International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878 (Online), Volume-8 Issue-2, July 2019

Development and Analysis of Semi-Automatic Safety Inflation Bag

R. Akil, R. V. Aswin, V. Prasanna, G. Mohanakrishnan, A. Ravinthiran

***Abstract:** Various safety gears and techniques are available in cars but save for the helmet, not much of safety gears have been introduced for the bike riders. Bike riders indulge in fatal accidents during their rides and race riders in spite of wearing the best safety gears get injured severely with spinal cord and chest being most vulnerable during the impact. Daily riders or race riders, accidents are inevitable. It's entirely upon us to equip ourselves with an additional safety gear for our own safety purposes. The project, safety inflation bag, provides the best solution to prevent injuries to spinal cord and chest. Here, a pneumatic actuator is used to inflate the air channels sewn inside the bag which provides protection for chest and spinal cord. This technique is implemented in a bag, as bag is most commonly used during bike rides. Be it for office goers or for riders on long trips, bag is necessary and fixating the safety gear inside the bag serves the rider than just for carrying items. It could save the life. It could prevent him from enduring critical injury to spinal cord or chest. During the time of impact, the pneumatic cylinder goes off, releasing the compressed air through the air channels pressed against chest and spinal cord thus inflating them at the right time to provide a solid balloon protection. This project could serve as the first step to a major safety innovation for bike riders.*

***Keywords:** safety, ansys, explicit dynamics, materials*

I. INTRODUCTION

Nowadays, the condition of increased road traffic makes the driving of vehicles more difficult, especially the two wheelers. Two wheelers are the one of the most preferred and largest sold mode of transport in India. From 2010 to 2018, around 20 million two wheelers (in units) were sold in India alone, making it the most popular vehicle category.With the increase in sales, the number of two-wheeler accidents gets elevated. In the year 2016, 9059 fatal accidents occurred all over India using two wheelers, especially in Tamil Nadu alone the number is reported to be around 3289.

Revised Manuscript Received on 30 July 2019.
* Correspondence Author
R.Akil, Department of Mechanical Engineering, Sri Sairam Engineering College, Chennai,India
R. V. Aswin, Department of Mechanical Engineering, Sri Sairam Engineering College, Chennai,India
V. Prasanna, Department of Mechanical Engineering, Sri Sairam Engineering College, Chennai,India
G. Mohanakrishnan, Department of Mechanical Engineering, Sri Sairam Engineering College, Chennai,India
A.Ravinthiran, Department of Mechanical Engineering, Sri Sairam Engineering College, Chennai,India

Considering these figures, there maybe even permanent damage such as losing a limb, spinal cord injury, etc. and on a worst case even to death. Whether the rider uses a moped or a geared bike, follows traffic rules or not, some additional safety is needed desperately to prevent these accidents.

An accident is always avoidable or can reduce the damage when involved. Apart from the helmet, there is no other special equipment to safeguard the commuters while driving. There are safety vests but not so feasible for the everyday commuter more than it being a burden or extra luggage. Backpack is something everyone carries throughout the day. From the school goers to the office goers, everyone uses a backpack. It is something which is part of every household now, irrespective of the gender. This safety system intertwined on the backpack will be a perfect integration which can be useful for both applications. Only the size and weight of the backpack being on the downside, the amount of safeness that it gives is about two to three folds. The air channels are similar to that of the air bag that is used in the car, only difference is its actuation and the area it covers. Here, to avoid any mistakes manual actuation is preferred, as it being more effective than any other sensors. Irrespective of the gender and age, this safety system is something which everyone should possess whoever rides a bike regularly.As our product is designed ergonomically to reduce damage, we prefer passive safety system over active safety system.To test our concept, we conducted a survey on basic questionnaires. We started off from the profession, where college students are the majority followed by working professionals.

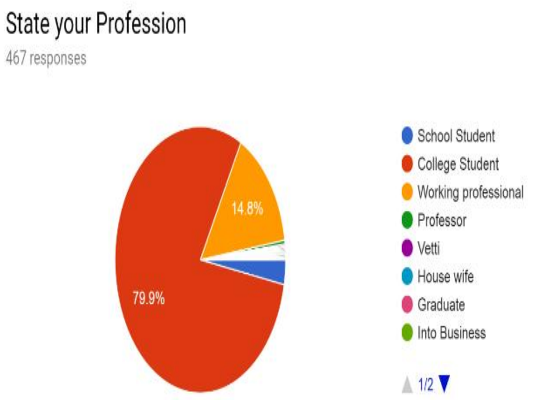

Fig. 1. Survey graph 1

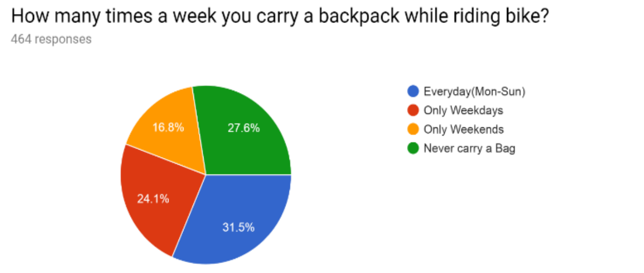

Fig. 2. Survey graph 2

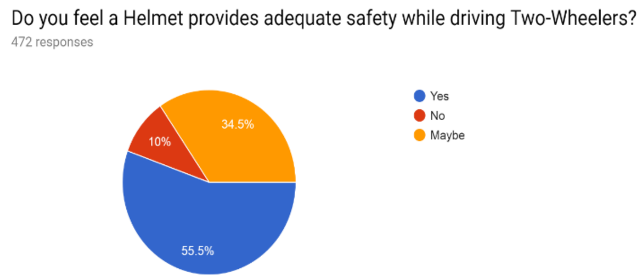

Fig. 3. Survey graph 3

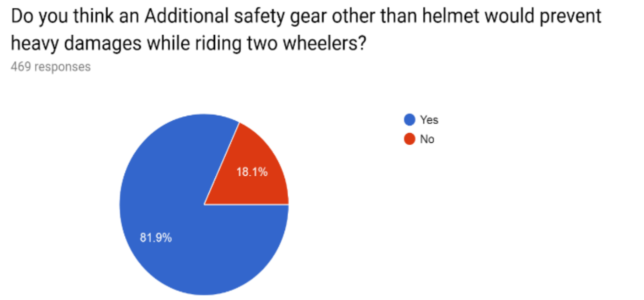

Fig. 4. Survey graph 4

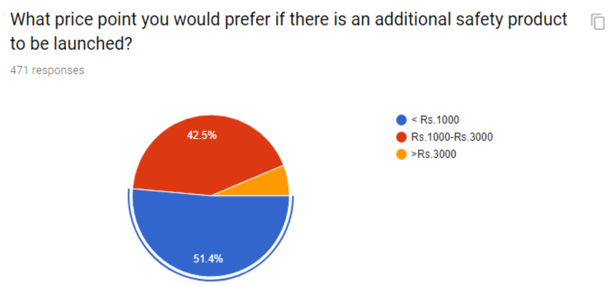

Fig. 5. Survey graph 5

From the survey we were able to draw out a clear plan to design a product with proper quality and produce it at a reasonable price point. Thereby, the survey boosted our concept of collaborating bag with safety gear as an additional safety.

II. WORKING

Cylinder is the primary component of the actuator. The cylinder we have used in this gear is 60cc (CO_2). We felt the cylinder of 60cc caliber is ideal for this mechanism because the average weight of a human adult is 150N and thus 60cc provides an adequate amount of CO_2 into the air channels. There key-ball lanyard connected at one end of the actuator which when pulled, activates a spring actuated release pin, which in turn impales one of the cylinder's ends. Thus, the pull of the key-ball lanyard opens up the cylinder, which inflates the air channels. The key-ball lanyard from the actuator is connected to a rigid part of the bike. We decided to connect it to a rigid part because we can't risk pulling the string at normal situations like getting down the bike or while pulling over. The lanyard is of considerably long length to allow free access. One and only if the impact is great enough to haul the rider off the bike, the lanyard gets pulled, activating the whole gear. The actuator is sewn inside the bag along with air channels. Actuator can be sewn at either side of the bag depending on the ergonomics.

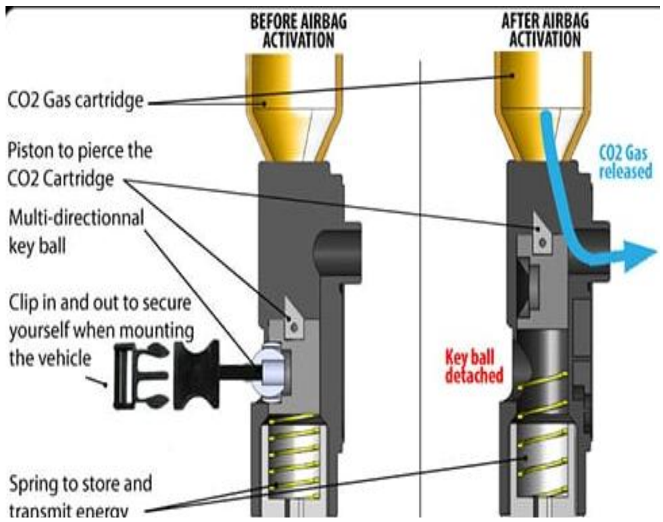

Fig. 6. Working of an actuator

The lanyard must have sufficient length as it should not open the air channels unnecessarily if the driver forgets to untether the cord while exiting the bike. The length of the cord should not be too high or too low, it should be ergonomically perfect (the attachment cord should be at maximum length when the driver is standing on the foot pegs).It is recommend that the lanyard is attached under the seat to a solid part of the bike frame. Attaching the tether to the handlebar is to be avoided. The ball lanyard activates the mechanism and the inflation of the bag happens in 2 seconds maximum. Inflation happens at the right time to save the rider from fatal injuries. Air channel has also got a tube connected to it. It is for to release the inflated air. The length of the tube is 18 cm.

III. MATERIAL SELECTION

Selection of Selection of material is the crucial part for any engineering application. Furthermore, material selection plays a pivotal role in every part design and analysis. From the plethora of materials available this project is concerned on the materials which must have the following behavior and properties,

- Highly wear resistant
- Chemically inert
- Resilient
- High impact strength
- High flexibility
- Hydrophobic

Considering these above properties, selected materials were

- Kevlar 49
- Nylon 6
- Nylon 6,6.

In comparison, Nylon 6 is selected as our prime material based on cost effectiveness and above stated properties. Although, Kevlar is more effective than others and used considerably in high impact areas, the project demanded nylon for its outstanding additional property i.e. easy manufacturing and flexibility. The general properties are listed below for clear understanding,

Kevlar 49

Kevlar is majorly found in the ballistic applications involving high impact applications. It was also a reason for choosing this material for this project's application. The downside of this material is that it is not as flexible as an air bag when blown. There are two types of Kevlar materials namely Kevlar 29 and Kevlar 49. Kevlar 49 having better material properties than the Kevlar 29 is why Kevlar 49 is chosen. Some of the properties of Kevlar 49 are tabulated as follows.

Table 1. Properties of Kevlar 49

PROPERTIES	VALUES
Density	1.44 g/cm3
Breaking strength	264 N
Tensile modulus	112,400 MPa
Specific Heat 25 ºC 100 ºC 180 ºC	 1420 J/kg K 2010 J/kg K 2515 J/kg K
Coefficient of thermal expansion	77-302
Thermal conductivity	0.04 W/m K

A. *Nylon 6*

Nylon 6 fibres have high tensile strength, resulting in high toughness. They are wrinkle-proof and very much chemically inert. The fibres can absorb up to 2.4% of water, but the tensile strength is reduced. The properties are tabulated below.

Table 2. Properties of Nylon 6

PROPERTIES	*VALUES*
Density	1.13E+3 kg/m3
Young's modulus	2.95 GPa
Tensile ultimate strength	82.7 MPa
Thermal conductivity	0.245 W/m K
Compressive yield strength	103 MPa
Flexural modulus	3.45 GPa

B. *Nylon 6,6*

Nylon 66 is synthesized by polycondensation of hexamethylenediamine and adipic acid. Removing water drives the reaction toward polymerization through the formation of amide bonds from the acid and amine functions. Thus molten nylon 6,6 comes as the output. Nylon 66 is frequently used when high mechanical strength, rigidity, good stability under heat and/or chemical resistance are required. The properties are tabulated below.

Table 3. Properties of Nylon 6,6

Properties	Values
Density	1140 kg/m3
Young's modulus	1.6 GPa
Tensile ultimate strength	100 MPa
Thermal conductivity	0.2575 W
Compressive yield strength	66 MPa
Flexural modulus	2.0 GPa

IV. DESIGN

A. *Design Softwares Involved*

The design of all the parts and the assembly were done using the SolidWorks software. SolidWorks is a solid modeler, and utilizes a parametric feature-based approach, whichwas initially developed by PTC to create models and assemblies. The software is written on Parasolid-kernel.

B. *Design Specifications*

The dimensions of the safety backpack was calculated from some standard backpack which was already in the market. Based on the dimensions of standard backpack some of the dimensions were modified so as to fit the application. Though the dimensions were modified, the size of the backpack increased by only some mere percentages. Weight of the new backpack will be predominantly higher than the standard backpack.

Table 4. Design Specifications

Description	*Dimensions of new bag (cm)*	*Dimensions of the standard bag (cm)*
Length	44	33
Breadth	23	18.5
Height	50	47
Straps	70x9	44x9

C. *Product Design*

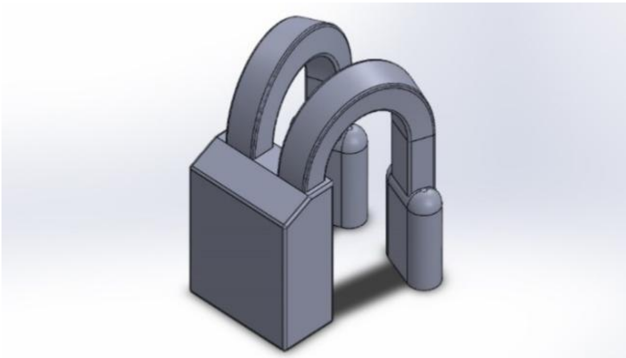

Fig. 7. Backpack with inflated air channels

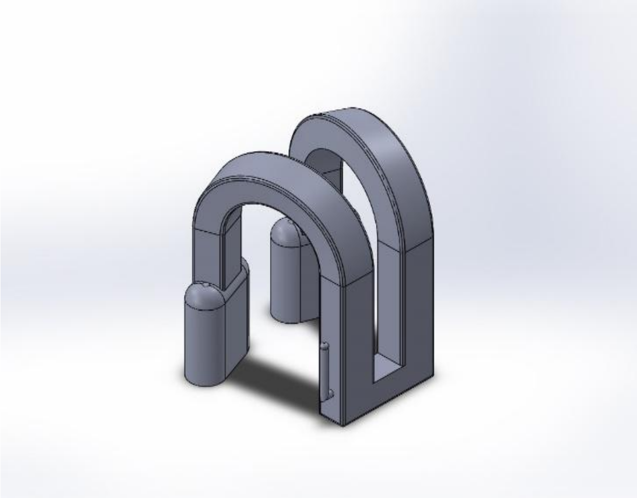

Fig. 8. Air Channels

Fig. 9. Actuator

V. ANALYSIS

A. *Softwares Used*

As mentioned in the title, analysis was done on the designed part. To avoid unnecessary complexities, only the air channels were analyzed excluding the surrounding bag. Here, the analyses were carried out using the ANSYS software especially explicit dynamics, as the case being an impact event between the air channels and road.

B. *Introduction To Ansys*

ANSYS is a general purpose finite element modeling package for numerically solving a wide variety of mechanical problems. These problems include: static/dynamic structural analysis (both linear and non-linear), heat transfer and fluid problems, as well as acoustic and electro-magnetic problems. Finite Element Analysis is a numerical method of deconstructing a complex system into very small pieces (of user-designated size) called elements. The software implementsgoverning equations to these elements and solves them, creating a comprehensive explanation of how the system acts as a whole. These results can be presented in tabulated or graphical forms. This type of analysis software is used for the design and optimization of those systems that are far too complex to analyze by hand. Systems that may fit into this category are too complex due to their geometry, scale, or governing equations.

C. *Need For Ansys*

ANSYS provides a cost-effective way to know the behavior and performance of products or processes in a virtual environment. This type of product development is termed as virtual prototyping. With this type of available techniques, users can iterate various scenarios to optimize the product very much before the manufacturing planned to begin. This enables a reduction in the level of risk, and in the cost of scraps The multifaceted nature of ANSYS also provides a means to ensure that users are able to see the effect of a design the overall behavior of the product, be it electromagnetic, thermal, mechanical etc. In general, a finite element analysis may be broken into the following three stages.

D. *Generic Steps To Solving Any Problem In Ansys*

Like solving any problem analytically, you need to define

1. The solution domain,
2. The physical model,
3. Respective boundary conditions
4. Corresponding physical properties.

Then the problem is solvedto present the results. In numerical methods, the main difference is an extra step called mesh generation. This step divides the complex model into small elements, which makes them solvable in an otherwise too complex situation. Below describes the processes in terminology slightly more attune to the software.

E. *Preprocessing*

The major steps in preprocessing are given below:

- Define key points/lines/areas/volumes
- Define element type and material/geometric properties
- Mesh the body as required

F. *Post Processing And Results*

- Lists of nodal displacements
- Element forces and moments
- Deflection plots
- Stress contour diagrams.

G. *Explicit Dynamics*

ANSYS Explicit Dynamics is a transient explicit dynamics Workbench application that can perform a variety of engineering simulations, including the modelling of nonlinear dynamic behaviour of solids, fluids, gases and their interaction. A typical simulation consists of setting up the model, interactions and the applied loads, solving the model's nonlinear dynamic response over time for the loads and interactions, then examining the details of the response with a variety of available tools. The Explicit Dynamics application has objects arranged in a tree structure that guide you through the different steps of a simulation. By expanding the objects, you expose the details associated with the object, and you can use the corresponding tools and specification tables to perform that part of the simulation. Objects are used, for example, to define environmental conditions such as contact surfaces and loadings, and to define the types of results that are needed for review.

An explicit dynamics analysis is used to determine the dynamic response of a structure due to stress wave propagation, impact or rapidly changing time-dependent loads. Momentum exchange between moving bodies and inertial effects are usually important aspects of the type of analysis being conducted. This type of analysis can also be used to model mechanical phenomena that are highly nonlinear. Nonlinearities arise from the materials, (for example, hyper elasticity, plastic flows, failure), from contact (for example, high speed collisions and impact) and from the geometric deformation (for example, buckling and collapse). Events with time scales of less than one second are efficiently simulated with this type of analysis. The time step used in an explicit dynamics analysis is constrained to maintain stability and consistency via the CFL condition, that is, the time increment is proportional to the smallest element dimension in the model and inversely proportional to the sound speed in the materials used.

Time increments are usually on the order of one microsecond and therefore thousands of time steps (computational cycles) are usually required to obtain the solution. An explicit dynamics analysis typically includes many different types of nonlinearities including large deformations, large strains, plasticity, hyper elasticity, material failure etc.

VI. SOLUTIONS

A. *Preprocessing*

To begin with, the material properties as described above were loaded in the ANSYS engineering data as a common component. The explicit dynamics analysis systems for each and every iterations were placed individually and those engineering data were shared between them. The process of analysis was divided into three ways, they are:

- Frontal impact analysis
- Shoulder impact analysis
- Lateral impact analysis

The frontal impact analysis focuses on the straight equal impact of the air channels with the ground. Shoulder impact analysis focus on the impact that takes place in the upper side of the air channels. Lateral impact analysis focuses on the uneven impact taking place in the front side of the air channels. To avoid complexities and inaccuracies, only the air channels were taken for explicit analysis. The three aforementioned analysis were carried out for all the three materials as mentioned above. The output from the analysis taken as total deformation, directional deformation, equivalent stress and equivalent strain. In the preprocessing stage some of the values were added. This preprocessing inputs are same for all the three impact analysis which are done, with some minor changes in the displacement. The preprocessing values that are inputted are tabulated as below.

Table 5. Ansys Preprocessing

DESCRIPTION	*VALUES*
Connections	No contacts established Only body interactions
Mesh	Coarse mesh with minimum edge length of 1.7430 mm
Pre stress	None
Velocity	19444 mm/s (Z component)
Displacement	X component: free Z component: free Y component: 0 mm/s
End time	0.0003 s
Result number of points	100

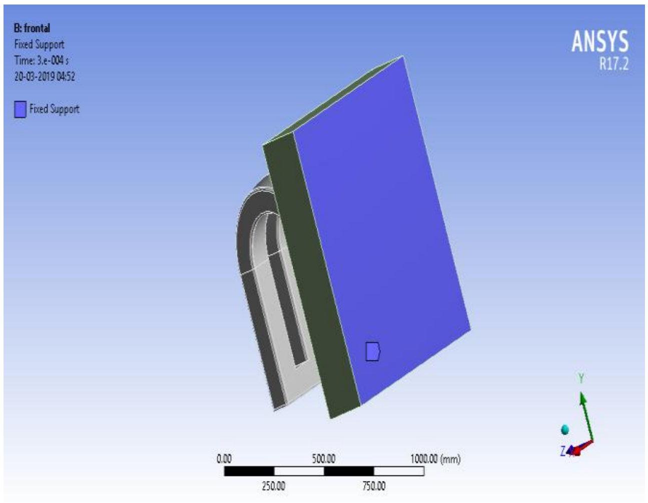

Fig. 10. Fixed Support

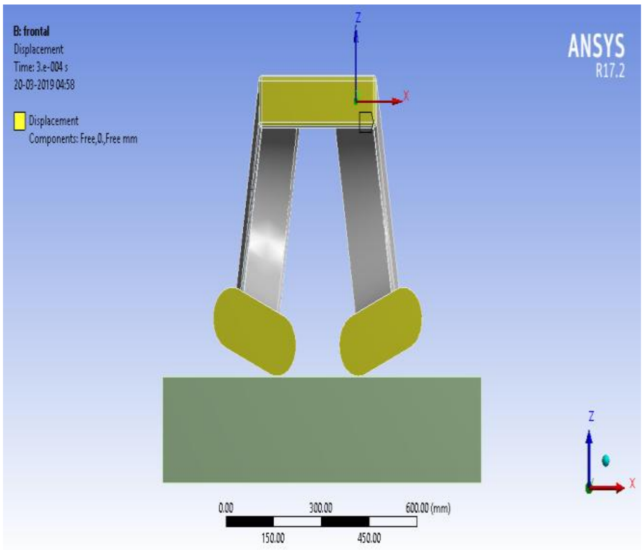

Fig. 11. Displacement Faces

B. *Solution*

After providing the required values as inputs in the preprocessing stage. Now, the required solution information is chosen. As mentioned earlier, total deformation, directional deformation, equivalent stress and equivalent strain are chosen. Before solving, the project is checked once again if there is any value that is missed out. The solution information is solved and the corresponding values are obtained.

C. *Frontal Impact Analysis*

The frontal impact analysis was carried out and the solution information such as total deformation, directional deformation, equivalent stress and equivalent strain were obtained for all the three materials.

FOR KEVLAR 49

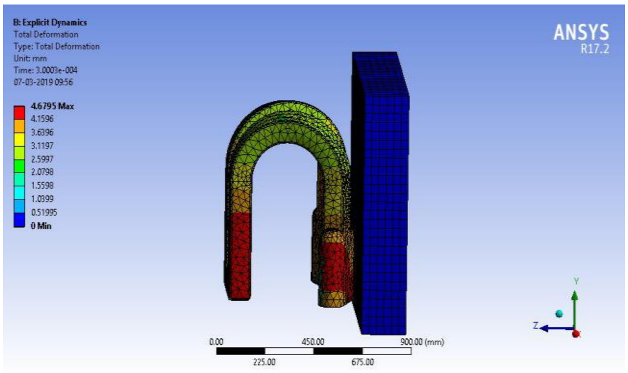

Fig. 12. Frontal impact total deformation of Kevlar 49

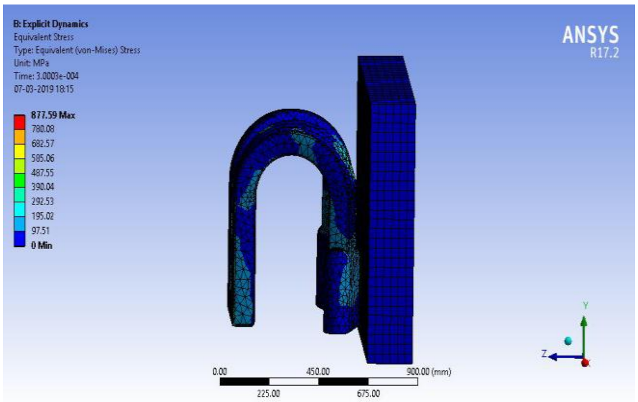

Fig. 13. Frontal impact equivalent stress (von-mises) of Kevlar 49

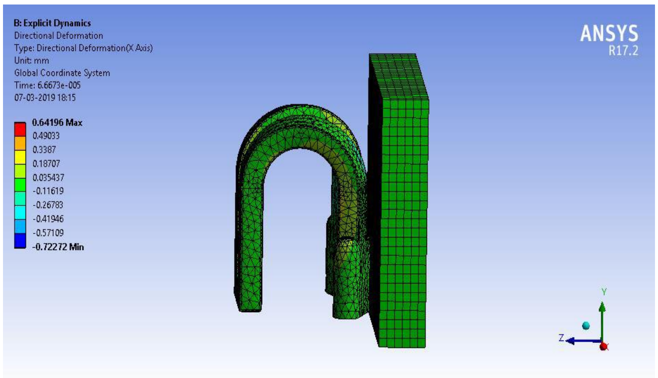

Fig. 14. Frontal impact directional deformation of Kevlar 49

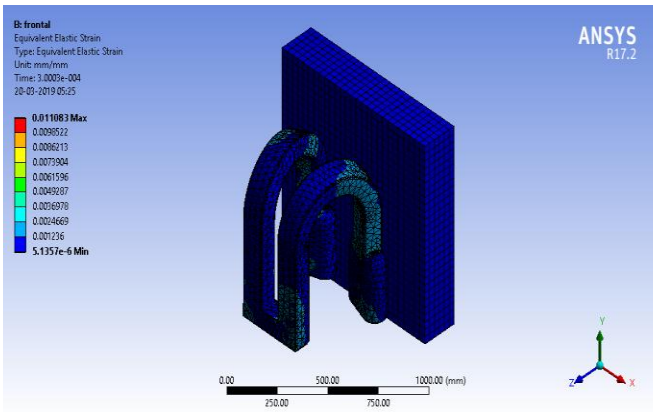

Fig. 15. Frontal impact equivalent elastic strain of Kevlar 49

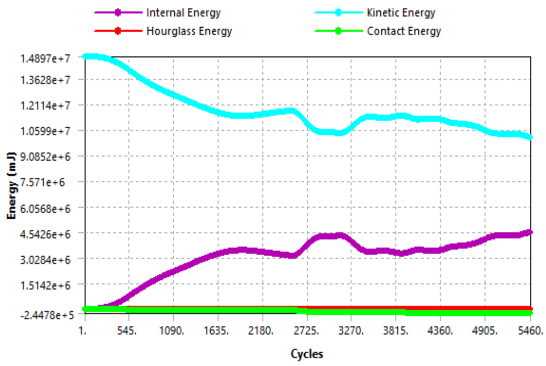

Fig. 16. Frontal impact energy summary of Kevlar 49

NYLON 6

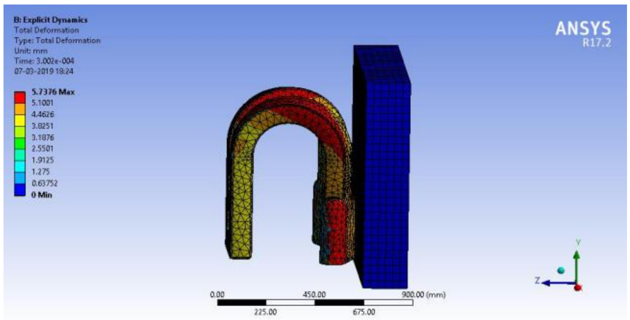

Fig. 17. Frontal impact total deformation of nylon 6

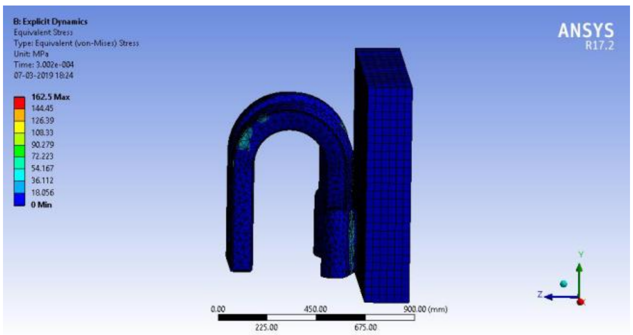

Fig. 18. Frontal impact equivalent stress of nylon 6

International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878 (Online), Volume-8 Issue-2, July 2019

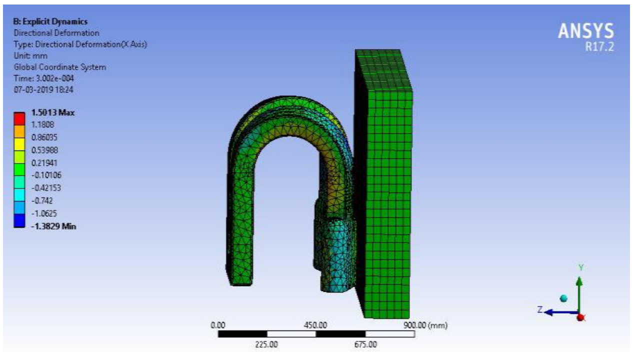

Fig. 19. Frontal impact directional deformation of nylon 6

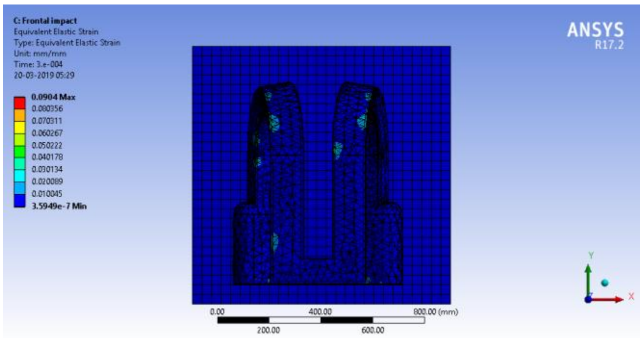

Fig. 20. Frontal impact equivalent elastic strain of nylon 6

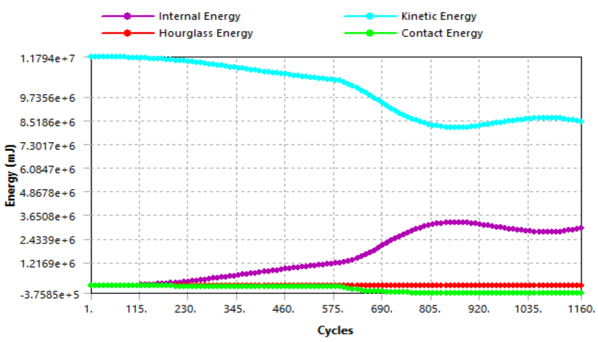

Fig. 21. Frontal impact energy summary of frontal impact nylon 6

NYLON 6,6

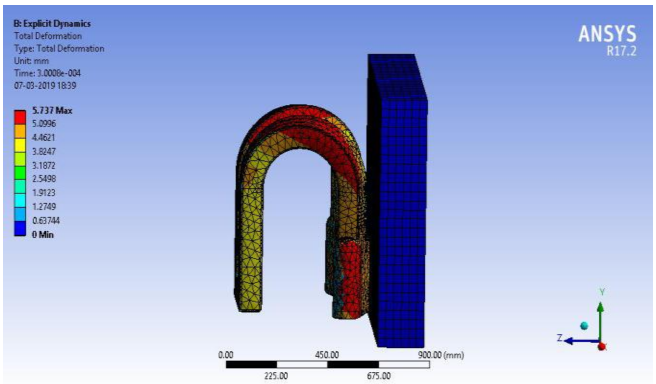

Fig. 22. Frontal impact total deformation of nylon 6,6

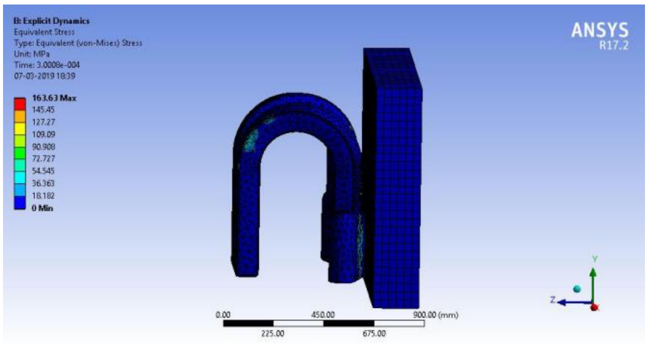

Fig. 23. Frontal impact equivalent stress of nylon 6,6

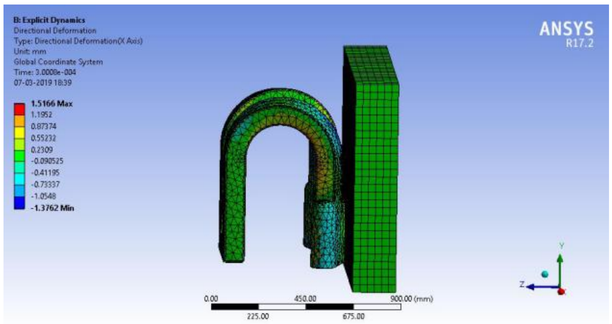

Fig. 24. Frontal impact directional deformation of nylon 6,6

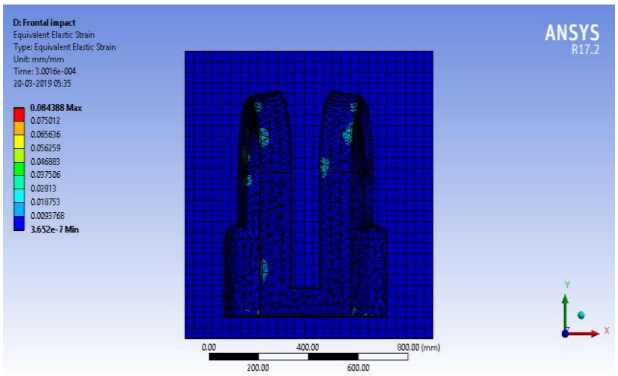

Fig. 25. Frontal impact equivalent elastic strain of nylon 6,6

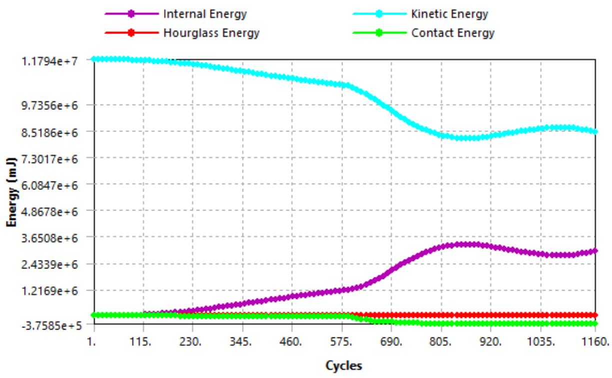

Fig. 26. Frontal impact energy summary of frontal impact nylon 6,6

D. *Shoulder Impact Analysis*

The shoulder impact analysis was carried out and the solution information such as total deformation, directional deformation, equivalent stress and equivalent strain were obtained for all the three materials. Starting off with for Kevlar 49

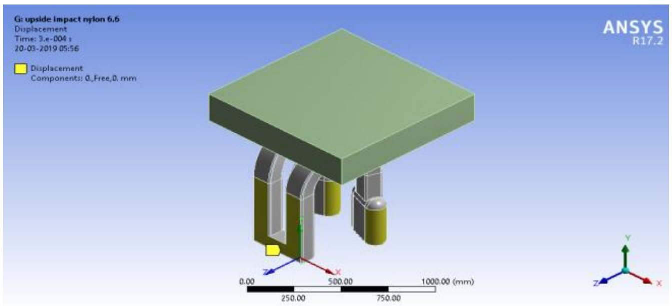

Fig. 27. displacement support for shoulder impact

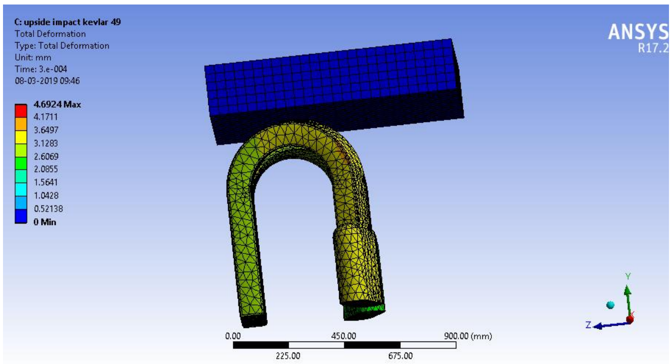

Fig. 28. Shoulder impact total deformation of Kevlar 49

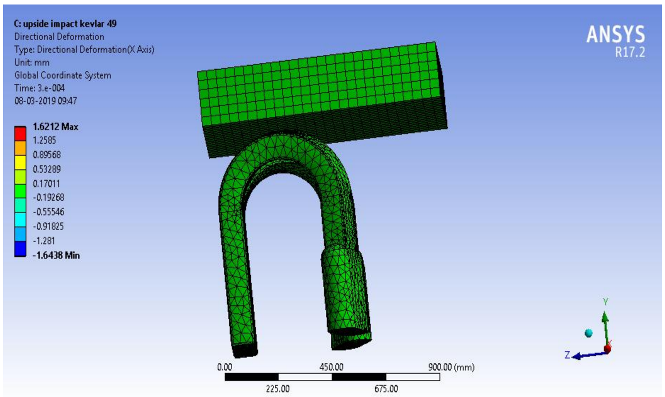

Fig. 29. Shoulder impact directional deformation of Kevlar 49

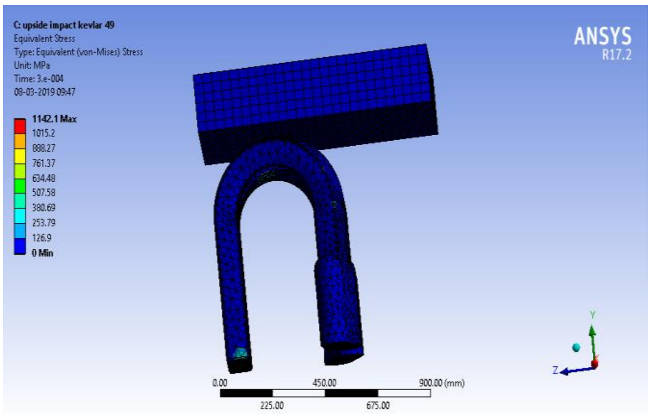

Fig. 30. Shoulder impact equivalent stress of Kevlar 49

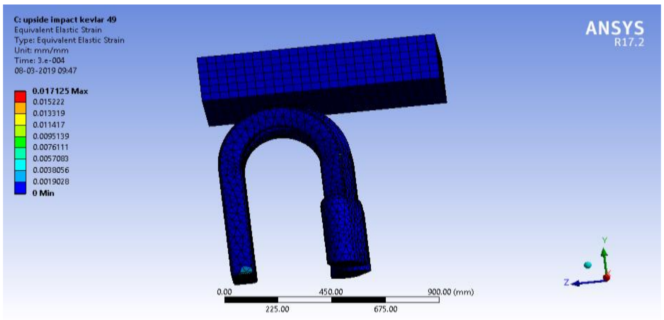

Fig. 31. Shoulder impact equivalent elastic strain of Kevlar 49

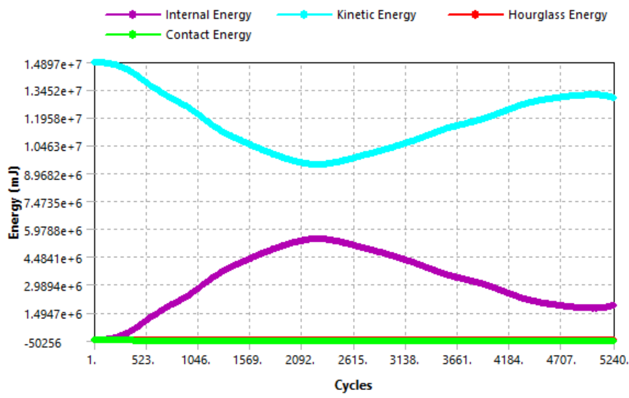

Fig. 32. Shoulder impact energy summary of shoulder impact Kevlar 49

NYLON 6

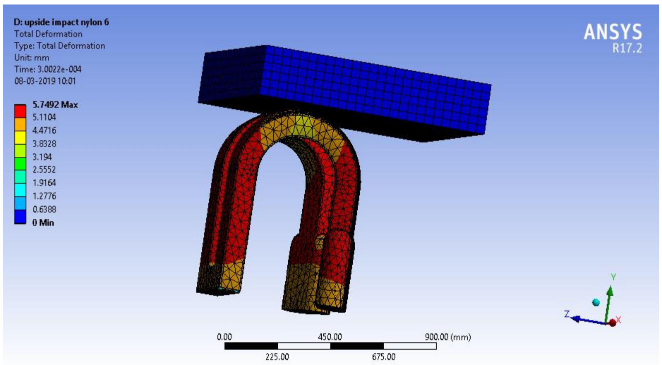

Fig. 33. Total deformation of nylon 6

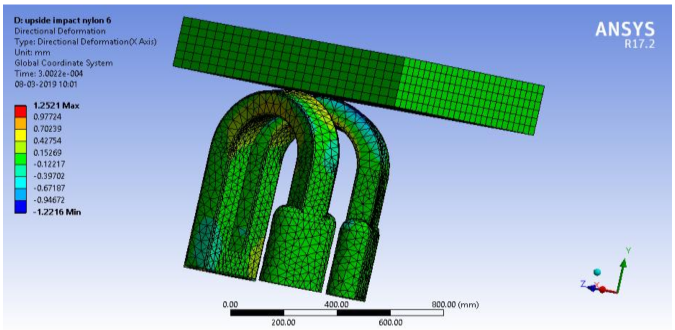

Fig. 34. Shoulder impact directional deformation of nylon 6

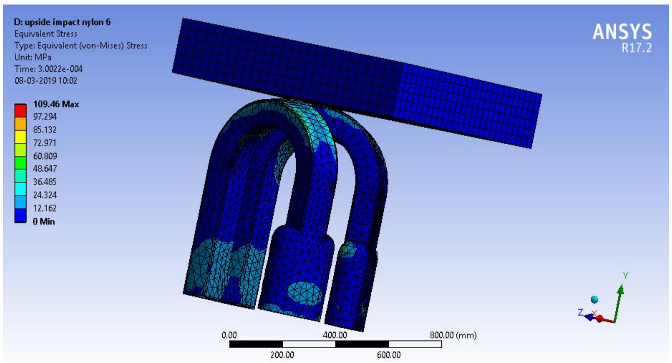

Fig. 35. Shoulder impact equivalent stress of nylon 6

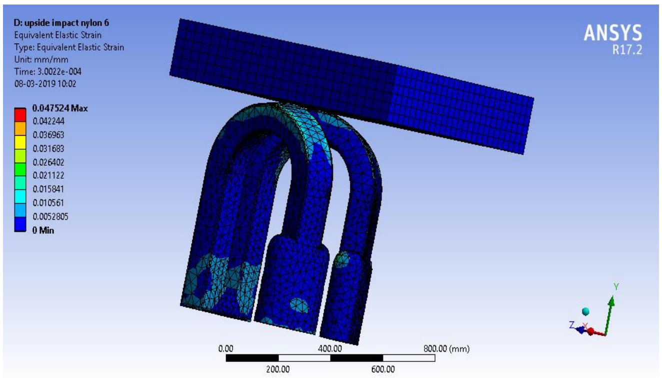

Fig. 36. Shoulder impact equivalent elastic strain of nylon 6

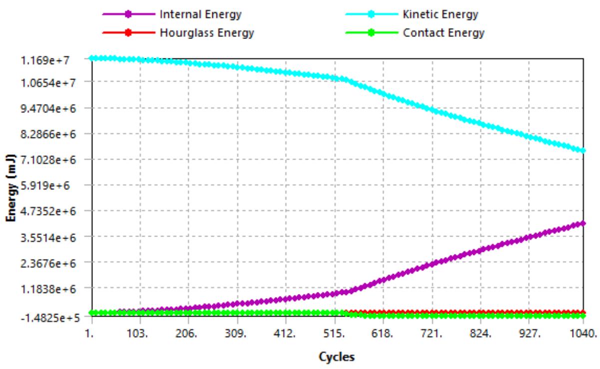

Fig. 37. Shoulder impact energy summary of shoulder impact nylon 6

NYLON 6,6

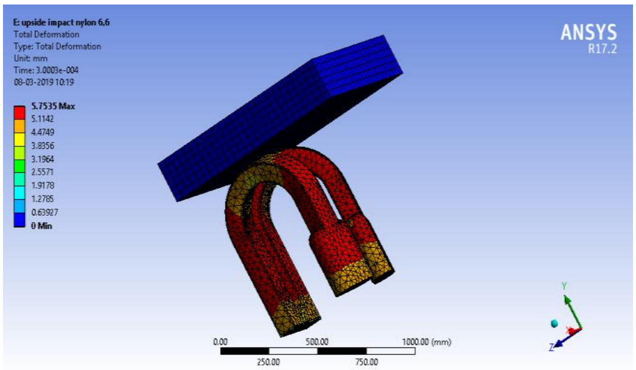

Fig. 38. Total deformation of nylon 6,6

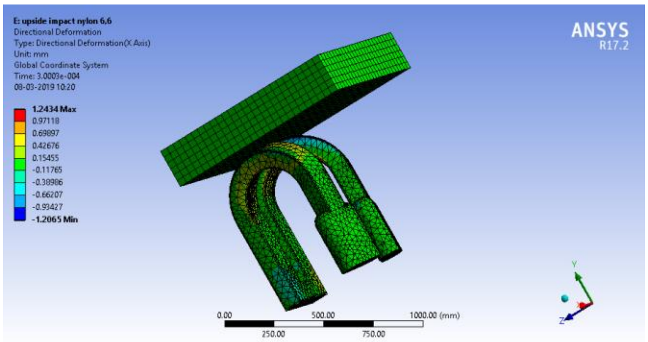

Fig. 39. Shoulder impact directional deformation of nylon 6,6

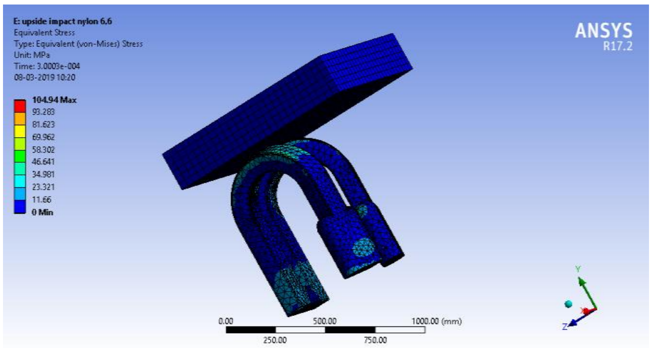

Fig. 40. Shoulder impact equivalent stress of nylon 6,6

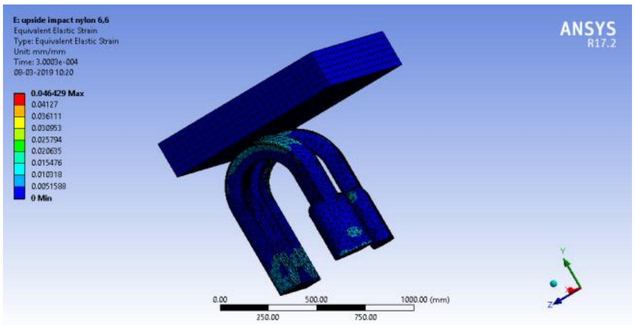

Fig. 41. Shoulder impact equivalent elastic strain of nylon 6,6

E. *Lateral Impact Analysis*

The shoulder impact analysis was carried out and the solution information such as total deformation, directional deformation, equivalent stress and equivalent strain were obtained for all the three materials.

KEVLAR 49

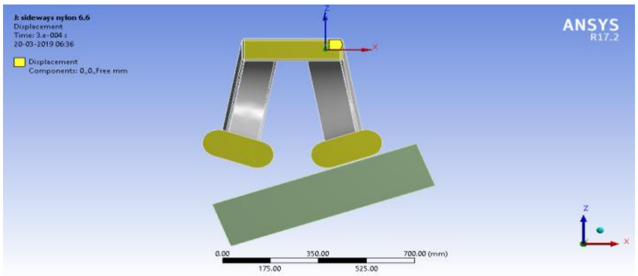

Fig. 42. Displacement support for lateral impact analysis

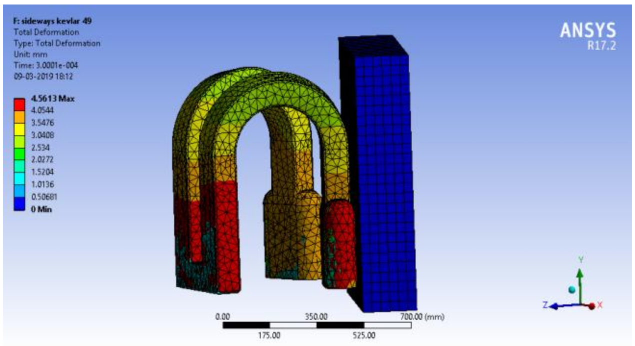

Fig. 43. Lateral impact total deformation of Kevlar 49

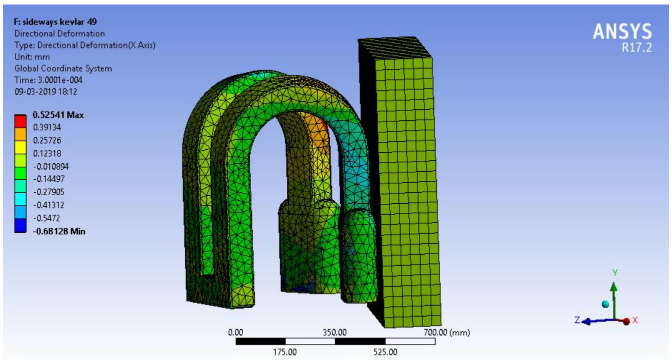

Fig. 44. Lateral impact directional deformation of Kevlar 49

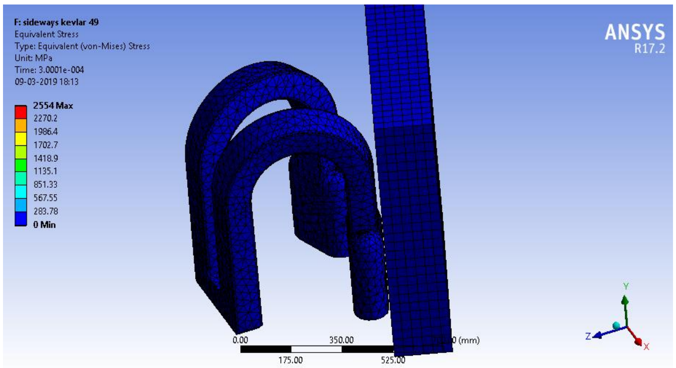

Fig. 45. lateral impact equivalent stress of Kevlar 49

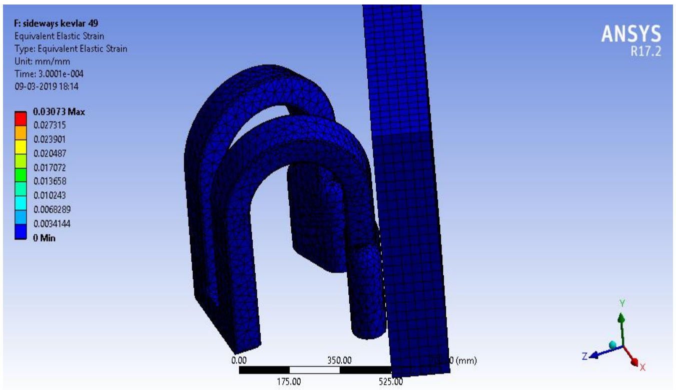

Fig. 46. Lateral impact equivalent elastic strain of Kevlar 49

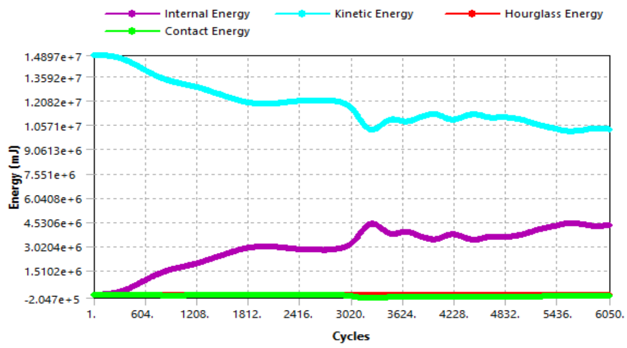

Fig 46.a: Lateral impact energy summary of lateral impact Kevlar 49

NYLON 6

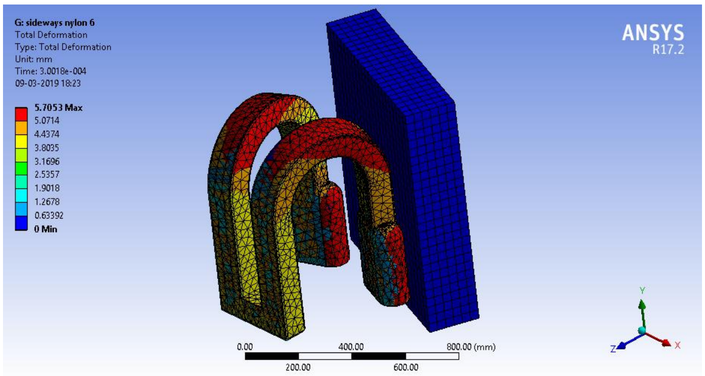

Fig. 47. lateral impact total deformation of nylon 6

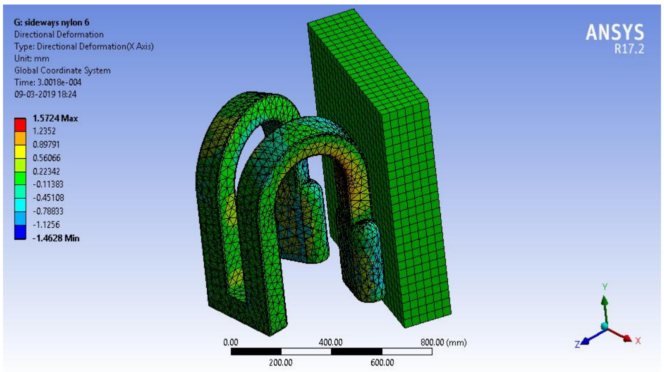

Fig. 48. lateral impact directional deformation of nylon 6

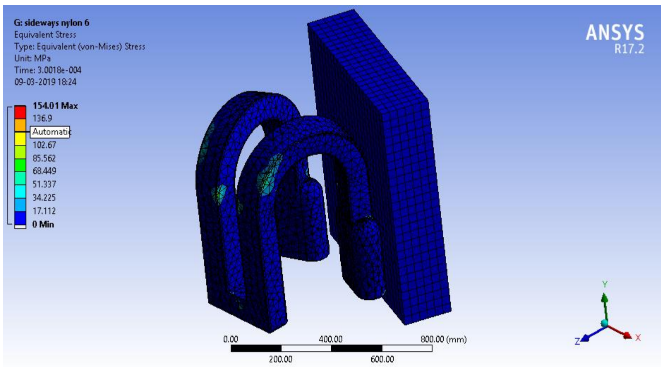

Fig. 49. lateral impact equivalent stress of nylon 6

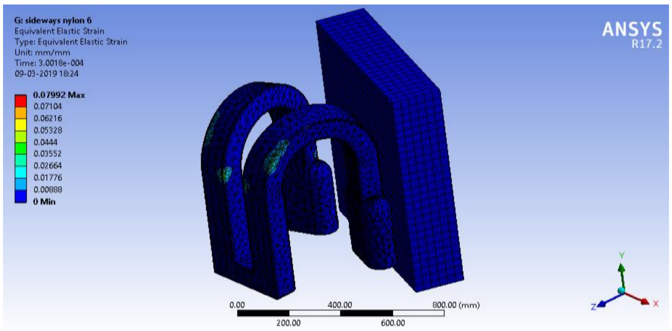

Fig. 50. lateral impact equivalent elastic strain of nylon 6

NYLON 6,6

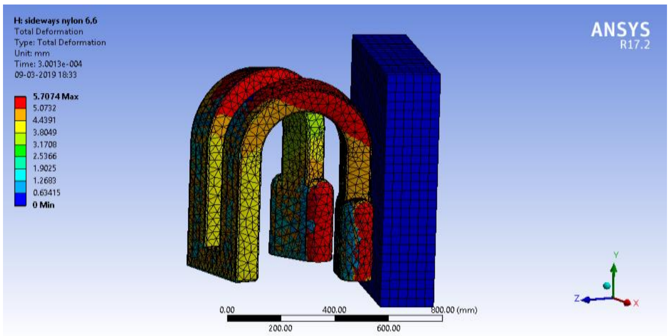

Fig. 51. lateral impact total deformation of nylon 6,6

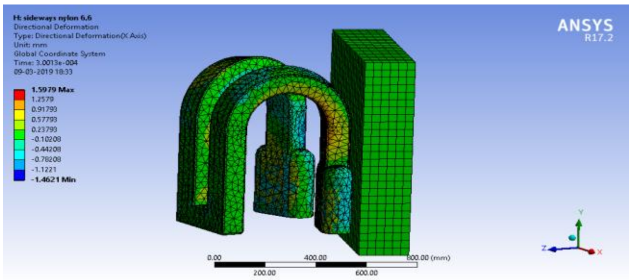

Fig. 52. lateral impact directional deformation of nylon 6,6

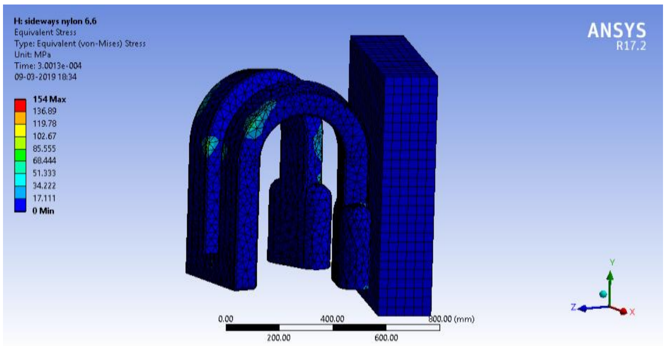

Fig. 53. lateral impact equivalent stress of nylon 6,6

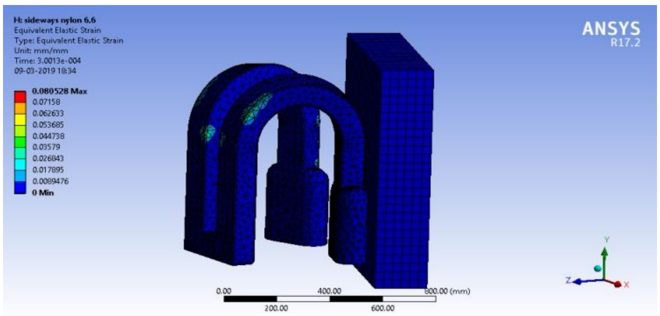

Fig. 54. lateral impact equivalent elastic strain of nylon 6,6

VII. RESULTS AND DISCUSSIONS

Initially, the materials were chosen and their properties were noted. The analysis was done in three ways for all the three materials and their corresponding solutions were obtained and tabulated as below.

Table 6. Frontal Impact Solutions

Solutions	*Kevlar 49*	*Nylon 6*	*Nylon 6,6*
Total deformation, mm	4.6795	5.7376	5.737
Equivalent stress, MPa	877.5	162.5	163.63
Equivalent strain mm/mm	0.011083	0.0904	0.084388
Directional deformation, mm	0.64196	1.5013	1.5166

Table 7. Shoulder Impact Solutions

Solutions	*Kevlar 49*	*Nylon 6*	*Nylon 6,6*
Total deformation, mm	4.6924	5.7492	5.7535
Equivalent stress, MPa	1142.1	109.46	104.94
Equivalent strain, mm/mm	0.01712	0.047524	0.046429
Directional deformation, mm	1.6212	1.2521	1.2434

Table 8. Lateral Impact Solutions

Solutions	Kevlar 49	Nylon 6	Nylon 6,6
Total deformation, mm	4.5613	5.7053	5.7074
Equivalent stress, MPa	2554	154.01	154
Equivalent strain, mm/mm	0.03073	0.07992	0.080528
Directional deformation, mm	0.52541	1.5724	1.5979

From the From the results, it is evident that the Kevlar 49 outperforms nylon 6 and nylon 6,6. The solutions from all the three cases is evident that Kevlar 49 takes the maximum stress and has minimum total deformation. Even though the Kevlar 49 has better performances, there raises some practical difficulties. Kevlar as air channels adds additional weight eventually becomes less ergonomic to carry. As for as processing is concerned, processing the Kevlar is also complex and requires extra hand. Nylon 6 and nylon 6,6 on the other hand has similar results due to its similar properties. However, there are minor differences between them.

Comparing the two materials, nylon 6 does better job than the nylon 6,6 even though having only minor differences. The difference between Kevlar and nylon is in terms of cost. The nylon is low cost; it is lightweight and readily available. Focusing on the application of air bag, Kevlar 49 is not feasible to be employed as air channels, instead the nylon 6 and nylon 6,6 performs well in all aspects such as cost, processing and performances.

VIII. FUTURE SCOPE

The airbag won’t go off accidentally even if the rider forgets to unclip as he/she is getting off. If the rider forgets to untether, he/she will feel a strong tug to remind them to disconnect the coiled wire. It takes a reasonably strong force of around 66 pounds (approximately 30kg) to release the key and deploy the airbag. To improve this system further, a sensor can be employed which disconnects the coiled wire from the bike as soon as the rider gets off. The bags can be made using self-healing materials; in this case, a fabric. Self-healing materials are artificial or synthetically createdsubstances, which have the built-in ability to automatically repair the damage to itself without any intervention. Generally, materials will degrade over time due to fatigue, environmental conditions, or damage incurred during operation, which leads to change in thermal, electrical and acoustical properties. The self-healing materials counter degradation through the initiation of a repair mechanism, which responds to micro damage. So, to improve the quality of the bag further, it can be made using self-healing fabrics which has resealing and repairing capabilities. The fabric is covered with a special coating that reacts to heat and friction. Therefore, in case of a puncture, one can just the rub the area to fix a tear or hole.

IX. CONCLUSION

This paper deals with the design and analysis of safety inflation bag that also serves a purpose as a normal bag. We have designed a bag that fits perfectly for a normal adult whose height ranges from 5.5-5.10 feet. The dimensions of a normal bag were considered and then our safety gear mechanism was installed inside it. It has also been made sure that the comfortableness of a normal bag was retained. For the inflation air channels, we narrowed down on three materials; Nylon 6, Nylon 6, 6 and Kevlar 49 and explicit dynamic analysis was performed. From the analysis, we have inferred that Kevlar 49 would be the ideal material to fabricate an air channel with but considering the economics, Kevlar 49 could be of a high expenditure. The next ideal material is Nylon 6. It is of modest rate and is almost as effective as Kevlar 49. Thus, Nylon 6 can be used as a viable material for fabricating the air channels. Our safety bag protects all of the following areas during an accident: Neck, Collarbone, Thorax, Ribs, Lungs, Pelvis and Spine. Approximately 40% of deaths from fatal accidents happen due to impact on frontal parts. Our bag provides complete protection to the frontal part of the rider. Our product could serve as a potential stepping-stone to a major revolution for rider’s safety.

REFERENCES

1. Harry Lahrmanna, Tanja Kidholm Osmann Madsena, Anne Vingaard Olesena, Jens Chr. Overgaard Madsenb, Tove Helsc,” The effect of a yellow bicycle jacket on cyclist accidents”, Safety Science 108 (2018) 209–217.
2. A. Grassi, D. Barbani, N. Baldanzini, R. Barbieri, M. Pierini,Belted Safety Jacket: a new concept in Powered Two-Wheeler passive safety”, Procedia Structural Integrity 8 (2018) 573–593.
3. Xingyu Chena, Xingda Qub,” Effects of backpack load on stair gait in young male adults”, international Journal of Industrial Ergonomics 67 (2018) 53–59.
4. C.V. MacDonald, C.J. Brooks, J.W. Kozey, A. Habib,” An ergonomic evaluation of infant life jackets: Donning time & donning accuracy”, Applied Ergonomics 42 (2011) 314-320.
5. Mohamed Z. Ramadan, Adel M. Al-Shayea,” A modified backpack design for male school children” International Journal of Industrial Ergonomics 43 (2013) 462-471.
6. Katy Rose, Anne Davies, Matthew Pitt, Didi Ratnasinghe, Luigi D'Argenzio,” Backpack palsy: A rare complication of backpack use in children and young adults-A new case report”, European journal of paediatric neurology xxx (2016) 1-4.
7. Sudhir Kumar, K. Panneerselvam,” Two-body Abrasive Wear Behavior of Nylon 6 and Glass Fiber Reinforced (GFR) Nylon 6 Composite”, Procedia Technology 25 (2016) 1129 – 1136.
8. A. Bersani, L. Canonica, M. Cariello, R. Cereseto, S. Di Domizio, M. Pallavicini,” Long term elongation of Kevlar-49 single fiber at low temperature”, Cryogenics 54 (2013) 50–53.
9. S.M. Burkinshaw, Young-A. Son,” Stain resist treatments for nylon 6,6”, Dyes and Pigments 76 (2008) 650-655.
10. Lulu LIU, Zhenhua ZHAO, Wei CHEN, Gang LUO,” Influence of pre-tension on ballistic impact performance of multi-layer Kevlar 49 woven fabrics for gas turbine engine containment systems”, Chinese Journal of Aeronautics, (2018), 31(6): 1273–1286

AUTHORS PROFILE

Mr. R. Akil, Under graduate Scholar in Mechanical Department,Sri Sairam Engineering College, Chennai, Tamil Nadu, India.SAE member with active participation in design competitions.

Mr. R. V. Aswin, Under graduate Scholar in Mechanical Department,Sri Sairam Engineering College, Chennai, Tamil Nadu, India.SAE member with active participation in SAE EFFICYCLE events.

Mr.V. Prasanna, Under graduate Scholar in Mechanical Department,Sri Sairam Engineering College, Chennai, Tamil Nadu, India.Member in SAE. Participated in SUPRA events.

Mr. G. Mohanakrishnan, Under graduate Scholar in Mechanical Department, Sri Sairam Engineering College, Chennai, Tamil Nadu, India. SAE member with active participation in Tier events.

Mr .A. Ravinthiran, working as Assistant professor in Mechanical Department of Sri Sairam Engineering College, Chennai, Tamil Nadu, India. Having 8 years of experience in the field of Engineering Design and Analysis.