SOZLER BRAILLE

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CIVIL ENGINEERING DEPARTMENT

POLITEKNIK SULTAN SALAHUDDIN ABDUL AZIZ SHAH

SESI 1 2022/2023

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This Report Submitted in Partial Fulfilment of Requirement for

The Diploma of Wood Based Technology in the Department of Civil Engineering

Polytechnic Sultan Salahuddin Abdul Aziz Shah

Sesi 1 2022/2023

DECLARATION OF ORIGINAL AND OWNERSHIP

TITLE : BOX SOZLER BRAILLE

SESSION : 1 2022/2023

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APPROVAL SHEET

This Final Year Project Report entitled 'Box Sozler Braille' were submitted in fulfilment of requirements of the Diploma in Wood Technology.

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APPRECIATION

Here we would like to express a million thanks to our supervisor Mr. Zullhyzrifee Ishraf Bin Zulkifly, for his excellent efforts as an outstanding supervisor in guiding us in producing the final semester product in Semester 5. We greatly appreciate all his efforts in helping to solve the problems that we did not able to complete and his advice to complete the final product. We are very proud to have received guidance from him. May En Zullhyzrifee Ishraf Bin Zulkifly always be granted prosperity in life.

Don't forget to also thank the group members and myself who became members of this group and stayed on until the final product was ready. Finally, despite the many obstacles in our efforts, we must not give up in everything we do. We are very grateful to Allah SWT for still giving us health and mental intelligence to do this final product, we are also grateful because You are the one who always gives us solutions in all difficulties, we will always to trust in You in our future. Thank you.

ABSTRACT

The use of braille is basically used by blind people who cannot see from birth or have had an accident to the point of loss of vision but there are also those who are visually impaired such as short-sightedness so severe that they have to use a special magnifying lens among those who also use braille to make it easier for them to read, type, write, and even carry out their daily lives. Braille is not just an empty point on paper, but braille has its own system. Braille reading starts from left to right by using their index finger, to read each one of the braille scripts. A blind or visually impaired person can read in 125 words in a minute. Their sensitivity to touch is very strong. So reading 200 words in a minute can also happen. the use of braille can make it easier for the blind or visually impaired to check and learn to read words. The braille system in Malaysia has been exposed from the very beginning of schooling where they learn the basics of letters and numbers. The syllabus is also similar to children who can see only different ways of teaching.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Braille is a 6-point writing system that raises up the braille system to help people with visual disabilities to gain knowledge, read, and live their lives. The braille system is not only for those with disabilities to gain knowledge but also to share and give to the vision-savvy people to help them. The way to use this braille system is to move the index finger from left to right, there are also people with visual impairments using their two index fingers to read.

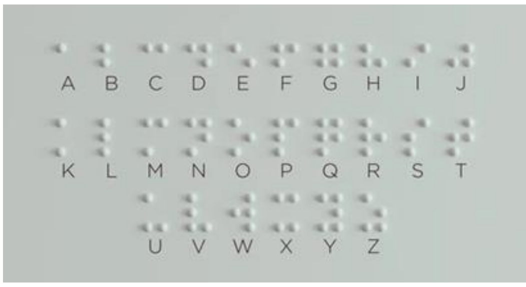


Figure 1.1(a) *Letters in Braille*

The Braille system is the inspiration of the 'night writing' system designed by Charles Barbier is an inventor. Barbier blasphemed the 'system night' writing to allow soldiers to read at night without turning on the lights and making noises so as not to be detected by the enemy. But the military said the 'night writing' system was difficult for them to use. With that, Barbier went to the Royal Institute of Blind Youth in Paris and shared about the 'night writing' system, but it is also quite difficult for people with visual impairment to use it. Until, Louis Braille was inspired and began to simplify this night writing system for people with disabilities in terms of vision to be able to use it.

Louis braille's 3-year effort has replaced the 'night writing' code to the new code by adding numbers and punctuation marks to the 'night writing' system or braille system adopted to this day.

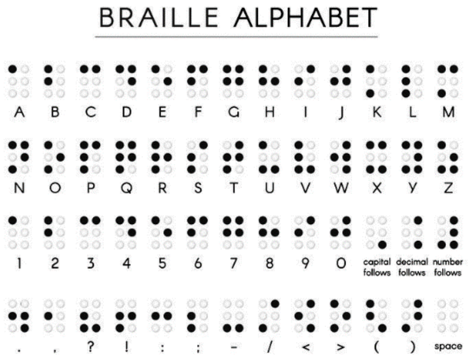


Figure 1.1(b) *Letters, Numbers, Punctuation marks in Braille.*

In addition, the Braille System is also not only in the alphabet 'ABC' but also the braille system also has code in other languages such as Japanese, Korean, Russian, Indian and many more. The difference from this braille system is the position of the point, for example braille code in Japanese. Japanese writing is named as *tenji*. Bahasa Japanese has many syllabuses including hiragana and katakana which are used without the use of the word kanji.

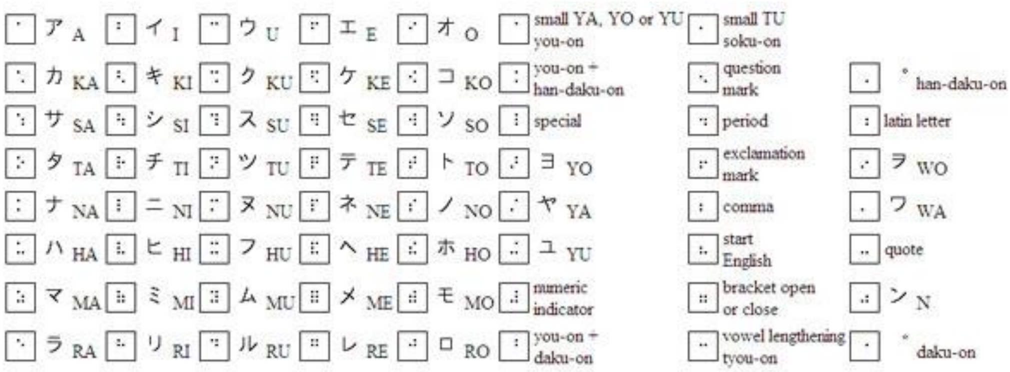


Figure 1.1(c) *Japanese braille letters*

1.2 Objective

In this era of success, people with disabilities are also chasing to walk together in the pursuit of a growing era. The objective focused on creating this product is for people with disabilities (OKU) in terms of vision regardless of age and level.

- To produce based system braille product to educations.
- To use the Laser Engraver to introduce a wider use of the Laser Engraver.

1.3 Scope of Study

This braille making is designed in the type of game that references game Sahibba and spiner games, the published game is 2 sets of Games that are based on braille one game of alphabetical order and another game matching syllables.
Preparation, the braille code is according to the standards that have been set by the naturalness of education in the braille base. What is braille code? Braille code is a 6-point place on braille to distinguish braille on each letter and number. This product is generally designed for children to adults, not only for children.

This because we want these products to be played in general no matter which stage they are at which stage. Especially, so that they deserve to continue their learning easily and more friendly for them to study in special education. This product is only for students, can even provide some facilities to special education instructors to have various teaching aids other than what has been provided.

1.4. Significance of study

In this age of progress, many people consider that the Disabled Person (OKU) is not advanced in this learning due to the lack of exposure to the braille system. Braille is an intermediate for the disabled in terms of vision to learn and live their daily lives. But what's called the word 'blind', people out there think where people with vision disabilities or blind people are beggars selling tissues then this thought becomes the norm and no change is done. The current generation needs to be exposed to a variety of skills and learning for the visually disabled. There are many Braille toys that have been on the market but it is quite difficult to get those games in the game store, except in online shopping platforms.

Figure 1.4 (a) : *Example Braille toys in the market.*

This braille game gives early exposure to children with visual disabilities in order to learn the same as normal children. This learning style for people with vision disabilities has three components called VAK. (Visual, Auditory, Kinesthetic). For the age group of children, they use all these learning styles because they are all developmental foundations for children. For blind children of course, they can only learn with hearing and kinesthetic force alone.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

Braille is not the language itself. On the other hand, it is a code that allows several languages, including English, Spanish, Arabic, Chinese, and many more languages, to be written and read. Braille is used in the local language by thousands of people around the world, and it provides a way of literacy for everyone. English Braille, American Edition has become a specific code used in the United States, but until 2016, the main code for reading material was the Unified English Braille, a code used in seven other English-speaking countries.

Louis Braille is a sculptor of the braille system he is a French educator and creator of the reading and writing system for use by the visually impaired . Its system remains almost unchanged to this day, and is known all over the world as braille. Early in braille because in 1812, in a village of courvray located in France, louis braille was playing in the workshop of his father Simon, a horse guard rope maker. His father was known as a conscientious Leather Smith and his work was full of skin-cutting activities with sharp equipment.

Louis Braille who was born on January 4, 1809, at the time of the incident that made him no longer able to see the world of Louis Braille was only 3 years old. At that point Simon his father went to talk to a customer leaving Louis alone in the workshop and then a small Louis while trying to imitate the stunts of his working father that he observed every day. Then the unexpected circumstances of the sharp equipment escaped from the grasp of the Louis and hit his left eye. *(artic of namri sidek on 31 mar 2018)*

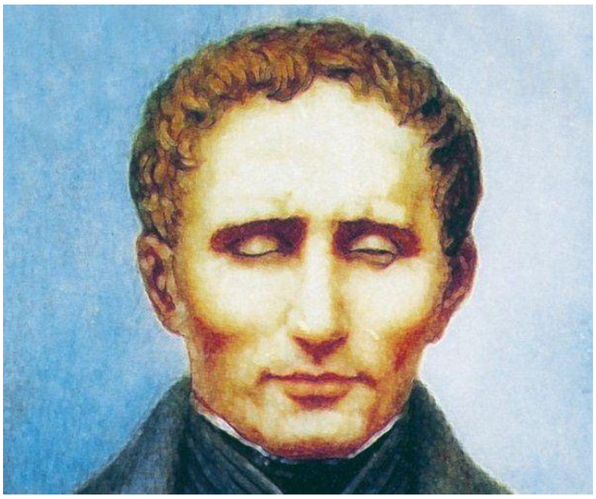


Figure 2.1 (a) : *Louis Braille.*

Because medicine at that time was not modern they used traditional medicine by wrapping louis eyes using a cloth soaked with herbs. However, the germ strain began to spread throughout his left eye within a few weeks and moved to the right eye with the condition that the germs began to damage his eyes until Louis' vision began to be limited until the Louis could no longer see. When Louis was 10 resistant a priest persuaded mother louis to consider sending louis to the Royal Institute of Blind Youth School for Louis to get a decent special education.

In February 1819, Louis began school and lived in an old dormitory, but the education received by Louis is now more in line with his conditions. The curiosity of Louis is strong but books for visually impaired individuals are very hard to find *(says namri sidek on 31 mar 2018)* the book at that time printed the letters but popped on thick paper, making the book heavy and thick. But it is difficult for a teenager like Louis to read it and even in the book on each page can only print one sentence *(the word namri sidek on 31 mar 2018).*

A meeting with Charles Barbier that changed Louis's life and gave an important moment in his life. Charles visited the institute where he learned and introduced the night writing system which was adapted for the use of the soldiers to read at night without having to open the lights and make noise and even the system was difficult for the soldiers to use it. Even for the institute say this night writhing system is quite difficult to produce and read. However, in the opinion of Louis, Louis found this night writhing system to be very helpful for him because the code used is smaller than printing the letters so one page can house more words. For 3 years louis started repairing the night writhing system he knew he needed to simplify the system so that it was easy to print and read by the visually impaired. By the age of 15 Louis found the system he designed was already capable of making him read faster. Louis Braille Successfully created 64 codes by using six circles arranged in two columns.

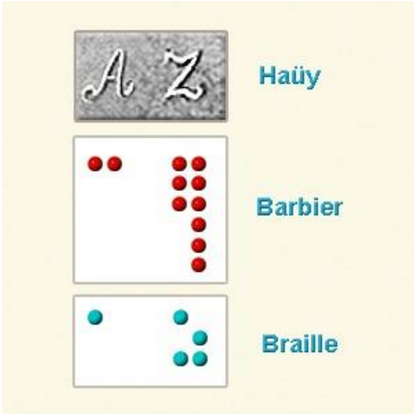


Figure 2.1 (b) *: Three forms of letters "A" and "Z"*

In 1839, Louis further expanded his system and introduced a Decapoint System, where the writings of the visually impaired were more similar to the letters of the Rumi, allowing people to be able to see to read their poems. Through Collaboration with his colleague Pierre Victor Foucault, they were able to produce a typewriter known as a 'raphigrapher' to make it easier for blind individuals to type using a Decapoint System. On 6 January 1852 the French government began to recognize its writing system and named the system after its surname "Braille". However, Louis could not see the results of his hard work in introducing braille due to the health condition of the Lousi which resulted in his death earlier 2 years before the French government recognized his system.

In 1873 other European countries began using braille systems and expanded around the world. The United States began recognizing braille in 1916 and the braille code for English was finalized in 1932.

2.2 VISUALLY IMPAIRED

Individuals who cannot see or experience limited vision in either one or both eyes even with the use of visual aids such as glasses or contact lenses. The intended visual disability can be divided into: **Blind** Vision less than 3/60 in the better eye even with the use of visual aids or a field of vision less than 10 degrees from fixation; **Limited Vision (Low Vision/Partially Sighted)** Vision worse than 6/18 but equal to or better than 3/60 even with the use of a visual aid or visual field less than 20 degrees from fixation.

The teachers for visually impaired students in school employed a variety of techniques. These methods are appropriate for visually impaired students who want to learn. Reading and writing methods are among those employed. Dictation, listening, and other methods are used. Speaking, drills, memorization, demonstration, and lectures are all examples of activities. The method to be used must be chosen and planned ahead of time in order to maximize time and minimize non-productive activities, with the uncertainty of method selection owing primarily to differences between the teacher, students, and lesson topics. Using a variety of teaching methods will improve the learning process and increase student motivation to learn.

Method that is often used by the teacher is dictation. This method involves two skills; listening and writing skills. This will strengthen the sensitivity of students by using their hearing and touching sense in the process of writing in class. For teachers in special education schools, they taught by pronounced the letter or syllables, and the students will press the keys on a Braille machine according to the suitable dot. By following this method, the students were more proficient in writing Braille as well as strengthen their sensitivity using the sense of hearing. However, there was a difference between dictation method among teachers according to the level of the students.

Listening and speaking methods are used in tandem with listening and writing activities through dictation methods. Listening and speaking are two methods that make use of the sense of hearing. Teachers will say a letter or syllable, and students will repeat the sound before writing it down. Because it emphasizes the sound of a letter, this method is very effective. Because it emphasizes the sound of a letter, this method is very effective. Through the sound of the letter, the student will be able to identify the letter or word. Not only can teachers use them, but teaching aids (BBM) can also be used to allow students to speak through audio material. It necessitates the use of two skills: listening and speaking. The methods used are appropriate for their level.

2.3 LASER ENGRAVING AND CUTTING

2.3.1 Introduction

The practice of laser engraving is to engrave an object with a laser. On the other hand, laser marking encompasses a broader range of techniques for leaving marks on an object, including colour change caused by chemical/molecular alteration, charring, foaming, melting, and ablation. The technique does not require inks or tool bits that come into contact with the engraving surface and wear out, which gives it an advantage over other engraving or marking technologies that require regular replacement of inks or bit heads. Laser marking has had a greater impact on specially designed "lacerable" materials, as well as on certain paints. Laser-sensitive polymers and novel metal alloys are two examples. Laser marking is also a generic term that refers to a variety of surfacing techniques, including printing, hot-branding, and laser bonding. Because laser engraving and laser marking machines are identical, those without knowledge or experience in the field may occasionally confuse the two terms.

Figure 2.3.1 (a) : Common laser engraving machine in market

2.3.2 Automatic Laser Engravers

A laser engraving machine is made up of three primary components: a laser, a controller, and a work surface. The laser serves as a drawing tool: the controller can trace patterns onto the surface using the laser's beam. The controller controls the direction, intensity, velocity, and spread of the laser beam aimed at the surface. The surface is selected to correspond to the material on which the laser can act.

Engraving machines are classified into three types. The most common is the X–Y table, in which the workpiece (surface) is typically stationary and the laser optics move in two dimensions, directing the laser beam to draw vectors. Occasionally, the laser is stationary while the workpiece is in motion. Occasionally, the workpiece will move in one direction while the laser moves in the opposite direction. A second type is for cylindrical workpieces (or flat workpieces mounted around a cylinder), in which the laser effectively traverses a fine helix while producing the desired raster image via on–off laser pulsing. In the third genre, the laser and workpiece are both stationary, and the laser beam is moved across the workpiece surface by galvo mirrors. This technology enables laser engravers to operate in raster or vector modes

figure 2.3.2 (b) *: Laser engraving machine where the X-Y table stationary, only laser is moving.*

Figure 2.3.2 (c) : *Cylindrical laser engraving & cutting machine*

The point at which the laser beam makes contact with the surface should be on the laser's optical system's focal plane; this point is frequently referred to as the laser's focal point. Typically, this point is very small, less than a fraction of a millimetre in diameter (depending on the optical wavelength). When the laser beam passes over the surface, only the area inside this focal point is significantly affected. The laser's energy modifies the material's surface at the focal point. It may heat the surface and vaporize the material, or it may fracture (a process known as "glassing" or "glassing up") and flake away from the surface. Laser engraving is generally accomplished by cutting through the paint on a metal part.

If the surface material is vaporized during the laser engraving process, ventilation via blowers or a vacuum pump is almost always required to remove the noxious fumes and smoke produced by the process, as well as to remove debris from the surface to allow the laser to continue engraving.

A laser can efficiently remove material because the laser beam can be designed to deliver energy to the surface in a way that converts a high proportion of the light energy to heat. The beam is highly focused and collimated—in the majority of non-reflective materials, such as wood, plastics, and enamel surfaces, the conversion of light energy to heat is greater than x percent. However, as a result of its efficiency, laser engraving equipment can become quite warm. The laser requires highly sophisticated cooling systems. Alternatively, the laser beam could be pulsed to reduce excessive heating.

By programming the controller to traverse a specific path for the laser beam over time, different patterns can be engraved. The laser beams trajectory is precisely controlled to ensure uniform material removal depth. For instance, crisscrossed paths are avoided to ensure that the laser is only exposed to each etched surface once, removing the same amount of material. Engraving patterns are also created by considering the speed at which the beam moves across the material. Increasing the design flexibility by adjusting the beam's intensity and spread. For instance, by adjusting the percentage of time the laser is on during each pulse (referred to as "duty-cycle"), the power delivered to the engraving surface can be adjusted to the material's specifications.

Due to the controller's precise knowledge of the laser's position, no barriers on the surface are required to prevent the laser from departing from the prescribed engraving pattern. As a result, laser engraving doesn't require a resistive mask. This is the primary reason for the technique's distinction from earlier engraving techniques.

The production line is an excellent illustration of how laser engraving technology has become an industry standard. The laser beam is focused on a rotating or vibrating mirror in this configuration. The mirror may move in such a way that it traces out numbers and letters on the marked surface. This is especially useful for printing dates, expiration dates, and lot numbers on products as they move down a production line. Laser marking enables the "onthe-go" marking of materials such as plastic and glass. The marking station is referred to as a "marking laser station," which is frequently found in packaging and bottling plants. Laser engraving has largely supplanted older, slower technologies such as hot stamping and pad printing.

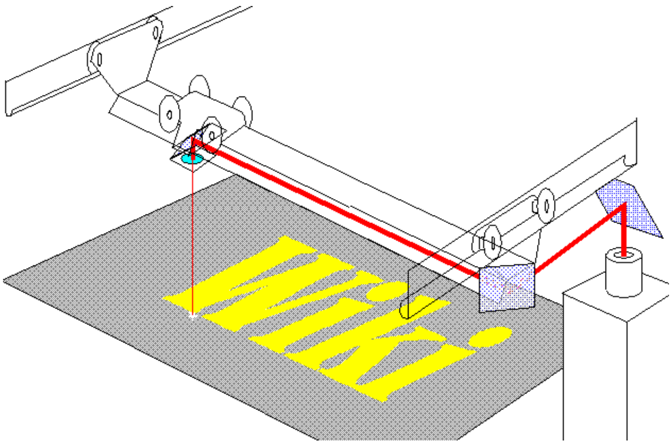


Figure 2.3.2 (d) : *Mirrors on both X and Y carriages allow exact positioning.*

2.3.3 X And Y Carriages Position

A laser table (also known as a "X–Y" or "XY" table) is used for more precise and visually appealing engravings. Typically, the laser is permanently attached to the table's side and emits light toward a pair of movable mirrors, allowing the laser to sweep across the entire table surface. The laser beam is focused at the engraving point through a lens onto the engraving surface, allowing for the creation of extremely precise and intricate patterns.

A typical laser table configuration involves a fixed laser emitting light parallel to one of the table's axes and aimed at a mirror mounted on the end of an adjustable rail. The beam is reflected off the mirror at a 45-degree angle, ensuring that the laser travels precisely along the rail's length. This beam is then reflected by another mirror mounted on a movable trolley, which directs it parallel to the original axis. Two degrees of freedom for etching can be represented using this scheme (one vertical and one horizontal).

Other laser engraving devices, such as flat table or drum engraving, control the laser beam to direct the majority of its energy into a predetermined penetration depth into the material to be engraved. When the engraving is performed in this manner, only a specific depth of material is removed. A simple machined stick or angle-iron can be used to assist trained technologists in focusing the engraver. This configuration is preferable for flat surfaces with little variation in height.

More complicated focusing mechanisms have been developed for surfaces with varying heights. Certain systems are referred to as dynamic autofocus systems. They make real-time adjustments to the lasing parameters to account for changes in the material during etching. Typically, the height and depth of the engraving surface are determined using devices that measure changes in the intensity of ultrasound, infrared, or visible light directed at the engraving surface. These devices, referred to as pilot beams or pilot lasers (if a laser is used), assist in guiding the laser's lens adjustment process to determine the optimal spot to focus on the surface and effectively remove material.

2.3.4 Vector And Raster Mode

Vector engraving follows the line and curve of the pattern being engraved, much like a pen-based plotter does when creating line segments from a description of the pattern's outlines. Much early engraving (laser or otherwise) of signs and plaques relied on pre-stored font outlines, allowing letters, numbers, and even logos to be scaled to size and reproduced with precisely defined strokes. Regrettably, "fill" areas were problematic, as cross hatching and dot-fill patterns occasionally exhibited moiré effects or uber patterns as a result of imprecise dot spacing calculations. Additionally, font rotations and dynamic scaling were frequently incompatible with the capabilities of the font-rendering device. With the advent of the PostScript page-description language, virtually anything that can be described in vectors by PostScript-enabled software such as CorelDRAW or Adobe Illustrator can now be outlined, filled with appropriate patterns, and laser engraved.

Raster engraving uses a laser to trace a back-and-forth pattern across the surface, similar to the printhead on an inkjet or similar printer. Typically, the controller/computer optimizes the pattern so that areas to either side of the pattern that are not intended to be engraved are ignored, shortening the trace across the material. Each line advances less than the laser's actual dot size; the engraved lines overlap slightly to create an engraver continuity. As is true of all rasterized devices, curves and diagonals can suffer if the length or position of the raster lines varies even slightly from the adjacent raster scan; thus, precise positioning and repeatability are critical to the machine's design. The benefit of rasterizing is the near automatic "fill" that it generates. The majority of engraved images are large continuous engraved areas or bold letters, which are well-rasterized. Rasterized images (as in printing) have dots larger than the laser's spot, and these are also the best for engraving. Virtually any page layout programmed can be used to feed a raster driver for an X–Y or drum laser engraver. While traditional sign and plaque engraving favoured solid strokes, modern shops typically run their laser engravers in raster mode, reserving vector for a more traditional outline "look" or for quickly marking outlines or "hatches" where a plate is to be cut.

2.3.5 Materials Used In Laser Engraving & Cutting Machine

a. Nature Materials

Organic materials such as wood are marked via a process called carbonization, which results in a darkening of the surface and highly contrasted marks. Engraving lasers were initially used to directly "burn" images on wood. The required laser power is frequently less than 10 watts, depending on the type of laser utilized, as they are all unique. The results are excellent when using hardwoods like as walnut, mahogany, and maple. While softwoods can be etched with care, they tend to evaporate at shallower depths. Marking softwood needs the least power and enables the fastest cut rates, while active cooling (e.g., a fan with adequate airflow) prevents fire. Hard papers and fiberboard perform admirably; linty papers and newsprint perform similarly to softwoods. Fur cannot be engraved; nevertheless, polished leathers can be laser-engraved to resemble hot-branding. Laser engraving is possible on certain types of latex rubber. These can be used to create inking stamps, for instance.

On polished and resinous woods, paper masking tape is occasionally used as a pre-engraving coating to make cleanup easier than removing the sticky and smoky surround "halos" (and requires no varnish-removing chemicals).

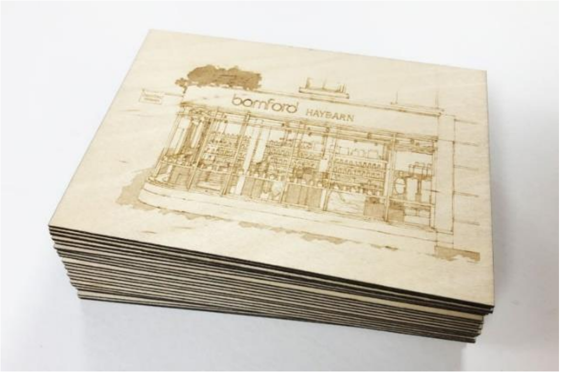


Figure 2.3.5 (a) : *Plywood is a sample from nature supply*

b. Plastics

Each plastic has unique material features, most notably the spectrum of light absorption. Laser irradiation can alter the chemical composition of the substance directly, causing it to melt or evaporate. Plastics are rarely seen in their purest form due to the addition of colorants, UV retardants, and release agents. These additives have an effect on the final outcome of the laser marking process.

Acrylic plastic sheet, standard cast acrylic plastic, and other cast resins all laser extremely well. A frequently engraved award is a cast acrylic object that has been intended to be laser engraved from the rear. Styrene (as used in compact disc casings) and a variety of thermoforming polymers have a tendency to melt around the engraved spot's perimeter. Typically, the outcome is "soft" with little "etch" contrast. At the lip areas, the surface may even distort or "ripple." This is permissible in some instances; for instance, date stamps on 2-liter soda bottles do not have to be precise.

Figure 2.3.5 (b) : *Acrylic is sample from plastic material.*

Laser-marked polymers were developed for signage, face plates, and other applications. These are composed of silicate or other components that transport excess heat away from the material prior to its deformation. This material's outer laminates quickly vaporize, revealing different colored material beneath.

Other plastics may be engraved satisfactorily, although it is recommended to do controlled experiments on a sample piece. Bakelite is supposed to be easily etched with a laser; other hard technical plastics work well as well. However, expanded plastics, foams, and vinyl are typically more suited to routing than to laser engraving. When laser engraved on plastics containing chlorine (such as vinyl or PVC), corrosive chlorine gas is produced, which reacts with the hydrogen in the air to form vaporized hydrochloric acid, which can harm the laser engraving system. Generally, urethane and silicone polymers perform poorly—unless they are filled with cellulose, stone, or another solid insulator material.

Numerous light switch plates manufactured by Leviton or Lutron can be etched using a laser. Again, testing may be required to determine the optimal laser settings for engraving rather than melting the surface. Often, when the laser engraving is completed, the engraved surface is backfilled with paint to increase the contrast between the engraved and surrounding surfaces.

2.4 PLYWOOD MATERIAL

Plywood is a material manufactured from thin layers or "plies" of wood veneer that are glued together with adjacent layers having their wood grain rotated up to 90 degrees to one another. It is an engineered wood from the family of manufactured boards which include medium-density fibreboard (MDF), oriented strand board (OSB) and particle board (chipboard).

All plywoods bind resin and wood fibre sheets (cellulose cells are long, strong and thin) to form a composite material. This alternation of the grain is called cross-graining and has several important benefits: it reduces the tendency of wood to split when nailed at the edges; it reduces expansion and shrinkage, providing improved dimensional stability; and it makes the strength of the panel consistent across all directions. There is usually an odd number of plies, so that the sheet is balanced—this reduces warping. Because plywood is bonded with grains running against one another and with an odd number of composite parts, it has high stiffness perpendicular to the grain direction of the surface ply.

Smaller, thinner, and lower quality plywoods may only have their plies (layers) arranged at right angles to each other. Some better-quality plywood products will by design have five plies in steps of 45 degrees (0, 45, 90, 135, and 180 degrees), giving strength in multiple axes.

2.4.2 Types plywood

a) Softwood

Softwood plywood is usually made either of cedar, Douglas fir or spruce, pine, and fir (collectively known as spruce-pine-fir or SPF) or redwood and is typically used for construction and industrial purposes. The most common dimension is 1.2 by 2.4 metres (3 ft 11 in × 7 ft 10 in) or the slightly larger imperial dimension of 4 feet × 8 feet. Plies vary in thickness from 1.4 mm to 4.3 mm. The number of plies—which is always odd—depends on the thickness and grade of the sheet. Roofing can use the thinner 16-millimetre (5⁄8 in) plywood. Subfloors are at least 19 millimetres (3⁄4 in) thick, the thickness depending on the distance between floor joists. Plywood for flooring applications is often tongue and groove (T&G); This prevents one board from moving up or down relative to its neighbor, providing a solid-feeling floor when the joints do not lie over joists. T&G plywood is usually found in the 13-to-25-millimetre (1⁄2 to 1 in) range.

b) Hardwood

Hardwood plywood is made out of wood from dicot trees (oak, beech and mahogany) and used for demanding end uses. Hardwood plywood is characterized by its excellent strength, stiffness, durability and resistance to creep. It has a high planar shear strength and impact resistance, which make it especially suitable for heavy-duty floor and wall structures. Oriented plywood construction has a high wheel-carrying capacity. Hardwood plywood has excellent surface hardness, and damage- and wear-resistance.

c) Tropical

Tropical plywood is made of mixed hardwood species of tropical timber. Originally from the Asian region, it is now also manufactured in African and South American countries. Tropical plywood is superior to softwood plywood due to its density, strength, evenness of layers, and high quality. It is usually sold at a premium in many markets if manufactured with high standards. Tropical plywood is widely used in the UK, Japan, United States, Taiwan, Korea, Dubai, and other countries worldwide. It is used for construction purposes in many regions due to its low cost. However, many countries' forests have been over-harvested, including the Philippines, Malaysia and Indonesia, largely due to the demand for plywood production and export.

d) Aircraft

De Havilland DH-98 Mosquito was made of curved and glued veneers
High-strength plywood, also known as aircraft plywood, is made from mahogany, spruce and/or birch using adhesives with an increased resistance to heat and humidity. It was used in the construction of air assault gliders during World War II and also several fighter aircraft, most notably the multi-role British Mosquito. Nicknamed "The Wooden Wonder" plywood was used for the wing surfaces, and also flat sections such as bulkheads and the webs of the wing spars. The fuselage had exceptional rigidity from the bonded ply-balsa-ply 'sandwich' of its monocoque shell; elliptical in cross-section, it was formed in two separate mirror-image halves, using curved moulds.

Structural aircraft-grade plywood is most commonly manufactured from African mahogany, spruce or birch veneers that are bonded together in a hot press over hardwood cores of basswood or poplar or from European Birch veneers throughout. Basswood is another type of aviation-grade plywood that is lighter and more flexible than mahogany and birch plywood but has slightly less[citation needed] structural strength. Aviation-grade plywood is manufactured to a number of specifications including those outlined since 1931 in the Germanischer Lloyd Rules for Surveying and Testing of Plywood for Aircraft and MIL-P-607, the latter of which calls for shear testing after immersion in boiling water for three hours to verify the adhesive qualities between the plies meets specifications. Aircraft grade plywood is made from three or more plies of birch, as thin as 0.40 millimetres (1⁄64 in) thick in total, and is extremely strong and light.

Howard Hughes' H-4 Hercules was constructed of plywood. The plane was built by the Hughes Aircraft Company employing a plywood-and-resin Duramold process.The specialized wood veneer was made by Roddis Manufacturing in Marshfield, Wisconsin.

e) Decorative (overlaid)

Usually faced with hardwood, including ash, oak, red oak, birch, maple, mahogany, shorea (often called lauan, meranti, or Philippine mahogany, though having no relation to true mahogany), rosewood, teak and a large number of other hardwoods.

f) Flexible

Flexible plywood is designed for making curved parts, a practice which dates back to the 1850s in furniture making.[citation needed] At 3⁄8 inch (9.5 mm) thick, mahogany three-ply "wiggle board" or "bendy board" come in 4 by 8 feet (1.2 m × 2.4 m) sheets with a very thin cross-grain central ply and two thicker exterior plies, either long grain on the sheet, or cross grain. Wiggle board is often glued together in two layers once it is formed into the desired curve, so that the final shape will be stiff and resist movement. Often, decorative wood veneers are added as a surface layer.

In the United Kingdom single-ply sheets of veneer were used to make stove pipe hats in Victorian times, so flexible modern plywood is sometimes known there as "hatters ply",[citation needed] although the original material was not strictly plywood, but a single sheet of veneer.

2.5 THE DEVELOPMENT OF BRAILLE

2.5.1 Stylus braille

Slate and stylus are tools that blind people use to write text that can be read without help. Created by Charles Barbier as a tool for writing letters that can be read by touch, slate and stylus allows for a quick and easy method in the 18th century, this stylus continues to create embossed prints for the encoding of Braille characters. Previous methods of making embossed prints for the blind require a movable type printing press .

Figure 2.5.1 (a) *: stylus braille*

The basic design of the slate consists of two pieces of metal, plastic or wood fastened together with hinges on one side. The back of the slate is solid with a slightly spaced indentation in a braille cell of six points each. The bend is about 0.75 mm (0.030 in) deep and about 1.5 mm (0.059 in) in diameter. The horizontal and vertical distance between the points in the cell is approximately 2.5 mm (0.098 in), while the distance between adjacent cells is about 4 mm (0.16 in). The front part of the slate consists of a rectangular window that fits the braille cell at the back. The rim in each window is provided with six indentations, which helps the user to correctly place the stylus and press to form a dot.

There is a pin or pole on the back of the slate placed in a non-cell area to hold the paper in place and make sure the top is correctly placed on the back. The pins align with the corresponding indentations on the opposite side of the slate. A slate like the one designed for an ordinary 8.5-inch piece of paper has 28 cells in each row. Rows can be any number, usually at least four. The stylus is a short blunt underlayer with a handle to fit comfortably on the user's hand.

How to Write using a braille stylus

Start by holding the pen or stylus with the right hand of the index knuckle is above the head of the pen and the tip of the index touches the pen stick, the thumb and the middle finger clamp the nail of the pen. (Refer picture 2. 2.1 (b)). Start by writing on the second line, so that the writing of the first line is not too much to the top edge of the paper, and the writing begins from the right side. In general if ordinary people like us will start writing from left to right. This Karana writing using the stylus should use the "mirror system", so at the time of writing, you have to number the Braille dots with an inverted orientation. (See back study diagram 2 .3.1 (c) about the numbering of Braille dots). With this reverse orientation, point 1 is at the top right, point 2 in the center right, point 3 in the bottom right, point 4 at the top left, point 5 in the center left, and point 6 is below left.

Figure 2.5.1 (b) *: how to fit a stylus pen*

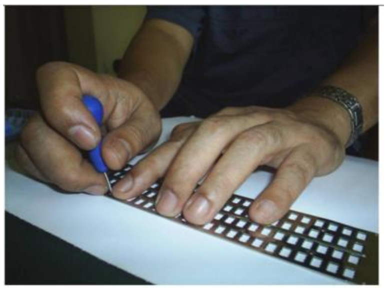


Figure 2.5.1 (c) *: how to write a stylus*

When piercing the stylus pen should be in a vertical state. In addition, the right hand presses the stylus pen, the forefinger end of the left hand serves as a "bounce" of the stylus pen movement. Especially important for people with visual impairment, the left forefinger should always be in the compartment to be pierced so that the author does not lose track of making a braille point. The tip of this left index finger must remain light on the stylus pen nail and must move from the compartment to the left so as not to puncture another compartment. (Refer picture 2. 2.1 (c)).

In addition to the system designed by Louis Braille, several other methods for blind people read or write on paper have been used. One of the most popular is the English system of Dr. William Moon created in 1845. The English/Moon system or Moon type is easy to learn for those who are newly blind because it has a strong resemblance to familiar writing. alphabet, but Braille has such a great advantage over the "Moon system" for regular use that the Moon system has never been that popular. Braille with its slate and stylus is unique in that it is the first and, up to a computer with a screen reader, the only method a blind person can write and read for themselves what has been written.

***Figure 2.5.1 (d)** : Six principal systems of embossed type*

The earliest systematic attempt to provide a method to "teach the blind to read and write, and give them self-printed books" was by Valentin Haüy who used the embossed roman character system . In June 1784, Haüy searched for his first disciple in the church of Saint-Germain-des-Prés. On December 5, 1786, haüy's disciples made arising from the type of movable printing machine " Essai sur l'éducation des aveugles " (Essay on the Education of Blind Children), the first book ever published for the blind. Before 1786, tools for blind people to read or write were the result of individual personal solutions. Professor of Lucasian Mathematics at Cambridge) blind almost from birth, who invented the Arithmetic slate.

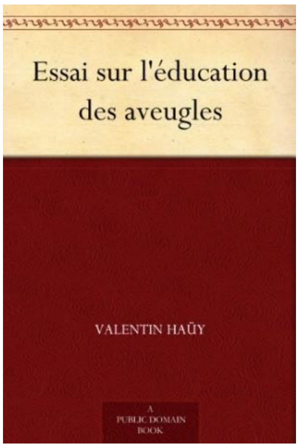


Figure 2.5.1 (e) *: the first book ever published for the blind*

Braille grew out of the method developed by Charles Barbier . It was successfully used at the Institution Royale des Jeunes Aveugles in Paris for several years, until Braille created its own system, which was more compact and flexible.

2.5.2 Braille Typewriter

The Perkins Brailler has been the most widely used mechanical braille writer in the world since its invention in 1951. With over 70 years of craftsmanship, the brailler stands the test of time with a resilient metal casing and a closed body architecture that limits dust accumulation. Braille Perkins Braille machine model products produced by Howe Press, Perkins School for the Blind, USA. That can be used on a piece of paper measuring 11 x 11 1⁄2 inches, with this Perkins Braille machine a person with visual impairment can write 25 lines of Braille text, with 42 Braille characters per line. In addition, this Perkins Braille machine can also be used in paper that is smaller in size.

Figure 2.5.2 (a) *: Perkins Braille*

The Perkins Braille is a "braille typewriter" with keys that match each of the six code braille points, space keys, backspace keys, and line space keys. Like the typewriter manual, it has two side knobs for forwarding paper through the machine and a car return lever on top of the key. The rollers that hold and advance the paper have grooves designed to avoid crushing the points raised by the braille. Although braille notes were made for people who were blind or visually impaired, before the introduction of Perkins Braille, writing braille was a burdensome process. Braille writers created braille codes such as the letter a using a braille stylus and slate (as developed by Louis Braille) or by using one of the complex, expensive, and fragile braille writing machines that existed in the 18th century.

The first Braille writer's machine was presented by the Frank Haven Council in 1892. The original Perkins Braille was produced in 1951 by David Abraham (1896–1978), a carpentry teacher at the Perkins School for the Blind who was unhappy with the technological problems that existed in those days. The director of the Perkins School for the Blind, Gabriel Farrell, asked Abraham to create a cheap and reliable machine to allow students to write braille more easily. Farrell and Abraham worked with Edward Waterhouse, who was a math teacher at Perkins, to create a design for the Braille machine.

Figure 2.5.2 (b) *: Perkins Braille*

In keeping with the six-point pattern used in Braille, this braille perkins machine has only six press buttons, three on the left and three on the right, separated by a spacing button. The three buttons on the left are used to make points 1, 2, and 3; whereas three buttons on the right to make points 4, 5, and 6. The button for point 1 is pressed with the left forefinger, point 2 with the left middle finger, and point 3 with the left ring finger; whereas the button for point 4 is pressed with the right index, point 5 with the right middle finger, and point 6 with the right ring finger. To make a letter consisting of several dots (e.g. the letter q consisting of the point 1-2-3-4-5), all the buttons that make up those dots are pressed simultaneously.

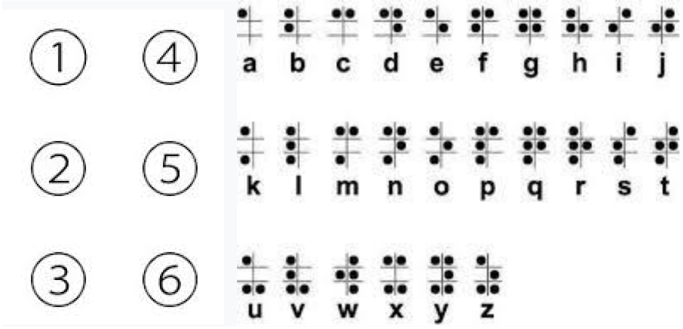


Figure 2.5.2 (c) *: braille point position*

2.6 BRAILLE TECHNOLOGY

2.6.1 Braille Sense PLUS

Figure 2.4.1 (a) *: computer usage*

Braille Sense PLUS is a tool used to make notes for people with visual impairment using the Braille keyboard. The size of this tool is small and has an attractive design and is easy to carry anywhere. There are various functions among them are "word processor", "web browser", "schedule manager", and "media player". The tool also has internet software that allows its users to send emails and can be connected to a computer using USB, CF memory and Bluetooth. In addition, audio facilities such as MP3, MP4, WAV equipped with sound effects sets such as "Bass Boost", echoes and 3D effects. This audio software also allows users to record voice.

This tool is very expensive and is not available in Malaysia and is only available in developed countries such as Japan, Canada, Germany, and France. This tool is very helpful especially for the visually impaired who use the Braille medium as it is designed for them and makes it easier for them at work or study. This is so because, this tool can translate Braille into plain writing.

2.6.2 Braille e-book

Figure 2.6.2 (a) *: E-book*

The design of the Korean concept published in 2009 by Yanko Design attracted attention. A British prototype design called "Ana graphs" was created in 2013, but funding from the European Union ran out before it could be brought to

4th quarter 2016 by the Austrian company Blitab. It is expected to cost under US$3000. As of February 2019, the company has invited people to register as "Testers", with the explanation, "Be among the first to touch and feel the future of large-scale touch Braille displays."

In 2018, the German company Metec introduced the Braille E-Book, which, unlike its predecessor, has a field size of 120 x 97 mm, which can accommodate eight lines with 16 characters each. The device allows blind users to learn graphs and geographical maps by means of touch. The cost of the device is €13,800 (in 2019). Since then it has had a number of improvements including the size of the display, now it reaches 260 x 150 mm.

In 2019, Orbit Research together with the American Printing House for the Blind released a Braille Graffiti e-book, which allows blind people to explore infographics. 2,400 points that rise to different heights are capable of transmitting topographic maps and other graphic elements such as shadows and colors. The device also includes an eight-key braille keyboard for text entry. The cost of the device is $24,666 (in 2021).

In 2020, engineering startup 4Blind, Inc. of Boston created a touch e-book called Braille Pad. This is an 8-inch tablet (contains 3249 touch pixels) with a built-in camera, which gives access to any graphic image (map, graph, etc.), and also allows the user to take pictures with instant touch transmission.

2.6.3 Voice stick

Figure 2.6.3 (a) *: Voice stick*

Translate printed text to voice for visually impaired people The latest figures from the World Health Organization (WHO) put the number of visually impaired people worldwide at 314 million, with about 45 million of them blind. Women are more at risk than men in all age categories, and 87 percent of the world's visually impaired people are in developing countries.

Voice Stick combines scanning technology with voice output technology to allow blind people to read printed text like a short-sighted person. In short, when Voice Stick is used to scan pages, the text is read aloud.

The goal of Sungwoo Park designers to create a hearing reading system for the visually impaired involves two translation steps: "First, optical character recognition technology scans typed text and translates it into machine-editable text," he explains. " Second, Voice Stick then uses text-to-speech technology to translate scanned written text into voice-speech renditions."

"It's very difficult for someone with vision to fully understand the experiences and needs of a blind person," Park explains of the design process. "I closed my eyes for two days to try to understand the challenges, and I did a lot of training in touching things and trying to understand the world that way. It gives me a symbolic meeting point factor in the work as well. Two senses are brought into the game in the service of the other.

2.7 SPI transitions the use of BBP code to UEB code

British Braille Primary (BBP) CODE, Unified English Braille (UEB)
BBP was adopted in 1932. The International Council on English braille made a forfeiture in 2004 so it was surprising that the UEB di coordinated the use of braille. The UED code is the main literacy code adopted by people with visual impairment in the fields of science, technology, engineering and mathematics in foreign countries such as AM. Company, UK, Australia, Singapore and Indonesia. The transition from the BBP to UEB code will positively affect people with visual impairment taking into account the needs of people with visual impairment in international exams such as A-Level, International English Language Test System (IELTS) and Test English as a foreign Language (TOEFL).

This transition is said to be very important for visually impaired people in Malaysia to be able to use a uniform literacy code as used in other countries today. Ministry of Education Malaysia (MOE), Committed to ensuring that visually impaired people get quality education in quality education programs in integrated education programs and inclusive education programs, Thus, people with visual disabilities can access quality education with the transition of the BBP code to the UEB code to help people with visual disabilities to obtain information and share braille publications using the UEB format is widely online. KPM professional meeting no. 20/2021 dated 1 June 2021, approved the transition of the BBP code to the UEB code for people with visual impairment in stages starting in 2022.

The implementation is that the instructors or advocates in the examination of the learning certificate in the Malaysian learning certificate examination and the Malaysian high school certificate using the UED code which can be referred to in the Unified English Braille: Guidelines for Technical material published by the International Council on English Braille (2014 review) which can be downloaded on the website provided as a reference. The effective date is stated by the SPI from the first day of the school calendar in 2022.

CHAPTER 3

METHODOLOGY

3.1 Introduction of Research Method

The basic of our group search is from internet resources which are among the easiest access to use, especially in this Covid-19 pandemic situation. Our search begins with a history of the final year project of braille that has been made by past senior students. Therefore, from the created braille to the appropriate and practical games and the result of ergonomic design for users of this game. We started with the idea of a sahiba game that everyone uses to play and can be used as a learning tool because it uses the basics of thinking to build sentences. Next is how the game is created to give positive results from the players who play this game. The game should also meet the learning objectives in which the game should be designed for learning. For meetings in controlling the Covid-19 pandemic, we use the MS Teams app which we will have a discussion about all shared ideas and selection suitable for design. Not only that, we also tried to have discussions with those with experience in teaching visually impaired and blind children who are teachers from special schools in Kuala Besut.In addition, we propose to conduct research activities with external agencies face-to-face with assistants from the Department of the Association of People with Islamic Vision Disabilities Malaysia (PERTIS). It is the help and ideas from supervisors and teachers that help us continue to improve ideas about this product.

3.2 Development of the research

At the beginning of our group's research, we need to study first about the design to be built next we can propose different types of ideas and sketch them to choose one type of product and all designs from it can provide good usability. For example, we are looking for designs from internet sources such as furniture, equipment racks, braille and so on. Therefore, the discovery of all these ideas can be considered a product of choice. We have selected one type of product which is braille games for visually impaired children. This braille game can also benefit others such as children with vision problems such as blindness. After we selected Braille games as our product, we created a variety of game designs and types for our braille. Therefore, we propose to make alphabetical letters and put the product title as Sozler Braille which is divided into 2 parts of the product which is Box Sozler Braille with Wheel Sozler Braille and our design has been presented and approved by our own supervisor is Mr. Zullhyzrifee Ishraf Bin Zulkifly.

Next, we do in-depth research related to our braille game, we also look for information available on the internet related to the letters of the alphabet. In fact, we also conducted studies to find schools or NGOs with the Integrated Special Education Programme (PPKI) that have a visually impaired category in their schools. So we have been in touch with many NGOs and finally we got some teachers and female assistants from the Special School in Kuala Besut, Terengganu and from the agency of the Department of the Association of People with Islamic Vision Disabilities Malaysia (PERTIS). We contacted Cikgu Amirah Adilah from the Special School in Kuala Besut and she wanted to work with our group to give their thoughts and views on our braille game. In fact, not only that, Amirah Adilah's teacher is also interested in this game that we designed. In addition, our group once again improved our braille game design such as doing in-depth research and improving in terms of design. Therefore, the views and opinions of some parties regarding the alphabetical braille game are very positive and encouraged to continue and we plan to use a cover case for our products to ensure more effective storage of this game. Therefore this game can be carried anywhere .

In addition, this Box Sozler Braille game is designed by having a braille-shaped laptop-like keyboard that has only 27 letters of the alphabet. And each letter of the alphabet has 3 layers of parts. Next, the product has a special area for constructing 2 syllables. Once the braille game design is planned, our group discusses and determines each size that our braille products should have.

	LENGTH	THICKNESS
Box Sozler Braille	290mm X 375mm	31mm
Wheel Sozler Braille	250mm (Diameter)	23mm

Table 3.2 (a): *Measurements for all board and blocks.*

Next, we make a list of cuts and approximate calculations for our product set. Once almost everything is ready, our group also produces and prepares reports for our braille products. Therefore, everyone from our group has participated in preparing research reports on our braille products. Finally, after studying and doing various research related to our braille products, then we were able to find out a little about braille products for blind children. Next our group will prepare a final report to send to our supervisor, Mr. Zullhyzrifee Ishraf Bin Zulkifly.

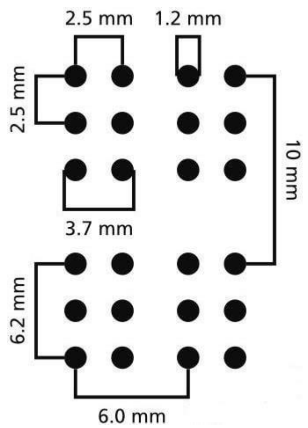


Figure 3.2 (a) : *Size and spacing braille dot*

Our research on the size and size of braille points is that every major braille-producing country has standards for the size and distance of embossed braille on paper. In the United States and Canada, the de facto standard is the value presented in Specification 800, "Books and Brochures of Braille," from the National Library Services for the Blind and Physical Disabled of the Library of Congress.

3.3 System Design and Development of Braille Educational Toys

a. System Design

Figure 3.3.a (a) : *Box Sozler Braille*

Figure 3.3.a (b) : *Wheel Sozler Braille*

For our Braille Products, we create designs inspired by other products on the market. We want to make it portable and easy to carry, whether it's for teachers to use in schools. Most of the other products on the market only offer for use to normal people. We want to produce products that can be helpful and useful to those who use them.

***Figure 3.3.a (c)** : Case to use at Box Sozler Braille*

***Figure 3.3.a (d) :** Case and Box Sozler Braille*

The design of our Box Sozler Braille Products is like a sahiba game so to make it easier for users to use it and store it is to create a cover case. Therefore it can please the users to be carried around such as the example of use in school . This type of toy can stimulate children's sensory touch and make their fingers more sensitive to touch when reading braille.

***Figure 3.3.3 (e)** : Box Sozler Braille rendering*

For Box Sozler Braille products, we only include basic letters from A to Z. Next, each keyboard number per letter is 3 while for vowels we overstate the number of each keyboard . On each keyboard surface, we place a braille so that children playing can detect it with their hands and pick up and sort on the space build 2 syllables at the top of the surface of the Box Sozler Braille. This causes the child to think about building 2 syllables that they want to do. It can be a great lesson in the classroom.

Figure 3.3.3 (f) : Wheel Sozler Braille rendering

For Wheel Sozler Braille products, we inspire from the existing Magicphonic Wheel product on the shopee purchase site which is the use to build 1 syllable. For the design of this product is like a circle map flowchart where the vowels are on the outside while all the consonants are inside. In addition, we inspired the game in terms of the mechanism of the spinner fidget tool. For reading always start on the right side to form 1 syllable.

b. System Development

In this project, we use the Waterfall method for product development. The Waterfall methodology is a sequential development process, in which progress flows continuously towards the conclusion through the project phase.

1. Analysis

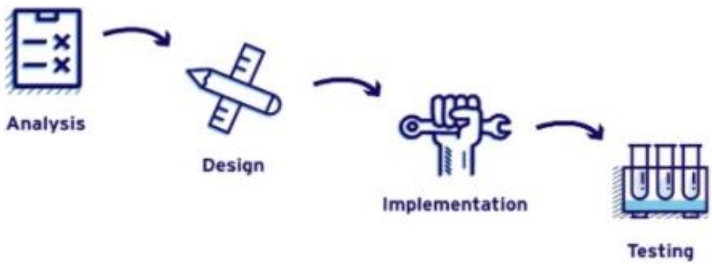


Figure 3.3.b (a) : *Project phases in Waterfall methodology.*

We did a discussion and did some research on braille toys that are already available on the market. There are not many braille toys in the Malaysian market. Besides, there are no more products that are the same as the ones we want to implement.

2. Design

According to research for analysis, we also looked at and created designs for each product. We take into account functionality, portability and creativity based on available data

3. Implementation

Using AutoCAD software, we began to develop our designs based on research and data collected. In between the processes, several changes have been made to make it work and innovation. Our team members and supervisors help a lot in this process.

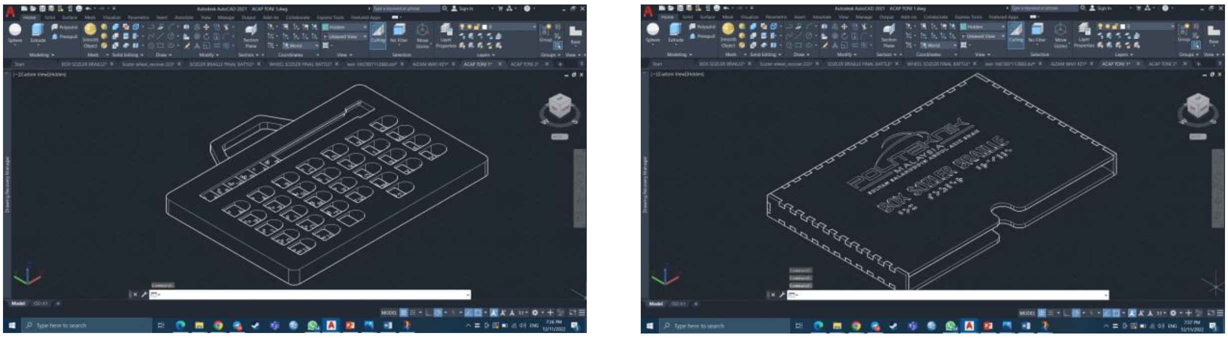


Figure 3.3.b (b): *Drawing AutoCad Box Sozler Braille*

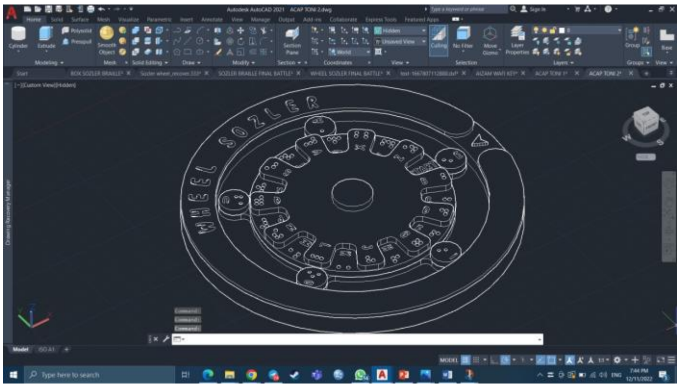


Figure 3.3.b (c): *Drawing AutoCad Wheel Sozler Braile*

4. Product Testing

This product is tested by modeling to ensure that it can see the shape of the project to be done. Therefore, it can be simulated using the model that has been created to ensure that it can be functional and usable.

Figure 3.3.b (d): *Model Product Box Sozler Braille*

3.4 Research Site

The term for a Research Site is that on-site research involves physically moving to a specific place to collect information related to a research project. It may consist of a visit to the institution's archive to collect information related to the research or a visit to a place involved in a research project to obtain direct information through interviews, record checks and visual inspections.

Figure 3.4 (a): *Site we visit for research*

Figure 3.4 (b): *Show the model product to Puan Nor Saliza*

Our research has also been carried out through external assistance at the Department of the Association of People with Islamic Vision Disabilities Malaysia (PERTIS) located in Taman Capital, Gombak. We plan and conduct face-to-face interview sessions to source research knowledge on our products. In addition, we also bring our product model for verification and do a demonstration of use of the product model to ensure that the product we want to do is good and can work properly.

Figure 3.4 (c): *Supervisor teach Puan Nor Saliza use model*

Figure 3.4 (d):*Puan Nor Saliza use model*

There was a lot of information that we got during our visit to the Department of the Association of People with Islamic Vision Disabilities Malaysia (PERTIS). Various books and machine tools are available in the PERTIS building which focuses on learning to the visually impaired. In addition, the PERTIS assistant showed a demo session on the use of machines to print braille on paper. With this, our group can learn about the use of the machine and how it operates. Next, we can also taste and see the braille print paper given by the PERTIS assistant.

Figure 3.4 (e): *Machine Printing Braille Paper*

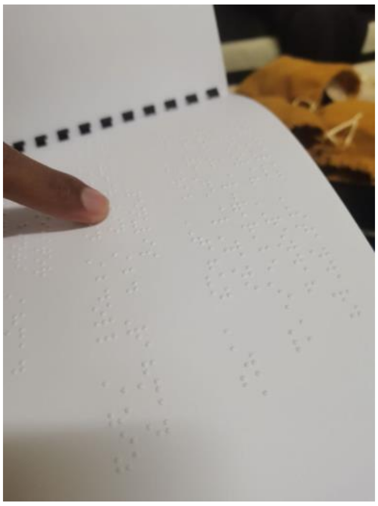


Figure 3.4 (f) :*Braille Paper*

One thing our group noticed was that all of Braille's books were written only in its symbols, no six-point brackets. For us, that can see, it might be confusing because we don't know what alphabet it is and where the sentence ends. The books featured are likely to be intermediate to experts in reading Braille as most of the books are there for ages around 14 and older. Therefore, there are many assistants who are experts who are there to help those who come to visit there to do research.

Figure 3.4 (g) *: Site the school*

In addition, our group is also offered from the agency of the Association of People with Islamic Vision Disabilities Malaysia (PERTIS) to conduct testing on products that are almost completely completed to children with visual impairments to ensure the effectiveness of the product for use at a good rate. PERTIS offers to go to Sekolah Kebangsaan Putrajaya Precinct 18(1) located at No 1, Jalan P18, Precinct 18 62250 Putrajaya. The school also has a special school in terms of hearing impairment and visual impairment.

Figure 3.4 (h) *: The school hall meeting*

Our group and our supervisors together with the PERTIS agency held a meeting with the administration teachers of Sekolah Kebangsaan Putrajaya Precinct 18(1) together with several number of visually impaired children in the meeting hall to conduct interview initiation sessions as well as product testing sessions.

Our group gave and stated how our products are played and used, namely Box Sozler Braille and Wheel Sozler Braille products to administration teachers at the school as well as visually impaired children.

Figure 3.4 (i) *: Show the product at administrative teacher*

Figure 3.4 (j) *: Blind children play the Box Sozler Braille and Wheel Sozler Braille*

3.4.1 Machines

At the beginning of our discussion session, in addition to using a table saw to cut wood, we wanted to use machine tools to provide our products, namely Laser Carving and Cutting where this machine is located in Digital Maker Space which is located in the Faculty Studies Management building, Polytechnic Sultan Salahuddin Abdul Aziz Shah. After that, we use as much laser engraving and cutting as possible to complete our project from neat cutting of each wooden board to the smallest hole to put the bead seeds used as braille. Because of this, laser cutting and gravity are one of the objectives for our final project. In addition, we also use finished finishing materials such as sandpaper to ensure that the surface of the product looks neat and beautiful.

Figure 3.4.1 (a): *Faculty Management Studies building*

Figure 3.4.1 (b*): Laser Engraving and Cutting machines*

3.5 Laser Engraving and Cutting

Figure 3.5 (a): *Laser Engraving and Cutting machines at Digital Maker Space.*

The use of laser carving and cutting in our project is 100% as we make full use of this machine to produce products to complete the cutting and graving. The finishing result is very satisfied and the use of this engraving machine and laser cutter is also easy to operate and safe compared to other cutting machines. The disadvantage of the machine here is that it has set a large size and maximum thickness used wood should not exceed 700cm x 250cm and its thickness should not exceed 5mm. This size factor is important because it will interfere with the finish on the product we want laser because the operation of this machine is to use a program that has been prepared or according to laser carving and cutting machine. The program used for machines in polytechnics is RDWorks where RDWorks is a free program that allows you to easily carry out the process of cutting and engraving lasers. RD Works is a design and drawing program that supports drawing points, horizontal and vertical lines, polylines, ellipticals and circles, rectangles and squares, Bezier curves, text and formats for CAD models such as DXF, AI and PLT. So,the steps to use laser carving and cutting as follows:

1) Turn on the switch machine industrial chiller (CW-3000) and also turn on machine C02 laser engraving with release E-Stop Switch and turn the key power switch . Cooler is to cool laser carvings and cutting machines because the machine consumes very high heat.

Figure 3.5 (b) :*Industrial Chiller switch on*

Figure 3.5 (c) : *Machine C02 Laser Engraving on*

2) Take the plywood that has been rubbed with a sandpaper machine and place it on the workbench to measure the height of the laser eye using the tools provided. Between laser and stick eye spacing must be measured correctly and accurately so that simple settings are set on the RD Work program later.

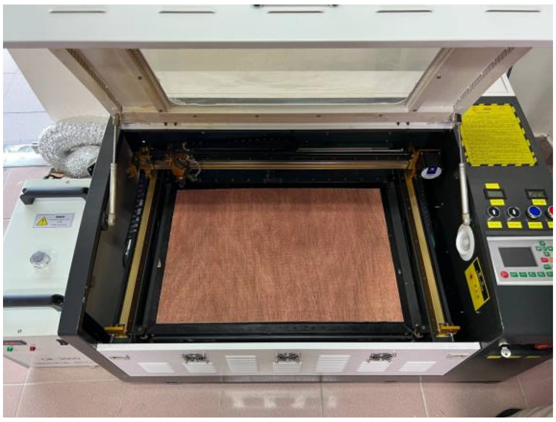


Figure 3.5 (d) : *Setting the height between laser and plywood*

3) Next, open the RD Work program on a laptop or computer and connect the laser engraving and USB cutting machine (Universal Serial Bus) , open the RD Work program on a laptop or computer and connect the laser engraving and USB cutting machine (Universal Serial Bus) wire to the laptop or computer. Yar to a laptop or computer. At the same time, tap the pendrive on your laptop or computer to get the work file you want to do.

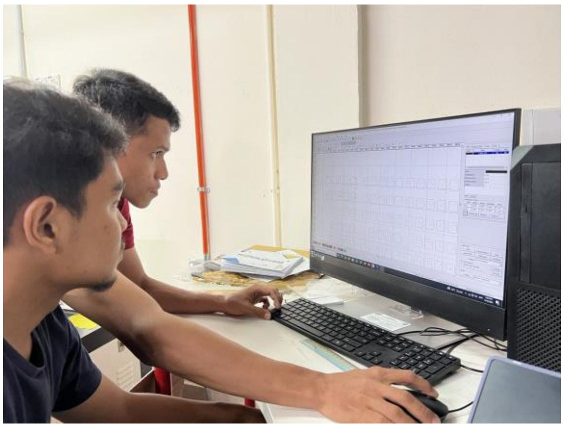


Figure 3.5 (e) *: Setting RD Work Program*

4) Convert CAD (DWG file) to a file compatible with programs like DXF.

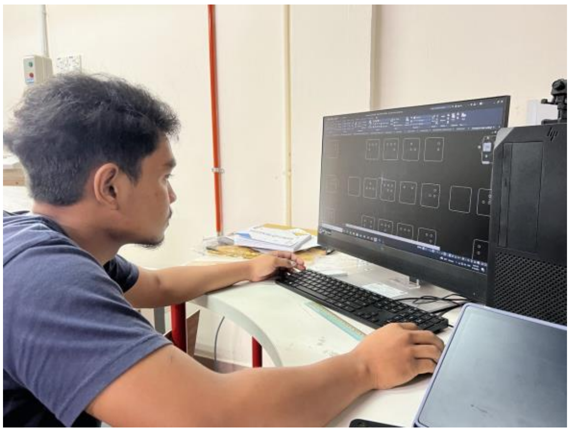


Figure 3.5 (f): *Convert CAD file to RD Works.*

5) After transferring the CAD file to the RD Work program, the next step is the drawing settings that you want to cut and which you want to carve where the use of laser scans is for laser engraving and the use of laser cuts for laser cutting.

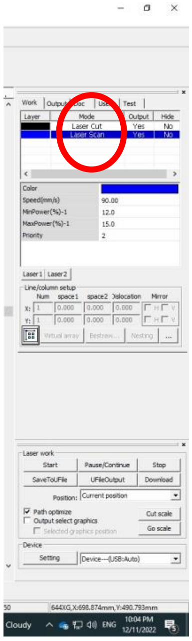


Figure 3.5 (g) : *In red circle, it show a mode in RD Works program*

6) Different colors on the sides of the cut column and laser scans are a way to arrange layers for cuts and scans that need to be done in advance so that the laser movements move quickly and in order.

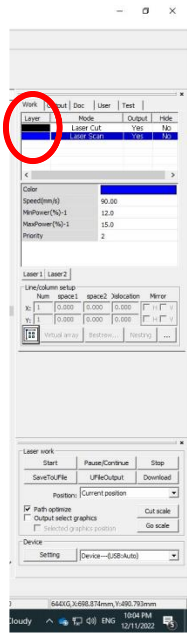


Figure 3.5 (h) : *In red circle, it show a different layer.*

7) Next, the most important setting to do is the power and speed that will impact according to the thickness of the wood cut and the desired thickness of the carving on the wood.

The speed we usually put on the cut is 6 mm / s power and 60-65% on wood and for scanning we use a speed of 90mm / s and a power of 12%. Changes in speed and power consumption will also vary according to the thickness of the material and the type of material used.

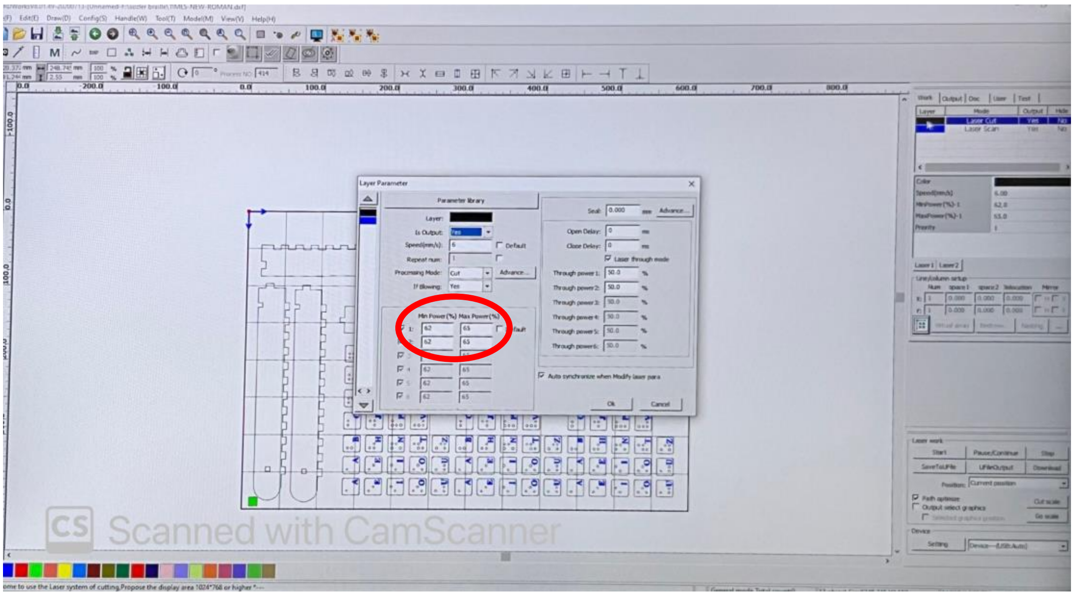


Figure 3.5 (i) *: In red circle, it show setting for speed and power for cutting*

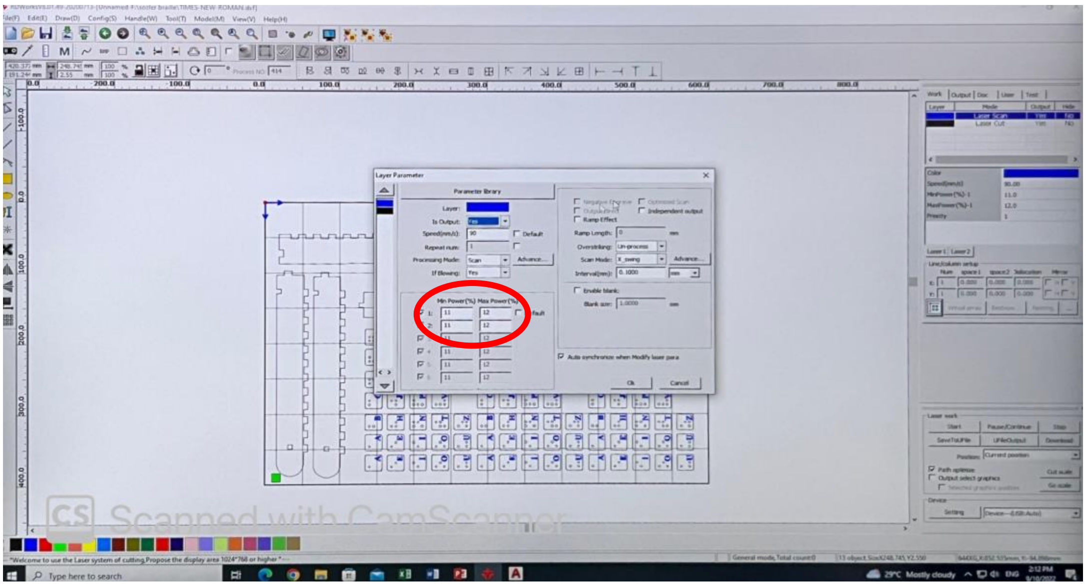


Figure 3.5 (i) : *In red circle, it show setting for speed and power for engrave*

8) After completing the settings in the RD Work program, files can be saved with download and transferred to a laser engraving and cutting machine.

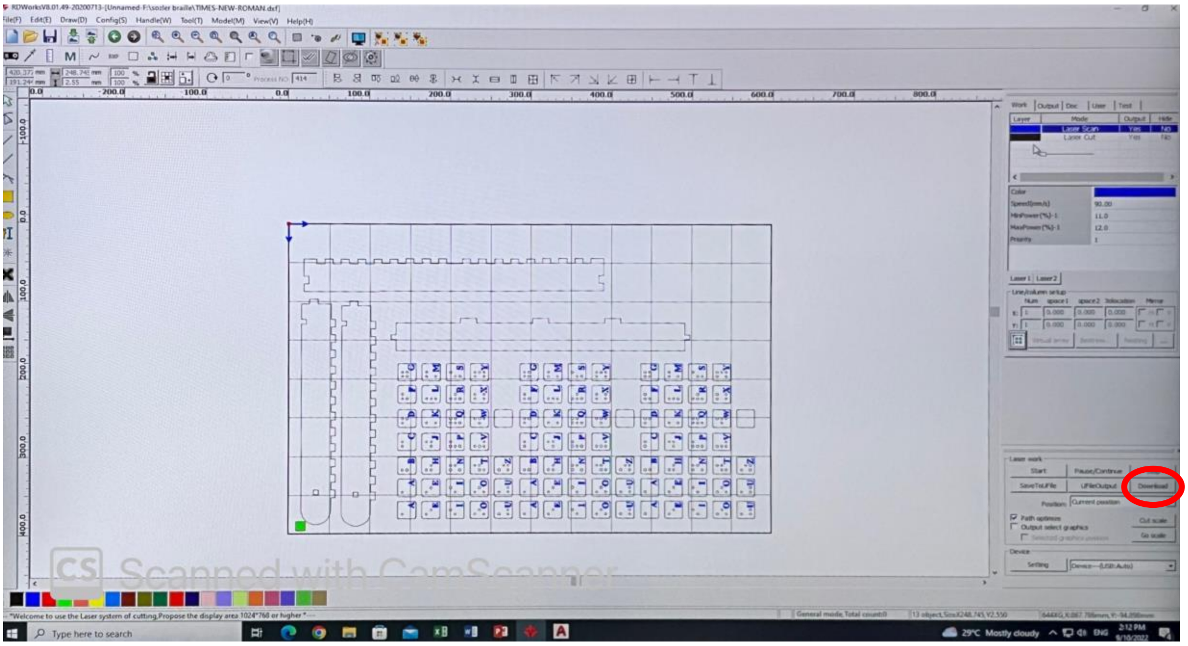


Figure 3.5 (j) : *Ready to transfer*

9) Adjust the origin of the laser at the point of the wooden surface. The origin is the first stage of operating the laser machine.

Figure 3.5 (k) : *Button control Machine C02 Laser Engraving*

10) The controller on the laser engraving and cutting machine is to measure the height of the workbench, the position of the laser eye and other

Figure 3.5 (l) : *Laser engraving and cutting controller.*

11) Once the origin has been set, you can press the start button on the controller and close the door of the machine to avoid debris and dust coming out.

Figure 3.5 (m) : *Door machine close*

12) Operate laser engraving and cutting

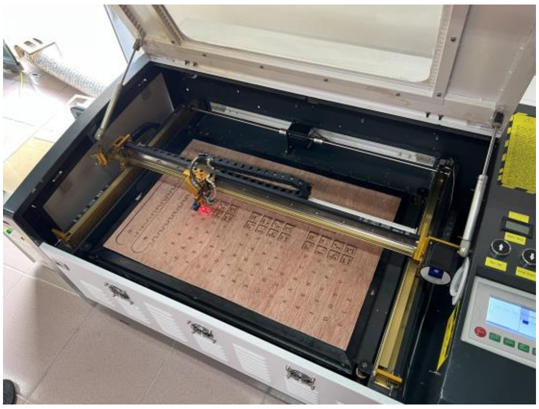


Figure 3.5 (n) : *Cutting Box Sozler Braille*

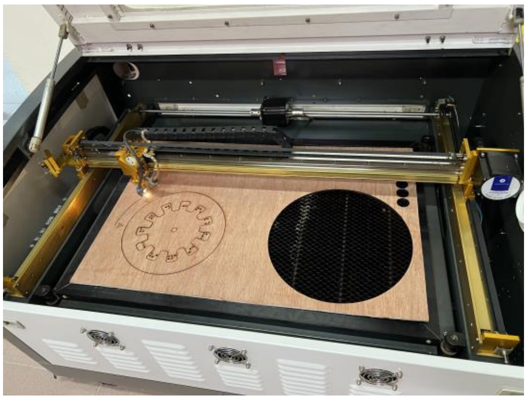


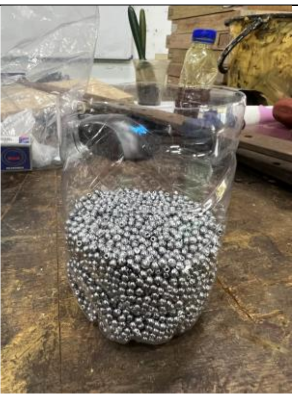
Figure 3.5 (o) : *Cutting Wheel Sozler Braille*

3.6 Assembly and Finishing

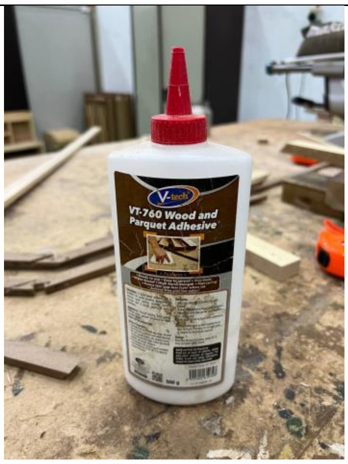
Each process of manufacturing a wooden product must have a finishing installation for the purpose of joining, finishing and beautifying the product. We're just using a few tools to pack our Braille Box Sozler Braille and Smart Wheel Braille products. Among the materials and tools we use are:

Material and tools

No.	Name	Picture
1.	Sanding Paper	

2.	Beads	
3.	Bearing	
4.	Wood Stain (Golden Pine)	
5.	Wood Stain (Clear)	

6.	Wood Filler	
7.	Washer	
8.	Bolt And Nut	
9.	Poster Colour	

10.	Brush	
11.	Wood Glue	
12.	Clamp	
13.	Glue	

a) <u>Box Sozler Braille</u>

1) Sanding Paper

Figure 3.6 (a) : *Sanding Key Box Sozler Braille*

Figure 3.6 (b) : *Sanding Box Sozler Braille*

2) Wood Glue for attach to pieces Box Sozler Braille of wood

Figure 3.6 (c) : *Glue the pieces of wood using wood glue*

3) Using a clamping tool to clamp the pieces of wood parts that have been glued so that the adhesion is neater.

Figure 3.6 (d) *: Clamp the wood pieces*

4) Placing and applying wood stain clear liquid in each part of the Box Sozler Braille to ensure the color looks shiny and beautiful. Let it dry.


Figure 3.6 (e) *: Box Sozler Braille with wood stain*

5) Apply the poster color on the cover of Box Sozler Braille.

Figure 3.6 (f) *: Brush cover Box Sozler Braille with poster colour*

6) Apply wood stain clear liquid on the cover part of the Box Sozler Braille

Figure 3.6 (g) : *Brush cover Box Sozler Braille with clear liquid*

7) Placing bead seeds and glue at back hole on each part of the key Box Sozler Braille.

Figure 3.6 (e) : *Placing bead seeds on each key side*

b) Wheel Sozler Braille

1) Combines each part of the Wheel Sozler Braille product with bolt, nut, washer and bearing mechanisms.

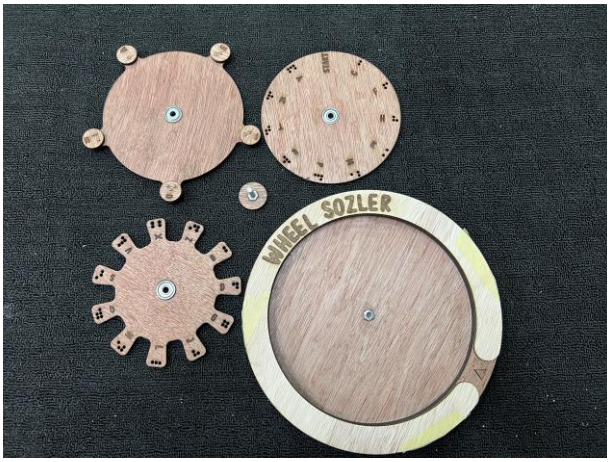


Figure 3.6 (a) : *Wheel Sozler Braille with bolt,nut and bearing*

2) Sanding 2000 Cw grided sandpaper on each part of the Wheel Sozler Braille

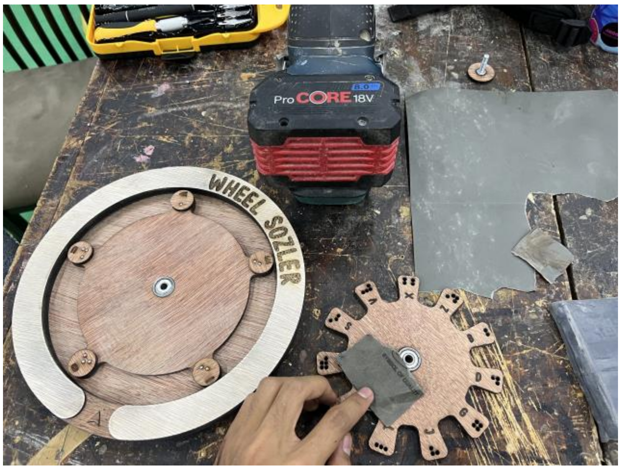


Figure 3.6 (b): *Sanding the part Wheel Sozler Braille*

3) Apply beads and putting glue on each letter of the alphabet on Wheel Sozler Braille

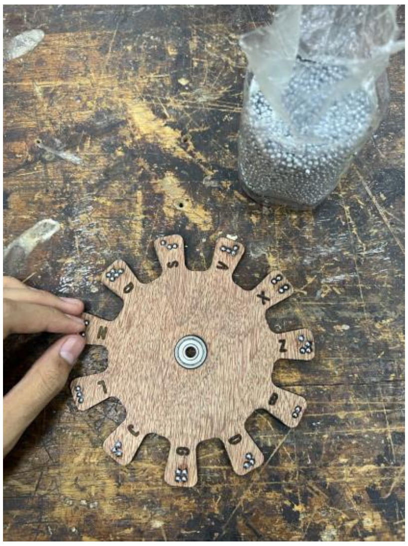


Figure 3.6 (c) *: Puts the beads at alphabet Wheel Sozler Braille*

4) Combine parts of Wheel Sozler Braille products that need to be glued using wood glue.

Figure 3.6 (g) *: Part Wheel Sozler Braille with glue wood*

5) Using a clamping tool to clamp the pieces of wood parts that have been glued so that the adhesion is neater.

Figure 3.6 (h) : *Clamp the part of Wheel Sozler Braille*

6) Apply each part of the Wheel Sozler Braille with wood stain clear liquid and leave it dry.

Figure 3.6 (i) : *Brush clear liquid at the part of Wheel Sozler Braille*

7) Apply with the poster color paint on the Wheel Sozler braille section and the word letter.

Figure 3.6 (j) : *Brush poster colour at part Wheel Sozler Braille*

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

We have done research about our products to be produced with various searches and information that we collect to produce our products. in Various sources and references that we found were from interviews with special education school teachers in Besut Terenganu and looking for some organizations to get clearer and more detailed information about the use of braille and the effectiveness of our products for the future. After some time, we chose PERTIS KL (MALAYSIA ISLAMIC VISUALLY DISABLED PERSONS' ASSOCIATION KL) to be used as a research site.

4.2 Real Type Project

We had a preliminary meeting with the teachers of visually impaired children of SPECIAL SCHOOL, Besut, Terengganu to discuss the preliminary findings of our study to the teacher, Mrs. Amirah. We present to him the initial concept and design. During our discussion, her also gave an opinion on the products produced

Design

- Games that children can easily play.
- Place a sign in the corner so that the blind child can distinguish the top and bottom of the game.
- Use not too large seeds to make cells so that blind children are not difficult to distinguish between each code.
- A design that is not too difficult to identify.
- A simple game for the teacher to control.
- The distance between each dot needs to be tightened.

4.3 Expected results

From the beginning of our project discussion, we have decided that we want to give our Braille Sozler to a special children's school in the Putrajaya primary school and the blind people's center. After our Braille Sozler was completed, we visited SK PUTRAJAYA PRECINCT 18(1) to test the effectiveness of our products before we gave our products. We have explained to teachers who teach children special education how to use such toys. She gives good feedback and appreciates our efforts to make teaching for special children easier and more enjoyable.

Figure 4.3 (a) *: description of how to use Box Sozler Braille at SK PUTRAJAYA PRECINCT 18(1) to blind children*

Figure 4.3 (b) *: description of how to use Box Sozler Braille at SK PUTRAJAYA PRECINCT 18(1) to children with autism*

Figure 4.3 (c) *: description of how to use the Sozler Braille wheel at SK PUTRAJAYA PRECINCT 18(1) to blind children*

Figure 4.4 (d) *: description of how to use the Sozler Braille wheel at SK PUTRAJAYA PRECINCT 18(1) in children with autism*

4.4 Feedback and improvement

We ask feedback and improvements about our products to the children and teachers who teach them. Him gave us some of his opinions on the product. Here are some of them:

Feedback

- User-friendly for teachers and visually impaired students.
- Also useful for children with autism.
- Suitable for the education of visually impaired children and not too clear vision.
- Products that are interesting and can be removed or introduced more widely.
- Assisting teachers of special education in providing education.
- who do not recognize braille because there is an alphabet for visually intelligent people to understand.

Improvement

The education teacher at SK PUTRAJAYA PRECINCT 18(1) stated that Sozler Braille has advantages that can be used by children in the school not only for blind children but can benefit children with autism in the school, where children - some of these autistic children are active and some are shy, but most of them cannot read. thus the joke at school asked us to improve in terms of the colour game and wheel Sozler Braille in English. On Box Sozler Braille, we were asked to improve in terms of marking each braille letter on the box to put the letter back because the children were worried that they could not identify the position of the box on each braille letter.

Figure 4.4 (e) : *Our colour Wheel Sozler Braille*

Figure 4.4 (f) : *Box Sozler Braille*

CHAPTER 5

CONCLUSION

5.1 conclusion

A summary of the beginning of this final project will be explained in this chapter. From the whole report, recounting the problem statement, the scop study selected to be used as a study before making educational products for the use of children with visual impairment. In this report we explain our objectivity to create a learning game product for children with aini boots using engraving laser machines, in chapter 2 also shared as well as the existence of the braille system and the history of braille creators. In addition, in chapter 3, it is described how each member of the group travels in creating the product. In this topic, members of the group will discuss the braille educational toys that have been chosen as a project. In fact, this product will be given as a contribution to some of the people who helped us in making this products .

Overall, despite many difficulties in the implementation of this project, the project was still completed successfully. This project becomes difficult because it is to obtain research data from some quarters to make this product workable. In addition, in our products we greatly correct our ideal from design changes and in terms of finishing selection. This is because this product is specially designed for children in terms of finishes we need to be mindful of not being squeamish and not harmful to children to use. In addition, this product also requires a detailed study as it needs to be used for education so to ensure that this product can provide a long-term effectiveness we need to search and visit the area that can be a study. We conducted interviews with education teachers and experimented on the effectiveness of this product so that it can continue to be used and will not sink

Next to ensure that the objective product is successfully implemented each member needs to work harder in conducting research and completing the project, in implementing the product then the group members are in the difficult level to change the case box design for Box Sozler Braille products. Yet with hard work we managed to cope. Ultimately, we are able to prepare our products that can be used and can have a positive impact on the consumers we target.

5.2 Recommendations

This Sozler braille project is recommended by our supervisor En. Zullhyzrifee he asked to create a product that can help people with disabilities no matter what in terms. At the beginning of the discussion this project was an auxiliary tool but to develop the idea was very difficult because in the age of modernity the project to be produced had to be in line with the additional progress we were asked to make a product that was no longer available in the market. At the beginning we did a search on autism but with a lack of knowledge and reference resources we thought about creating a product that uses the braille system where the reference source is also available from the previous semester's senior experience they made a game that also constituted the braille system but their product for children who started their education early.

The aim of creating a Sozler Braille is to further expand the learning game product among children with visual impairment so that they can also experience learning while playing. Some do not answer However, the process of implementing this braille game is very reasonable to conclude that we as students who create braille game products want this work to be presented with the function of use, product design or model and material that is good if it can be watched in public. What makes a hunch as a student work so hard to create this braille game? This is because this braille game allows children's vision blindness to have a braille mentor to guide them through their learning, and has proven to teachers and parents that this braille game is essential for the success of blind children to deepen their knowledge. However, can we Malaysians influence the level of satisfaction of blind children in their education?

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