International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075 (Online), Volume-11 Issue-9, August 2022

Server Room Monitoring System using CCTV

Mahesh Subray Hegde, Ramakanth Kumar P

Abstract: ***Server Room is the main part when it comes to any organization since any malicious activity in the server room may bring down the whole server room bringing the work of organization to halt. Hence, we need a server room monitoring system which works on real time images and monitors using compressed circuit television (CCTV). The framework used for server room monitoring is YOLO (You Only look Once). YOLO employs Convolutional neural networks (CNN) for image processing. In CNN image must pass through different layers like Convolutional layer, pooling layer, ReLu layer and fully connected layer.***

Keywords: CCTV, YOLO, CNN, ReLu

I. INTRODUCTION

In today's fast moving world internet is one very important thing which the world relies upon. For proper working of internet, server should be up and running and for this server room should be always functioning properly. We implement a monitoring system which not only notifies the administrator whenever a person is entering the server room but also prevents any malicious activity happening in server room by recording the session whenever the system is switched on with the help of node MCU. Another advantage of this system is it maintains the log activity which can be used to check when a person entered and when exited. In this system the status of the room will be occupied when any person enters and will be empty only when there is no person present in the room. Along with maintaining the logs the system also keeps count of number of people entering the room On Global level server room monitoring can be used for storage systems which store huge data for large companies. The companies only use temperature monitoring for storage systems; Hence CCTV monitoring can prove to be and add on to these systems and be helpful to monitor the storage room for any fire accidents or anybody causing any damage to the systems.

II. LITERATURE SURVEY

In [1] the main aim is reducing the huge bill that is generated due to cooling of datacenters. This paper proposes a Fiber Bragg grating systems as an alternative for sensors. The focus is to show thermal measurement at critical non monitored regions called blind spots. The advantage of this system is temperature at different regions can be sensed with high sensitivity. The proposed thermal monitoring method can be further extended to monitor larger areas of data center. In [2] a novel lightweight approach with short training time for multiface recognition algorithm is proposed which mainly uses ABASNet for neural networks. The main advantage of this paper is that it not only has high accuracy but also strong robustness. This multiface re4cognition method combines traditional image processing methods with strong, practical significance with high applied value In [3] a hybrid method for feature extraction is introduced which uses CNN-PCA (Convolutional neural network-Principal component analysis). The face recognition-based attendance system has accurate data processing and high accuracy which results in system that is reliable and recognizes human faces in real time. The tests show that the accuracy of the system can be upto 98%. In [4] face recognition method using 3WPCA (Wavelet decomposition Principal component analysis) is proposed. This method uses dual vision face recognition which makes use of two sides of face to avoid any falsification of facial data. The features are extracted using 3WPCA and later combined to form a full-face using half join method. These methods take short time and have high accuracy. The main advantage of method proposed in this paper is that it can be used to reduce forgery of facial data.
In [5] a face detection system on surveillance camera is proposed namely Viola-Jones method. In this method the camera turns on automatically and moves in the direction of moving object. The output of this method is it can find an ideal face position based on images detected In [6] the paper mainly focuses on factor of illumination change challenge which is hard to achieve with real time data and hence proposes a deep network model which takes both visible light image and near infrared image into account for image processing and face recognition. In this methodology nearest neighbor algorithm is used for final classification. The experimental results show that the proposed model achieves better results than the traditional deep learning model. In [7] the paper focuses on developing and alert mechanism which warns the administrator when server rooms temperature value goes beyond certain critical value. It does this using ZigBee based monitoring system which uses thermal monitoring of server rooms. One of the affecting factors is distance of device with area being scanned determines the accuracy of the data. Another major advantage of ZigBee based monitoring systems is that the device used for monitoring is of low cost compared to other thermal imaging devices. In [8] main aim is to develop a system for complex environment such as college exams which has higher system requirements. This paper proposes a c# based control system which focuses on monitoring student behavior during online exams, greatly reducing the work on computer room personnel.

Manuscript received on 14 July 2022 | Revised Manuscript received on 17 July 2022 | Manuscript Accepted on 15 August 2022 | Manuscript published on 30 August 2022.
***** Correspondence Author
Mahesh Subray Hegde*, Department of Computer Science and Engineering**,** R V College of Engineering, Bangalore (Karnataka), India.
E-mail: maheshshegde.scn20@rvce.edu.in
Dr. Ramakanth Kumar P, Department of Computer Science and Engineering**,** R V College of Engineering, Bangalore (Karnataka), India.
E-mail: ramakanthkp@rvce.edu.in

© The Authors. Published by Blue Eyes Intelligence Engineering and Sciences Publication (BEIESP). This is an open access article under the CC-BY-NC-ND license http://creativecommons.org/licenses/by-nc-nd/4.0/

In [9] the aim of paper is web-based video transmission of images from CT and MRI consoles to intranet environment. Images captured from consoles are compressed to video resolution and then broadcasted. This improves the patient care by reducing the time spent for radiologists to study the report y removing it from scanner. In [10] a microcontroller-based room monitoring system is presented which integrates the computer and microcontroller with assembly language used to program the micro controller. Two programs are developed one is client side and other is server side. Server side is used for monitoring the room and alert user if anybody is trying to break through and client side for the client to know whether door is free to enter or not.

III. METHODOLOGY

This section shows the methodology used for building the proposed server room monitoring system. Figure below shows the complete system wherein monitoring system is the main part and to the left are components that are connected to the system. It may be CCTV which is wireless connection or Node MCU which is connected to the system with help of USB data cable. To access the CCTV, the system and CCTV both are connected to the same network. Node MCU on other hand is useful for sending SMS alerts.

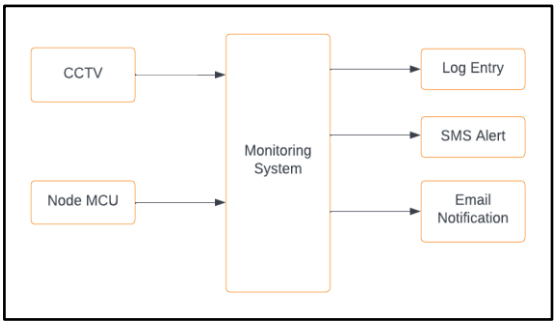

Fig 1 Methodology

The right side of system shown in Fig 1 is output that is obtained from the system after execution. Log entry is made from CCTV detects a person, and can be considered as output from CCTV. The SMS alert is sent which is combined effect of both of connected devices [CCTV and Node MCU]. Email notification is sent when person presses the switch connected to the board on which Node MCU is placed. This can be considered as output obtained from Node MCU. The people entering exiting and activities can be monitored and all this happens because of CCTV. The console shows the operations happening in background like SMS Email and even the recording of video which is also one of Outputs that can be considered from Node MCU. The console ouput is shown in Fig 2 below and ouput from CCTV capture can be seen in Fig 6

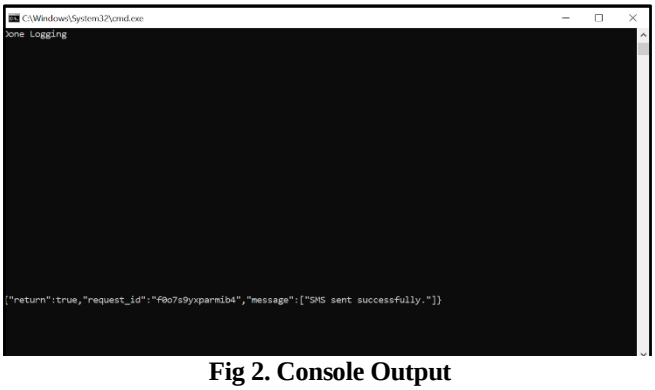

Fig 2. Console Output

Done Logging message is shown when logs have been recorded and SMS sent successfully is also shown in console itself. The main thing to be noted in case of Node MCU is that in the script the port to which the board is connected should be mentioned correctly else it may lead to connection to any open port in the system and this in turn may lead to wrong and unexpected output

IV. REQUIREMENTS SPECIFICATION

The software requirements for the proposed system includes Windows 10 Operating system, IDLE for python development The hardware requirements include, CCTV, Jumper wires, Node MCU, switch, USB Data cable. Some of the other requirements that are involved in the proposed system to properly monitor the server room CCTV must be in good condition, code must be proper so that the camera starts capturing video when anybody enters the room. The libraries needed are OpenCV, Imutils, Pillow, NumPy, random, pandas. Along with that some pre-trained model like coco model and framework like YOLO is used in this Project.

V. DESIGN

The Flow-chart for the server room monitoring system is shown in below fig.

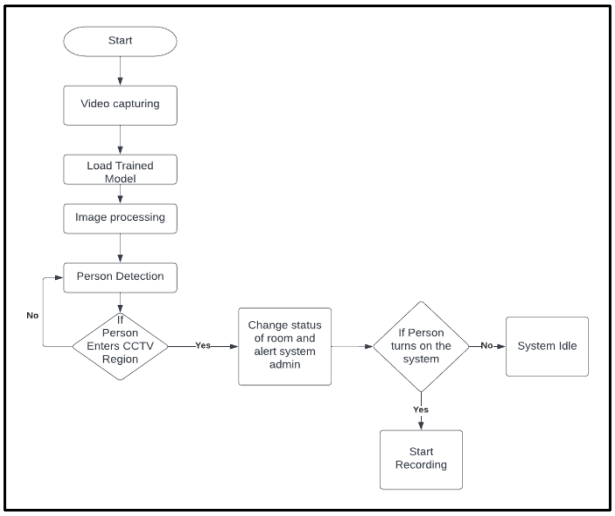

Fig. 3: Flowchart for Server Room Monitoring System

VI. IMPLEMENTATION

The flowchart explains the overall mechanism done by the proposed system. The CCTV will be capturing video as usual. When a person is detected in the region being captured by camera it alerts the system admin by sending an SMS, increases the count of people in the room and changes the status of the room from empty to occupied. Different things that can been seen on the screen are number of persons, Frames (FPS) , room status. The number of people in room is dyanamic value and is kept count of using bounding box for all persons in CCTV. FPS value is static which we provide during coding and Room status is also dyanamic which is either occupied when atleast one person is present in the room else empty.

© Copyright: All rights reserved.

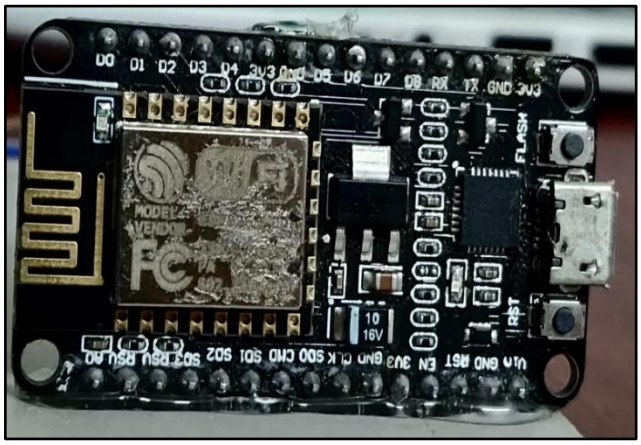

Fig.4 Node MCU with jumper wires

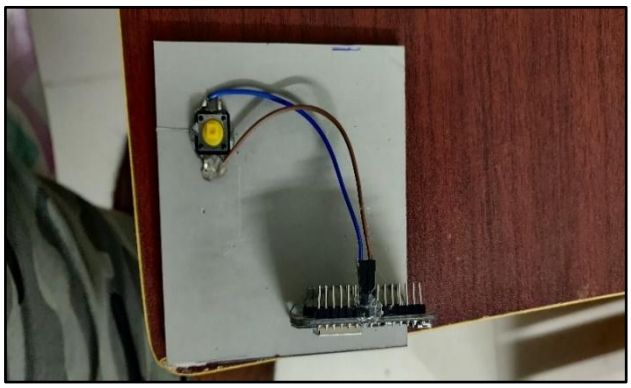

Fig.5 Switch connected to NodeMCU

The Fig 4 shows node MCU with jumper wires connected and Fig 3 shows switch connected to node MCU. This switch when pressed acts as start button for video recording and as mentioned starts recording the session until the room becomes empty. In our project to understand when any person switches on any system in the server room we are connecting the combination of NodeMCU and switch to our system using USB data cable. The USB data cable acts as signal carrier for CCTV to start recording. The connection is as shown in Fig 5. Along with recording the session and storing it, a notification in the form of mail is sent to the administrator that someone is accessing the system in server room. A notification in form of SMS is sent when a person tries to enter server room and is captured in the CCTV. Another important thing to note is that as soon as person enters an entry is made into the log file and as soon any person exits again an entry is made into the log. In this way we can check if server goes down, around same time who exited or who all entered the room.

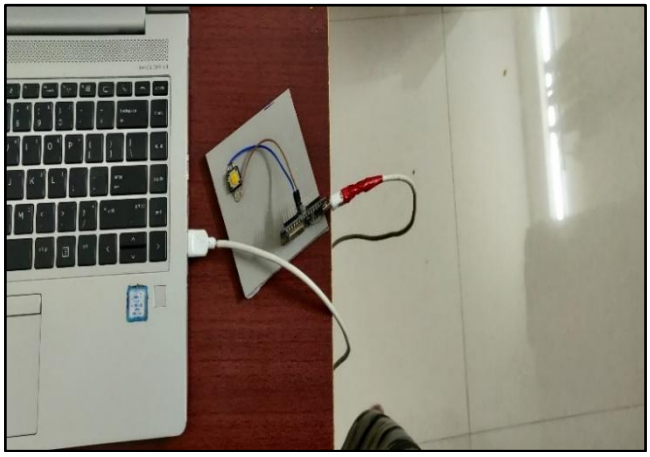

Fig.5 Switch connected using USB Cable

With mail the first frame picture taken by the camera is also sent for admin to know who the person in the server room is. Below sheet shows the log file which consists of entry time and exit time of a person. With this sheet we can see that an entry is present on 22/5/2022 At 15:29:33 which means a person had entered on this date and on this time into the server room. The exit log pattern is also same and from sheet it can be seen that a person had exited on 22/5/2022 at 15:34:24.
The date format is yyyy-mm-dd and the time format for excel sheet is hh:mm:ss

ENTRY	2022-05-22 15:29:33.643376	1
ENTRY	2022-05-22 15:33:31.349024	2
ENTRY	2022-05-22 15:33:52.814670	3
EXIT	2022-05-22 15:34:24.917045	4
ENTRY	2022-05-22 15:34:30.331269	5
ENTRY	2022-05-22 15:37:48.500304	6
ENTRY	2022-05-22 15:39:21.687174	7
ENTRY	2022-05-22 15:39:48.397797	8
ENTRY	2022-05-22 15:52:34.430915	9
ENTRY	2022-05-22 15:53:31.759807	10
ENTRY	2022-05-23 09:08:27.666797	11
ENTRY	2022-05-23 09:09:26.206750	12
ENTRY	2022-05-23 09:10:42.014380	13

Excel sheet for entry and exit

VII. RESULTS

Once the hardware setup is done and the system is set, testing was done for different scenarios like room empty, room with persons and checked whether administrator receives SMS or not. Initially, Room was empty, and the status was seen to be empty, when any person came into range of CCTV, the status of room was changed to occupied and person count was also increased. These test scenarios can been seen in Fig.6 and Fig. 7 respectively.

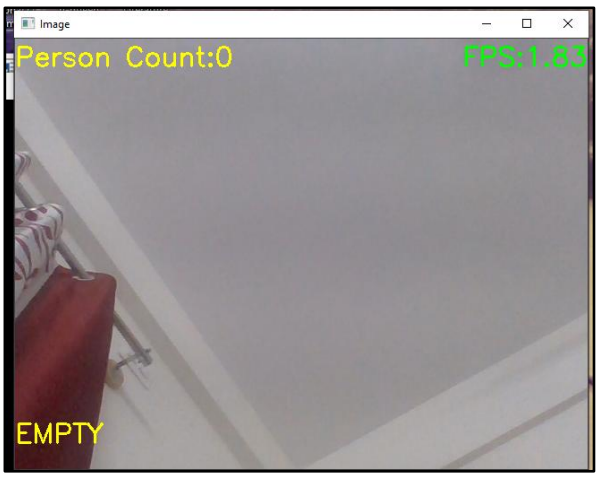

Fig 6 Empty Room

© Copyright: All rights reserved.

Fig 7. Room Occupied

It can been seen that in Fig.5 The room status is Empty, FPS is shown and Person count is 0. Likewise in Fig.6 the room status is changed to occupied and person count has also increased to 1. As soon as room status changes an SMS is sent which is shown in Fig.8

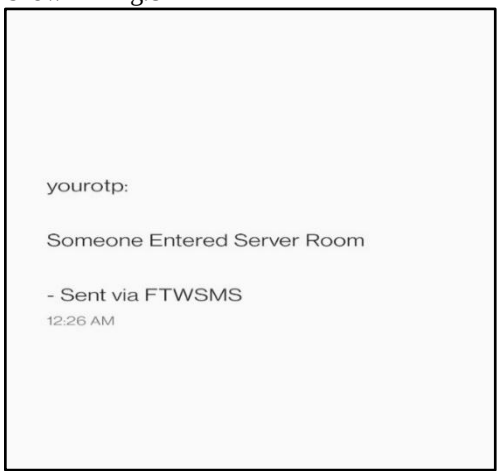

Fig.8 SMS received at persons Entry

The figure 8 shows the mail notification which is sent to administrator when the person inside server room presses the button. Along with mail photo frame is sent of person who switched on the system.

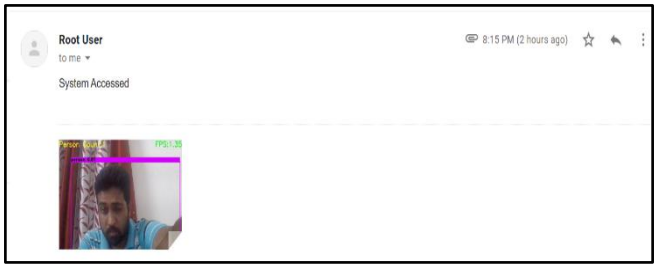

Fig 9 Email to alert with photo frame

The video recorded is stored at one place so that it can be later viewed as and when required. The videos captured are many but frame captured is overwritten and hence consists of person who had entered the server room last.

VIII. CONCLUSION

The Server room monitoring system provides the user with a product wherein the user is not only be updated about the server room but also monitor the server room for any malicious activity taking place and control it if acted in timely manner. As we have logs present, we can reduce the work of checking all the recorded videos when anything happens to server. The main advantage of server room monitoring is administrator can be updated about the things happening in server room also can avoid malicious activity taking place in server room which could lead to lot of damage to organizations. This server room monitoring can further be extended to detect fire in the server room or storage area's which could cause potential harm to the server /storage rooms. There are many advantages apart from those mentioned but there are also some limitations like the CCTV and the systems being monitored should be under same network for administrator to monitor, administrator should be reachable for SMS notification and should be having internet connection to receive mail notification.

REFERENCES

1. R. A. G. d. Santos et al., "Datacenter Thermal Monitoring Without Blind Spots: FBG-Based Quasi-Distributed Sensing," in IEEE Sensors Journal, vol. 21,no.8, pp. 9869-9876, 15 April15, 2021, doi: 10.1109/JSEN.2021.3058513. [CrossRef]
2. F. Wang, F. Xie, S. Shen, L. Huang, R. Sun and J. Le Yang, "A Novel Multiface Recognition Method with Short Training Time and Lightweight Based on ABASNet and H-Softmax," in IEEE Access, vol. 8, pp. 175370-175384, 2020, doi: 10.1109/ACCESS.2020.3026421. [CrossRef]
3. S. Opipah, H. Qodim, D. Miharja, Sarbini, E. A. Z. Hamidi and T. Juhana, " Prototype Design of Smart Home System Base on LoRa," 2020 6th International Conference on Wireless and Telematics (ICWT), 2020, pp. 1-5, doi: 10.1109/ ICWT50448.2020.9243643. [CrossRef]
4. XiaoYu Dou, Yan Yuan, Weihua Cao, Peilun Ouyang, "A Privilege Management Method of Centralized Management System in the Computer Room", *2020* Chinese Automation Congress *(CAC)*, pp.957-961, 2020.
5. E. Winarno, I. Husni Al Amin, H. Februariyanti, P. W. Adi, W. Hadikurniawati and M. T. Anwar, "Attendance System Based on Face Recognition System Using CNN-PCA Method and Real-time Camera," 2019 International Seminar on Research of Information Technology and Intelligent Systems(ISRITI),2019,pp.301-304,doi: 10.1109/ISRITI48646.2019.9034596. [CrossRef]
6. C. Jiang, Y. Qiu, H. Gao, T. Fan, K. Li and J. Wan, "An Edge Computing Platform for Intelligent Operational Monitoring in Internet Data Centers," in IEEE Access, vol. 7, pp. 133375-133387, 2019, doi: 10.1109/ACCESS.2019.2939614. [CrossRef]
7. E. Rohadi et al., "Internet of Things: CCTV Monitoring by Using Raspberry Pi," 2018 International Conference on Applied Science and Technology (iCAST), 2018, pp. 454-457, doi: 10.1109/iCAST1.2018.8751612. [CrossRef]
8. E. Winarno, W. Hadikurniawati, I. H. Al Amin and M. Sukur, "Anti-cheating presence system based on 3WPCA-dual vision face recognition," 2017 4th International Conference on Electrical Engineering, Computer Science and Informatics (EECSI), 2017, pp. 1-5, doi: 10.1109/EECSI.2017.8239115. [CrossRef]
9. I. G. N. Made Kris Raya, A. N. Jati and R. E. Saputra, "Analysis realization of Viola-Jones method for face detection on CCTV camera based on embedded system," 2017 International Conference on Robotics, Biomimetics, and Intelligent Computational Systems (Robionetics),2017,pp.15,doi:10.1109/ROBIONETICS.2017.8203427. [CrossRef]
10. Kai Guo, Shuai Wu, Yong Xu, Face recognition using both visible light image and near-infrared image and a deep network, CAAI Transactions on Intelligence Technology, Volume 2, Issue 1,2017, Pages 39-47, ISSN 2468-2322,https://doi.org/10.1016/j.trit.2017.03.001. [CrossRef]

© Copyright: All rights reserved.

11. A. N. Yumang, C. C. Paglinawan, M. M. Sejera, A. S. Lazam, J. C. Pagtakhan and J. S. B. Santos, "ZigBee Based Monitoring of Temperature and Humidity of Server Rooms using Thermal Imaging," 2016 6th IEEE International Conference on Control System, Computing and Engineering (ICCSCE), 2016, pp. 452-454, doi: 10.1109/ICCSCE.2016.7893616. [CrossRef]
12. F. Yin and J. Shi, "The Design and Implementation of User Monitoring System of College Computer Room," 2016 International Conference on Information System and Artificial Intelligence (ISAI), 2016, pp. 476-478,doi: 10.1109/ISAI.2016.0107. [CrossRef]
13. J. Kim, J. K. Lee and K. M. Lee, "Accurate image super-resolution using very deep convolutional networks", *Proc. IEEE Conf. Comput. Vis. Pattern Recognit. (CVPR)*, pp. 1646-1654, Jun. 2016. [CrossRef]
14. Winarno, Edy & Harjoko, Agus & Arymurthy, Aniati. (2014). Development of face recognition system and face distance estimation using stereo vision camera. Journal of Theoretical and Applied Information Technology. 67. 652-657.
15. Y. Zhu, L. Xie and T. Yuan, "Monitoring system for forest fire based on Proceedings of the 10th World Congress on Intelligent Control and Automation, 2012, pp. 4245-4248, doi: 10.1109/WCICA.2012.6359191. [CrossRef]
16. Choi Jongho, Han Dongil and Seong Joon Yoo, "Real-Time Face-Detection Engine for Robustness to Variable Illumination and Rotated Faces", International Conference on Computers Networks Systems and Industrial Engineering, 2011. [CrossRef]
17. M. G. Rodriguez, L. E. O. Uriarte, Y. Jia, K. Yoshii, R. Ross and P. H. Beckman, "Wireless sensor network for data-center environmental monitoring", *Proc. 5th Int. Conf. Sens. Technol.*, pp. 533-537, Dec.2011. [CrossRef]
18. R. Rao and S. Vrudhula, "Performance optimal processor throttling under Thermal constraints" Proc. *Int. Conf. Compil. Archit. Synth. Embedded Syst. CASES*, pp. 257-266, 2007 .
19. P Viola and M Jones, "Rapid Object Detection Using A Boosted Cascade of Simple Features", *IEEE Conference on Computer Vision and Pattern Recognition*. [CrossRef]
20. O. Ratib, M. Dahlbom, J. M. Zucek, K. Kong McCoy and D. J. Valentino,"Web-based video for real-time monitoring of radiological procedures," In IEEE Transactions on Information Technology in Biomedicine,vol. 4, no. 2, pp. 108-115, June 2004, doi: 10.1109/4233 845203. [CrossRef]
21. R. K. Z. Sahbudin, Lee Choong Hooi, Tan Chin Guan and Ling Siong Liet,"Room access monitoring system," Proceedings. Student Conference on Research and Development 2003. SCORED 2003., 2003, pp. 304-308, doi: 10.1109/SCORED.2003.1459711.
22. P. Viola and M. Jones, "Rapid object detection using a boosted cascade of simple features", *Proceeding IEEE Conference on computer vision and pattern recognition 2001 (1-9)*, 2001

AUTHORS PROFILE

Mahesh S Hegde, is a B. Tech graduate in Computer Science and Engineering from VTU Belagavi. Currently is pursuing MTech in Computer Network Engineering at R V College of Engineering (RVCE) Bengaluru, Karnataka. Mahesh has done his internship in web development and currently working as an intern for Maxlinear Technologies Pvt Ltd. The domain Mahesh is currently working under Automation WLAN QA team wherein it requires understanding the frame work, resolving bugs and implementing new test cases. Mahesh is good at communication, is a quick learner and love implementing new things to gain knowledge. Mahesh has previously published paper based on IoT for IEEE-CSITSS conference in 2021 which was held in RVCE Bengaluru. The name of paper is "Smart Dry and Wet Waste Management System using IoT". Mail id-(maheshshegde.scn20@rvce.edu.in)

Dr. Ramakanth Kumar P, is professor and Head of the Department, Computer Science Engineering in R V College of Engineering, Bengaluru, Karnataka. Dr. Ramakanth has done his B.tech in CSE from S.J.C.E Mysore, M.S in software systems from BITS Pilani and Ph.D from Mangalore University and has an experience in teaching of 25 years. In R&D Dr.Ramakanth has 14 years of experience. Area of Interest of Dr. Ramakanth are Digital Image Processing, Pattern Recognition, Natural Language processing. Dr. Ramakanth is highly motivated, supportive professor who always encourages students in achieving their goals. Dr. Ramakanth is also head of CCTV research center at RVCE where many students are provided with internships during their college life. Dr.Ramakanth has served for various positions like lecturer, Asst. Professor, Dean Academics, Asst. Director SAP and Hod CSE. Mail id-(ramakanthkp@rvce.edu.in)

© Copyright: All rights reserved.