Development of Mechanism for Using in Multipurpose Wheelchair Using Dimensional Synthesis of Mechanism

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Abstract **- The wheelchair is transportation device for patients, physically handicapped people, and old age people. These wheelchairs have been using for many decades. As the technology is developed with time, much advancement took place in the design of the wheelchair. Though there is much advancement, the patients are still facing some problems with the wheelchairs while flipping wheelchair into bed. This is the situation happening for many years. So, to avoid this problem and make them ease to convert their wheelchair directly to the bed whenever they require, this mechanism will help them. This mechanism makes the patient very comfortable in converting his/her own wheelchair into bed. This multipurpose wheelchair is developed by one of the methods in dimensional synthesis of mechanism which is "FUNCTION GENERATION-THREE POSITION-Graphical method" to define the dimensions and positions of the links.**

Index Terms **- Wheel chair, Multipurpose wheelchair, Dimensional synthesis, function generation**

I.INTRODUCTION

The wheelchair is designed using the mechanisms which are the combination of rigid links. So that the parameters like velocity and acceleration are under control as of our requirement. This makes the patients to operate the chair very easily. Such mechanism used in this multipurpose wheelchair is developed by using dimensional synthesis of mechanism. The chair can be adjusted for both sitting and sleeping positions.

In synthesis of this mechanism, by using one of the methods of dimensional synthesis of mechanism that is "FUNCTION GENERATION-THREE POSITION-Graphical method" the dimensions and positions of the links are defined.

II.PROCEDURE FOR MECHANISM DEVELOPMENT BY FUNCTION GENERATION-GRAPHICAL METHOD

The fixed link, input link and output link are taken as per the requirement.

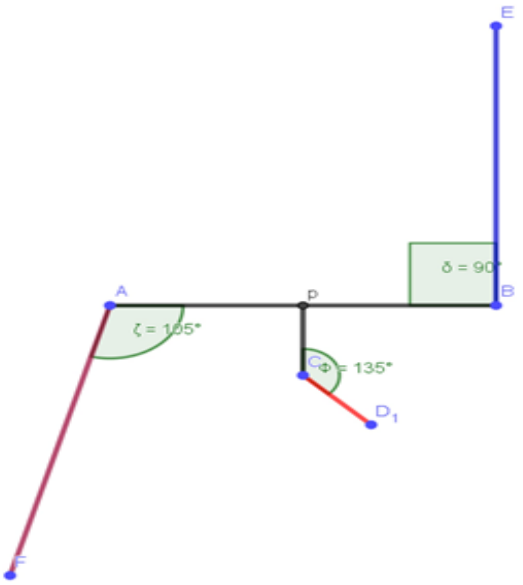

Figure.01: Links taken as of our requirement

ABC-Fixed link, CD1-Input link and BE, AF-Output links

AB= 4 units, AF=4 units, BE=4 units, pC=1 unit, CD1=1 unit.

Relationship between input and output links (as per the requirement)

$\theta_{12}=45^0$, $\theta_{23}=45^0$

$\alpha_{12}=45^0$, $\alpha_{23}=45^0$

$\beta_{12}=37.5^0$, $\beta_{23}=37.5^0$

θ=input link position

α, β=output links position

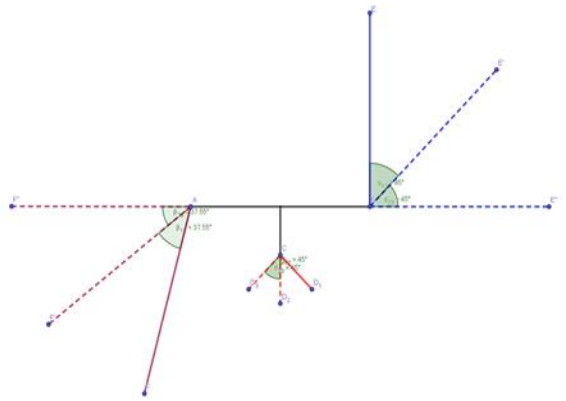

Figure.02: Relationship between input and output links

STEP: 1

1. Draw a line joining BD_2, with B as center locate D^1_2 with an angle $\alpha_{12}=45^0$ counter clock wise from D_2.

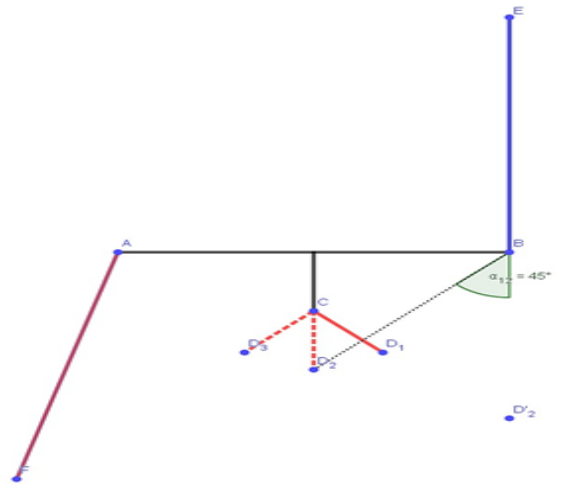

Figure.03: Step1-(i)

2. Draw a line joining BD_3, with B as center locate D^1_3 with an angle $\alpha_{13}=90^0$ counter clock wise from D_3.

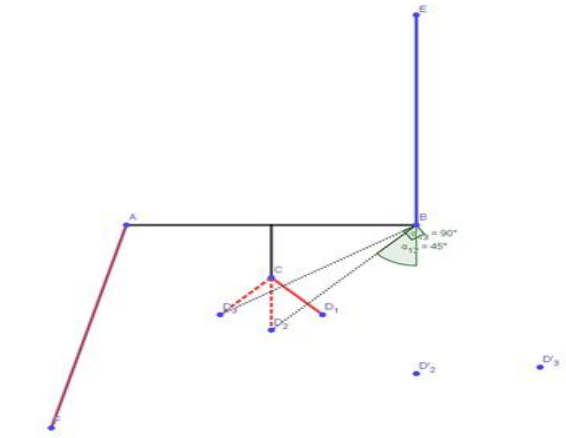

Figure.04: Step1-(ii)

3. Now join D_1, D^1_2, and D^1_3, draw perpendicular bisectors to $D_1D^1_2$ and $D^1_2D^1_3$, locate intersection point as G.

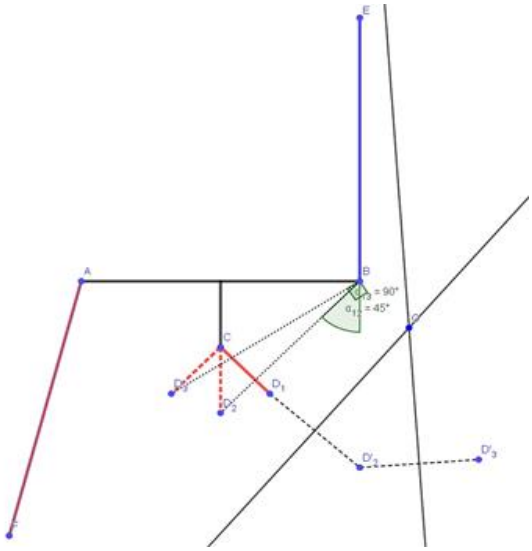

Figure.05: Step1-(iii)

4. Join E, B, and G. EBG-rigid link (output link). Join D_1 and G. D_1G-rigid link (coupler).

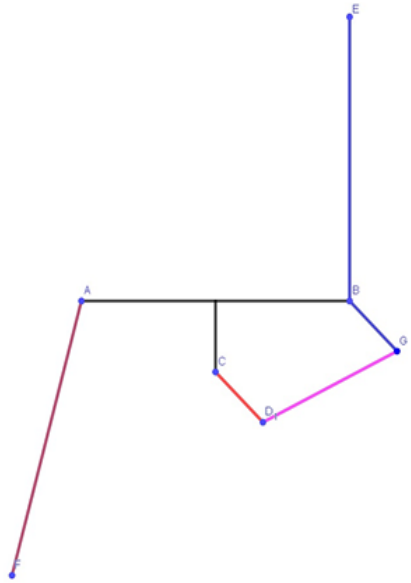

Figure.06: Step1-(iv)

STEP: 2

1. Draw a line joining AD2, with A as center locate D112 with an angle β12=37.50 counter clockwise from D2.

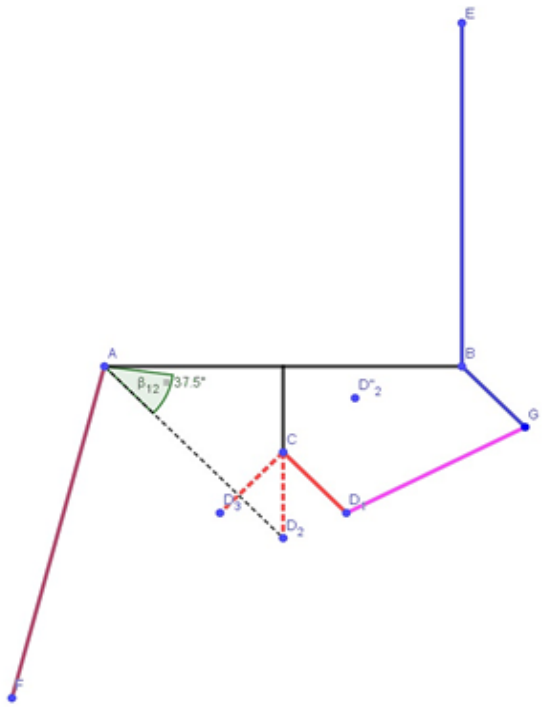

Figure.07: Step2-(i)

2. Draw a line joining AD_3, with A as center locate $D^{11}{}_3$ with an angle $\beta_{13}=75^0$ counter clock wise from D_3.

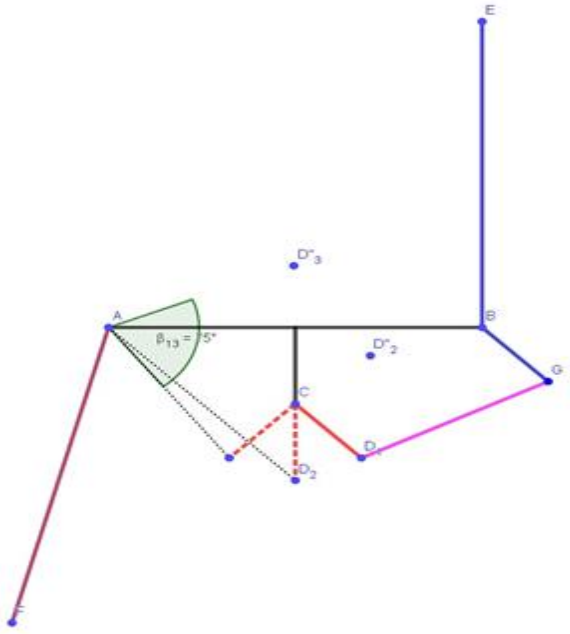

Figure.08: Step2-(ii)

3. Now join D1, D112, and D113, draw perpendicular bisectors to D1D112 and D112D113, locate intersection point as H.

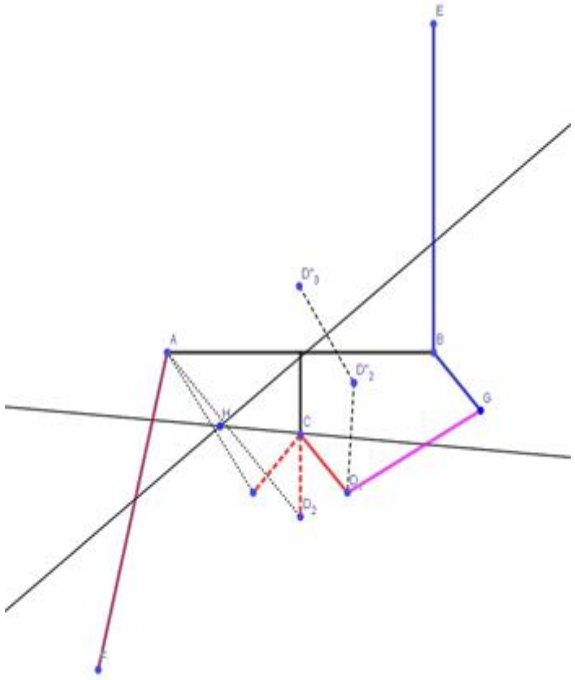

Figure.09: Step2-(iii)

4. Join F, A, and H. FAH-rigid link (output link). Join D1 and H. D1H-rigid link (coupler).

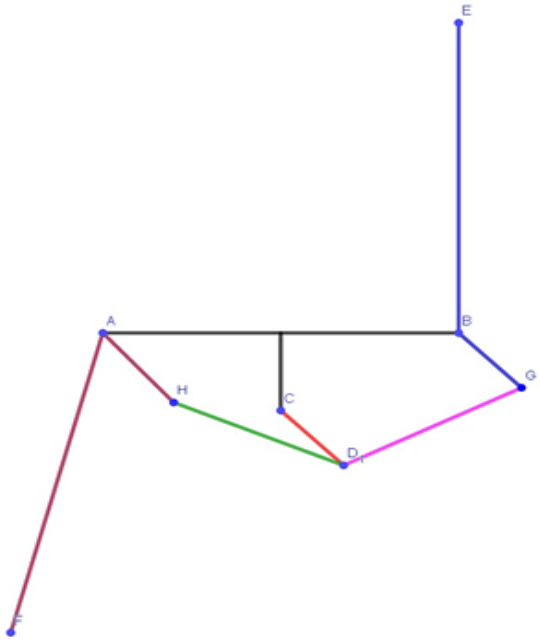

Figure.10: Step2-(iv)

III. OPERATION

1.Sitting position:

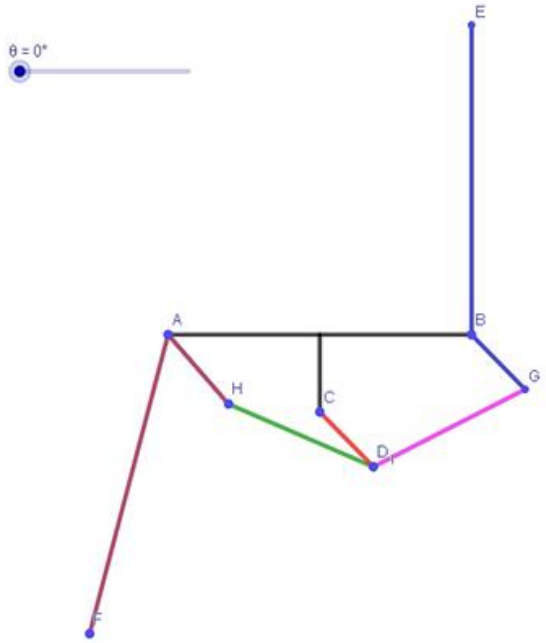

Figure.11: Mechanism in sitting position

1.Sleeping position:

Whenever the input link rotates, the two-output links moves i.e., 90^0 clockwise rotation of CD_1 gives the 90^0 clockwise rotation of BE and 75^0 clockwise rotation of AF.

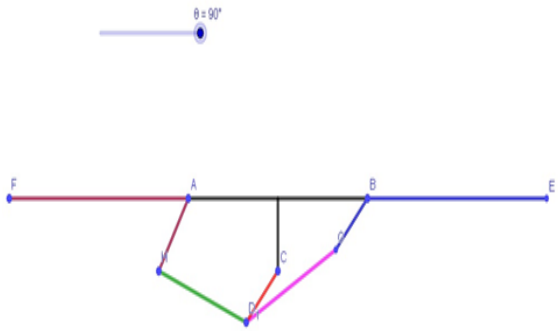

Figure.12: Mechanism in sleeping position

IV. RESULT

Dimensions of the links are:

a. Output link 1-EBG:

EB=4 units

BG=1 unit

Angle (EBG)=135^0

Figure.13: Output link-1

b. Output link 2-FAH:

FA=4 units

AH=1.2 units

Angle (FAH)=56.63^0

Figure.14: Output link-2

a. Coupler 1-HD_1:

HD_1=2.07 units

b. Coupler 2-DG:

D_1G=2.23 units

Mechanism in three positions:

1. When θ=0

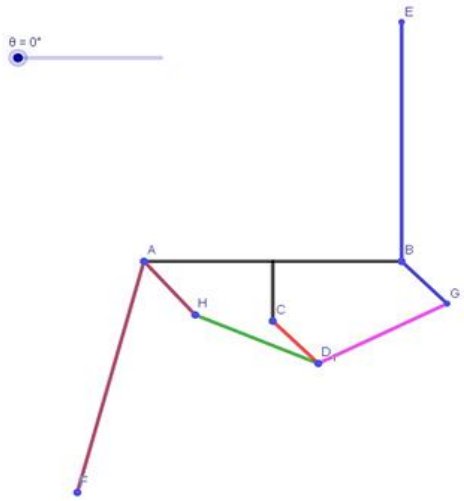

Figure.15: Mechanism when θ=0

2. When $\theta_{12}=45^0$

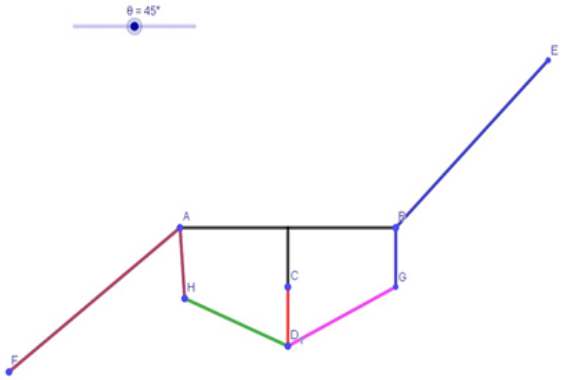

Figure.16: Mechanism when $\theta_{12}=45^0$

3. When $\theta_{13}=90^0$

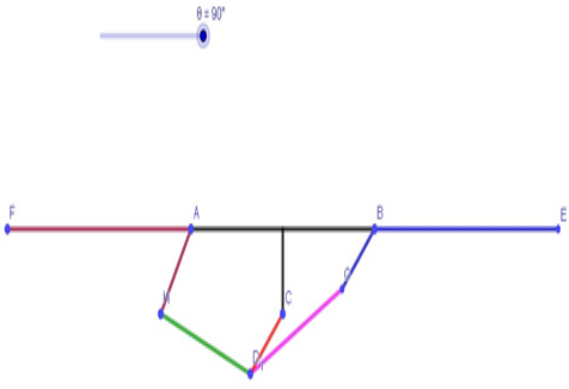

Figure.17: Mechanism when θ13=900

ACKNOWLEDGEMENT

We express our sincere thanks to Dr. Ch. Sridhar Reddy, Professor and Head of the Department of Mechanical Engineering, JNTU College of Engineering, Manthani, Dr.K.Prasanna Lakshmi Associate professor, Mechanical Department, JNTUCE Manthani and Mr.S.ShivaRama Krishna, Asst. Prof (C), Mechanical Department, JNTUCE Manthani, Dr. A. Raveendra, Principal, Malla Reddy Engineering College, Hyderabad, Dr. N Rishi Kanth, Head of the Department of Mechanical Engineering, Malla Reddy Engineering College, Hyderabad for their valuable suggestions and guidance.

- We would like to express our sincere gratitude to Dr.R.Markandeya, Professor and Principal, JNTUCE Manthani, Dr.B.Vishnu Vardhan, Professor and Vice Principal, JNTUCE Manthani for their support.
- We would also like to thank all the faculty members of the department of Mechanical Engineering, all the staff members JNTUCE Manthani, Malla Reddy Engineering College, Hyderabad for their kind cooperation.

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