A Study for Improving Parental Engagement with Childcare Centers in New Zealand via Mobile Technology

Advance Mobile and Wireless Technology

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1. Introduction

Childcare centers play a vital role in daily lives of New Zealanders where it serves as the foundation for Early childhood education and care, facilitating professional parents' participation and supporting infants and toddlers in their holistic development. Childcare centers are increasingly incorporating digital tools to enhance communication, safety, education, and administrative efficiency with the rapid advancement of mobile and wireless technology. In this era where both parents often engage in the workforce, the demand for childcare services that provide more than supervision, but also educational and social development has increased. Childcare center provides early childhood education, care, and supports children's holistic development [1]. This report aims to explore the background analysis of New Zealand childcare services, evaluating the current business process.

2. Background Study and Analysis

As in many urban areas in world, the childcare industry in New Zealand consists of a variety of offerings, from private day care centers to community-based services. Around 96.8% of children in New Zealand attend childcare centers while every center is guided by the curriculum framework of "Te Whariki" [2]. However, parents always face difficulties in finding & selecting the right childcare service due to a lack of centralized information. They must navigate through various resources to get details about locations, availability, staff, facilities, and rates, which can be time-consuming and stressful. Searching for data on different platforms can waste considerable time and inefficiencies. Each resource can have its own interface, search parameters and methodologies for performing data, which increases the duration required to collect all essential information.

The flow of collecting information from dissimilar sources can be mentally demanding. It includes safeguarding accuracy, categorizing through many data, and comparing the best option. The parental side observes their decision-making flow regarding childcare as inactive and often depends on recommendations from others rather than actively discovering numerous options. This suggests a tendency towards accepting default options rather than actively engaging in a comparative analysis of available alternatives [3]. An Early Childcare center is considered a child's first environment outside of their home where they engage in both socialization and structural education [4]. Therefore, modern parents are more concerned about the quality of education provided by teachers in care centers.

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3. Business Process

The ministry of education provides a certain amount of funding for three to five years old up to a maximum of 6 hours per child per day and 20 hours per week as subsidy. [2] The number of children a childcare center can enroll and maintain depends on how big it is and where it is located. Info care is currently the most widely used system in childcare centers. The center's business process encompasses several key aspects:

- **Enrollment** – Information is received about the center's programs, philosophy, and enrollment procedures and followed by registration using manual paperwork for billing and tracking attendance.
- **Registration** - Parents interested in enrolling their children to the center fill in the form and schedule a visit to the center and move for the orientation program.
- **Communication** - Communication in childcare centers is multifaceted and vital for maintaining strong relationships between parents and caregivers. Regular updates and reports are provided to offer detailed insights into a child's behavior, keeping parents informed and engaged in their child's daily experiences. Information about upcoming events and activities are communicated through newsletters or digital platforms, allowing parents to participate and plan accordingly. In times of emergency, clear protocols ensure swift communication with parents, providing reassurance and updates as needed. [5]
- **Safety and Security** - Safety and security in childcare centers are upheld through a multi-layered approach. It begins with an inclusive risk valuation of the premises to identify potential threats, followed by the growth and operation of stringent safety policies and procedures. Staff members undergo rigorous training to ensure they are equipped to respond effectively to emergencies and maintain proper supervision of the children. Secure entry and exit procedures are enforced, along with regular drills to prepare for various emergencies. Furthermore, childcare centers prioritize well-being and cleanliness practices to prevent the spread of illness. Transparent communication with parents about safety measures and continuous evaluation and improvement of protocols ensure that the center preserves a secure environment for the well-being of the children under their care.
- **Emergency Preparedness Plans** - Childcare centers are designed with safety features, including equipment for fire suppression, sensors to detect harmful gases, and first

aid kits. child-sized furniture and equipment are also selected and arranged to minimize injury risks.

- **Staff Training** - All staff members receive training in safety procedures, including CPR, first aid, and basic childcare safety protocols. They are also trained to recognize signs of abuse or neglect and understand reporting procedures. [4]
- **Child Supervision** - Childcare centers always maintain strict supervision of children, both indoors and outdoors. Ratios of children to staff members are typically set and monitored to ensure adequate supervision and individual attention.
- **Health and Hygiene Practices** - Centers enforce strict health and hygiene practices to prevent the spread of illness and maintain a clean environment. This includes regular handwashing for children and staff, proper diapering and toileting procedures, and routine cleaning and sanitizing of toys, surfaces, and common areas.
- **Background Checks** - As mentioned earlier, thorough background checks are conducted on all staff members to ensure they have no history of criminal activity or child abuse.
- **Child Pick-Up Policies** - Centers implement strict policies for child pick-up, requiring authorized individuals to present identification and sign children in and out. This helps prevent unauthorized individuals from accessing the facility or removing children without permission.
- **Continuous Monitoring and Improvement** - Childcare centers constantly evaluate and update their safety protocols to ensure compliance with legal standards. This ongoing process of monitoring and enhancement is essential to keep the environment secure for children.

By implementing these safety and security methods, childcare centers strive to create a nurturing and protective environment where children can learn, grow, and thrive.

4. Overview of the Problem

Early childhood education (ECE) is crucial in New Zealand, especially for children from disadvantages backgrounds, as it sets them up for better academic and social development. According to a previous research study in New Zealand, children who participate in early learning programs tend to excel academically and socially throughout their schooling [6]

However, the high cost of childcare in New Zealand, often forces mothers to leave their jobs or seek unconventional childcare solutions, hindering their ability to participate in the workforce. [7] The government's "He Taonga te Tamaiti" — Early Learning Action Plan aims to ensure all children have access to early learning programs [8]. However, despite government 20 hours subsidies, childcare costs in New Zealand remain among the highest globally, exceeding $300 per week for children over three years old. [9] According to figure 1, it shows the cost of New Zealand childcare is among most expensive in the world specially compaired to the other countries in the region. [7]

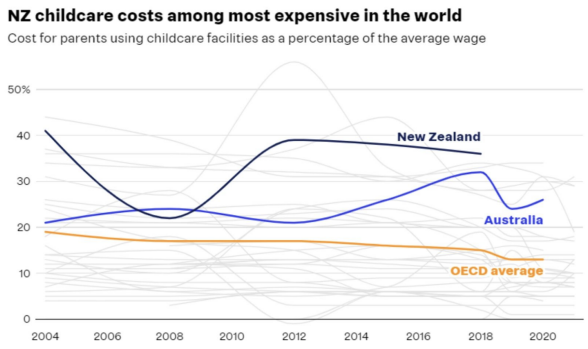

Figure 1: NZ childcare costs among most expensive in the world [10]

This financial burden leads many women to make career sacrifices or face difficulties finding affordable and quality childcare options [9]. As the figure 2 shows from a previous research done in new zealand, it appears that there's a reduced participation intensity of children between age 3-4, beyond the government concession of 20 hour period. [11]

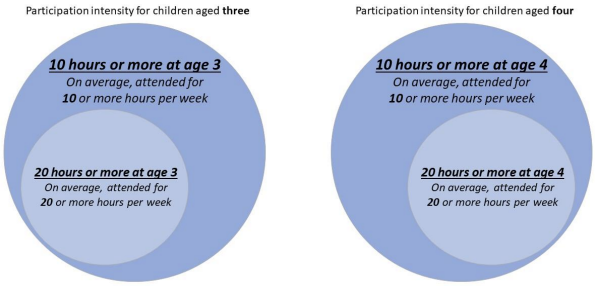

Figure 2: Participation intensity grouped by age and the number of hours [11]

It further shows that the childcare centers in New Zealand mostly operate independently, each with their own websites and communication channels. This decentralized setup causes inefficiencies for parents, experience teachers, especially new immigrants, who will require to individually contact multiple centers to inquire about availability, suitability and employment oppotunities. This fragmented system inconveniences for both parents and potential employees while posing challenges for childcare centers in reaching more potential clients and enrollment processes.

5. Analysis and Justification for the proposed solution.

As per the analysis, the issue of disconnected childcare centers in New Zealand underscores the need for a centralized communication platform to streamline the enrollment process to improve coordination between parents and centers. Addressing this problem can enhance accessibility, efficiency, and satisfaction for all stakeholders involved.

5.1. Analysis of potential solutions.

The issue at hand revolves around the lack of connectivity and centralized communication among individual childcare centers in New Zealand. Considering the facts and it appeared four, but not limited solutions as follows:

- **National Online Portal** - Develop a government-backed online portal that serves as a centralized platform for all childcare services across New Zealand.

  Benefits: This portal could provide comprehensive information on available childcare centers, including location, capacity, fees, programs offered, and staff qualifications. It would allow parents to apply to multiple centers through a single application form, track their application status, and receive updates.

  Limitations: The Early Childhood Council has already raised several concerns to the new government. [12] However, building such a centralized national platform could take a considerable time and will not be sufficient to address the current situation at hand as it requires an immediate solution.

- **Web Site** - Creating a website to function as a centralized platform for all childcare services.

  Benefits: Selecting a web-based application for centralized childcare centers will streamline operations, improve parent communication, ease managing regulatory compliance in childcare industry, and provide a safe environment for children.

  Limitations: Accessibility will be an issue due to the requirement of internet for every access. This may have communication interruptions. As far as security is concerned, there is always a risk of data breaches. A web-based method of communication will be costly.

- **Existing Applications** - Select and promote an existing childcare application that has subscriptions in the market to help address this issue.

  Benefits: Using existing applications for centralized childcare centers helps streamline related operations and will avoid investing for developing such a solution.

  Limitations: The government has issued specific guidelines for handling personal information offshore, stressing due diligence regardless of where providers process data. Providers are required to protect personal data, while agencies remain accountable for its privacy. [13] However, the prevalence of applications storing data in various countries poses limitations.

- **Mobile Application** - Create a mobile app for New Zealand market, making it easier for parents to search for childcare services on-the-go.

  Benefits: Mobile applicants improve efficiency and productivity by streamlining communications and tasks [14]. Enhance user engagement through personalized, interactive experiences and leverage smartphone features like GPS and cameras for innovative functionalities. Personalization improves customer service and loyalty, while accessibility allows for the convenience of using services anytime, anywhere [15].

  Limitations: Data privacy and security concerns due to the sensitivity of children's information.[16] The digital divide presents access challenges for some families, potentially exacerbating inequalities [17]. Over-reliance on technology can also reduce personal interaction between parents and caretakers. The need for substantial investment in training and infrastructure poses a challenge for resource-limited settings.

5.2. Justification for selecting the solution

In summary, creating a Mobile Application, offers a comprehensive and forward-thinking approach to addressing the childcare needs of parents in New Zealand. By embracing mobile technology, we can deliver a user-centric, accessible, and engaging platform that empowers parents with the tools and information they need to make informed decisions about their child's care. Therefore, out of the above discussed solutions, it appears developing a centralized mobile application is a more viable option.

6. Detailed Technical Discussion of the Solution

Technical overview of the solution can be broken down into two main aspects such as features proposed via the new childcare mobile application and high-level proposal for the technical deployment design of the solution.

6.1. Proposed Features in Mobile Application

The mobile app for a cenrtalized platform of childcare services offers instant access to vital information, engages parents with notifications, and simplifies center location through geolocation. It allows customization, seamlessly integrates with different existing systems of childcare centers, and will have capability to scale with future updates.

- **Mobile-First Accessibility** – A mobile-first approach to childcare services ensures instant access to vital information and services for parents, recognizing their reliance on smartphones for daily tasks.
- **Enhanced Engagement** - The mobile app engages parents with push notifications, updates, and alerts, promoting active participation in childcare.
- **Geolocation Features** - Using mobile device capabilities, the app utilizes geolocation for personalized recommendations, allowing parents to easily find nearby childcare centers and access relevant information, streamlining the search process efficiently.
- **Customizable Preferences** - The mobile app provides personalized experiences, allowing parents to customize preferences and receive tailored recommendations based on their needs.
- **Seamless Integration** - The app seamlessly integrates with the National Online Portal, providing a unified experience for parents. Data sync ensures consistency in the childcare search process.
- **Scalability and Futureproofing** - The mobile app offers scalability for future enhancements and updates, ensuring its relevance as technology evolves.

6.2. High-Level Deployment Design of the Proposed Solution

The proposed cross-platform mobile application solution while the backend is proposed to be deployed as microservices on cloud infrastructure, an API gateway for routing, an IAM component for authentication and a scalable database. The proposed design is as follows;

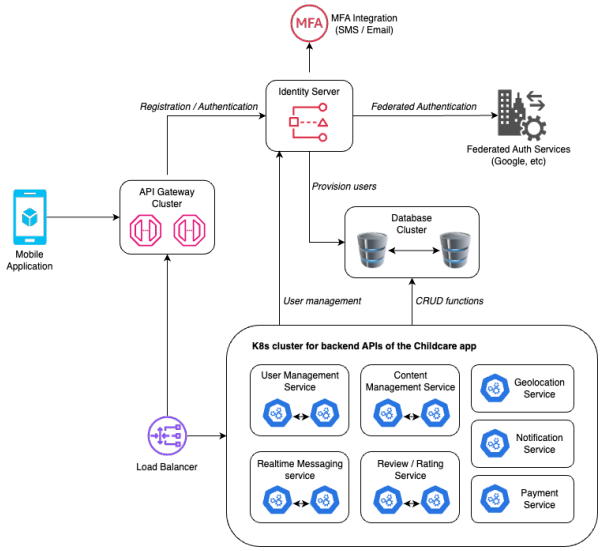

Figure 3: Deployment design diagram in high-level

- **Mobile Application** – Flutter framework is selected to develop the application due to the cross-platform efficiency, rapid and cost-effective app creation with a single codebase, and dynamic UI components make it a preferred choice for mobile app development. [18]
- **API Gateway** - MuleSoft has been chosen as the API gateway for its robust features, including centralized management, rate limiting, policy management, and seamless integration with various systems, enabling the development of a scalable and efficient infrastructure. [19]
- **Load Balancer** - Using a load balancer like Nginx or F5 ensures optimal performance, reliability, scalability, and availability by evenly distributing incoming network traffic, dynamically adjusting server resources, and automatically rerouting traffic away from unhealthy servers. [20]
- **IAM server** - Okta was chosen as a flexible and comprehensive identity management solution that offers customizable policies, automation for streamlined operations, and robust security features including multi-factor authentication. [21]
- **Database Server** - A non-relational database, MongoDB was selected due to it's renowned for supporting complex mobile apps with transactional, search, and analytical features, it excels in managing large volumes of unstructured data with flexibility.
- **Micro-Service Cluster for backend APIs** - Scalability and independent functionalities are enabled through microservice architecture in this communication platform which helps for flexibility and service uptime maintenance.

7. Conclusion

In conclusion, the comprehensive analysis of early childhood education (ECE) in New Zealand underscores the critical need for accessible, efficient, and quality childcare solutions, particularly in addressing the challenges faced by parents in New Zealand. The proposal for a centralized mobile application emerges as a viable and forward-thinking solution, promising to leverage mobile technology to enhance accessibility, engagement, and user experience. This initiative not only addresses the immediate challenges of connectivity and communication among childcare centers but also lays the groundwork for a more integrated and responsive centralized system in New Zealand.

References

[1] I. Duhn and J. Ritchie, "Making "eco-waves": Early childhood care and education sustainability practices in aotearoa new zealand," *Children, Youth and Environments*, vol. 24, no. 2, p. 123, 2014.

[2] M. of Education, "Education in new zealand," https://www.education.govt.nz/our-work/our-role-and-our-people/education-in-nz/, 2023.

[3] S. J. Barraclough and A. B. Smith, "Do parents choose and value quality child care in new zealand?" *International Journal of Early Years Education*, vol. 4, no. 1, p. 5–26, Jan 1996.

[4] M. Fenech and J. Sumsion, "Promoting high quality early childhood education and care services," *Journal of Early Childhood Research*, vol. 5, no. 3, p. 263–283, Oct 2007.

[5] L. Mitchell, M. Haggerty, V. Hampton, and A. Pairman, *Teachers, parents, and whānau working together in early childhood education*. New Zealand Council for Educational Research Wellington, New Zealand, 2006.

[6] M. of Education, "Early learning participation," May 2023. [Online]. Available: https://www.educationcounts.govt.nz/__data/assets/pdf_file/0003/208713/Early-Learning-Participation-Final-1.pdf

[7] I. Sin, "Access to childcare interim report 2: How persistent are issues with access to affordable childcare?" https://women.govt.nz/sites/default/files/2022-04/Access

[8] M. of Education, "Education in new zealand," https://conversation-space.s3-ap-southeast-2.amazonaws.com/SES_0342_ELS_10YP_Final+Report_Web.pdf, 2019.

[9] M. Duff, "I can't afford to work: 'free' childcare is a myth, and costs for parents are high," https://www.stuff.co.nz/national/300696444/i-cant-afford-to-work-free-childcare-is-a-myth-and-costs-for-parents-are-high?rm=a, Sep 2022.

[10] C. P. A. Group, "Election 2023: Early childhood care and education toolbox," https://www.cpag.org.nz/media-releases/election-2023-early-childhood-care-and-education-toolbox, Aug 2023.

[11] M. of Education, "Early childhood education participation intensity measure," Nov 2023. [Online]. Available: https://www.educationcounts.govt.nz/__data/assets/pdf_file/0003/195816/ECE-Participation-Intensity-Measure-June-2023-Results.pdf

[12] M. Abbas, "New zealand's daycare shortage crisis: Parents wait over a year," Nov 2023. [Online]. Available: https://bnnbreaking.com/breaking-news/education/new-zealands-daycare-shortage-crisis-parents-wait-over-a-year/

[13] N. Z. G. digital.govt.nz, "Guidance — risk discovery tool for public cloud," Jul 2023. [Online]. Available: https://www.digital.govt.nz/dmsdocument/251~guidance-risk-discovery-tool-for-public-cloud/html

[14] M. Sarwar and T. R. Soomro, "Impact of smartphone's on society," *European journal of scientific research*, vol. 98, no. 2, pp. 216–226, 2013.

[15] A. A. Shaikh and H. Karjaluoto, "Mobile banking adoption: A literature review," *Telematics and informatics*, vol. 32, no. 1, pp. 129–142, 2015.

[16] P. Commissioner, "New zealand privacy act 2020 changes," 2020. [Online]. Available: https://www.privacy.org.nz/assets/New-order/Resources-/Publications/Guidance-resources/Privacy-Act-2020-information-sheets-full-set.pdf

[17] G. Di Pietro, F. Biagi, P. Costa, Z. Karpiński, and J. Mazza, *The likely impact of COVID-19 on education: Reflections based on the existing literature and recent international datasets*. Publications Office of the European Union Luxembourg, 2020, vol. 30275.

[18] W. S. El-Kassas, B. A. Abdullah, A. H. Yousef, and A. M. Wahba, "Taxonomy of cross-platform mobile applications development approaches," *Ain Shams Engineering Journal*, vol. 8, no. 2, pp. 163–190, 2017.

[19] B. Zylstra, G. Netscher, J. Jacquemot, M. Schaffer, G. Shen, A. D. Bowhay, T. L. Braley, K. L. Possin, B. L. Miller, A. M. Bayen *et al.*, "Extended, continuous measures of functional status in community dwelling persons with alzheimer's and related dementia: Infrastructure, performance, tradeoffs, preliminary data, and promise," *Journal of neuroscience methods*, vol. 300, pp. 59–67, 2018.

[20] D. Tudor, G. Macariu, C. Jebelean, and V. Cretu, "Towards a load balancer architecture for multi-core mobile communication systems," in *2009 5th International Symposium on Applied Computational Intelligence and Informatics*. IEEE, 2009, pp. 391–396.

[21] W. Fang, S. Ding, Y. Li, W. Zhou, and N. Xiong, "Okra: optimal task and resource allocation for energy minimization in mobile edge computing systems," *Wireless Networks*, vol. 25, pp. 2851–2867, 2019.