Surveillance Robot Using Raspberry Pi

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Abstract: **Communication mainly is the transfer of whatever thing or exchanging of data, so that the Internet of things is naught but the transferring or exchanging of anything with several other things. The using of internet authorized system or devices roughly calculated as that by 2020 there will be nearly about billions. The purpose of the paper is to define a safe keeping alert device spending little handling power by Internet of things which help out to observer plus alerts when gestures or else motion are there then send images to a cloud server. Besides, internet of things centered use can be used tenuously to observe the action as well as acquire warning when gestures or else indication are there. The images are showed straight to a cloud attendant, when the cloud attendant is not accessible at that time the records are put in storage close by on a Raspberry Pi. A credit card size Raspberry Pi with an advantage of Open Source Computer Vision (Open-CV) software knobs the image processing, control algorithms used for the attentiveness then shows taken images to concern persons email by the use of Wi-Fi module. The system uses ordinary webcam.**

The main objective of this paper is to develop a virtual environment for detecting suspicious and targeted places for user without any loss of human life. It is based on development of a robot vehicle for observing/spying the suspicious objects. It can continuously monitor the objects. Robot can move in every direction (left, right, forward and backward). It is used for video surveillance and remotely control the particular place using Wi-Fi as medium. The webcam which is placed on the robotic unit will capture the video and it transmits lively to the remote end. The major application of this paper can be analyzed using HTML web page which can be used to control the movement of the robot.

Keywords: **CCTV, GSM, HTML, IoT, USB.**

1. Introduction

In today's world the robotics field is growing exponentially and some of the popular robotic products are used largely by the industries, defense, academic and research communities.

The design and implementation cost of a robot is very less than hiring a human caregiver. The robots can be reprogrammed faster and more efficient. The robot has sufficient intelligence to cover the largest area to provide a secured space. The intelligent robots can perform preferred tasks in unstructured environments with or without human direction. The real time object detection is required because safety and security are essential in the remote monitoring and control systems such as intelligent home environments, consumer surveillance system, etc. The real-time human body detection is essential for various fields like home security systems, surveillance systems, communication systems and more. Basically the surveillance systems are building up with multiple cameras which are placed in different angles of view to track human objects. Particularly the tracking task is needed on cameras for dynamic objects which increases the number of cameras used in the system [2].

Earlier the robots were controlled through wired networks but now to make robot more users friendly, they are framed to make user commanded work. There is no distance limitation issues in this project. The robot is capable to work everywhere where there is a wireless connection. This project can be used for security purposes where we need to get information about some suspicious area/people. We can do this by sitting at a far secure place and safely devise a plan to tackle their activities It acquires image from cameras through a web browser. The robot contains a PC with a web server. It receives real-time uploaded image from cameras. As the internet of things is the concept, newly introduced in the field of electronics. The concept is about handling the things with the use of internet and the best model for these applications is raspberry pi [3].

2. Literature review

This project presents about utilizing Wi-Fi that is a specification for wireless personal area network in which the device connection is wireless. In this project Raspberry Pi is used to controlled the robot. In this project, control of robotic unit is from remote end with the use of internet also we are able to get the videos from robot end for surveillance purpose.

Using this purposed technology, it gives a helping hand to our security forces in detection of intruders. This project presents that one can control the robot from remote end. So that live streaming of video can be obtained. Limitation of range of operation does not arise. In this project, there is use of different kinds of standard protocols and machine-human interface. This system interface, sensors with Raspberry Pi, motor [1].

In the IoT platform based home security system, the main emphasis on protecting our loved ones and our belongings at home. Today numbers of IoT based home security systems are available in market. According to the literature and market survey, the common parameters of IoT enabled home security system are 24 hours monitoring and detection of the intruder,

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real time, cost effective and precise notification system suggested by various researchers. Following are the contributions of various researcher done in IoT domain.

Rani et al. (2018) explains the IoT based home security using Raspberry Pi which give SMS alert to authorize person through WAY2SMS and image of the unauthorized person via gmail. Dinakar et al. (2018) proposed IoT based automated home security system using Raspberry Pi which gives intruder detection alarm and notification to the owner. Ghodke et al. (2017) explains in their paper how the IoT network based system send the information of any person image coming close to the door for home security to the owner. Anwar et al. (2016) explains the IoT based door accessibility and voice alerting through smart phone for home security system. Tanaya and Kishore (2016) explains the up-gradation of home security system with face detection technique using haar algorithm in open CV for the detection of authorized or design and build unauthorized person. Chowdhury et al. (2013) describes IoT based remote access control system for authorized person at door using Raspberry Pi. The internet connectivity, raspberry pi, pi-camera and PIR sensor, these are common components are used in the above references system. PIR sensor is used for detection of movement at the door and pi-camera is used to capture the image according to movement in all system. Few system gives the remote access for authorized person at the door step. Comparatively very less work is done on the human face and object detection algorithm [2].

In literature camera based system and its advantages are explained which uses web server and web page to store data, literature discussed about remote image data transfer to web server with Wi- Fi but with limited distance constrain. The limitation of CCTV cameras is discussed while the real time systems provide an immediate response for crime detection and the prevention. The main principle of network remote video surveillance system based on embedded system as discussed in literature is to set an embedded web server at the video surveillance terminal. The video signal should be digitized first, then compressed by the high compression chip and finally is sent to the built-in web server. In literature power management is explained in sensor base system. The continuous monitoring of the videos is not required as discussed where the video frames were compared with a template image. While comparing if any intrusion is detected then the authorized person is notified via GSM which include one extra hardware in system and make is costlier. Previous talks about performance evolution of PIR sensor of deployment schemes. They operate autonomously in unattended environments. And literature suggests system, captures video, shares among networked systems and also alerts the controlling person with short message service. This considers visual transporting, storing, raising, using and connecting object with internet [5].
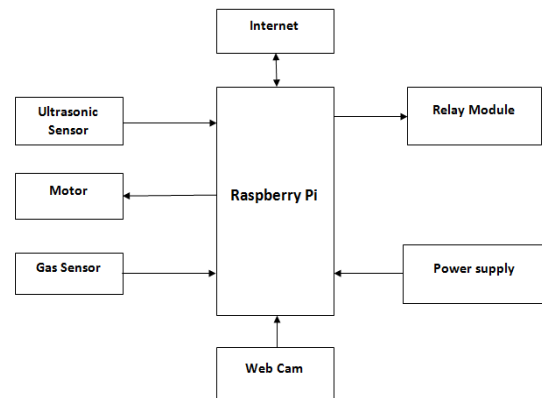
3. Proposed architecture

Fig. 1. Block diagram

A. Functional description

1) Raspberry Pi: A computer which is credit card sized is the Raspberry Pi, in which any HDMI input gadget is able to plug as well as for an operation, a keyboard is required for a procedure. When that one is prepared then the HDMI as well as control panel are similarly not necessarily needed meant for that one operation as you can then operate it by other means.

2) Gas sensor: Gas sensor is a device that detects the presence of gases in a area, often as a part of security. It detects gas leakage and other emission and control system so the process can be automatically shut down. In this project MQ-6 LPG gas sensor is used. It can detect gas concentration anywhere from 2000 to 10000ppm.

3) Ultrasonic Sensor: Ultrasonic sensors emit short, high-frequency sound pulses at regular intervals. These propagate in the air at the velocity of sound. If they strike an object, then they are reflected back as echo signals to the sensor, which itself computes the distance to the target based on the time-span between emitting the signal and receiving the echo.

4) Relay: The household electronic or electrical appliances are connected to R-Pi board with the relay interface circuit. The circuit comprises of a relay (12v, 50A), a transistor and freewheeling diode are used to drive the relay input The relay is the device that open or closes the contacts to cause the operation of the other electric control. It detects the undesirable condition with an assigned area and gives the commands to the circuit breaker to disconnect the affected area through ON or OFF.

5) USB Camera: USB Camera captures the image and sends it to the USB port of the Raspberry Pi board. The camera model used here is USB Camera model 2.0.

4. System Development

A. Hardware Design

1) *Raspberry Pi3B*

The Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard

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keyboard and mouse. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python. It's capable of doing everything you'd expect a desktop computer to do, from browsing the internet and playing high-definition video, to making spreadsheets, word-processing, and playing games.
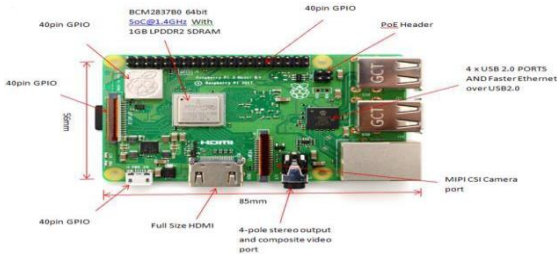

Fig .2. Raspberry Pi3B

2) HC-SR04 Ultrasonic Sensor

As the name indicates, ultrasonic sensors measure distance by using ultrasonic waves. The sensor head emits an ultrasonic wave and receives the wave received back from the target. Ultrasonic Sensors measure the distance to the target by measuring the time between the emission and reception. An optical sensor has a transmitter and receiver, whereas an Ultrasonic sensor uses a single ultrasonic element for both emission and reception.

Fig. 3. HC-SR04 Ultrasonic Sensor

3) MQ-6 Gas Sensor

This sensor contains a sensing element, mainly aluminium-oxide based ceramic, coated with Tin dioxide, enclosed in a stainless steel mesh. Sensing element has six connecting legs attached to it. Two leads are responsible for heating the sensing element, the other four are used for output signals. Oxygen gets absorbed on sensing material when it is heated in air at high temperature. Then donor electrons present in tin oxide are attracted towards this oxygen, thus preventing the current flow.

Fig. 4. MQ-6 Gas Sensor

4) Relay module

This is a 5V 4-channel relay interface board, and each channel needs a 15-20mA driver current. It can be used to control various appliances and equipment with large current. It is equipped with high-current relays that work under AC 250V 10A or DC 30V 10A.It has a standard interface that can be controlled directly by raspberry pi.

Fig. 5. Relay module

5) Web Camera

Webcam is a compact digital camera which works same as conventional digital camera but is designed to interact with the web pages and other internet pages. It captures the real time images through a tiny grid of light-detectors, known as charge-coupled device (CCD) from the location where it is placed. The CCD converts the image into digital format so that computer can access this data. Webcams don't have the internal memory to store the images so it transmits the data immediately to the host device through the USB or other analog cable. Some of these devices also come with built in microphone for video calling.

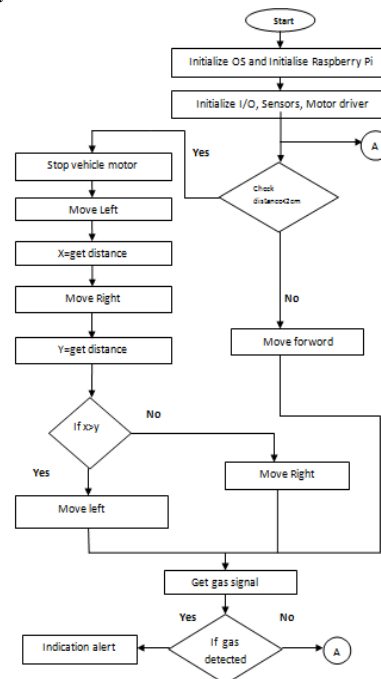Fig. 6. Web Cam

B. Software Design
1) Flowchart

Fig. 7. Flowchart

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2) Algorithm
1. Initialize OS and Raspberry Pi.
2. Initialize Hardware and Software.
3. Check if distance is less than 20cm, if not move forward and go to step 7.
4. If Yes, then stop vehicle.
5. Rotate motor to check distance to the left and right.
6. If distance is greater, then move vehicle in that direction.
7. Get the signal from gas sensor.
8. If gas is detected, indicator will indicate it and then go to step 3.
9. If not, then again go to step 3.

5. Implementation Result

Fig. 8. Hardware Module

The basic aim of system design is to continuously capture the surroundings under surveillance and if there is any moment is noticed, it turns on the lights and captures the screenshots and sends those over internet and it also alerts the authorized persons about human presence.
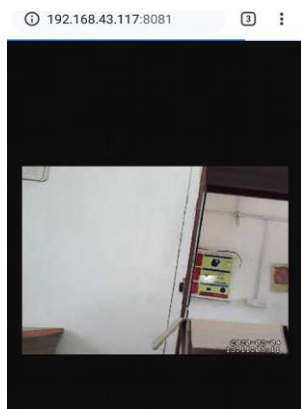

Fig. 9. Web page

The purpose of designing web page is to control robot.

6. Conclusion

In our project, we have designed and implemented a low-cost and efficient surveillance system capable of recording/ capturing video/image and transmitting to the internet. It is advantageous as it offers reliability and privacy on both sides. It is authenticated and encrypted on the receiver side; hence it offers the sensitive information only to the authorized personnel. Also because of its small size and portability, it can be placed in any kind of surrounding for surveillance. Areas where movement is restricted such as sensitive military/nuclear sites or in banks, this kind of surveillance and monitoring systems can be implemented. This will not only omit the requirement of physical presence for surveillance, but will also capture all information in the storage which will be proving very beneficial.

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