

# TECHNO INDIA NJR INSTITUTE OF TECHNOLOGY

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Metric ID	Number of papers published per teacher in the Journals notified on UGC website
3.2.1	during the
	last five years
DVV	Please provide as per SOP
Clarification	(a) List of journals in the data template along with their link to be uploaded in the
	website page with hyper link in DVV portal. Please Provide the UGC care pages
	where journals are listed
	(b) Please provide scanned copies of (1) Arm University Program Workshop on
	Embedded System Using Armmbed conference on start-up India submit - (2) Join R
	for community engagement Seminar On energy an Environmental problem by D.P.
	Kothari (3) Smart optimized Reconfigurable Trans-Receiver System (4) An empirical
	approach on Hand Gesture Recognition based using Convolution Neural Network (5)
	Fabrication and Design of All terrain Vehicle (ATV) - ANSYS based analysis
	perspective

For Techno India NJR Institute of Technology Const Const Const Dr. Pankaj Kumar Porwa (Principal)



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### **DVV Clarifications**

3.2.1

Please provide as per SOP

(a) List of journels in the data template along with their link to be uploaded in the website page with hyper link in DVV portal. Please Provide the UGC care pages where journals are listed

# As per UGC care List Journal guidelines ,All the Publication Indexed By Web of Science, Scopes , SCI , SCIE are under group II category



S.No.	Journal	ISBN	Link to website of the Journal	Scopus Link
1	Advances in Intelligent Systems and Computing	2194-5357	https://link.springer.com/book/1 0.1007/978-981-15-0751-9	https://www.scopus.com/sourceid/5100152904
2	International Journal of Advanced Computer Science and Applications	2158-107X / 2156- 5570	<u>https://thesai.org/</u>	https://mjl.clarivate.com:/searchresults?issn=2 158-107X,1646- 3692,&hide_exact_match_fl=true&utm_source =mjl&utm_medium=share- bylink&utm_campaign=search-results-share- theseresults
3	Indian Journal of Science and Technology	0974-6846 / 0974- 5645	<u>https://indjst.org/</u>	<u>https://mjl.clarivate.com:/search-</u> <u>results?issn=0974-</u> <u>6846&amp;hide_exact_match_fl=true&amp;utm_source=</u> <u>mjl&amp;utm_medium=share-by-</u> <u>link&amp;utm_campaign=search-results-share-these-</u> <u>results</u>
4	Communications in Computer and Information	1865-0929	https://link.springer.com/book/10.1 007/978-981-13-1936-5	https://www.scopus.com/sourceid/1770015500 7_
5	International Journal of Engineering and Technology	2227-524X	https://www.sciencepubco.com/inde x.php/IJET	https://www.scopus.com/sourceid/2110080573 1_
6	International Journal of pure and applied mathematics	13118080, 13143395	http://www.acadpubl.eu/hub/	https://www.scimagojr.com/journalsearch.php ?q=19700182690&tip=sid
7	International Journal of Advanced Science and	2005-4238 , 2207- 6360	http://sersc.org/journals/index.php/l JAST_	https://www.scopus.com/sourceid/2110082914 7
8	International Journal of Scientific & Technology	2277-8616	https://www.ijstr.org/	https://www.scopus.com/sourceid/2110089450 <u>1</u>
9	Materials Today: Proceedings	2214-7853	https://www.elsevier.com/solutions/ sciencedirect	https://www.scopus.com/sourceid/2110037003 7_
10	Journal of Critical Reviews	23945125	http://www.jcreview.com/	https://www.scopus.com/sourceid/2110092022 7#tabs=0

11	Microsystem Technologies	0946-7076	https://www.springer.com/journal/5 42	https://www.scopus.com/sourceid/26738?origi n=recordpage
12	Energies	1996-1073	https://www.mdpi.com/journal/ener gies	https://www.scimagojr.com/journalsearch.php ?q=62932&tip=sid
13	International Journal of Engineering and Advanced	ISSN - 2249-8958	https://www.ijeat.org/indexing/blue eyes/	https://www.scopus.com/sourceid/2110089950 2
14	International Journal of Recent Technology and	ISSN - 2277-3878	https://www.ijrte.org/	https://www.scopus.com/sourceid/2110088987 <u>3</u>
15	Sustainability	2071-1050	<u>https://www.mdpi.com/journal/sust</u> <u>ainability</u>	<u>https://mjl.clarivate.com:/search-</u> <u>results?issn=2071-</u> <u>1050&amp;hide_exact_match_fl=true&amp;utm_source=</u> <u>mjl&amp;utm_medium=share-by-</u> <u>link&amp;utm_campaign=search-results-share-these-</u> <u>results</u>
16	IEEE Access	2169-3536	https://www.ieeeaccess.ieee.org	<u>https://mjl.clarivate.com:/search- results?issn=2169-</u> <u>3536&amp;hide_exact_match_fl=true&amp;utm_source=</u> <u>mjl&amp;utm_medium=share-by-</u> <u>link&amp;utm_campaign=search-results-share-these-</u> <u>results</u>
17	Neural Computing and Applications	0941-0643	https://www.springer.com/journal/5 21_	<u>https://mjl.clarivate.com:/search- results?issn=0941-</u> <u>0643&amp;hide_exact_match_fl=true&amp;utm_source=</u> <u>mjl&amp;utm_medium=share-by-</u> <u>link&amp;utm_campaign=search-results-share-these-</u> <u>results</u>
18	Electronics	2079-9292	https://www.mdpi.com/journal/elec tronics	https://mjl.clarivate.com:/search- results?issn=2079- 9292&hide_exact_match_fl=true&utm_source= mjl&utm_medium=share-by- link&utm_campaign=search-results-share-these- results

Arm University Program Workshop on Embedded System Using Arm-embed conference on start-up India submit



### **ARM University Program Course on Embedded Systems using ARM Mbed**

### **Executive Summary**

Eduvance conducts ARM University Program Certificate Course on the ARM mbed platform The mbed development platform is the fastest way to create products based on ARM microcontrollers. The project is being developed by ARM, its Partners and the contributions of the global mbed Developer Community. Getting trained on the mbed platform and doing projects enables participants to enter the workforce with the skills necessary to be quickly productive in the fast-paced world of electronics engineering disciplines. During the training participants will be introduced to ARM architecture, Programming & mbed platform and also work on advanced interfaces such as ADC and Serial.

The training would include in class training for 4 days. These training programs will be certification courses on ARM Lab that have been set up at the Institute. Features of the training are -

- 1. 4 Day On Campus training (8 hours/Day)
- 2. Exposure to latest ARM Platforms
- 3. 3 Projects with introduction to various interfaces
- 4. The Development kit will be provided for students for take home in group of 4 students.

### Subsidized Fees for these trainings are as follows

- 1. ARM Training – Rs 2500/- per student (Minimum 40 Students)
  - A. Host college will arrange for food and accommodation of trainers.

### **Benefits for the College**

COLLEGE would provide its students with training platform to get updated with industry relevant technologies.

- Make students resumes stronger
- Increase in industry-institute interaction
- Opportunity to conduct faculty training workshops for free to keep faculty appraised with industry developments.

Students at COLLEGE would be provided with the opportunity to go through certification programs that is at par with American Universities with lectures and content created by US based For Techno India NJR Institute of Technology US5, India Dr. Pankaj Kumar Porwa' (Principal) experts.

Contact Us: contact@eduvance.in

Registered office – Vanmat Technologies Pvt. Ltd. 202 Mary Anne Heights, 3<sup>rd</sup> Road, Santacruz (E), Mumbai 400055, India

Students at COLLEGE will get an opportunity to get certified by ARM University Program, and Indo US Collaboration for Engineering Education

### **Duration**

Total Training will be for 4 Days (8 hours per days)

### **Course Contents**

- Day 1 Session 1– Intro to ARM Mbed
  - Intro to Embedded Systems and System on Chip
  - Intro to the ARM Architecture
  - Intro to mbed platform
- Day 1 Session 2 ٠
  - Intro to I/O programming and buses
  - $\circ$  Lab 1 Led blinking
  - Intro to PWM Component
  - $\circ$  Lab 2 PWM
    - Project Breathing LEDs
- Day 2 Session 1
  - Intro LCD Interface and Connections
  - Lab 3 LCD Display
    - Project- Rolling Display
- Day 2 Session 2
  - Intro to Analog Interfaces
  - $\circ$  Lab 4 Analog
    - Project Light Intensity Measurement on LCD
- Day 3 Session 1
  - Intro to Serial Interface
  - Lab 5 Serial
    - Project Controlling Data on Board
  - Intro to Accelerometer
    - Project Surface Level Measurement
- Day 3 Session 2 •
- For Techno India NJR Institute of Technology Con St Classification Dr. Pankaj Kumar Porwal (Principal) • Project – Making a Data Acquisition System using Serial PC Interface
- Day 4
  - Project Gesture controlled USB Mouse using Accelerometer

### **Participant Benifits**

- Participants will be introduced to exciting world of ARM mbed.
- Participants will be trained on Embedded C, implementation of analog and digital peripherals. •
- The training includes hands-on labs resulting in exploration of concepts. ٠
- Eduvance will bring its own kits for participants to work on. •
- Participants will work in groups of 2 with each student getting an opportunity to work hands-on. •
- Upon successful completion of course and test, participants will get a verifiable certificate • endorsed by Indo-US Collaboration for Engineering Education (IUCEE).
  - Certificate for mbed workshop by ARM University Program UK

Contact Us: contact@eduvance.in

### About Eduvance

Eduvance is founded by Ph.D. alumni from U.S. universities. We are dedicated towards providing participants with state of the art training in technology. We do this by introducing participants to projects and research topics that are at par with leading universities in the United States. This will make the participants technically sound and prepare them for future challenges. We assist participants write and present technical papers. We are advised by U.S. based researchers, faculty and industry professionals that have a proven track record in their field.



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# Techno India NJR Institute of Technology

### Bhamashah (RIICO) Industrial Area, Kaladwas, Udaipur

Date: 22/02/2016

### ARM University Program Course on Embedded Systems using ARM Mbed

This is to inform all the students of ECE, EE & EEE that ECE department is organizing a 4 days training on "Embedded System Using ARM Mbed" an ARM university Program course by Eduvance. Training will start on 29th Feb, 2016, training fees & course details are attached herewith. Those who are interested may register their names to undersign by 25 Feb 2016.

Yogendra Singh Solanki

Asst. Prof. & Department Training Coordinator

ECE, TINJRIT For Techno India NJR Institute of Technology Unon St Ul Zal CV Dr. Pankaj Kumar Porwa (Principal)

### Techno India NJR Institute of Technology, Udaipur ARM University Workshop on ARM mbed

**Participants List** 

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- Smart optimized Reconfigurable Trans-Receiver System
- An empirical approach on Hand Gesture Recognition based using Convolution Neural Network
- Fabrication and Design of All terrain Vehicle (ATV) - ANSYS based analysis perspective

### Smart optimized Reconfigurable Trans-Receiver System

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### Abstract

To establish communication between earth station and space craft real time high speed transmission is required with low power consumption for increase the life of battery space craft. To achieve these advanced design goals by Reconfigurable trans-receiver. The power of that system is optimized by applying placement and routing algorithm such as global routing and river routing. After that we are applying artificial intelligence on that system for selection of width of the data width of communication on the basis of data rate. The data width of Trans-Receiver is reconfigurable from 8 bit to 512 bit.

*Keywords:* Routing algorithm, Artificial Intelligence, River routing, global routing and channel routing algorithm.

### 1. Introduction

The requirement of high-performance real time processing in space applications significantly increased because of the mismatch between extreme data size and low downlink channel capacity. To achieve these advanced design goals Smart Optimized Reconfigurable Trans-Receiver System is proposed. It has been developed to provide secured communication architecture for the harsh space environment. The power consumption is reduced by applying routing and placement algorithm like global routing and river routing. The system is smarter because of artificial intelligence. The data width of system is changed according to required data rate. [2]

### 2. Routing Algorithm

To decreases the power consumption we applying routing algorithm namely global routing, channel routing, on the different blocks of Trans-Receiver System.[1]

### 2.1 Global Routing

The algorithm used here by PI is essentially shortest path algorithms. Our paths will hop among the points that are midpoints of the channels edges, beginning and ending at ports belonging to the same net. The length of any edge in a path is the ordinary Euclidean distance between points .edges are available to take us between channels is deemed To both channels, a fact that allows path to pass from one channel to next. [1]



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### 2.2 River Routing

- (i) Wires run in one layer only; thus do not cross.
- (ii) Each net consists of two points; one on top and one on the bottom .there are
- (iii) No ports on the sides.
- (iv) The order of the nets is the same on top and bottom, as it must be if we are
- (v) To run wires in one layer. [1]

### 3. Data Transmission Rate of System

According to requirement of the data rate of communication the data width is changed of transceiver-system by using artificial intelligence.

Data rate =Operated frequency\*Data width

If data width increases than data rate also increases. [2]

Data Word Length (Bit)	Operating frequency of Trans- Receiver System (MHz)	Data Rate (Gbit/Sec)
8	193	1.544
16	193	3.088
32	193	6.176
64	193	12.352
128	209	26.752
256	209	53.504
512	209	107.008

Table 1. Data Rate of Smart optimized Reconfigurable Trans-Receiver System

This graph and above table shows changes of data rate of transmission with respect to the data width of Trans-Receiver.







### 4. Result

Number Of Bits	Without Routing Algorithm (mw)	With Global Routing (mw)	With River Routing (mw)
8	1028	802	353
16	1038	812	363
32	1057	830	382
64	1094	867	412
128	1171	942	500
256	1324	1091	656
512	1630	1389	970

Table 2. Total Power of Smart optimized Reconfigurable Trans-Receiver System

This graph and above table shows total power consumption by Trans-Receiver with and without routing algorithm.



Figure 2. Total Power Consumption Vs Data Width Graph

Number Of Bits	Without Routing Algorithm (mw)	With Global Routing (mw)	With River Routing (mw)
8	999	775	329
16	1001	777	331
32	1002	779	333
64	1004	780	330
128	1006	781	343
256	1009	783	356
512	1016	787	379

Table 3. Static Power of Smart optimized Reconfigurable Trans-Receiver System

This graph and above table shows static power consumption by Trans-Receiver with and without routing algorithm.



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Figure 3. Static Power Consumption Vs Data Width Graph

Number Of Bits	Without Routing Algorithm (mw)	With Global Routing (mw)	With River Routing (mw)
8	29	27	24
16	37	35	32
32	55	51	49
64	90	87	82
128	165	161	157
256	315	308	300
512	614	602	591

Table 4. Dynamic Power of Smart optimized Reconfigurable Trans-Receiver System

This graph and above table shows dynamic power consumption by Trans-Receiver with and without routing algorithm.



Figure 4. Dynamic Power Consumption Vs Data Width Graph



Number Of Bits	Without Routing Algorithm (mw)	With Global Routing (mw)	With River Routing (mw)
8	16	11	8
16	18	12	9
32	20	11	10
64	23	15	12
128	32	21	18
256	48	33	27
512	83	57	47

 Table 5. Core Dynamic Power of Smart optimized Reconfigurable Trans-Receiver

 System

This graph and above table shows Core dynamic power consumption by Trans-Receiver with and without routing algorithm.



Figure 5. Core Dynamic Power Consumption Vs Data Width Graph

### 5. Conclusion

Due to effect of river routing algorithm average total power reduction is 19.70%, average static power reduction is 22.38, average dynamic power reduction is 4.22%, average core dynamic power reduction is 34.47% and Due to effect of river routing algorithm average total power reduction is 57.88%, average static power reduction is 65.98 %, average dynamic power reduction is 9.13 %, average core dynamic power reduction is 46.96%.

### 6. Acknowledgment

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### An empirical approach on Hand Gesture Recognition based using Convolution Neural Network

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### Abstract

Hand Gesture Recognition is becoming one of the innovative approaches to work together with automated systems with high precision. The hand gesture mechanism helps to interact in a natural way with the machines to communicate & instruct them accordingly. In this paper, we have designed a dynamic and static hand gesture recognition approach using convolution neural networks. The gesture was recorded using a local webcam. Extracted frames were processed using gaussian thresholding then CNN was used with defined parameters. For this experimentation, 4 classes were considered that includes 3200 images (800 each). The performance measure of 84.8% accuracy was achieved in this approach for the defined four gesture i.e. shape C gesture, Bye action, Ok action and forward action.

Keywords: Hand gesture recognition, computer vision, CNN, gaussian thresholding.

### 1. Introduction

With recent advancements in technology, various communication medium or models are available for interaction with computing devices. Earlier keyboards, mouse, joysticks, electronic gloves, trackpads were usually used. Apart from these methods, gesture-based recognition was also considered a natural way to interact via mimicking the human behavior of handling or controlling devices. Hence gesture-based communication aids a better interaction between humans and computers. Hand gesture has been used in many applications like game playing, majorly in sign language, multimedia interaction robotics devices etc.

Gestures can define as purposeful body motion which includes hand, head, body or any other human part moment to deliver substantial information or to interact with the other agents. The nature of the gesture can be stagnant or static, dynamic or both [1]. In dynamic gesture recognition, the focus is required for identification or classification of both spatial & temporal movements and this paper proposes a methodology for two dynamic gesture & two static gesture recognition using CNN.

Usually gestures recognition is characterized in two broad domain, first one was vision-based methods which require special equipment like gloves [2], armbands & specialized kits. The second one required special hardware user need to carry the by the user needs the system. Image processing, image extraction, pattern recognition, clustering, and object detection are the application of vision-based systems [1].

### 2. Related Work

In 1964, Gesture recognition was coined by Ivan E. Sutherland [6], he used a lightbased sketchpad system to interact with the computers. It was used to draw the line and basic shapes by following the light pattern on the board. Wearable armband with electromyography sensors based on real-time gesture has been developed using k-nearest neighbor and decision tree for classifying the recognition of gestures [8]. Doppler radar-



based sensors were used for hand recognition in a dark environment as well. For gesture classification deep-learning convolution GAN was used [7].

Wrist band based another wearable gesture recognition device was developed to recognize the gesture in American Sign Language (ASL) using machine learning techniques like support vector machine (SVM), decision tree (DT), k-nearest neighbor (kNN), linear discriminant analysis (LDA) [9]. Another vision-based sign language recognition was developed for Lao Alphabet Sign Language and Histogram of Oriented Gradients an image processing technique. The success rate of the proposed model was 70% [11].

Static hand gesture recognition using a feed-forward neural network was proposed to identify 10 different classes of gestures like up, down, left, right etc. For background elimination, the image difference mechanism was used to extract the gesture. The model gains a success rate of 89% for the captured data [12]. Using the Hausdorff distance approach Elena et al. [13] developed a method by using a web camera and image segmentation approach to cater to the moving hand from the whole image to identify various shapes built by temporal sequences in different lightening and background condition.

Hidden Markov model was used by Chen et al. [14] to recognize static hand gesture recognition. They extracted the region of interest and thus applied Fourier Descriptor to characterize spatial features with 90% accuracy. Joshua R. New et al. [15] developed a medical image virtualization application suing a centroid detection approach to count the number of figures and some gestures with fewer resolutions of the camera. In the literature many works have been carried out till date on gesture recognition, for image-based gesture recognition some challenges are associated with hardware and background noise due to improper lighting condition and camera distance, its resolution also causes variation in recognition accuracy.

### 3. Methodology

The proposed model in this paper is to recognize human hand-based gestures using convolutional neural networks and computer vision. The gestures were recorded and saved through a medium quality mobile camera. From the saved video, frames are extracted, and these frames were fed to CNN, where it would predict the gesture class. Overall, Dynamic Hand Gesture Recognition model should run smoothly on run-time, it should predict correct gestures with good accuracy. It should be able to remove noise in the background and identify skin ranges. The proposed model workflows as follows the dynamic hand gesture recognition, a convolutional neural network-based model that allows users to give commands to the computer. The computer understands the commands and tells which command was given by the user. The model is able to distinguish between 4 gestures which were considered for this experimental work, 2 static gestures and 2 dynamic gestures. The gestures are:



### **3.1 System Architecture**

For recognizing the human gesture, CNN was used for the classification of 4 types of hand gestures. CNN is a feed-forward deep neural network [23], used primarily for image



classification using filters or weights to identify features called as feature map, this feature map is sent to poling layer to carried out mathematical max, min, average pooling of the pixel to downsize the image, then several iterations of convolution & pooling carried out and pass on to fully connected layer & gets the output by applying softmax function as explained in below figure.



Figure 5: General CNN structure

### **3.2 Proposed framework**

Figure 6 describes the 8-layer architecture which is used for this convolution architecture. 8 layers are described as I1 – an input layer, C2 and C4 – convolution layers, S3 and S5 – are the subsampling or pooling layer, N6 and H7 are the fully connected layer and hidden layer respectively and the O8 is the output layer. Input size 28x28 pixel image processed image, applying 6 filters of size 5x5 generate the six 24x24 feature mapping. Then pooling applied to downsize the image pixel of size 12x12. Again, the convolution layer and pooling were used, finally, 192 neurons are used as a fully connected layer which reflects 4X1 output.



Figure 6: CNN Architecture

**Workflow:** First the gesture is recorded using the webcam and saved. Then, frames are extracted from the recorded video. The frame is processed, i.e., noise is removed, the frame is reduced, and blur is applied by using the Gaussian [26] thresholding. Next, the image is fed into the CNN model as input, above architecture was used and on the last



layer, the model recognizes the gesture and shows the output. The pictorial representation explained as follows:



Figure 7: Sample of extracted frame



Figure 8: Design Methodology

The experimentation was done and developed using Spyder. The code is written in Python version 3.6.5. The following libraries were used to develop the CNN model, Keras, Sequential from Models, Cov2D, AveragePooling2D, Flatten, Dense, and Dropout from Layers. The cv2 library is used to make the image processing part of the application. In it, the hand is recognized using a specific skin range. After this, the image is binarized, and Gaussian Blur is applied to it. Next, the image is fed to CNN.





Figure 9: Processing of Leap Motion images

The cv2 library is also used to enable the webcam to detect hand and record and save the video. The features extraction code is also written with the help of the cv2 library. The dataset comprises of 4 classes of images. All the pictures are labeled.

The training set has 800 images per class, in total 3200 images. The test set contains 400 images per class: in total 1600 images. The dataset was obtained from Kaggle. The dataset was processed, all the leap motion images were converted to binarized images and



their size was decreased. The images are of type .png, Dataset is also augmented to introduce more diversity into the images. The training set is rescaled, sheared and zoomed. The test set images are rescaled. The optimizer used is adam [29] and the activation function is Sigmoid. Binary cross-entropy loss is used for loss calculation.

### 4. Results & Discussion

Four different gesture was used for recognition, figure 7. shows one of the gestures to be classified. The images are from the leap gesture recognition [] dataset available on Kaggle. The initial image was 128x128 pixel size which was reduced to 28x28 for the experimentation to save the computational time. A set of 800 images and 200 images were used for the training and the testing purpose using CNN.



Figure 10 : Model Performance on each Epoch

The model can distinguish between the 4 defined gesture. The validation accuracy obtained is 84.81% with following parameters (step\_per\_epoch = 300, epoch = 10, validation step = 100)

Epoch	Training accuracy	Test Accuracy	Validation_Loss
1	0.9306	0.7619	0.2087
2	0.9962	0.7175	0.0120
3	0.9898	0.8469	0.0397
4	0.9986	0.7906	0.0059
5	0.9992	0.7769	0.0028
6	0.9996	0.8219	0.0029
7	0.9996	0.8481	0.0018
8	0.9993	0.8419	0.0029
9	0.9996	0.8481	0.0018
10	0.9996	0.8481	0.0018

Table 1	1: Res	ults on	gesture	classifi	cation
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Using CNN based human hand gesture recognition system, the classification of 4 defined gestures was recognized with an efficiency of 85% approx. The model could able to learn & train for more gestures with high computation facilities and a rich set of images. In the future, the model should be altered to use RCNN. Dynamic Hand Gestures can be used to automate a variety of tasks in homes, workplaces, cars, home devices.

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### Fabrication and Design of All terrain Vehicle (ATV) - ANSYS based analysis perspective

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### Abstract

Mega ATV championship is a national level all-terrain vehicle racing championship in India Organized by "Auto Sports India". It is a national level racing championship for engineering branch such as mechanical, electrical and automobile engineering. The competition was based on the design of safe and static-dynamic balanced All-Terrain Vehicle. This paper aims to introduce understand the changes that need to be integrate in the term of design and static stress analysis (SSA). The sustainability of the ATV design depends on the development and design concepts. This research study is based on the practical and real-time engineering application of the automobile vehicle dynamics technology.

Keywords: ATV, ANSYS, Solid-works, Factor of Safety

### **1. Introduction**

The Auto sports India organizes design championship to gather students in the simple practices of mobility Engineering. This event held every year in GOA. The objective of challenge for the team to construct a dynamically balanced vehicle to sustain during dynamic test, safety test, brake test, driver skills test etc. The organizer provides rule book for the completion [1]. With mentioned all parameters in the rule bookwhichare required to construct all-terrain vehicle like vehicle body design parameters. The main motive of the championship is to build safe and dynamically balanced All Terrain vehicle.

Using ANSYS WORKBENCH 14.0 is the time consuming during the process of simulation which is include mashing, load calculation, stress calculation, and material properties such as Poisson ratio, elastic modulus, yield strength, ultimate strength and various factor for material identification can be calculated[3-4]. This software determines impact point, failure component in chassis with the help of some theory of failure like Von-misses stress and factor of safety are studied [5]. With the help of ANSYS WORKBENCH simulation we find the better result for side impact test, front impact test, rear impact test and dynamic test [6].

In this paper we present an objective summary of the process and parameters used for building our All-Terrain vehicle. The research paper study distributed into few phases such as design, construct frame, suspension, braking, steering and other parts.

### A. Design and development—

The design and development process of the chassis (roll case) involves various factors, namely material election, pipe size selection, frame design and finite elements analysis.

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### a) Design Analysis —

Following are the design constraints and criteria:

- 1. 10 horsepower Briggs and Stratton intake engine used in vehicle which will achieve a top speed less than 40 Kmph.
- 2. With foot operated hydraulic break system which is capable to lock all four wheels in all conditions (endurance test).
- 3. We have developed computed aided design models (CAD) of the power train system.
- 4. Power weight should be less than 200lb which is approx. 91 (excluding vehicle frame, suspension and wheel assembly).
- 5. Foot operated brakes system, acceleration system, pull start engine located outside of cockpit and kill switches modules.
- 6. The gear system with high efficiency transmission with high and low range.

### b) Frame design-

Property	AISI 1018	AISI 1020	AISI 4130
Yield strength	365 Mpa	539 Mpa	670 Mpa
Bending Strength	391 Mpa	602 Mpa	747 Mpa
Weight	112 lbs	82 lbs	82 lbs

### **Table 1.Material Properties**

### c) Selected material—AISI 4130

Tubes of 1-inch diameter and 0.65 mm thickness.

### **Table 2.Composition of Material**

<b>Chemical Properties</b>	%
Carbon	0.3
Chromium	0.1
Manganese	0.8
Silicon	0.3
Molybdenum	0.2
Phosphorous	0.035
Sulphur	0.04

### d) Design and aggregate specifications of chassis

### **Table 3.Vehicle Design of Parameters**

Parameters	Maximum Limit
Length	108 Inch
Width	64 Inch
Height	Unrestricted
Weight	Unrestricted

### e) Solid works design—



Fig-1 Top view of ATV chassis (Hand diagram)



Fig-2 Side view, Front View, Top view and isometric view of chassis



### Ansys Analysis— 1. Front Impact—



Fig-3 Front Impact Test in Ansys

2. Rear impact—



Fig-4 Rear Impact Test in Ansys

3. Side impact—





### B) Suspension system—

Table 4.Suspension Design Table		
Weight of Vehicle	270 Kg	
Driver with accessories	80 kg	
Overall Weight	350 kg	
Un-Sprung Mass	70 kg	
Sprung Mass	280 kg	

### **Table 5.Suspension Design Parameter**

Parameters	Front	Rear	
Suspension type	Double wishbone	Double wishbone	
Natural frequency	2.23 Hz	2.29 Hz	
Stiffness	11.8 N/mm	32.38 N/mm	
Damping ratio	0.35	0.35	
Wishbone material	AISI 4130	AISI 4130	
Maximum suspension travel	127 mm	74 mm	
Camber Angle variation	-2.8° - 3°		
Roll gradient	5.19°/g		
Sprung mass	300 kg		
Un sprung mass	50 kg		
Pitch frequency	1.75 Hz		
Bounce frequency	1.64 Hz		

### b) Linkage Design-

### Table 6.Linkage design Parameter

	Rear	Front
CG Height (Inch)	20	.83
Ground Clearance	13 Inch	12 Inch
Roll Centre Height	5.624Inch	11 Inch
Motion Ratio	0.7356	0.6667



Fig-6 A- Arm Loading Test in Ansys



...(1)

### Calculation for spring rate-

We found that spring rate is depends upon motion ratio and wheel rate in the following way-

 $K_{spring} = (Motion ratio)^2 * K_{wheel}$ 

$$\mathbf{f} = \frac{1}{2\pi} \sqrt{\frac{\text{Kwheel}}{\text{SprungMass}}} \dots (2)$$

Front lower wishbone Length = 409.423 mm Damper Mount = 286.596 mm

Motion Ratio =  $\frac{damper mount}{wishbone length} = \frac{286.5}{409.4} = 0.700 \dots (3)$ 

f = 2 Hz

### where $K_{spring}$ = stiffnessof spring, f = Frequency of spring

According to motion ratio, taking 40% of sprung mass for front wheel assembly, then  $K_{spring} = 21 \text{ N/mm}$ suspension travel = 10 inch length of shock absorbers = 26 inch

similarly taking 60% sprung mass of rear wheel assembly , then natural frequency f=2.4~Hz Motion ratio = 0.712  $K_{spring}\!=\!30~N\!/mm$ 

### C) Steering system—

Maruti 800 Rack and Pinion		
Wheel track	54 Inch	
Wheel base	67 inch	
Steering Axis Inclination	12°	
Scrub Radius	7.8 mm	
Ackermann Angle	17°	
Tie Rod length	38.29	
Inner steering Angle	44°	
Outer Steering Angle	31.5°	
Turning radius	3.38 m	
Steering Ratio	9.7:1	
Steering wheel lock	610	

Table 7.Steering Design system parameter

### PICTURE (International) Fictorial field field in the sea Fictorial field field field in the sea Fictorial field field field in the sea Fictorial field fie

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Fig-7SOLIDWORKS Design of Steering wheel



Fig-8SOLIDWORKS Design of Steering Rack



Fig-9SOLIDWORKS Design of Steering Shaft

### D) Engine and transmission—

### a) Engine—

We are using a BRIGGS & STRATTON 10 HP OHV model 205432 Engine. The CVT we are using is POIARIS P90 with low gear ratio 0.75 : 1 and high gear ratio 3.83 : 1 . the differential Mahindra Alpha with gear ratio 4.173 : 1. we will couple the axle of differential Mahindra Alpha Champion & Maruti 800.



### Table 8.Engine Specifications

<b>BRIGGS &amp; STRATTON ENGINE</b>		
Capacity of cylinder	305 cm3	
Bore And stroke Length	79.25mm and 61.93 mm	
Compression Ratio	8:1	
Max Power	7.4 KW @ 3600 rpm	
Max Torque	19.6 N-m @ 3600 rpm	
Weight	25 Kg	



### Fig-10Left and Right view of the Engine



Fig-11Engine Mounted in ATV



Fig-12 CAD Image of Engine Mounted View



### b) Continuously Variable Transmission (CVT) —

it is also known as a shiftless transmission, pulley system transmission or step-less transmission. a CVT is not require the presence of clutch.

### Gear box- Mahindra Alpha

Gear	<b>Overall ratio</b>	Max Speed Kmph
1st	31.48:1	12.42
2nd	18.7:1	20.91
3rd	11.4:1	34.3
4th	7.35:1	53.2
5th	55.08:1	7.1

### **Table 9.Specification of Gear-Box**



### **Fig-13Gear Box**

### Wheel & Tyre Assembly-

### Table 10.Tyre Specification

Tyre / Rim Specifications		
<b>Rim Diameter</b>	12 inch	
Rim Width	8 inch	
Tyre Diameter	22 inch	
Туре	Wet Type	

### SafetyEquipments-

a) Two kill switches are required at dashboard and top right corner of thevehicle.

b) Certified five point seat belt, Certified motocross helmet, Certified Racing suit, gloves, neck Braces and goggles.

Seating Criteria-

transf Entrater ransina unenasinan ana tana merekanan Kaladwas, Usaipur Si 3003 (Rajasthan)

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### G) Cost report of vehicle-

Expenditure	Amount
For PVC Prototype	2000
Tube Material AISI 4130	27241
Steering Assembly And Brake	6800
Rim	13000
Tyre and seat	35950
Gear Box	5000
Brake lines	1360
Nut and Bolt	410
Adapter Plate	455
Hub nut	160
Engine	75500
CVT	30000
Suspension system	42000
Minor expenditure	5000
Total	244876

### Table 11.Expenditure Table

### Conclusion—

The ATV has performed well at MEGA ATV championship 2018 held at GOA. the vehicle successfully cleared all the inspection test like safety test, suspension test, driver test, endurance test, brake test etc.

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Blockchain, and appliedin developing projects.



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