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Using Real-Time Crowd Data to Reduce Overstimulation and Anxiety in Adolescents and Young Adults

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ABSTRACT: Crowded public spaces often cause intense anxiety and sensory overload for neurodivergent youth, limiting their independence and daily functioning. Through this project, results showed that the group of surveyed neurodivergent individuals (13-24) in Massachusetts would most likely experience reduced anxiety when given access to real-time crowd data before visiting public spaces. Interviews resulted in qualitative data and were based on a small sample size. The interviews revealed that the majority of participants who experienced increased anxiety in crowds valued simple features like notifications of peak times, which will help them plan daily activities more comfortably. Additionally, customizable features to work with their preferences, such as environment, noise levels, and more. The secondary research confirmed that the majority of neurodivergent youth avoid grocery stores, gyms, and community centers due to sensory issues, and the app could directly address this barrier by giving them tools for a less overwhelming experience. Analysis of both primary and secondary data confirmed the proposition that providing reliable real-time crowd tracking increases independence, reduces social isolation, and helps close mental health disparities for neurodivergent youth. This research highlights the potential for expanding real-time data about different environments beyond Massachusetts.

KEYWORDS: Entrepreneurship, Social and Behavioral Science, Neurodivergent, Independence, Anxiety.

Introduction

Neurodivergent teens and young adults with anxiety or sensory sensitivities frequently encounter challenges in navigating crowded public spaces. They are unable to predict the noise, lighting, or density of crowds, often leading to the avoidance of essential activities.

The affected population primarily includes individuals aged 13-24, specifically neurodivergent youth with conditions such as autism, ADHD, or social anxiety, as well as those with milder sensory sensitivities. In Massachusetts, nearly 18.2-18.4% of young adults experience anxiety disorders, and urban and suburban environments with frequent crowds heighten the challenge.[1] Additionally, about 20% of Massachusetts teens are experiencing a mental health disorder, and 31.9% are facing anxiety disorders.[2]

The state largely contains middle-class families, with most owning smartphones but lacking access to specialized mental health support or alternatives. Current trends indicate that affected individuals prefer digital tools that increase predictability, reduce anxiety, and allow participation in public spaces.

The study of over 10,500 Spanish adults with high sensory processing sensitivity found that individuals with high overstimulation experienced significant anxiety in everyday social interactions and crowded environments.[1] For example, participants reported feeling mentally exhausted and overwhelmed when exposed to crowded areas or overstimulating environments, leading them to withdraw from social situations or avoid public places. High overstimulation was also linked to lower vitality, increased body pain, and a greater tendency to use unhealthy coping strategies such as self-criticism and social withdrawal. These findings illustrate how sensory overload can directly affect mental and physical well-being, especially in situations where social demands are high. These results connect to research on supporting neurodivergent adolescents and young adults in crowded or socially intense settings.[3]

Overstimulation can trigger anxiety, prompting avoidance behaviors that limit participation in daily activities and reduce quality of life.[4] By understanding how overstimulation causes stress in public spaces and social interactions, tools such as real-time crowd tracking apps can help highly sensitive individuals prepare and manage anxiety, making social environments more accessible and reducing sensory overload-related stress.

Existing tools provide vague crowd information but fail to offer detailed sensory data or real-time updates, leaving a clear gap in user needs. There is an increased demand for a mobile application that provides accurate, customizable updates on both crowd density and environmental sensory factors, enabling individuals to plan outings and maintain autonomy.

The absence of suitable tools limits independence, reduces participation in essential activities, and contributes to mental health challenges. neurodivergent youth are nearly twice as likely to experience anxiety or depression compared with neurotypical peers, highlighting the severity of the problem. This is evident in Figure 1 because, as the rate of autism in adolescents and individuals is growing, so is their level of anxiety. This clearly emphasizes the issue of the absence of tools that will promote independence, because with anxiety, individuals are more likely to face overstimulation and have a shutdown.[5]

The proposed solution is a mobile application that tracks real-time crowd density and environmental sensory factors such as noise and lighting. Its primary features include a live map of locations such as stores, gyms, and coffee shops. The app

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will also include a forecast of busy periods, personalized alerts to prevent overstimulation, and user-generated reporting to improve accuracy. Development will rely on smartphone location data, user feedback, and potential partnerships with public venues to access more detailed information.

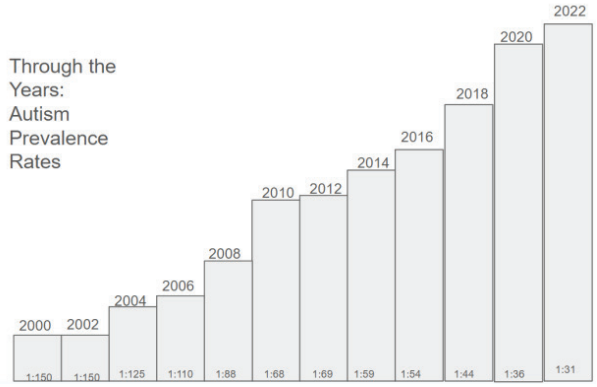

Figure 1: Data on the increase in Autism in the last 2 decades. Based on CDC surveillance data, it is shown that annually, the rate of young adults facing autism is growing, which emphasizes the need for a tool that could prevent spikes of anxiety in these individuals.
Bohnsack, Chris. "CDC Releases New Autism Prevalence: 1 in 31 Children in the U.S. Identified With Autism." Southwest Autism Research & Resource Center (SARRC), April 16, 2025. Accessed August 24, 2025. https://autismcenter.org/autismprevalence/.

As of right now, the demand for real-time crowd and sensory data is partially addressed by general navigation apps and social media, which provide basic crowd estimates for stores, gyms, and public venues. Some venues display projected peak hours online. However, these tools focus primarily on crowd size and do not account for noise, lighting, or other sensory triggers. The market reports that existing solutions lack personalization, accuracy, and real-time updates, which limits their effectiveness in reducing anxiety or sensory overload.

Currently, few producers are providing real-time crowd information, and very few address sensory sensitivities or anxiety-specific needs. The market is concentrated around crowd estimation apps, which offer basic data but lack customizable alerts or live sensory information. Most times, those statistics are inaccurate and don't update frequently. Most products are widely available online, though smaller developers may face challenges acquiring sensors to track crowds or tools to predict the environment, limiting their ability to compete.

The current research aims to explore the extent to which neurodivergent individuals face excess anxiety and overstimulation in a public outing, causing them to leave or have an unpleasant experience.[6] The implementation of a mobile application that provides real-time crowd density and sensory information will reduce anxiety and sensory overload for neurodivergent teens and young adults, enabling them to plan outings more confidently and participate in public spaces with greater independence and comfort.

Methods

Procedure:

10 neurodivergent individuals aged 13 to 24 were interviewed to collect primary data on experiences with crowded public spaces and sensory overload. 5 interviews were conducted online, and 5 were conducted in person. All participants provided consent to share their responses, participation was voluntary, and they were able to skip any questions they did not feel comfortable answering. The interviews began with simple, open-ended questions to allow participants to share general experiences, which then led to more in-depth questions to explore how crowding and sensory overload affected their daily routines.

Questions included:

- Are you currently diagnosed with Anxiety, Autism, or any behavioral challenge?

- How does overstimulation affect you in a public place? If it does, how do you try to overcome the challenge?

- How many times in the past few weeks have you faced overstimulation?

Each interview lasted approximately 15 to 30 minutes, depending on the degree to which the topic impacted the participant's daily life. Responses were kept anonymous and used solely to understand the development of a mobile application designed to help neurodivergent adolescents and young adults navigate public spaces more comfortably.

Table 1: Description of the diagnoses and behavioral challenges faced by the interviewees. This data table, based on the interviews, shows the diagnoses of individuals interviewed. Most of the interviewees had been diagnosed with autism.

Of the 10 surveyed neurodivergent young adults (13-24)	
Diagnosed Autism and face overstimulation	7
Undiagnosed Autism and face overstimulation	3

The secondary research conducted for this study focused on understanding the prevalence of crowd-related anxiety in neurodivergent adolescents and young adults, exploring strategies for grounding, avoidance, and sensory regulation, and identifying market trends and data relevant to potential app users. The research questions helped determine how common crowd-induced anxiety is among neurodivergent young adults, what coping mechanisms are currently used, and how existing tools and services fail to address these needs.

Results

Data Collected:

The data collected from both primary and secondary sources provides insight into the proposition that a mobile app offering real-time crowd and sensory information would meet a significant unmet need for neurodivergent individuals.

Primary Data Analysis: Qualitative Interviews:

The qualitative interviews revealed that crowded public spaces such as grocery stores, gyms, and malls frequently trigger anxiety and sensory overload for neurodivergent individuals aged 13 to 24 in Massachusetts. There were 3 main themes that emerged: avoidance behaviors, coping strategies, and trust

in technology. Participants reported avoidance behaviors and reliance on the Google Maps data, which was usually inaccurate. One stated, "I went on Google Maps before going to Market Basket once, and it was inaccurate. Google Maps stated that around 8 a.m., it is the least busy on the weekends, but it was packed, and I was so overstimulated that I left." Many expressed a strong desire for accurate, real-time updates that included sensory-specific details such as noise levels, lighting, and overall environment intensity. Customizable notifications and updated quiet hours were frequently mentioned as features that would improve daily experiences and increase confidence in public settings. Customization promotes accessibility for all different users regardless of disabilities or any type of barriers. The interviews consistently highlighted a gap in current tools, emphasizing the importance of specificity and personalization in crowd-sensing technology. Additionally, many expressed coping strategies such as mindbreaks, breathing methods, but in the end, they said it would be a more efficient process if there was an app that they could trust to keep track of environments and crowd levels.

Interviewees also suggested making a feature to select stores to their liking, such as places like Target, Walmart, Costco, and big chains. Additionally, participants stated that the app should have a feature to set preferred times to go out. With that, the app can then send a notification with how busy the place is, and users can use that to decide what to do. Ultimately, the interviewees stated that they would prefer a customizable approach.

Furthermore, as seen in Figure 3, many of the individuals decided to leave the public space due to overstimulation. It is evident that overstimulation is currently difficult to manage, and access to real-time data is essential for effectively reducing it. This is because overstimulation overwhelms the brain's ability to process information, and this triggers the body's stress response, making it harder to adapt to the environment. Although some do try to stay and overcome the challenge, most individuals cannot.[7]

Additionally, as seen in Table 1, all individuals faced overstimulation at least once in a public environment. Some of the individuals were not diagnosed with anxiety or autism, and also did not have any behavioral challenges, but still faced overstimulation. That emphasizes the need for real-time data because overstimulation in public places impacts more than just individuals with autism.

Table 2: How overstimulation affected the interviewees and how they decided to handle the situation. This data table, derived from the interviews, highlights the comparison of individuals who had to leave a public space due to overstimulation.

	Experienced overstimulation or sensory overload at a public space but stayed and tried to overcome the challenge.	Experienced overstimulation or sensory overload at a public space and left the place due to the impact.
Male (3)	2	1
Female (7)	5	2

Within the interviews, several divergences appeared in how neurodivergent individuals experienced and managed overstimulation. Some participants reported grocery stores and gyms as their most overwhelming environments, while others emphasized social events, concerts, or even public transit as the hardest to navigate. A few interviewees described leaving spaces immediately when overstimulated, but others preferred strategies such as finding quieter corners, using headphones, or waiting out the crowd. There were also differences in perceptions of technology. While many saw potential in real-time crowd updates, others doubted whether any app could truly capture the unpredictability of public spaces. These divergences highlight that although there is a need for better support, the specific triggers and coping mechanisms varied widely across individuals.

Secondary Data Qualitative and Quantitative Market Research:

The research revealed that individuals with other health conditions, such as high blood pressure, diabetes, or chronic stress, often experience heightened anxiety in crowded environments.[5] Many of these individuals rely on online ordering, pickup, or home delivery to avoid the stress of crowded places, indicating a clear behavioral trend that supports the need for tools providing real-time crowd data.[6] In Massachusetts, there are approximately 900,000 individuals aged 13 to 24, and studies indicate that roughly 18.2-18.4 percent of this population experiences anxiety disorders or sensory sensitivities triggered by the environment.[7] The most frequently avoided locations include grocery stores, gyms, and malls, particularly during afternoons and weekends.

This data complements the primary interviews by providing a broader understanding of the potential market size and showing the limitations of existing tools. While interviews offered detailed personal experiences, the secondary research gave quantitative context and background information on neurodivergent youth and the disorders. Additionally, through primary interviews, it was evident that many of the neurodivergent individuals faced excess overstimulation in public spaces. They also expressed the usage of coping strategies, such as apps that can help their brain calm back down.

Evidence showed that using breathing strategies is useful and effective for neurodivergent individuals because it allows their brains to reset.[8]

■ Discussion

The qualitative data gathered in the interviews showed initial support for the proposition that neurodivergent individuals face excess anxiety and overstimulation in a public outing, causing them to leave. The primary interviews and secondary research suggested that crowded public environments such as grocery stores, gyms, and malls frequently trigger anxiety and sensory overload for this population. Convergences across the data revealed consistent avoidance behaviors and reliance on inaccurate third-party information, confirming that there is a real and unmet need for accurate crowd data. These convergences supported the proposition by showing that users want

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accurate tools to make informed decisions about when and where to go. Additionally, both primary and secondary data emphasized the importance of customizable notifications, preferred locations, and quiet hour alerts, highlighting that personalization is essential for use.

Divergences highlighted considerations for the app design. While secondary data indicated widespread interest in crowd tracking apps, some interviewees expressed hesitation about trusting new technology unless reliability could be verified. This revealed that simply providing real-time data is insufficient. Trust, accuracy, and transparency are the main concerns of the app and should be clearly addressed.

Several challenges were encountered during the study, primarily related to participant recruitment and data accuracy. Finding neurodivergent individuals aged 13 to 24 who experienced anxiety or sensory overload in public spaces proved more difficult than anticipated, which limited the sample size and diversity. The biggest limitation is the fact that there are only 10 interviewees, which limits the generalizability of the data.

All participants were recruited through the interviewer, which may have resulted in a sample more aware of or concerned about anxiety and sensory challenges than the broader population. Additionally, the study focused exclusively on one age group and geographic area, limiting generalizability. The sample size for interviews was small, and participants' concerns about data accuracy were not fully explored through secondary sources.

Implications for future implementation:

Based on participant interviews and their real-life experiences, an app made as a promising solution could help manage anxiety and overstimulation. It could provide real-time crowd density, noise, and lighting levels, customizable notifications, and an accessible, low-stress interface for neurodivergent individuals aged 13 to 24. The system could focus on smartphone location inputs, public sensors, and user feedback to deliver timely updates and personalized alerts.

Participants also raised concerns about the reliability of real-time sensory data, revealing a gap between user expectations and current technological limits. While the interviews offered rich qualitative insights, they could not capture long-term usage patterns or determine which features most effectively reduce anxiety across different subgroups. Some users also feared becoming too reliant on the app, worrying that consistently overwhelming readings might discourage them from going out altogether. These concerns helped clarify that the concept has value, but its success depends on dependable data, personalization, and attention to behavioral support.

Crowd-related anxiety remains a major barrier for neurodivergent young adults, and public health and market reports show rising demand for digital tools that offer tailored sensory information. The findings indicate that a well-designed app with customizable alerts and real-time data could help users navigate public spaces more comfortably. Future work could explore long-term behavioral impacts, usage patterns, and which sensory metrics are most helpful, as well as expand research to additional age groups and geographic or demographic contexts.

This gap highlights a clear opportunity for a new product that prioritizes accuracy, real-time updates, and customization, offering features such as personalization of preferred locations, alert notifications for low crowd periods, preferred timings, and adjustable filters for specific environmental triggers. By addressing both crowd density and sensory-specific needs, the app can differentiate itself from existing navigation and wellness tools while providing accurate and efficient data.

The data should be collected ethically by making sure all users consent to how their data will be used. However, if they don't want their data used, they can use a version that shows an estimated number of people and environment checks. The app could help people, but also respect how their data is shared. We must gather data from a vulnerable population and make sure all the data that is estimated is from past, accurate, and real-time data.

■ Conclusion

This study highlights the potential of a mobile app providing real-time crowd density and sensory environment information to support neurodivergent teens and young adults in Massachusetts. Currently, many neurodivergent individuals experience anxiety when overstimulated, and that leads to lower independence and avoidance of certain public places. The research demonstrates that anxiety and sensory overload in public spaces remain significant barriers to participation and that accurate, customizable, and reliable crowd data could improve confidence and decision-making. The app could be highly customizable so that all different users can use it with ease. Additionally, the app should have features where users can consent to their data being used. This will ensure that the app is ethical and transparent to all users. The findings suggest that a digital tool prioritizing personalization and user-friendly design can meet an unmet need. As well as help limit excess anxiety in neurodivergent individuals.

Additionally, public institutions and universities can integrate this tool to improve accessibility for students with behavioral challenges or disabilities. There can be a feature to show the environment of a certain class, and students can use the app to filter classes by their specific needs. This will be highly beneficial for students who are neurodivergent and struggle in noisy or crowded areas.

Furthermore, partnerships with public transit could be beneficial because many neurodivergent individuals avoid public transport because it is hard to predict how many people will be there. With an app that shows the current crowd size and predicts how many people will be there later, individuals can plan their trip more easily.

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I attest that the ideas, graphics, and writing in this paper are entirely my own.

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Author

Vanshika Seku is a senior in high school. Hers ultimate goal is to start a business where people who are underprivileged can learn how to manage their own finances at a low cost. She believes that everyone, no matter their background, should be able to be financially stable. The proposed in my research is to make an impact on individuals through hers work and have a role in my own community to serve as a leader and look out for members in my community. Thank you so much for taking the time to read and support my research.

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