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Military Surveillance Robot Using IOT

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Abstract: Remote surveillance and monitoring of our frontier has seen a growing need in emerging times. Currently the surveillance of International border areas is a strenuous task for soldiers. As every field is opting for robotics in order to improve the existing systems, our aim is to implement the robotics in military security systems for the at most security. By this paper, we put forward a surveillance robot which is capable of surveilling and detecting for intruders in region of international borders Therefore the surveillance robot is designed in such a way that it would automatically detect the invader in the borders and alert the nearby security personnel as a helping hand by alerting him through video streaming over Internet of Things. The heart of the robot is a powerful Raspberry Pi 3 Model B which is used as the ultimate controller for the entire operation of the robot in this bot we have used PIR sensor which is interfaced with the raspberry pi in order to rotate the camera for video streaming and it would be enabled when an intruder is detected. And Infrared sensor is used for detecting the obstacles in order to avoid collisions. For capturing and streaming the video the raspberry pi camera is attached to the micro controller which actively monitors the area and send a notification when any obtrusion is detected. The transmission part of the surveillance robot is carried out using Internet of Things by enabling WiFi. The live streaming ability of the raspberry Pi allows the camera feed to be analyzed from any location using internet. The IOT module eliminates the need of transmitter and receiver module thus it makes the node compact, cost effective and ease of using. Thus, the Raspbian operating system-based surveillance robot is designed to achieve the objective of this paper.

Keywords: Surveillance Robot, Wireless Camera, IOT, Video Streaming, Raspberrypi

I. INTRODUCTION

In the current scenario, ensuring safety and security has become an inevitable essentiality. Traditionally, surveillance systems have been installed in every security critical areas. These systems generally have high quality cameras, multiple computers for monitoring, servers for storing these videos and many security personnel for monitoring these videos. Wireless system has been under rapid development in recent years. Communication without wiring makes control systems very compact and robust. The key feature of this technology is that it reads a signal (Transmitting / Encoding Circuit) and processes it into a wave (low frequency) form which is then Decrypt into a specified signal receiver (Receiver / encoding) which then decrypt the signal into the previously transmitted signal resulting in a successful wireless data communication. In robotics, this technology is of heavy demand. By the application of a wireless signal communication, a robotic system can be made more efficient and compact.

U. Bokade and V. R. Ratnaparkhe [1] has proposed a method for controlling a wireless robot for surveillance using an application built on Android platform. Android Smartphone and Raspberry pi board is connected to Wi-Fi. The Video Streaming is done using MJPG streamer program that gets mjpg data and sends it through a HTTP session. The experimental result shows that the video streamed up to 15 frames per second. H. R. and M. H. Safwat Hussain [2] has designed a smart surveillance bot is designed for highly restricted areas with automatic surveillance of an area specified by the user and obstacle detection and avoidance using Ultrasonic Sensor. human detection using Infrared (IR) thermal camera and Identification of Friend or Foe (IFF) using RFID tags. Live video surveillance using camera and manual remote-control mode. The bot has the ability to detect human presence in an area using thermal image processing. If the bot identifies the person as foe, it automatically sends the user a notification of intrusion and turns on live video streaming. Nayyar A., Puri V., Nguyen N.G [3] has proposed an Internet-of-Things-based Internet of Robot. InterBot 1.0 is IoT. based via ESP8266, and all the data can be viewed in live graphs via ThingSpeak.com. The Results state the efficiency of Interbot 1.0 in monitoring real-time environments. G. O. E. Abdalla and T. Veeramanikandasamy [4] has given a Raspbian operating system-based spy robot platform with remote monitoring and control algorithm through Internet of Things (IoT). The human intervention is detected by PIR sensor and it sends the signal to the web server which inturn sends the video to the control room. This surveillance system using spy robot can be customized for various fields like industries, banks and shopping malls. Suryavamsi P.S.N., Arockia Selvakumar A [5] proposes, a

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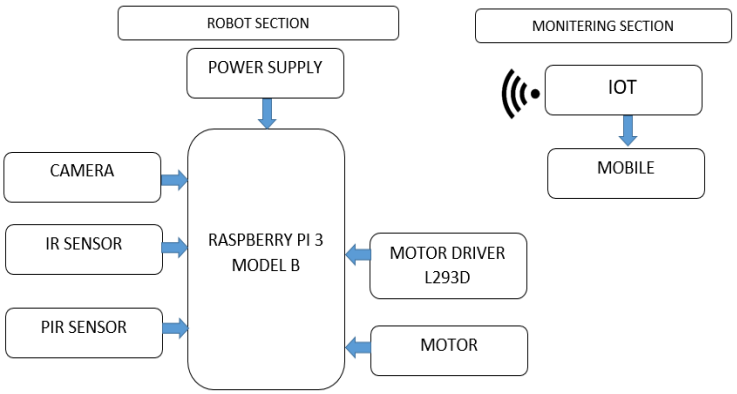
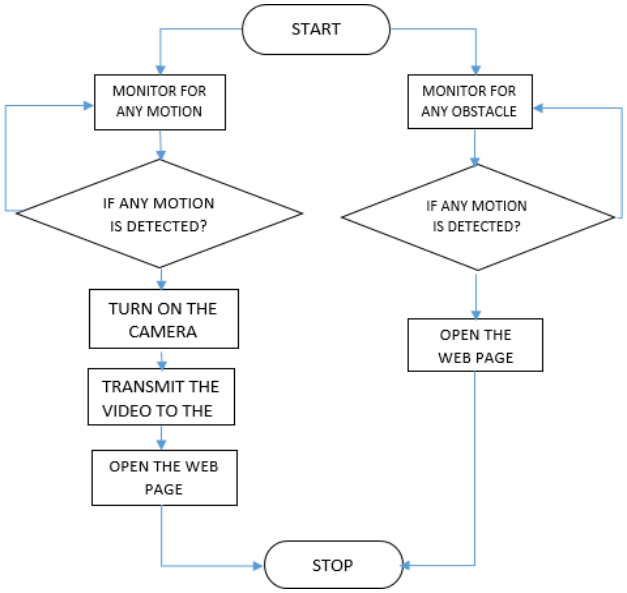
smart user-friendly surveillance robot is proposed. This obstacle avoiding robot can monitor the status of the entire house while the resident is away, by detecting the presence of burglars and gas leakage from LPG Cylinders. The robot's design also includes transmission of monitored data to the Thing-Speak IoT Cloud Server, from which the resident receives instant email messages in case of presence of a burglar or excessive gas leakage detected by the robot. Kyunghoon Kim, Soonil Bae and Kwanghak Huh [6] proposes a new security solution that integrates vision, intelligent algorithm and robot technology This system transmits images to the control room when unusual movement is detected. This system is used for a small area. G. Song, K. Yin, Y. Zhou and X. Cheng [7] gives the development and characterization of a surveillance robot with hopping capabilities for home security. It depends on the elastic elements in a six-bar linkage leg system to enable hopping locomotion. It can also roll freely on flat floors and change its directions by the two-wheeled differential drive system. It adopts the ZigBee protocol for wireless communication and therefore can be added to a ZigBee-based home control network as a mobile video sensor node. Xinyu Wu, Haitao Gong, Pei Chen, Zhong Zhi and Yangsheng Xu [8] designs, a household surveillance robot that can detect abnormal events by utilizing video and audio information. In our approach, moving targets can be detected by the robot with a passive acoustic location device. Then the robot tracks the targets by employing a particle filter algorithm. In adapting to different lighting conditions, the target model is updated regularly based on an update mechanism, For audio surveillance, Mel Frequency Cepstral Coefficients (MFCC) is used to extract features from audio information. In our proposed system the surveillance robot uses raspberry pi 3 model B as the controller. The unusual movement due to human interventions is detected by PIR sensor which sends the signal to the raspberry pi which inturn turns on the USB camera. The camera live streams the video to the web page using Internet of Things. The robot's movement is controlled using IR sensor. The camera used here is a night vision camera. Thus the system is more flexible to monitor even during night.

II. METHODOLOGY AND DISCUSSION

1. Block Diagram



2. Flow Chart



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3. Hardware Implementation

Raspberry pi 3: The entire proposed system has Raspberry pi Model 3 board, PIR and IRs sensors, L298N motor driver, and robot chassis. The Raspberry pi 3 Model-B is the 3rdgeneration Raspberry pi minicomputer with a 64-bit 1.2GHz quad-core processor, 1GB RAM, WiFi and Bluetooth 4.1 controllers. It also has 4 x USB 2.0 ports, 10/100 Ethernet, 40 GPIO pins, Full- size HDMI 1.3a port, Camera interface (CSI), Combined 3.5mm analog audio and composite video jack, a Display interface (DSI), MicroSD slot and VideoCore IV multimedia/3D graphics core at 400MHz/300MHz. The GPIO11 of Raspberry Pi is connected to the PIR motion sensor.

Passive Infrared Sensor: A Passive Infra Red (PIR) sensor is a pyroelectric device which detects level of IR radiation from the living objects. The PIR device does not emit an IR signal, rather passively detects the infrared radiations coming from the human body in the surrounding area. The detected infrared pulses are passed to raspberry pi which will reset or set the sensor output. The PIR sensor will set the output (logic '1') when the living body within the range approximately less than 10meters and otherwise it reset the output. The PIR sensor module has three terminals: Pin1 is connected to the vcc terminal of the raspberry pi, Pin2 corresponds to the output terminal of sensor connected to pin 11 of the raspberry pi, and Pin3 is connected to the ground. It is used in many systems because low-power, inexpensive and easy to interface with all type of microcontrollers.

Fig1 PIR sensor and raspberry pi-3 Interface

Night vision camera: The iball night vision USB camera is 20MP static sensitive type camera. The iball camera is connected to USB port of Raspberry pi.whenever the motion is sensed the camera is turned on and start recording video.Then it transmit the recorded video to the IOT cloud via Raspberry Pi.Finally the video could be viewed in the webpage. The IR sensors determine the obstacles and show the status(high or low) of each IR, and according to the state of the obstacle the robot moves the opposite direction. The major intention of this system is to capture images when the human-being is present in the Robot's ambient and transmit it as soon as possible to the storage which can be accessed through a webpage. The Robot is developed by using DC geared motors, which is controlled through the GPIO pins of the Raspberry Pi. The Python programming language is used to operate the robot. Furthermore, the webpage is used to monitor the action of surveillance robot which is controlled though IoT.

Fig:2 Camera and raspberry pi-3 Interface

Relay board: The relay logic is used for controlling the direction of the robot and it is achieved by interfacing the Infar red sensor with the relay board.

Fig:3 Relay Board with IR Sensor and motor

The hardware is interfaced in a such a way that whenever the obstacle is detected by the IR sensor the bot turns its direction in order to avoid the obstacle. And the entire relay board, IR and the motors are powered up by using the rechargeable 12 volt battery along with the free wheeling diode so that the reverse current doesn't causes damage to the

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battery as well as the circuit by blocking the flow of reverse current. IC 7805 voltage regulator is used for the purpose of converting the 12v into 5v and it is used for driving the IR sensor. It is arranged in such a way that the OUT 1 pin of IR 1 and OUT 2 pin of IR 2 are connected to the R1 port and R2 port respectively so whenever detected control's the robot's motion.

4. Software Implementation

Steps to install Rasbian OS in Raspberry pi

In order to install Raspbian OS in the raspberry pi3 modelB, The Next Out of Box Software(NOOBS) has to be installed first of all.

1. Allocate the drive for installing OS
2. Insert SD card by using the CARD READER or else insert in directly in the SD card slot provided in the raspberry pi and it can be of 16GB or else 32GB accordingly.
3. Download the WINDISK 32 utility from source forge project which is a zip type file.
4. Extract and run the zip file.
5. Select the file and run as administrator
6. Select the image file which was extracted above
7. Click the drive letter of the SD card in the device box
8. Select write and wait for write process to complete.
9. Exit the image and eject the SD card

Steps to install VNC Viewer

1.Go to - https://www.realvnc.com/en/connect/download/vieweR/ and download the vnc viewer
2.Goto downloads and run the VNC CONNECT setup.
3.Set up the password and user name once the installation is complete.
4.Open the VNC CONNECT using the password.
5. Connect the raspberry pi with the viewer using raspberry pi's IP address. 6.Now the viewer is ready for executing the output.

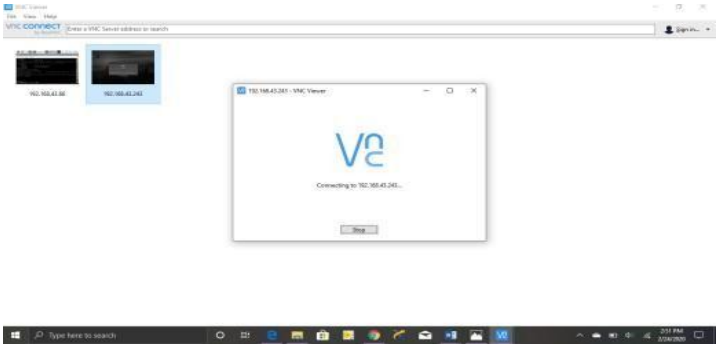

Fig:4 VNC Viewer home page

Webpage Designing: The webpage is created with the help of Hyper Text Mark language, the HTML gives the provision for the basic layout of the site, which is further improved and personalized by other technologies like PHP and JavaScript.

Fig:5 Web page

PHP and javascript is used to transmit the video which been captured using the night vision Web camera to the webpage, and the webpage displays the video which is captured using camera when the PIR value goes high when any motion is detected and the same transferred to the webpage via php.

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Internet of Things: The Internet of Things (IoT) can be considered as a universal network which enables the interaction between non living to non living things and human and the non living things. It is the mechanism in which anything in the world can by identified using an unique identity to each and every object. The video captured can be sent through the web page with the help of internet. The user can access the video from anywhere in the world through web page. And the robot can be used in the hazardous place in order to capture the video and to live stream the same over internet.

Indication section: when the motion is detected, an email notification is received by the end user through registered the email address. Once the mail is sent, the user can login to the Raspberry Pi by using its IP address and VNC rebooted and connected to the network again.

Fig:6 Email notification

IV. RESULT AND DISCUSSION

The Passive Infrared sensor senses the motion for a range of 3 to 7 meters around the robot's ambience. After the robot's algorithm is executed the detected signal is fed as an input to the Raspberry pi3 which notifies the camera to turn on. Once the camera is turned on it starts recording the video of the intruder. The video is transmitted through Internet Of Things to the web page created by the user. Once tshe video is uploaded, he can login to the Raspberry Pi by knowing its IP address and using VNC viewer software. For this purpose, the Pi's IP address should be made static, that is, it should not change whenever it reboots and connects to the network again.

Fig:7 VNC Viewer Authentication

For logging in to the Raspberry Pi from remote location, we need to enter the right credentials, namely, Username and password which are defined at the time of installation. Once logged in, we can see our desktop from remote location.

Fig:8 VNC Viewer desktop site

Once we gain remote access to our Raspberry Pi, we can view live feed from the camera easily using IoT. The quality of live feed obtained depends on the resolution of camera used as well as the internet speed at the Raspberry Pi's end (for uploading) as well as the user's end (for video streaming).The robot's motion is controlled using relay logic and modified wall follower algorithm.

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Fig:9 Video of the motion detected

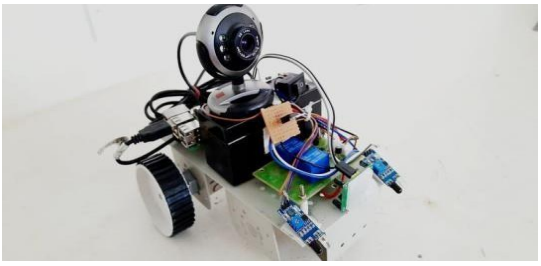

Fig:10 Surveillance Robot

V. CONCLUSION

Thus we have designed a smart surveilling system is capable of recording andtransmitting the video to anyportable device . It is beneficial as it offers quick transmission of the video through Internet of Things. Necessary action could be taken in short span of time in the case of emergency such as the presence of the unwanted people in war areas who are not allowed in re areas can be determined by the PIR sensor which sends a signal to the Raspberry Pi when a human - being is in the ambience of the Robot. In turn, the Pi triggers the camera immediately to capture an image and send it to the web page. The PIR sensor and proximity sensors are activated depend on external stimuli via Internet of Things.In addition to this, the email notification would be received by theuser.

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