Sri Lanka Institute of Information Technology

Smart Baby Room with IoT

Software Requirement Specification

Professional Engineering Practice and Industrial Management - IE2090

Project ID: PEP_01

Submitted by:

Registration #	Student Name
IT22092724	Dampage V.I.
IT22198204	Vithanage V.T.M.
IT22112996	Jayawardhana K.G.M.S.
IT22315700	Shaethaynie R.

Submitted to:

(Supervisor's signature)

……..

Name of the supervisor
Ms. Narmada Gamage

Date of submission
20/04/2024

Table of Contents

Revision History

Name	Date	Reason For Changes	Version

1. Introduction

The introduction of the Software Requirements Specification (SRS) serves as a comprehensive overview of the document, aiming to provide clarity on its purpose, conventions, intended audience, reading suggestions, scope, and references.

1.1 Purpose

The purpose of embarking on the Smart Baby Room with IoT project is to create an innovative and technologically advanced environment for infants. This document serves to consolidate and analyze the key concepts defining the project, offering a detailed overview of the hardware and software components involved, including system functionalities, requirements, constraints, and features. Intended for utilization by the project team, module instructors, and stakeholders, this document serves as a comprehensive guide, decision-making, and tracking throughout the project development

1.2 Document Conventions

The SRS document was developed in accordance with the conventions listed below.

Titel – Font – Times New Roman, Size – 18, Bold

Sub Titel – Font – Times New Roman, Size – 14, Bold

Content – Font – Times New Roman, Size – 12, Italic

1.3 Intended Audience and Reading Suggestions

The target audience for this document is broad and includes stakeholders, project managers, hardware developers, IoT designers. There are recommended reads for each function that are unique to their duties. It is recommended that project managers carefully go over each part to obtain a comprehensive understanding of the project. IoT specialists and hardware developers

should concentrate mostly on the in-depth portions, except the introduction, since these provide crucial information that directs the creation of the smart baby room system. To understand the functioning and user experience components of the project, designers would find it helpful to read through the sections on the system features and overall description. The project's goals, features, and possible advantages are of special interest to stakeholders, such as parents or caregivers.
This document ensures that stakeholders receive the necessary information for their involvement in the successful realization of the Smart Baby Room Project through tailored reading suggestions.

1.4 Product Scope

The Smart Baby Room with IoT project aims to create an intelligent, secure environment for infants by integrating IoT devices and sensors, facilitating real-time monitoring and control. Also system is designed to enhance infant safety and well-being through the integration of smart devices and technologies. Its main feature includes cry detection, cradle automation, and moisture sensing for diaper changes, mosquito detection and protection, smart lighting, door control, and temperature regulation. The system continuously monitors environmental factors and provides real-time feedback to caregivers. The Smart Baby Room with IoT aims to provide cost-effective solutions, improve caregiving efficiency, and offer peace of mind to parents

1.5 References

[1] Burak, A. (2023, March 23). Your 2024 guide to writing a software requirements specification – SRS document. Relevant Software. https://relevant.software/blog/software-requirements-specification-srs-document/. [Accessed 18 April 2024]

[2] Krüger, G., & Lane, C. (2023, January 17). How to write a software requirements specification (SRS document). Perforce Software; Perforce. https://www.perforce.com/blog/alm/how-write-software-requirements-specification-srs-document. [Accessed 18 April 2024]

[3] Kaur, T., Mittal, M., & Singh, H. (n.d.). The baby monitoring room prototype model using iot. Ijarse.com. Retrieved April 18, 2024, from http://www.ijarse.com/images/fullpdf/1524396416_AIET1050ijarse.pdf. [Accessed 18 April 2024]

[4] (N.d.). Researchgate.net. Retrieved April 18, 2024, from https://www.researchgate.net/publication/352600525_Development_of_an_IoT_based_Smart_Baby_Monitoring_System_with_Face_Recognition. [Accessed 18 April 2024]

[5] HVS Technologies [@hvstechnologies]. (2023, April 25). smart Cradle system using IoT with live streaming and Blynk Monitoring. Youtube. https://www.youtube.com/watch?v=pVgwXGuiLxU. [Accessed 18 April 2024]

2. Overall Description

2.1 Product Perspective

The Smart Baby Room with IoT project represents a new, self-contained product aimed at revolutionizing infant care through innovative IoT technologies. Unlike traditional baby monitoring systems, this project integrates advanced features such as cry detection, cradle automation, moisture sensing, mosquito detection, smart lighting, door control, and temperature regulation. It is not a replacement for existing systems but rather a pioneering solution that enhances infant safety and caregiver convenience. The project originated from the increasing demand for smart home automation solutions and advancements in IoT technology. It is a stand-alone device, it can easily interact with current smart home ecosystems to provide improved functionality and compatibility.

2.2 Product Functions

- Cry detection for identifying infant distress.
- Cradle automation to soothe the baby.
- Moisture sensing for timely diaper changes.
- Mosquito detection and protection.
- Smart lighting adjustment based on environmental conditions.
- Door control for security and access management.
- Temperature regulation to ensure infant comfort.
- Continuous monitoring of environmental factors.
- Real-time notification system for caregivers.

2.3 User Classes and Characteristics

1.)Parents: Parents are the primary users of the Smart Baby Room with IoT

system, engaging with it daily to ensure the safety and well-being of their infants.

Characteristics: Concerned about infant safety and well-being, may not have technical expertise but require easy-to-use interfaces.

2.) Caregivers: Caregivers play a crucial role in the daily care of infants and are frequent users of the Smart Baby Room with IoT system.

Characteristics: Responsible for direct care of infants, need real-time alerts and monitoring capabilities, varying technical expertise levels.

3.) Infants: While infants themselves are passive users of the system, their well-being is directly impacted by its functionalities.

Characteristics: Depend on caregivers for comfort and safety, no direct interaction with the system but benefit from its functionalities.

4.) System Administrators: They have infrequent but critical interactions with the system.System administrators ensure to support parents, caregivers, and infants' needs.

Characteristics: Responsible for system setup, maintenance, and troubleshooting requires technical expertise and access to system configurations.

2.4 Operating Environment

The Smart Baby Room with IoT operates in a diverse environment conducive to infant care and home automation. It requires compatible hardware platforms such as ESP32 and Arduino, along with sensors for cry detection, moisture sensing, and temperature regulation. The system interfaces with operating systems like Linux or Windows, leveraging their capabilities for data processing and analysis. Additionally, it must seamlessly coexist with other IoT devices and applications within the smart home ecosystem, ensuring interoperability and efficient communication.

2.5 Design and Implementation Constraints

The Smart Baby Room with IoT project faces constraints stemming from regulatory policies governing infant care and privacy, shaping security measures for data transmission and storage.

Hardware limitations, such as memory and processing power, impact component and algorithm selection. Interfaces to other applications within the smart home ecosystem necessitate adherence to established protocols and compatibility standards. Specific technologies like Arduino and MQTT for IoT communication is mandated for interoperability. Adherence to programming standards ensures long-term maintainability, with the customer's organization likely assuming software support responsibility.

2.6 Project Documentation

1.)Introduction:

Provides an overview of the Smart Baby Room with IoT project, explaining its purpose, goals, and stakeholders.

2.)Software Requirements Specification (SRS):

Details what the software should do, including its features, functionalities, and constraints.

3.)User Manual:

Guides users on how to set up and use the Smart Baby Room system, with step-by-step instructions.

4.)Installation Guide:

Helps users install and configure the hardware and software components of the Smart Baby Room system.

5.)Maintenance Manual:

Offers instructions for maintaining and troubleshooting the system, ensuring its smooth operation.

6.)Project Charter:

Outlines project objectives, scope, and responsibilities for reference by stakeholders and team members.

7.)Design Documentation:

Includes technical diagrams and specifications detailing the system's design and implementation.

8.)Test Plan and Test Cases:

Describes how the software will be tested and includes specific test cases to ensure its quality.

9.)Release Notes:

Documents changes and updates made in each software release, informing users about new features or fixes.

10.)Compliance Documentation:

Ensures the Smart Baby Room system meets regulatory standards and industry requirements.

2.7 User Documentation

1.)User Manual:

Provides detailed instructions on how to set up, operate, and troubleshoot the Smart Baby Room with IoT system.

2.)Installation Guide:

This document provides comprehensive instructions on the step-by-step installation and configuration of the Smart Baby Room system's hardware and software components.

3.)Quick Start Guide:

The system provides a concise overview of its setup and basic operations for users who want to start quickly.

4.)Troubleshooting Guide:

The Smart Baby Room system assists users in diagnosing and resolving common issues they may encounter.
.

5.)FAQ (Frequently Asked Questions):

answers frequently asked questions and addresses issues users may have with the functionality and operation of the system.

6.)Online Help:

Offers contextual assistance within the software interface, guiding specific features and functionalities.

7.)Video Tutorials:

Provides visual demonstrations of key tasks and operations to supplement written instructions and enhance user understanding.

8.)Glossary:

Defines technical terms and concepts used in the user documentation to ensure clarity and comprehension.

9.)User Feedback Form:

Allows users to provide feedback on their experience with the Smart Baby Room system, helping improve future versions and updates.

2.8 Assumptions and Dependencies

Assumptions:

1.)Reliable Power Supply - We assume that there will be an uninterrupted power supply to operate all IoT devices consistently.

2.) Stable Internet Connection - We assume a stable internet connection for cloud-based data storage and remote monitoring.

3.) Sensor Accuracy - We assume that the sensors (sound, moisture, temperature) provide accurate readings.

4.) User Adoption - We assume that caregivers will adopt and use the smart baby room features effectively Caregivers are expected to regularly update and maintain the system software to ensure optimal performance and security.

Dependencies:

1.)The project is dependent on third-party suppliers for the procurement of hardware components such as sensors, IoT devices, and networking equipment.

2.)The project relies on the availability of compatible mobile devices (smartphones or tablets) for accessing the system's mobile application.

3.)The Smart Baby Room system may depend on cloud-based services for data storage, analytics, and remote access functionalities.

4.)The project's development timeline is dependent on the timely availability of resources, including human resources, funding, and infrastructure.

5.)The successful integration of various hardware and software components is dependent on the compatibility and interoperability of these components.

3. External Interface Requirements

3.1 Hardware Interfaces

- Arduino Mega
  Used to read inputs and turn them into an output.
- ESP32S WIFI Bluetooth Board
  Used to provide a Wi-Fi signal for the embedded system to turn on/off lights.
- Voice Sound detection mic sensor
  Used to detect the frequency of baby crying.
- Capacitive Soil Moisture Sensor
  Used to check the wetness of the baby's mattress.
- PIR Sensor
  Used to detect motion above the baby.
- DHT11 humidity sensor
  Used to detect temperature
- RFID Module kit/ RFID key tag token
  Used to identify the tagged token by using radio waves
- Servo Motors
  Used for Mosquito net covering, cradle Automation, and door system.
- Laptop
  Used to power up the system

3.2 Software Interfaces

Developing End

- Atmel Studio (IDE)
  Used to code the Arduino program

Client End

- Alexa voice assistant
  Used to connect lighting system with parents' mobile phone

4. System Features

4.1 System Feature 1 – Functional Requirments of the project

F1	Cry detection and cradle Automation
Input	Positive sensor reading from Voice Sound Detection Mic sensor
Process	Sending Output signal to output servo motor pin
Output	Swing the cradle
Definition	Voice Sound Detection Mic sensor

F2	Moisture Sensor for Diaper Changes
Input	Positive sensor reading from Moisture Sensor
Process	Sending output signal to an alarm
Output	Ring the alarm
Definition	Capacitive Soil Moisture Sensor

F3	Mosquito Detection and Protection
Input	Positive sensor reading from PIR Sensor
Process	Sending Output signal to output servo motor pin
Output	Cover the cradle with a mosquito net
Definition	PIR Sensor

F4	Smart Lighting System
Input	WIFI signal
Process	Sending wifi signal through ESP32S board
Output	Turn the room light on
Definition	ESP32S WIFI Bluetooth board

F5	Door Control System
Input	Positive reading from RFID Module and RFID key tag token
Process	Sending Output signal to output servo motor pin
Output	Open the door
Definition	RFID Module kit

F6	Temperature Regulation
Input	Positive reading from DHT11 Temperature and Humidity Sensor
Process	Sending output Signal to the fan
Output	Activate fan
Definition	DHT11 Temperature and Relative Humidity Sensor

4.2 System Feature 2 - Block Diagram

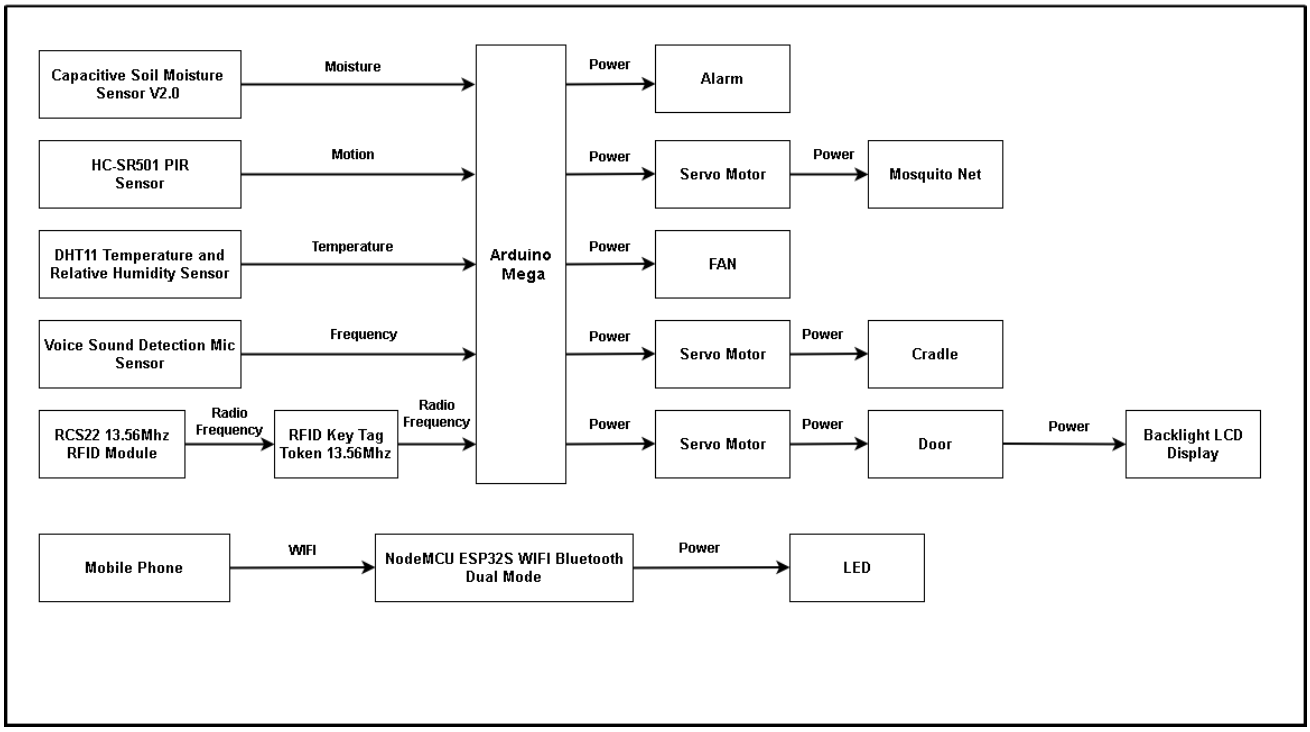

Figure 1 *– Block diagram of the smart babay room with IoT system*

4.3 System Feature 3 –Activity Diagram

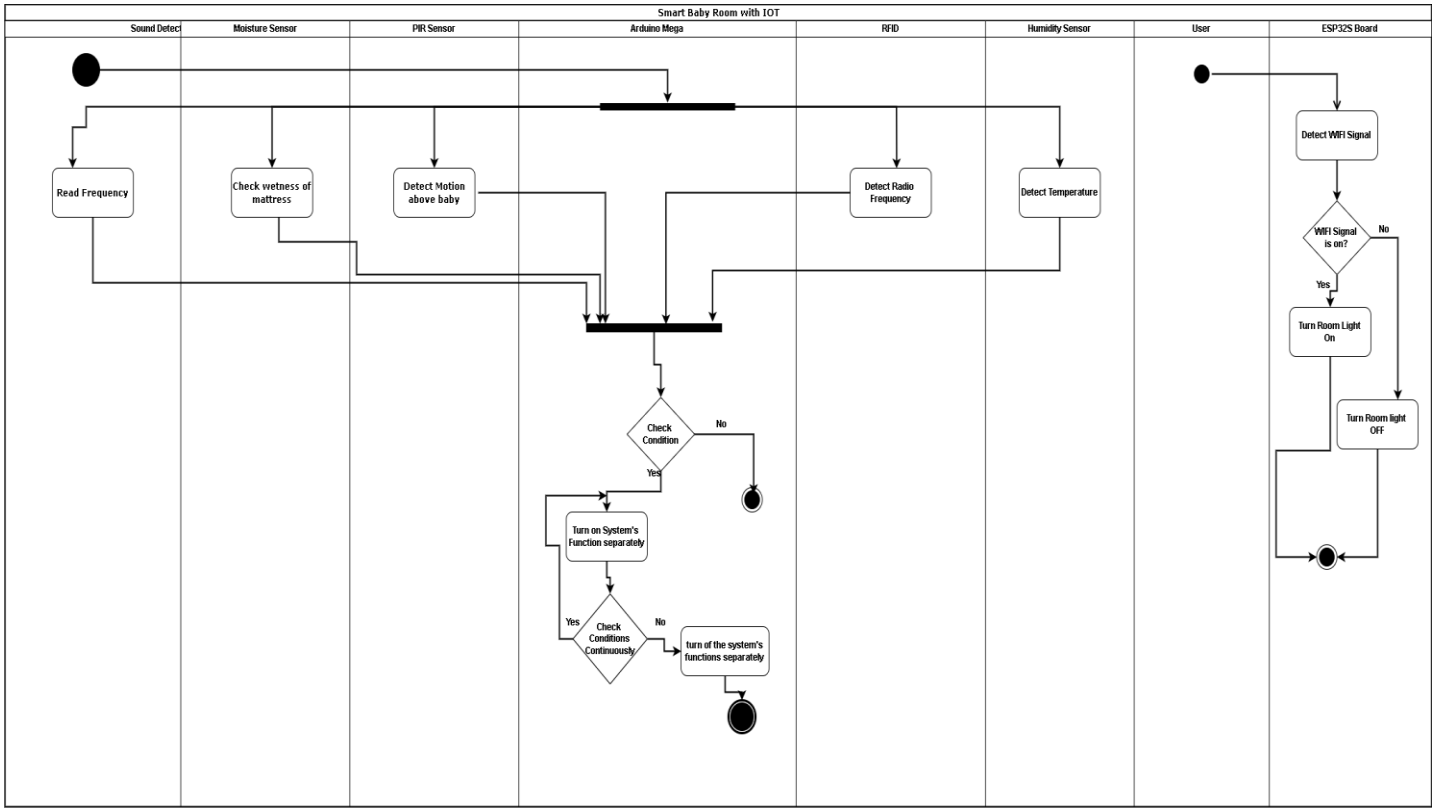

Figure 2 *– Activity Diagram of the system*

5. Other Nonfunctional Requirements

5.1 Performance Requirements

The system should achieve a minimum accuracy of 95% in identifying baby cries. Real-time monitoring of the baby's vital signs, movements, and surroundings (such as humidity and temperature) must be provided by the system. The device is designed to detect differences in room temperature and modify it within 5 minutes.

5.2 Safety Requirements

The system should use certified and insulated electrical components and frequently inspect wiring and connections. Mobile app should use authentication and authorization mechanisms.

5.3 Security Requirements

Parents and authorized caregivers should authenticate themselves before accessing the smart baby room system. Make sure that physical parts are difficult to tamper with, such as cameras, sensors, and microphones. When appropriate, use tamper-evident seals.

Appendix A: Glossary

IoT	Internet Of Things
RFID	Radio Frequency Identification
Arduino mega	Used to create complex projects due to its structure
ESP32	Provides wifi and Bluetooth connectivity For embedded system
Sensor	A device that detects the environmental changes and responds to some output on the other system

Appendix B: Analysis Models

- ***Use Case Diagram***

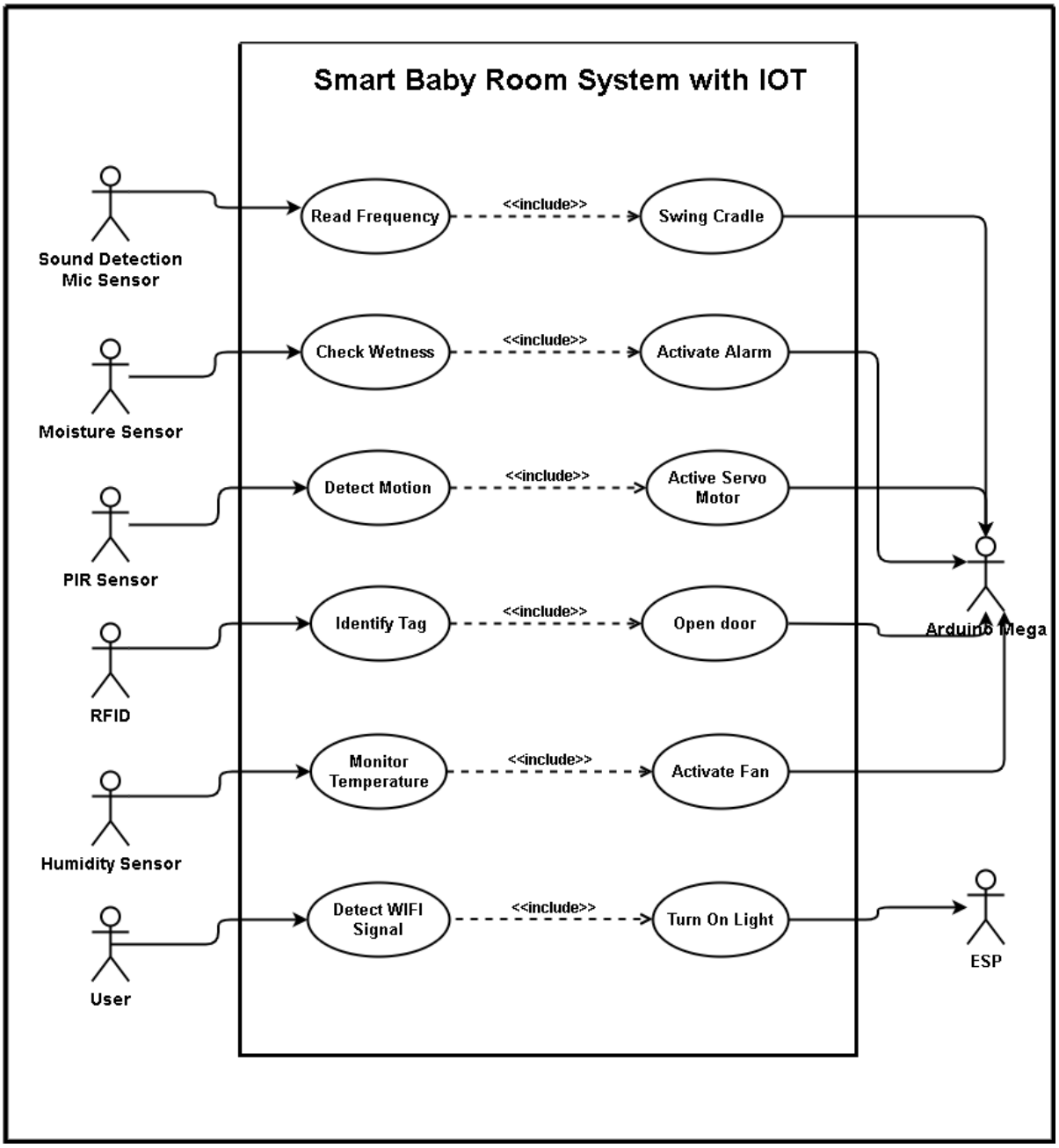

Figure 3 *– User case diagram of the system*