

Virtual Reality based Hologram for Emergency Situation



S Sri Heera , Abina M, Jayashree Pavna S, Malavika Shetty

Abstract: *Virtual reality is seen as an elite way for viewing and it has the potential to target a wide range of applications. Holography is a pictorial method that records the light scattered from an object, presenting it in a way that appears in a 3D form. During mining the miners will be in need of certain essential requirements to make their work more efficient. Existing system only detects if there is any dangers inside the mines and does not provide with the required items to the miners. The proposed system focuses on providing these essential requirements. The items include Hearing protection device, PAPRs, foot protection, clothes, belts and D-rings and self-rescue device. We have conducted a survey based on various algorithms and methods that are used to create a hologram and for analysing holographic image. The survey tells us that methods like Rule based approach which requires large amount of data is used to classify human activities. Multiplexing is used to combine many signals into one and produce an image. These systems have various issues when it comes to time and performance. It provides with some handy data on some of the encouraging milestones that have been attained in hologram acquisition, display and processing.*

Keywords: *Hologram, LED device, Machine learning, Micro-controller, Virtual reality, WSN.*

I. INTRODUCTION

Virtual Reality may be a pc interface that tries to mimic the universe over the flat monitor to convey associate immersive three-dimensional visual expertise. Typically, the scales and distances should be reconstructed between objects in static two-dimensional pictures. So the dimension helps transfer depth to things. A holograph forms a three-dimensional image as a result of light weight interference pattern are recorded, not simply mirrored. To form this, an irradiation is split into 2-beams that pass-through lenses to expand them. One beam (reference beam) is directed on to a high distinction film. The opposite beam is geared towards the article (object beam). The article beam gets scattered and it is out of section with the reference beam and once they act, interference is formed.

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This forms a 3- dimensional pattern. Today holograms are used for information storage, optical communication, security etc. Machine learning is to know the structure and work that data into models which will be understood and used by the folks.

Machine learning formula yield computers to coach on information inputs and use applied maths analysis so as to output values that falls inside the precise vary. Two of the foremost adopted machine learning techniques are supervised learning and unattended learning.

[1]Sherien Mohamed Hassan, Ahmed Farouk Al-Sadek conducted a survey for sleuthing human activity by analysing and understanding the motion of the trajectories. This can be done by employing a rule-based system. Recognising the movement action needs the analysis of motion trajectories. Most of the present ways observe abnormal trajectories by processing the pairwise similarities between the trajectories. The ways embody geometrician distance, Harsdorf distance and its distinction variations and its dynamic time deformation. These approaches have many drawbacks. The planned system enhances the item detection method by classifying the trajectories into 3 classes specifically traditional, sei normal and abnormal trajectories in step with their distances between their adjacent points. The effectiveness of the planned approach is incontestable through many experimental results victimisations known human motion knowledge sets. The item motion are often diagrammatic by a flight path that represents a path for a selected purpose throughout the video. The system seems between the item detection and object following as a pre-processing part for enhancing and clearance of the detection method of the item. System includes input video, object illustration, feature choice, object detection and following object rule. The advantage is that this part is often supplementary to any following system as a result of it doesn't rely upon the item or moving nature. The flight area is increased by applying noise removal rule and choosing the simple key trajectories. Human activity recognition is beneficial for several applications like video-surveillance, video annotation and retrieval and human-computer interactions.

[2]Osamu Matoba, Xiamgyu Quan, Yasuhiro Awatsuji conducted a survey on fluorescence imaging for biological field. The visualization of fluorescence is a common path off-axis incoherent digital holography using dual grating on dual Fresnel lenses. A defocused two dimension fluorescence is recovered by using the defocussed distance. The spherical aberration is used for blurring the fluorescence bead image. These techniques are applied to the biological imaging. To measure the phase and fluorescent distributions, digital holography is used.



The proposed system uses multimodal imaging techniques to measure simultaneously both phase and fluorescent distributions. The quantitative measurement is used for calculating the phase image. To measure the biological samples a three dimensional phase imaging based on digital holography is applied.

The issues to the fluorescence imaging is digital holography because to record the hologram interference is required. The advantage is implementing the off-axis holography and it is difficult to make the system compact. The diffractive optical element uses a common path configuration. The DOH created a self-interference pattern between the diffracted waves. This configuration is stable. The proposed system uses an off-axis incoherent digital holography based on dual focusing lenses with different optical grating. The defocused image is observed by placing the fluorescent molecules out of focus plane by using conventional epifluorescence microscopy. Uses: the object depth is shifted by a movable stage along the depth direction, so the defocused image is obtained with known defocused distance [3]Mrs Savitha C, Dr D Ramesh conducted a survey in video surveillance to gather information, to monitor people, events and activities. Passive video surveillance system has no effect as the number of cameras are more than the capability of human beings to monitor them. The proposed system deals with visual surveillance system with many cameras which help a lot in increasing the area of surveillance. The main aim of visual surveillance is not only to install cameras which can be viewed by the human eye but to achieve a complete surveillance as automatically and systematically as possible. All the surveillance systems deals with motion and object identification. The steps in the proposed system: 1) To identify the object 2) To systematize the identified object 3) To analyse the behaviour and activities of the person identified. Major disadvantage is to find out the anomaly in time which implies in which frame anomalies occurs and space which implies the region within the frame. Disadvantage: camera calibration, camera installation, automated camera switching, object matching, data fusion. Advantages: improve tracking result, precise tracking based on the ground co-ordinates, error minimization in object localization process, improved accurate performance for crowd behaviour analysis, Robust performance for several data base and several scenarios. Machine learning methods are used to identify anomalous behaviour. Optical flow, support vector machine and K-means algorithm provide modelling of human behaviour.

[4]Xian-feng Xu, Li Zhang, Ge-tao Zhang, Su-su Wang, Yu-Lei Jia, Hui Zhang, Zhi-Yong Jiao conducted a survey on quality of holographic pictures. The holographic image was reconstructed from digital holographic data system with mono chromatic CCD. In this paper, one singular mono chromatic CCD is used to employed to figure within the data system of vibrant section shifting digital optics. The extracted section shifts are reconstructed after the formulae are deduced and programs designed. The chromatic errors are induced by totally different wavelengths. The looks of recent photoelectric recording device and powerful computing machine has created digital optics become a speedily growing analysis field in data optics. The digital holography avoids the inconvenience of wet processing and issue of positioning and may also effectively realise the recording of interferogram, the information storage, processing, transform, reconstruction. The technique used is

3D visual perception, vibration analysis, little displacement measure, deformation detection, surface review, fluid measure, particle fluid analysis, microscopy imaging, biomedical diagnosis. In digital holography phase-shifting was introduced to resolve the contradiction between the off-line angle enough to separate the initial object image and recording device a resolution limitation on the off-axis angle. It is conjointly used for section shifting interferometry, to eliminate the zero order, twin image, some error in homocentric digital holography. The digital holography will mechanically extract the section shift value and cut back the price of experiment.

[5]Yasuhiro Awatsuji, Kazuki Shimizu, Peng Xia, Osamu Matoba, conducted a survey on optical microscope supported parallel phase- shifting holography. The digital Holography may be a technique for 3 dimensional measurements and section measurements of object. Sometimes the standard of the reconstructed image is degraded and therefore the measure accuracy in 3D measure and phase measure is cut. To get rid of the ordinal order optical phenomenon wave and the conjugate image, phase-shifting digital holography was made up. This method can't be utilized for dynamic method. However the projected system will use it. After we carry the magnifier to a different location, we've to decompose the magnifier and make it. The parallel phase-shifting digital holographic microscope is built on associate degree optical bread board as a vertical microscope to resolve the above drawback. The dynamic phase motion picture of clear gas flowing in microscopic space is recorded using this technique. This method will also contribute to phase measurement and 3D measurement in specific flow cytometry, biological microscopy and product inspection.

[6] Zhenbo Ren, Hayden K.H. So, Edmund Y Lam conducted a survey that employs deep learning to extend the resolution of a hologram. A deep learning network is strained with a group of examples, having a low-resolution hologram as the input and a high-resolution hologram as the output. After finishing the training, deep learning network is applied to simply accept an arbitrary hologram, and super resolved it into a high-resolution hologram. The process is conducted with interpolation or reconstruction. These processes are usually computation intensive; and within the case of interpolation the synthesized fringe patterns might not match accurately with the first patterns of the hologram. Typically because of constraint and value of imaging sensors the ensuing picture is restricted in terms of pixel count that successively reduces the resolution of the image. The planned system super-resolves holograms by treating deep learning and improves the standard of low-resolution holograms by coaching a convolutional network with large-scale knowledge for resolution enhancement without further changes in hardware and parameter improvement. Advantages: to boost the performance of coherent and incoherent image formation techniques that are widely used in industries, such as CT, pc radiography, and X-ray imaging. Compared to multiple-image approach, single-image theme has broader relevancy owing to its high potency and low procedure load. This technique is used wherever the complicated field data of the object is desired and has been widely applied to measure cell observance, field topography measurement, and wafer examination.

[7]Holographic display is one among the core analysis areas in DH. The basic application of a hologram is to give a three-dimensional visual image.

Though various advancements are re-modelled during the years within the development of high quality holographic display system, imperfections within the producing of the SLM's and optical setup of the display system are inescapable. In the paper "Distortion-Correction Method Based on Angular Spectrum Algorithm for Holographic Display", the authors have planned a technique to beat this drawback. The aforesaid imperfections are modelled as a further distortion function that is added to the hologram. Applying a four-step phase shifting technique, a camera-based wavefront acquisition is done to record the distortion operation. Afterwards, the distortion operation is used to change the digital hologram, so that the distortion from the imperfect display system can be often minimised. Traditional distortion correction strategies are pricey and time intense. The planned system uses angular spectrum formula for this purpose. Advantages: 1) scale back the cost of hardware design and will be faster in calculation. 2) various sorts of distortions are often corrected. 3) quality of the image is greatly improved. The options of this techniques bring the chance to use it in holographic encoding.

[8]Yunbo Li, Aobo Li, Tiejun Cui, Daniel F. Stevenpiper conducted a survey for generating microwave holograms using impedance metasurfaces for multiple simultaneous wavelengths. In this paper, they change only one physical dimension in the unit cell to satisfy the necessary condition of impedance distribution for two frequencies at the same time in the same aperture. To produce the beams at the same time two excitation ports are used. The new low-profile holographic leaky-wave antenna has potential applications in coming up with multi-frequency communication and radar systems. A two-dimensional surface is organised as a periodic or quasi-periodic subwavelength unit cells that consists of meta-surfaces. Meta-surfaces-based antennas are investigated by several teams as a result of their engaging performance of low-profile, low-loss and low-cost. It has been applied to magnetic force devices such as spatial wave modulators. In optical holograms the phase-gradient meta-surfaces even have applications. The subsequent approach is employed to style a low-profile holographic leaky-wave antenna. In the microwave band, the object wave corresponds to the meant radiation pattern instead of the image in the optical band. Multiplexing is employed to extend the channel capacity in communication systems. This idea is applied to style multi-functional devices employing a shared multiplexing meta-surface. The proposed system uses multiplexing technique to produce a hologram for multiple wavelengths using impedance meta-surfaces. Broadside leaky-wave radiation is generated for two frequencies at the same time by using this approach. The proposed multiplexing technology is applied to combine the two holograms corresponding to different wavelengths into one pattern using impedance meta-surfaces which is designed by varying only one geometric parameter of the impedance unit.

[9]Wen Chen conducted a survey on binary computer-generated hologram. This has three-dimensional optical correlation. The 2D input image is split into some squared blocks, and are kept in 3D space. Using phase-only pattern, the blocks are encoded and binarization of the generated

phase pattern is done. In this system extreme security measures can be achieved and to decrypt only one axial position is used. It is also shown that the binary phase-only pattern is easily generated for the decoding. The hologram which is binary computer generated of 3D optical correlation can productively enrich in 3D optical security space. The collimated plane wave is produced for the illumination, and the encryption method is performed based on an iterative approach between spatial space and reciprocal space. Throughout the iterative retrieval, some data like the input image kept in 3D space and a series of axial distances, are applied as well-known parameters, and the encoding aim is to produce an approximated phase-only pattern. Wave propagation is done between the phase patternplane and the image plane. Back propagation method is done. For the decoding, binary phase-only pattern and setup parameters are applied. For encoding, a binary phase-only pattern is generated as ciphertext, and for threshold an average value of angle is calculated and used. In the iterative process a rapid convergence rate can be achieved. When an authorized receiver uses the exact ciphertext and security keys, a decoded image is obtained. Thanks to the designed strategy no information can be visually determined, and a correlation distribution is generated.

II. THE PROPOSED MODEL

SYSTEM ARCHITECTURE:

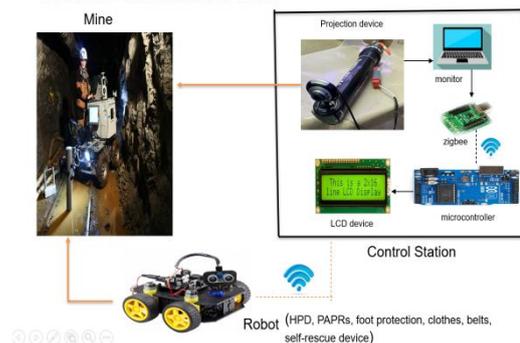


Figure 1: System Architecture

The above diagram is the flow of the proposed system where a holographic view is presented to the user from which the user can select the respective icons needed. The process is captured by a camera and displayed on the monitor and the convolutional neural network algorithm is used to identify the icon selected by the user. The zig-bee device is used to transmit the data to the Arduino which in turn activates the motor which is used to provide the items.

III. PRINCIPLE OF OPERATION

The holographic projector is placed in the control station which is installed near the underground mining. The holographic projector projects the holographic view from the control station to the underground mining to communicate with the miners. The holographic view is like a virtual screen where we can touch the input. The virtual screen contains buttons like hearing protected device, powered air purified respiratory, foot protection, clothes, belts and D-rings, self-rescue device.

After the projection of virtual screen the user selects the button. The input that are given through virtual display unit in screen is captured by the camera which is installed above the holographic projector[fig:1].

By using the track-V software we can see the input in the system. The camera used to capture the input and the input that captured can be seen in the system. By applying the convolutional neural network algorithm the user selected data is generated. To implement CNN algorithm AlexNet architecture is used. The wireless communication device zig-bee is used to transmit the generated data. The transmitted data is received by the zig-bee and the it is transmitted to the Arduino(micro-controller). The 2*16 LCD[FIG:2] is connected with the Arduino micro-controller to display the user selected data. Embedded C program is given to the micro-controller. The embedded c program is used to check the data and to define the path for the robot. If the generated data is correct then it activates the robot through wireless communication. The robot path is defined in the embedded c program. The activated robot is used to give the needed requirements to the miners.

IV. ALGORITHM

The Convolution Neural Network is used for image classification and to generate the user selected data. The algorithm is implemented on AlexNet architecture. The AlexNet architecture has five convolutional layer and three fully connected layers. An RGB image of size 227x227 is given as input to the AlexNet. The input image should be an RGB image. The two convolution layers comes first followed by the overlapping pooling layer. The third, fourth and fifth convolutional layers are connected directly. An overlapping max pooling layer comes after the fifth convolution layer, the output of which goes into a series of two fully connected layer.

V. EXPERIMENTAL SETUP

The proposed system as the following modules to achieve the result

A. List of modules :

- Projection of holographic view and transmission using camera.
- Processing of the input image using track-V12 software.
- Direct the robot using wireless communication and providing the items to the miners.

B. Projection of holographic view and transmission using camera:

In this module, the virtual screen is a screen where the input image can be touched .The OHP sheet is engraved with the items like hearing protection device, powered air purifying respiratory system, Foot protection, belt and D-rings, clothes, self-rescue device. The light is passed through the Over Head Projector(OHP) sheet to the convex lens. The refracted image is the resulting holographic view. The user selects the required icon. This activity is captured by the camera and the input image is displayed on the monitor using track-V12 software which has four co-ordinates. It can also have x or y corresponding value. The camera used here is web camera of 3.8mm lens.



Figure 2: Transmission light device

C. Processing of the input image using track-V12 software:

In this module, the image which is captured by the camera is displayed on the monitor. The captured image is converted into the grey-scale image and then into the binary image. First all the icons in the holographic view is identified and then only the selected icon is recognized using convolution neural network algorithm. The data is received by the zig-bee and transmitted to the Arduino which displays the selected item in the LCD.

D. Direct the robot using wireless communication and providing the items to the miners:

In this module, the generated data is transmitted to the Arduino controller. The TTL board is used to transmit the serial data using zig-bee device. The Arduino is programmed using embedded c and the path for the robot is defined. Then the robot is activated through the wireless communication and the items are provided to the miners.

VI. RESULT

The system uses virtual reality due to light rays through the wall to display the icons like hearing protection device, powered air purifying respiratory system, foot protection, belt and D-ring, clothes and self-defence device. This holographic view is projected by passing rays which spilt into object beam and reference beam and fall on the OHP sheet and the interference pattern is formed. In the proposed system we use two data sets to train the neural network to enable the process of identifying the images by Convolutional neural network using AlexNet architecture. The LED device displays the particular icon selected by the user. The robot is used to transmit the items to the end user which operates automatically in a predefined path. The proposed system can be made more efficient by providing with the exact requirements needed for the miners which makes their work easy.

VII. CONCLUSION

We have proposed a system for the mining industry for providing the necessary required items for the miners. The developing countries face more problems than the developed countries. This system helps to overcome the discomfort faced by the miners. The miners can select their requirement from the holographic view projected which is captured by the camera and displayed on the monitor where the processing of the image takes place by using CNN algorithm. The selected icon is identified and sent to the microcontroller which displays it in the LCD and the data is also sent to the robot which gives the items to the miners.

VIII. APPLICATION AND FUTURE ENHANCEMENTS

This system can also be employed in restaurants for the customers to place their order by themselves and the processed order can be directly sent to the kitchen. After the order has been ready it can be sent to the respective table through a robot.

The holographic view where the icons are displayed can be projected on the table from which the customers can select. This system can also be used to communicate and provide the necessary item to the patients who are kept in isolation in the hospitals. The future enhancements include: Making the system possible to work for vertical mines and increasing the resolution of holographic projection.

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