SIGN LANGUAGE DETECTION USING PYTHON AND OPENCV

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ABSTRACT

This work focuses on detection of (sign) hand gesture techniques and introduces the merits and limitations in various circumstances. The hand segmentation theories and hand detection system is used to construct hand gesture recognition using Python with OpenCV. The hand gestures use as a natural interface motivates research in gesture representations, taxonomies and recognition methods/algorithms, and software platforms/ frameworks, all of which are briefly covered in this work. All the processes have been done using webcam by keras and tensorflow. The ever-increasing public acceptance and funding for multinational projects emphasizes the need for sign language. The desire for computer-based solution is significant in recent age of technology for deaf people. Still, researchers are attacking the problem for quite sometimes and the results are showing promises. This work represents a comprehensive review of vision-based sign recognition methodologies, emphasizing importance of taking the things into consideration in addition with algorithm's recognition accuracy during predicting their success in real world applications. This project matches the sign language action with dataset images with various categories of sign (gestures) that already been trained using webcam. This project applies neural network to compare the actions with data set images. The coding language used is Python 3.10.
Keywords – Hand Gestures, Hand Segmentation Theories, Recognition Methodologies, Keras and Tensorflow.

1.INTRODUCTION

The increased public acceptance and funding of international projects emphasizes necessity of the sign language. The desire for the computer-based solution is significant in this age of technology for deaf people. However, researchers are attacking the problem of quite sometimes now and the results show some promises. Although interesting technologies become available in voice recognition, but there is currently no commercial solution for sign recognition in markets. The goal is to make computers for understanding human language and developing a user-friendly HCI (human computer interface). Some steps toward this goal include teaching a computer for recognizing speech, human gestures and facial emotions. Gestures are non-verbal exchanged information. Gesture recognition is an aspect of human-computer interaction which demonstrates the academic treatise and is vital for popularizing notion of the human-to-human connection and open dialogue that implies the correlation between user and machine [1]. Gesture analysis is the scientific field which recognizes gestures like hand, head, arm and even structural motions which usually entail the certain posture and/or motion. Using hand gestures, individual may tell/send out more information in shorter amount of time. Several approaches are explored in application of computer-vision ideas to real-time processing of gesture outputs. [2]. The Computer Vision study concentrates in gesture recognition in open CV framework with Python language. Language is huge part in communication. Languages are useless for persons with disabilities. Gesture is vital and meaningful communication mode for visually impaired person. So here is the computer-based method for regular people in understanding what differently-abled individual try to say. To monitor, there are numerous similar algorithms and object recognition

systems. This allows identification of gestures that overcome the boundaries and disadvantages of earlier systems. Various robust approaches in gesture recognition are developed as well as reported to function well. The video/image is one of the demonstrations of hand gesture detection systems to operate a robotic arm. Adaptive boosting, Neural networks and Support Vector Machine are the algorithms utilized in reconnaissance.

Hand gestures [3] are implemented with the use of convex hull for better fingertip identification. The accuracy result for corresponding paper is more than existing systems. The objective is to highlight effective methods widely of capturing gestures which are fundamental in recent past. It explains also how to identify skin colors in shape identification using convex hull approach and the YCbCr color space transformation. It also describes a python-based Linux-based hand motion recognition system. The algorithm utilized isn't depending on the context. It recognizes the number of fingertips and as well as the task carried out per requirement the 2011 Indian census cites roughly 1.3 million people with "hearing impairment". In contrast to that numbers from India's National Association of the Deaf estimates that 18 million people roughly 1 percentage of Indian population are deaf. Hence the need for a system since these speech impaired and deaf persons require an appropriate route to communicate with regular people. As a result, the project aims to transform sign language motions into text that can be read by ordinary people.

2.RELATED WORKS

In this paper [1] the authors stated that as computers are becoming more pervasive today, facilitating natural human–computer interaction (HCI) have a positive impact in their uses. So, there has been growing interests in development of new approaches and technologies to bridge the human–computer barrier. The ultimate aim is to come up with HCI to the regime in which interactions with computers will be as natural as an interaction between human beings, and to this end, incorporate gestures in HCI is one of the important research areas. Gestures have been considered as an interaction technique that could potentially deliver natural, creative and intuitive methods to communicate with the computers. The hand gestures use as a natural interface serves as motivating force to research in gesture taxonomies. Gesture recognition is being done in three main phases i.e., a) detection, b) tracking and c) recognition. The main goal of this project is to provide researchers in field of gesture based HCI with a summary of progress achieved up to date and then to help identify areas where further research is needed. Computer is used by more people either at their spare time or in their work. Special input/output devices are being designed over years with the purpose of easing the communication between humans and computers; two most known are keyboard and mouse. Every new device is being seen as a try to make the computer more intelligent and making human beings able to do more complicated communication with the computer.

This has been possible due to result-oriented efforts being made by computer professionals to create successful human computer interfaces. As the complexities of human needs are turning into many folds and continues to grow, need for Complex programming ability and intuitiveness are the critical attributes of computer programmers to survive in the competitive environment. The computer programmers are incredibly successful in easing communication between computers and human. With the emergence of new product in markets; it attempts to ease complexity of jobs performed.

Earlier, Computer programmers are avoiding such kind of complex programs as focus was more in speed than other modifiable features. But, a shift towards a user-friendly Environment has driven them to revisit focus area. The idea is to make the computers understand human language and then develop a user-friendly human computer interface (HCI). Making a computer understand speeches, facial expressions and human gestures are some of the steps towards it. Gestures are non-verbal exchanged information. A person can do innumerable gestures at a given time. Since human gestures are perceived through visions, it is the subject of great interest for computer vision scientists/researchers. The project aims to find human gestures by creating an HCI. Coding of the gestures into machine language demands the complex programming algorithm. In present world,

interaction with the computing devices is being advanced to such an extent that as humans it become necessity and humans cannot live without it.

In this paper [2] the authors stated that **w**ith ever-increasing diffusion of computers into society, it is widely believed that the present popular mode of interactions with the computers. Vision based Gesture recognition has a potential to be natural and powerful tool that support efficient and intuitive interaction between human and computer. Visual interpretation of hand gestures helps in achieving ease and naturalness desired to Human Computer Interaction (HCI). This motivated many researchers in the computer vision-based analysis and interpretation of the hand gestures as a main active research area.

The purpose of this review is introducing the field of gesture recognition as the mechanism to interact with computers. With the development of information technology in the society, we expect that computer systems to the larger extent are embedded into the environment. These environments impose needs for new types of human computer interaction, with interfaces that are easy to use and natural. The user interface (UI) of personal computers has evolved from a text-based command line tool to a graphical interface with mouse and keyboard inputs. But they are inconvenient and unnatural for many people. The hand gestures use provides an attractive alternative to the cumbersome interface devices in human-computer interaction (HCI). User's generally use hand gestures to express their feelings and notifications of thoughts. So, in particular, visual interpretation of hand gestures helps in achieving ease and naturalness desire to HCI. Vision has a potential of carrying the wealth of information in non-intrusive manner and also at low cost, therefore it constitutes very attractive sensing modality to develop hand gestures recognition. In this paper [3] that authors focused on reviewing the literatures on hand gesture techniques and also introducing their merits and limitations in different circumstances. The theories of hand segmentation/ hand detection system, which employ Haar cascade classifier, were used to construct the hand gesture recognition with Python and OpenCV. The use of hand gestures as the natural interface motivated research in gesture representations, taxonomies, and recognition algorithms, and software platforms/frameworks, all of which are briefly covered in that paper.

They represented the comprehensive reviews of vision-based sign recognition algorithms published in previous 16 years, emphasizing importance of taking the things into consideration in addition to algorithm's recognition accuracy during predicting its successful in real world applications. The increased public acceptance and funding of international projects emphasizes necessity of the sign language. The desire for the computer-based solution is important in these age of technology for deaf people. However, re- searchers have been studying the problem sometimes now and results are showing some promises. Although interesting technologies are becoming available for voice recognition, there is currently no commercial solution to recognize sign on the market. The goal is to make the computers to understand the human language and then develop a user-friendly human computer interface (HCI). Some steps toward this goal include teaching the computer to recognize speech, human gestures and facial emotions.

3.METHODOLOGY

The existing system focuses on checking the image with hand gesture sign present or not. The image is checked exactly with the data set image and if it matched with any of the image in dataset, then it is decided as sign present in the given image. No binary image conversion and histogram checking is made for test image with data set image collection. Even slight variation in given image can be declared as sign absence.

- Data set images with hand gesture available are collected but not categorized with sign meaning.
- Input images are checked only for sign present or not.
- Binary image preparation and histogram presence checking is not made for test image.
- Only hundred percent match of given image with dataset image are taken for sign presence.

The proposed system focuses on existing system work and in addition, it checks the image with hand gesture sign present along with the meaning of sign. The image is first gray scale converted and binary image conversion takes place. Then histogram values are prepared and checked with the data set image and if it matched with any of the image in dataset, then it is decided as sign present in the given image. Binary image conversion and histogram checking of test image with data set image collection not only finds the presence of sign but also meaning of sign is also found out.

3.1 CREATE GESTURE
In this module the new actions with caption will be trained through webcam present in the system. These captured images are saved in dataset folder with caption of sign.

3.2   GRAYSCALE CONVERSION
The dataset is collected which contain images with hand gesture sign as well as its category. Some of the categories are happy, welcome, eating, thank you, sorry and please, etc. During input image checking for sign presence, the image pixels are converted to its grayscale value for both input image as well as images in dataset folders.

3.3   BINARY IMAGE CONVERSION AND HISTOGRAM PREPARATION
During input image checking for sign presence, the image pixels are converted to its grayscale value and then binary values are prepared, then histogram values are prepared for both input image as well as images in dataset folders.

3.4 FIND SIGN PRESENCE IN IMAGE
In this module the live action will be detected, and start compares with training set images using keras and tensorflow.

3.5   FIND MEANING OF SIGN IN IMAGE
During live action checking for sign presence, the image binary values (histogram data) are compared with all images in dataset folders which are also prepared with histogram values. The data set images are given names with their meaning like happy, thank you etc. The names are extracted and displayed after the input image is matched with any of the data set images.
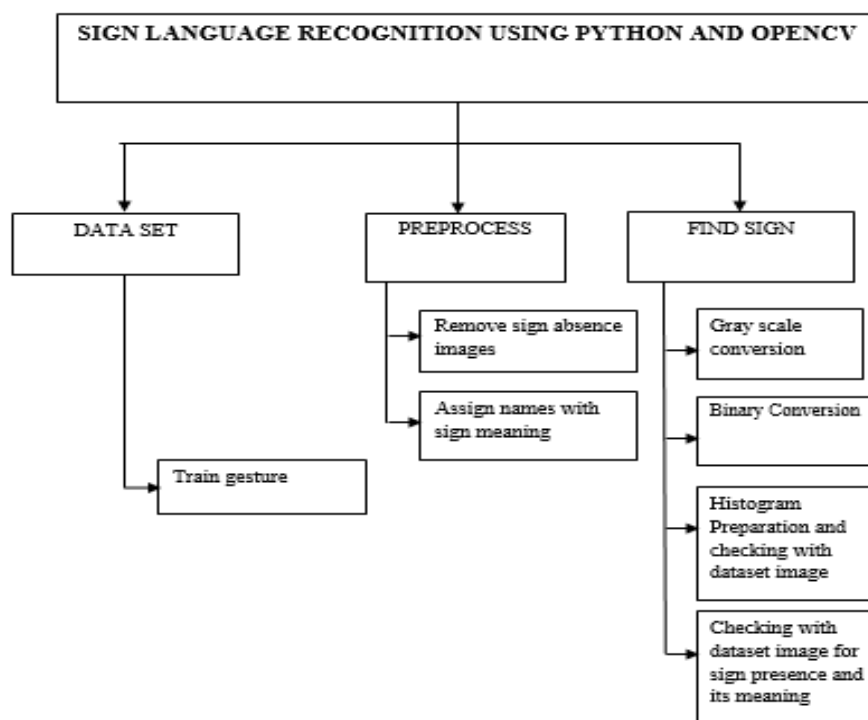
4. PROCESS FLOW DIAGRAM

Fig. 1. Overall Workflow

5. EXPERIMENTAL RESULTS AND FINDINGS

• The data set images are collected with various hand gesture positions for better classification.

• More input images are collected to be checked with dataset images.

• Both checking for presence of hand gesture sign as well as its meaning in given image is carried out.

• The sign category of given image is also checked with data set images.

• Grayscale and binary image conversion with adaptive thresholds are carried out.

6. CONCLUSION

Applications using in nowadays require a variety of image types as data source for explanation and also the analysis for sign presence. Several attributes are gathered to conduct various tasks like grayscale conversion. Degradation happens when an image is changed from one form to other, like during scanning, sharing, digitalizing, saving, and so on. Thus, the output image is to endure the procedure like image enhancement which includes the range of approaches that strive to develop visual presence of an image. Image enhancement enhances awareness or interpretability of information in the images to human listeners during giving superior input for some other autonomous image processing systems. The image is subjected to extract features then with a variety of order to create the image more understandable by the computer. The project presented an effective tool for preparing expert knowledge, grayscale conversions and preparing histogram values of input image to be checked with dataset images. Furthermore, algorithm could be consistently checked to classify and methods under various conditions like with/without sign images. The further enhancements will be made with still more data set images and SVM, KNN like classification methods could be applied to improve accuracy in prediction.

REFERENCES

1. Swapnil Athavale and Mona Deshmukh. Dynamic hand gesture recognition for human computer interaction; a comparative study. International Journal of Engineering Research and General Science, 2(2):38–55, 2014.

2. GRS Murthy and RS Jadon. A review of vision based hand gestures recognition. International Journal of Information Technology and Knowledge Management, 2(2):405–410, 2009.

3. Vinayak S Kunder, Aakash A Bhardwaj, and Vipul D Tank. Sign language recognition system

4. Omkar Vedak, Prasad Zavre, Abhijeet Todkar, and Manoj Patil. Sign language interpreter using image processing and machine learning. International Research Journal of Engineering and Technology (IRJET), 2019.

5. Parshwa P Patil, Maithili J Phatak, Suharsh S Kale, Premjeet N Patil, Pranav S Harole, and CS Shinde. Hand gesture recognition for deaf and dumb. Hand, 6(11), 2019.

6. Hai, P. T., Thinh, H. C., Van Phuc, B., & Kha, H. H. (2018). Automatic feature extraction for Vietnamese sign language recognition using support vector machine. 2018 2nd International Conference on Recent Advances in Signal Processing, Telecommunications & Computing (SigTelCom).

7. Purva C. Badhe, Vaishali Kulkarni, "Indian Sign Language Translator using Gesture Recognition Algorithm", 2015. IEEE International Conference on Computer Graphics, Graphics and Information Security (CGVIS).

8. Md Azher Uddin, Shayhan Ameen Chowdhury, "Hand Sign language recognition for Bangla Alphabet using Support Vector Machines", 2016 International Conference on Innovations in Science Engineerig and Technology (ICISET).

9. Muhammad Aminur Rahaman, Mahmood Jasim, Md. Haider Ali and Md. Hasanuzzaman, "Real-Time Computer Vision based Bengali Sign Language Recognition", 2014 17th International Conference on Computer and Information Technology (ICCIT).

10. Rahat Yasir, Riasat Azim Khan, "Two Handed Hand Gesture Recognition for Bangla Sign Language using LDA and ANN", The 8th International Conference on Software, Knowledge, Information Management and Applications (SKIMA 2014).

11. P.Gajalaxmi, T, Sree Sharmila, "Sign Language Recognition for Invariant features based on multiclass Support Vector Machine with BeamECOC Optimization", IEEE International Conference on Power, Control, Signals and Instrumentation Engineering (ICPCSI-2017. certification. In Proc. of ACM Conference on Computer and Communications Security (CCS), pages 235–245, 2009.

12. J. Kramer, "Communication system for deaf, deaf-blind and non-vocal individuals using instrumented gloves," United States Patent No. 5047952, Virtual Technologies Co., 1991.

13. R. Carmel, C. Ullrich, and J. Silver, "VirtualHand v2.5-user's guide," Virtual Technologies Inc., 2001.

14. C. Charayaphan and A. Marble, "Image processing system for interpreting motion in American sign language," Journal of Biomedical Engineering, Vol. 14, 1992, pp. 419-425.

15. T. Takahashi and F. Kishino, "Gesture coding based in experiments with a hand gesture interface device," ACM SIGCHI Bulletin, Vol. 23, 1991, pp. 67-73

16. Shwetasaibal Samanta Sahoo; Mousime Xalxo; B G Mukunda. "A Study on Tourist Behaviour Towards Sustainable Tourism in Karnataka". *International Research Journal on Advanced Science Hub*, 2, 5, 2020, 27-33. doi: 10.47392/irjash.2020.28

17. Muniyandy Elangovan; Mohamed Yousuf; Mohamed Nauman; Mohammed Nayeem. "Design and Development of Delivery Robot for Commercial Purpose". *International Research Journal on Advanced Science Hub*, 4, 07, 2022, 192-197. doi: 10.47392/irjash.2022.047

18. Manikandan N; Swaminathan G; Dinesh J; Manish Kumar S; Kishore T; Vignesh R. "Significant Attention in Industry and Academia for Wire Arc Additive Manufacturing (WAAM) - A Review". *International Research Journal on Advanced Science Hub*, 4, 07, 2022, 198-204. doi: 10.47392/irjash.2022.048

19. Shoeb Ahmed Syed; Steve Ales; Rajesh Kumar Behera; Kamalakanta Muduli. "Challenges, Opportunities and Analysis of the Machining Characteristics in hybrid Aluminium Composites (Al6061-SiC-Al2O3) Produced by Stir Casting Method". *International Research Journal on Advanced Science Hub*, 4, 08, 2022, 205-216. doi: 10.47392/irjash.2022.051

20. Ashima Saxena; Preeti Chawla. "A Study on the Role of Demographic Variables on Online Payment in Delhi NCR". *International Research Journal on Advanced Science Hub*, 4, 08, 2022, 217-221. doi: 10.47392/irjash.2022.052

21. Vishnupriya S; Nirsandh Ganesan; Ms. Piriyanga; Kiruthiga Devi. "Introducing Fuzzy Logic for Software Reliability Admeasurement". *International Research Journal on Advanced Science Hub*, 4, 09, 2022, 222-226. doi: 10.47392/irjash.2022.056

22. GANESAN M; Mahesh G; Baskar N. "An user friendly Scheme of Numerical Representation for Music Chords". *International Research Journal on Advanced Science Hub*, 4, 09, 2022, 227-236. doi: 10.47392/irjash.2022.057

23. Nirsandh Ganesan; Nithya Sri Chandrasekar; Ms. Gokila; Ms. Varsha. "Decision Model Based Reliability Prediction Framework". *International Research Journal on Advanced Science Hub*, 4, 10, 2022, 236-242. doi: 10.47392/irjash.2022.061

24. Vishnupriya S; Nithya Sri Chandrasekar; Nirsandh Ganesan; Ms. Mithilaa; Ms. Jeyashree. "Comprehensive Analysis of Power and Handloom Market Failures and Potential Regrowth Options". *International Research Journal on Advanced Science Hub*, 4, 10, 2022, 243-250. doi: 10.47392/irjash.2022.062

25. Minh Duc Ly; Que Nguyen Kieu Viet. "Improvement Productivity and Quality by Using Lean Six Sigma: A Case Study in Mechanical Manufacturing". *International Research Journal on Advanced Science Hub*, 4, 11, 2022, 251-266. doi: 10.47392/irjash.2022.066

26. Ragunath A; Poonam Syal. "Net Zero Energy Buildings Initiatives - A Review". *International Research Journal on Advanced Science Hub*, 4, 11, 2022, 267-271. doi: 10.47392/irjash.2022.067

27.   Suresh P; Justin Jayaraj K; Aravintha Prasad VC; Abishek Velavan; Mr Gokulnath. "Deep Learning for Covid-19 Identification: A Comparative Analysis". *International Research Journal on Advanced Science Hub*, 4, 11, 2022, 272-280. doi: 10.47392/irjash.2022.068

28.   Chirag H B; Darshan M; Rakesh M D; Priyanka D S; Manjunath Aradya. "Prediction of Concrete Compressive Strength Using Artificial Neural Network". *International Research Journal on Advanced Science Hub*, 4, 11, 2022, 281-287. doi: 10.47392/irjash.2022.069

29.   Minh Ly Duc; Que Nguyen Kieu Viet. "Analysis Affect Factors of Smart Meter A PLS-SEM Neural Network". *International Research Journal on Advanced Science Hub*, 4, 12, 2022, 288-301. doi: 10.47392/irjash.2022.071

30.   Lely Novia; Muhammad Basri Wello. "Analysis of Interpersonal Skill Learning Outcomes in Business English Students Class". *International Research Journal on Advanced Science Hub*, 4, 12, 2022, 302-305. doi: 10.47392/irjash.2022.072

31.   Ms. Nikita; Sandeep Kumar; Prabhakar Agarwal; Manisha Bharti. "Comparison of multi-class motor imagery classification methods for EEG signals". *International Research Journal on Advanced Science Hub*, 4, 12, 2022, 306-311. doi: 10.47392/irjash.2022.073

32.   Aniket Manash; Ratan Kumar; Rakesh Kumar; Pandey S C; Saurabh Kumar. "Elastic properties of ferrite nanomaterials: A compilation and a review". *International Research Journal on Advanced Science Hub*, 4, 12, 2022, 312-317. doi: 10.47392/irjash.2022.074

33.   Prabin Kumar; Rahul Kumar; Ragul Kumar; Vivek Rai; Aniket Manash. "A Review on coating of steel with nanocomposite for industrial applications". *International Research Journal on Advanced Science Hub*, 4, 12, 2022, 318-323. doi: 10.47392/irjash.2022.075

34.   Twinkle Beniwal; Vidhu K. Mathur. "Cloud Kitchens and its impact on the restaurant industry". *International Research Journal on Advanced Science Hub*, 4, 12, 2022, 324-335. doi: 10.47392/irjash.2022.076

35.   T. Pravin, C. Somu, R. Rajavel, M. Subramanian, P. Prince Reynold, Integrated Taguchi cum grey relational experimental analysis technique (GREAT) for optimization and material characterization of FSP surface composites on AA6061 aluminium alloys, Materials Today: Proceedings,Volume 33, Part 8, 2020, Pages 5156-5161, ISSN 2214-7853. doi.org/10.1016/j.matpr.2020.02.863.

36.   R. Ranjith, C. Somu, G. Tharanitharan, Venkatajalapathi.T, Naveenkumar M, Integrated Taguchi cum Grey Relational Experimental Analysis (GREAT) for Optimization and Machining Characterization of Cryogenic Cooled AA6063 Aluminium Alloys, Materials Today: Proceedings, Volume 18, Part 7, 2019,Pages 3597- 605, https://doi.org/10.1016/j.matpr.2019.07. 291.

37.   R. Devi Priya, R. Sivaraj, Ajith Abraham, T. Pravin, P. Sivasankar and N. Anitha. "Multi-Objective Particle Swarm Optimization Based Preprocessing of Multi-Class Extremely Imbalanced Datasets". International Journal of Uncertainty, Fuzziness and Knowledge-Based Systems Vol. 30, No. 05, pp. 735-755 (2022). Doi: 10.1142/S0218488522500209

38.   M. S. N. K. Nijamudeen, G. Muthuarasu, G. Gokulkumar, A. Nagarjunan, and T. Pravin, "Investigation on mechanical properties of aluminium with copper and silicon carbide using powder metallurgy technique," Advances in Natural and Applied Sciences, vol. 11, no. 4, pp. 277–280, 2017.

39.   Pravin T, M. Subramanian, R. Ranjith,Clarifying the phenomenon of Ultrasonic Assisted Electric discharge machining, "Journal of the Indian Chemical Society", Volume 99, Issue 10, 2022, 100705, ISSN 0019-4522, Doi: 10.1016/j.jics.2022.100705

40.   V.S. Rajashekhar; T. Pravin; K. Thiruppathi , "Control of a snake robot with 3R joint mechanism", International Journal of Mechanisms and Robotic Systems (IJMRS), Vol. 4, No. 3, 2018. Doi: 10.1504/IJMRS.2018.10017186

41.   T. Pravin, M. Sadhasivam, and S. Raghuraman, "Optimization of process parameters of Al-10% Cu compacts through powder metallurgy," Applied Mechanics and Materials, vol. 813-814, pp. 603–607, 2010.

42.   Rajashekhar, V., Pravin, T., Thiruppathi, K.: A review on droplet deposition manufacturing- a rapid prototyping technique. Int. J. Manuf. Technol. Manage. 33(5), 362–383 (2019) https://doi.org/10.1504/IJMTM.2019.103277

43.   Rajashekhar V S, Pravin T, Thirupathi K, Raghuraman S.Modeling and Simulation of Gravity based Zig-zag Material Handling System for Transferring Materials in Multi Floor Industries. Indian Journal of Science and Technology.2015 Sep, 8(22), pp.1-6.