HAPTIC SOFT TOYS FOR CHILDREN WITH AUTISM

A PROJECT REPORT

Submitted by

Shreya Dandwate (21BOE10068)
Amitasha Mishra (21BOE10018)
Sanavi Tambe (21BOE10052)
Devika Rajendran (21BOE10016)
Vikas Singh (21BOE10023)
Sourabh Tillu (21BOE10035)

in partial fulfillment for the award of the degree of

BACHELOR OF TECHNOLOGY
in
BIOENGINEERING

SCHOOL OF BIOSCIENCE ENGINEERING AND TECHNOLOGY

VIT BHOPAL UNIVERSITY

KOTHRI KALAN, SEHORE
MADHYA PRADESH - 466114

OCTOBER 2022

VIT BHOPAL UNIVERSITY, KOTHRI KALAN, SEHORE MADHYA PRADESH – 466114

BONAFIDE CERTIFICATE

Certified that this project report titled **" HAPTIC SOFT TOYS FOR CHILDREN WITH AUTISM "** is the bonafide work of " **AMITASHA MISHRA(21BOE10018)**, **SHREYA DANDWATE(21BOE10068), SANAVI TAMBE(21BOE10052), DEVIKA RAJENDRAN(21BOE10016), VIKAS SINGH(21BOE10023), SOURABH TILLU(21BOE10035)"** who carried out the project work under my supervision. Certified further that to the best of my knowledge the work reported at this time does not form part of any other project/research work based on which a degree or award was conferred on an earlier occasion on this or any other candidate.

PROGRAM CHAIR
Siddhartha Maiti, Assistant Professor
School of Bioscience Engineering
and Technology
VIT BHOPAL UNIVERSITY

PROJECT GUIDE
Siddhartha Maiti, Assistant Professor
School of Bioscience Engineering
and Technology
VIT BHOPAL UNIVERSITY

ACKNOWLEDGEMENT

First, we would like to thank the Lord Almighty for its presence and immense blessings throughout the project work.

We wish to express my heartfelt gratitude to our Program chair and Project guide Dr. Siddhartha Maiti, for continually guiding and actively taking part in our project, giving valuable suggestions to complete the project work.

We would like to thank all the technical and teaching staff of the School of Bioscience Engineering and Technology, who extended directly or indirectly all support.

Last, but not least, we are deeply indebted to my parents who have been the greatest support while we worked day and night for the project to make it a success.

TABLE OF CONTENTS

ABSTRACT

Autism is a spectrum of neurodevelopmental disorders characterized by limited social skills.. This paper explores the design process for interactive soft toys for autistic kids that may be personalised and customised to help them communicate in more effective ways. Preliminary investigation indicates that interactive soft toys have the potential to engage kids with autism through various elements of the toys and elicit sensory relaxation. Researchers have proposed a method of customising soft toys with children's drawings, favourite objects or superheroes, different materials, fillers, sizes and sensors.

CHAPTER 1
INTRODUCTION
1.1 INTRODUCTION TO ASD

Autism spectrum disorder (ASD) is a complex neurodevelopmental disorder generally manifesting in the first few years of life and tending to persist into adolescence and adulthood. It is characterized by deficits in communication and social interaction and restricted, repetitive patterns of behavior, interests, and activities. It is a disorder with multifactorial etiology.'

Types Of Autism Spectrum Disorder

Autistic Disorder

This is sometimes called "classic" autism. It is what most people think of when hearing the word "autism". People with autistic disorder usually have significant language delays, social and communication challenges, and unusual behaviors and interests. Many people with autistic disorder also have intellectual disability.

Asperger Syndrome

People with Asperger syndrome usually have milder symptoms of autistic disorder. They might have social challenges and unusual behaviors and interests. However, they typically do not have problems with language or intellectual disability.

Pervasive Developmental Disorder – Not Otherwise Specified

This is sometimes called "atypical autism," or PDD-NOS. People who meet some of the criteria for autistic disorder or Asperger syndrome, but not all, may be diagnosed with atypical autism. These people usually have fewer and milder symptoms than those with autistic disorder. The symptoms might cause only social and communication challenges.

Autism spectrum disorder is a condition related to brain development that impacts how a person perceives and socializes with others, causing problems in social interaction and communication. The disorder also includes limited and repetitive patterns of behavior. The term "spectrum" in autism spectrum disorder refers to the wide range of symptoms and severity.

Autism spectrum disorder includes conditions that were previously considered separate — autism, Asperger's syndrome, childhood disintegrative disorder and an unspecified form of pervasive developmental disorder. Some people still use the term "Asperger's syndrome," which is generally thought to be at the mild end of autism spectrum disorder.

Autism spectrum disorder begins in early childhood and eventually causes problems functioning in society — socially, in school and at work, for example. Often children show symptoms of autism within the first year. A small number of children appear to develop normally in the first year, and then go through a period of regression between 18 and 24 months of age when they develop autism symptoms.

While there is no cure for autism spectrum disorder, intensive, early treatment can make a big difference in the lives of many children.

Symptoms

Some children show signs of autism spectrum disorder in early infancy, such as reduced eye contact, lack of response to their name or indifference to caregivers. Other children may develop normally for the first few months or years of life, but then suddenly become withdrawn or aggressive or lose language skills they've already acquired. Signs usually are seen by age 2 years.

Each child with autism spectrum disorder is likely to have a unique pattern of behavior and level of severity — from low functioning to high functioning.

Some children with autism spectrum disorder have difficulty learning, and some have signs of lower than normal intelligence. Other children with the disorder have normal to high intelligence — they learn quickly, yet have trouble communicating and applying what they know in everyday life and adjusting to social situations.

Because of the unique mixture of symptoms in each child, severity can sometimes be difficult to determine. It's generally based on the level of impairments and how they impact the ability to function.

Below are some common signs shown by people who have autism spectrum disorder.

Social communication and interaction

A child or adult with autism spectrum disorder may have problems with social interaction and communication skills, including any of these signs:

- Fails to respond to his or her name or appears not to hear you at times
- Resists cuddling and holding, and seems to prefer playing alone, retreating into his or her own world
- Has poor eye contact and lacks facial expression
- Doesn't speak or has delayed speech, or loses previous ability to say words or sentences
- Can't start a conversation or keep one going, or only starts one to make requests or label items
- Speaks with an abnormal tone or rhythm and may use a singsong voice or robot-like speech
- Repeats words or phrases verbatim, but doesn't understand how to use them
- Doesn't appear to understand simple questions or directions
- Doesn't express emotions or feelings and appears unaware of others' feelings
- Doesn't point at or bring objects to share interest
- Inappropriately approaches a social interaction by being passive, aggressive or disruptive
- Has difficulty recognizing nonverbal cues, such as interpreting other people's facial expressions, body postures or tone of voice

Patterns of behavior

A child or adult with autism spectrum disorder may have limited, repetitive patterns of behavior, interests or activities, including any of these signs:

- Performs repetitive movements, such as rocking, spinning or hand flapping
- Performs activities that could cause self-harm, such as biting or head-banging
- Develops specific routines or rituals and becomes disturbed at the slightest change
- Has problems with coordination or has odd movement patterns, such as clumsiness or walking on toes, and has odd, stiff or exaggerated body language
- Is fascinated by details of an object, such as the spinning wheels of a toy car, but doesn't understand the overall purpose or function of the object
- Is unusually sensitive to light, sound or touch, yet may be indifferent to pain or temperature
- Doesn't engage in imitative or make-believe play
- Fixates on an object or activity with abnormal intensity or focus
- Has specific food preferences, such as eating only a few foods, or refusing foods with a certain texture

As they mature, some children with autism spectrum disorder become more engaged with others and show fewer disturbances in behavior. Some, usually those with the least severe problems, eventually may lead normal or near-normal lives. Others, however, continue to have difficulty with language or social skills, and the teen years can bring worse behavioral and emotional problems.

When to see a doctor

Babies develop at their own pace, and many don't follow exact timelines found in some parenting books. But children with autism spectrum disorder usually show some signs of delayed development before age 2 years.

If you're concerned about your child's development or you suspect that your child may have autism spectrum disorder, discuss your concerns with your doctor. The symptoms associated with the disorder can also be linked with other developmental disorders.

Signs of autism spectrum disorder often appear early in development when there are obvious delays in language skills and social interactions. Your doctor may recommend developmental tests to identify if your child has delays in cognitive, language and social skills, if your child:

- Doesn't respond with a smile or happy expression by 6 months
- Doesn't mimic sounds or facial expressions by 9 months
- Doesn't babble or coo by 12 months
- Doesn't gesture — such as point or wave — by 14 months
- Doesn't say single words by 16 months
- Doesn't play "make-believe" or pretend by 18 months
- Doesn't say two-word phrases by 24 months
- Loses language skills or social skills at any age

Causes

Autism spectrum disorder has no single known cause. Given the complexity of the disorder, and the fact that symptoms and severity vary, there are probably many causes. Both genetics and environment may play a role.

- **Genetics.** Several different genes appear to be involved in autism spectrum disorder. For some children, autism spectrum disorder can be associated with a genetic disorder, such as Rett syndrome or fragile X syndrome. For other children, genetic changes (mutations) may increase the risk of autism spectrum disorder. Still other genes may affect brain development or the way that brain cells communicate, or they may determine the severity of symptoms. Some genetic mutations seem to be inherited, while others occur spontaneously.

- **Environmental factors.** Researchers are currently exploring whether factors such as viral infections, medications or complications during pregnancy, or air pollutants play a role in triggering autism spectrum disorder.

No link between vaccines and autism spectrum disorder

One of the greatest controversies in autism spectrum disorder centers on whether a link exists between the disorder and childhood vaccines. Despite extensive research, no reliable study has shown a link between autism spectrum disorder and any vaccines. In fact, the original study that ignited the debate years ago has been retracted due to poor design and questionable research methods.

Avoiding childhood vaccinations can place your child and others in danger of catching and spreading serious diseases, including whooping cough (pertussis), measles or mumps.

Risk factors

The number of children diagnosed with autism spectrum disorder is rising. It's not clear whether this is due to better detection and reporting or a real increase in the number of cases, or both.

Autism spectrum disorder affects children of all races and nationalities, but certain factors increase a child's risk. These may include:

- **Your child's sex.** Boys are about four times more likely to develop autism spectrum disorder than girls are.
- **Family history.** Families who have one child with autism spectrum disorder have an increased risk of having another child with the disorder. It's also not uncommon for parents or relatives of a child with autism spectrum disorder to have minor problems with social or communication skills themselves or to engage in certain behaviors typical of the disorder.

- **Other disorders.** Children with certain medical conditions have a higher than normal risk of autism spectrum disorder or autism-like symptoms. Examples include fragile X syndrome, an inherited disorder that causes intellectual problems; tuberous sclerosis, a condition in which benign tumors develop in the brain; and Rett syndrome, a genetic condition occurring almost exclusively in girls, which causes slowing of head growth, intellectual disability and loss of purposeful hand use.
- **Extremely preterm babies.** Babies born before 26 weeks of gestation may have a greater risk of autism spectrum disorder.
- **Parents' ages.** There may be a connection between children born to older parents and autism spectrum disorder, but more research is necessary to establish this link.

Complications

Problems with social interactions, communication and behavior can lead to:

- Problems in school and with successful learning
- Employment problems
- Inability to live independently
- Social isolation
- Stress within the family
- Victimization and being bullied

Prevention

There's no way to prevent autism spectrum disorder, but there are treatment options. Early diagnosis and intervention is most helpful and can improve behavior, skills and language development. However, intervention is helpful at any age. Though children usually don't outgrow autism spectrum disorder symptoms, they may learn to function well.

Treatment

No cure exists for autism spectrum disorder, and there is no one-size-fits-all treatment. The goal of treatment is to maximize your child's ability to function by reducing autism spectrum disorder symptoms and supporting development and learning. Early intervention during the preschool years can help your child learn critical social, communication, functional and behavioral skills.

The range of home-based and school-based treatments and interventions for autism spectrum disorder can be overwhelming, and your child's needs may change over time. Your health care provider can recommend options and help identify resources in your area.

If your child is diagnosed with autism spectrum disorder, talk to experts about creating a treatment strategy and build a team of professionals to meet your child's needs.

Treatment options may include:

- **Behavior and communication therapies.** Many programs address the range of social, language and behavioral difficulties associated with autism spectrum disorder. Some programs focus on reducing problem behaviors and teaching new skills. Other programs focus on teaching children how to act in social situations or communicate better with others. Applied behavior analysis (ABA) can help children learn new skills and generalize these skills to multiple situations through a reward-based motivation system.

- **Educational therapies.** Children with autism spectrum disorder often respond well to highly structured educational programs. Successful programs typically include a team of specialists and a variety of activities to improve social skills, communication and behavior. Preschool children who receive intensive, individualized behavioral interventions often show good progress.

- **Family therapies.** Parents and other family members can learn how to play and interact with their children in ways that promote social interaction skills, manage problem behaviors, and teach daily living skills and communication.

- **Other therapies.** Depending on your child's needs, speech therapy to improve communication skills, occupational therapy to teach activities of daily living, and physical therapy to improve movement and balance may be beneficial. A psychologist can recommend ways to address problem behavior.

- **Medications.** No medication can improve the core signs of autism spectrum disorder, but specific medications can help control symptoms. For example, certain medications may be prescribed if your child is hyperactive; antipsychotic drugs are sometimes used to treat severe behavioral problems; and antidepressants may be prescribed for anxiety. Keep all health care providers updated on any medications or supplements your child is taking. Some medications and supplements can interact, causing dangerous side effects.

Managing other medical and mental health conditions

In addition to autism spectrum disorder, children, teens and adults can also experience:

- **Medical health issues.** Children with autism spectrum disorder may also have medical issues, such as epilepsy, sleep disorders, limited food preferences or stomach problems. Ask your child's doctor how to best manage these conditions together.
- **Problems with transition to adulthood.** Teens and young adults with autism spectrum disorder may have difficulty understanding body changes. Also, social situations become increasingly complex in adolescence, and there may be less tolerance for individual differences. Behavior problems may be challenging during the teen years.
- **Other mental health disorders.** Teens and adults with autism spectrum disorder often experience other mental health disorders, such as anxiety and depression. Your doctor, mental health professional, and community advocacy and service organizations can offer help

Alternative medicine

Because autism spectrum disorder can't be cured, many parents seek alternative or complementary therapies, but these treatments have little or no research to show that they're effective. You could, unintentionally, reinforce negative behaviors. And some alternative treatments are potentially dangerous.

Talk with your child's doctor about the scientific evidence of any therapy that you're considering for your child.

Examples of complementary and alternative therapies that may offer some benefit when used in combination with evidence-based treatments include:

- **Creative therapies.** Some parents choose to supplement educational and medical intervention with art therapy or music therapy, which focuses on reducing a child's sensitivity to touch or sound. These therapies may offer some benefit when used along with other treatments.
- **Sensory-based therapies.** These therapies are based on the unproven theory that people with autism spectrum disorder have a sensory processing disorder that causes problems tolerating or processing sensory information, such as touch, balance and hearing. Therapists use brushes, squeeze toys, trampolines and other materials to stimulate these senses. Research has not shown these therapies to be effective, but it's possible they may offer some benefit when used along with other treatments.
- **Massage.** While massage may be relaxing, there isn't enough evidence to determine if it improves symptoms of autism spectrum disorder.
- **Pet or horse therapy.** Pets can provide companionship and recreation, but more research is needed to determine whether interaction with animals improves symptoms of autism spectrum disorder.

Some complementary and alternative therapies may not be harmful, but there's no evidence that they're helpful. Some may also include significant financial cost and be difficult to implement. Examples of these therapies include:

- **Special diets.** There's no evidence that special diets are an effective treatment for autism spectrum disorder. And for growing children, restrictive diets can lead to nutritional deficiencies. If you decide to pursue a restrictive diet, work with a registered dietitian to create an appropriate meal plan for your child.

- **Vitamin supplements and probiotics.** Although not harmful when used in normal amounts, there is no evidence they are beneficial for autism spectrum disorder symptoms, and supplements can be expensive. Talk to your doctor about vitamins and other supplements and the appropriate dosage for your child.

- **Acupuncture.** This therapy has been used with the goal of improving autism spectrum disorder symptoms, but the effectiveness of acupuncture is not supported by research.

1.2 MOTIVATION FOR THE WORK

The primary reason for conducting this study is to propose a model for advancing our approach to autism by customizing and personalizing the model. Additionally, the goal of this research is to determine that many interactive environments and wearable projects developed for children with autism help them to reduce their anxiety and to learn social interactions.

The inclusion of children with special educational needs in mainstream schools is a global trend. The inclusion of children with special educational needs in these schools has been the subject of ongoing research and discussion in recent decades. Inclusion as a concept is concerned with the provision of education throughout the student world. Its most important condition is the transformation of schools into ready-made structures so that they can integrate all kinds of students.

Since the early 20 th century children with disabilities are divided according to their specificities and attending special schools, where they are intended to provide education to children with disabilities.

In recent years there has been an increased interest in education for all students. Thus, we refer to the integration of children with special needs in the general school. By integration, we define the creation of a school that integrates all students. The purpose of integration is to provide equal educational opportunities to all students without discrimination. The theory of inclusion is that all students with disabilities should attend the same classroom as their classmates. Each student has their own educational needs and capabilities, which require a specific educational program. The inclusion of children with autism in general school is an issue where it is controversial and there are many views on the issue. The inclusion of children with autism creates many challenges and issues that need to be addressed. Children with autism face many problems when entering mainstream school. The risk of poor school adaptation for these children exacerbates the poor adaptive behaviour of these children and thus integration becomes more difficult.

Teachers are the key to the effective integration of students with autism. Their attitude and behaviour are very important. The inclusion of these children in the mainstream school depends mainly on the will, mood, knowledge, perceptions and experience of the teacher. Thus, in this context, the purpose of this research is to investigate the views of teachers regarding the inclusion of children with ASD in general classes. More specifically, issues such as knowledge and implementation of existing legislation and the organization of integration will be studied. The ultimate goal is to enrich the academic child and to inform the educational community about the inclusion of children with autism in the general school.

Inclusion in a general classroom is a positive option for children with autism. Inclusion has often been a highly debated topic, and if schools are prepared students with autism should be able to be in inclusive settings. Most students on the autism spectrum are included within general classrooms, because they have the right to be taught in an inclusive classroom. Inclusion can benefit all children, including peers within the classroom. Inclusion of students with autism in the general classroom can minimize stigma against autism while students learn how to communicate appropriately with one another. Having a student with autism in a general classroom also reduces negativity associated with autism, and children will learn how to work with one another. Inclusive classroom settings teach students to build relationships with all peers. Teachers already practise beneficial differentiation techniques for all students, and it should be continued. For teachers to feel comfortable with successfully integrating a

student with autism in a general classroom, it would be beneficial for the teacher and the family to meet prior to school starting. Teachers can consider teaching to the students' interests and abilities so that a student with autism is successful in an inclusive classroom. Teachers should ensure that they have some education on autism so that they can successfully integrate a child with special needs in the classroom setting, because a more knowledgeable teacher is more comfortable with inclusion. Inclusion can benefit more than just a child with autism, and should be an option for that child.

1.3 PROBLEM STATEMENT

According to the Rehabilitation Council of India, it is estimated that 1 in 500 people have autism spectrum disorder (ASD). While symptoms can vary widely between individuals, autism symptoms begin to manifest in exceedingly early childhood and can be an emotional challenge for parents, causing extreme difficulties in the development of communication. Children with Autism suffer from severe communication deficits, especially with social interaction and emotional control. One of the main reasons is that children with autism are overly sensitive to external sensory information: light, touch, sound, etc. So, it is important for them to always have some means of relaxation.

1.4 OBJECTIVE

The objective of this study is to suggest an approach to the design process of interactive soft toys for children with autism. Autism spectrum disorders (ASD) are a triad of disturbances affecting the areas of communication, social interaction, and behavior, and each subject has quite different cognitive and functional characteristics. The methods of customization and personalization with children's drawings, favorite objects or superheroes, varied materials, fillers, sizes, and sensor-based products for example favorite song, response to gentle touch and hug, etc can help to improve cognitive-motor and sensory skills.

Developmental delay is common in children deprived of normal sensory stimulation – for example, in premature neonates and some institutionalized children. Touch has emerged as an important modality for the facilitation of growth and development; positive effects of supplemental mechanosensory stimulation have been demonstrated in a wide range of organisms, from worm larvae to rat pups to human infants. Animal models are being used to elucidate the cellular and molecular mechanisms underlying these effects. In rats, the amount of maternal licking received as a pup has a profound impact on the behaviour and physiology of the adult; in the microscopic roundworm Caenorhabditis elegans, physical interactions with other worms promote growth and increase adult responsiveness to mechanosensory stimuli. By understanding the underlying mechanisms, as well as the timing and degree of stimulation required to fully reverse the effects of early childhood deprivation, strategies can be developed to best help those in need. Impaired responses to tactile stimulation are a commonly reported symptom among children with autism spectrum disorder (ASD). Furthermore, impairments in filtering or habituation to tactile input have been described in ASD. This study measured different aspects of tactile processing to investigate atypical touch sensitivity in children with ASD, methodology that has not been previously used in this population. Children with ASD show raised static detection thresholds and an absence of the effect of a dynamically increasing subthreshold stimulus on static detection threshold. Children with ASD also show poorer amplitude discrimination than typically developing children (TDC), as well as decreased adaptation. There were no significant differences in frequency discrimination or TOJ performance between the groups. Differences in the effect of dynamic stimulation on detection threshold suggest impaired feed-forward inhibition in autism, which may be linked to poor sensory filtering. Increased baseline amplitude discrimination thresholds in ASD suggest that lateral inhibitory connections are weaker in ASD, and an absence of the effect of adaptation suggests impaired modulation of lateral inhibitory connections in ASD, which may relate to aberrant habituation. These results suggest a functional deficit in the somatosensory inhibitory system in autism. Understanding the specific mechanisms underlying sensory symptoms in autism may allow for more specific therapeutic or drug targeting in the near future.

CHAPTER 2

REQUIREMENTS ARTIFACTS

The work done in this project is the designing of customized and personalized soft toys that provide sensory relaxation and playful sensory feedback including light, sound, and vibration.
The aim is to create soft interactive toys that invite children and caregivers (therapists or parents) to communicate through a multisensory experience. The further study below explores the diverse types of materials, fillers, sizes, weights, and sensors to be installed in the haptic soft toys for children with autism.

2.1 MATERIALS

Materials are one of the most important parts of the design of sensory-based soft toys as the fabric should be safe for children to touch and easy for parents or caregivers to maintain the quality. For our design, microfleece has been studied and examined. The fabric is soft, synthetic wool material often made from polyester. It is warm like wool and similar in appearance, but it is much softer, lighter, and easier to wash. Microfleece is also hydrophobic, or water-repellent, making it quick to dry and warm even when wet. It is also considered to be more environmentally friendly than wool. It is wonderful to touch and is mostly geared for baby and children projects.

2.2 SHAPES

The shape of the soft haptic toy depends upon the children or parents. Since the study focuses on customization and personalization, children's drawing, favorite cartoon, superhero, object would help them to associate personal meanings to the object. This would evoke an emotional connection with the soft toys.

2.3 FILLERS

In our haptic toy we plan on putting an option of customizable fillers meaning each filler will have a different tactile stimulation. The main types of fillers we can put into our toy is:

- Sawdust: this is very fine stuffing which has been used for an extremely long time before the modernization of toy making and it is medium weight and a fine texture.

- Plastic pellets: are medium sized beads that can be used for stuffing and they are extremely light weight making them perfect as lightweight stuffing.

- Glass pellets: they can be used to add weight to the toys if a medium weight toy is requested.

- Mohair toy stuffing: Mohair is a natural fiber stuffing similar to wool but from the Angora goats. Mohair is fire-retardant, hypoallergenic, and antibacterial. It compacts much more than polyester toy stuffing which will make toys firmer and heavier.

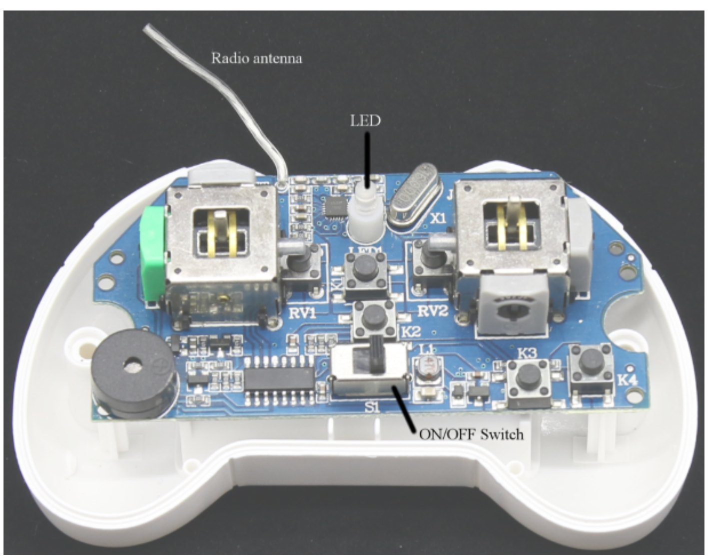
- Polyester toy Stuffing: Polyester toy filling is now the most commonly used toy stuffing for manufactured as well as homemade dolls and stuffed animals. It is a synthetic fiber derived from coal, air, water and petroleum. Extremely light weight which makes it suitable for children’s toys and especially great for baby toys which you want to be very light.

2.4 SENSORS

The soft haptic toys would have sensors made with LEDs, when it is hugged by a child, the cat pillow starts playing a song. When a child hugs it, the glow rhythm becomes faster. Lilypad Arduino USBs were used to utilize various interactions. To create soft, comfortable as well as playful tactile experiences, all the electronic components (LEDs, vibe board, buzzer, and registers) were securely sewn on the fabric and insulated by cotton stuffing materials. Crocheted sensors using conductive yarns were also sewn on the pillows.

Almost all lights in modern toys are light emitting diodes (LEDs). LEDs are generally safer, cooler, cheaper, longer-lasting, and more power efficient than incandescent light bulbs. A few toys may still have incandescent lamps, mostly in nightlights.

LEDs are on when there’s a voltage difference across them. If I wanted an LED to be on whenever a toy is powered on, then I could simply connect one side of the LED to power, which is the positive (+) voltage of a battery, and the other side to ground, the negative (-) voltage, through a current limiting resistor.



Lilypad Arduino Usbs Useful For Haptic Sensing:

The Lily Pad Arduino USB is the perfect board for e-textiles and wearables projects. It can be sewn to fabric and to power supplies, sensors and actuators with conductive thread. You can attach this board directly to your computer using only a micro USB cable.

The Lily Pad Arduino USB is a microcontroller board based on the ATmega32u4. It has 9 digital input/output pins (of which 4 can be used as PWM outputs and 4 as analog inputs), an 8 MHz resonator, a micro USB connection, a JST connector for a 3.7V LiPo battery, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a battery to get started. The Lily Pad Arduino USB differs from previous Lily Pad boards in that the ATmega32u4 has built-in USB communication, eliminating the need for a separate USB-to-serial adapter.

A child interacting with the haptic soft toy

CHAPTER 3

DESIGN METHODOLOGY AND ITS NOVELTY

3.1 CHARACTERISTICS OF THE TOYS

1. 3 Years

Three-year-olds have a moderate degree of dexterity and fine-motor control, and begin to enjoy low to moderately complex cause-and-effect in their pretend play. They like to push buttons and to use devices that produce sound, lights or action, and more specialized, realistic features like crying, sucking, wetting, and walking. They prefer dolls and stuffed toys with about a dozen diverse, easy-to-manipulate loose parts, and moving eyes. They also enjoy a moderate level of realistic detail, preferring dolls and stuffed animals that have accurate proportions and anatomy, moderately authentic parts, and body parts that can move in multiple directions. These children can manipulate clothing with large openings that allow easy dressing and undressing, as well as those with large buttons, hooks, and hook-and-loop or touch fasteners.

2. 4 Through 5 Years

These children enjoy moderately to highly detailed, familiar, realistic dolls and stuffed toys to incorporate into their moderately to highly complex pretend play. Dolls and stuffed animals designed for moderately to highly complex cause-and-effect appear to promote more complex and longer periods of pretend play. Since they have moderate problem-solving abilities and have developed richer symbolic meanings in their toys, 4- and 5-year-olds prefer fashion, military, and other thematic dolls, action figures about 4 to 8 inches in length, and stuffed toys that become the major characters for enacting diverse, often extended, stories during pretend or role play. They are attracted more to dolls and stuffed animals that are collectible, as well as larger or oversized ones. They enjoy well-defined facial features, dressing dolls and stuffed toys with simple outfits, and choosing among many loose parts like grooming supplies. Such toys may also have moderately to highly complex cause-and-effect, such as multi-directional rotation of body parts, multiple functions, or multiple voice, light, sound, movement responses to buttons pushed, or smart-chip accessories that are plugged-in. They also are attracted to smart, robotic dolls and stuffed toys that feature various reactions to different stimuli or a lack of stimuli, and begin to master these toys.

3. 6 Through 8 Years

6- through 8- year-olds enjoy using dolls and stuffed animals in their diverse, often extended stories. These children enjoy life-sized or oversized dolls and stuffed animals that have many accessories. They also enjoy miniature dolls that are more fashion oriented. Children of this age have a keen awareness of and interest in licensed characters and collectibles that are popularized mostly by mass media. In addition, their dexterity, fine motor control, and gross- motor skills allow these children to manipulate most small parts, such as fingers that move and small levers or buttons that activate features.

4. 9 Through 12 Years

They mostly prefer to collect dolls and stuffed toys that are highly detailed, highly functional, authentic, and unique. Such toys include fashion or miniature dolls that are also used as decorative pieces, especially dolls with ornate costumes. Realistic toys, however, are not necessary. They are often licensed and come with numerous licensed accessories.

CHAPTER 4
CONCLUSION

Preliminary tests and research indicate that interactive soft toys may help children with autism calm down and become relaxed. Once they feel relaxed by and engaged with the interactive soft toys which are personalized and customized, they would start feeling comfortable about the situation and become open to various external stimulations. Therefore this design method approach can be considered as a useful one that may help children with autism to talk more and connect with other people in a non-invasive but playful way.

REFERENCE

https://pubmed.ncbi.nlm.nih.gov/32006355/

https://health.alaska.gov/dph/wcfh/Pages/autism/spectrum.aspx

https://www.mayoclinic.org/diseases-conditions/autism-spectrum-disorder/symptoms-causes/syc-20352928

https://www.mayoclinic.org/diseases-conditions/autism-spectrum-disorder/diagnosis-treatment/drc-20352934

https://www.scirp.org/journal/paperinformation.aspx?paperid=111978

https://files.eric.ed.gov/fulltext/EJ1304391.pdf

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2865952/

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4044368/#:~:text=Impaired%20responses%

20to%20tactile%20stimulation,have%20been%20described%20in%20ASD.

https://www.funkyfriendsfactory.com/blog/toy-stuffing/

https://docs.arduino.cc/retired/boards/lilypad-arduino-usb

https://www.icdl.com/parents/about-autism?gclid=CjwKCAjwwL6aBhBlEiwADycBIG4acF_-

https://link.springer.com/chapter/10.1007/978-3-319-21380-4_66#Sec4

https://www.cpsc.gov/PageFiles/113962/adg.pdf

https://link.springer.com/chapter/10.1007/978-3-319-21380-4_66

https://carmenbpingree.com/blog/art-therapy-activities-for-autism/#:~:text=Art%20has%20been%20shown%20to,express%20their%20thoughts%20and%20feelings.