Real-time Object Prediction by Collaboration of IOT and Deep Learning

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Abstract

Object detection or the prediction of the objects in the image form can be performed in tremendous ways as a general means. Here we are detecting the objects by the collaboration of the deep-learning along with the IOT technology, so that the predicting system or PC will be in one place and the capturing smart phones will be in some-other place, using IOT the auto capturing, and the detection of object along will label of name is achieved with one of the pre-trained neural networks in deep learning called Google net. So as to reduce the training time and the accurate prediction of the object can be obtained. The object detection is probability checked out or compared out between the prediction accuracy inside state and the other state. And the time taken for the prediction of the objects is also made into concern. In this paper the simple smart phones which can be available with everyone's hand the object detection is handled out in the real-time and predicted with the personal computer with the booming technologies.

Keywords
IOT, real-time, deep-learning, object detection and object prediction.

1. Introduction
Now a day, the most challenging and trending task is the object detection in collaboration of the hardware devices with the computer vision for the accurate prediction of the objects. As the object detection is in fact used in tremendous applications such as in retail, in the crop lands to predict the animals arrival, even in the houses for the security purposes etc, and the featuring advancement like the face detection , emotions prediction , vehicle number plate prediction, numbering of the persons in the crowd of people gathering, as the advancement of this the object detection is even in the autonomous vehicle technology for the safety drive of the driver , passengers as well as the pedestrians. As far as above said the importance of the object prediction pays a major role.

In the Existing System the object detection importance is given in the video surveillances using bounding box and horizontal boxes, by using of the IP camera for the real time prediction with more accuracy, by the inclusion of the hardware device Raspberry pi uses the pi camera in order to predict the real time objects in the fixed places etc., so the prediction of the objects whether in the normal means or the real time means the predictions are all carried out by the static PC or the hardware devices in the fixed means.in other wards we could say that the detection of objects and the prediction will be covered under the same less coverage area and the clarity and the accuracy of prediction process is somewhat less also.

Here considering this we experimented to predict the objects between inside and outside State. The objects are detected by means of using the Internet of things technology and using deep-learning technology with more accurate label and less time interval irrespective of the smart phone camera resolution and the distance.

1.1 Objectives

Connecting of smart phone Devices inside and outside state via internet with the trustee committee using IoT, Object detection with labels are predicted out by using Google-Net CNN. In order to predict and analysis the possible outcome by the fixed place PCs to the mobile mode smart phones in the real time world.

2. Literature Review

Kim et al. (2016) it deals with the emotions or sensations of the human beings. Here the implementation of this process takes place by means of Mat lab where the controlling part is coping up by the ATmega328P microcontroller. An eco-friendly acoustic transducer is feed in the object like door handle which senses the emotions and traces out the patterns and sends the signal to the cloud for detecting the every single person. Shet-Talathi K. and Khobragade, S. V (2017) the video input is taken as 30frames per second and by use of the state vector machine (SVM) the objects are detected via classification, particularly the abandoned objects are all found out automatically by the microcontroller, where in addition to the micro controlling unit is connected to the GPS and the alarm system. The setup is connected through the IOT pattern, the prediction of objects automatically and updating the location by means of GPS tracker and if any risky object like bomb then the alarm system will switch ON to give the warning to all, and as the location of the bomb is too easily traceable it could be easy to find out the bomb. The implementation of this process is carried out by means of Mat lab.

Aribas and Daglarli (2017) Here YOLO algorithm provides the higher sensitivity is used to predict the objects in the real time. The smart work is accomplished by connecting the hardware Raspberry pi to this computer vision algorithm in order to analyses the detection of objects simultaneously. The snapshot of the images is carried out by the bounding boxes and the prediction of the nearest objects continuously in the real time environment. The gain of the prediction is computed by the comparison of the 9, 17, 84 and 24-layer models. Y. Zhang et al. (2019) For detecting the objects in the intelligent vehicle, locally assembled binary HAAR is integrated with the particle swarm optimization algorithm and the support vector machine .In order to raise the real time object detection more effectively and accurately. The function of this classifier thus evaluated by means of False positive per window (FPPW) in LABH and the performance is compared by means of SVM and optimized by means of PSO.

Srinivasan and Azhaguramyaa (2019) Though there exist a lot of technologies and advancement for the object detection especially in the computer vision to help the visually impaired people in their daily activities, but as the internet is necessary for the detection or in least high battery consumption its not affordable to every blind people , in order to overcome this low battery consumption offline hardware set up of raspberry pi which is connected to the pi cameras and the stereo speaker and the commonly used or available 30 objects are available inside the house is recognized and speakers spells out the objects and labels it too which acts as a great substitute among rest of others to help visually impaired people. Bhave et al. (2019) In the traditional method of the traffic signaling, it fails to handle out the huge traffic so in the way to help it out the reinforcement technology, YOLO is used so that if the object i.e. the ,persons etc. detected means then the microcontroller which is connected to it will start counting and send it to the the cloud then huge traffic is cleared out by means of the turning green light and the red light will be switched on for the least count irrespective of the time schedule in real time, here COCO dataset is used to find out the efficiency of the prediction.

Chowdhury et al. (2020) In this, the cup and saucers of different colors are detected out among the various objects by means of cascade classifier called HAAR- a machine learning algorithm which makes use of the number of images of the same cup and saucers in order to train a classifier and the implementation of this algorithm is carried out by OpenCV to detect the other things and labeling . The testing is carried out by MATLAB and the accuracy prediction can be carried out by using Evaluation Board (EVB). Yang et al. (2020) The queue management of object detection (QMOD) is connected to the IP camera which captures the video footages via internet of things as send to the cloud, which converts the videos into ip packages and stored in the adaptive queue typically so other than the static queue size, makes the capturing as fast and comfort of video irrespective of the size. The computation of the Xavier, Jetson and Nano were verified and observed that latency has been observed between 80%-90% and implemented by means of python 3.7.

Fujitake and Sugimoto (2021) The UA-DETRAC dataset is used here which consists of a collection of sequence of 100 videos, 1.2 million vehicles and 140,000 frames for the real time object prediction from the surveillance video. The temporal feature enhancement network (TFEN) is used for the exact analysis and the prediction of the objects present on the edges of the frames. The input frame is feature extracted by means of CNN after that they are

encoded and sent to the temporal decoder and stored in the external memory for the review purpose after that the objects are detected by means of YOLO and the prediction will be more accurate when comparing to the ground truth method. Irrespective of the climate such as summer, winter and the spring seasons objects are predicted more reliable. P. Shi et al. (2021) The detection of the oriented object images by means of horizontal box results in lower accuracy so the angle classification which uses neural architecture search framework width feature pyramid network and RetinaNet which work over the main problem of the background effect problem and the overlapping of the box frames. The angular periodicity problem is thus eradicated by means of five parameter quadrilateral method for edge exchangeability. The boundary discontinuous problem is kicked out by means of IOU smooth. The efficiency of the dataset is validated by means of DOTA dataset.

3. Methods

In this real-time object prediction method there are two smart phones are used in two different zones of inside and outside state. This is clearly in the block diagram Figure 1. The very first testing process of the object detection is carried out region inside the state from the local area zone; the second detection spot is the region outside the state. The smart phones are connects over the internet i.e. Internet of things technology to the PC. These two smart phone region members are going to detect or sense the objects from their concern regions and those predicted object images are stored in the PC. The mediator between these IOT devices nodes of the smart phone devices and the PC is obviously the cloud.

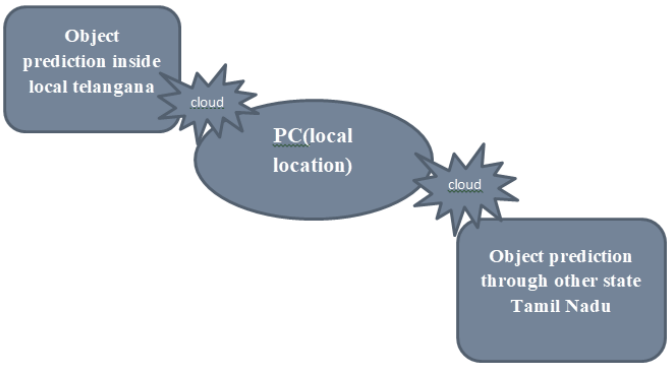

Figure 1 Block diagram (real time process)

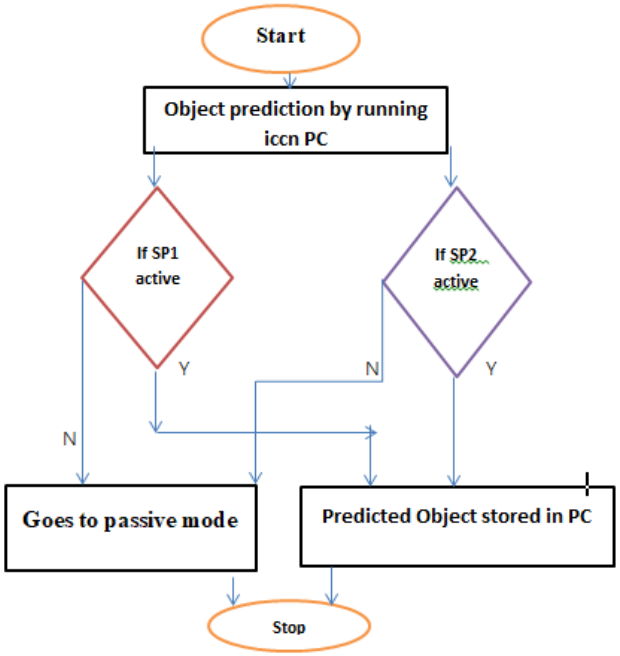

Figure 2. Flow chart of the object detection process

Figure 2. shows the flow of the object detection process in the real time environment. The prediction process is carried out by the PC personal computer which is connected to the two smart phones SP1 and SP2 in via cloud. if SP1 is going to detect the object from their corresponding zone then the concern phone is selected in the online Matlab program simulation tool and the code is executed to the run mode in the PC . And the predicted objects are stored in the PC. During the run time of any one of the smart phones in the two regions then the other smart phone is jumped in to the passive mode. And the device which detects the object whiling run time that device enters into active mode. Within the minimal interval of time the prediction takes place more accurately and speedily.

4. Results and Discussion

The object detection within the same local region via smart phone1 in the first zone is predicted successfully and the observed images with the accuracy with label of names are as follows,

The Figure 3 shows the objects which are all predicted in the local area with the smart phone 1 inside the state zone of the Telangana, here the category **a** and **b** objects are the backpacks predicted with a very good accuracy levels of 96% in the detection at the indoor and 93% in the detection at the outdoor levels with the perfect label though the background color is almost the same in the indoor image it differentiated the object backpack with the very high accuracy value, category of figure **c** thus detected as the ashcan as the structure is unique the object is present in the outdoor it came out with the very good accuracy level of 94%, category **d** is just predicts over the moped here the prediction accuracy value is 93% and the interesting thing here is that though at the low resolution and with the capture of the half view of the object it could able to detect the object with the correct label but with some of the wavering accuracy levels, category **e** shows the object motor scooter and its another type of the two wheeler and as because of the structure of prediction of the object is perfect with the accuracy level of 83% , category **f** shows the bicycle, and it is labeled with the detailed description of the object as the bicycle build for two wheeled like that and the accuracy value is 74% and it may be number of the structured bicycles are present as unicycle , mountain bike, gear type cycle, road bicycle, hybrid bicycle, folding type of cycle etc,. and the among those varieties it has been given with the perfect label a reasonable accuracy value.

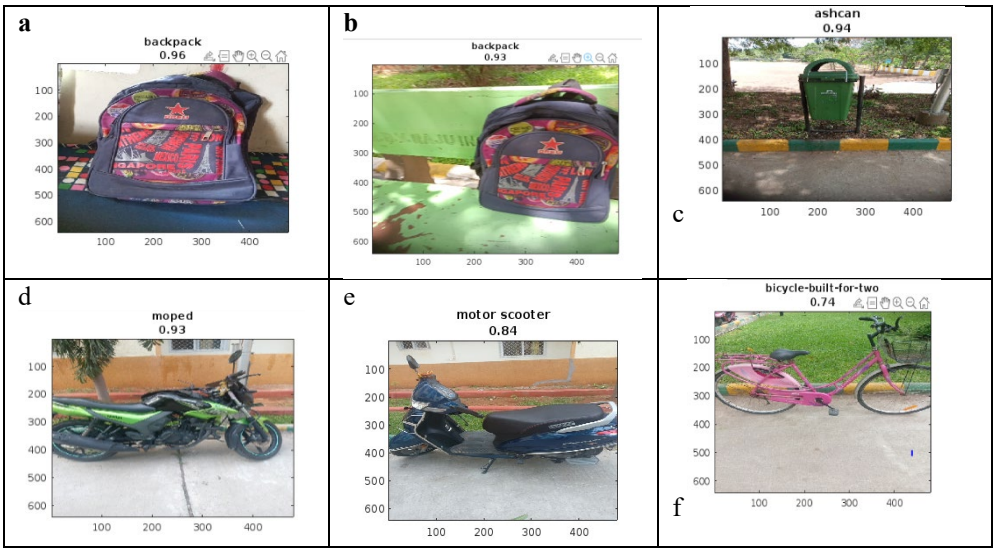

Figure 3. Objects detected from local area via SP1

The possibilities of detecting the object via the smart phones outside the state is handled out here.The object detection is performed in the Tamil Nadu state by sitting in the Telangana state in the real time. As the detection of the object started with success, the object detecting process commence with the small objects in the indoor so that analysis can be easily done about the accuracy and the perfect label.

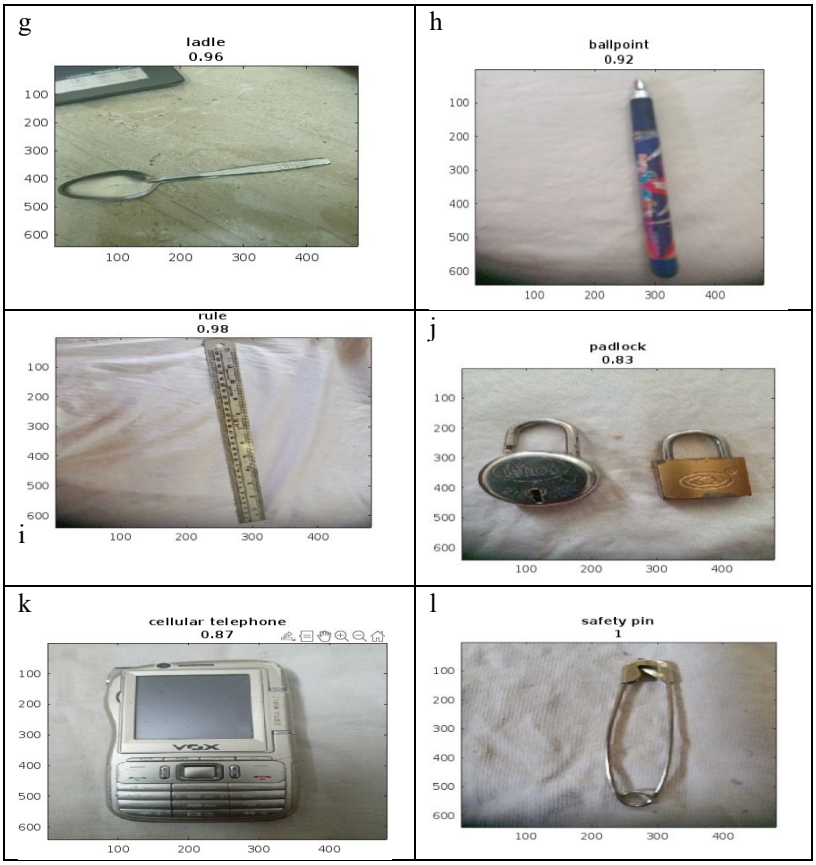

Figure 4. Object detection outside state via SP2 in indoor

Figure 4 shows the predicted objects outside the state zone in the indoor, where category **g** is detected as an object ladle with the accuracy prediction of 96% which is a huge I could say more or less the features of the ladle is resembles with the forks, spatula etc,. the label name is keen. The category **h** is a ballpoint in which stick, flute, pencils etc,. the accuracy value is 92% good. Category **i** is rule with the accuracy value as 98% almost full, though the measuring tape, inch tape are almost having the same structure based on the rigidity of the object it is find out perfectly, category **j** is a padlock with 83% prediction among the lock systems like deadbolts locks, leaver and even the knob locks, the label is perfect, category **k** is a cellular telephone of 87% based on the design and at the final category **l** with safety pin with complete 100% accuracy value, as it has the unique structure.

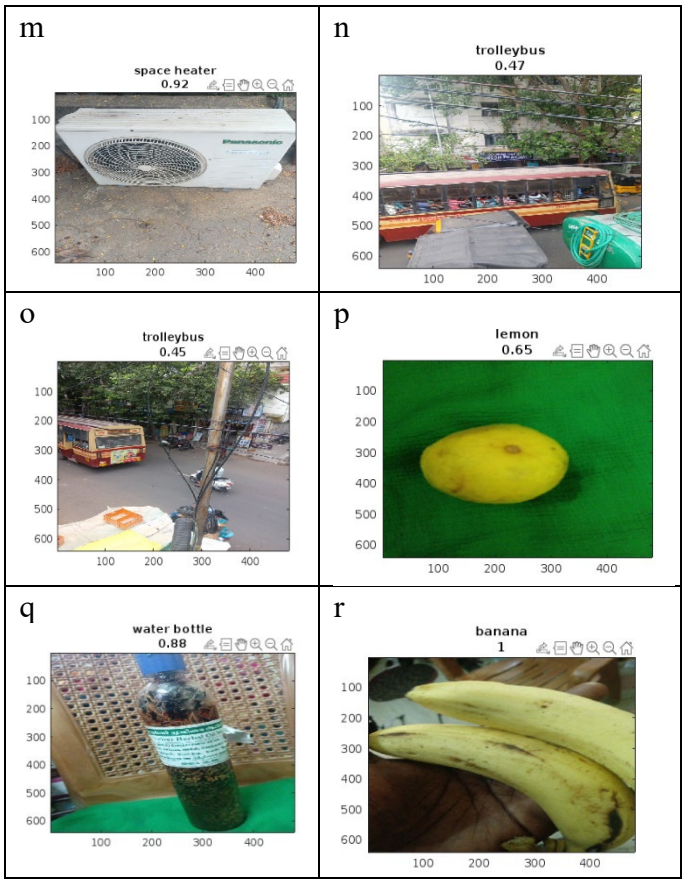

Figure 5. Object detection outside state via SP2 in outdoor

The Figure 5. Shows the category **m** with the object space heater with the accuracy as 92%, logically pretty cool label and even its true too. Then the category **n** and **o** with trolley bus with the average accuracy value of 47% this is because of the number of vehicles resembles like the same as we can see the back with its side view so the probability may be the street car, van, wagon etc,. but the label name is predicted good and the object too is in moving condition, the category **p** shows as a lemon with the 65% of the accuracy in which there are number of the same structured objects like tennis ball, ping pong ball etc were there but the prediction over reading out the perfect features of the lemon, the category **q** shows up the water bottle of the perfect probability prediction of 88% and the final category **r** is the banana, the accuracy percentage is 100% , however the detection of any fruits are keen and perfect while observing.

5.1 Numerical Results

The Table 1 consists of the detected objects with the maximum accuracy value from the local zone of our locations using the smart phone SP1.

Table 1. Accuracy of SP1

S.No	Detected object from SP1	Accuracy %
1	Backpack	96
2	Ashcan	94
3	Moped	93
4	Motor scoter	84
5	Bicycle	74

Here the smaller objects from far away location but outside the state, and the prediction is quite good in accuracy results, the accuracy of the objects detected through the SP2 is given in the Table 2.

Table 2. Detected objects with its accuracy via SP2 in indoor

S.No	Detected object in SP2	Accuracy %
1	Ladle	96
2	Ballpoint	92
3	Rule	98
4	Padlock	83
5	Cellular phone	87
6	Safety pin	100

Table 3 shows the prediction of objects with the maximum accuracy, the accuracy prediction is less for bus as it was in the motion and the pole is predicted among the nearer focus point rather than the other objects present in that image.

Table 3. Object detected in SP2 with accuracy in outdoor

S.No	Detected object From SP2	Accuracy %
1	Space heater	92
2	Trolly bus	47
3	Lemon	65
4	Water bottle	88
5	Banana	100

5.2 Graphical Results

Thus the graphical representation of the detected objects from both the states and the prediction accuracy in both the indoor and the outdoor are also given below.

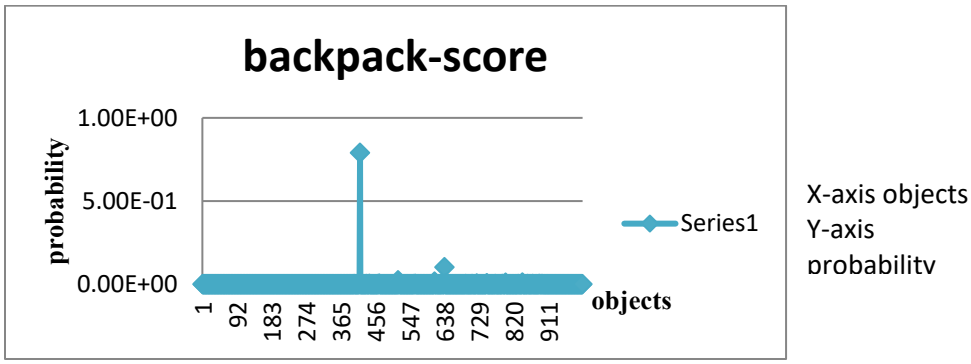

Figure 6. back bag-score from local area via SP1

The Figure 6. Shows the graphical outcome of the detected object backpack from the local region using the smart phone , where the x-axis represent the objects and y-axis represents the probability in which it helps to find out the accuracy values of the prediction

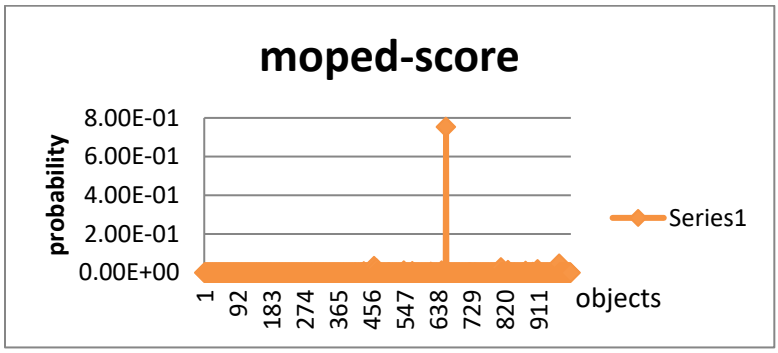

Figure 7. Moped-score from local area via SP1

The Figure 7. Shows the graphical representation of the object moped, where x-axis represents objects and the y-axis as usual the accuracy prediction through the probability of the outcome.

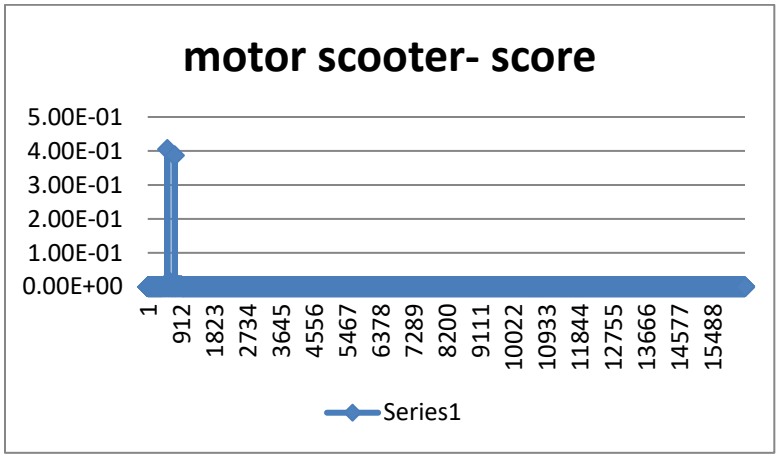

Figure 8. Objects detected from local area via SP1

The Figure 8. Shows the graphical representation of the object motor scooter which is detected from the local area.

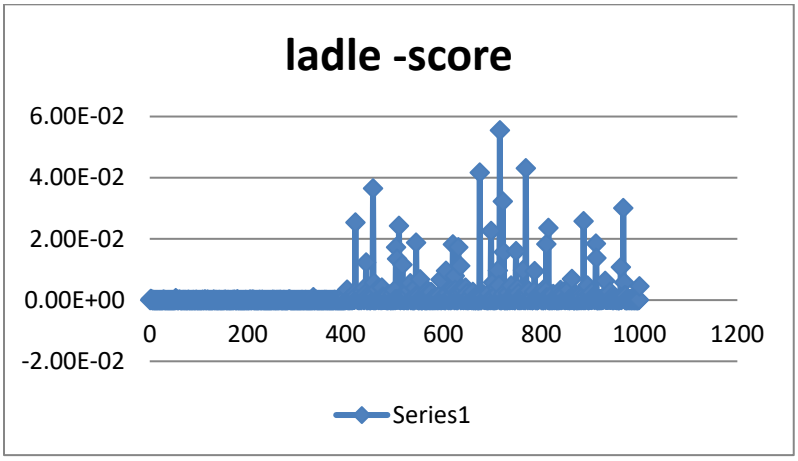

Figure 9. ladle-score via SP2 indoor

The Figure 9. Shows the graph of the perfect detection of the object ladle though there exist numerous objects as we can see that literally but prediction is great where its is taken from other state by sitting in one place.

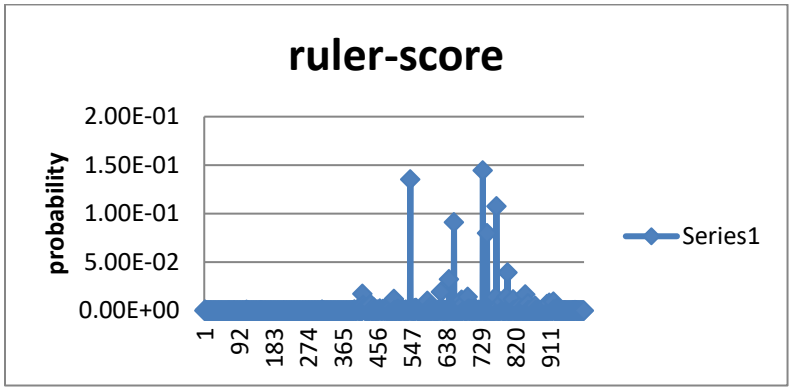

Figure 10. safety pin-score via SP2 indoor

The Figure 10. Shows the graphical plotting of the ruler with more same figures more or less but prediction is good. And the detecting objects are handled over by the indoor area.

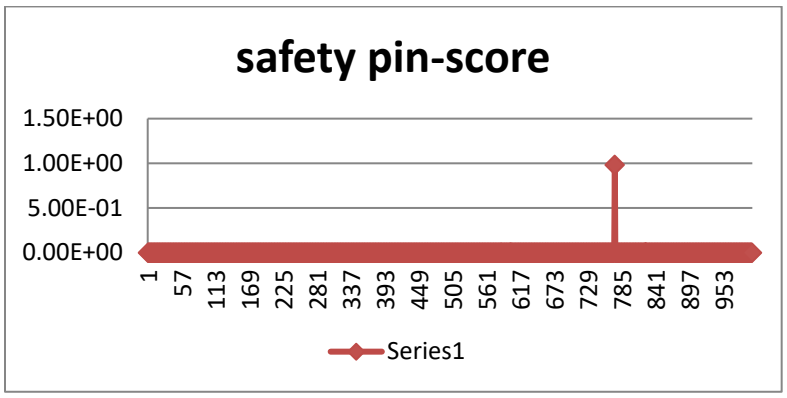

Figure 11. safety pin-score via SP2 indoor

The Figure 11. Shows the graphical form of the safety pin object and as the outfit is unique it complete success probability true prediction.

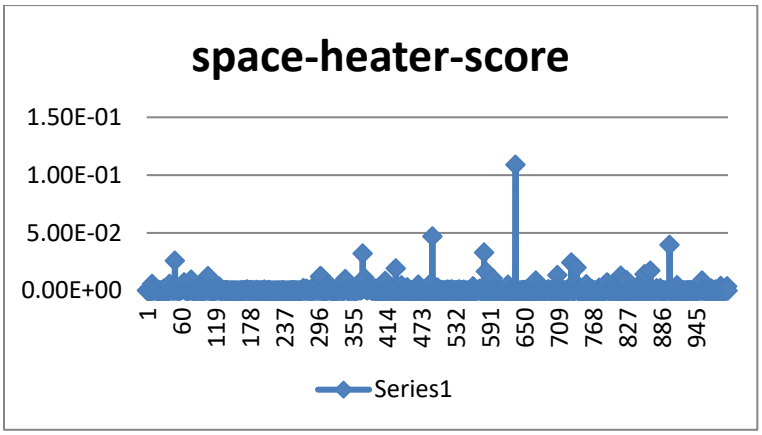

Figure 12. space heater-score via SP2 outdoor

The Figure 12. Shows the graphical flow of the object resemblance however more numbers are there the detection in the technical and the logical base is perfect.

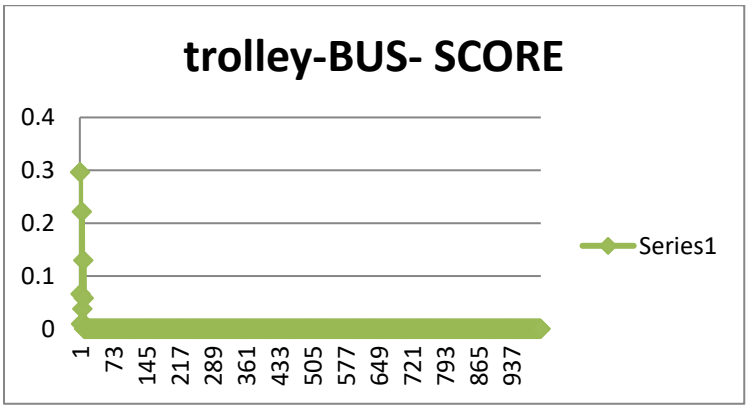

Figure 13. Trolley bus-score via SP2 outdoor

The Figure 13. Shows the graphical form of the trolley-Bus has more similar objects with a same line that we could able to see so the accuracy is less for this object.

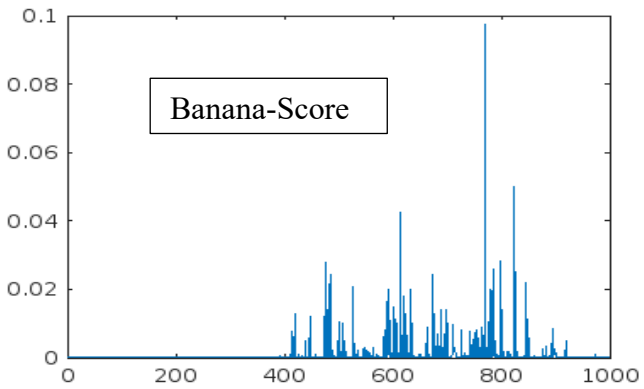

Figure 14. banana-score via SP2 outdoor

The Figure 14. Shows the graphical representation of the object Banana with complete full accuracy value though there exist a numerous number of extensions to indicate the similar things the prediction is fabulous.

5.3 Proposed Improvements

There is no need for the fixed hardware component to detect objects. The range of prediction is high and the memory storage of the objects is less as the object can be detected in the required time interval.

5.4 Validation

The validation of the detected objects from the two different zones is done by means of the effective and simple online Mat lab tool so that the score card and the and the object prediction in the real time is got out here.

6. Conclusion

Thus the prediction of the objects from one static area with the smart phone devices of different states are connected via cloud are predicted with a high accuracy in the high internet strength regions and the less accuracy is only because of the low internet strength only, rather than this the prediction time required all over the two zone is in minimum time of 10sec and maximum time of 12sec. so the experimentation of the prediction of the objects between the two states by sitting one place is successfully achieved. This general idea and the methodology of the object prediction could be applied for the applications of the object detection for specific tasks and the only drawback is the internet strength required is quiet good so that the probability of prediction and the accuracy results in high.

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Biography

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