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A novel approach for animal recognition by using various recognition methods based on enhanced hybrid classifier technique

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ABSTRACT

Crops are vulnerable to wild animals. Therefore, it is very important to monitor the nearby presence of animals. Then the actuation of various devices should follow to repel the hazardous animals. Traditional methods have been widely applied depending on the kinds of produce and imperiling animals. In this paper, we propose a method to protect farms from wild animals via ubiquitous wired network devices, which is applied to farm along with traditional methods to improve the protection performance. Operational amplifier circuits are utilized mainly for the detection of animal intrusion from the outside of farms. The proposed monitoring scheme is to provide an early warning about possible intrusion and damage by wild animals. The performances of image recognition methods such as Principal Component Analysis (PCA), Linear Discriminant Analysis (LDA) and Local Binary Patterns Histograms (LBPH) are tested and compared for the image recognition of the input animal images. The main idea of this paper is to present an independent, comparative study and some of the benefits and drawbacks of these most popular image recognition methods. Two sets of experiments are conducted for relative performance evaluations. In the first part of our experiments, the recognition accuracy of PCA, LDA, HoG and LBPH is demonstrated. Further, a method for combining the classifier into the Minimum Distance Classifier (i.e., Cascade classifier) is done which statistically guarantees the background extraction and pictures only the object of interest. The proposed system is tested with animal database and if the wild animals are detected, then the Alerted by Buzzer.

Keywords: Animal recognition, Image recognition method, PCA, LDA, HOG, LBPH.

INTRODUCTION

The enormous increase in human population in Asian countries like India propelled by agricultural and industrial growth has led to the conversion of forest land into human settlements. Due to this, the wild animals face an acute shortage of water and food. Further, wildlife is greatly affected due to deforestation forcing them to move into the human habitats [1]. It creates great loss to property and life when wild animals enter cities. In Times of India it has been reported that over 1300 people died due to tiger and elephant attacks in India in past three years. From 1979 through 1990, there are 1882 animal related deaths in United States. Thus, humans face a grave danger especially because of elephants, tigers and monkeys and the time to recover from the major loss is negligible. Human - Animal Interaction can prove dangerous for both the species and therefore, there is a need for an intelligent surveillance and alert system. Countering to the problem this paper focuses on algorithm to detect the presence of animals in areas having high human intervention. The approach focuses on detecting animals with the aid of an aid of intelligent image algorithm process and sending warning messages using the GSM. The key platform that is used here is the Microcontroller. The Microcontroller is a sequence of credit card–sized single-board computers established in United

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Kingdom by the Microcontroller Foundation. The Microcontroller is a widespread platform. The position of the animal once detected is tracked in order to calculate the distance of animals with areas having high human interference [2]. At present, all camera-based studies of wildlife are manual but here a highly intelligent system is used were in the messages are sent instantly without the aid of humans. Ojala at al. [5] introduced a very efficient multi resolution approach to gray scale and rotation invariant texture classification based on local binary patterns. In [6], the authors proposed a novel rotation invariant Local Binary Pattern Histogram Fourier features (LBP-HF) image descriptor based on a uniform Local Binary Patterns. The very important properties of features are tolerance against illumination changes.

The main goal of this paper is to present an independent, comparative study of three most popular image recognition algorithms in completely equal working conditions. They are: Principal Component Analysis (PCA), Linear Discriminant Analysis (LDA) and Local Binary Patterns Histograms (LBPH). Comparison will be done using the created animal dataset. The created dataset contains images of 5 different classes of different animals (bear, hog, deer, fox and wolf). Each class consists of 60 different images.

LITERATURE SURVEY

An electric fence were used as barrier to protect a farm from wild animals. An electric fence were first used in Texas 1888. Electricity from a generator using an wheel was to charge top two wires of four wire fence [1]. Often solar-powered, such fences were used extensively in the Panhandle to prevent cattle from wandering onto farmlands [2]. One major disadvantage of an electric fence is that it might slow down emergency services from reaching you. This might even result in help reaching you after it is too late. There is a possibility of electric fences posing the risk of fire when bushes or trees grow in close proximity. Hence, it is important to keep the area near the fence cleared of any such vegetation. It will also have to ensure that the grounding has been done properly. Failure to do so might render the electric fence ineffective. In this case there will be loss of animal life and it is very dangerous to human being also. It will be too much expensive for farmers [1, 3].

Animal detection and prevention of human-animal collision is a newly addressed problem in the field of Computer Vision. XiaoyuanYu in his paper proposed a detection process where he made use of the SIFT and the cell-structured LBP (cLBP) as the local features. An average classification accuracy of 82%was obtained [1] .R. K. Vigneshwar, R.Maheswari developed a perfect model for a real time interaction of elephant intrusion in forest border areas by making use of IoT and Raspberry pi [2].

Matthias Zeppelzauer and AngelaS.Stoegaer proposed a model to detect the elephants with the help of the sound produced by the elephants. Elephants make extensive use of powerful low-frequency vocalizations termed “rumbles” (10Hz-30Hz) [3]. IshaDua, PushkarShukla, Ankush Mittal extracted a regions with higher human movements from the initial video frames. This process is followed by detecting motion in the video frame with the help of PHOG features and Support Vector Machines (SVM) classifiers. An overall accuracy of 85.29% was attained when static images containing elephants and other objects were classified. The drawback is PHOG feature is used for the extraction of global features [4]. Burghardt and Calic made use of Haar like features along with Ada Boost classifiers to detect Lion faces [6]. Mammeri et al have proposed an Elephant Image Detection System (EIDS) identify elephants in an image. The technique makes use of Haar features to detect elephants in an Image.

The system achieved an overall accuracy of 83% [7].Matuska et al proposed an Automatic System For Animal Recognition (ASFAR) making use of Bag of Visual Words for animal detection. SIFT and SURF features of the image were used as key point detectors [8]. A variety of systems apart from cameras have been used for detecting animals. A Large Animal Warning Detection System (LAWDS) making use of 360 degree radar was proposed by Mukherjee et al .method in which the wildlife detection was based on the PHOG features and SVM classifier [9]. . Dan Valente, Haibin Wang, Peter Andrews, and Partha P. Mitra had idea to detect animals based on tracking

algorithm. Smoothing and segmentation techniques were used in the detection of the wild animals inside the forest [10].

PROPOSED METHODOLOGY

The main goal is to present an independent, comparative study of three most popular image recognition algorithms in completely equal working conditions. They are:

1. Principal Component Analysis (PCA),
2. Linear Discriminant Analysis (LDA)
3. Histogram of Gradient (HoG) and
4. Local Binary Patterns Histograms (LBPH).

Comparison will be done using the created animal dataset. The created dataset contains images of 5 different classes of different animals (bear, deer, fox and wolf).To identify defected fruits using Image Processing , PCA, LDA, HoG, LBPH Features extraction, and Enhanced hybrid classifier. To generate more accurate results. To minimize the computational time to get an output from the system. The procedure of the image recognition system is as follows. First, features of images are extracted. Second, the classifier is trained on training set of images and models for classes are generated. Finally, these classifications models will be used to predict test images. Common transform methods are listed in the middle column of Fig. 1 (PCA, LDA, HOG and LBPH).

Block diagram for Animal Detection

Pre-processing is a common name for operations with images at the lowest level of abstraction both input and output are intensity The aim of pre-processing is an improvement of the image dataoimages. That suppresses unwanted distortions or enhances some image features important for further processing. Four categories of image pre-processing methods according to the size of the pixel neighborhood that is used for the calculation of new pixel geometric, pixel brightness transformations, brightness: pre-processing methods that use local neighborhood transformations, image restoration that requires knowledge of the processed pixel, and other classifications of image pre-processingoabout the entire image methods exist.

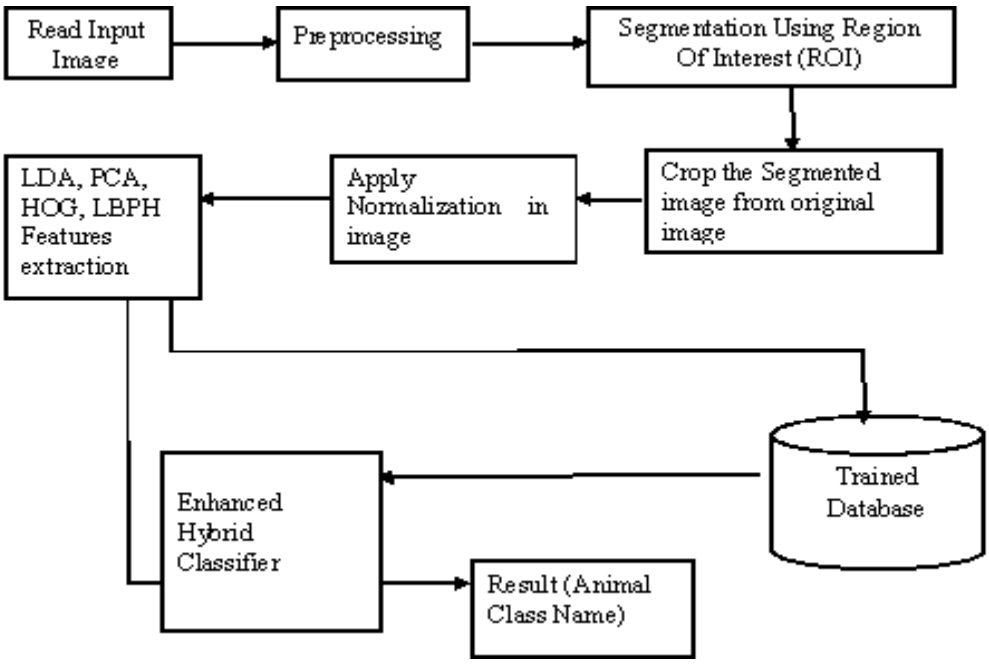


Fig.1 Animal Detection

Principal Component Analysis

The Principal Component Analysis (PCA) uses the idea of representing a vector as a weighted sum of basis vectors. The number of dimensions is equal to number of pixels in the image. The set of training images form a cluster in the high dimensional space. The directions corresponding to maximum data variations are the eigenvectors of the covariance matrix for the cluster [7].

Linear Discriminant Analysis

The Linear Discriminant Analysis (LDA) approaches typically include two phases: training phase and classification phase. LDA is a widely used method for feature extraction and dimensionality reduction in pattern recognition. LDA tries to find the “best” project direction in which training samples belonging to different classes are best separated. In the training phase, the Fisher space is established from the training samples using LDA and the training images are mapped to the fisher space for classification.

Implementation steps for LDA

All the images in the database are loaded. The images are partitioned into training images and testing images. The training image feature vectors are computed using LDA feature extraction and then a subspace is created using training data. The computed training and test image feature vectors are matched using cosine distance. Then results are evaluated and performance metrics are presented.

LBP Approach to Animal Analysis

The Local Binary Pattern (LBP) is a simple and efficient operator that is used to obtain features which are used for classification in computer vision. The two most important properties of LBP features are its tolerance against illumination variations and also its computational simplicity. The image is equally divided into blocks (e.g. 3x3 block for each input image) with aim to extract the LBP histogram from each block. For each pixel in a block, compare the pixel to each of its 8 neighbors (on its left-top, left-middle, left-bottom, right-top, etc.). Follow the pixels along a circle, i.e. clockwise. Where the center pixel's value is greater than the neighbor’s value, write "1". Otherwise, write "0". This gives an 8-digit binary number (this number is usually converted to decimal system).In mathematical terms, recognition of images using PCA takes three basic steps. The covariance matrix is first created using the training images. Next, the eigenvectors and corresponding eigenvalues are computed. Finally, the test images are identified by projecting these into the subspace and comparing them with the trained images in the subspace domain [8]. LBP features are gray scale and rotation invariant texture operator. LBP feature extraction is faster than any other feature extraction method and it provides good performance make this most researched features.

Hybrid Machine Learning Methods

Supervised learning is the machine learning task of inferring a function from supervised training data. This function is called a classifier; with other words, the supervised learning problem is to find an approximation to unknown function given a set of previously labeled examples. Different methods explore different hypothesis spaces, use different search strategies and are appropriate for different types of problems. The training data consist of a set of training examples. In supervised learning, each example is a pair consisting of an input object (typically a vector) and a desired output value (also called the supervisory signal). A supervised learning algorithm analyzes the training data and produces an inferred function, which is called a classifier (if the output is discrete, so we deal with classification) or a regression function (if the output is continuous, so it is a regression). The inferred function should predict the correct output value.

Proposed System Block Diagram

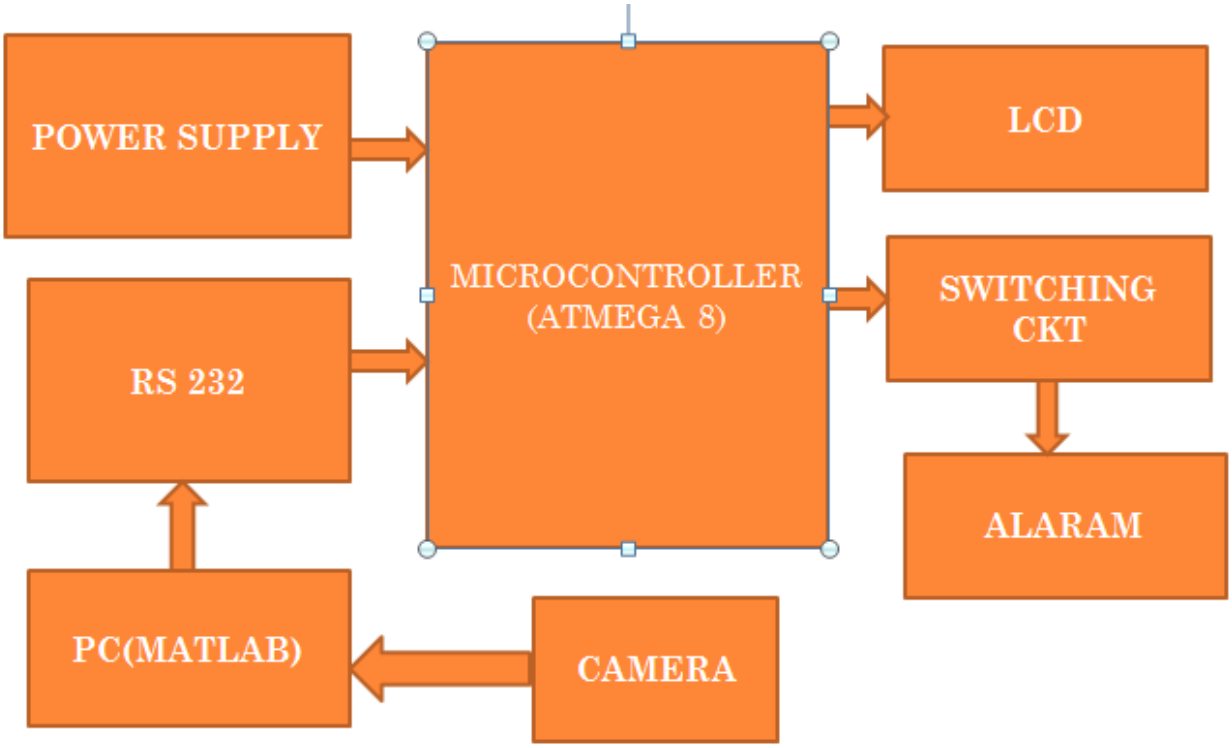
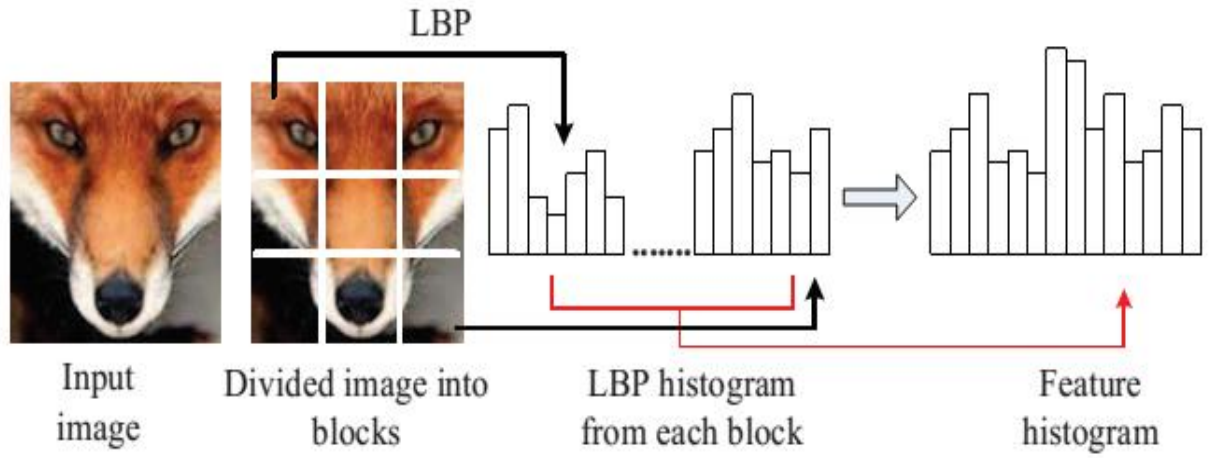


Fig.2 project block diagram

EXPERIMENTAL RESULTS

In the case of the 3x3 block, there are 8 neighborhood pixels, it is total of 27 (128) different labels. Histogram of these labels is then used as a texture descriptor. The example of LBP is performed on 3x3 block, where the LBP image and histogram is obtained from the original image



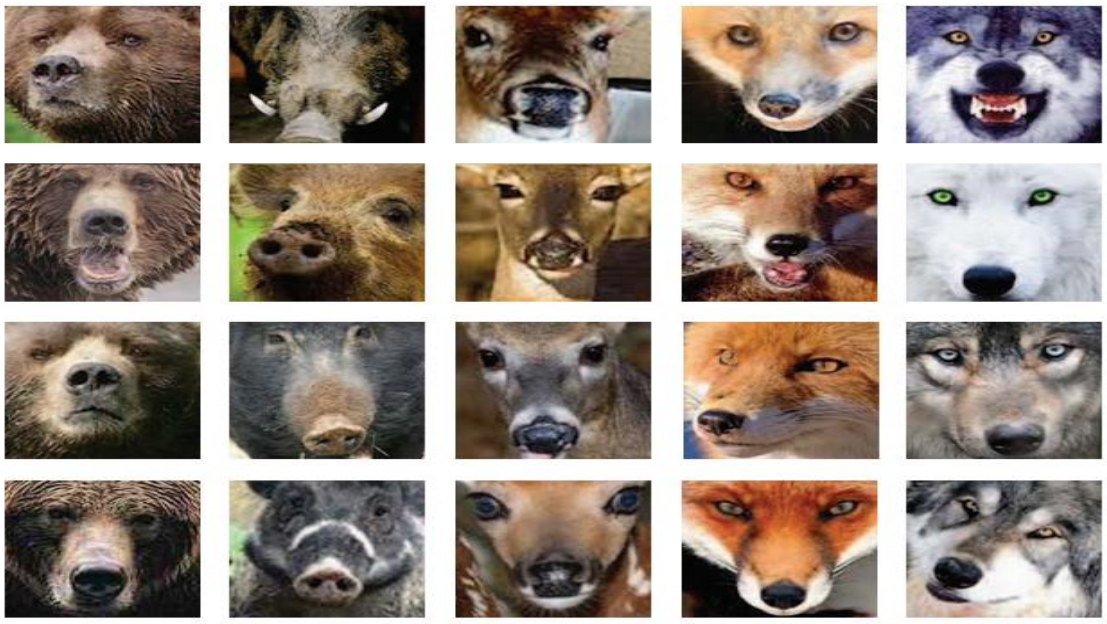


Fig.3 LBF Results

The LBP feature vector can be created in the following manner:

- The image is equally divided into blocks (e.g. 3x3 block for each input image) with aim to extract the LBP histogram from each block.
- For each pixel in a block, compare the pixel to each of its 8 neighbors (on its left-top, left-middle, left bottom, right-top, etc.). Follow the pixels along a circle, i.e. clockwise.
- Where the center pixel's value is greater than the neighbor's value, write "1". Otherwise, write "0". This gives an 8-digit binary number (this number is usually converted to decimal system).
- LBP feature extraction is performed on an input image (fox) and the resulting features are shown in Fig. 6 along with the feature histogram. To increase the feature strength and to get more details, the input images are divided into number of blocks (in our case to 3x3 block).

CONCLUSION

The paper presents an image recognition approach using the PCA, LDA and LBPH. These methods are very popular feature extraction techniques for image recognition. We have introduced a feature extraction technique from input images, which have been evaluated on created animal database. A comparative performance analysis of these three techniques was conducted. The performances were obtained using different number of training images and test images. The obtained experimental results of the performed experiments show that LBPH methods give best recognition rate (above 88%) for small test dataset (*A* – 1:59). On the other hand, increasing the number of test images and decreasing the number of training images (*F* – 50:10) has a great impact on PCA, LDA and LBPH, the performance decreases. In the future work, we plan to perform experiments and also tests of more complex algorithms with aim to compare the presented approaches (PCA, LDA and LBPH) with other existing algorithms and other combination. We are also planning to investigate reliability of the presented methods by involving larger databases of animal images.

REFERNCES

[1]. E. Kussul, T. Baidyk, D. Wunsch, O. Makeyev, "Image Recognition Systems Based on Random Local Descriptors", International Joint Conference on Neural Networks (IJCNN '06), IEEE, 2006, 2415-2420, ISBN 0-7803-9490-9.

[2]. L. W. Kang, H. Chao-Yung, Ch. Hung-Wei, L. Chun-Shien, "Secure SIFT-based sparse representation for image copy detection and recognition", 2010 IEEE International Conference on Multimedia and Expo (ICME), 2010, 1248-1253, ISBN 978-1-4244-7491-2.

[3]. P. N. Belhumeur, J. P. Hespanha, D. J. Kriegman, "Eigenfaces vs. Fisherfaces: Recognition Using Class Specific Linear Projection", IEEE Trans Pattern Analysis and Machine Intelligence, 19(7), 1997, 711- 720, Cambridge, UK, 45-58.

[4]. K. Delac, M. Grgic, S. Grgic, "Independent Comparative Study of PCA, ICA, and LDA on the FERET Data Set", International Journal of Imaging Systems and Technology, 15(5), 2002, 252-260.

[5]. T. Ojala, M. Pietikainen, T. Maenpaa, "Multiresolution Gray Scale and Rotation Invariant Texture Classification with Local Binary Patterns", IEEE Transactions on Pattern Analysis and Machine Intelligence, 24(7), 2002, 971–987.

[6]. T. Ahonen, J. Matas, Ch. He, M. Pietikainen, "Rotation Invariant Image Description with Local Binary Pattern Histogram Fourier Features", Springer-Verlag Berlin Heidelberg, A.-B. Salberg, J.Y. Hardeberg, and R. Jenssen (Eds.): SCIA 2009, LNCS 5575, 2009, 61–70.

[7]. H. M. Ebied, "Feature extraction using PCA and Kernel-PCA for face recognition", 8th International Conference on Informatics and Systems (INFOS), 72-77, ISBN 978(1), 2012, 4673-0828-1.

[8]. F. Ye, Z. Shi, Z. Shi, "A Comparative Study of PCA, LDA and Kernel LDA for Image Classification", International Symposium on Ubiquitous Virtual Reality (ISUVR), 2009, 51-54, ISBN 978-1-4244-4437-3.

[9]. K. Meena, A. Suruliandi, "Local binary patterns and its variants for face recognition", International Conference on Recent Trends in Information Technology (ICRTIT), 2011, 782-786, ISBN 978-1-4577-0588-5.

[10]. C. Shan, S. Gong, P. W. McOwan, "Facial expression recognition based on Local Binary Patterns: A comprehensive study", Image and Vision Computing, 27, 2009, 803-816, 5/4/.

[11]. M. Heikkila, M. Pietikainen, C. Schmid, "Description of interest regions with local binary patterns", Pattern Recognition, 42, 2009, 425-436, 3.

[12]. C. Shan, T. Gritti, "Learning discriminative lbp-histogram bins for facial expression recognition", In Proceedings of the British Machine Vision Conference 2008.

[13]. Lih-Heng Chan, Sh-Hussain Salleh, Chee-Ming Ting, "Face Biometrics Based on Principal Component Analysis and Linear Discriminant Analysis", Journal of Computer Science 6(7), 2010, 693-699, ISSN 1549-3636.

[14]. Kenneth, A. The 8051 Microcontroller, West publishing Company, St Paul, USA 1991.

[15]. Krishna, K. Microprocessors and Microcontrollers: Architecture Programming And System Design PHI Learning Pvt. Ltd., 2007 ISBN 81, 2007, 203- 3191-5.

[16]. Luo, R.C., Min-Hsiung, Chou, Y.T., Liao, C.T., & Lai, C.C. (2007). An Intelligent Security Robot System; Industrial Electronics Society, 2007. IECON 2007, 33rd Annual Conference of the IEEE. 2007, 5-8.

[17]. McCarthy, C.K. Vehicle compartment occupancy detection system: US 6768420, B2USPTO, USPTO Assignment, Espacenet 2004.

[18]. Michael, B. (2007). Embedded Systems Glossary. Neutrino Technical Library. Retrieved 04, 2007, 21

[19]. Michael, B. & Anthony, J. M. Introduction Programming embedded systems: With C and GNU development tools. O'Reilly. 2006, 1–2. ISBN 978-0-596- 00983-0

[20]. Microchip Technology, Inc. (2007), PIC18F1220/1320 Data Sheet, retrieved 04, 2012, 02

[21]. MOSDATA, (1976). General Instrument, 1976 Data book.

[22]. Oludele, A., Ayodele, O., Oladele, O., &Olurotimi, S. Design of an Automated Intrusion Detection System incorporating an Alarm: Journal of Computing, 1(1), 2009, ISSN: 2151-9617.