Future Role to be played by CC TV Camera's by Integrating with IoT

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Abstract: Today one of the greatest challenge being faced by the Governments is to provide safety, security and guard its citizens from vulnerable terrorist and other criminal attacks. In Current scenario, the role played by CC camera's is just acting as an **Eye** by recording all the visuals at the crime scene, which is later used by the Government or Security officials to understand the crime and act accordingly with the next steps.By leveraging today's technology capabilities and integrating with IoT, CC Cameras can be transformed into intelligent systems to take proactive actions based on the situation. In other words, instead of being just an "**Eye**", CC Cameras can act as an "**Eye**" with "**Brain**" and "**Hand**" to think and respond to a critical situation by taking an appropriate action by its own or can be operated from a remote location.IoT integration enables the current passive CC Camera's to see, hear, think, analyze, perform jobs and provide real time alerts and information to avoid the criminal activity in advance. The IoT transforms the CC Camera's being just traditional to smart device by exploiting the underlying technologies such as machine learning, embedded technologies, communication/internet protocols, sensor networks and related applications.Smart CC Camera Integrated with IOT aims at proactively avoiding the criminal activity or a mishap to be happening. Saving lives and actively preventing loss and injuries cut down costs associated and provide a safety environment to the citizens.

Keywords :CCTV,IOT, Face Recognition System, Sensor networks, Machine Learning, protocols.

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I. INTRODUCTION

Closed Circuit Television (CCTV) refers to video surveillance,which,uses video cameras to transmit a signal to a specific place,on a limited set of monitors. InClosed Circuit TV, picture is not broadcast but is viewed orrecorded. When developed, it was very expensive and used as a means of security system in banks and hotels. Nowadays CCTV technology is used in many fields.The main use of it is in Crime Prevention, industrial processes, traffic monitoring, control of retail and other sectors.Today Internet of Things(IoT) has become a communication paradigm that visualizes the upcoming future in which the objects which we use in our day to day life will be equipped with sensors and communication protocols that make the objects to communicate digitally with each other and user becoming an integral part of that digital communication. The concept of IoT aims at making the Internet more prevalent by enabling easy digital interaction with a wide variety of objects such as monitoring sensors, Surveillance Camera's or CC Camera's and so on. Using the IoT we can develop numerous applications that make use enormous wide variety of data generated by those devices to provide security and safety to the citizens by enabling the law

keeping forces with high end technology to take proactive actions even being located at remote.

From an application perspective, the utilization of IoT along with the backend network services and devices still lacks an established acceptable practice due to its complexity. Due to this technical difficulties the IoT adoption is lacking clear acceptable business model to gain investments to promote and develop these technologies.

The application of the IoT methodology to a Safety and Security context is of particular interest, as it caters the strong need of many government security agencies to adopt IoT solutions in the field of public safety and security, thus realizing a concept called Intelligent CC/Surveillance camera's which can act as an Eye with Brain and Hand. Although

there is no formal concept of Intelligent CC camera, the aim is to make the intelligent use of CC Camera's integrated with IoT and Facial Recognition software to provide security and safety to the citizens by identifying the criminals in a crowd and taking proactive action in a hazardous situation.

OBJECTIVES

The fundamental objective of this paper is to discuss a reference framework for the application anddesign of an Intelligent CC Camera. We discuss the specific characteristics of an Intelligent CC camera and its services that may drive the adoption of IoT by Government Security agencies. We then discuss the overview of approach for the design of IoT services and their related technologies and protocols, identifying their suitability for the Intelligent CC Camera concept.The specific objectives of the study are:

1. Provide a Safe and Secure Environment by proactively avoiding the mishaps.
2. Building an Intelligent CC Camera integrated with IoT to operate actions from a remote location (CC Camera acting as Eye, Ear, Brain and Hand).
3. CC Camera capable of taking proactive action based on the situation.
4. Real time alerts and information to the officials to take preventive actions within minutes.
5. Build an intelligent CC Camera with Face Recognition software to identify the Wanted criminals.

II. REQUIREMENT FOR INTELLIGENT CC CAMERA'S

Currently CC cameras are being used manually to monitor the live footage. CC Camera's apart from live streaming also record the ongoing activity. In case of any discrepancy or mishap, the CC TV recordings are manually verified and are used to identify the sequence of incident. But currently the CC Cameras are not equipped with intelligence, where they respond proactively if any unwanted incident happens or respond an intruder. Due to the limitations, humans cannot vigilantly monitor the CC camera's live streaming. This drawback of humans with current CC Camera technology is leading to a demand for an intelligent CC camera's that could serve the required task proactively. A Smart camera or intelligent camera is a vision system which in addition to image capture circuitry,is capable of extracting application-specific information from the captured images along with generating event descriptions or making decisions that are used in an intelligent and automated system.Operator watching a monitor for more than 20 minutes will lose attention andcannot differentiate the significant events. With multiple monitors it will be impossible for any operator manually maintain the attention and respond to an unwanted incident.While adoption of CC Cameras has been greatly increased by wide range of users like Government Security agencies, shopping malls, independent houses, schools, Traffic monitoring and so on. Extensively CC Cameras were used to merely record for possible use to identify the wanted criminals, vehicles after the attack or incident. CC Cameras to be geared and integrated with latest technologies to play a double role of just monitoring to object tracking, facial recognition, and recording for the purpose of monitoring anomalous or any suspicious activity, match against watch lists by providing real time alerts.

III. KEY FEATURES AND SERVICES BY INTELLIGENT CC CAMERA'S

3.1 INCLUSION OF FACE RECOGNITION SOFTWARE

CC Camera equipped with Face Recognition Software. With this intelligent feature equipped with CC Camera will help to identify proactively the wanted persons in a crowd, shopping malls, Public transportation areas and any security sensitive areas. Face recognition software is a software capable of verifying and identifying a person from a video frame or a digital image. This is done by comparing the available facial features from the image with the faces available in the database. There are different Face Recognition techniques such as Traditional – where algorithms for face recognition identify

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facial features by comparing the features of an image from the subject's face. The software analyzes the size, shape and color of nose, eyes, jaw and cheekbones. Three dimensional face recognition is an emerging trend where the 3D sensors capture details about the features of the face. Another emerging trend is skin texture analysis where the visual details of the skin captured in digital or scanned image. In this technique the unique lines, patterns and spots of a person skin is compared. The captured information is used to identify the distinctive features of a face such as eye color, shape of nose and chin. Using the above techniques the face characteristics are compared within the database and if any image is matched, the CC Camera will send out a real time alert with the location, time and direction to the security official to take an appropriate action. Using CC Camera with Face Recognition software will largely help to identify the wanted person or criminals in a crowd, bus, train or airport terminals. Unlike Bio Metrics like finger printing, iris eye scan techniques, Face recognition system in CC Camera does not require the person's cooperation, it will work independently without the suspect's cooperation and will identify and send alerts to the security officials. The advantage with CC Camera is it can be used for mass identification without the persons support, where as it is not possible with the bio metrics technique which requires the person's support.

3.2 VECHICLE MONITORING

CC Camera's equipped with Intelligence of Automatic Identification of Vehicle or Vehicle Number. Automatic License Plate recognition (ALPR) leverages a technology based on optical character recognition of images to identify the Vehicle license plates. This software integrated with CC Cameras can be used by law enforcing agencies or police to check whether the vehicle license plate is genuine and identify if it is as per government laws. Also this software can be used to collect tolls and other payments pending on that particular license plate by sending proactive alerts or information to the appropriate authorities and the owners of the vehicles. Regarding the application software aspect

of the program runs on standard PC and can be linked with integrated applications and software's using network sensors. ALPR technology detects the license plate of the vehicle to read the alpha-numeric details of the license plate. When integrated with CC Cameras this ALPR technology using IoT transmits the images from the road and detects for any wanted license plate and will send a real time alert to the security official for further action. Several algorithms need to be developed for accurately identifying the license plate, such as Localization of the license plate for isolating the picture on the plate. Size and Plate orientation to adjust the dimensions and size.Segmentation of characters for identifying the individual numbers and characters on the plate.Automatic Speed Limit Enforcement process can be implemented by using IoT and CC Camera's by sending real time alerts to Law enforcement personnel and also can be leveraged to send messages to the phone number associated with the license plate.

3.3 INTEGRATION WITH ARTIFICIAL INTELLIGENCE

CC Cameras integrated with Artificial Intelligence for Surveillance: Artificial intelligence for CC Cameras uses application software programs that analyzes the videos and images from CC Cameras to recognize objects, humans and vehicles. Software to be defined for restricted areas with the camera's view such as fenced area, parking lot and the property being protected by CC Camera. The Artificial intelligence sends a real time alert if a trespasser breaks into the property The Artificial intelligence functions by a set of algorithms or mathematical procedures knows as machine vision, which consists of a set of questions or flow chart to compare and identify the image seen with hundreds of stored images in database. Further to the rule of restricting human beings or vehicles from restricted areas at certain times of day, more sophisticated and complex rules can be set. An alert can be sent if vehicles drive in wrong direction. CC Cameras with Artificial intelligence can be capable of maintaining the surveillance of multiple cameras simultaneously. It will be capable of spotting a trespasser in the distance and in different weather conditions which will not be possible to do manually by

humans.Advantage of CC Camera's equipped with Artificial intelligence will prevent the incidents in real time. The most significant feature of the system is that the law enforcement officer or operator on receiving an alert from the IoT Integrated CC Camera could immediately communicate over speakers to the intruder. Most criminal activities are opportunistic and the risk of getting caught to the intruder becomes so evident when a live person is communicating to them and they are likely to abstain from intrusion and retreat. The law enforcement officer describes the actions of the intruder, so that intruder assumes that a real person is watching him and retreats from the scene, thus avoiding any offence to happen.

3.4 SURVEILLANCE FOR PUBLIC SAFETY

The large number of camerasoftendeployed in public areas, the automatic detection of events of importance for safety and security has become important – the events are required to trigger

an alarm,to alert humans able to make decisions about the need for action [14,15]. For example, one might wish to identify unattended baggage in a rail station. Of course,the sudden appearance of a suitably-shaped stationary object may be detected by conventional imageprocessing methods. Alternatively, if a person being tracked 'splits' into a moving person-like object and a smaller stationary object (e.g. depositing an item and walking away from it), this could be used to trigger an alarm.

It is relatively easy to automatically detect individuals in forbidden areas (Fig. 1) or individuals who loiter for excessive times in one place (which canbe a sign of criminal intent). Falling pedestrians may beidentified as person-like objects which take up ahorizontal position with little or no motion. This maybe of particular importance needing rapid response if observed on rail tracks [2].

**Fig.1 Pedestrian automatically identified as too close
to platform edge (marked by rectangle and bar)**

CC Camera Integrated with IoT and Artificial Intelligence for Real Time Action: In the above all sections we discussed, CC Camera with integration of IoT will be acting as an Eye with Brain. But with respect to the available high end technology software's and applications, CC Camera can act as an Eye with Brain and Hand. During 26/11 Mumbai Terrorist attacks in CST Railway station, the CC Camera was just recording all the activities of Terrorists, but since it is a mere CC Camera just used for recording, no other action was being performed by it. Using the latest hardware and software technologies, the proposal for the NextGen CC Cameras should equipped to handle scenarios more than just recording the incidents. CC Camera equipped to do a light firing of pellets or capable of releasing mild anesthesia gas during critical situation in security sensitive areas will make the criminals to disable temporarily and avoid the loss significantly. This is still a hypothetical proposal which needs to be discussed in large to develop NextGen CC Camera's integrated with IoT and Artificial intelligence to take actions accordingly.

IV. PROPOSED WORK

There are several components that we have to think before starting to develop the IoT based intelligent CC Cameras or surveillance system. We can think of an Architecture which consists of three layers. The Home Layer, consists of cameras, network sensors, actuators, edge router and servers.The router layer acts as gateway in the remote environment. The gateway layer which contains a router and database connected to a cloud platform

where video and images are stored and analyzed. Real time data is stored in the cloud database and any changes in the data are updated online. In our framework we focus on connection between cameras, sensors and actuators. The nodes to be connected to each other with links to communicate for video and image data transfer. The network topology which we think to be used can be mesh topology where cameras and network nodes are interconnected with each other. More research need to be performed on this area using the latest machine learning technologies and hardware equipments.

V. CONCLUSION

The vast and growing data produced by CC Camera's is a big challenge for the law enforcement officials to analyze due to the huge security footage and shortage of manual resources. CC Camera surveillance is tremendously valuable to fight criminal activity, therefore it is a big support to law keeping officials. But the main challenge is the ways of dealing manually this huge amount of data with limited human resources will hamper to take the advantage to the maximum extent. Hence we suggest to embrace the available high end technologies consisting of IoT and Artificial intelligence to enhance the current static CC Camera to be intelligent self-action cameras. Using the latest deep learning tools and technologies these cameras can process huge datasets in real time from different sources. Apart from that they can flash the abnormalities detected as they occur. This reduces the more monotonous and time consuming reading tasks are deputized to the software, reducing the law keeping forces workload while improving the productivity and efficiency. Using the Artificial intelligence and IoTtheNextGen CC Cameras will be avoiding the potential threats proactively.

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