

# A Guide to Preparing Sprint-0 Report

Product Release-1 (IT 496: Project-1)

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# Noom Sprint-0 Report

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## 1 Introduction

Diabetes represents one of the most common chronic metabolic diseases of children. Type 1 diabetes in children is a condition in which your child's body no longer produces an important hormone (insulin). Your child needs insulin to maintain good health, so the missing insulin needs to be replaced with injections or with an insulin pump.<sup>[1]</sup>

Sleep is biological behavior strongly related to metabolic control of the human body. Children need to sleep for more than 10 hours at night to achieve optimal growth. Sleep disturbances occur in about 30% of youth in the general population.<sup>[2]</sup> Children with T1D may be particularly vulnerable to sleep disturbances. Getting poor sleep or less restorative slow-wave sleep has been linked to high glucose levels in people with diabetes.<sup>[3]</sup>

Researchers believe that sleep restriction may affect glucose levels due to its effects on insulin. The problem we will address in this project is the effect of sleep disturbance and irregular sleep routines on diabetic children.

As IT students we will use technology by developing an app that will help in the significant expansion in the development and use of IoT devices and smartphones in our targeted population. The ability to provide customized feedback based on real-time data. This way it will be much easier and more convenient.

In this proposal we will present in the first section the problem and our solution for it. we will also present the product vision and roadmap the objectives and scope and finally the hardware and software tools and cost as well as the scrum team.

### 1.1 The Problem

Diabetes represents one of the most common chronic metabolic diseases of children. In 2017, Saudi Arabia reported more than 35,000 confirmed diabetes type 1 (T1D) cases among children, which lead to place Saudi Arabia the 8th country in prevalent. Sleep is biological behavior strongly related to metabolic control of the human body. Children need to sleep for more than 10 hours at night to achieve optimal growth. Unfortunately, nowadays children suffer from social jet lag (late sleeping hours) and insufficient sleep duration.

### 1.2 The Solution

Design a mobile application that supports (android) platforms. That targets children with type 1 diabetes and their parents. The application aims to create an interactive Arabic mobile-based software, which delivers customizable feedback\reminders to the parents and their children based on the provided data by them, such as bedtime, wake up time and glucose level. The purpose of our application is to build a good sleeping habit by tracking and sending daily motivational feedback that improves the efficiency, quality and duration of children's sleep to improve diabetes management.

## 1.3 Product

### 1.3.1 Product Vision

*For a T1D children and their parents*

*Who needs to maintain a healthy sleeping routine.*

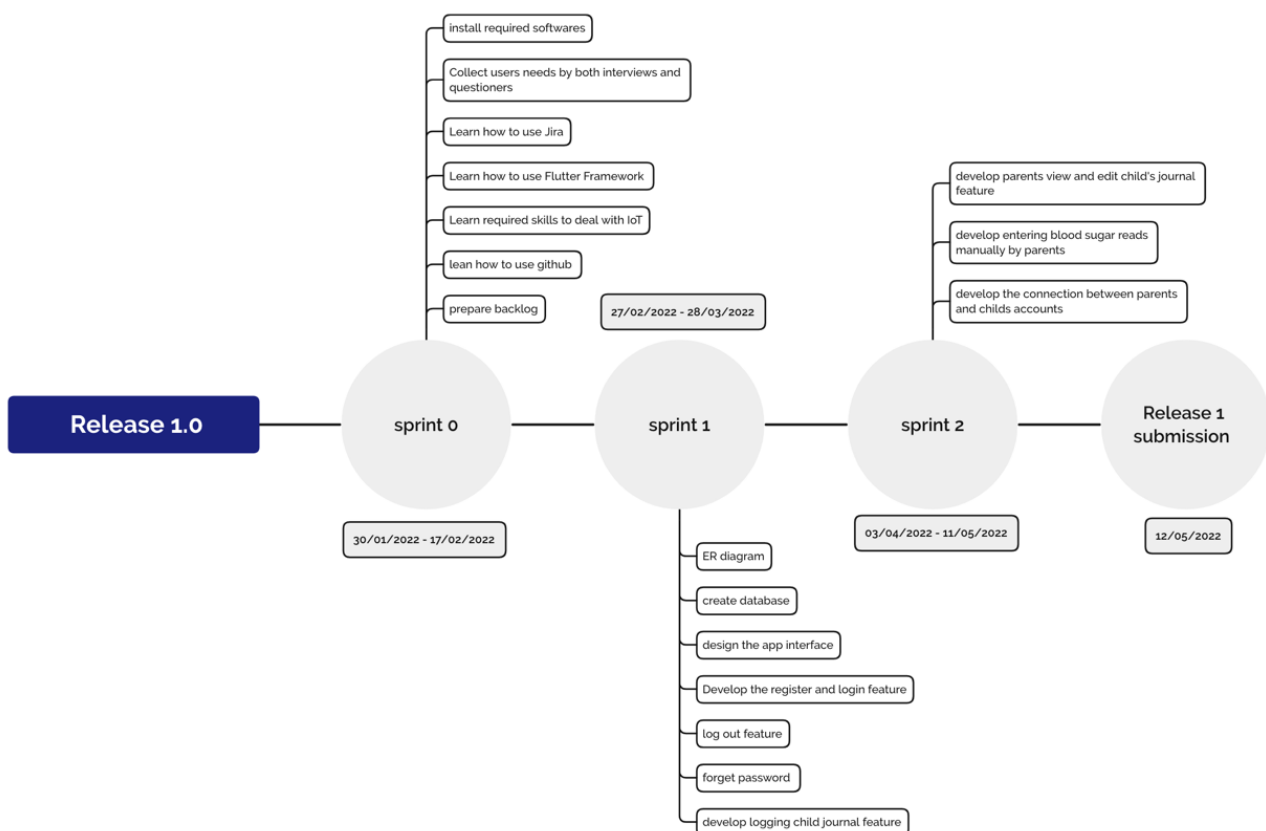
*The Noom is a cellphone-based software.*

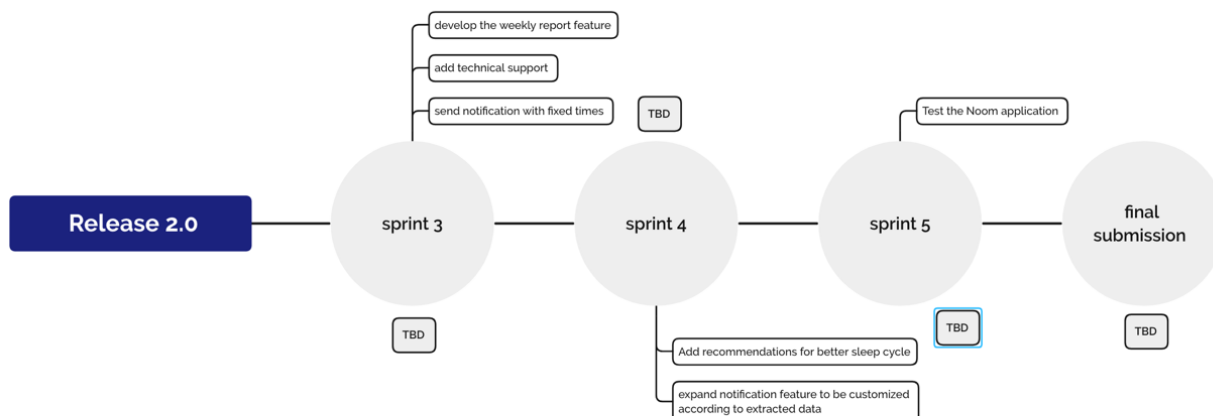
*That motivate T1D children to maintain glucose level by improving their sleep cycle*

*Unlike similar apps, our app is an Arabic application that motivate T1D children to maintain their sleep schedule by sending enriched customized notifications/reminders based on personalized data*

*Our product will provide a logging feature that allows the child to log in a journal about his everyday activities and a weekly report that summarize the child's sleeping pattern.*

### 1.3.2 Product Roadmap





### 1.3.3 Objectives

- **Product (customer focus-value):**

We build this application to motivate T1D children who have irregular sleep cycles to improve their sleeping hours since differences in sleep duration and higher variability in the timing of sleep were strongly linked with poorer glycemic control and insulin resistance. Our application will benefit children who have T1D and their families by letting the child enter their daily sleeping routine (the time they sleep and wake up) and the app will send a customized notification by comparing the entered data with the extracted data from the watch, and by receiving the customized notification the child will feel excited and accomplished.

Product objective are as follows:

- 1-Register and create accounts for parent and child.
- 2- Logging that allows the child to log in a journal about his everyday activates.
- 3- Parents can view and edit their child's journal.
- 4- Parent can enter child's sugar blood level.
- 5- Send daily customized notifications based on extracted data from the phone and watch to ensure the entered data by the child is accurate.
- 6- Weekly report that summarize the child's sleeping pattern

- **Project (solution focus-plan):**

Our Team need to collect client's requirements using both interviews and questioners. We also collect data by reading research articles, documents. And organize the obtained information in a way that helps us develop the app to suit the clients' requirements. Designing two interfaces a child friendly interface, and a different interface for the parents. We will use data science algorithms to analyze, preprocess, process and visualize the data that collected by the sensors that embedded within the smartwatch.

- **Learning (student focus):**

Our Team will learn a new open-source UI framework(flutter)along with the dart programing language that supports IOS(android) platforms. We will also learn how to use Jira software, and the required skills to deal with IoT. Learn how to design a program interface suitable for children. And to learn how to create a project using agile methodology.

#### 1.3.4 Scope

Our phone application will be available in Arabic on (android) platforms and target children with T1D and their families/ Doctors. Parents can create an account for themselves and their children. Parents interface allows them to enter the child's glucose blood level, as well as view and edit their child's journals. Child's interface will have a logging feature that allows the child to log everyday a journal about his/her daily activities such as bedtime and wake up time. Children and their parents are required to have an internet connection in order to save their data in the database.

Our application will track and send customized notifications based on entered data in the phone and compare it to the extracted data from watch, to motivate the child and remind the parents. A weekly report will be sent that summarize the child's sleeping pattern to their parents. Reports will be provided to guide the parents so that their child gets better sleep habits.

#### 1.3.5 Hardware/Software Tools and Cost

Hardware Tools	
Name and Description	Cost
android mobile	4000
HP laptop	5000
MacBook	10000

Huawei	4000
Software Tools	
Name and Description	Cost
Flutter framework (Dart language): Flutter is an open-source framework by Google for building beautiful, natively compiled, multi-platform applications from a single codebase.[4]	Free
Visual studio code: Visual Studio Code is a streamlined code editor with support for development operations like debugging, task running, and version control. It aims to provide just the tools a developer needs for a quick code-build-debug cycle and leaves more complex workflows to fuller featured IDEs, such as Visual Studio IDE	Free
Android SDK: The Android SDK is a software development kit that includes a comprehensive set of development tools. These include a debugger, libraries, a handset emulator based on QEMU, documentation, sample code, and tutorials	Free
GitHub: "Is a provider of Internet hosting for software development and version control using Git. It offers the distributed version control and source code management (SCM) functionality of Git, plus its own features. It provides access control and several collaboration features such as bug tracking, feature requests, task".[6]	Free
Jira: is a software application used for issue tracking and project management. The tool, developed by the Australian software company Atlassian, has become widely used by agile development teams to track bugs, stories, epics, and other tasks.[7]	Free



## Scrum Team

### 1.3.6 Skill Set Requirements

Technical Skill Required	What is the current level of the team ( <i>beginner-intermediate-advanced</i> ) for each skill? How will the gap be bridged? ( <i>If necessary</i> ) Learning plan
Mobile application implementation using flutter framework	Beginner Using online resources
Academic writing and research	Intermediate Practice writing reports
IoT background	Beginner Using online resources

#### 1.3.6.1 Learning

What we want to learn	Learning steps	Stage
How to use Flutter framework	Using online resources: YouTube, Udemy, Google	Beginner
Dart language	Using online resources: YouTube, Udemy, Google	Beginner
How to use Jira	Seminar, Jira guide	Intermediate
How to design children friendly interface	Using online resources: Google, children apps	Beginner
How to write reports	Using online resources: Seminar, Google From previous reports	Advanced
How to use Data science	Using online resources: YouTube, Coursera, Google	Beginner

### 1.3.7 Roles and Responsibilities

Scrum Team	
Product Owner:	Nailah Saleh AlHassoun
Developers:	Jumanah Bin Zayid, Nada ALOsaimi, Alaa Alslman, Reem Alotaibi, Leen Aldubaikhi
Scrum Master (SM):	Dr. Maha Al-Yahya
Stakeholders:	The medical college T1D children and their parents

## 2 Background

Children with T1D who have trouble sleeping have been shown to have poorer glycemic control, which leads to increased insulin resistance [4]. We as IT students decided to solve the problem by using health monitoring devices and data science algorithms.

Home health monitoring is the use of IT and telecommunications to monitor the health of patients in their homes and to help ensure that appropriate action is taken. Patients are provided monitoring devices that measure vital signs, such as blood pressure, glucose level, pulse, blood oxygen level and weight [5].

Smart watch is the most popular health monitoring device. A smart watch with a sleep tracker monitors the child's sleep duration and sleep quality based on their body movements, heart rates, and external noises. For the sleep duration, the smart watch will track the length of time when the child goes inactive at night and the moment he/she starts to move in the morning. For the sleep quality, the smart watch will detect any interruption in the child's sleep. Smart watch will also record environmental factors such as the room lighting, temperature, and surrounding noises which may affect the child's quality of sleep [6]. The smart watch remains on the child throughout the night to measure their sleep, all the sensors that embedded inside the smart watch upload the data to Noom application for exploratory data analysis, preprocessing, processing and data visualization.

Exploratory Data Analysis (EDA) is a robust technique for familiarizing yourself with Data and extracting useful insights. Data Scientists sift through Unstructured Data to find patterns and infer relationships between Data elements. Data Scientists use Statistics and Visualization tools to summarize Central Measurements and variability to perform EDA [8].

Before processing the collected data, preprocessing steps must be applied. Data preprocessing is a data mining technique that involves transforming raw data into an understandable format, excluding noise (unwanted data) and handling missing data [7].

Data processing stage is the essential stage in Noom application. In data science, the data is subjected to various data processing methods using machine learning and artificial intelligence algorithms to generate a desirable output [9].

Data visualization is the graphical representation of information and data. By using visual elements like charts, graphs, and maps, data visualization tools provide an accessible way to see and understand trends, outliers, relationships between features and patterns in data [10]. The displayed results, charts and graphs are used in the weekly reports. Child's parents can use the results to help optimize their child sleep schedule.

### 3 Literature Review

This section presents competitors systems that are similar to Noom. The systems are introduced in terms of their main provided features and adopted technologies. Then the systems are compared with the potential features of Noom.

#### 3.1 Competitive Product Analysis

There are several competitive products to Noom application. Our application provides in Smart Watch App it is Available in Arabic language it Provides two different interfaces (parent's interface and child's interface), Parent can enter child's sugar blood level also it Compares your sleep patterns statics to world sleep statistics.

It Targets children with T1D and their families, it will track and send customized notifications based on extracted data from the smart watch to motivate the child and remind the parents.

Personal health applications (PHA):



(PHA) are tools of storing, managing and sharing health information in illness and wellness by an individual in a secure and confidential environment. and services in medical informatics which utilises information technologies to aid individuals to create their own personal health information Medications.

The most important features offered by it:

- Patient's personal data (name, date of birth and other demographic details).
- Patient's diagnosis or health condition and details about the various treatment/assessments Delivered by health professionals.
- Patient's sleeping progress

Application sleep Cycle:

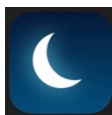


analyses your sleep patterns

The most important features offered by it:

- Teaches you about your bedtime routine by giving detailed sleep tracking and analysis.
- Weather & Sleep - See how different types of weather affect your sleep.
- Online Backup Lets you secure your sleep data online.

#### SleepWatch:

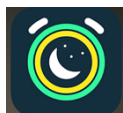


is a health-focused sleep app that automatically tracks sleep with the Apple Watch. It uses to help you track, achieve, and improve. can use in Apple Watch sensors also SleepWatch can be used without an Apple Watch by entering sleep times manually.

#### FEATURES

- Daily Briefings: Effortlessly get daily notifications about how you slept.
- Includes Apple Watch App.
- Send a weekly report that summarize sleeping progress.

#### Sleepzy:



Sleepzy is a smart alarm clock that tracks your sleep patterns, wakes you up during the lightest sleep phase in a way that feels natural to get up, analyzes your sleep quality, and notifies you if you have a sleep debt.

The most important features offered by it:

- Track your sleep patterns.
- Get helpful weekly stats.
- Can use in Apple Watch.

In the following table competitor products are compared with NOOM potential features. The (✓) mark means system provide the feature while the (NA) mark means the feature is not provided. In some system, there is no clear information whether a system offers feature or not in this case Not Available (NA) mark is used.

4	Feature	Health	sleep Cycle	Sleep watch	Sleepzy	NOOM
	Provides two different interfaces (parent's interface and child's interface)	NA	NA	NA	NA	✓
	patients can enter their daily activates (bedtime and wake up time).	✓	✓	✓	✓	✓
	Parent can enter child's glucose blood level	NA	NA	NA	NA	✓
	Send a weekly report that summarize the patient's sleeping progress	✓	✓	✓	✓	✓
	Extract data from digital watch	✓	NA	✓	✓	✓
	Available in Arabic language	✓	NA	NA	NA	✓
	Send enriched and customized notification to a patient	NA	NA	NA	NA	✓

## System Description

In our project we used interview and questionnaire for requirements collecting. we interviewed 2 mothers having child with diabetes. Also, in the questionnaires we had 14 questions participated by 30 parents who have children with diabetes.

The questions we asked in the interview:

- 1-Have you ever noticed the effect of unhealthy sleep on your child's glucose blood level?
- 2-can you manage your child's sleep?
- 3-have you tried to use an app that helps you to organize your child's sleep?
- 4-What methods do you use to control your child's glucose blood level?
- 5-if there is an app that motivates your T1D child to have a better and healthier sleeping routine why would you like it?
- 6- What do think the things inhibit the children from having a healthy sleeping?
- 7- What the things will help the child to sleep early? (Stories, shower)

And for questionnaire:

- 1-How old is your child?
- 2-Does your child have a phone?
- 3-Does your child have a smart watch?
- 4- Do you have enough information about the effects of Late and Inconsistent sleep on child's glucose blood level?
- 5- Does getting better sleep help with your child's glucose level?
- 6- Do you have a hard time organizing your child sleeping schedule?
- 7- Do you think having an application asks the child to enter his sleeping and waking up time could motivate them to sleep early?
- 8- Do you think having an application sends customized notification could motivate them to sleep early?
- 9- Do you think having an application relies on a smart watch to extract sleeping and waking up time data could be a good idea and helpful for child?
- 10- Do you think having a weekly report representing the sleeping times and duration of your child's sleep will help you know the changes and progress of your child's sleep?
- 11- Do you think having a weekly report representing the effect of sleeping hours on the child's blood glucose level could help your child's doctor with the treatment plan?
- 12- Does your child think that the child's interface contains symbols, graphics and colors that he might like?
- 13- what the thing helps your child to sleep?
- 14- Have you used any application can manage with your child sleeping?

### 4.1 Users

Noom users are children with T1D aged 6 years and over, suffer from inconsistent sleep and have general knowledge of technology. All our children's patients can read and understand Arabic language.

Child's Parents have a bit information on diabetes and the effect of irregular sleep cycles on the glucose level in children. They have general knowledge of technology and have experience with similar applications

## 4.2 Requirements Elicitation

Results and findings of interviews:

Interview 1:

Q1-Have you ever noticed the effect of unhealthy sleep on your child's glucose blood level?

Yes, I noticed after learning the effect of lack of sleep on sugar reading, previously I wasn't known about the relationship

Q2-can you manage your child's sleep?

By turning off the lights and making the place is quite on his bedtime

Q3-have you tried to use an app that helps you to organize your child's sleep?

No, I have never tried any.

Q4-What methods do you use to control your child's glucose blood level?

Make sure my child gets enough sleep in addition eating a healthy diet as much as possible.

Q5-If there is an app that motivates your T1D child to have a better and healthier sleeping routine why would you like it?

My child is 9 years old and has a curiosity for everything related to the iPad, so the application may help him more than the traditional methods.

Q6- What do think the things inhibit the children from having a healthy sleeping?

Using an iPad, watching TV and playing video games.

Q7- What the things will help the child to sleep early? (Stories, shower)

Control room temperature helps him fall asleep faster, in addition to turning off the lights, also turning off the TV

Findings of interview 1:

The participant previously wasn't knowing the relationship. she noticed the effect of unhealthy sleep on her child's glucose blood level when she had the information about it. Her ways to manage child's sleep is by turning off the lights and making the place is quite on his bedtime. She is controlling child's glucose blood level by making sure her child gets enough sleep and having a healthy diet. She thinks our app could help because her 9 years child has a curiosity for everything related to the iPad.

Interview 2:

Q1-Have you ever noticed the effect of unhealthy sleep on your child's glucose blood level?

Yes, I noticed in vacations with unhealthy sleeping the reading of glucose levels in the other day gets effected.

Q2-can you manage your child's sleep?

Manage his time using iPad or PlayStation and having a time with him before sleeping and let him talk about thing he loves.

Q3-have you tried to use an app that helps you to organize your child's sleep?

No, I didn't think before to try any app.

Q4-What methods do you use to control your child's glucose blood level?

Healthy eating, doing some activities and following-up medical care.

Q5-If there is an app that motivates your T1D child to have a better and healthier sleeping routine why would you like it?

I think anything related to devices will attract him so he will be excited to use it also

Q6- What do think the things inhibit the children from having a healthy sleeping?

Insisting on using iPad to play or sometimes he feels so active and resist to sleep

Q7- What the things will help the child to sleep early? (Stories, shower)

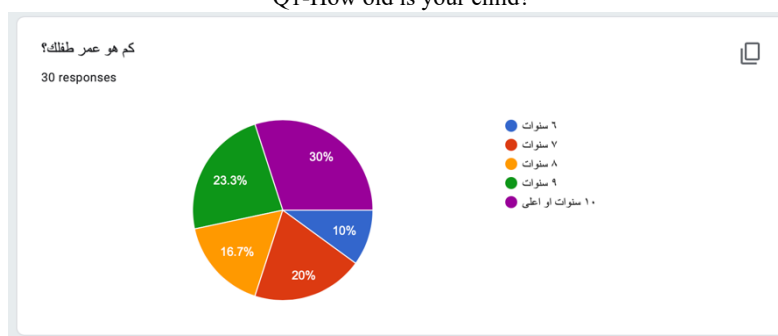
Drink hot milk and getting shower before sleeping

Findings of interview 2:

The participant noticed the effect of unhealthy sleep on her child's glucose blood level when her child has bad sleep routine in vacations. Her ways to manage child's sleep is by control his time using iPad or PlayStation. It is her first time thinking of using an app to help with her child sleeping routine. Her way to control blood glucose level by doing activities and following-up medical care. She finds insisting her child in using iPad to play inhibit from having a healthy sleeping.

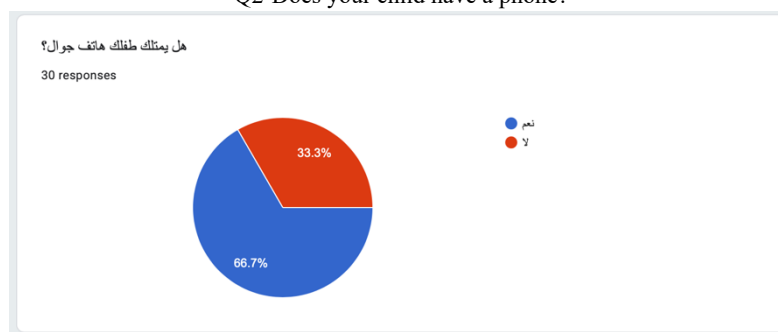
Results and findings of questionnaire:

Q1-How old is your child?



Almost half of children are between 9 and over.

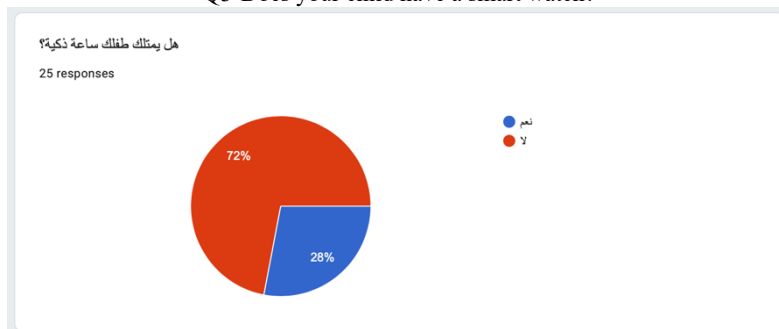
Q2-Does your child have a phone?



66.7% of children own a phone while the other don't have.

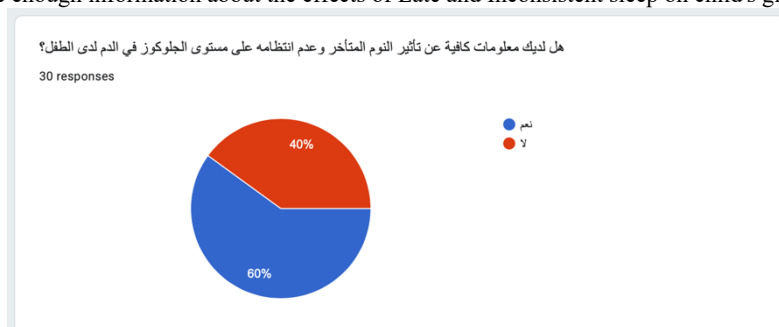


### Q3-Does your child have a smart watch?



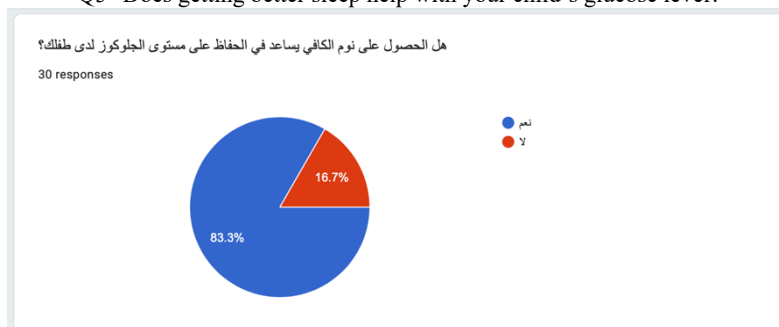
Most of the children don't have a smart watch so it might not be helpful using it as main source of collecting data.

### Q4- Do you have enough information about the effects of Late and Inconsistent sleep on child's glucose blood level?



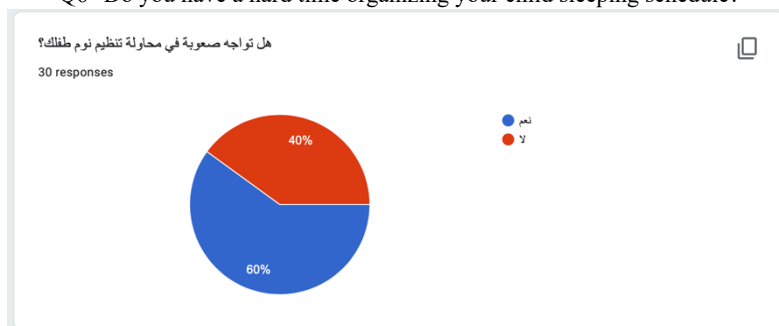
60% have already enough information about the effects of late sleep on glucose blood level

### Q5- Does getting better sleep help with your child's glucose level?



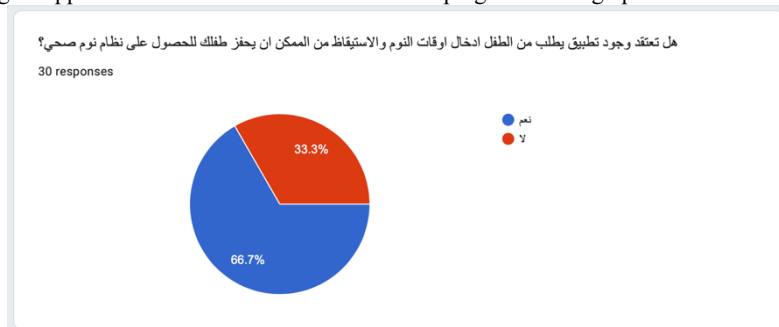
83.3% of the participants which is big number thought it is healthier when their child has good sleep

### Q6- Do you have a hard time organizing your child sleeping schedule?



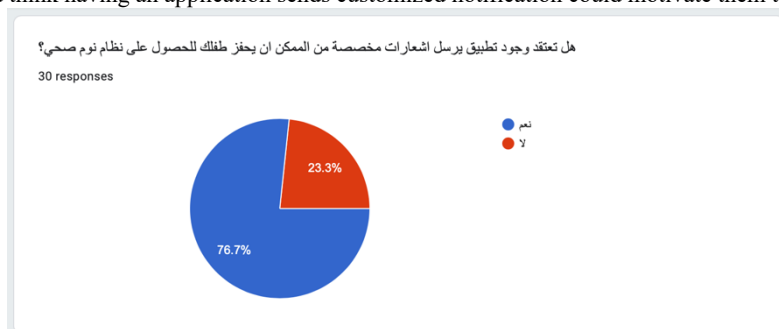
60% of the participants do have difficulties managing their child sleep.

Q7- Do you think having an application asks the child to enter his sleeping and waking up time could motivate them to sleep early?



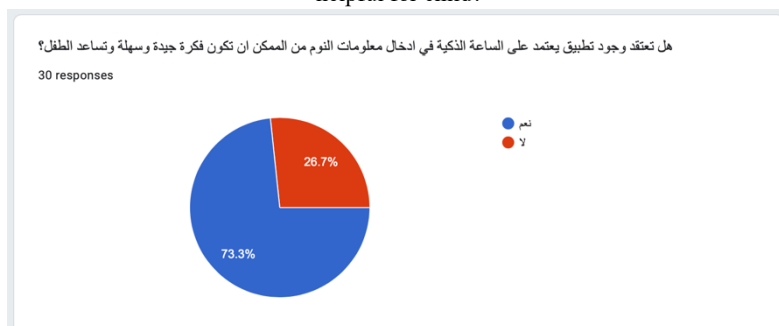
66.7% of the participants agreed it is a helpful idea.

Q8- Do you think having an application sends customized notification could motivate them to sleep early?



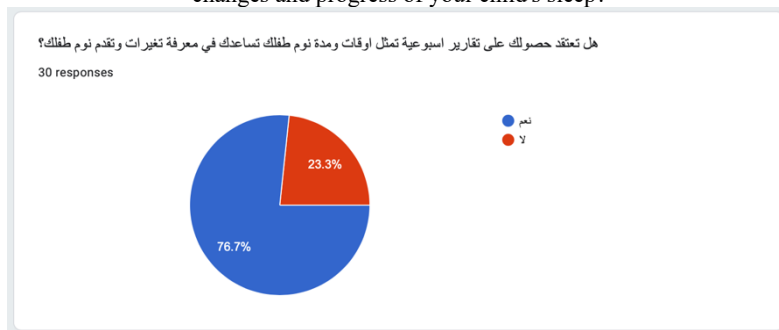
Most of the participants agreed it will help managing their child sleep.

Q9- Do you think having an application relies on a smart watch to extract sleeping and waking up time data could be a good idea and helpful for child?



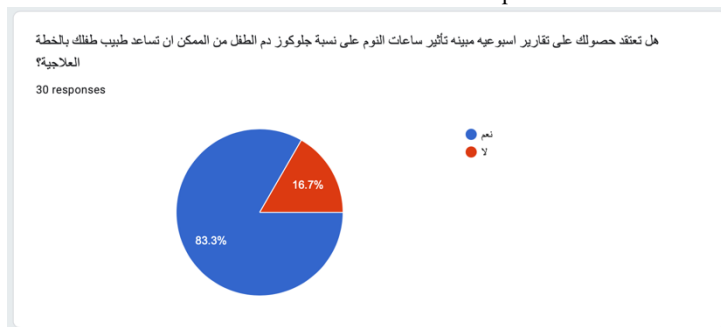
73.3% think Extracting data from the smart watch could be helpful to their child.

Q10- Do you think having a weekly report representing the sleeping times and duration of your child's sleep will help you know the changes and progress of your child's sleep?



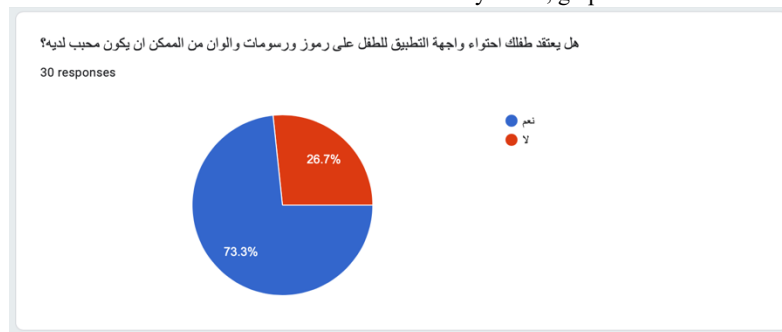
76.7% of the participants agreed it would be helpful.

Q11- Do you think having a weekly report representing the effect of sleeping hours on the child's blood glucose level could help your child's doctor with the treatment plan?



83.3% of the participants agreed it will also help the doctor with the treatment plan.

Q12- Does your child think that the child's interface contains symbols, graphics and colors that he might like?



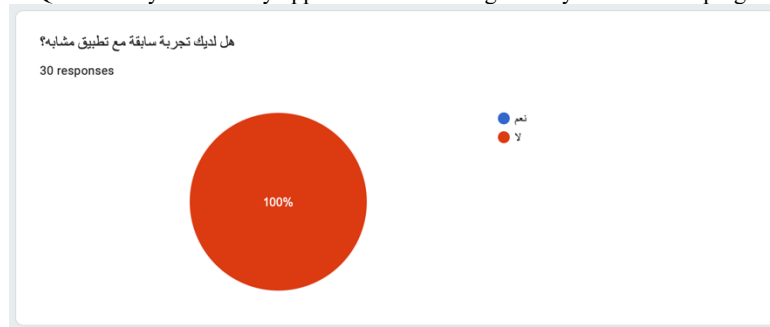
Most of the child like having graphics and colors on their interface.

Q13- what the thing helps your child to sleep?



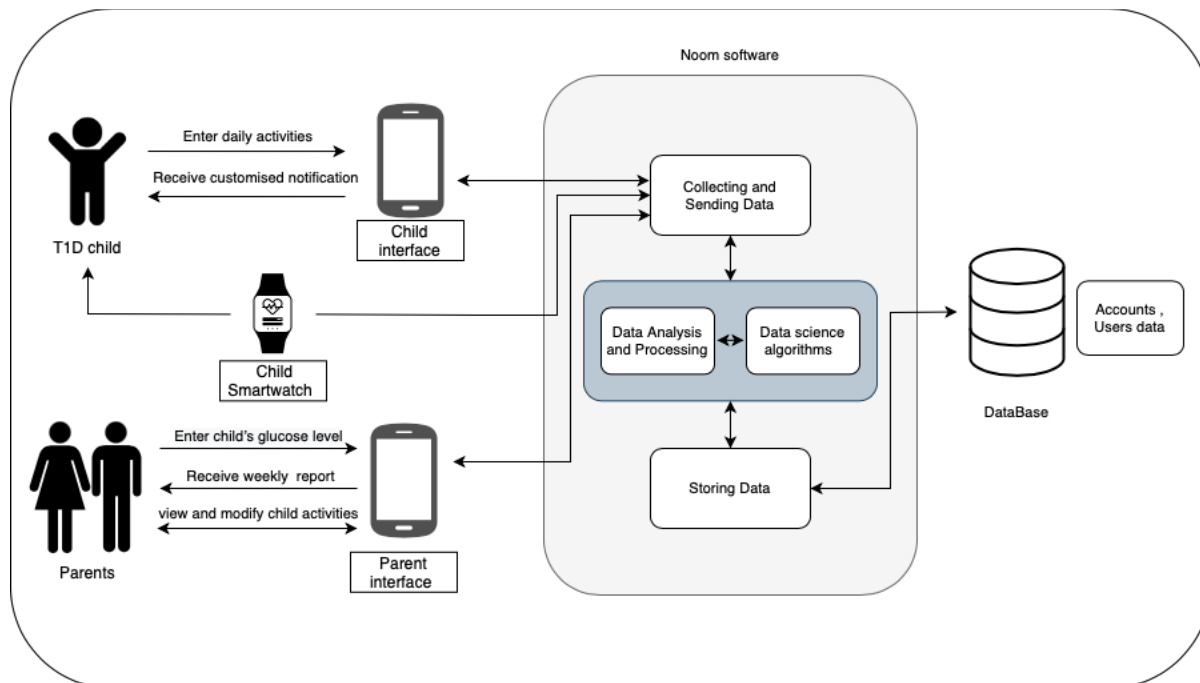
Most of the participants said that some drinking that helps to sleep and taking a shower it would make them to sleep. Some other answers were quietness, listening to Quran, and watching some videos.

Q14- Have you used any application can manage with your child sleeping?

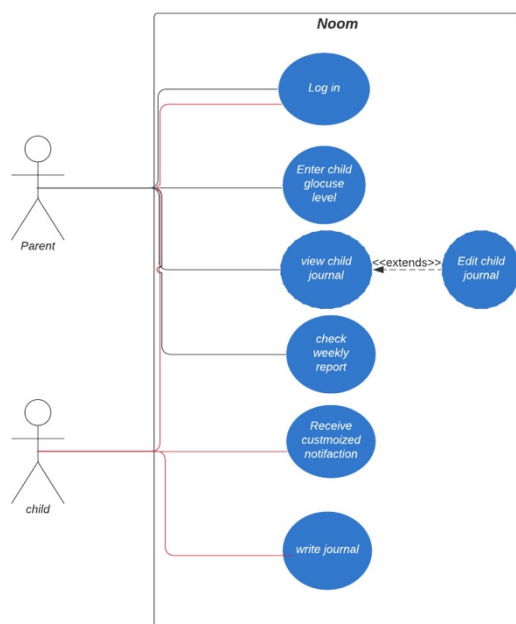


All the participants didn't any applications before.

### 4.3 Architecture



### 4.4 Use Case Diagram



## 5 Product Backlog

### 5.1 Product Backlog Table

PBI (User story)	Size (Story points)	Type (Feature, defect, technical work, knowledge acquisition)	Acceptance Criteria The conditions of satisfaction that must be met for that item to be accepted.
As a parent, I want to enter my child's blood glucose level so that I can see the relationship between bedtime and sleep duration with glucose level in the morning.	3	Feature	—
As a parent, I want to modify the data entered by my child so that the weekly report will be correct.	2	Feature	—
As a parent, I want to view the information entered by the child so that I make sure that the information entered by my child is accurate.	3	Feature	—
As a parent, I want to connect the smart watch with the app so that the app could extract sleep and wake up time.	8	Feature	As a parent, if connect the smart watch with the app then Anotification should appear that the connection is successful.
As a child, I want to use a smart watch so that I can get the right customized notification.	3	Feature	—
As a parent, I want to receive a weekly report so that I can observe the changes in the child's sleeping progress.	5	Feature	—
As a child, I want to receive notifications so that I feel excited and accomplished.	5	Feature	—
As a parent, I want to register and create an account for me and my	3	Feature	Given that I am a parent, when I go to create an account

child so that I can view and edit my children's journal.			page and enter a username and password and click on create an account, then I am successfully registered and able to log in with my chosen credentials.
As a child, I want to log in to my account so that I can enter my daily activities (sleep and wake up time).	3	Feature	—
As a parent/child, I want to log in with my username and password so that the system can authenticate me.	3	Feature	<p>Given that I am a parent/child and logged out, if I go to the log in page and enter my username and password and click on Log in, then the data associated to my user should be accessible.</p> <p>Given that I am a parent/child, if I go to the log in page and enter my username but an incorrect password and click on Log in, then log in fails with an error message that specifies that the username or password was wrong.</p>

- As a parent, I want to enter my child's blood glucose level so that I can see the relationship between bedtime and sleep duration with glucose level in the morning.
- As a parent, I want to modify the data entered by my child so that the weekly report will be correct.
- As a parent, I want to view the information entered by the child so that I make sure that the information entered by my child is accurate.
- As a parent, I want to connect the smart watch with the app so that the app can extract sleep and wake up time.
- As a child, I want to use a smart watch so that I can get the right customized notification.
- As a parent, I want to receive a weekly report so that I can observe the changes in the child's sleeping progress.
- As a child, I want to receive notifications so that I feel excited and accomplished.
- As a parent, I want to register and create an account for me and my child so that I can view and edit my children's journal.
- As a child, I want to log in to my account so that I can enter my daily activities (sleep and wake up time).
- As a parent/child, I want to log in with my username and password so that the system can authenticate me.

## 5.2 Non-functional requirements

A non-functional requirement that describes the system *performance* is

- As a child, I want to receive the right customized notification at the right time, so that I get excited to sleep early.

A non-functional requirement that describes the system *safety* is

- As a parent, I want to be the only person who can access my child information.

A non-functional requirement that describes the system *usability* is

- As a child, I want an application that considers my lack of experience of using similar applications.

A non-functional requirement that describes the system *maintainability* is

- As a parent, I want an application that can be modified and updated in the future, so that the application will be contemporary.

A non-functional requirement that describes the system *Reliability* is

- As a parent, I want an application that can measure my child's sleep duration correctly.



## 6 References

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