Investigating Security and Privacy Practices in Childcare Apps

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Abstract

Parents and childcare workers commonly use mobile childcare apps to match with each other, communicate, and log data about the children in their care. Because children are a vulnerable population, and because of the power dynamics between parents and childcare workers, there are potential security, privacy, safety, and equity concerns with these apps. We investigated 10 Android childcare apps with different functionality in terms of childcare. We analyzed the apps technically with both static and dynamic analysis. We also qualitatively analyzed the user reviews in Google Play Store to understand the experiences of the users. Among our results, we find that there are feature limitations in these apps, and that they commonly include third-party trackers.

Childcare Apps Analyzed

urbansitter · Lillio · Sittercity · Procare SOLUTIONS · Care.com · brightwheel · bambino (Find. Book. Pay. Babysitting made easy.®) · nina care · care. · Babysits

RQ1: What features do the apps have?

Overview of method:

- **Read over reviews from customers from app reviews section**
- **Performed in-depth user analysis on how secure user-friendly**
- **Created a spreadsheet with features of each individual app**
- **Identified security misconfigurations/ privacy invasive features**

Manual app review findings:

App Name	Login	Subscription	Share photo	Punch-In and Out Times	Calendar
UrbanSitter	X	X	X	X	X
Procare	X	X	X	X	
Nina	X	X			X
Lillio	X	X			
Care (Hire Caregivers)	X	X			
Care (Find Caregiving jobs)	X	X			
Brightwheel	X	X			
Bambino	X	X			
Babysits	X	X			
Sittercity	X	X			

RQ2: What concerns do people have?

Overview of method:

- Studied Google Play Store reviews to identify common user experiences and concerns
- Aimed to understand user complaints and experiences with the app
- Provided qualitative data on user satisfaction and app functionality
- Highlighted concerns not evident through technical analysis alone

Summary of findings:

- Inconvenience and frustration caused by issues with software updates or other glitches in the apps
- Concerns about how slow apps are when loading and processing huge volumes of data
- Missing features:
  - No punch in/out times for childcare workers
  - Confusing and repetitive setup
  - Higher scam risk with payment only on booking (Bambino app)
  - Can't contact families before booking
  - Frequent logins needed as data isn't saved
  - Hard to find matches, especially outside cities
  - Can't see kids' check-in times or activities
  - Slow data entry and loading

RQ3: What permissions and trackers do apps use?

Overview of method: *Static Analysis using MobSF*
Static analysis aims to answer:

- Identify the permissions and trackers used by the apps, we employed static analysis using the Mobile Security Framework (MobSF).
- Analyze the application codebase to uncover potential security or privacy vulnerabilities.
- Provide insights into how these apps operate and what data they may be accessing or monitoring.

Summary of findings:

- **Permissions**: The apps generally request common permissions like receiving cloud messages, keeping the device awake, posting notifications, accessing the internet.
- **Trackers**: The apps frequently use trackers such as Google Firebase Analytics and Google CrashLytics.

For permissions, the apps predominantly request fundamental permissions such as `ACCESS_FINE_LOCATION`, `ACCESS_NETWORK_STATE`, and `INTERNET`, essential for their core functionalities, user connectivity, and data management.

For trackers, `Google Firebase Analytics` and `Google CrashLytics` are the most commonly utilized across these apps, indicating a strong focus on user analytics and crash reporting to enhance user experience and app performance. Many also include social features/trackers via `Facebook`.

App Name	Permissions	Trackers	Total
Babysits	24	6	30
Bambino	28	7	35
Brightwheel	17	4	21
Care	27	6	33
Caregiver	30	7	37
Lilio	41	8	49
Nina	29	3	32
Nula	13	2	15
Procare	19	4	23
UrbanSitter	16	7	23
Grand Total	**244**	**54**	**298**

RQ4: What are the network behaviors of the apps when run?

Overview of method: *Dynamic Analysis using HTTP Toolkit*
Dynamic analysis aims to answer:

- How does the application **behave during execution**, particularly in terms of **network communication** and **data handling?**
- We wanted to **observe** how it interacts in real time viewing the **traffic between the app and network**.

This is Future Work:
Unfortunately, due to limitations, for example, lack of experience, we are unable to run the dynamic analysis. However, this will still be our future work in this research.

Discussion and Conclusions

- Many childcare apps have feature limitations or buggy implementations that frustrate both caregivers and parents.
- Childcare apps generally use reasonable permissions; we did not note anything particularly concerning.
- Childcare apps commonly include trackers, usually for analytics/performance, but also social trackers predominantly from Facebook.
- Dynamic analysis of apps is technically challenging, due to the need to man-in-the-middle encrypted network requests and circumvent certificate pinning.