Electronic Assisted Hydraulic Jack System For Heavy load vehicles

B Saravanan
Professor,DepartmentofAuto,
Bannari Amman Institute
ofTechnology,Sathyamangalam,Erode
,Tamil Nadu,
638401praveensm@bitsathy.ac.in

M Deepanraj
UG Scholars, Department of
Auto,Bannari Amman Institute
ofTechnology,Sathyamangalam,Erode
,Tamil Nadu,
638401mitun.au18@bitsathy.ac.in

A Dharmesh
UG Scholars, Department of
Auto,Bannari Amman Institute
ofTechnology,Sathyamangalam,Erod
e,Tamil Nadu,
638401,nandhakumar.au18@bitsathy.
ac.in

R Rajesh
UG Scholars, Department of
Auto,Bannari Amman Institute
ofTechnology,
Sathyamangalam,Erode,Tamil Nadu,
638401,raghul.au19@bitsathy.ac.in

Abstract—**There are numerous security perils presented with physicallyraising a heavy vehicle to replace a tire. Standard weightyjacks represent an incredible security danger due to the physicalfurther more tedious contribution of the administrator. Secondary selling programmed hydraulicjacks however more securestill are risky as they must be physicallyset under the vehicle and have restricted use. Ahydraulicjack that is forever appended tothe under body of a vehicle will diminish andwipe out a significant number of these security issues.The hydraulicjack was planned dependent on therelative loads of the client prerequisites thatare given the most significance and the designinghighlights with the most elevated relative significance inrequest to guarantee that client needs are met. Thisapproach guaranteed that the jack was plannedwith the client's requirements in sight and hence demonstratedto be a useful item.**

Keywords - Hydraulic jack, heavy vehicle, Redesign, Lifting force.

I. INTRODUCTION

The proposed system is a comfort based valuable structure which is used to lift the vehicle with basically no difficulty, knowledge and genuine work. The standard vehicle jacks require the head to recuperate the jack from the capacity compartment, place it under the vehicle in the suitable region, and a short time later actually turn the screw string to lift the vehicle.. The essential lead of the proposed system is the amount of jacks used is constrained; the power for the incitation is directly obtained from the engine of the vehicle. The quick power extraction prompts the finish of the battery and the motor, which in a general sense grades the decline of weight and the cost. This works on the sensibility of the system. This cycle is monotonous, really mentioning and addresses a couple of safety risks. Horrible environment conditions can intensify the communication and make it a more significant prosperity danger. The structure is generally developed regarding the difficulties experienced by the more established individuals and genuinely tried individuals in jacking a vehicle in case of an emergency fix. The justification behind this senior arrangement project is to counter the security risks and real demands related to using manual jacks or affiliate's trade pressure driven jacks by arranging a jack structure that is forever associated with the vehicle. This vehicle mounted jack structure will be automated so overseer input is kept to a base and thus security risks can be avoided.Whenever the vehicles is static condition the vehicles applies direct weight on tire due toward this stackthe wear of the tire occurs. So the present of hydraulic jack extends the presence of thetire and moreover it helps in reduction of transportation cost. What's more besides it helps the customer forchanging of tires whenever they were busted or infiltrated. Hydraulicjack system is associated to vehicle on front and back piece of the suspension. A vehicle pressure driven jackstructure can be easily associated with all at present collecting vehicle skeleton and housings.

II METHODOLOGY

A different framework comprising of two hydraulic jacks, pump and a control valve will be associated and situated in the vehicle. The pump will be combined with the principle axle shaft of the motor which has the unaltered revolutions of the motor wrench. The shaft of the pulley and

the motor axle is coupled utilizing an unmistakably planned belt drive. The inactive conditions bring about the progression of the hydraulic liquid from the reservoir to the reservoir without doing any work, so the energy from the motor isn't devoured. When there emerges a requirement for lifting the vehicle the driver necessities to apply a delicate push to the activating switch gave up to the degree of the tallness required. Consequently, when he, impels the switch the directional control valve coordinates the hydraulic liquid to the necessary hydraulic jack and results in the activation cycle. The withdrawal period of the hydraulic jack is likewise

basically the same as the activation interaction however in contrast the switch must be pushed the other way to the prior. Along these lines the pump fosters a strain up to 250 bars inside the restricted time stretch and the heap conditions applied in the vehicle. The hydraulic jack is planned thinking about the parts of different contemplations and created in the mode that it could lift around two tones separately

III LITERATURE SURVEY

The conceptual thought of lifting the vehicle using jacks has emerged earlier at the period of late 1920's Pneumatic jacks were initially prescribed for this scenario since it can be compressed; it was believed that it had a far better scope than any other working fluid in nature to lift the vehicle. But as time emerged it is found that the better and efficient means of lifting vehicle was hydraulics which is still in practice in lifting the heavier loads, since hydraulics are provided with accumulators so the rate of getting injured due to failure is considerably reduced. Usually a jack is consisted of a cylinder and a piston in most of the cases the guiding medium is stationary and the sliding piston is restricted in it which would result in the uplifting of the components connected to those structures. There are many other methods to constrain the cylinder piston arrangement and even their execution is carried out using many numbers of methods. When a novel hydraulic system is provided for the vehicle jacks whereby the various jacks attached to a vehicle can be quickly and easily controlled from a common central point and one or more of the jacks may be extended or collapsed as desired.

Regarding assembly and positioning of the cylindersthenotable method is using hydraulic jacks in all the four wheels of the vehicle to lift the vehicle when need arises.The disadvantages and defects of the models mentioned above in this chapter are discussed in the following passages. First the model which has the hydraulic jack in the front and rear end of the vehicle is discussed. For the efficient placement and for achieving better mass balance effects the engine assembly has to be rearranged and the placement of the cylinders are to be done if not the available space should be used efficiently which is not possible in practice. Other disadvantages are the mass balance feature this is achieved only when the placement axis attains symmetric nature, if not then the mass balance will not be up to the expected level which will lead to the wobbling of the vehicle at once when it gets lifted. The actuation is also a tougher task because the cylinder in front of the vehicle which would experience more loads than the rear because of the weight of the engine so the cylinders has to be manufactured for two different specifications, if it was for same specifications then the rear cylinder would have more lifting force than required. This particular function will demand more oil or the working fluid which would ultimately increase the capacity of the reservoir tank and the weight of the whole setup. The setup requires more clearance from the ground level since lifting it from the mid plane of the vehicle which is also a tedious action to perform and achieve the required result.

IV.DESIGN CALCULATIONS & RESULTS

Design of hydraulic jack

The design of the hydraulic jack includes the following consideration which includes,

- Positioning features,
- Overall dimensions,
- Volume of space required,
- Weight exerted and the changes likely to be made.

Cylinder Diameter (d) = 50mm

Area of the cylinder = $\pi d^2/4$

$= \pi 50^2/4$

=1963.495mm2 .

The lifting power needed for the normal heavy vehicles would be almost 1000 kilograms since there are four hydraulic jacks put at four sides of the vehicle.

Thinking about heavy utility vehicles, and in case of physically challenged some of the passengers might find it

difficult to step down.
Instilling all of these above factors a comfort range of five tone lifting power is accommodated every chamber. Accordingly the
computations for the lifting force of the hydraulic jack is as follows,
Lifting Force = 5000 kg
= 5000 kg * 9.81
= 49,050 N

For the designed diameter of the cylinder and the total height to be lifted to isolate the wheels from the ground and the energy from the engine output in considered in this pressure calculations and in the selection and implementation of the pump. Thus the theoretical calculations of the pressure signifies that the pressure of about 250 bar is required, which is generated by the compact gear pump which is implemented in the system.
Pressure acting on the cylinder (p) = Lifting force / Area of the cylinder
= 19620 / 1963.495
= 24.980 N/mm2
=249.80 bar
≈ 250 bar

Stroke Length of the cylinder =279.4 mm.

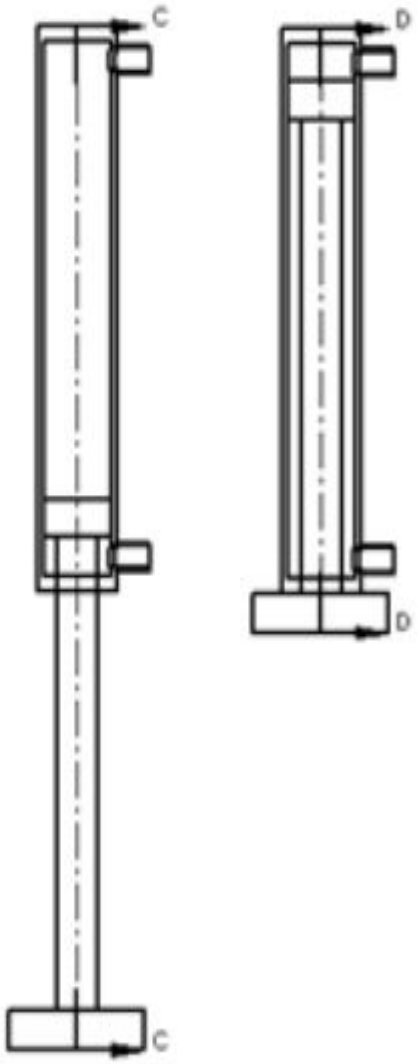


Fig.2 Design of hydraulic jack

Design of pulley
Pulley P1 = The driver pulley
Pulley P2= The driven pulley
Two pulleys have to be designed as per the requirement of the engine and the type of vehicle that is in use. The pulleys are to be designed in such a way that the Pulley P2 connected in the shaft of the pump should step down the energy that is transmitted from the Pulley P1 which is coupled with the main spindle shaft of the engine.

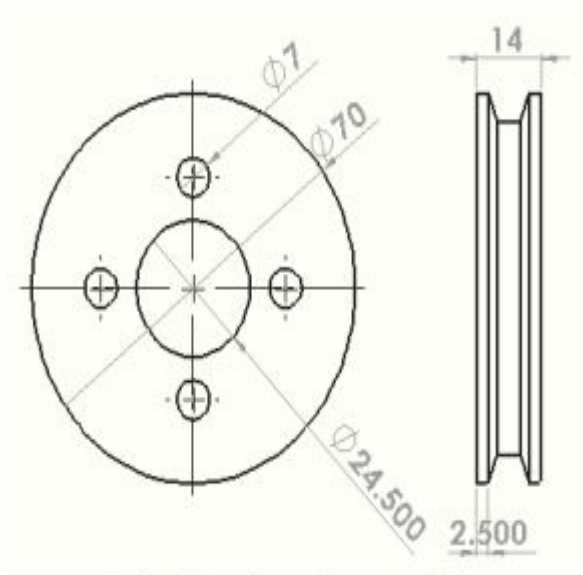


Fig.3 Design of pulley P1

The design of Pulley P1 shown in fig.3 includes the design considerations of the existing pulley that is present in the engine which is used to run the radiator fan and the coolant pump.

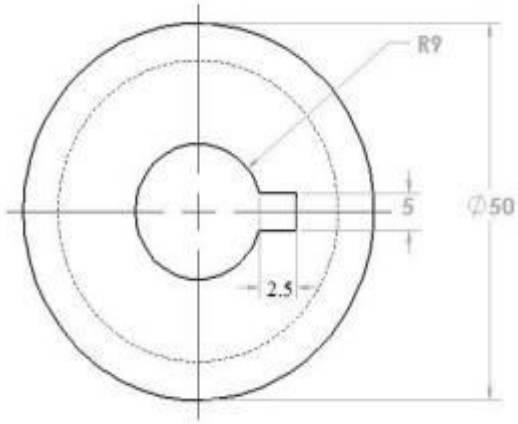


Fig.4 Design of pulley P2

The design of Pulley P2 shown in fig.4 includes the design of the Pulley P1 and the ratio at which the power is to be stepped down. The design should be made and confirmed that the energy obtained in the form of rotations per minute (RPM) should be within the prescribed limit of the pump used. Exceeding the limit might result in adverse effects

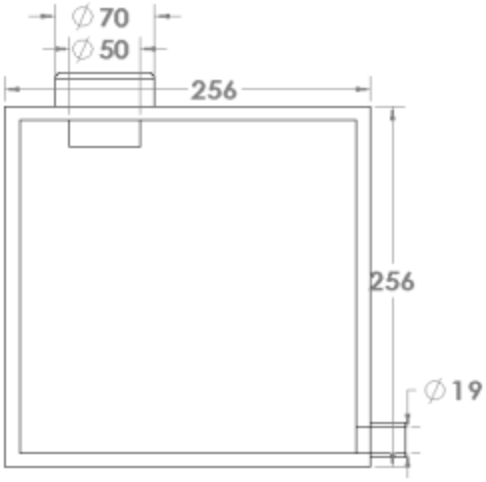


Fig.5 Design of Reservoir

The reservoir shown in fig.4 is designed and fabricated in a manner that it can hold the exact amount of fluid required, to avoid the fluid tumbling to and fro inside the reservoir tank and to reduce the addition of weight. The reservoir is fabricated and firmly fixed using fixtures under the rear seat of the vehicle.

Design of belt drive

Driven pulley diameter:

Rpm of Driver pulley = 900

Rpm of Driver pulley = 1300

Diameter of driver pulley = 70mm

Diameter of driven pulley = 900/1300 * 70

= 48.46 mm

= 50 mm

Belt Length:

$$=2C + 1.57(D+d) + \frac{(D-d)^2}{4C}$$

$$=2*600 + 1.57\ (70+50) + \frac{(50-70)^2}{4*600}$$

= 1390 mm

Centre to centre distance = 600mm

Speed Ratio:

Dia of Driven/Dia of Driver = 50/70

=0.72: 1

Belt velocity:

$$V= \frac{\pi*D*N}{60}$$

$$= \frac{\pi*0.007*900}{60}$$

= 3.32 m/s.

Angle of arc of contact:

= 180-2sin-1[(D –d)/2C]
= 180-2sin-1[(70-50)/2*600]
= 178.04º.

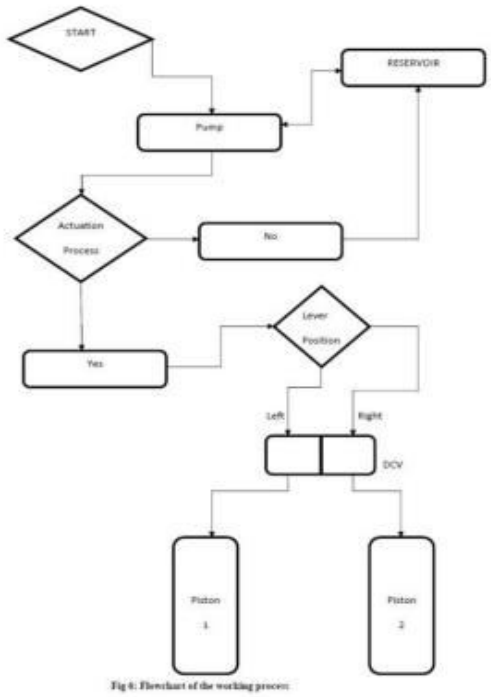
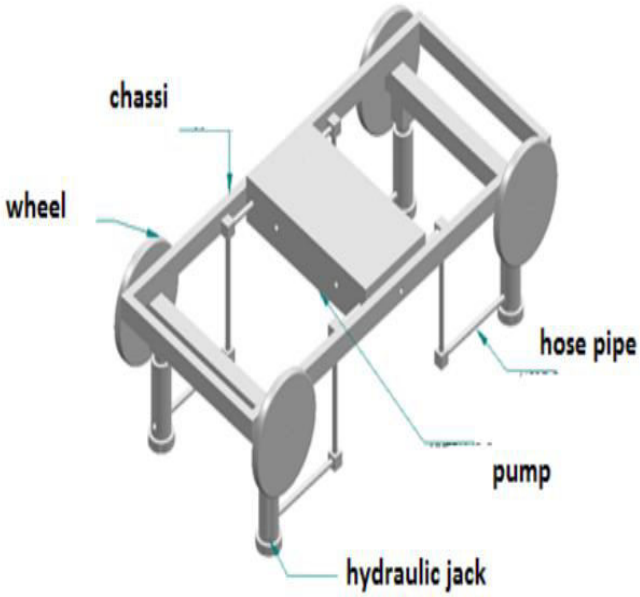


Fig 4: Flowchart of the working process

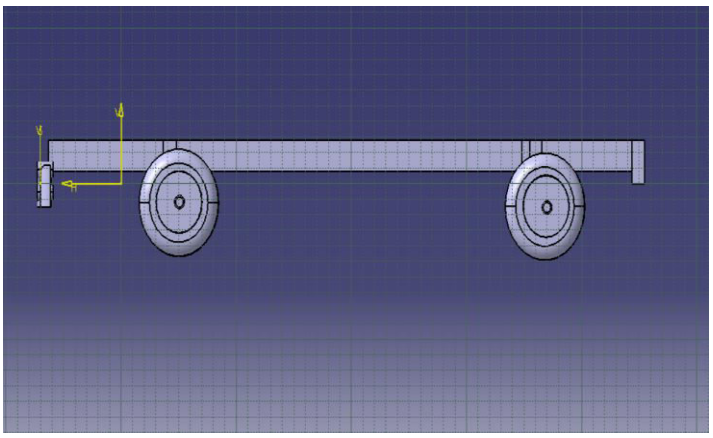
IV EXPERMENTAL SETUP:



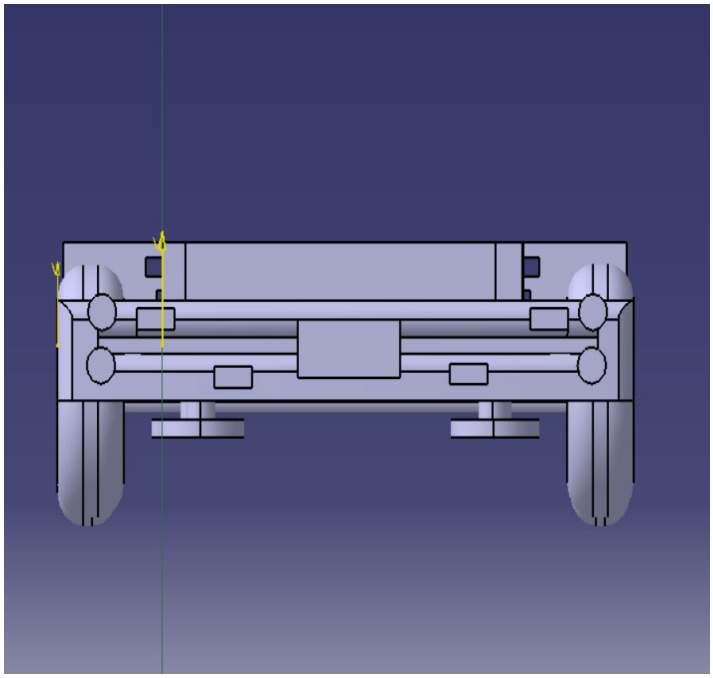
This is the experimental setup of the project,
It consists of, hydraulic jacks,pump , hose pipe , those are attached with the chassis frame .

V DESIGN METHODS

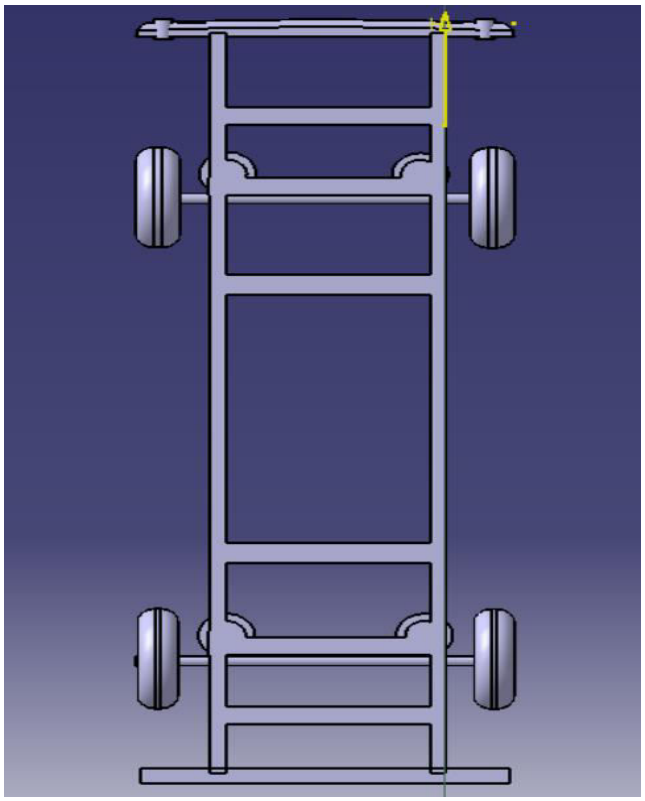
The side view, front view,top view and isometric view of the designs are given below,



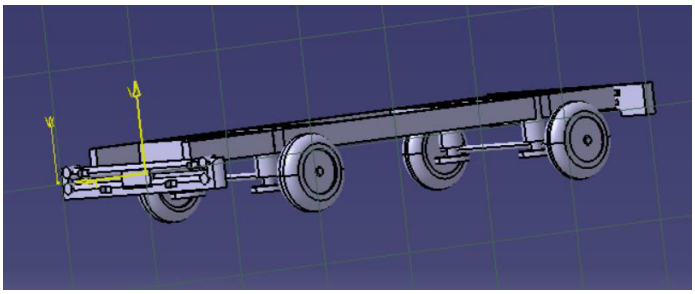
(A). Side view



(B). Front view



(C). Top view



(D).Isometric View

VI CONCLUSION

The proposed framework for heavier vehicle is planned, created andcarried out as a real time project. All the proposed strategies and the recommended thoughts have been appropriatelybroke down carried out and has been endeavored in an ongoingmotor. The framework is planned and created in the perspectivethat it is bound to be marketed and furthermore satisfiesthe issues that is considered. The proposed framework enjoys its own benefits and is an outcome in awesomereasonable decisions accessible.

VII REFRENCES:

1. Clarence E. Williams of Kansas University, Missouri, “Pneumatic jack”, USPO patent paper, serial number 1957151. 2. M.D. Hall, “Hydraulic system for vehicle lifts”, USPO patent paper, serial number 2472294. 3. Vincent R Paolucci, “Hydraulic brake and jack combination unit control device for vehicle”, USPO patent paper, serial number 2764249. 4. Paul E Hanser, Meier, Vanroekel, “Automatic levelling system”, USPO patent paper, serial number 4746133. 5. C.E.Williams, “Pneumatic jack”, USPO patent paper, serial number 171940. 6. “Machine design”, Sundararajamoorthy T.V, Shanmugam.N, Anuradha publications, 2003. 7. “AUTOMOTIVE MECHANICS”, S.Srinivasan, McGrawHill Education publications, Edition-2006, ISBN 0070966303. 8. “AUTOMOBILE ENGINEERING”, Dr.K.R.Govindan, Edition-2004. 9. “THE AUTOMOBILE”, Harbans Singh Reyat, S. chand& Company ltd publications Edition-2009. 10. “Handbook of Rigging: For Construction and Industrial Operations”, MacDonald, Joseph A. McGraw-Hill Professional publications. 11. “Kinematics and Dynamics of Planar Machinery”,B. Paul, Prentice-Hall publications, 1979 Edition. 12. John A. Jakle, Keith A. Sculle. (2004). Lots of Parking: Land Use in a Car Culture. Charlottesville:article. 13. “Classical Dynamics of Systems and Particles”, Marion, JB; Thornton, ST (1995). Edition 4, Thomson publications.. 14. “AUTOMOTIVE TECHNOLOGY”, H.M.Senthil, Edition2003.

15. “PSG design data book”, revised edition of 1978, reprinted on 2011

16. Saravana Kumar, A., Hameed Hussain, J., Expanding the pass percentage in semester examination, International Journal of Pure and Applied Mathematics, International Journal of Pure and Applied Mathematics Special Issue 9909 V-116, I-15 Special Issue, PP-45- 48, 2017

17. Saravana, S., Arulselvi, S., AdaBoost SVM based brain tumour image segmentation and classification, International Journal of Pure and Applied Mathematics, V-116, I-20 Special Issue, PP-399-403, 2017

18. Saravana, S., Arulselvi, S., Dynamic power management monitoring and controlling system using wireless sensor network, International Journal of Pure and Applied Mathematics, V-116, I-20 Special Issue, PP-405-408, 2017

19. Saravana, S., Arulselvi, S., Clustered morphic algorithm based medical image analysis, International Journal of Pure and Applied Mathematics, V-116, I-20 Special Issue, PP-411-415, 2017

20. Saravana, S., Arulselvi, S., Networks, International Journal of Pure and Applied Mathematics, V-116, I-20 Special Issue, PP393-396, 2017

21. Saritha, B., Chockalingam, M.P., Adsorptive removal of heavy metal chromium from aqueous medium using modified natural adsorbent, International Journal of Civil Engineering and Technology, V-8, I-8, PP-1382- 1387, 2017

22. Saritha, B., Chockalingam, M.P., Adsorptive removal of brilliant green dye by modified coconut shell adsorbent, International Journal of Pure and Applied Mathematics, V-116, I-13 Special Issue, PP-211-215, 2017

23. Saritha, B., Chockalingam, M.P., Photodegradation of eriochrome black-T dye from aqueous medium by photocatalysis, International Journal of Pure and Applied Mathematics, V-116, I-13 Special Issue, PP-183-187, 2017

24. Saritha, B., Chockalingam, M.P., Photodradation of malachite green DYE using TIO2/activated carbon composite, International Journal of Civil Engineering and Technology, V-8, I-8, PP-156- 163, 2017

25. Saritha, B., Chockalingam, M.P., Synthesis of photocatalytic composite Fe-C/TiO2 for degradation of malachite green dye from aqueous medium, International Journal of Pure and Applied Mathematics, V-116, I-13 Special Issue, PP-177-181, 2017

26. Saritha, B., Chockalingam, M.P., Removal of heavy X`X`l from aqueous medium using modified natural adsorbent, International Journal of Pure and Applied Mathematics, V-116, I-13 Special Issue, PP-205-210, 2017

27. Saritha, B., Chockalingam, M.P., Degradation of malachite green dye using a semiconductor composite, International Journal of Pure and Applied Mathematics, V-116, I-13 Special Issue, PP195-199, 2017

28. Sartiha, B., Chockalingam, M.P., Photocatalytic decolourisationoftextileindustrywastewaterby TiO2, International Journal of Pure and Applied International Journal of Pure and Applied Mathematics Special Issue 9910 Mathematics, V-116, I-18 Special Issue, PP-221-224, 2017

29. Sartiha, B., Chockalingam, M.P., Study on photocatalytic degradation of Crystal Violet dye using a semiconductor, International Journal of Pure and Applied Mathematics, V-116, I-18 Special Issue, PP-209-212, 2017

30. Shanthi, E., Nalini, C., Rama, A., The effect of highly-

available epistemologies on hardware and architecture, International Journal of Pharmacy and Technology, V8, I-3, PP-17082-17086, 2016
31. Shanthi, E., Nalini, C., Rama, A., Drith: Autonomous,random communication, International Journal of Pharmacy and Technology, V-8, I-3, PP-17002- 17006, 2016
32. Shanthi, E., Nalini, C., Rama, A., A case for replication, International Journal of Pharmacy and Technology, V-8, I-3, PP17234-17238, 2016
33. Shanthi, E., Nalini, C., Rama, A., Elve: A methodology for the emulation of robots, International Journal of Pharmacy and Technology, V-8, I-3, PP-17182- 17187, 2016
34. Shanthi, E., Nalini, C., Rama, A., Autonomous epistemologies for 802.11 mesh networks, International Journal of Pharmacy and Technology, V-8, I-3, PP17087-17093, 2016
35. Sharavanan, R., Golden Renjith, R.J., Design and analysis of fuel flow in bend pipes, International Journal of Pure and Applied Mathematics, V-116, I-15 Special Issue, PP-59-64, 2017
36. Sharavanan, R., Jose Ananth Vino, V., Emission analysis of C.I engine run by diesel,sunflower oil,2 ethyl hexyl nitrate blends, International Journal of Pure and Applied Mathematics, V-116, I-14 Special Issue, PP-403-408, 2017
37. Sharavanan, R., Sabarish, R., Design of built-in hydraulic jack for light motor vehicles, International Journal of Pure and Applied Mathematics, V-116, I-17 Special Issue, PP-457-460, 2017
38. Sharavanan, R., Sabarish, R., Design and fabrication of aqua silencer using charcoal and lime stone, International Journal of Pure and Applied Mathematics, V-116, I-14 Special Issue, PP513-516, 2017
39. Sharmila, G., Thooyamani, K.P., Kausalya, R., A schoolwork on customer relationship management with special reference to domain 2 host, International Journal of Pure and Applied Mathematics, V-116, I-20 Special Issue, PP-199-203, 2017
40. Sharmila, S., Jeyanthi Rebecca, L., Anbuselvi, S., Kowsalya, E., Kripanand, N.R., Tanty, D.S., Choudhary, P., SwathyPriya, L., GC-MS analysis of biofuel extracted from marine algae, Der Pharmacia Lettre, V-8, I-3, PP204-214, 2016
41. Sidharth Raj, R.S., Sangeetha, M., Data embedding method using adaptive pixel pair matching method, International Journal of Pure and Applied Mathematics, International Journal of Pure and Applied Mathematics Special Issue 9911 V-116, I-15 Special Issue, PP417-421, 2017
42. Sidharth Raj, R.S., Sangeetha, M., Android based industrial fault monitoring, International Journal of Pure and Applied Mathematics, V-116, I-15 Special Issue, PP423-427, 2017
43. Sidharth Raj, R.S., Sangeetha, M., Mobile robot system control through an brain computer interface, International Journal of Pure and Applied Mathematics, V-116, I-15 Special Issue, PP413-415, 2017
44. Sivaraman, K., Sundarraj, B., Decisive lesion detection in digital fundus image, International Journal of Pure and Applied Mathematics, V-116, I-10 Special Issue, PP-161-164, 2017
45. Sridhar, J., Sriram, M., Cloud privacy preserving for dynamic groups, International Journal of Pure and Applied Mathematics, V-116, I-8 Special Issue, PP-117- 120, 2017
46.
1)P.S.Borkar,S.V.Sontakke,R.R.Dorwe,A.B.Ganorkar,S.P.Lokhande “Design and fabrication of pneumatic operated jack for four wheelers”,volume 3,ISSN (online):2321-0613@ 03/2015.
47. 2)S.Sathiyaraj, V.Selvakumar. “Design and fabrication of pneumatic jack for automobile.” International Conference on Information Engineering, Management and Security (2015): 272-281.
48. 3)Tweng-Huang Wang, “Automatic pneumatic-Hydraulic Jack”, United States Patent, Patent number4,523,743, June 1985.
49. 4)P. S. Rana, P. H. Belge, “Integrated Automated Jacks for 4- wheelers”, European Journal of Applied Engineering and Scientific Research, 2012, 1 (4):167-172, ISSN: 2278- 0041.
50. 5) P. S. Rana, P. H. Belge, “Integrated Automated Jacks for 4- wheelers”, European Journal of Applied Engineering and Scientific Research, 2012, 1 (4):167-172, ISSN: 2278-0041