Carebit: Using the Fitbit API to Support Telemonitoring for Informal Caregiving

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Introduction

- In the U.S., 43.5 million people provide some form of informal caregiving and spend on average 24.4 hours per week providing care for their loved one [1]
- Current assistive technologies have been developed to make informal caregiving more feasible [3-5], but are typically privacy invasive, unaffordable, or inconvenient.
- To address these limitations, we developed **Carebit**, an easy-to-use mobile application that supports remote informal caregiving.
  - The application uses Nissenbaum's **contextual integrity** privacy framework [2] to address the privacy concern aspect of caregiving. Carebit allows the caregivee to chose what information they want their caregiver to have access to.
  - For the purpose of the user study, a **Caregivee** is the person being monitored, and is over 50 years old. The **Caregiver** monitors the Caregivee, and is over 18 years old
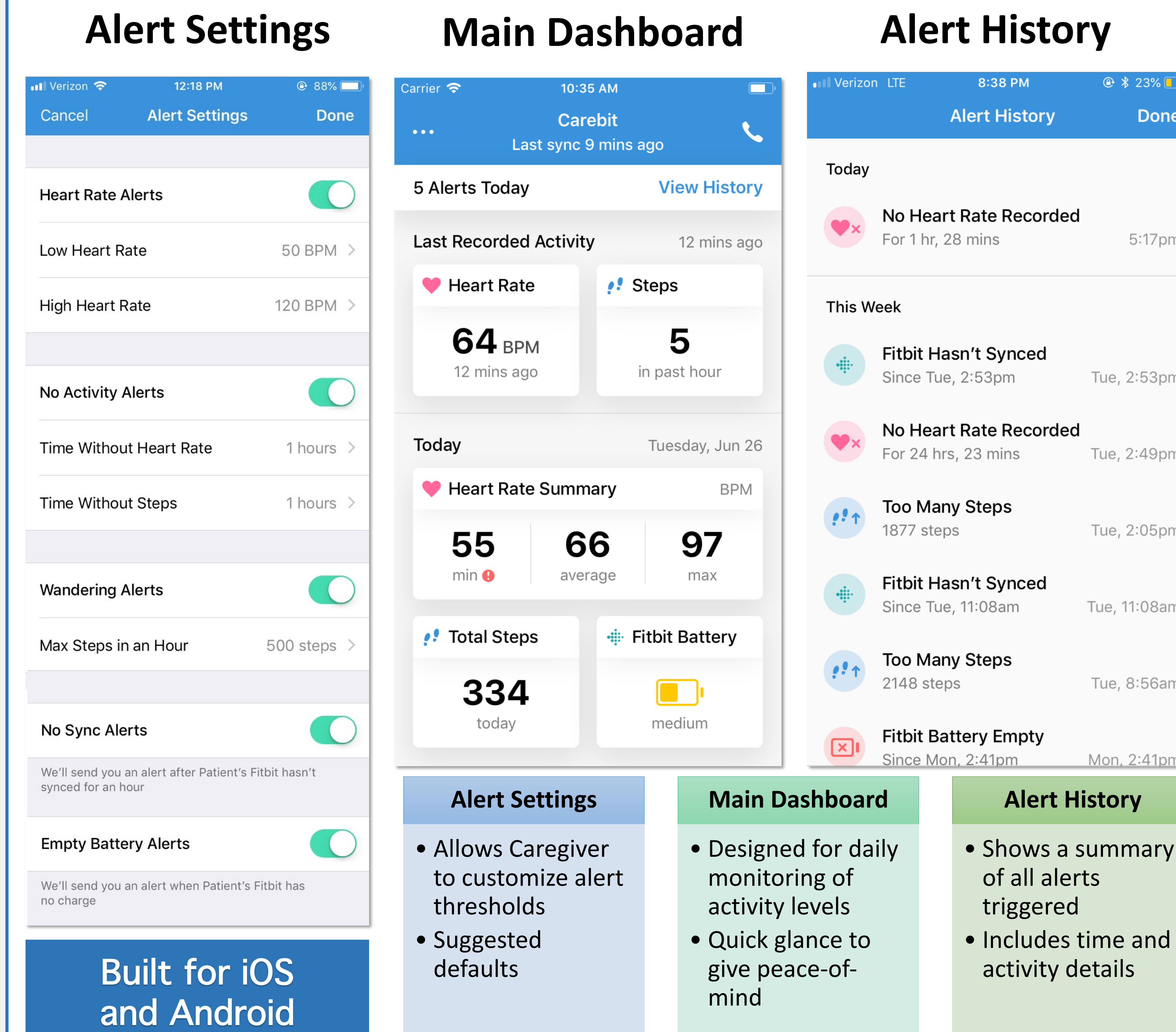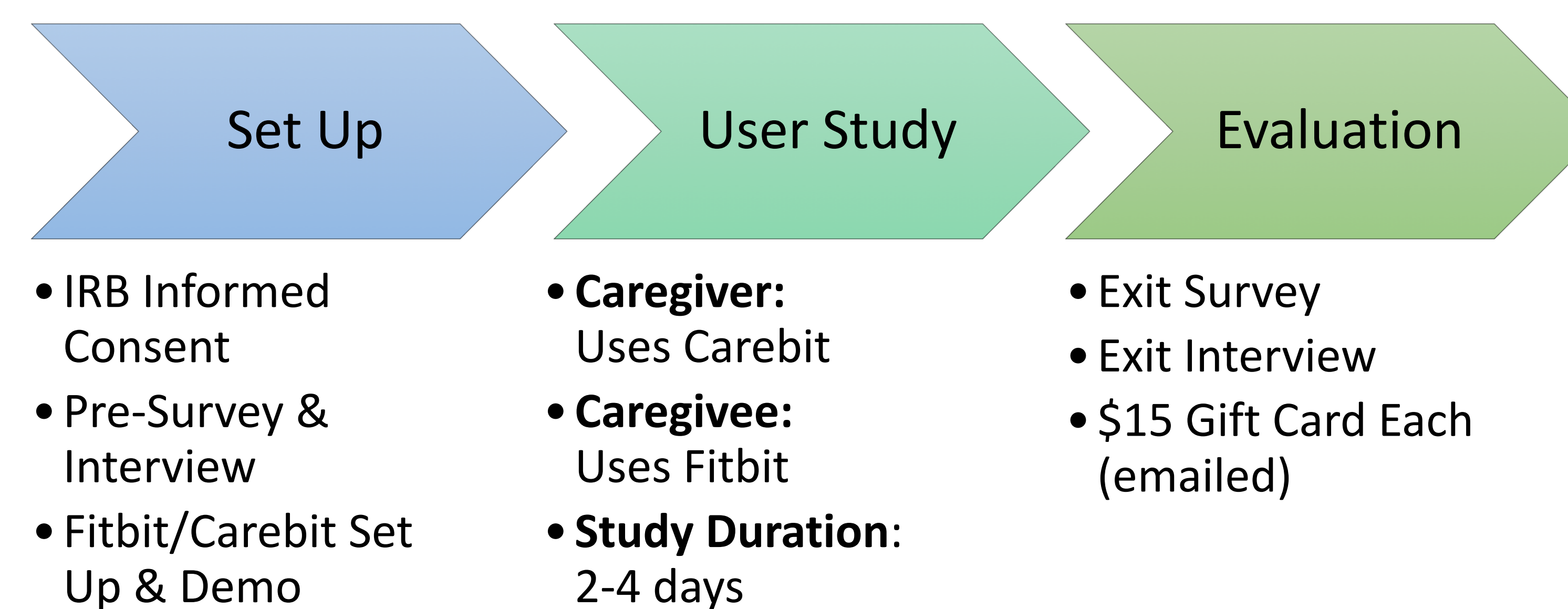
System Architecture
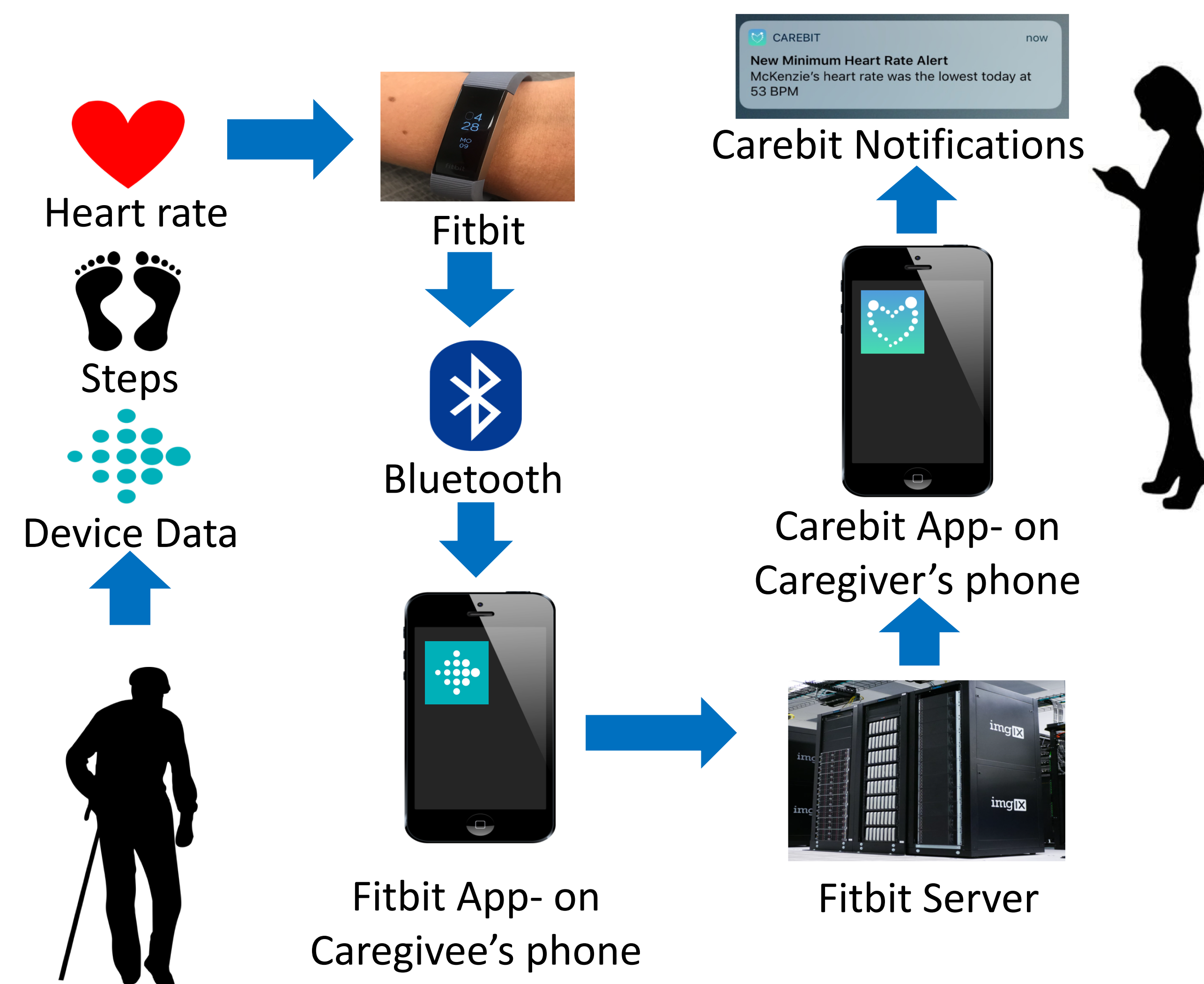
Obtaining Data from the Fitbit API to Use for Carebit:
1. The caregiver's Fitbit gathers heart rate, steps, and device data
2. This data syncs to the Fitbit app on the caregivee's phone
3. Once this data has synced to the Fitbit app, it immediately is sent to the Fitbit server
4. The Fitbit server then sends this data to the Carebit app on the caregiver's phone
5. Carebit throws a notification to the Caregiver, if the data triggers an alert
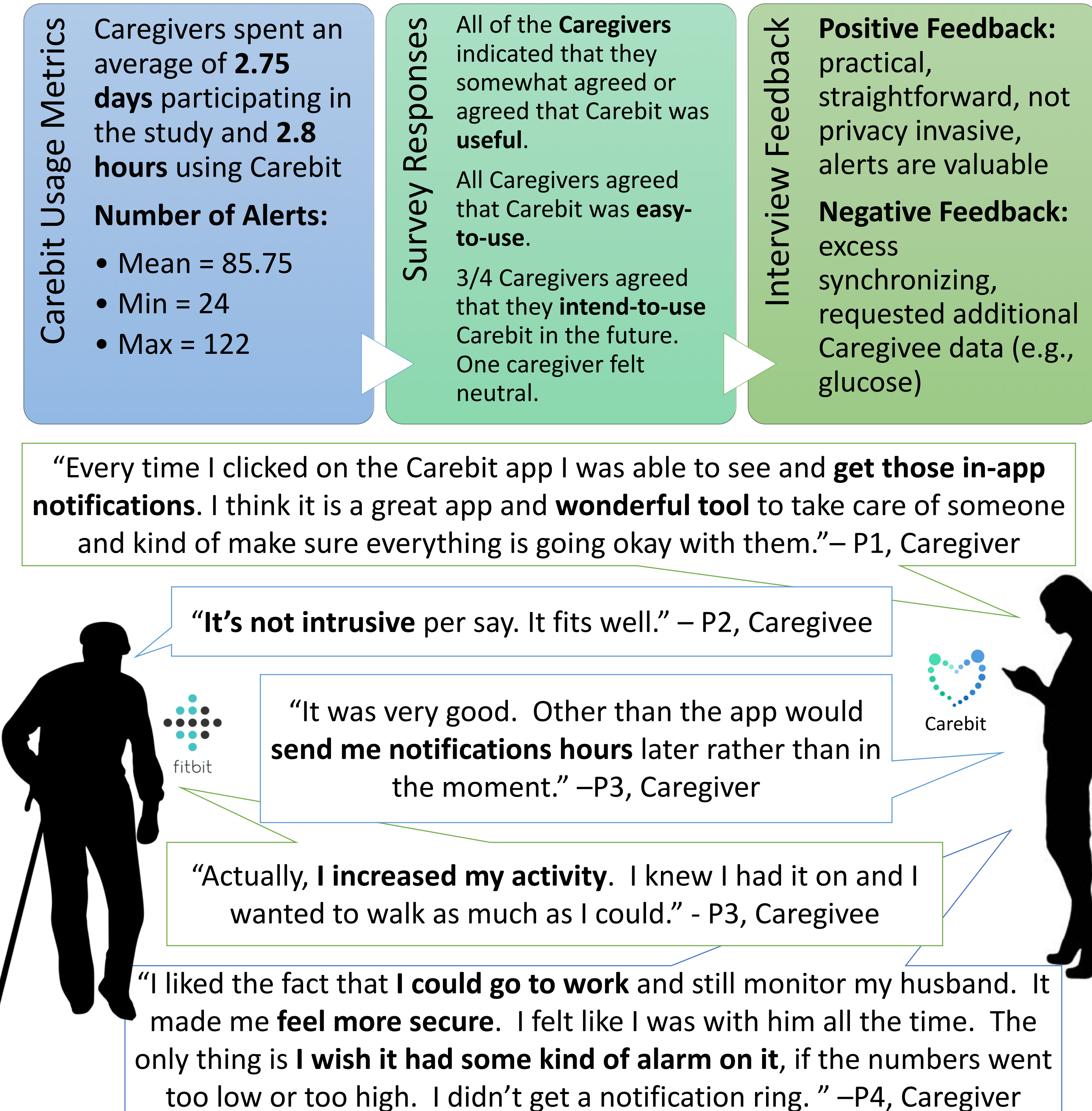
Carebit User Interface

Alert Settings

Main Dashboard

Alert History

Built for iOS and Android

Alert Settings
- Allows Caregiver to customize alert thresholds
- Suggested defaults

Main Dashboard
- Designed for daily monitoring of activity levels
- Quick glance to give peace-of-mind

Alert History
- Shows a summary of all alerts triggered
- Includes time and activity details

Methods

- IRB Informed Consent
- Pre-Survey & Interview
- Fitbit/Carebit Set Up & Demo

- **Caregiver:** Uses Carebit
- **Caregivee:** Uses Fitbit
- **Study Duration:** 2-4 days

- Exit Survey
- Exit Interview
- $15 Gift Card Each (emailed)

Group	Role	Age	Gender	Relationship	Fitbit Experience	iOS or Android?
Pair 1	Caregiver	44	F	Daughter	6 months	iOS
Pair 1	Caregivee	70	F	Parent	6 months	iOS
Pair 2	Caregiver	69	F	Spouse	No	iOS
Pair 2	Caregivee	70	M	Spouse	No	iOS
Pair 3	Caregiver	22	M	Son	No	iOS
Pair 3	Caregivee	61	F	Parent	No	iOS
Pair 4	Caregiver	54	F	Spouse	No	iOS
Pair 4	Caregivee	54	M	Spouse	No	iOS

Results

Carebit Usage Metrics: Caregivers spent an average of **2.75 days** participating in the study and **2.8 hours** using Carebit

Number of Alerts:
- Mean = 85.75
- Min = 24
- Max = 122

Survey Responses: All of the **Caregivers** indicated that they somewhat agreed or agreed that Carebit was **useful**.

All Caregivers agreed that Carebit was **easy-to-use**.

3/4 Caregivers agreed that they **intend-to-use** Carebit in the future. One caregiver felt neutral.

Interview Feedback:

Positive Feedback: practical, straightforward, not privacy invasive, alerts are valuable

Negative Feedback: excess synchronizing, requested additional Caregivee data (e.g., glucose)

"Every time I clicked on the Carebit app I was able to see and **get those in-app notifications**. I think it is a great app and **wonderful tool** to take care of someone and kind of make sure everything is going okay with them."– P1, Caregiver

"**It's not intrusive** per say. It fits well." – P2, Caregivee

"It was very good. Other than the app would **send me notifications hours** later rather than in the moment." –P3, Caregiver

"Actually, **I increased my activity**. I knew I had it on and I wanted to walk as much as I could." - P3, Caregivee

"I liked the fact that **I could go to work** and still monitor my husband. It made me **feel more secure**. I felt like I was with him all the time. The only thing is **I wish it had some kind of alarm on it**, if the numbers went too low or too high. I didn't get a notification ring. " –P4, Caregiver

Discussion & Future Work

- In the future, we intend to recruit additional Caregivers and Caregivees to gain more insights about the usefulness of Carebit.
- Based on participant feedback, here are 3 areas of improvement for Carebit:
  1.) The Fitbit application often requires **manual syncing**
  2.) The **Carebit application notifications** are not sent consistently with the alerts
  3.) The **default settings** on the alerts results in excess alerts being thrown
- The strengths of this app are that it is able to provide the caregiver vital health data to monitor their loved one without being too privacy invasive.
- Once the app is finalized, we plan to commercialize it.

References

[1] "Caregiver statistics: demographics," Family Caregiver Alliance, September 2002.
[2] H. Nissenbaum, "Privacy as contextual integrity," Washington Law Review, vol. 79, no. 119, 2004.
[3] S. A. B. E. J. S. M. S. K. Qing Ye, Uzma Khan, "An analysis of diabetes mobile applications features compared to aade7: Addressing self- management behaviors in people with diabetes," Sage Journals, pp. 1–9, 2018.
[4] N. S. Y. A. A. M. A.H.T.E. De Silva, W.H.P. Sampath, "Development of a wearable tele-monitoring system with iot for bio-medical applications," IEEE, pp. 1–2, 2016.
[5] M. D. Technology, "A mobile application for diabetes," Proquest, pp. 1–5, January 2018.

Acknowledgements