Office Asset Tracker using Machine Learning

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Abstract—**Machine learning is a technology which has gained wide popularity in the field of computer vision. Machine learning has applications ranging from face recognition to the recent advancement in the self-driving cars. This paper proposes a methodology for detection of assets present in an office setup. The proposed system is mounted to one end of the table and has a mechanism which travels from one table to another in a row. This mechanism captures images at each table through Raspberry pi and detects the assets present in the image using machine learning.**

Keywords—Raspberry pi;OpenCV; Machinelearning

I. INTRODUCTION

Asset tracking is the process of keeping an eye on the various physical assets present in the company. In a well-established office setup various kind of assets like IT devices, tools, laboratory equipment's, printed circuit boards, etc. These assets are carried away by the employee to the table where they are working from the inventory. The employee often forgets to return the asset to the inventory immediately after its usage. It will be in the same place where it was last used by the employee. When another employee approaches the inventory, who is in need of the same asset has to either wait till the return of the asset or he can roam around searching for the asset. A certain amount of time is wasted while searching. If there are hundreds of tables, the amount of time wasted is still more.

Some of the assets used in the company are laboratory equipment. This equipment has costs ranging from several hundreds of rupees to crores of rupees. Sometimes this equipment is carried away from one lab to another in case of an urgent need. The presence or absence of the equipment has to be verified in such cases.

Machine learning is a technology wherein a machine learns by itself based on the experience. In machine learning computer programme is developed which accesses the data and learns the characteristics of the data by itself. This learning process does not need any kind of external programming by the programmer. The machine learns by itself with the images provided in order to make better predictions in future.

In the proposed method images are captured by using raspberry pi camera. The raspberry pi is programmed to capture the images using the PiCamera module whenever it stops at each table. These images are analyzed using a trained machine learning model which is trained using haar cascade classifier. With the aid of machine learning the presence or absence of the object inside the office can be verified and the time for searching of the object can be reduced

II. METHODOLOGY

The proposed methodology consists of two parts a station and the shuttle . Station is a stationary part which is fixed at the one end. Shuttle is the moving part which travels from one table to another table.Station consists of a motor controlled by a microcontroller with a belt and pulley attached to one end. Shuttle is attached to the belt connected to the motor. As the belt moves forward the shuttle moves forward , as the belt moves backward the shuttle moves backward.

Shuttle consists of Raspberry pi attached to the camera module. This shuttle stops at each table and captures the image of the space on the table. This image is given as input to the machine learning model. The Machine learning model is trained to identify the assets like Keyboards, Mouse, equipment etc.

Shuttle starts from the initial position and moves in the forward direction. When the center of the table is detected the shuttle stops and captures the image and stores in the raspberry pi. After the capturing of the image, the shuttle moves forward till the next table is detected. When another table is detected it stops and captures image and uploads to raspberry pi. When the shuttle reaches the end, it changes the direction and starts moving backwards., After reaching the initial position the shuttle stops.

The Machine learning model used for detecting objects is trained based on the haar cascade classifier in the OpenCV. Haar cascade classifier is popularly used classifier for face detection and object detetction.
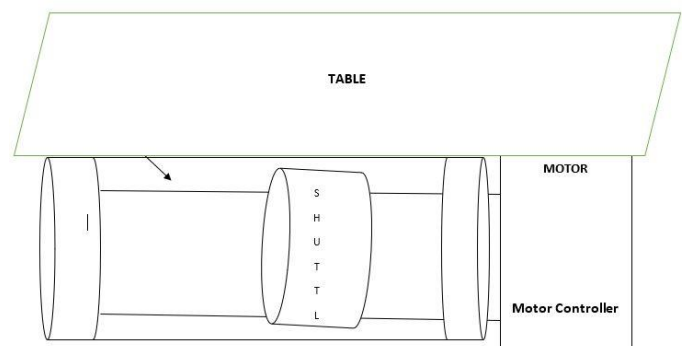

Figure 1 : Methodology of project.

III. MOTOR CONTROL

A stepper motor along with the stepper motor driver is placed in the station. This motor is connected to the belt through the pulley. To the one end of the belt shuttle is

attached. The shuttle starts moving from the initial position in the forward direction. This shuttle consists of hall effect sensor which stops the motor when a magnet is detected. The image is captured by raspberry pi camera and stored in the raspberry pi storage. After capturing the image, the motor again moves forward until the next table is detected. Again, when the table is detected the motor stops and captures the image. This process will continue until the end of the table is detected. When the end is detected the motor rotates in the reverse direction so that the shuttle travels backwards. Once the shuttle reaches the initial position again the motor stops. The sequence of operations performed are given in the flowchart below.
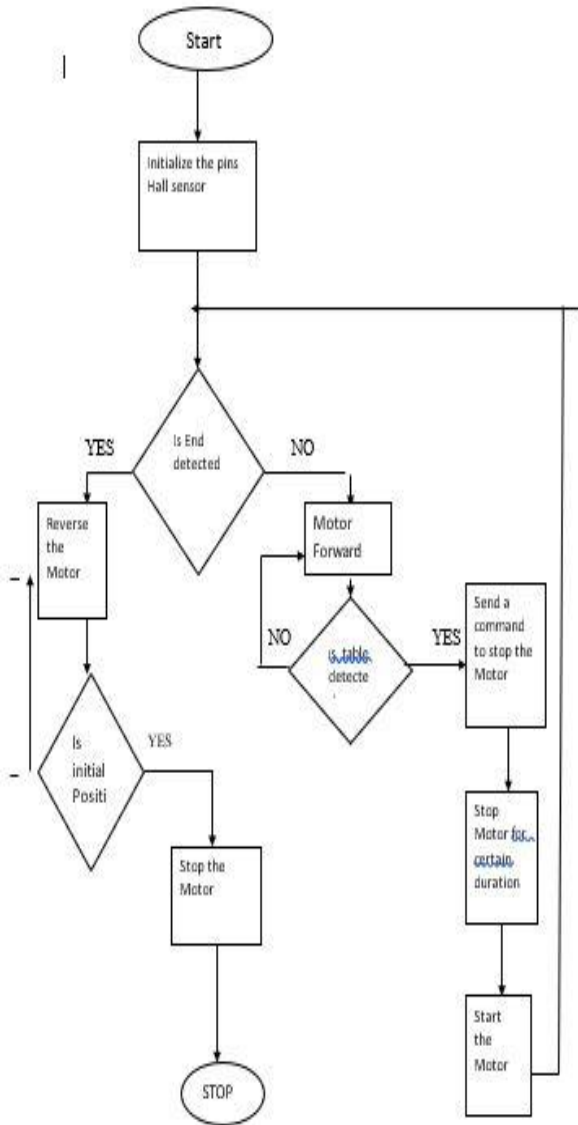
IV DEVELOPMENT OF MACHINE LEARNING MODEL

Machine learning is a technology which can be used in the field of computer vision for face detection, human detection, animal detection, vehicle detection etc. machine learning provides the ability to the machine to learn by itself without the need of external programmer. The machine learning model is trained with large datasets, in this case large number of images. As the number of images used for the training increases the accuracy of the model increases. The images used for training the model are called train images. The images used for testing the model are called test images.

OpenCV is a library which consists of various functions of computer vision and machine learning. This library has more than 2000 optimized algorithms for both performing image processing and machine learning applications. These algorithms are used for various applications like detection and recognition of faces, identification of objects, tracking of moving objects, classification of images, various image processing operations such as resizing of images, merging of the images, converting of the images from one background to another, padding etc.

Haar cascade classifier is a popularly used classifier for the detection of objects. This classifier is proposed by Paul Viola and Michael Jones. It is a machine learning algorithm which can be trained from lot of positive and negative images. After the training the classifier model will be generated and this model can be used for detecting the objects.

V. TRAINING HAAR CASCADE MODEL

Haar cascade classifier is trained for the detection of assets present in the office. An office setup has several hundreds of objects. For training each object for better accuracy the time required is more. For training the model to detect hundreds of objects the training of the model will take several months. In this project the model is trained to detect assets like computer keyboard and mouse. Several thousands of images of keyboards and mouse are collected for training the model to detect the assets . The training steps are discussed as follows.

i. Collection of 1500 images of different types and models of keyboards and mouse.
ii. Collection of 3000 negative images which does not contain keyboard and mouse
iii. Resizing and Filtering of the images
iv. Creating the text files bg.txt and info.dat which contains the information of all images with their names
v. Creating the vector file positives.vec which contains the information of all positive images along with their size and the number of objects in the image.
vi. Training the cascade with OpenCV commands with all the files till a good acceptance ratio is reached.
vii. Generation of classifier model in the form of XML file.

This XML file is the trained model which can be used for detection of assets.

VI RESULTS

The Machine learning model is fed with the images which are captured by the raspberry pi camera. These images contain the objects present on each table. The trained machine learning model will identify the objects which are present on the table. In this project the model is trained for detection of keyboard and mouse. The model detects the keyboard and mouse present in the image. With the proposed methodology it is possible to reduce the time for searching an object inside the office setup and also to know whether the asset is present or absent inside the office.
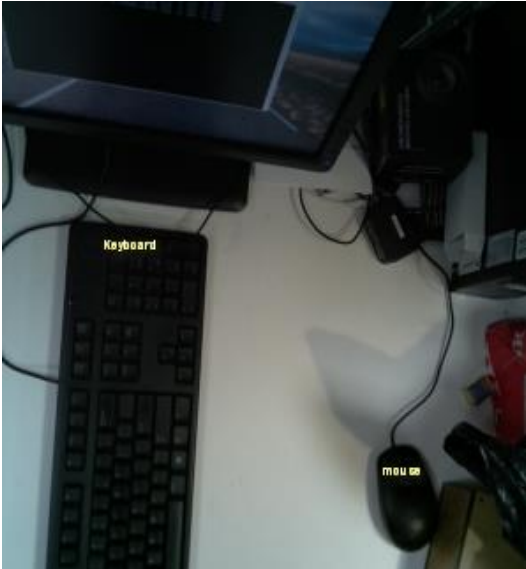
Figure 2: Result image

REFERENCES

[1] Mehul K Dabhi, Bhavana K Pancholi "Face detection System Based on Viola-jones Algorithm " IJSR

[2] Paul Viola , Michel Jones " Robust Real-time Object Detection ". Second International Workshop on statistical and computational vision-modeling, learning, computing and sampling.

[3] Ajeet Ram Pathak, Manjusha pandey,siddharth Rautaray "Application of Deep learning for object Detection" international conference on computational intelligence and Data science 2018

[4] Rajashree Tripathy , RN Daschoudhury " Real-time Face detection and Tracking using Haar classifier on SOC" International journal of electronics and computer science engineering Volume 3, Number 2

[5] Sander Soo "Object detection using Haar-cascade classifier"