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Smart cities and how they affect those with disabilities

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Smart Cities and How They Affect those with Disabilities

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Dedication

To my amazing father who stood by me through everything and taught me to never say I can't do something without giving it a chance. Who pushed for me to be accepted into honors at a young age.

To my birth mom, who isn't here anymore, but inspired me to work my hardest.

And to my amazing Bonus mom who reminded me to be kind to myself and to focus on my goals ahead. And for listening to me rant about courses for weeks on end.

To my little sister, who might not understand what I'm talking about, but will listen and try to understand, and then encourage me to go play.

I couldn't have done it without all of you supporting me. I love you all.

To my director, for teaching me and helping me get to this point.

To my thesis committee as a whole, for joining me in this journey and providing support throughout this process.

To all those who struggle with disabilities and being heard by others.

And finally, to myself, for following through even with the courses got tougher and the struggle increased. Perseverance is key.

Abstract

This study investigates how to further improve the lives of people with Autism and Cerebral Palsy when it comes to the development of Smart Cities. This is an effort to provide a glimpse into the perspective of those with these disabilities when it comes to technological advancement. The focus of this study was Chattanooga,Tennessee and Los Angeles, California. These two cities are respectively on the East and West side of the country. Thus, there is of course a difference when how these two cities function. This was done through research under the guise of a question and answer methodology. The process took several months and looked at many different aspects. These aspects included Transportation and Buildings, drawbacks of smart transportation and buildings along with fears and myths that many believe about Smart Cities. There is also discussion about what steps a City can take to reduce risk and inform those under their care to the positive aspects of Smart Cities. It also dictates how to properly start the implementation and whom to reach out to. This research has shown that there is plenty left to be done to properly integrate those with disabilities into Smart Cities. There is still a long way to go to get to a perfect Smart City and it is important to look at these aspects now instead of finding issues later on in the future. By doing small scale projects, it will allow those involved to get used to the idea and implementation of Smart Cities.

Table Of Contents

Introduction

With how society is advancing, there comes the topic of Smart Cities. There has been research done by many about how Smart Cities will work. Smart cities for those that do not know are places where technology has become integrated into the city for the people within the city. Smart Cities as a whole are made to make life simpler and easier for those within them and those that visit. This can include Smart Buildings, Smart Transportation, and Smart Grids. This can be done through updating the architecture within the city and making transportation more accessible for many. Smart Cities may have buildings with sensors on them that show those in charge who enter the buildings and facts about them thus allowing the owner to shift priorities to their major demographic and see where they can improve. We are already seeing smart transportation within Chattanooga as well. This includes the apps that we utilize to pay for parking around the city. It can even extend to traffic lights and make them more discernible with things such as different shapes as well as different colors.   However, how does the creation of these cities affect people with disabilities? Namely Cerebral Palsy, a congenital disorder that affects the body's ability to move along with aspects such as motor skills, and Autism which can affect the brain's ability to process different forms of information and emotions. These are two main disabilities with Cerebral Palsy in the United States being found "1 in 345 children" per the CDC website [1]. In fact, I have Cerebral Palsy albeit a mild form of it. Autism as well is found throughout the United States at a rate of "1 in 44 children" as well [2]. That makes these two extremely prevalent in our world today. There is a need to address this as society moves forward

with integrating technology within cities until society can develop into fully functional smart cities. Society cannot forget those with different abilities and the things that these people go through.

Background

The research that has been done is to answer questions posed by myself. These questions include how will it affect someone with Cerebral Palsy's ability to get around? Would it make it easier for them? Are there more ways to ensure help? For how it would affect those with autism questions, is there a way to make it less overstimulating? And overall, how would it improve their lives? The research that has been gathered is from many different studies including those done in other countries and right here in the United States. Most of these studies do make mention of how it affects these disabilities, however, I believe that many researchers do not look at it from a disabled viewpoint. Thus, I believe that I can add a fresh viewpoint with these sources and how it will affect people. As many of us know, everything can change with a slight change of view, which is where I hope to improve the previously done research. I hope to raise questions that might have been previously unnoticed along with solutions that can hopefully be used. Or if not, how the cities could focus on improvement for the future.

There are many different Cities I could have chosen to focus on, however, I am going to look at Chattanooga and Los Angeles and compare how these two cities might address the issue of disability in smart cities. Chattanooga has a disabled population of 10.8 percent as of 2021 according to the census that was done recently[3]. Los Angeles has a disabled population of 9.9

percent [4]. Thus, it is two different populations and two different cities, however, the questions that I have previously addressed and will continue to address throughout this paper.

Methodology

I have decided to make a comparison between Los Angeles and Chattanooga should the two become smart cities. I will access this information through different published sources that I have found throughout my research. This will include city websites and different news stories or studies. These questions are as follows:

1. How do these cities treat people with disabilities currently?

2. How will smart cities affect people with Cerebral Palsy and Autism?

    a. Defining Accessible Transportation and the effect it can have on those with these disabilities

    b. Defining Smart Buildings and the effects on those with these disabilities

3. How will it improve their lives and in what ways?

    a. Transportation Improvements

    b. Building Improvements

4. What challenges might people face?

    a. What drawbacks can we expect through transportation?

b. What drawbacks are possible through Smart Buildings?

c. Smart City Myths and Fears debunked

5. In what ways can the city help to mitigate these challenges?

These questions will be answered in a comparison style between the two chosen cities. I plan to gather information through the sources that I have gathered. I will then report my findings in question-and-answer style paragraphs. At the end of the paper, I will compile the evidence and offer some solutions that might not have been presented previously.

Current Treatment

With the idea of Smart Cities, one must first examine the treatment these marginalized groups face before they can process the necessity of these Smart Cities. So, how does Los Angeles treat people with Autism and Cerebral Palsy? California tends to identify those with autism faster and at a younger age, thus allowing people to get more resources at a young age [5]. And the majority of these people live in Los Angeles, however, a look into the medical reports shows that the information many of these parents receive about their child might reveal a bit more than the parent wishes, not only about their child but about themselves. As the phrase, 'Autism Parent' becomes used more, the parent must be careful with how they present themselves to not only appear knowledgeable but also without being seen as vulnerable when it comes to how they sit up something as simple as an IEP, also known as a Individual Education Plan, meeting for their child, since they have autism [6]. There is also a known discrepancy with the medical records, as when a child is observed by one doctor, all they might see is disinterest when

it is in reality the autistic inability to imitate [6]. But as the child progresses, some of the challenges they may face come to light. Many of those with disabilities have a lower quality of life with more bad days than those without, with an average of 6.8 more bad days a month [7]. There is also more housing instability, thus more food insecurity as well for those with disabilities [7]. However, most likely out of necessity, more adults have access to regular care, but they still face difficulty receiving the care and thus less support services that they need to function properly [7].

People with Cerebral Palsy in Los Angeles have many options for how they can get help. Los Angeles has the United Cerebral Palsy, a non-profit organization, that has a collection of information available for those with developmental disabilities [8]. This can help parents and children find the proper care they need. According to UCLA Health, they treat children throughout their entire lives thus making sure the child care stays local [9]. They even have different treatments for those with cerebral palsy to help them. Thus, people in Los Angeles can expect to get good care when it comes to cerebral palsy.

Similarly, in Tennessee as a whole, there is a Council for those with Autism, and at the time of this writing, nine members of the council either have autism or are primary caregivers [10]. The goal of this council is to create a way for people with autism in the State to get the help they need when they need it. Even the local university has a program called Mosaic to support students with autism specifically. The Chattanooga Autism Center hosts an Autism Conference and has for the last thirteen years. [11] It includes presentations from Parents on how to help their kids and for people with autism to learn new ways to have some sort of control and things

that can help them. They even have people there to help with the transition from childhood to adulthood, along with creating sensory-friendly experiences [11]. Thus, Chattanooga is helpful when it comes to Autism.

Cerebral Palsy in Chattanooga, however, does not have as big of a focus. There are preschools such as Siskin Children's Institute that take children with disabilities, however, there is not a big focus on supporting those with Cerebral Palsy outside of that. While there have been some good stories about people in the area getting the help they need, there is not much information to be found on what groups can help or provide care for these children. And from this author's experience, many of the doctors that focus on this tend to be out of state or in bigger cities. Thus, more support is needed in that area for Chattanooga and the surrounding areas.

1 How will Smart Cities Affect People with Autism And Cerebral Palsy?

A question that must be asked when one is looking at new concepts is how it will affect everyone, not just the neurotypical or abled-bodied. The two concepts this section will discuss are transportation and smart buildings and the benefits they will provide. Transportation such as things such as traffic lights, cars with sensors, and things of that nature. The second part, Smart Buildings, which make up the Smart Cities is important as they collect data that is necessary to adjust for what is happening. This section will focus on the positives of these two concepts. Later on, the negatives of the implementation of these Smart Cities will be discussed.

1.1 Defining Accessible Transportation and the effect it can have on those with these disabilities

When it comes to what is being defined as accessible transportation, some factors need to be considered. There are the concepts of wheelchair accessibility and vehicles such as smart buses which will be discussed. To put into perspective how much accessible transportation matters, a 2020 study found that "only 32.50%" of people with limited availability to a metro station and only "48.4%" of households with a disabled person have a car to utilize [12]. Thus, more accessible transportation would allow more freedom that does not require the amount of planning that some trips would take as many times a person has to make plans days in advance to even have access to the items, people, or things they would need for appointments But in this description, what are we accounting for when discussing smart transportation? In this report, the focus will be on the ability of concepts such as public infrastructure mobility with traffic lights and sensors; along with inventions such as smart cars are big steps towards a safer future for all.

Smart Cars, which we are seeing more of as we go along, can make it easier for a person to drive a car. Numerous advantages come from these cars such as accessible handle knobs and cars that allow the user if they are in a wheelchair to wheel themselves in completely to the car and drive from their chair instead of having to fold up their chair and take more time. However, there is also the factor of public transportation which would be easier to fix. Another factor is things like traffic lights and the reaction time. With accessibility in mind, cities can take into account different reaction times for traffic and how to enhance everyone's safety which will allow those who might have slower reflexes to properly react which will then enhance safety all

around. This will also enhance a person's ability to get through the city with better routes which can streamline things and thus cut back on things such as overstimulation in the context of public transportation which many autistic people face in their day-to-day lives.

The public infrastructure is a big part of this as conveyed in the earlier section. Public officials when planning need to consider the accessibility of their cities. A big part of this as mentioned previously is in public transportation itself being updated to help those with disabilities. The fact that Smart Cities can collect and utilize data to see what areas need improvement every few months and thus utilize that information to provide a better experience for everyone, not just disabled people. This allows the city to develop to meet the needs of the people and allows better transportation and accessibility for everyone across the board.

1.2 Defining Smart Buildings and the effects on those with these disabilities

Smart Buildings as well are a key infrastructure when it comes to smart city planning. Smart buildings in this context, are buildings that are connected through a system of automated devices that can control how the occupants of a building feel. For example, the lights can be controlled by the system depending on the amount of occupants. The temperature as well can be automatically changed. In the sense of a smart building, a person would not have to think about these things or how they could use them. However, how does this affect those with Cerebral Palsy and Autism?

As mentioned previously in this report, Autistic Individuals may have difficulty with overstimulation. Without intervention, this could lead to many problems for the individual including socially, emotionally, and mentally. This can cause the Individual to shut down or go through a nonverbal period, however, if there were ways to control things such as lighting to make it not as stark and bright to the occupants along with keeping the lighting uniform throughout the building, it could reduce the strain and stress for those involved. When it comes to driving as well, which will be covered later on, the ability of a car to take control and reduce the stress of the driver will also have a big impact on those with Autism.

Some individuals with Cerebral Palsy tend to have issues with thermoregulation, or the body's ability to adjust to cold and warm temperatures easily. The side effects for those with this part of the impairment can be small such as muscle spasms or can lead to an increase in joint pain. In more severe cases, it can lead to heat stroke or hypothermia. The muscle spasms can be caused by the body reacting to the temperature and the spasticity or lack thereof within the individual. It also directly affects those with limited movement ability. This is because those with limited movement cannot increase blood flow and can thus not be able to self-regulate their temperature. This is why things such as smart cars and inventions that can help them get around the city better are so important to many.

2 How will it improve their lives and in what ways?

Both Smart Transportation and Smart buildings are two fundamental aspects of Smart Cities. Both aspects affect a person, either with Cerebral Palsy or Autism, ability to function and

thus become a more functioning member of society. It can also help improve the lives of those without these two disabilities.

2.1   Transportation Improvements

Public infrastructure is one aspect that will help improve those with Autism and Cerebral Palsy when properly implemented in Smart Cities. For example, when it comes to things such as driving, those with Cerebral Palsy and Autism might have slower reaction times and thus not be able to correct themselves faster. Thus, the utilization of things such as a smart car or a special system to tell drivers when to go is needed. There is also the aspect of places with public transportation to get updates as to be more beneficial. There is not a lot of accessible public transportation around Chattanooga or the Cities that lay outside of it nor is it very walkable. Right now, the traffic light system caters to those who are neurotypical and have an easy time distinguishing the meanings behind the colors. It also relies on the knowledge of the Country you are in traffic laws. Thus, a system that is just a theory at this point, which instead tells a driver when they go bluntly would be very beneficial. As it could quite simply say, whether by sending a message to the car or by using a word system to tell others when to move. Utilizing this technology which is called an R-MEV or a Mutual Exclusive Vehicle scheduling component, a group-based mutual exclusion theory for vehicles, the programmers were able to utilize a turn-based system that informs the user of when to go and has a "70%" improvement when it comes to preventing accidents [13]. The implementation of this system would allow for easier driving and safer driving as well for anyone including neurotypicals. This would also avoid gridlocks which could cause frustration due to the cars being sorted in the order they arrived in, thus

making it safer overall. Another aspect of smart cars that can be utilized is the ability to take over should the driver have an issue. This is important as it can protect both the driver and those on the road as well. Both of these aspects can be utilized for a safer city for those not only with disabilities but those without. In Chattanooga alone, this could prevent numerous accidents and allow for less traffic on the highways especially during things such as rush hour.

Another aspect of smart transportation is things that can be utilized for those with sensory impairments. This can include aspects such as vision and movement. This study utilizes a project known as the "Electronic Long Cane project" which while currently envisioned for those with vision impairments can be used for those with motor skill issues [14]. The aspect of this project is that the Cane will beep to let someone know that something is in the way by searching the environment in front of them. This can be useful in things such as smart buildings and smart transportation as well. Using the concept of a scanner, if it is attached to the wheelchair, it could very well help those in it. If this technology is utilized on a wheelchair, such as on the arm of the chair itself, it could alert the person on it to things such as holes in the road that might not be visible to them or any kind of dips and cracks on the road as well. Thus, we would see improvements in the ability of those with wheelchairs which is a common trait for those with Cerebral Palsy to be able to leave their house more and be safer when going down the street. This also reduces the possibility of damage to their wheelchair and themselves. A wheelchair is not cheap to replace and many are tailored individually to a person's liking to make it more comfortable. Plus, it is harder for a person with cerebral palsy to heal due to their condition and if they fall out of the chair, it can make it much more difficult for them to get back in it.

2.2   Building Improvements

The improvements that those with Autism and Cerebral Palsy face when it comes to these aspects of life include things many take for granted such as shopping. Part of this is the aspect of those who utilize a wheelchair or other assistance to be able to do things such as shop. After all, "13 out of 14 shoppers" from this study needed assistance when they were utilizing items that needed to be grabbed from a shelf [15]. When utilized for inventory, a Radio Frequency Identification System otherwise known as an RFID system can inform users of where a product is and how much is left on the shelf currently. This allows the user to not have to search for a long time, which is helpful as it can be difficult to turn a wheelchair among shoppers with carts. However, when it comes to hand mobility, having less hand mobility with Cerebral Palsy is a possibility, it is found that using a smartphone, which is more precise, is not as doable for those with limited movement with users instead reporting needing a utilization of a touch screen next to the shelf [15]. These options of a screen that scans a shelf can allow users to find more information about a product and to see the inventory at the current time. Instead of a traditional shopping experience, the user adds the items to a list that allows them to have a worker gather what they need or the choice to grab it as well. This is also helpful for those with Autism who might be non-verbal and have trouble communicating what they wish to get while shopping. This also allows those without these disabilities to see how much product is currently on the shelf without having to bend down and search. This in general, can help anyone with mobility problems as well, since while you are shopping on the tablet, you are not actively doing an action that might be more difficult such as the normal shopping experience. It also works similarly to the Curbside option which most stories have already utilized. Thus, all it would need is the

addition of a touch screen and the RFID system on the shelf. If this was utilized within current demographic areas such as Chattanooga and Los Angeles, it would overall provide a better shopping experience for those who dwell within the city. Seeing as how Chattanooga is trying to move towards the process of becoming a Smart City, this is one aspect that needs to be looked at as it might be one of the easiest to implement.

There is also the aspect of how aspects such as Cloud Computing can be utilized within a Smart City. In theory, there would be some kind of format, most likely an app that citizens of a city could access. After a brief survey, the app would track the user and compare those with disabilities routes vs non-disabled routes [16]. This can also allow citizens to complain about certain problems or the amount of accessibility the city has [16]. For those with Cerebral Palsy, many routes might be too hard to walk due to environmental aspects such as gravel, and would thus take them longer to get places as they have to find a safer route. For those with Autism, this would allow them and/or their caretaker to plan their route better and prepare beforehand for the change that they will face. This will also allow cities to make sure they are accessible to not only their citizens but tourists as well.

Many improvements can be made through Smart Cities, whether it is the implementation of different traffic signals for those with vision issues and smart cars that can take over safely for a driver to RFID additions in shopping centers for easier shopping for all. All these aspects blended together to create a brighter future with a strong unity for those with disability and those without. However, what are some of the challenges they might face?

3 What challenges might they face?

As with anything, one expects challenges. Even with the benefits of Smart Cities, there are a few negatives, especially for people with different abilities. There are even a few negatives for those without these problems that can cause issues. It is important to look at both aspects of this situation and to compare the benefits for everyone versus the consequences of what is to come. Some of the negative aspects of Smart Cities do not even come from those with disabilities. For example, recently a post on my town's Facebook page was shared with the headline "Save Chattanooga, Stop the Smart City Plans", however, this is also due to the misunderstanding surrounding Smart Cities which will be debunked here as well.

3.1 Transportation Drawbacks

With transportation being a big focus, what are some drawbacks that can be faced by those with Cerebral Palsy and Autism? An aspect that comes into play for many is cost. Smart Cars that have the accessibility as previously discussed are costly and by United States law an individual can only earn up to "1,550 per month in 2024" before they risk losing benefits [17]. This also accounts for the amount of savings and assets a disabled individual getting benefits can receive. Thus, in reality, the aspect of owning a smart car is difficult with people with disabilities. Along with the cost of modifications that such a car would need, thus making an accessible car a shallow dream for many with these hindrances. There is, of course, financial assistance, but many focus on smaller and inexpensive items instead of things that are considered a luxury like a smart car.

The other aspects that were mentioned earlier were special, and as of this writing theoretical, traffic lights that tell a person when to go. While this would make things easier for

everyone, it would be a costly project as both the traffic lights and cars would need to be able to receive messages on when to go. This would also take time as it would have to be done as a slow rollout most likely. There is also the risk of people being unused to these traffic lights and thus possible accidents when first implemented. Along with the diverting of traffic while the improvements are being made. Cities must also account for the possibility of a blackout or cyber attack that could take these traffic lights down. This would also require travelers to be aware of the differences in the new lights when they are visiting.

Sensory Impairments which as stated above could be helped with the possibility of the "Electronic Long Cane project," can also be overwhelming. For example, the way that the electronic long cane and other sensors work is to beep as an alert sound. However, due to the possibility of repeated beeps, it could cause problems for those who are autistic. With the idea that the user is using this in public to help with their vision, it can also increase the risk of overstimulation in public due to the degree of the noise. It could also possibly be harder to hear for those with issues related to hearing due to the loudness of a public space. Thus, one must take into consideration their own needs and the possible issues that arise from this issue. There is also the issue of where one would add the technology to their wheelchair. While the sensor might be small, it could also be angled where it can not detect things properly and thus be prevented from issuing a timely warning.

3.2 Smart Building Drawbacks

There are, of course, drawbacks when it comes to either updating or building new buildings that come with Smart Tech. This could be the price or the upkeep of the building

themselves. Chattanooga is mostly made with older buildings which can be costly to update. And for those with Autism and Cerebral Palsy, there can be drawbacks to the buildings themselves as a whole.

A big part of the drawbacks come from the integration of the different services. With a Smart City, the city must constantly be taking in data and providing updates on possible events. Thus, there must be enough servers for the city to allow it to take in information and not face overload. There is also the risk of overdrawing power which can shut down the accessibility. There is also the possible latency in the system as well due to the amount of energy needed to cover the size of a Smart City [18].

For those with Autism and Cerebral Palsy, while there are advantages to these smart buildings, there are also disadvantages. For example, the latency in say, an elevator call button prevents those in wheelchairs from getting to their destination on time. There is also the risk when it comes to things such as wheelchair lifts which are available in some stages such as in theaters. Many times, one must wait for someone who is capable of accessing these devices and manning them properly as the regular employee might not have the knowledge to work the equipment. And when it comes to technology such as the RFID sensors on the shelves as mentioned before, there is the possibility of those with hand conditions being unable to properly access it as found within the data. That is why the study decided to go with Touch Screens that many even those with shaking hands or inability to grasp tablets can utilize [15].

The theoretical walking app that was proposed earlier on in this report, can have its drawbacks as well too. Those who have trouble with communicating could also have trouble

with utilizing the app, due to the aspects that are involved. The touch screen could be hard to utilize and can be a struggle for them to properly communicate if the app is not working. It can also cause emotional issues if there is sudden and unplanned maintenance on either the walking surface or the app itself. Thus, it might cause more probable harm than benefits at certain points.

3.3 Smart City Myths and Fears debunked

Many people have mistrust towards things such as Smart Cities. This is due to common misconceptions. Recently, a Facebook post was posted in my community's group. This was a link to a website to "Keep Chattanooga Beautiful. Say no to Smart Cities"[19]. However, upon further inspection, it seemed to me that the people involved with this page had a gross misconception of how a Smart City would be made. They wrongfully assumed that by converting to a Smart City, we would have to destroy the natural landscape around us. When in fact, you can work with the landscape and a lot of the improvements to be made are just additions to the buildings and structures that already exist within the city.

It also seems to me based on some posts on the website that they feared government control, with many comparing it to China. However, in a Smart City, the city itself is focusing on the environment around you, not what you are doing at this exact moment. The creation of the app that shows when roads are closed as mentioned in the advantages above, can utilize this information and make it easier for everyone to get around. These people are not thinking about the bigger picture and are instead spreading misinformation.

Those who are against Smart Cities seem to be worried that their freedoms are at risk within the City. However, those who pay attention can see the advantages when it comes to Smart Cities. Such as easier driving, increased help within buildings, and a better living environment for all those involved, not just those with disabilities. The amount of Seniors alone in Chattanooga is "17.2%" based on the last census [20]. All of these people within the city would benefit from the added features and advantages. This could also allow them to get more help that they need when it comes to grocery shopping and going places due to the added features that come with Smart Cities.

So while there are some fears about Smart Cities, there is no reason to dismantle the idea altogether. We can not remain still while the rest of the world moves on without us. Becoming trapped in old ideals will only lead to harm as the City will have trouble functioning in a future that does not embrace the new. There will be pushback, that is to be expected. But what can cities do to lower the amount of challenges that will be faced by those within the city?

4 How can Cities Mitigate these challenges?

One of the biggest challenges that come with a Smart City is power consumption. There is also the challenge of making sure the city can function as a smart city. Thus comes the implementation of Smart Grids. EPB, Chattanooga's local electrical power board, actually has one already up and running within the city. The smart grid in use allows EPB to know where problems are occurring and when citizens are getting close to a power threshold that could compromise the system [21]. This allows faster response times and fewer chances for the system to go down. The way they are implementing these smart grid solutions is to use fiber optic

cables, and as research advances they want to decrease the number of people that are helped by one grid so they can have multiple grids in play, thus drawing less on the main power and reducing risk for overconsumption [21]. Thus, we are already seeing the groundwork in Chattanooga for this type of equipment.

Another set of challenges for those within Smart Cities is the switch from what is known as Passive technologies to Active technologies. An example of passive technologies is things such as standard curb ramps, which tend to be bumpy and slow the wheelchair user down [22]. It does, however, help the wheelchair user to have more control over when they go into roadways along with being a guide that there is a dip in the sidewalk up ahead. However, it should not be up to those with disabilities to increase the amount of technologies that are within their cities. With just a bit of extra programming, a crosswalk signal would possibly be able to detect those with a disability and could increase the amount of time on the crosswalk through aspects such as RFIDs which have been previously mentioned in the paper when it comes to grocery stores. However, this same technology can be used similarly to a GPS with the restriction of not being able to pinpoint the exact location [22]. This, however, would help those with disabilities to not have to rush and possibly hurt themselves just to get to their destination before the cars were moving as they would have more time which helps those who mobility issues. This implementation is one way that cities can mitigate challenges by having the technology changed ever so slightly to become active instead of passive. Along with the technology being active, it will allow notifications to be sent to the city about when there is an issue that is arising due to the number of people who would need help.

Another challenge that can be seen is within the community itself. It is found that those with intellectual disabilities, which include autism, search for information less often than those of the same age [23]. And as technology advances, it becomes more complex thus making it harder to figure out how to work. Thus, what can a city do to help? The city itself might not be able to do much, but the community being educated more can. Those within the city can be taught how to interact with those who might struggle with the new technology. It also can affect how caregivers respond to situations around themselves. A caregiver or a therapist can help teach those who need it how to work the system and assist them if it necessary.

It is also important for the city to host meetings and discuss what is going on and how the city is changing for the better. This will help resolve possible fears that people may have. And allow the citizens to feel more comfortable and heard within the community. This is not something that should be sprung onto people one day, I will go over this more within the next section, Proposed Solutions.

5 Proposed Solutions

So, based on the research that has been done, what are some solutions that Los Angeles and Chattanooga can implement to start the move toward Smart Cities? Both cities should start with a news conference where they explain how the process would work and the advantages. This would also include data that is gathered from the local area and testimonies from those who have utilized this technology. There should also be involvement from the disabled community as well to explain how it would help them personally. They then could ask the citizens to vote on

the measure. Once the citizens have voted on the measure, the cities should look towards the budget to see what they have to work with when it comes to money.

As they look towards the budget, the Cities should look at the big corporations that are in the town and ask them if they would be willing to work with the city on these measures even for a trial period. Before both cities put anything into place, there should be trials run over some time such as a few months to see what the effects on the public would be before implementing all over the cities. Once the cities have done these steps, then they can look towards implementing these factors on a larger scale. The cities should also be open to their citizens about what is going on with the program as well and if there were any delays in the process. It would also be a good idea to offer local businesses something such as tax breaks or reimbursement for implementing this new technology.

The cities must highlight what these things will do for their citizens while also educating the general public so that they know what to expect in the next set of years. This might be easier for Chattanooga as its population was 184,086 in 2022 [3]. Los Angeles has roughly 3,638,152 more people [3]. However, Chattanooga does have a bigger disabled population as mentioned previously, so it would make more sense for Chattanooga to start the implementation as well. It truly depends on not only the people but what the focus for the governing parties is in these coming election cycles.

6 Conclusion

In conclusion, there are a lot of factors that come into play when it comes to the discussion of Smart Cities. Those who would be greatly impacted by the change tend to be the ones most often forgotten about those with disabilities. Throughout the process of writing this thesis, I have gathered and analyzed different studies that showcase specifically the development of Smart Cities within the scope of those with Autism and Cerebral Palsy. It is an interesting fact to point out that we will not see a fully Smart City for a long time due to the technology being developed. However, as Cities move towards this achievement, it is important to factor in those with non-traditional experiences and the things that could either assist or damage them. There has been an ongoing discussion of how Smart Cars which are starting to be seen in cities, along with the implementation of technology that is still in development such as the Long Cane project, which can be utilized in different fashions, and special traffic lights that tell people when to go. There has also been the discussion of the fears that those within the city could have and debunking the myths that surround these cities. As we move towards the future, there is the possibility as well that this technology could be implemented in different ways due to what is needed. But one thing is for sure: It would be a disservice to not think about those who will benefit from this and might struggle with the technology. The only way to move forward is together for the benefit of everyone.

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