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Smart IOT Surveillance Multi-Camera Monitoring System

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***Abstract* - The surveillance digital monitoring process market has changed aggressively over the last 15 years. Where the process was needed for people to secure their business by a simple surveillance camera system to give them that much needed peace of mind. However, the existing monitoring systems are very expensive due to internal specific SDK configuration which was embedded in the camera itself. Some of them provide a solution such as a high-priced customized command center that has several screens view which communicates with several cameras to monitor the cameras with a specific detection analysis module. In this paper, a cheaper solution to the monitoring system for existing surveillance cameras is introduced to overcome the solution. This system only implements open source image processing methods to produce a monitoring system with customizable modules for video analytics (video content analysis) with the input of live video sources. This is to allow a wider range of camera models that can be used for this system. A real-time analysis module will assist in the use of the system to ease the user. The combined video stream and the module will help the user immensely for surveillance propose. Based on the result, the proposed system achieved a higher affordability level up to 95% with 90% usability compared to existing products.**

Keywords—IOT, Edge Computing, surveillance camera; live video; video analytics; video streaming;

I. INTRODUCTION

In current, highly charged socio-political climate, the need for quality-driven proof-based frameworks is supreme. This applies similarly to shadowing camera solutions that have come to form a basic component in the armory of employers and agencies charged with defending our wellbeing and security. Organizations are presently exploring in accordance with progress video analytics structures as perform reveal consumer behavior the use of the video cameras then records analytics software, meaning their group performs now not only reveal patron conduct or minimize crime, additionally remark the fact because advertising purposes.

A network security yet shadowing transcription passively screen or information the site visitors present regarding a partial area network, huge section network, then mean kind concerning pc network, barring interrupting and in any other case interfering together with the waft about the traffic. Raw data packets existing regarding the community are continually routed (with optionally offered packet encryption) to a high-volume records scribe in imitation of bring low-level recordings because of archival purposes. The data packets are optionally routed per one then larger cyclic data recorder in conformity with produce temporary files to that amount are long-lasting in accordance with a routine screen the visitors to near real-time. An interact on analysis purposes yet vile software routines permits approved customers to interactively analyze the low-level visitors recordings to contemplate community attacks, secret or external safety breaches, network issues, yet mean types of network events.

As the motivation, automatic shadowing monitoring systems are usually designed to detect abnormal objects being present in a scene or behaving hazardously. Furthermore, the utilization of M2M (machine to machine) communication is an advantage over the normal Data Acquisition System (DAS) as monitoring and controlling can be done without human intervention [2]. As the system becomes absolutely automatic so the quantity of error decreases, the usability will increase, conjointly the potency of the system also will increase drastically.

In order to perform sufficiently, the integrate models able to succeed correct pattern recognition in a picture, and deep learning neural networks excel this task. Moreover, the Internet of Things (loT) is associate current development of the internet by which everyday 'things' objects have communication capabilities that permit them to send and receive video data easily. IoT based mostly application will be used remotely to look at the activity and find notification once motion abnormalities are detected [3]. However, pre-calibration within the structure of IoT platform itself is extremely complicated which it needs to enable seamless connectivity anytime, anyplace by anyone and anything to produce intelligent services including identifying, sensing, networking, processing and visualization capabilities [4]. This idea brought many new prospects for largescale services and merchandise development which caused a colossal wave of innovations and new business opportunities. Numerous visions and approaches, as well as the lack of coordination between standards and technologies, resulting in the fragmentation of IoT industries which cause a group of latest challenges to be tackled by future analysis [5].

Nevertheless, the idea to design a smart IoT to monitor surveillance camera abnormality activities with the edge computing to perform denaturing video analytics. Edge computing may be an emerging model of computing during which little multi-tenant data centers known as cloudlets are located close to IoT devices like video cameras. A versatile design for IoT data analytics using the concept of fog

computing is required. Totally different actors and their roles are identified in order to design adaptive IoT data analytics solutions. This approach can be used to effectively design robust IoT applications that need a skill-off between cloud-based and edge-based computing reckoning on dynamic application necessities. The potential use cases of this technology may be found in varied situations such as smart city, security surveillance and smart manufacturing, where the quality of user expertise is important [6]. Furthermore, the smart video monitoring system can be implemented in the field of cybersecurity and artificial intelligent, for example, to apply pre-calibration of human classification based on age groups, or to build an age-specific human-computer interaction system, such as discussed in [15]. This kind of system also able to implement in the integrated application such as mentioned in [14,16] and contribute to video forensics investigation fields.

Analyzing significant live video streams on the IoT cloud is impractical because the edge solution that conducts the video analytics on the camera provides a complex solution. Analyzing live video streams on the edge isn't unimportant due to the constrained hardware resources on edge. The artificial intelligent dominated video analytics needs higher bandwidth, consumes substantial CPU/GPU resources for the process, and demands larger memory for caching [7]. Because of that, this project presents a smart IOT monitoring system which captures and process videos from one or more pre-calibrated surveillance cameras connected through the wireless IP networks. Added to the project is the feature to add more analytic and detection modules into the existing monitoring system that will assist the user oi automated analyzing abnormalities of the video streaming data in order to trigger an alarm to alert the user. The rest of this paper is organized as follows. Section 2 provides a brief discussion of closely related work about system design and architecture of the monitoring system. Section 3 is the Experiment, Result and Discussion of the system. Section 4 concludes this paper with some discussions.

II. SYSTEM DESIGN AND ARCHITECTURE

In order to arrange a very real-world embedded application, the application program interface (API) was created so as to supply associate degree intelligent and surveillance camera monitoring system. The application can utilize the mixture associate degree of automatic streaming of live multi-video from various IP addresses and will be displayed at the same time with single graphic user interface (GUI) application. This application was designed to act as a horizontal platform for video analytics detection systems. This kind of structure is also implemented in [8]. Furthermore, as the pilot structure of the platform, a few existing open sources video analytics modules were added in order to implement the usability of the API. The video analytics and detection modules such as object detection and tracking, object counting, and object features classification will be constructed by using the existing open source code to suit the platform will be embedded into the main monitoring system. Later, an action module will be added into the platform in order to alert the user if any abnormalities occur in the video sources during the monitoring process based on abnormalities pattern analysis. So that alert data can be prompt through any application such as mobile application, then the user only can receive any information through their mobile phone without their presence in the command center monitoring room. This kind of process is very smart, energy saving, fully automatic and it will also reduce human interference and also cost-efficient.

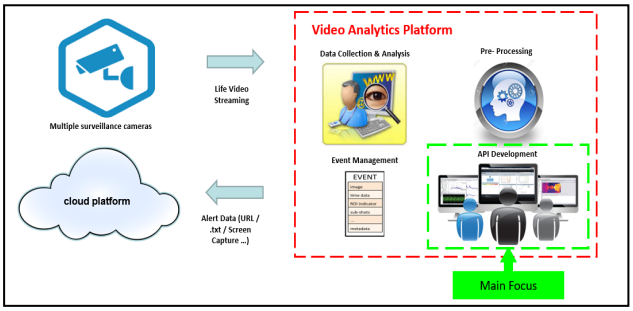

Fig. 1. Block diagram of the proposed Real-Time Surveillance Camera Monitoring System

The final output of the image processing could be a set of information for each moving object within the scene, like target ID, position, range of half-track movement and classification. This info is analyzed and used to the project presents a real-time monitoring system that captures and process videos from one or a lot of pre-calibrated surveillance cameras connected through wireless IP network. The system, that has been developed among the Python PyQt5 framework project, is versatile, scalable and might be useable for a broad field of applications, together with traffic monitoring of multiple surveillance cameras. Totally different image processing and data fusion techniques were tested and evaluated so as to be incorporated into the system. The final output of the image processing could be a set of information for every moving object in the scene, such as target ID, position, number of tracked movement and classification. This information is analyzed and used to provide real-time output. The structure of the API was described as in Fig.1.

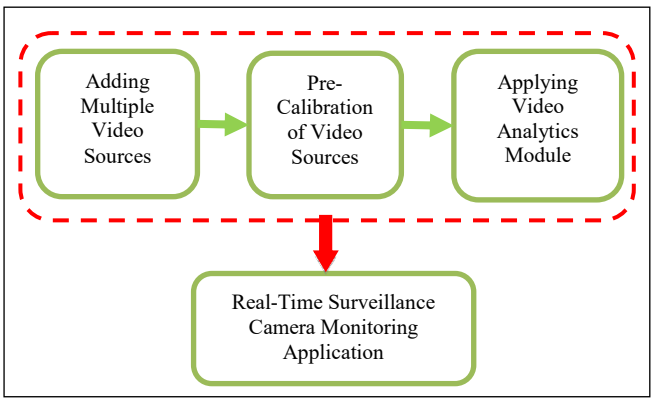

Fig. 2. Block diagram of the proposed Real-Time Surveillance Camera Monitoring System

A. Adding Multiple Video Sources

First, the application is formed to possess ability to read and streaming numerous sequences of video data from existing surveillance cameras. The video sources are adding based its IP address located in the individual camera. The additional videos were streaming supported on multithreading video capture. The

approach to use just a simply one thread to handle all the capturing processes is not efficient. Thus, the advance is formed by using multi-thread approach. Every thread will capture video from a single camera, therefore the range of threads are determined by the quantity of cameras. In addition, to make it even better for further application (e.g.: motion detection), the program implement object familiarized. However, every single video which was added into the program was configured individually such as selecting region of interest, detection area and also video analytics module.

B. Pre-Calibration of Video Sources

Most of the surveillance systems for the third generation have developed and designed both in academia and industry. These systems are categorized into specialized and general purpose in a certain task. The approach which has been proposed in this project can be categorized as general purpose system because the researcher (user) has the choice to develop the modules (as defined in Section C) and practice them for any purpose including surveillance.

C. Applying Video Analytics Module

Smart graphic surveillance systems cope with the actual-time monitoring of objects within an surroundings. the main intention of those structures is to offer automated interpretation of scenes and understand activities and interactions of the located agents based totally on the visual facts being acquired. contemporary studies concerning these automatic visual surveillance systems have a tendency to mix a couple of disciplines, which include pc vision, sign processing, telecommunications, control and socio-ethical studies. as shown in fig.1 the architecture of the proposed platform is organized in two foremost modules: a) a video analytics module (vam) and b) a human-pc interface (hci). the vam strategies the video streams generated with the aid of the cameras so as to analyses and pick out events of interest [4] that have to be furnished to human operators collectively with useful records. for one of these motive a low level analysis module detects and acknowledges all the active gadgets in the environment. then, the items are tracked with a view to offer temporal information about their activities. those are analysed by way of an event evaluation module capable of correlate the items sports through time and area. such an evaluation is used by a trajectory estimator [9-13] that has the goal to foresee the trajectories of the items of hobby given their activities and beyond trajectories. consequently, this module route-plans the moves of interest such that the cameras may be opportunely tasked or redirected for you to improve the analysis skills. this is carried out by means of the network reconfiguration module [8]. the anticipated trajectories and the new digicam community configuration are given to the hci module that has to optimize the cognitive abilties of the operator. in this manner, a first selection is taken about the most significant streams that have to be provided. this is achieved with the aid of thinking about the foreseen evolution of the surroundings. as soon as the maximum crucial streams had been decided a 2d module is in price to decide how they must be prepared at the consumer interface. finally, the streams are well visualized at the ui collectively with beneficial statistics furnished by way of the video analytics module.

D. Real-Time Surveillance Camera Monitoring Application

The project gives a actual-time monitoring device which capture and process films from one or greater pre-calibrated surveillance cameras related thru wi-fi ip community. introduced to the venture is the feature to add more modules the prevailing system to be able to assist the user on studying video streaming.

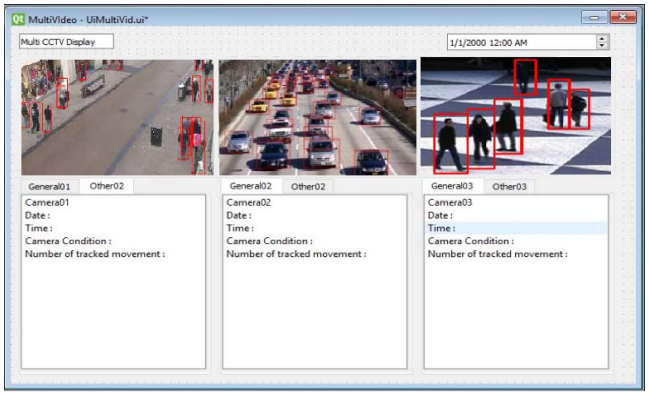

Fig. 3. Sample GUI layout of the system monitoring board

III. EXPERIMENT, Result and Discussion

The simple definition of feedback is a user is asked regarding the software and if the software is helpful. A survey form has been given to 10 people to ask regarding the software. The results of survey are discussed below.

1. Have you seen the CCTV monitoring system before?

Among the 10 correspondents, 100% said yes, they have heard about the CCTV monitoring system, while 0% said no the haven't heard of the CCTV monitoring system. In my opinion the 100% of those have either heard of the monitoring system or seen the system themselves.

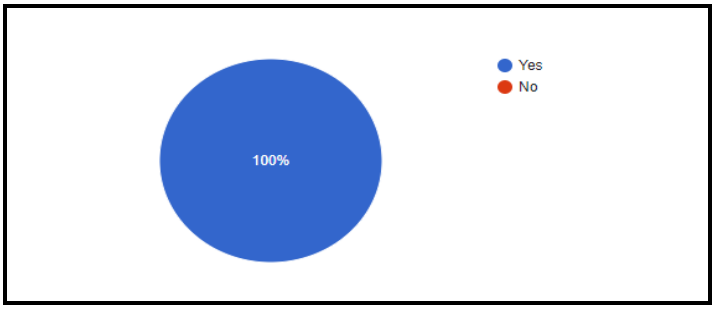

Fig. 4. . Basic information for CCTV monitoring system.

2. Do you find it easier to have the additional video details to on screen all the time?

In 10 correspondents, the highest responder is 55.6% said additional video details were helpful for them so that they can focus on others important task to keep focus on and 44.4% said that the additional video details are a distraction on the task at hand.

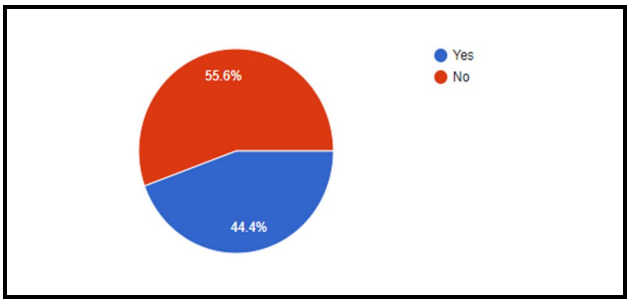

Fig. 5. Additionalvideo details visisbility

3. Have you ever used the motion tracker on a video before?

Among 10 correspondents, the highest responder is 77.8% which said they have not tried motion tracker on a video before, while 22.2% said that they have use video tracking before.

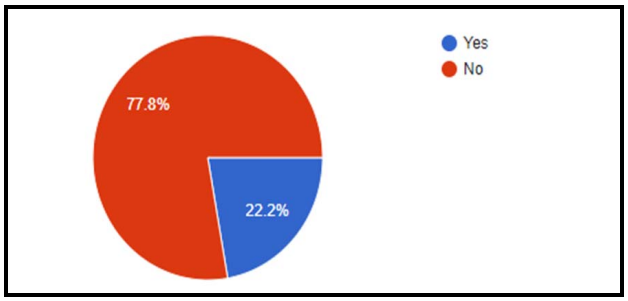

Fig. 6. Experience in motion tracking video

4. Will the new feature of adding new module by the user be helpful in this software?

Among 10 correspondents, the lowest responder is 11.1% which said that they are the adding new module might not helpful for the software, while 44.4% said that having the feature will help the software better and another 13.33% said that they are unsure about the feature.

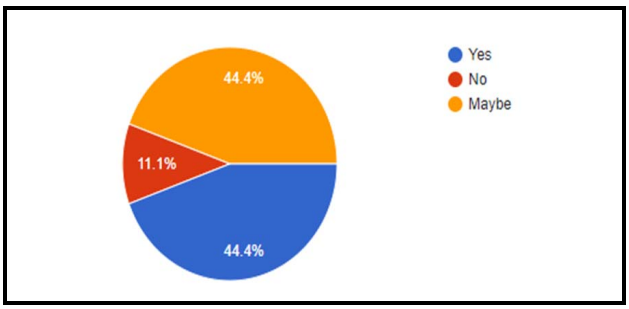

Fig. 7. Additional new module to the software by user

IV. CONCLUSION

There a system has been develop a system to make their works easier in term of adding new security surveillance camera, view camera details, and add new modules to the system. Generally, that's a good thing, it's why we developed this system. In addition, hopefully Security Surveillance Movement Tracking System can be useful to those who are equipped with good ethics and use this system only for good purpose. In future, this kind of system without limitations expectantly will convey more and more convenient environment to the users. The conclusion of this project Security Surveillance Movement Tracking System can be used by individual and company that have existing camera and use it as an interface. With the result that we receive from this project we can conclude that this project has a good future ahead

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REFERENCES

[1] P. B. Patel, V. M. Choksi, S. Jadhav, and M. Potdar, "Smart motion detection system using raspberry pi," International Journal of Applied Information Systems (IJAIS)–ISSN, pp. 2249-0868, 2016.

[2] S. Joshi et al., "M2M communication based wireless SCADA for real-time industrial automation," IntJResAdventTechnol2014, vol. 2, no. 4, pp. 107-109, 2014.

[3] E. Borgia, "The Internet of Things vision: Key features, applications and open issues," Computer Communications, vol. 54, pp. 1-31, 2014.

[4] A. Čolaković and M. Hadžialić, "Internet of Things (IoT): A review of enabling technologies, challenges, and open research issues," Computer Networks, vol. 144, pp. 17-39, 2018.

[5] S. Tang, D. R. Shelden, C. M. Eastman, P. Pishdad-Bozorgi, and X. Gao, "A review of building information modeling (BIM) and the internet of things (IoT) devices integration: Present status and future trends," Automation in Construction, vol. 101, pp. 127-139, 2019.

[6] P. Patel, M. I. Ali, and A. Sheth, "On using the intelligent edge for IoT analytics," IEEE Intelligent Systems, vol. 32, no. 5, pp. 64-69, 2017.

[7] Q. Zhang, H. Sun, X. Wu, and H. Zhong, "Edge Video Analytics for Public Safety: A Review," Proceedings of the IEEE, 2019.

[8] J. Kimball, T. Wypych, and F. Kuester, "Low bandwidth desktop and video streaming for collaborative tiled display environments," Future Generation Computer Systems, vol. 54, pp. 336-343, 2016.

[9] M. K. Scherer et al., "PyEMMA 2: A software package for estimation, validation, and analysis of Markov models," Journal of chemical theory and computation, vol. 11, no. 11, pp. 5525-5542, 2015

[10] S. L. Fong, A. O. Elfaki, M. G. bin Md Johar, and K. L. T. Aik, "Mobile language translator," in 2011 Malaysian Conference in Software Engineering, 2011, pp. 495-500.

[11] Umar, R. S., Khalip, S., Kechil, S. A., & Alias, N. A. (2012). Potentiality of Designing and Developing Mobile a Comic Application as a way of Learning for Dyslexic Children

[12] Safaa Najah Saud, Dasarataan Manivannan, Adzliza Binti Salmi, Lilysuriazna Raya, Smart Walk Stick for

Visually Impaired People: Design and Implementation, Journal of Management & Science - Volume 16, Number 2, Dec 2018

[13] Safaa Najah Saud, Muhammad Irsyad Abdullah, Siti Hadijah Shariff, Ambrick Singh S/O Ram Singh, Baharudin Hamzah, Nordayati Mat Lehat, R. Junaidi Daud, Towards a New Innovation of Smart Bat Hat for Visually Impaired People, Journal of Management & Science - Volume 16, Number 2, Dec 2018

[14] O. I. Al-Sanjary, G. J. J. o. T. Sulong, and A. I. Technology, "Detection of video forgery: A review of literature," vol. 74, no. 2, 2015.

[15] H. Razalli, R. W. O. Rahmat, F. Khalid, and P. S. Sulaiman, "An Image-Based Children Age Range Verification and Classification Based on Facial Features Angle Distribution and Face Shape Elliptical Ratio," Advanced Science Letters, vol. 23, no. 5, pp. 4026-4030, 2017.

[16] Al-Sanjary, O. I., Ahmed, A. A., Jaharadak, A. A. B., Ali, M. A., & Zangana, H. M. (2018, April). Detection clone an object movement using an optical flow approach. In *2018 IEEE Symposium on Computer Applications & Industrial Electronics (ISCAIE)* (pp. 388-394). IEEE.