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Scene Understanding Using IoT

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ABSTRACT: People who lack visual perception cannot feel what is happening around them. These days children and adults are more interested and spend their time in games and watching movies, but gaming and film industry are lacking real time effects which would bring a new experience to children and adults who use them. There comes a requirement for a way which would solve these issues together along with other benefits. Our project brings solution to above addressed problem by providing the output like if the scene in the video depicts fire it turns on the hairdryer, if scene depicts rain it turns on the sprinkler, if scene depicts wind it turns on fan and if the scene is normal there is no effect. It creates a way for blind people to feel their surroundings. Not only them we can create an environment at space similar to that of on earth like rain, water,wind etc which would bring a new experience there. Gaming and film industry can bring a new experience to people through this project. The IoT platform collects data through the IoT sensor system and we emulate the environment in the scene in the video using scene understanding algorithm and IoT technology.

KEYWORDS: CNN algorithm; Arduino; Relay module

I. INTRODUCTION

Scene understanding is the process, often real-time, of perceiving, analysing, and elaborating an interpretation of a 3D dynamic scene observed through a network of sensors. This process consists mainly in matching information coming from sensors observing the scene with models which humans are using to understand the scene. Based on that, scene understanding is both adding and extracting information from the sensor data characterizing a scene. This scene can contain a number of physical objects of various types interacting with each other or with their environment more or less structured. Scene understanding is influenced by the cognitive vision and it requires at least the melding of three areas: computer vision, cognition and software engineering. Scene understanding can achieve four levels of generic computer vision functionality of detection, localization, recognition and understanding.

PROBLEM STATEMENT: People who lack visual perception cannot feel what is happening around them.These days children and adults are more interested and spend their time in games and watching movies,but the gaming and film industry are lacking real time effects which would bring a new experience to children and adults who use them.There comes a requirement for a way which would solve these issues together along with other benefits.

OBJECTIVE: The main objective of our project is to perform some action based on the scene i.e., if the scene depicts fire it turns on the hairdryer, if scene depicts rain it turns on the sprinkler, if scene depicts wind it turns on fan and if the scene is normal there is no effect. It creates a way for blind people to feel their surrounding. Not only them we can create an environment at space similar to that of on earth like rain , water, wind etc which would bring a new experience there. Gaming and film industry can bring a new experience to people through this project. The IoT platform collects data through the IoT sensor system and provides support for the application platform through the integrated service sharing centre. where we emulate the environment in the scene in the video using scene understanding algorithm and IoT technology. At first video is fed into scene understanding AI algorithm, algorithm which analyse the video, collects data from the video, analyses the data and predicts the environment in the scene.

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II. RELATED WORK

Real-time raindrop detection based on cellular neural networks for ADAS. A core aspect of advanced driver assistance systems (ADAS) is to support the driver with information about the current environmental situation of the vehicle. Bad weather conditions such as rain might occlude regions of the windshield or a camera lens and therefore affect the visual perception. Hence, the automated detection of raindrops has a significant importance for video-based ADAS. The detection of raindrops is highly time-critical since video pre-processing stages are required to improve the image quality and to provide their results in real-time. This paper presents an approach for real-time raindrops detection which is based on cellular neural networks (CNN) and support vector machines (SVM). The major idea is to prove the possibility of transforming the support vectors into CNN templates. The advantage of CNN is its ultra-fast processing on embedded platforms such as FPGAs and GPUs. The proposed approach is capable to detect raindrops that might negatively affect the vision of the driver. Different classification features were extracted to evaluate and compare the performance between the proposed approach and other approaches.

[2]. Localised Assistive Scene Understanding using Deep learning and IOT The paper proposes a system for localized scene understanding to assist sufferers of visual disabilities. It determines the user's indoor location using WiFi fingerprinting and synthesizes a real-time description of the surrounding environment. The description is synthesized from prior information about the environment, real-time information obtained from object detection and localization using deep learning, and sensory information collected from IoT sensors. The system can be activated automatically or on-demand as configured. On-demand activation happens by issuing a voice command to the environment's smart speaker or the user's mobile phone. Alternatively, the system can be set to activate automatically when detecting a change in the user's environment. When triggered, it initiates a capture of an image using an environment-attached stationary camera and offloads the image to server for identifying objects and their approximate locations in the environment. The server uses deep learning to localize persons, pets, or furniture. A prior mapping of the environment is used to change the detected image-domain pixel coordinates to real-world relative locations. It also collect using IoT sensors information about the environment's temperature, humidity level, and light intensity. With the information available, it fuses a fixed description of the environment's permanent features with a dynamic description from the localized objects and sensors data. It finally use text-to-speech to change the textual description into an audio signal played on the user's Bluetooth headset or the environment's smart speaker. The results show that the system can be an effective tool in helping the visually-challenged navigate unknown environments using increasingly available smart home technologies

III. PROJECT DESIGN

The purpose of the design is to plan the solution of a problem specified by the requirements documents. This phase is the first step moving from problem to the solution domain. In other words, starting with what is needed design takes us to work how to satisfy the needs the design of the system is perhaps the most critical factor affecting the quality of the output and has a major impact on the later phases. System design aims to identify the modules that should be in the system, their functions and interactions with each other to produce desired results. This chapter presents the High Level Design and a brief description of the modules. The main objective of our project is to emulate the environment in the scene using IoT technology and scene understanding algorithm**.**

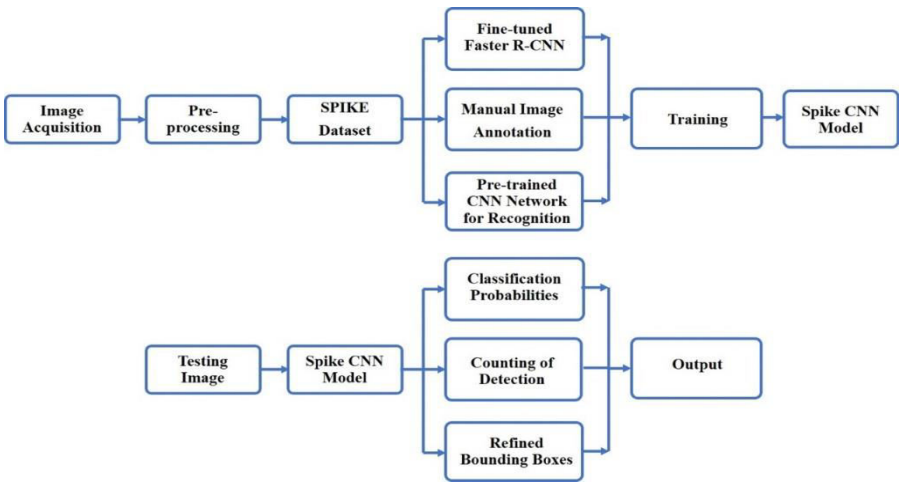

Fig. 1 Design Overview of Scene Understanding using IOT

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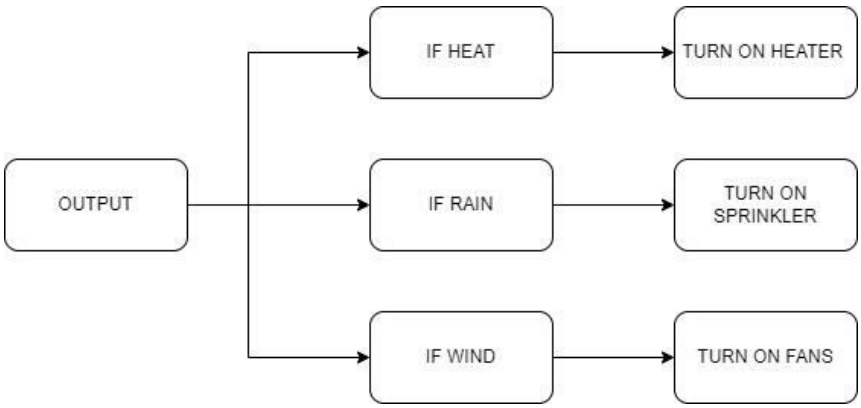

Fig. 2 Result Overview of Scene Understanding using IOT

IV. IMPLEMENTATION

The implementation includes video processing, frame processing and frame analysis and training model for getting results. The source code is given in appendix A. The process of implementation is as follows:

VIDEO PROCESSING: We make use of cv2 and pyfirmata libraries for this . cv2 is the opensource computer vision machine learning software library. It is used for scene detection and object detection. pyFirmata is a Python interface for the Firmataprotocol. It is used to allow serial communication between a python script on any computer and an Arduino. video is read frame by frame, the output ports on arduino is specified for each scene and it detects whether it is heat or rain or wind and provides the desired output

FRAME PROCESSING FRAME ANALYSIS: We make use of numpy,keras,h5py and PIL libraries for this. Numpy library is used for mathematical calculations that is, image is divided into small parts and it detects the parts matching the scene. Keras is built in python user-friendly library used foe easily building and training models. PIL is a python imaging library that provides interpreters with image editing capabilities, it adds support for opening,manipulating and saving images. The h5py package is a Pythonic interface to the HDF5 binary data format. HDF5 lets you store huge amounts of numerical data, and easily manipulate that data from NumPy.

TRAINING MODEL: We make use of numpy,keras,h5py and PIL libraries for training models, the same we used for frame processing and analysis.And we also make use of itertools and matplotplib libraries in addition to previous ones.Itertools is used to iterate over data structures that can be stepped over using a for-loop,for broken data stream error and matplotlib is used for visulaization as it is multi-platform data visulaization library. Image preparation step is followed by modifying model step which undergoes modification of model according to the need. Then the model is trained to detect the scene accurately. Followed by training , model is tested and confusion matrix is plotted and normalization can be done if required.

DETECT RAINDROPS WITHIN AN IMAGE BY USING SLIDING WINDOW: Source from where image is taken and the destination where image after raindrop detection is stored is specified. Initially PIL image object is converted into array.It gives an array ready for the CNN to predict.Then building a network according to requirements.Calculates all the windows that will slide through an image.Returns all of the sliding windows for an image, each element represents the coordinates of top left corner of the window and its size. Sliding window algorithm will generates too many rectangles.We use the groupRectangles method to reduce overlapping rectangles.

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groupRectangles() function to shrink the rectangle list.Parse the xml file that stores the ground truth raindrop locations in some file.Retrieve the coordinates of each ground truth raindrop locations.Slide the window across the image, pass each window (region of interest). If the region is classified as a raindrop, store the region's coordinates the list. We copy the image and draws the rectangles on the copied image. Then draw the rectangles that contains ground truth raindrops. Finally save the result image into a folder.

V. RESULT

Using IoT technology and CNN algorithm, one can sense virtual reality platform collects data through the IoT sensor system, we emulate the environment in the scene in the video using CNN algorithm and IoT technology. At first image is fed into scene understanding algorithm, algorithm which analyses the image and collects data, analyses the data predicts the environment in the scene. Algorithm captures images from the video and analyses them to provide the output. Image is divided into small parts i.e., array and it detects the parts showing fire for heat. Algorithm takes in an input image ,assigns learnable weights and biases to various aspects/ objects in the image and be able to differentiate one from another. If the scene is rain in the image then as output turns on the sprinkler. If the scene is windy in the image then as output turns on the fan. If the scene is heat in the image then as output turns on the hair dryer and if the scene is normal there is no effect. According to the prediction creates the artificial environment as in the video captured images. System provides a virtual effect which is useful in various fields.

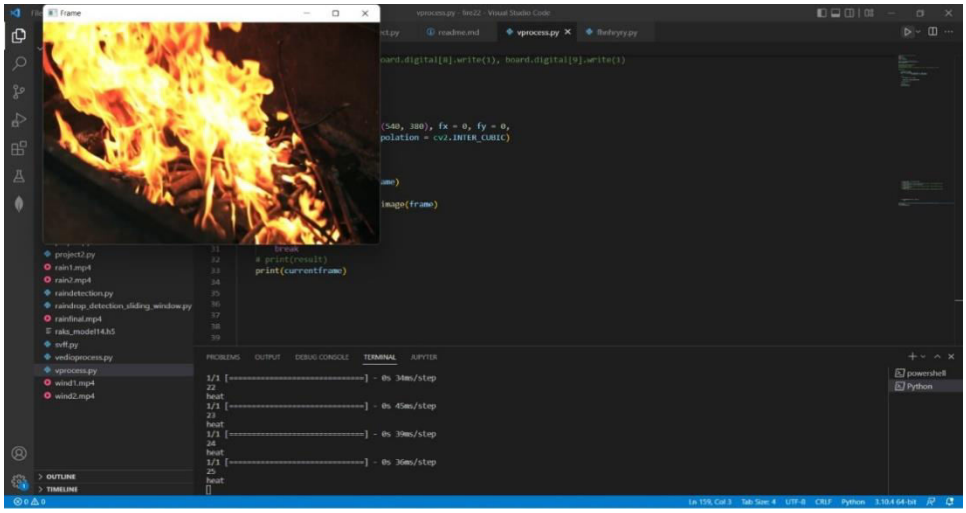

Fig. 3 Snapshot of fire detection

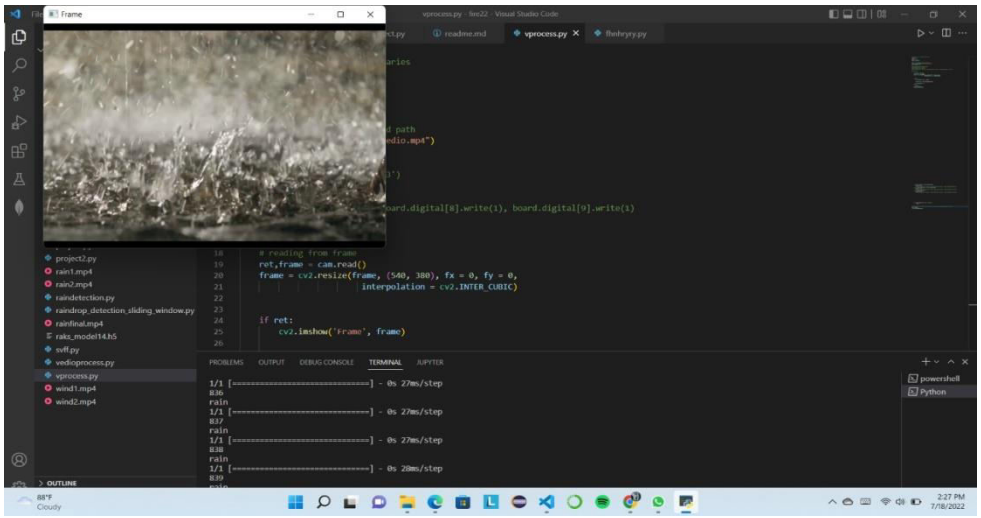

Fig. 4 Snapshot of water detection

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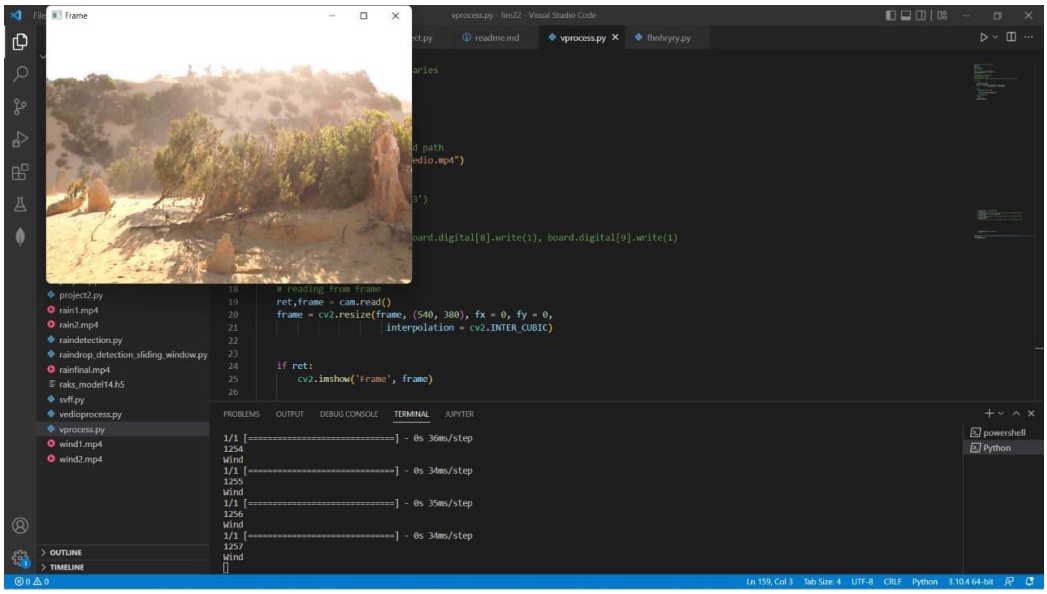

Fig. 5 Snapshot of wind detection

VI. CONCLUSION

According to estimates from the World Health Organization (WHO) Prevention of Blindness and Deafness Program: About 285 million people are visually impaired worldwide: 39 million are blind and 246 million have low vision (severe or moderate visual impairment.Modern societies are rapidly advancing their capabilities to support the visually disabled people and encouraging them to play more constructive roles. This project would help bring them a real world experience by giving them the actual view.Not only visually disabled people have benefits through this project,implementing this in film and gaming industry could bring a new experience to the people using them. This can be a different way to showcasing and experience the scenes we see in movies and videos.

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