

Surveillance System using Internet of Things

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Abstract— Security is a major concern of every individual today, be it of their assets, people, institute or workplace. A major part of security involves surveillance. Surveillance systems have been implemented almost everywhere now-a-days like in and around houses, shopping malls, hotels, air ports, railway stations and so on. This is due to its efficiency at capturing actual scenes involving crimes or giving opportunities to look at one's course of action all over again easily. Still surveillance systems available today consume lot of energy and man power, continuous surveillance in front of monitors is a tedious job and also not always possible. These issues of the current system can be resolved using Internet of Things (IoT) technology. Surveillance using cameras interfaced to motion sensors like Passive Infrared (PIR) sensor can help reduce power wastage due to continuous surveillance. Thus recording takes place only when required thus less man power required in monitoring surroundings. Our paper discusses these solutions in detail, highlighting IoT technology and its application in surveillance systems.

Keywords- Gas Sensor, IoT, PIR Sensor, Social Networking Site.

I. INTRODUCTION

Surveillance today finds application in almost every security sector. These sectors include personalized areas like houses, shops, industrial sector, corporate sector, institutional structures and housing societies and so on. With burgeoning security threats surveillance does not remain an option but has become a necessity. People today install surveillance system along with the very common and basic amenities of any edifice. The growing demand in this system demands growing need for energy and thus proportionally increased monetary investment.

The requisites for surveillance systems available are cameras, data storage systems, monitoring systems and personnel for monitoring the same. All these sum up to a huge amount of money adding a lot of weight to one's pocket. Also the energy consumption due to continuous surveillance and monitoring is very high. These drawbacks of the present system could be improvised using our proposed system which is energy efficient and cost effective too. We in our system have introduced motion detection sensor (PIR) which is based on principle detection of change temperature using Infrared radiation mapping. The sensors if detects a change of temperature it indicates the presence of a living object in front of camera interfaced with the sensor and only then the camera starts the surveillance. This helps reducing energy consumption and data to be stored.

Further our system on the basis of the output of the sensor notifies the end user about the crisis situation with the help of IoT technology. This technology thus reduces the man power required for continuous surveillance and also provides easy access to the installed system.

II. LITERATURE SURVEY

Surveillance can be basically defined as act of monitoring the behavior, activities and course of action of people with various purposes like their protection, management or direction. Surveillance finds a wide application in governments for tasks like crime prevention, security of processes or persons or for investigation of criminal cases. Surveillance systems are also misused today by various criminal organizations to execute properly planned crimes. These include robbery, kidnapping etc.

The present surveillance system^[1] includes various technologies like surveillance using computer, camera, telephone, data mining and profiling specified as follows:

A. Present Surveillance Systems

1) Computer:

Majority of computer surveillance includes data and traffic monitoring on the internet. This surveillance is carried out by automated internet surveillance computers. These computers skim through large amount of intercepted internet traffic and then report to investigation personnel. They notify the human investigators if they come across certain trigger words or phrases or websites or suspicious communications with other individuals or groups.

2) Telephone:

In telephonic surveillance, official and unofficial tapping of cell phones is done. In these systems advanced speech to text softwares are used which create machine-readable text from audio clips. This data is then processed by automated call-analysis programs in search of trigger words or phrases and based on the level of security threats involved, the human agents are notified.

Mobile phones are also used as a part of surveillance systems. Their common application is to collect location data. Tracking feature of mobile phone is useful as far as surveillance is concerned.

3) *Cameras:*

Surveillance is best carried out using cameras used to monitor a particular area. These cameras continuously record videos which are stored in a storage device or directly uploaded on a server. This surveillance is carried out by a human agent continuously hovering over the screens of the surveillance system. The overall surveillance system requiring a large equipment set up is an expensive affair consuming a lot of energy and man power. This system finds application in maximum surveillance sectors.

4) *Data Mining And Profiling:*

Data Mining is a technique which involves discovering of relationships within given statistical data using various programmatic algorithms. Similarly Data Profiling includes collection of information about an individual or a group to study their behavioral pattern or to create a profile. Both these are surveillance methods and are helpful in psychological or social network analysis. These methods today are directly performed by programmed software thus providing fast and more accurate results.

B. *Required Hardware and Software Tools*

1) *PIR Sensor:*

Passive Infrared (PIR) sensor^[2] is a pyroelectric device which identifies motion by tracking changes in the infrared levels emitted from the surrounding objects. It basically detects an infrared radiation emitting source. Infrared radiations are emitted by every living being with body temperature above absolute zero (-273.15°C or -459.67°F). These radiations are invisible to human eyes but can be detected by electronic devices like the PIR sensor. This sensor is termed passive as it just monitors the changes without any movement of its own structure. Using this sensor a motion sensor unit can be easily constructed. We in our proposed system use this sensor for detection of any intruder entering an unauthorized area. These sensors also come with dual channel technologies granting more precision and large coverage area.^[3]

- Working of Passive Infrared Sensors

The field of view of a PIR sensor is an area under which differences in infra-red radiations are noted. The range of field of a PIR is not fixed unlike the field of view. And the range of view deals with alterations in temperature and size of the source of heat. The PIR sensor regularly monitors every zone. The infrared radiation level increases whenever a heat source sneaks into sensor's zone. The PIR sensor identifies this change and turns ON the connected Transistor. And thus initiates the built-in "Time" process. PIR sensor continues processing changes in infra-red radiation if the target keeps moving in the zone.^[7]

TABLE I. PRE SE-10 SPECIFICATIONS^[6]

Item	Specification	Unit	Condition
Sensor Type	Dual Element		
Housing	To 5		
Element Size	2×1	mm	
Spacing	1	mm	
Responsivity Min Type	3.2 4.0	Xv/w	7...14mm, 1Hz, 100°C (One element Cover)
Match Max	<10	%	7...14mm, 1Hz, 100°C (Both element cover)
Noise Type Max	20 50	μVp-p	25°C, 0.4...10Hz
Effect Voltage Min Max	0.2 1.5		Re = 47XO
Window Material	Silicon, coated		
Spectral Range Transmission Blocking	T>30 average	%	7...14mm <5mm
Operating Voltage	12	V	
Operating Temperature	-10 - -40	°C	
Storage Temperature	-40 - -80	°C	

2) *Gas and Smoke Sensor:*

This sensor is used to detect the gas leakage and smoke occurring in home industry or in malls. Gases like LPG/ Ibutane/ propane/ methane/ alcohol/ hydrogen/ smoke can be detected using this sensor. Different types of gas sensors are used which detect different types of gases according to different concentration parameter of each of those gases. The gas and smoke sensors which we are using detect coal gas/ methane/ LPG.

3) *IoT:*

The network of physical objects, devices, vehicles, buildings and other items embedded with electronics, software, sensors, and network connectivity enabling these objects to collect and exchange data is called the Internet of Things (IoT). IoT allows objects to be sensed and controls them remotely across existing network infrastructure; it creates opportunities for direct integration between the physical world and computer-based systems. As a result we obtain improved efficiency, better accuracy and more economic benefits. IoT when augmented with sensors and actuators becomes an instance of the more general class of cyber-physical systems. Experts estimate that by 2020 IoT will consist of almost 50 billion objects.^[6]

The different essential systems like mechanical, electrical and electronic systems used in various types of buildings, which may be public and private, industrial, institutions, or

residential, can be monitored and controlled using IoT devices. IoT devices can be used to monitor and control home automation systems like lighting control, heating, ventilation, air conditioning, appliances, communication systems, entertainment and home security devices to improve convenience, comfort, energy efficiency, and security.

The various technologies compatible with IoT are :

- RFID and Near-field Communication (NFC) - RFID was the dominant technology in the 2000s. NFC became dominant later. Since then NFC have become common in smartphones. During the early 2010s, uses such as reading NFC tags or for access to public transportation made them common.
- Optical tags and Quick Response codes (QR codes) - These are used for low cost tagging. Phone cameras decode QR code easily using image-processing techniques. In reality the turnout from QR advertisement campaigns is less as users need to have another application to read QR_codes.
- Bluetooth Low Energy (BLE) - This is one of the latest technologies. BLE hardware in a built in part of every newly releasing smartphone. The power budget of BLE enables the tags based on BLE to operate for up to one year on a lithium coin cell battery.
- Low energy wireless IP networks - Embedded radio in system-on-a-chip designs, lower power WiFi, sub-GHz radio in an ISM_band, often using a compressed version of IPv6 called 6LowPAN.

III. PROPOSED SYSTEM

In our proposed system we gather data from different sensors like motion sensors, LPG gas sensors and temperature sensors. Then the data is uploaded over the server. Here we chose the THINGSPEAK as an IoT server to upload data. Data gathered from different sensors is uploaded over server in different fields which are represented in the form of graphs on the server. This will help to perfectly manage the data.

If the output of the LPG sensor is high then it will update the message “LPG gas is detected in your house” over the twitter and turn on the exhaust fan in order to remove LPG Gas from the house. The message regarding to the house condition is send over the twitter account in order to keep user updated about the security of his/her house.

A. Motion Sensor Usage

When motion is detected by the motion sensors, which are placed on the left side, right side and back side of the house, the controller will wait for a 1 minute to confirm the unidentified person. This avoids the miscalculations and unnecessary detection of stray animals and other things which do not move like human beings. If after 1 minute output of the corresponding sensor still remains high then it will send message to user through his/her twitter account saying “Motion is detected on left or right or back side”. Then controller will turn ON the camera and rotate the camera towards the side where motion is detected. Thus by

implementing this system we need to use only single camera to keep eye on whole house and require less storage space to store the video feed which saves the additional space required for data storage on server.

B. Camera Usage

The camera will be rotated towards the side where the motion is detected. Then the camera will send the video feed over the mobile screen. In this process initially, the camera records the video and sends that data to the Mbed board which then sends that feed over a server through Ethernet shield.

To upload data over the IoT server we are using the Arm controller and Ethernet shield^[4]. The Arm controller is used to connect and manage the connection between the sensor system and the IoT server. In Remote Procedure Call (RPC) a client makes a procedure call to send data packets to the server. When the packets arrive, the server calls a dispatch routine to perform whichever service is requested. The server sends back a reply to the client when the dispatch routine returns.

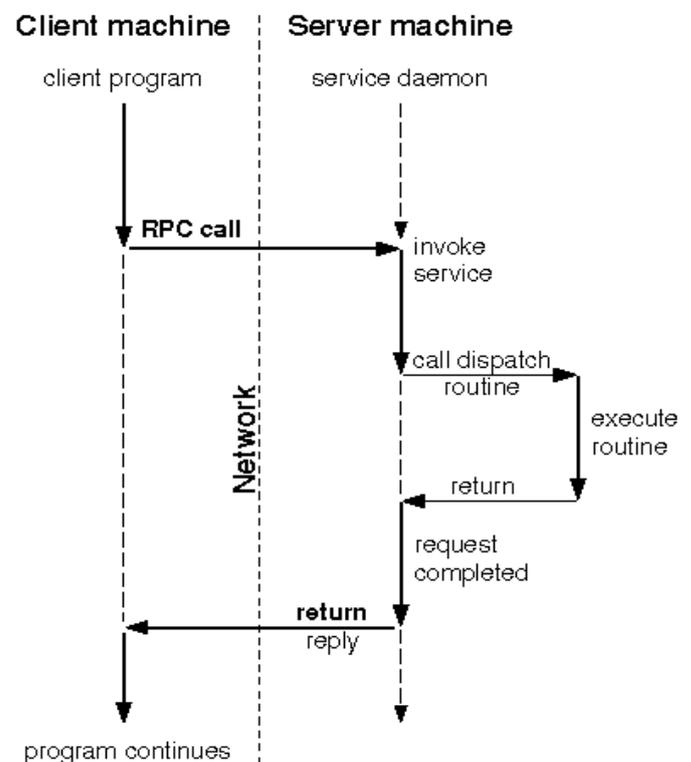


Figure 1. Network communication with remote procedure call

Programs designed to run within a client/server network model are produced using programming with RPC. Such programs to avoid the details of interfacing to the network use RPC mechanisms.

Also these programs provide network services to their callers without requiring that the caller be aware of the existence and function of the underlying network. The caller is not explicitly aware of using RPC as the call to users is as simple as a call to malloc.

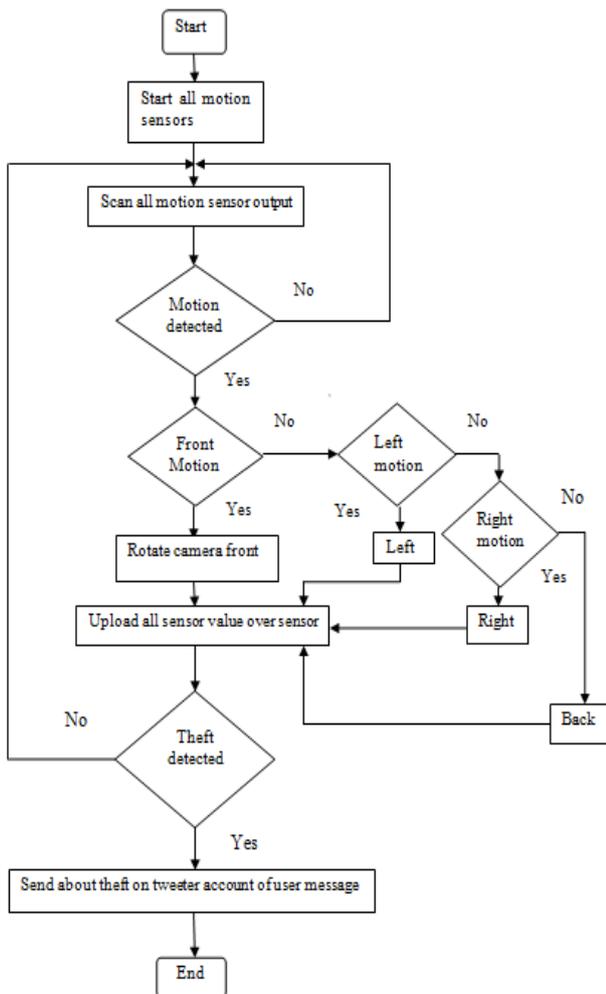


Figure 2. Flowchart of proposed Surveillance System

IV. CONCLUSION

In systems using IoT the proper management of data acquired from different sensors used for surveillance becomes

very easy. The data stored from different sensors can be used for development of system in future so that it can work more efficiently and it can be accessed easily by using the internet on personal computers and mobiles. Also many servers offer some extra features along with data recording like representation of the recorded data in pictorial forms such as graphs and hierarchical diagrams. These services offered by IoT servers are free of cost services so that the system becomes more economical as compared to normal surveillance system. Thus it can be used for surveillance of home in which data is gathered from different sensors such as motion sensors and uploaded over the IoT server. Also this system informs the user when certain value of sensor is reached its limit by using the social networking site account of user (e.g. Twitter). Thus it keeps the user updated about the status of his/her home (e.g. whether a theft is detected or not?). The IoT servers also offers online security so that the data can be accessed only by the home owner and any unauthorized person be blocked from accessing the data.

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