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An Efficient Approach using Visual Display Matrix Computation for Smart Object Detection

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Abstract: ***This paper studies about the algorithm (VDMC) which enables the detection of multiple objects present in the image with smart learning capabilities. VDMC also have the capability to display result in the formatted GUIs and has audio based output. VDMC here is implemented on rover which helps us to get distant images in the processing environment implemented using Matlab.***

Keywords: VDMC; Visual Display Matrix Computation; Smart; object; GUI; audio; images

I. INTRODUCTION

In modern world object detection and recognition is used in military, space, automobile manufacturing industry, chemical industries etc, so there is a need of developing an efficient and smart algorithm for object detection and recognition. In this paper we are proposing this algorithm called VDMC which is efficient and smart to detect multiple object in single image and has ability to learn new objects parallel. VDCM uses BLOB analysis based SURF (Speed Up Robust Features) an faster implementation of SIFT (Shift Invariant Feature Transform) to identify the objects present in the image effectively and a smart learning method is used to improve VDCMs effectiveness and intelligence.

To demonstrate VDCM we have developed a simple rover which increases the mobility of the camera to get distinct and unreachable objects, the rover consists of simple motors and a microcontroller development board and an android powered wifi camera. Rover is wirelessly controlled via rf module which increase the flexibility of the rover. The rover consists of on board power supply with voltage regulators used for voltage conditioning.

This paper is organised as follows. Section II discuss of the method of getting distant object into the working environment. Section III discuss about the method used to detect the object present in the image and storing the results. The stored results are formatted to present them in GUI with audio which is discussed in Section IV. Section V discuss about the learning capability and database update for the new objects. Section VI discuss about the rover and its hardware components used for implementation. Section VII consists of generalised block diagrams. Finally conclusions are offered in Section VIII.

II. IMAGE ACQUISITION

This section talks about the method to obtain the image into the VDCM since VDCM is implemented in Matlab video input () function was utilised. Digital imaging or digital image acquisition is the creation of a digitally encoded representation of the visual characteristics of an object, such as a physical scene or the interior structure of an object. The first stage of any vision system is the image acquisition stage. After the image has been obtained, various methods of processing can be applied to the image to perform the many different vision tasks required today. The parameters of the camera i.e brightness frames per seconds were adjusted as per the requirements to increase the efficiency.

Fig 1. Snapshot of Image acquisition window

III. OBJECT PREDICTION

Once the image enters the predictor block VDCM uses Computer Vision System tool box and some of its functions to identify the objects in the image. This is done by comparing the images present in the database with the image obtained from the rovers on board camera; initially 1st image in the database (Y) is taken for the operation as seen in flowchart.

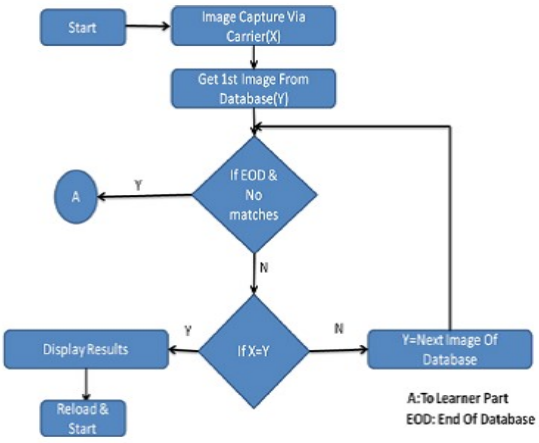

Fig 2. Flowchart of predictor part of VDCM

Later the predictor takes the next image from the database and continues the comparisons this is repeated until an end of database is reached, during this operation all positive results are stored in an array and negative once are rejected. The positive once are passed to result display part where in the result is formatted and displayed to the user.

IV. DISPLAY FORMATTED RESULTS USING GUI

After the completion of computation in the predictor, a part an array of results is passed to this function. The array is now filtered for duplicate entries and formatted with the distant image and detected objects with objects markers and names with different colours. If any of the objects in the image is missing, one can feed it, which takes VDCM to learner part.

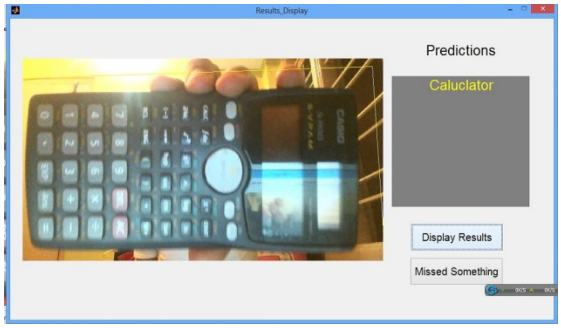

Fig 3. Snapshot of GUI window with formatted result.

V. SMART LEARNER

When the predictor part fails to identify the objects in the image the user can redirect the flow into the learner part. The Learner part asks the user to feed the name of the object into the database as shown in Fig.5.

Once the database has been updated with the new image in his case student id ,the user can now re run VDCM to identify the failed object once again as shown in Fig.6 and one can see predictor has successfully identified the object.

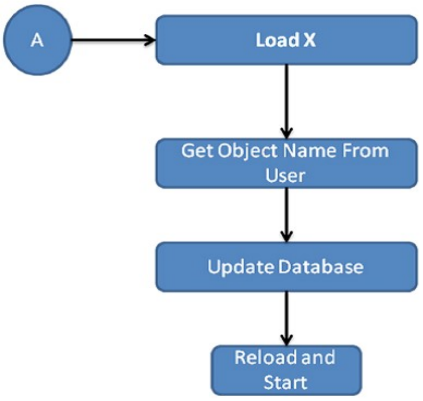

Fig 4. Flowchart of Smart Learner loop

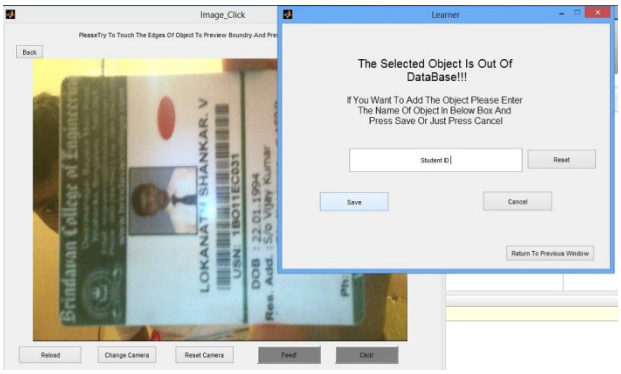

Fig 5. Snapshot of Smart Learner GUI

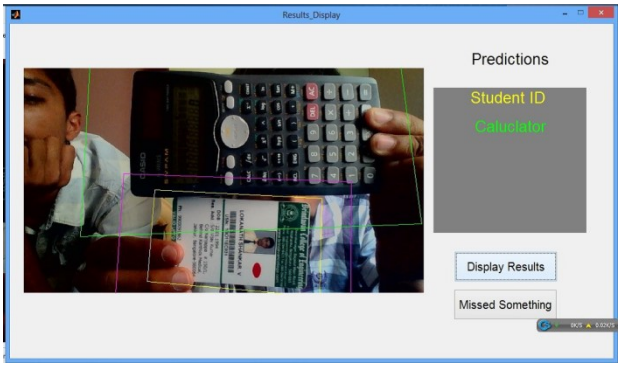

Fig 6. Snapshot of Multiple object detection with updated Item student ID

VI. HARDWARE

In order to increase the mobility of the camera we are using the basic rover model with all direction movement capabilities this rover is equipped with the following components:

a) **Arduino ATMEGA 2560**: is a AVR based development board which has Atmel 2560 8- Bit microcontroller 5V ,it consists of 256Kbytes flash 8Kbytes ram with powerful peripherals i.e timers , counters ,ADC ,JTAG , Touch support ,PWM ports ,SPI and Serial communication options.

b) **Geared Motors**: The rover is equipped with two 12V 45RPM, 4.5kg/cm torque geared motors which help the rover move around.

c) **Motor Drivers**: The rover is equipped with L293D dual H-Bridged drivers which are commanded via PWM ports to control motors in both directions.

d) **Voltage Regulator**: is used to step down the voltage to 5V to support the devices.

e) **Batteries**: used in this project are rated at 6V, 1.25Ahr. We have taken 3 of them for this.

f) **RF Modules**: used operate at 433 MHz, It consists of one transmitter at the pc side and on receiver at Rover Side.

g) **Camera**: We are using an android WIFI camera which uses a software called Epochal to transmit the live video feed into the matlab working environment and has a decent range

h) **Other accessories**: Chassis, Bread board, jumper's connecters, wheels and belts etc.

VII. BLOCK DIAGRAMS

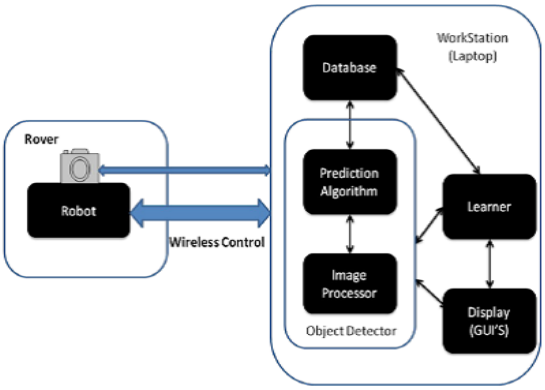

Fig 7. Block Diagram used for Software Implementation of VDCM in Matlab

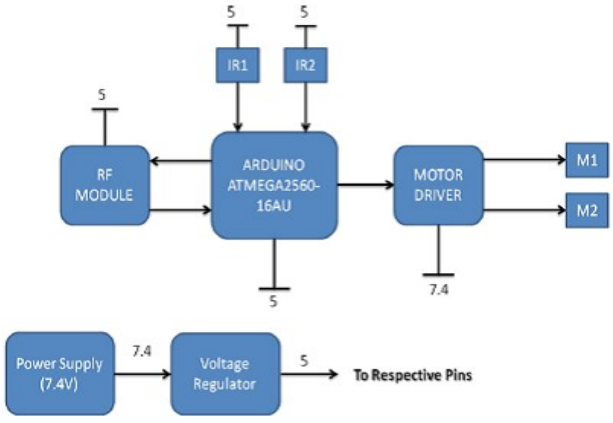

Fig 8. Block Diagram used for hardware side implementation

VIII. CONCLUSION

This paper discussed one of many possible methods to detect the object in the image in smart and efficient way with neat GUIs with confident output and can be used in many industrial applications such as military, space, automotive etc and can be improved over the fact that the recognition can be made real time with high end equipment's available in the modern world. The project can be improved by making the algorithm fully automatic without and user intervention and Audio based controls can be used control the whole setup and safety features can be added for enhanced controls i.e collision avoidance ,auto pilot etc.

REFERENCES

[1] Bay, H., A. Ess, T. Tuytelaars, and L. Van Gool. "SURF:Speeded Up Robust Features." Computer Vision and Image Understanding (CVIU).Vol. 110, No. 3, pp. 346–359, 2008.

[2] Muja, M. and D. G. Lowe."Fast Matching of Binary Features."Conference on Computer and Robot Vision. CRV 2012.

[3] Muja, M. and D. G. Lowe. "Fast Approximate Nearest Neighbors with Automatic Algorithm Configuration." International Conference on Computer Vision Theory and Applications.VISAPP, 2009.

[4] Hartley, R., and A. Zisserman, "Multiple View Geometry in Computer Vision," Cambridge University Press, 2003.

[5] Torr, P. H. S., and A. Zisserman, "MLESAC: A New Robust Estimator with Application to Estimating Image Geometry," Computer Vision and Image Understanding, 2000.

[6] Mathworks ,"Matlab Documentation",2016a.

[7] R. Hartley, A. Zisserman, Multiple View Geometry in Computer Vision, U.K., Cambridge:Cambridge Univ. Press, 2003.

[8] Y. Ma, S. Soatto, J. Kosecka, S. Sastry, An Invitation to 3D Vision From Images to Models, Germany, Berlin:Springer-Verlag, 2003.

[9] S. Joo, Q. Zheng, "A temporal variance-based moving target detector", Proc. IEEE Int. Workshop Perform. Eval. Track. Surveill. (PETS), 2005-Jan.

[10] K. Kim, L. S. Davis, "Multi-camera tracking and segmentation of occluded people on ground plane using search-guided particle filtering", Proc. Eur. Conf. Comput. Vision, vol. 3, pp. 98-109, 2006.

[11] S. M. Khan, M. Shah, "A multi-view approach to tracking people in crowded scenes using a planar homography constraint", Proc. Eur. Conf. Comput. Vision, vol. 4, pp. 133-146, 2006.

[12] T. J. Broida, S. Chandrashekhar, R. Chellappa, "Recursive techniques for the estimation of 3-d translation and rotation parameters from noisy image sequences", IEEE Trans. Aerosp. Electron. Syst., vol. 26, pp. 639-656, 1990.

[13] W. Hu, T. Tan, L. Wang, S. Maybank, "A survey on visual surveillance of object motion and behaviors", IEEE Trans. Syst. Man Cybern. C Appl. Rev., vol. 34, no. 3, pp. 334-352, 2004.

[14] Q. Delamarre, O. Faugeras, "3D articulated models and multi-view tracking with silhouettes", Proc. ICCV, vol. 99, pp. 716-721, 1999.

[15] K. Kanatani, Statistical Optimization for Geometric Computation: Theory and Practice, New York:Elsevier Science, 1996.

[16] G. Aggarwal, A. K. R. Chowdhury, R. Chellappa, "A system identification approach for video-based face recognition", Proc. 17th Int. Conf. Pattern Recognit. (ICPR 2004), vol. 4, 2004.

[17] P. N. Belhumeur, J. P. Hespanha, D. J. Kriegman, "Eigenfaces vs. Fisherfaces: Recognition using class specific linear projection", IEEE Trans. Pattern Anal. Mach. Intell., vol. 19, no. 7, pp. 711-720, 1997.

[18] L. Xiao, S. Boyd, S. J. Kim, "Distributed average consensus with least-mean-square deviation", J. Parallel Distrib. Comput., vol. 67, no. 1, pp. 33-46, 208.