

D.S.T.P. : DEVICE FOR SPASTICITY TREATMENT WITH P.R.O.M. BY MICROCONTROLLER ARDUINO UNO R3 AND 3D PRINTER

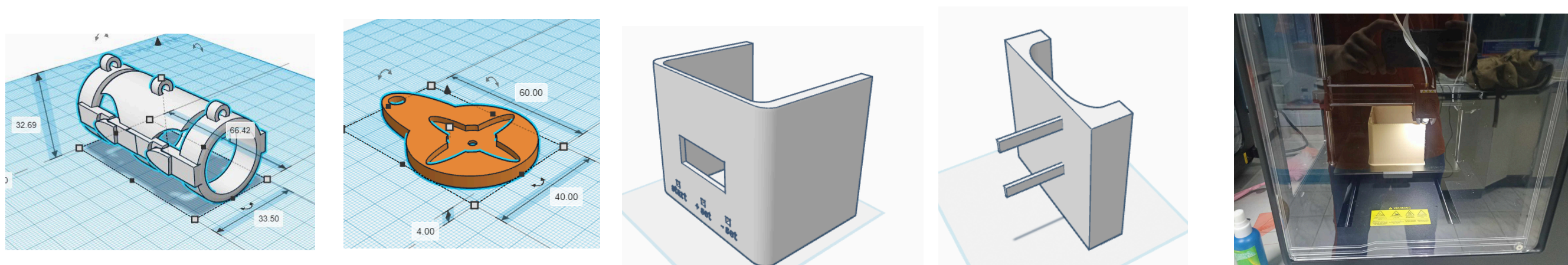
INVENTORS : MR. NORASING BARACHON MISS THITIPAT SUPPHAMAT
 ADVISERS: MR. JIRAYUS ARUNDECHACHAI
 SPECIAL ADVISERS : MRS. PRICHART YATIKULKASAME MR.SUTHUT BHUTCHANON

INTRODUCTION

SPASTICITY IS A DISORDER OF THE NERVOUS SYSTEM IN WHICH THE BODY IS UNABLE TO CONTROL ITS PROPRIETARY MOVEMENTS. AND IN THE AREAS WHERE THIS DISORDER HAPPENS OFTEN ARE THE WRISTS AND ARMS. IT WAS FOUND THAT MUSCLE CONTRACTION CONTRIBUTES TO JOINT STIFFNESS. IT WILL BE AN OBSTACLE TO THE MOVEMENT AND CAUSE THE PATIENTS' ABILITY TO TAKE CARE OF THEMSELVES TO DECREASE. THERE ARE MANY WAYS TO TREAT FOR PATIENTS WITH MUSCLE SPASMS ACCORDING TO THE SEVERITY, LOCATION, AND SYMPTOM DISTRIBUTION PATTERN OF SPASTICITY. IT IS GENERALLY ACCEPTED THAT THE ESSENTIAL PRINCIPLE IN TREATING MUSCLE SPASMS IS PHYSICAL THERAPY, ESPECIALLY STRETCHING MUSCLES AND TENDONS TO REDUCE SPASMS AND PREVENT TENDON CONTRACTURES INCLUDING JOINT ADHESIONS. THE ORGANIZER THEREFORE STARTED A PROJECT NAMED D.S.T.P.: DEVICE FOR SPASTICITY TREATMENT WITH P.R.O.M. BY MICROCONTROLLER ARDUINO UNO R3 AND 3D PRINTER TO DEVELOP A MEDICAL DEVICE THAT ALLOWS PATIENTS WITH MUSCLE SPASMS TO BE ABLE TO DO PHYSICAL ON THEIR OWN WITHOUT THE HELP OF A PHYSICAL THERAPIST IN THE FUTURE, BASED ON PASSING ORDERS BY MICROCONTROLLER ARDUINO WITH ARDUINO IDE PROGRAM.

EXPERIMENTAL PROCESS

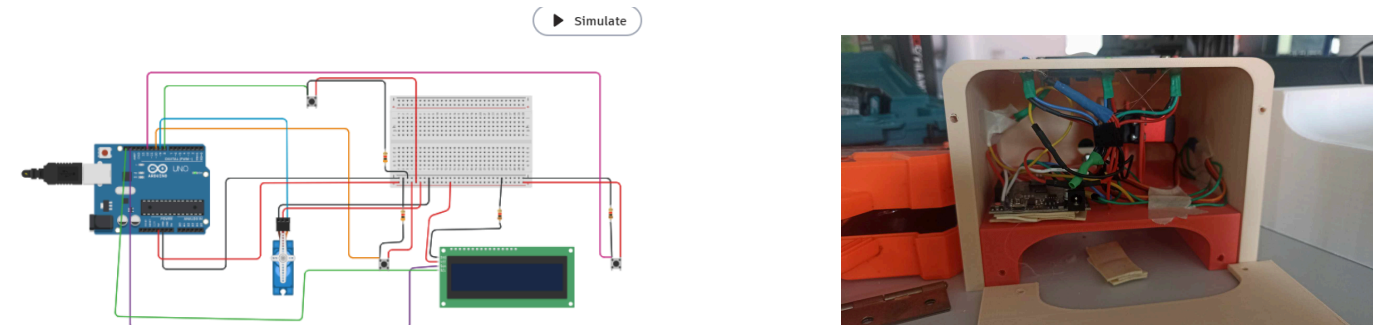
1. DESIGN FINGER GUARD,INTERNAL CIRCUIT BOX, AND SERVO MOTOR SHAFT WITH TINKERCAD 3D DESIGN AND PRINT IN 3D USING FLASHFORGE 3D PRINTER A3 AND FLASHFORGE 3D PRINTER A4 PRO



2. ASSEMBLE FINGER GUARD, WRIST EQUIPMENT, INTERNAL CIRCUIT BOX, AND SERVO MOTOR SHAFT TOGETHER.



3. DESIGN THE CIRCUIT IN TINKERCAD CIRCUITS DESIGN, THEN IMPLEMENT AND TEST THE CIRCUIT TO ENSURE FUNCTIONALITY.



4. ATTACH CLEAR RUBBER BANDS FROM THE GLOVE AND PE WIRES TO THE FINGER GUARD, AND SEW THE RUBBER BANDS ONTO THE FABRIC GLOVE.

5. SEW THE CABLE TIES TO THE FABRIC GLOVE AND ATTACH THEM TO THE INTERNAL CIRCUIT BOX AND WRIST EQUIPMENT.

6. TIE THE END OF THE PE WIRE WRAPPED AROUND THE FABRIC GLOVE TO THE END OF THE ROTATING ARM 180 DEGREES OF THE TD-8120MG SERVO MOTOR.

7. TEST AND DOCUMENT THE TEST RESULTS, ALLOWING EXPERTS TO EVALUATE THE DEVICE'S PERFORMANCE IN VARIOUS ASPECTS.



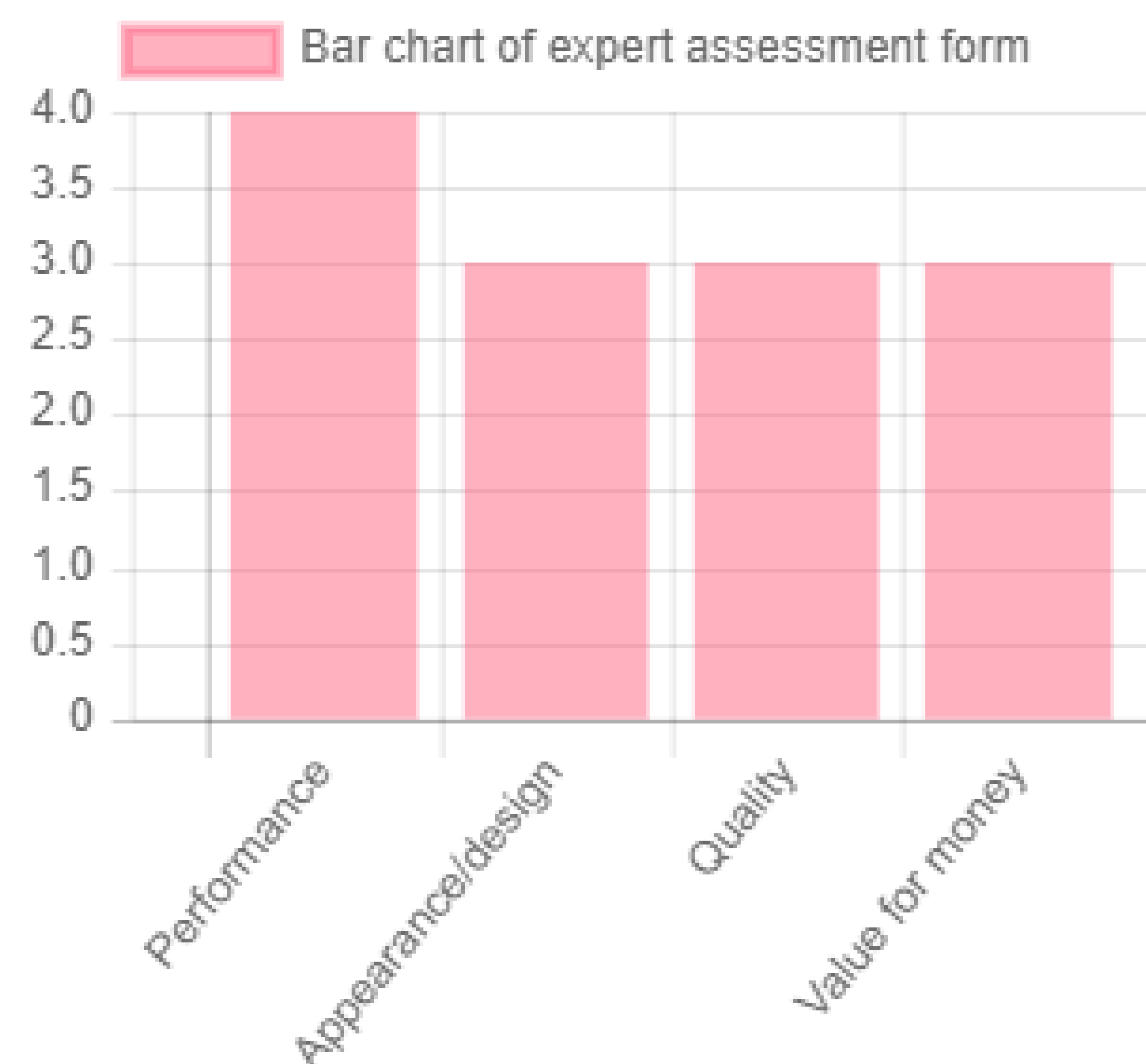
8. SUMMARIZE AND DISCUSS THE RESULTS.

8.1 ANALYZE IF THE OBJECTIVES HAVE BEEN ACHIEVED.

8.2 DISCUSS THE OBTAINED RESULTS AND PROVIDE SUGGESTIONS FOR IMPROVEMENT.

RESULT AND DISCUSSION

THE EFFECTIVENESS OF "D.S.T.P. : DEVICE FOR SPASTICITY TREATMENT WITH P.R.O.M. BY MICROCONTROLLER ARDUINO UNO R3 AND 3D PRINTER" WAS EVALUATED BY EXPERTS IN VARIOUS ASPECTS. THE EVALUATION CRITERIA INCLUDED PERFORMANCE, APPEARANCE/DESIGN, QUALITY, AND VALUE. DATA WAS COLLECTED FROM 5 EXPERTS, AND THE SCORES WERE AVERAGED AND PLOTTED INTO A BAR GRAPH AS FOLLOWS.



CONCLUSION

FROM PREPARING A SCIENCE PROJECT TECHNOLOGY FIELD: DEVICE FOR SPASTICITY TREATMENT WITH P.R.O.M. BY MICROCONTROLLER ARDUINO UNO R3 AND 3D PRINT. WHEN STARTING TO TEST THE INITIAL USE WITH THE ORGANIZING TEAM, IT WAS FOUND THAT

1. DEVICE FOR SPASTICITY TREATMENT WITH P.R.O.M. BY MICROCONTROLLER ARDUINO UNO R3 AND 3D PRINT CAN WORK.

2. THE PRINCIPLES AND TREATMENT PROCESS USING THE P.R.O.M. TECHNIQUE CAN BE USED AS A GUIDELINE FOR DEVELOPING A DEVICE THAT CAN BE USED WITH PATIENTS IN THE TARGET GROUP.

3. THE ARDUINO UNO R3 MICROCONTROLLER DEVICE AND 3D PLASTIC PRINTING CAN BE APPLIED TO CARE FOR PATIENTS WITH MUSCLE SPASMS IN STROKE PATIENTS.

THERE IS A REFERENCE TO THE WORK OF THE DEVICE FOR SPASTICITY TREATMENT WITH P.R.O.M. BY MICROCONTROLLER ARDUINO UNO R3 AND 3D PRINTED FROM THE EVALUATION OF A TOTAL OF 5 EXPERTS. IN TERMS OF EFFICIENCY, THE AVERAGE OPINION SCORE IS 4.3/5 POINTS, WHICH IS AT A GOOD LEVEL, THE APPEARANCE AND QUALITY ASPECTS HAVE AN AVERAGE OPINION SCORE OF 3.7/5 POINTS, WHICH IS AT A GOOD LEVEL, AND THE VALUE FOR MONEY ASPECT HAS AN OPINION SCORE OF 3.9/5 POINTS, WHICH IS AT A GOOD LEVEL SUCH AS TOGETHER

IT CAN BE CONCLUDED THAT THE SCIENCE PROJECT TECHNOLOGY FIELD: DEVICE FOR SPASTICITY TREATMENT WITH P.R.O.M. BY MICROCONTROLLER ARDUINO UNO R3 AND 3D PRINTER CAN DEVELOP DEVICE FOR SPASTICITY TREATMENT WITH P.R.O.M. BY MICROCONTROLLER ARDUINO UNO R3 AND 3D PRINTED CORRECTLY AND SAFELY. CAN BE FURTHER DEVELOPED TO BECOME A MEDICAL DEVICE. PATIENTS CAN PERFORM PHYSICAL THERAPY ON THEIR OWN CORRECTLY AND SAFELY. AT PRESENT, THE DEVICE HAS ONLY BEEN DEVELOPED TO FUNCTION IN PREVENTING JOINT NARROWING AND TREATING MUSCLE SYMPTOMS IN PATIENTS WITH MILD SYMPTOMS, WITH A MODIFIED ASHWORTH SCALE (MAS) SCORE OF 0-2.

MAS	m-MAS	Description
0	0	No increase in muscle tone
1	1	Slight increase in muscle tone, manifested by a catch and release
1+	2	Slight increase in muscle tone, manifested by a catch, followed by minimal resistance
2	3	More marked increase in muscle tone through most of the ROM, but affects part(s) easily moved
3	4	Considerable increase in muscle tone, passive movement difficult
4	5	Affected part(s) rigid in flexion or extension

OBJECTIVES

1. TO DEVELOP A REHABILITATION DEVICE FOR PATIENTS WITH MUSCLE SPASTICITY AND TO PREVENT JOINT CONTRACTURES USING THE P.R.O.M. TECHNIQUE, UTILIZING THE MICROCONTROLLER ARDUINO UNO R3 AND 3D PLASTIC PRINTING.

2. TO STUDY THE PRINCIPLES AND PROCESSES OF THERAPY USING THE P.R.O.M. TECHNIQUE AS A GUIDELINE FOR DEVELOPING THE PROJECT.

3. TO APPLY THE MICROCONTROLLER ARDUINO UNO R3 AND 3D PLASTIC PRINTING IN THE CARE OF PATIENTS WITH MUSCLE SPASTICITY IN STROKE PATIENTS.

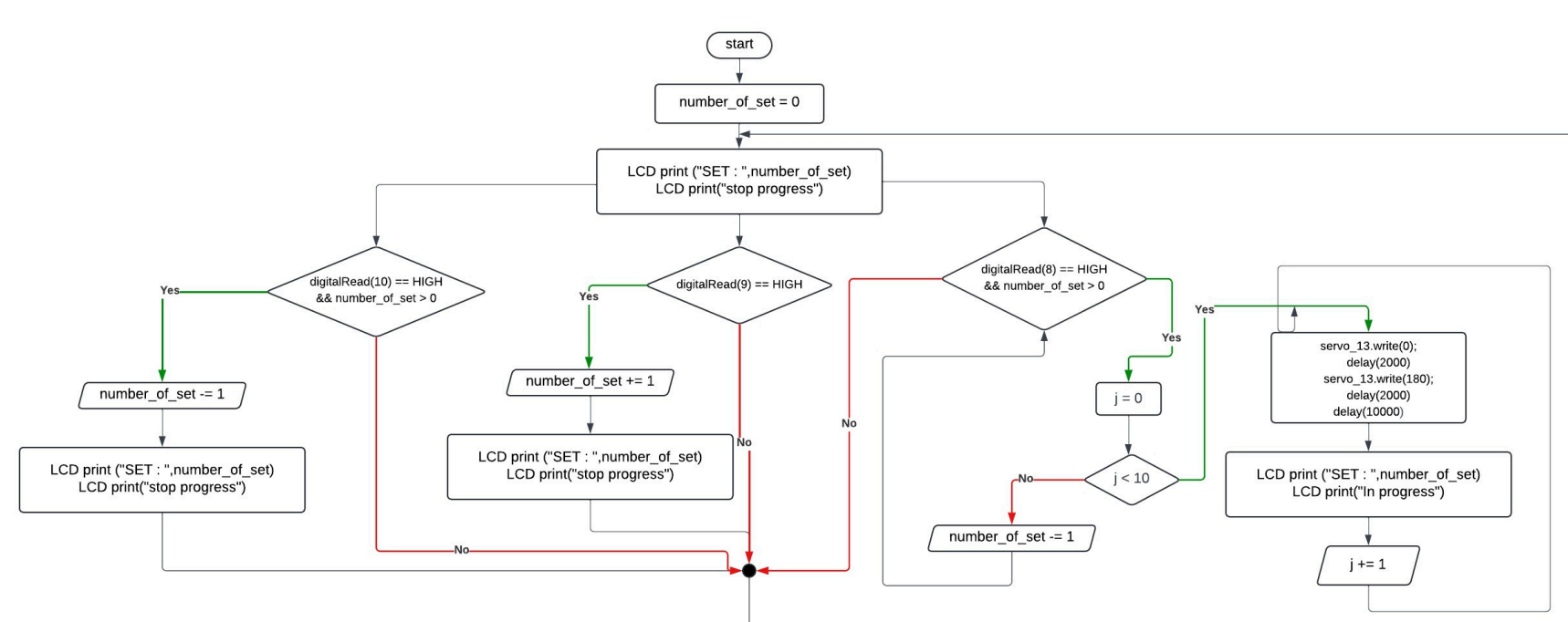
HOW DOES D.S.T.P. 'S ALGORITHM WORK?

1. SET THE SET NUMBER TO 0, AND THE 16X2 I2C LED SCREEN WILL DISPLAY "STOP PROGRESS".

2. RECEIVE INPUT FROM THE "+ SET" SWITCH TO INCREASE THE SET NUMBER BY 1 AND DISPLAY THE SET NUMBER ON THE LED SCREEN.

3. RECEIVE INPUT FROM THE "- SET" SWITCH TO DECREASE THE SET NUMBER BY 1, WITH THE CONDITION THAT THE SET NUMBER MUST BE GREATER THAN 0, AND DISPLAY THE SET NUMBER ON THE LED SCREEN.

4. RECEIVE INPUT FROM THE "START" SWITCH, THEN COMMAND THE SERVO MOTOR TO ROTATE TO A 90-DEGREE ANGLE AND BACK TO 0 DEGREES, DISPLAYING "IN PROGRESS" ON THE LCD SCREEN. THIS ACTION IS SUBJECT TO THE CONDITION THAT THE SET NUMBER MUST BE GREATER THAN 0. WITHIN ONE SET, THERE WILL BE 10 CYCLES OF ROTATION BACK AND FORTH WITH A 10-SECOND PAUSE PER CYCLE. AFTERWARD, DECREASE THE SET NUMBER BY 1 SET.



REFERENCE

THE MAIN PURPOSE OF PERFORMING PASSIVE RANGE OF MOTION (P.R.O.M.) EXERCISES IS TO IMPROVE MOBILITY AND FLEXIBILITY IN JOINTS WITHOUT REQUIRING THE PATIENT'S OWN MUSCLE ACTIVATION. ACCESSED ON SEPTEMBER 9, 2023, FROM [HTTPS://SHORTURL.ASIA/RY5Z7U](https://shorturl.asia/ry5z7u)
 MICROPROCESSOR AND MICROCONTROLLER: SIMILAR NAMES, DIFFERENT FUNCTIONS. ACCESSED ON SEPTEMBER 2023, FROM [HTTPS://SHORTURL.ASIA/2Q24H](https://shorturl.asia/2q24h)
 ARDUINO: A GLOBAL LEADER IN OPEN-HARDWARE AND SOFTWARE ECOSYSTEMS. ACCESSED ON SEPTEMBER 9, 2023, FROM [HTTPS://SHORTURL.ASIA/S2ZDU](https://shorturl.asia/s2zdu)
 UNDERSTANDING WHAT IS THE ARDUINO UNO R3 MICROCONTROLLER BOARD AND WHAT CAN IT BE USED FOR? ACCESSED ON SEPTEMBER 9, 2023, FROM [HTTPS://WWW.AI-CORPORATION.NET/2021/11/19/ARDUINO-UNO-R3/](https://www.ai-corporation.net/2021/11/19/arduino-uno-r3/)
 IMMEDIATE REDUCTION OF SPASTICITY IN THE ARMS AND HANDS OF STROKE PATIENTS FOLLOWING NEUROPHYSIOLOGICAL AND ORTHOPEDIC STRETCHING: A PRELIMINARY RESEARCH REPORT. ACCESSED ON SEPTEMBER 9, 2023, FROM [HTTPS://SHORTURL.ASIA/GVEOML](https://shorturl.asia/gveoml)
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