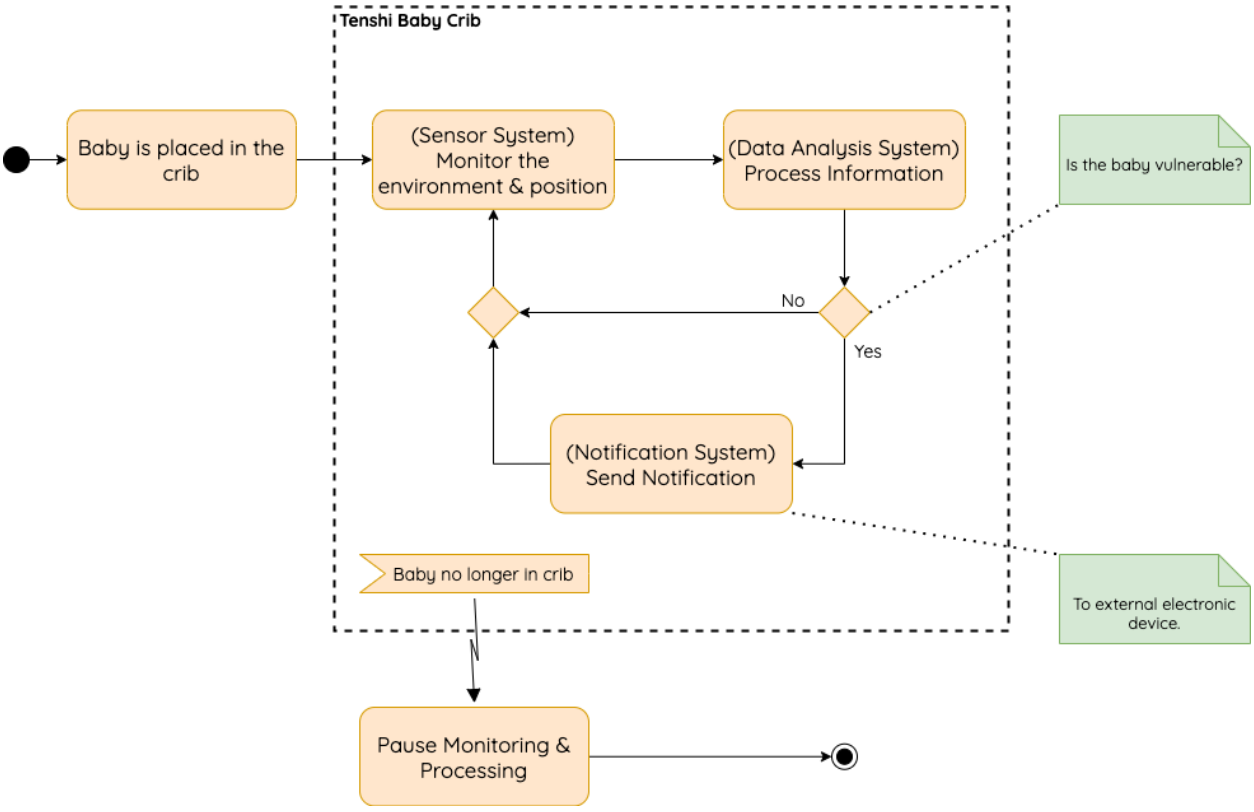


**Figure 2.1:** Tenshi Baby Crib Activity Diagram [7]

## 2.2. Sensor System

The electronic sensor system's purpose is to accurately sample temperature, noise levels, and positional information that is to be sent to the data analysis and notification system. In regards to temperature, the system shall utilize a temperature sensor that will allow for a small range of measurement normally found in households, but with enough precision to detect unideal conditions. Additionally, the system shall employ a simple and reliable microphone to monitor for the moment the baby awakes crying, or when external noise impacts sleep. However, the crucial aspect of the sensor system is the pressure mat that must be able to determine when the baby rolls over to their front or side, which can be detrimental to the baby's ability to breathe. All of these components make up the electronic sensor system—showcased in Figure 2.2 below—which provides measurements to the data analysis and notification system.

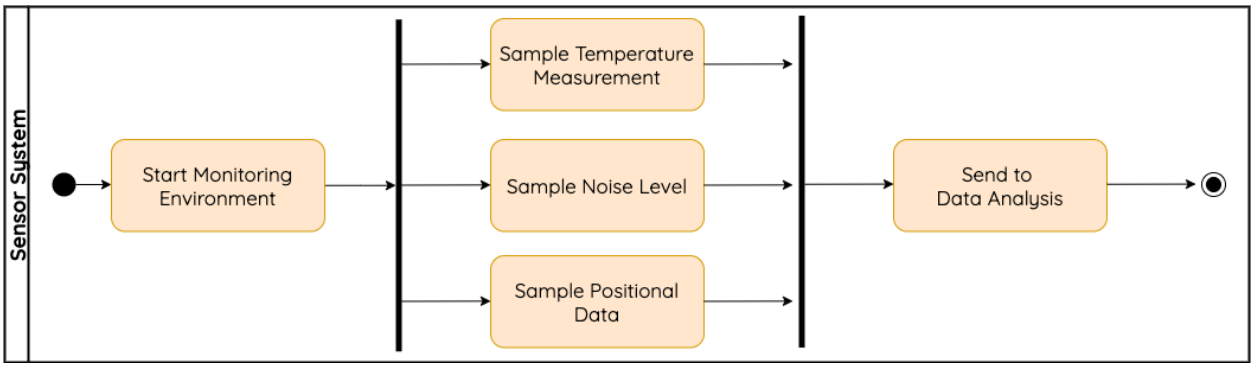


**Figure 2.2:** Sensor System [7]

## 2.3. Data Analysis and Notification System

Taking the information provided by the sensor system, the data analysis system must process and cross check the measurements alongside thresholds that may put babies in vulnerable situations. These thresholds must be defined by government health organizations and paediatric organizations. Once these thresholds are crossed or are about to be crossed, the system must notify the parents or caretakers through an external electronic device to enable them to check up on their baby as soon as possible. Alongside the notification system, the data analysis system must time log measurements and notifications so that they shall be visualized to inform the parents of any environmental, noise, and sleeping patterns of their baby. In short, the data analysis and notification system processes information from the sensor system through software-based programs and interfaces. A high-level activity depicting its operation is provided in Figure 2.3.

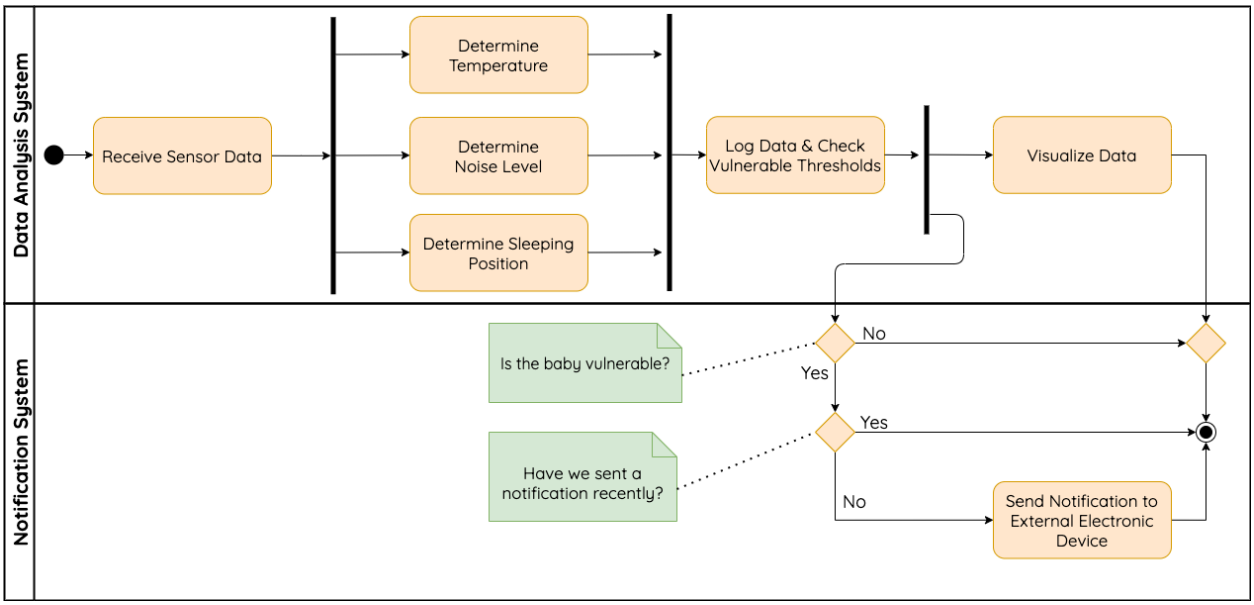


**Figure 2.3:** Data Analysis System and Notification System [7]

# 3. System Requirements

## 3.1. Classification

Tenshi's requirement specifications will be defined and encoded with the following described convention for readability and consistency:

**R<Section>-<Design stage>-<Number>**

The baby monitoring system development process has been organized into three stages of deliverables: proof-of-concept, prototype, and final/production product, as shown in Table 3.1. The following requirement specification encodes the expectations for each deliverable.

| Code | Design Stage | Goal |
|---|---|---|
| POC | Proof-of-Concept | Proof-of-concept of a functional system. |
| | | Components of the system are designed. |
| | | Components of the system should pass high-level acceptance tests. |
| PT | Prototype | Components of the system should be integrated together. |
| | | System components efficiently function together. |
| FP | Final Product | System meets safety standards. |
| | | System meets commercial/industry standards. |
| | | System meets sustainability standards. |

**Table 3.1:** Requirements Classification Code

## 3.2. Functional Requirements

Functional requirements describe the services Tenshi must provide, and the range at which the crib reacts and behaves according to various inputs, and its outputs [8]. In particular, Section 3.2.1 outlines the requirements for the sensor system which consists of the temperature sensors, sound level sensors, and the pressure sensor. Furthermore, Section 3.2.2 describes the requirements for the software-based data analysis and notification systems, which take inputs from the sensor system and processes that data into outputs.

### 3.2.1. Sensor System

| | |
|---|---|
| R3.2.1-POC-1 | The sensor system must be able to measure temperature within room temperature ranges of 16°C to 22°C [9] |
| R3.2.1-POC-2 | The sensor system must be able to measure noise level ranging from at least household levels at 40 dB(A) [10] to a crying baby (maximum) 120 dB(A) [11] |
| R3.2.1-POC-3 | The sensor system will be able to detect varying pressure ranging from 0 to 1kg at a given contact point. |
| R3.2.1-POC-4 | The sensor system must be able to detect when a baby of at minimum 3kg rolls over on front whilst in the crib [12]. |

**Table 3.2.1:** Sensor System Requirements

### 3.2.2. Data Analysis and Notification System

| | |
|---|---|
| R3.2.2-POC-1 | The data analysis system must take input from the sensor system. |
| R3.2.2-POC-2 | The data analysis system must log data with timestamps. |
| R3.2.2-POC-3 | The data analysis system must log temperature measurements. |
| R3.2.2-POC-4 | The data analysis system must log noise levels. |
| R3.2.2-POC-5 | The data analysis system shall visualize datasets for parents/caretakers to analyze. |
| R3.2.2-PT-6 | The data analysis system must log when the baby is on their back. |
| R3.2.2-PT-7 | The data analysis system must log when the baby rolls over to their front. |
| R3.2.2-PT-8 | The data analysis system shall visualize datasets in hourly, daily, and weekly ranges. |
| R3.2.2-PT-9 | The notification system must notify when measured temperatures change to vulnerable thresholds of 20°C and 23°C [4]. |
| R3.2.2-PT-10 | The notification system must notify when noise levels change to a level of a crying infant at 75 dB(A).[13] |
| R3.2.2-PT-11 | The notification system must notify when the baby rolls over to their front whilst in the crib. |
| R3.2.2-PT-12 | The external electronic device that receives notifications must be able to receive notifications in the same house as the Tenshi Baby Crib at minimum. |

**Table 3.2.2:** Data Analysis and Notification System Requirements

## 3.3. Non-functional Requirements

Non-functional requirements identify constraints and requirements that are concerned with the system as a whole rather than each of its components. Hence, Section 3.3.1 highlights product requirements, outlining system behaviour such as performance requirements for the speed the system must operate, reliability requirements for the acceptable failure rate, security requirements to prevent system risks, and usability requirements to ensure the system is user friendly. Additionally, Section 3.3.2 concentrates on the external requirements, that is, requirements external to the system including regulatory requirements [8].

### 3.3.1. Product Requirements

#### 3.3.1.1. Performance Requirements

| | |
|---|---|
| R3.3.1.1-PT-1 | A notification of a change in position must be sent within 5 seconds. |
| R3.3.1.1-PT-2 | A notification of a change above temperature thresholds must be sent within 5 seconds. |
| R3.3.1.1-PT-3 | A notification of a change above vulnerable noise levels must be sent within 5 seconds. |

**Table 3.3.1.1:** Performance Requirements

#### 3.3.1.2. Reliability Requirements

| | |
|---|---|
| R3.3.1.2-POC-1 | The system must operate under healthy home conditions of a temperature range of 16°C to 22°C [9]. |
| R3.3.1.2-POC-2 | Sensor readings should be sampled such that sensor specific data is no older than 1 second old. |
| R3.3.1.2-PT-3 | The monitoring application must indicate if the connection to the external electronic device is unavailable. |
| R3.3.1.2-PT-4 | The pressure sensor must indicate if it is faulty or has no connection. |
| R3.3.1.2-FP-5 | The notification system must continuously attempt to send notifications to the designated external electronic device in 20 second intervals if it is not received. |

**Table 3.3.1.2:** Reliability Requirements

#### 3.3.1.3. Security Requirements

| | |
|---|---|
| R3.3.1.3-PT-1 | The data sampled and processed must be secured in each system. |
| R3.3.1.3-PT-2 | The data sent to the external electronic device must only be accessible by the caregiver(s) of the crib. |
| R3.3.1.3-FP-3 | The monitoring application should keep the analyzed data for at least 2 years. |

**Table 3.3.1.3:** Security Requirements

#### 3.3.1.4. Usability Requirements

| | |
|---|---|
| R3.3.1.4-PT-1 | The pressure sensor housing should be detachable from the mattress to allow for cleaning. |
| R3.3.1.4-PT-2 | The method at which caregivers view the visualized data must not hinder its understandability. |
| R3.3.1.4-PT-3 | The external electronic device that receives notifications must not hinder the usability of the Tenshi Baby Crib system. |
| R3.3.1.4-FP-4 | The Tenshi Baby Crib must be easy to set up and use. |
| R3.3.1.4-FP-5 | System product noise must be kept under 40dB to maintain a quiet room [14]. |

**Table 3.3.1.4:** Usability Requirements

### 3.3.2. External Requirements

| | |
|---|---|
| R3.3.2-FP-1 | The design of the Tenshi Baby Crib must adhere to Health Canada's guidelines. [15] |
| R3.3.2-FP-2 | The pressure sensor and mattress must be at most 3cm smaller in width than the crib from all sides [15] |
| R3.3.2-FP-3 | The pressure sensor must not have padding that adds more than 15 cm of height to the maximum mattress height of a crib. [16]. |
| R3.3.2-FP-4 | The pressure sensor sleeping surface must be greater than 5500cm$^2$ [17] |
| R3.3.2-FP-5 | The Tenshi Baby Crib must not have any sides be obstructed by its components [18] |
| R3.3.2-FP-6 | The pressure sensor must have no plastic coverings [18]. |
| R3.3.2-FP-7 | The pressure sensors must not be detached from the crib whilst the baby is within it. [16] |
| R3.3.2-FP-8 | The Tenshi Baby Crib must be able to hold at least 10kg of weight [19] |
| R3.3.2-FP-9 | The Tenshi Baby Crib must contain at most one mattress and one baby [19] |

**Table 3.3.2:** External Requirements

# 4. Sustainability and Safety Requirements

## 4.1. Sustainability Requirements

Sustainable development can only be achieved by considering the interconnected components of environmental, economic, and social sustainability together [20]. These considerations must span the entire project lifetime, from project analysis through operation & maintenance.

As such, Tenshi will adopt cradle-to-cradle (C2C) principles to produce a sustainable system. C2C principles add to the cradle-to-grave concept by promoting sustainable development by considering extraction of the raw materials for the system to the recycling of the product's materials as opposed to ending in the landfill (i.e., grave) [21].

Tenshi will consider a new product life cycle, as shown in Figure 4.1, and make intentional product development decisions to make each step more sustainable. We will actively consider the manufacturing and processing of our product's materials. Tenshi hopes to promote sustainable development by buying materials and parts as local as possible, to support the local economy and ethical sourcing of the raw materials. Additionally, we hope to minimize the transportation impacts between manufacturing and our use, so as to reduce the overall carbon footprint. To complete the cradle-to-cradle cycle, Tenshi would like to partner with Canadian e-recycling companies for proper upcycling of our system.

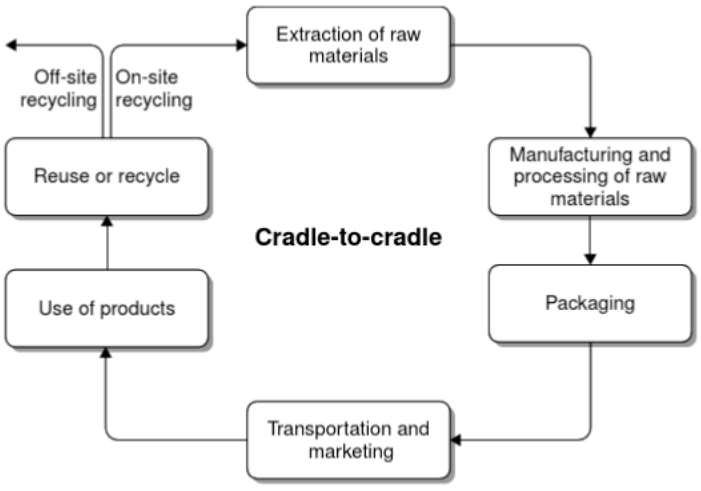


**Figure 4.1:** Cradle-to-Cradle Product Life Cycle [21]

Alongside those design choices, Tenshi is designing a product with the use of the product and the reuse/recycle portion of the cycle in mind. By employing the C2C principles for materials and the product's longevity/durability, Tenshi will consider eco-efficiency design. To consider an eco-efficiency is to create a product with as little resources and toxicity as possible [21].

Furthermore, if Tenshi's final product system meets the commercial market standards, we would like to strive to price the system fairly to ensure that it is an affordable solution. By doing so, Tenshi's system encourages the target market to buy sustainably developed products.

| | |
|---|---|
| R4.1-PT-1 | Included instruction manual should contain directions on disposal of the crib and its electronic components. |
| R4.1-PT-2 | System must be designed to be power efficient in idle mode. |
| R4.1-FP-3 | Electronic components must be able to be recycled, or returned to Tenshi Co. for durability testing and analysis |
| R4.1-FP-4 | System must be able to be deconstructed into its primary electronic components for recycling. |
| R4.1-FP-5 | System components must be encased to prevent deterioration to promote longevity. |
| R4.1-FP-6 | Materials to manufacture the crib should be purchased locally. |

**Table 4.1:** Sustainability Requirements

## 4.2. Safety Requirements

It is not only important to adhere to the Canadian regulation requirements for cribs, but to also take into account safety requirements specific to this system in order to avoid any harm to all users.

| | |
|---|---|
| R4.2-FP-1 | The crib component of the Tenshi Baby Crib must meet the current safety regulations of Canada [22] |
| R4.2-FP-2 | The Tenshi Baby Crib must not contain physically hazardous or sharp surfaces. |
| R4.2-FP-3 | The Tenshi Baby Crib must not contain any loose components. |
| R4.2-FP-4 | The Tenshi Baby Crib must not contain exposed electrical components, including sensors or wires. |
| R4.2-FP-5 | The Tenshi Baby Crib must not be damaged by applied forces that are necessary for utilization. |
| R4.2-FP-6 | Surface of the Tenshi Baby crib temperature should not increase ambient temperature by 1°C. |
| R4.2-FP-7 | Exposed materials must be hypoallergenic and exclude toxic substances. |

**Table 4.2:** Safety Requirements

## 5. Engineering Standards

Tenshi Baby Crib aims to keep infants and babies safe and provide parents assurance that their child will be okay when left alone. Being that our project is tailored for infants, we will take into account all necessary precautions to ensure the infant is safe. The following standards will be set in place to adhere to the Canadian laws and standards.

| Standard | Title |
|---|---|
| CSA C22.1:21 | Canadian Electrical Code, Part I (25th Edition), Safety Standard for Electrical Installations [23]. |
| ISO 12949:2011 | Standard test method for measuring the heat release rate of low flammability mattresses and mattress sets [24]. |
| CAN/CSA-ISO/TR 14062-03 (R2013) | Environmental Management - Integrating Environmental Aspects into Product Design and Development (Adopted ISO/TR 14062:2002, first edition, 2002-11-01) [25]. |
| IEC 61508-1:2010 | Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 1: General requirements [26]. |
| IEC 60335-2-111:2015 | Household and similar electrical appliances [27]. |

**Table 5:** Engineering Standards

## 6. Conclusion

To release a high-quality product, Tenshi will ensure that all requirements in this document will be met and exceeded where possible. Meeting the functional requirements will allow basic services and features to be operational and ready for caregivers. In addition to those, meeting non-functional requirements will optimize efficiency, accuracy, and reliability of the aforementioned features. Lastly, sustainability and safety requirements will make certain that customer satisfaction on all aspects is the forefront of our project.

In the end, it is evident that caregivers and parents alike constantly monitor their newborns so that they may grow up to be healthy children. Infants are extremely vulnerable at their age and unfortunate situations can happen. Even with baby monitors today, parents cannot rely on current baby monitors due to their singular purpose service. As such, Tenshi aims to seamlessly integrate multiple systems into one crib in order to provide caregivers the peace of mind. With its simple use design, that peace of mind can just be achieved by placing the baby in the crib. This system will watch over children and notify caregivers when their children are in vulnerable situations. Moreover, it will provide detailed and visualized information so that parents can take informed actions to modify their children's environment. As a result, the Tenshi Baby Crib strives to be the ultimate baby monitor that is relied on to inform caregivers that their children are safe in their crib.

## 7. Acceptance Testing

The high-level acceptance plan outlines the deliverables that will be presented for the proof-of-concept.

| Purpose | Test | Acceptance Criteria |
|---|---|---|
| Test pressure mat resolution and accuracy. | Press a baby doll in various positions on the pressure mat.<br><br>Use a pressure visualization tool to verify. | The pressure mat must display an accurate pressure distribution. |
| Test pressure mat value accuracy. | Apply known weights to different regions of the pressure mat. | The velostat resistance value must be accurate within 10% corresponding weight. |
| Test baby position identification. | Press a baby doll facedown, on its back, and sideways. | The system must correctly identify baby position with 95% accuracy. |
| Test temperature sensor accuracy. | Use heating and cooling instruments to reach temperature thresholds.<br><br>Use a thermometer to verify temperature. | The temperature readings must be accurate to within 1°C when compared with the thermometer. |
| Test noise sensor accuracy. | Use artificial sounds to reach noise thresholds.<br><br>Use a sound level meter to verify noise level. | The sound level must be accurate to within 1dB when compared with the sound level meter. |

**Table 7:** Acceptance Test Plan

## 8. References

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