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Occupational Therapy Board: Improving Finger Movement Using Ardiuno

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Abstract: *Occupational therapy has sometimes been mixed with physical therapy, but in its essence, occupational therapy is an assessment and intervention to help people through the therapeutic use of everyday activities. It starts with an assessment, and then an intervention is planned to allow those to maintain, recover, or even develop activities or occupations of individuals. In order to recover the problems, the stroke patient will need the rehabilitation process. The finger rehabilitation should concentrate on how the motor skill operates at the finger. A motor skill is a learned series of movements that combine to produce a smooth, efficient action. There are two types of motor learning which is fine motor skill and gross motor skill. Fine motor skill is more focused to dexterity in the movement of small muscle in contact with movement of eye to control the fingers, thumb and hand. The fine motor is suitable for drawing, writing and coloring as children refine their motor skills during child age (Fine motor skill. 2008). On the other hand, gross motor skill is more on grasping the large object.*

Keywords*: .Ardiuno, Rehabilitation, occupational therapy, Dexterity, motor skill, hemiparesis, neurological*

I - INTRODUCTION

Fingers play an important role in our daily life but when there are presences Of diseases, injured by accident or physical disability since child may give effect to The normal routine of our daily life. Stroke frequently happens to middle ages and Above. Based on research conducted by the National Institute of Neurological Disorders and Stroke (NINDS), there are about more than 700,000 stroke patient Over the world. Rehabilitation for stroke patient helps to enhance the relearn skill of Brain. The rehabilitation process taken will maintain the skill and required specialist. For a certain period of time depends on the patient conditions. Rehabilitation does Not cure the stroke but can help patient with best possible long term outcome (National Institute of Neurological Disorder and Stroke, 2009).Stroke can be divided into several types of disabilities which are paralysis or Problems controlling movement, sensory disturbances including pain, problems Using or understanding language, problems with thinking and memory, and Emotional disturbances (National Institute of Neurological Disorder and Stroke, 2009). In this research, main focus is more on problems

controlling movement Which include the upperbody of human especially finger and hand called Hemiparesis. Hemiparesis attack on the half of the body part thus allowed motor disabilities to the damaged part. The damage part especially fingers usually need for grasping and hold things cannot be used anymore thus will effected routine life of patient.

In order to recover the problems, the stroke patient will need the rehabilitation process. The finger rehabilitation should concentrate on how the motor skill operates at the finger. A motor skill is a learned series of movements that combine to produce a smooth, efficient action. There are two types of motor learning which is fine motor skill and gross motor skill. Fine motor skill is more focused to dexterity in the movement of small

muscle in contact with movement of eye to control the fingers, thumb and hand. The fine motor is suitable for drawing, writing and coloring as children refine their motor skills during child age (Fine motor skill. 2008). On the other hand, gross motor skill is more on grasping the large object.

Physical therapists and occupational therapists are suitable for handling rehabilitation process on the post-stroke patient. The physical therapist specializes in treating disabilities related to motor and sensory impairments. The physical therapist is well-known with anatomy and physiology related to normal function with an emphasis on movement. There are several strategies used by physical therapists to encourage the use of impaired limb include selective sensory stimulation such as tapping or stroking, active and passive range-of-motion exercises, and temporary restraint of healthy limbs while practicing motor tasks. The occupational therapist is focused with improving motor and sensory abilities. The therapist helps stroke survivor to perform self-directed activities-occupations-such as personal grooming, preparing meals, and housecleaning. The stroke patient will be teach on how to develop compensatory strategies and how to change elements of their environment that limit activities of daily living..

Rehabilitation should be done 2 days after the patient had diagnosed to have stroke. At the time, patient will be given intensive care for several weeks. Many of the patient will do the further intensive care when go home and some will do the care at other facilities. There are several types of rehabilitation that helps to enhance the motor disabilities of post-stroke patient. There are inpatient and outpatient rehabilitation units, nursing facilities and home based rehabilitation. The home based rehabilitation is the best care because it provided a private place for patient to do their therapy. The patient also has their own time to perform the therapy. Sometimes, at the facility may requires hours of therapy and make the patient tired. In addition, if the therapy must do everyday also counting on the cost of transportation go and back to home (National Institute of Neurological Disorder and Stroke, 2009). There are also some disadvantages when done the therapy exercise at home such as lack of device and specialized equipment.

The combination of rehabilitation and specialized equipment or device would help the stroke patient to improve their daily life plus the motor ability of hand and fingers. The stroke patient will develop the motor skill functions and rehabilitation exercise helps more on brain relearn skill thus will enhance movement of disabilities part. However, every device has its own disadvantages or problem occur during rehabilitation practice. Thus, a new design should be created in order to make the device is user friendly to patient, durable, lighter and doesn't required much cost to fabricate.

To design finger rehabilitation device and further study this finger device as an alternative for finger disability.. Occupational therapy is used in treating Traumatic Brain Injury during many phases of recovery and rehabilitation. As the patient's condition improves, occupational therapy helps them regain skills ranging from basic self-care, to complex cognitive skills such as memory and problem solving. According to numerous studies, many physical therapies incorporate repetition of movement in a patient with neurological delay/damage (head trauma, stroke, nerve damage, etc.) This can stimulate the brain to make new neural connections that will circumvent the damaged part of the brain.The exercise encourages dexterity, hand-eye coordination, and left/right brain interaction. The exercise uses hands, fingers, and cognitive skills to equate the correct color and corresponding muscle reflex. Hand-eye coordination is the ability of the vision system to coordinate the information received through the eyes to control, guide, and direct the hands in the accomplishment of a given task, such as writing or catching a ball (in this case, identifying matching color sets and directing the correct muscles to actuate) Reclaiming fine motor skills in an affected hand, after a paralytic stroke, requires determination, repetition, and innovative physical therapy.

II - LITRETURE REVIEW

Various traditional dexterity measurement tests are available in the database. The lists of different test instruments are based on electronic databases such as PubMed, Medline, EMBASE, Cochrane library, IEEE Xplore, Google Scholar, and CINAHL. Only those test instruments are considered which have standard procedures and norms. The keywords used in the search are upper extremity, upper limb or arm and assessment test, dexterity, hand function test, and outcome measure. Measures not specific to the upper limb are excluded from the search.

Sığırtmaç and Öksüz (Citation2021) verified the psychometric properties the hand injured patients during dexterity assessment. JHFT is found to be a reliable instrument for the hand function test. Some of the test items in JHFT require cognitive ability, and writing tasks using a non-dominant hand are always challenging. Kellor et al. (Citation1971) developed a test to measure finger dexterity called Nine-Hole Pegboard Test

(NHPT). The test consists of a pegboard and nine pegs. This timed measure of fine dexterity involves placing and removing nine pegs in a pegboard. Two hundred fifty subjects were taken as a sample, and normative data was prepared. The authors have not performed validity or reliability test.

From the literature on various traditional dexterity tests, it is observed that clinicians must continuously monitor the stopwatch during the test process. In addition to this, there may be variation in noting down the time. This is mainly due to the "reaction time" of the clinician. Clinicians need to wait continuously for the patient to start the test, holding the stopwatch ready in hand. On the other hand, computer-based hand dexterity measurement has better outcomes than paper and pencil measurements (Levanon, Citation2013). Many attempts have been made to automate the pegboard test in the literature.

Jobbágy et al. (Citation2018); Ingram et al. (Citation2019) have developed a smart pegboard that reduces clinician burden during the pegboard-related test. Johansson and Häger (Citation2019) have developed a standardized NHPT set-up that consists of two pegboards. The limitation, or rather unavailability of the features in these test set-ups is the detection of the number of pegs held in hand during the test session. A patient can pick up more than one peg during the insertion or removal process and falsely improve the test score. Also, not following the specific pattern during the peg insertion and removal process may lead to unintentional delay and reduces test-retest reliability.

These conditions are common and need to take care during development of the device for tele rehabilitation. Thus, in our previous research work (Acharya et al., Citation2021), we developed a portable, cost-effective pegboard that is easy to administer and time-efficient. During the present pandemic, going clinic each time for outcome measurement is a tedious job. In this research work, the electronic model of the dexterity test kit is made to overcome manual errors, thereby making it a more reliable and accurate system for improving patients' hand-eye coordination and motor skills. The first apparatus developed in this work is the reaction time testing system. Reaction time is calculated as the time taken for the subject to react to the Light Emitted Diode (LED) signal, which changes once the subject's push button is pressed manually. The second apparatus is the Loop Wire testing system, wherein the total time to complete the navigation of a hand-held lock and key unit through a three-dimensional maze is calculated.

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III - METHODOLOGY

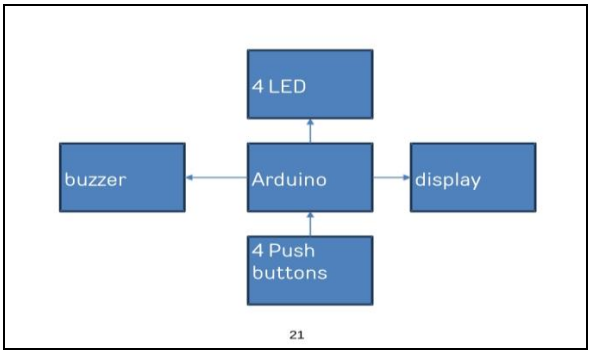
Occupational therapy is used in treating Traumatic Brain Injury during many phases of recovery and rehabilitation. As the patient's condition improves, occupational therapy helps them regain skills ranging from basic self-care, to complex cognitive skills such as memory and problem solving.

The goal is to use that finger to touch the lit button, which turns it out.As each light is turned out, another combo is illuminated at random. The exercise can be counted/timed to track progress. The exercise uses hands, fingers, and cognitive skills to equate the correct color and corresponding muscle reflex.

Hand-eye coordination is the ability of the vision system to coordinate the information received through the eyes to control, guide, and direct the hands in the accomplishment of a given task, such as writing or catching a ball (in this case, identifying matching color sets and directing the correct muscles to actuate)

Reclaiming fine motor skills in an affected hand, after a paralytic stroke, requires determination, repetition, and innovative physical therapy**.**

IV - BLOCK DIAGRAM



We chose to use an Arduino board as the foundation of our project, since it's versatile and easy to program

We used 4 LEDs to generate patterns for the patient.

Push buttons are used for the patient to input their response.

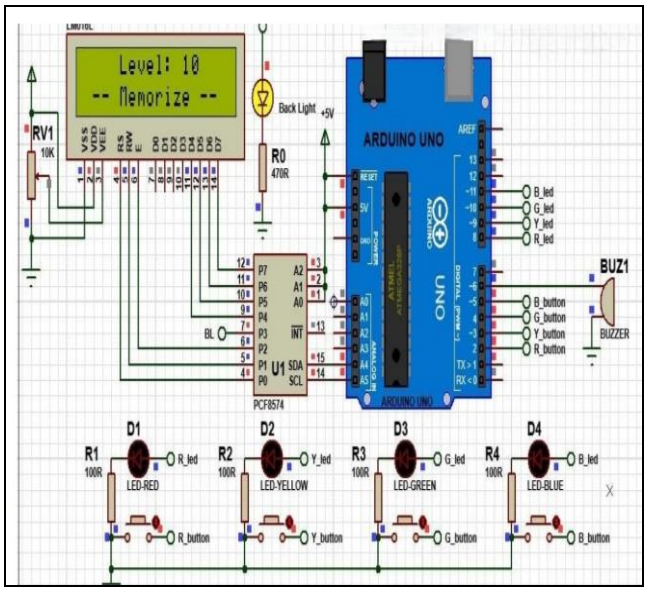
A 7-segment display shows the result.

A buzzer is played if the answer is incorrect.

We connected the LEDs, buttons, 7- segment display, and buzzer according Coding and 2 to the circuit diagram.

Our code generates random patterns for the LEDs, and compares the patient's button input to the pattern displayed. If the input is correct, it's shown on the display. Otherwise, the buzzer is played.

V - CIRCUIT DAIGRAM



VI - WORKING

Initially the supply to dexterity kit is turned ON

The kit starts with showing LEVEL 1 of the exercise which is basic and easy level

If the user clears this level then it moves towards next level and allows the user to try difficult level and if user loses he has to start back

The kit is useful to track daily progress of a patient

During a therapy session, a random number is chosen between 1 and 13 using Arduino's built-in random() function. The randomly chosen button is then illuminated. The color of each button is stored in a char array, so that the appropriate RGB digital output is selected based on which button is randomly chosen.

The program then waits and monitors the button inputs until the user presses the correct button or not.

VII - APPLICATONS

To use the therapy board, and encourage them to practice regularly. By providing a fun and interactive physical therapy activity, we hope to make the rehabilitation process more enjoyable and effective.

Our board is suitable for anyone recovering from a finger injury, stroke, or other disability.

It's also useful for anyone looking to improve their hand-eye coordination and cognitive skills.

It is also used for small children for their brain development.

VIII - FUTURE SCOPE

Occupational therapy can work in a variety of settings ,including Hospital's clinics, schools, rehabilitation center, & private practice.

Implementation of audio in board to inhance the technology for those people who is handicapped person.

Using AI innovation allows occupational therapy board to enhance the overall practice & patient care.

IX - CONCLUSION

An Arduino-based finger movement rehabilitation occupational therapy board can be a valuable tool in helping individuals regain strength and dexterity in their fingers after an injury or surgery. By using sensors and actuators connected to an Arduino microcontroller, this device can provide interactive exercises tailored to the specific needs of the user. The sensors can detect the movement of the fingers, while the actuators can provide resistance or assistance to help improve muscle strength and coordination.

The Arduino platform allows for customization and flexibility in designing different exercises to target specific finger movements. For example, users could be prompted to perform tasks such as pressing buttons, moving sliders, or gripping objects, with real-time feedback provided through visual or auditory cues. Additionally, data logging capabilities can track progress over time, allowing therapists to adjust the therapy program as needed. Overall, an Arduino-based rehabilitation board offers a cost-effective and engaging solution for individuals undergoing finger rehabilitation therapy.

Occupational therapy is crucial for individuals looking to improve their fine motor skills, and using an Arduino-

based memory game can make the process engaging and effective. By incorporating four LEDs to generate patterns and push buttons as inputs for the Arduino to verify the patterns, you can create a fun and interactive way for patients to work on their finger movement rehabilitation.

The game could work by displaying a sequence of LED patterns that the user would need to memorize and then replicate by pressing the correct sequence of push buttons. With each successful round, the patterns could become more challenging, providing a progressive challenge for the user. Additionally, you could incorporate feedback mechanisms such as sound or visual cues to indicate whether the user has correctly replicated the pattern, further enhancing the interactive experience. Overall, this Arduino-based occupational therapy board has the potential to not only aid in finger movement rehabilitation but also make the process enjoyable and motivating for patients. It combines technology with therapy in a creative and innovative way, showcasing the endless possibilities when merging healthcare with advancements in electronics and programming.

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