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ABSTRACT

Nowadays robot plays a vital role in our day to day life, thus reducing human activities. The main function of Spy robot is to roam around high sensitive region and provide video information from the required environment to the remote monitoring station. In this project, one can control the robot using Bluetooth reducing human effort. The user can continuously monitor the surrounding activities of robot location with live video streaming using wireless camera from the robot. This robot is modeled with Raspberry Pi microcontroller which control the robot behavior. The proposed spy robot is used to find smugglers infiltration.

KEYWORDS: Robot, Raspberry Pi, Sensor, Motor, RF transmitter/Receiver.

1. INTRODUCTION

All A Robot is a machine that is designed to perform a particular task based on programming is done by the user and it can perform multiple tasks at a time. Nowadays most of the industries are automated with a robotic module. The development of automation in a robot is used to perform the risky task in which the human cannot perform the task. The infiltration at border and forest area is still a challenging task in monitoring. The forest areas are patrolled by forest guarding forces and it is difficult to monitor the forest area continuously. An essential requirement of this situation is the robot which automatically detects infiltration activities in the forest to monitor illegal activities (tree smuggling) and to alert nearby security control units.

The application of the spy robot in the border area is to detect infiltrators and also to carry out the risky job that the soldiers cannot perform. An RF based spying robot with wireless camera which sends the signal to the base station to avoid human risk and the movement of robot is controlled by android based smart phone [1]. The near field robot control can be attained using wireless gesture recognition in which an ATMEGA32 processor integrated with Android operated smart phones [2]. Most of spy robot are destructed due to the obstacles in the application field and a hybrid approach based on limit-cycles method and fuzzy logic controller for the problem of obstacle avoidance of mobile robots in an unknown environment. A hybridization approach with basic limit-cycle method to obtain safe and flexible navigation [3]. The robotic movement plays an important role in surveillance system. A rope climbing robot capable of moving vertically and horizontally embedded with a drop box performs surveillance at different location [4]. An embedded system with video capture, short message service (SMS) alarm, and client video monitoring uses Video 4 Linux to get the camera video data, which is transferred to the Web Server on the client browser. The entire system is modeled in such a manner that data transfer is possible with internet connectivity[5]. A data base for video control server is used to automatically store the selected frames of the video stream data with 3G network and a high-speed video monitoring sub-system using 802.11[6]&[7]. For video transfer application in home security system captures the information and transmits it via a 3G Dongle to a Smart Phone using web application in Raspberry pi[8],[11] & [12]. A spy robot platform using Raspberry pi with control algorithm for remote monitoring through Internet of Things (IoT) is proposed to reduce manual error and protect the country from enemies. The sensor values from PIR is sent to the users through the web server and pi camera capture the moving object which is posted inside the webpage simultaneously [9]. A PIC controller with Radio Frequency modules using wireless logic signals to control the motors of the Spy robot control system for remote access[10]. The design of our project encourages developing a spy robot based on remote access through RF signal. The intruder movement in forest area is captured by the camera and the image is stored in the memory. The Raspberry Pi controller activates the

RF transmitter based on the sensor data. The RF signal is transferred through wireless power transfer module to remote control room. The robotic movement is controlled from the remote location enabled through RF signal Transmitter.

2. OBJECTIVES AND HARDWARE REQUIRED

The main objective is to construct a robot for spying purpose in dense forest area where infiltration activities such as animal poachers, Maoist movement, tree smugglers. The human effort in continuous monitoring is a risky job and the same task can be performed by robot. The spy robot can monitor even in darker places or in night and it can record the view clearly. To convert the image to information, the image processing application of Raspberry pi controller is used. For communication with remote location, an additional communication module is used as Bluetooth and Zigbee communication is not achievable.

A. Raspberry Pi Microcontroller

The Raspberry Pi itself is an embedded computer and it is also known as single board computer. The processor in Raspberry Pi is a hybrid between a microprocessor and microcontroller. This system on chip contains a Broadcom BCM 2835/6/7 ARM CPU, a Broadcom VideoCore GPU (graphics processing unit) and RAM all tied together.

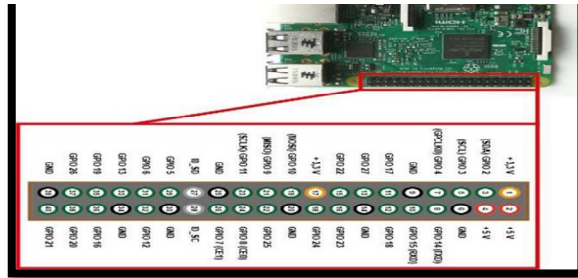


Figure.1 Pin Configuration of Raspberry Pi

In our proposed model of spy robot the Raspberry Pi controller plays the major role in infiltration detection. Raspberry pi can handle multiple programs simultaneously and has the advantage of wireless router. An Ethernet network serves as a wireless access point, creating a secondary network, which is entirely managed by the Raspberry Pi.

B. Sensor Module

The sensor module block consists of three sensors to identify human and animal movement, for calculating the distance of infiltration from spy robot and to identify the dimness to activate camera module.

Passive Infrared Sensor (PIR sensor), identifies the changes in the radiation which is generated by warm-blooded motion objects. The PIR sensor is made of two slots, which is sensitive to IR. When the sensor is idle, both slots identify the same amount of IR which is radiated from the room or walls or outdoors. The human or animal interference causes a positive differential change. When the interference has crossed the sensing area a negative differential change occurs.

Ultrasonic sensor detects the objects or any obstacles present while moving. It is also used to measure the distance between the object and the robot by sending ultrasonic waves. These waves have frequencies that are beyond the normal hearing frequencies. It consists of two transducers one is the transmitter and the other is the receiver.

Light Dependent Resistor (LDR) uses its resistivity variation with respect to the incident light. LDR changes its magnitude of the resistance falling as the level of light increases.



Figure.2 Sensor Module

C. Camera Module

Raspberry Pi Camera module is used to take pictures and high definition video and the CSI (Camera Serial Interface) interface connects the Pi Camera module with the controller board directly. The Pi camera has a resolution – 5 MP with HD Video recording in 1080p @30fps, 720p @60fps, 960p @45fps and so on. It can also capture wide, still (motionless) images of resolution 2592x1944 pixels. The images are flipped horizontally or vertically and also a change in image quality parameters such as brightness, contrast, saturation and sharpness and access advanced camera features to improve image effects. These features of camera is used to capture the image of smugglers infiltration in dense forest.

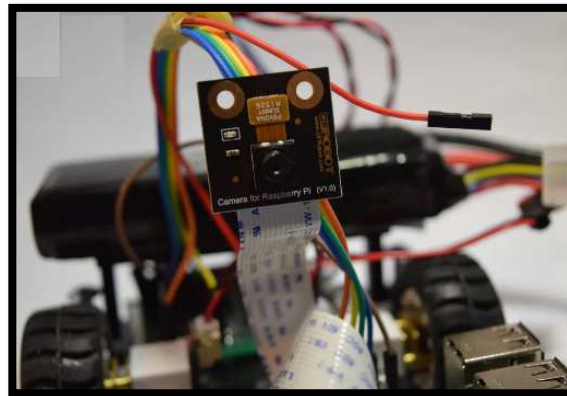


Figure.3 Camera Module

3. PROPOSED SYSTEM

The proposed model is used for uninterrupted monitoring of forest areas using mobile robots. The monitoring action in dense forest is performed as two task. In task-1 the sensor block monitors the activity surrounding the robot and if the sensor data is above the threshold value the camera module turns on. The camera module is able to deliver clear 5MP resolution image, or 1080p HD video recording at 30fps. The camera module attaches to Raspberry Pi through dedicated 15 pin MIPI Camera Serial Interface (CSI) for interfacing to cameras. The CSI bus carries pixel data with high data rate to the BCM2835 processor. The human infiltration in forest area is identified based on sensor data and image comparisons with captured data and raspberry pi data base .The image processing features of Raspberry is initiated with preprocessing of image data. The quality of image acquisition is enhanced with enhancement algorithms.

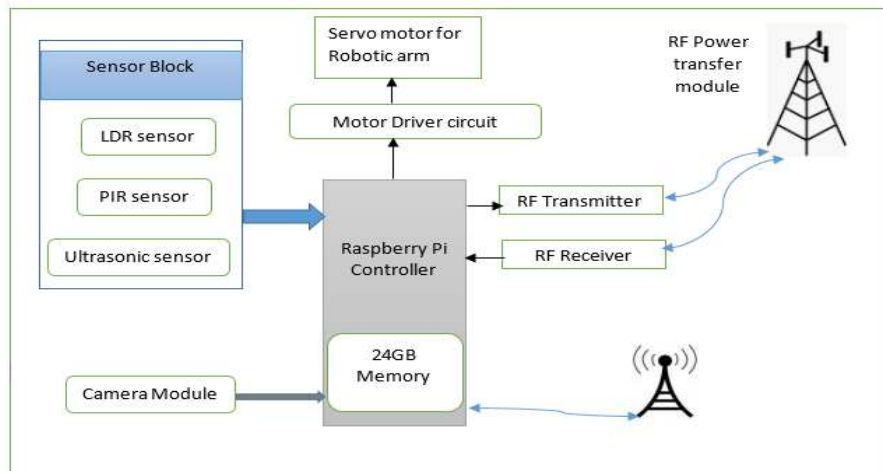


Figure.4 Proposed block diagram of spy robot

The Raspberry Pi is based on the Broadcom BCM2835 system on a chip (SOC) has a Secure SD or Micro SD card reader sockets for boot media and as memory. The system provides Debian Linux operating system Raspbian image for download. Python The program code in python is developed to compare the captured image with system image to identify the human intrusion based on the threshold value of sensor module. The movement of robot is controlled based on image captured and sensor data. A motor driver acts as an interface between raspberry pi and motors. An L293D dual bridge motor driver integrated circuit(IC) is used for motor movement. The intruder movement is communicated to remote location as RF signal. The RF module operates at Radio Frequency and transmits data or command with 434 MHz. RF modules comprises of an RF Transmitter and RF Receiver. A serial input is transmitted as RF signal through pin 4 with the rate of 1 Kbps- 10 Kbps. The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter in remote location. The long range signal transfer is possible with RF power transfer module.

In task-2, the raspberry pi itself is a wifi module and if it is connected with wifi network the image captured can be transferred to distant location with real time monitoring. Monitoring a dense forest location is applicable through task-1 methodology. The working model of proposed system is expressed in Fig-5. The spy robot uses battery backup and solar cells for power supply. Once the device is in ON condition the sensor module fetches the input. The sensor module will be in fetch mode till the threshold value is obtained. If the PIR and ultrasonic sensor value reaches threshold limit the camera module is subjected to ON condition and surrounding image is captured. The Raspberry pi controller compares the image with the memory image for human detection. Once the human detection is confirmed, an RF signal is generated which is propagated to remote control location through RF power module. The RF signal communicated is used to alert the authority about human infiltration.

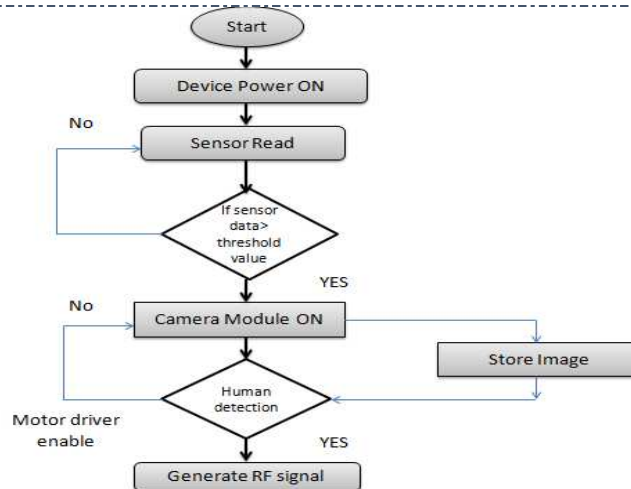


Figure.5 Flow chart of proposed spy robot model

4. RESULT

The overall outcome of the system is to eliminate the human infiltration in dense forest. The spy robot automatically detects trespasser in the forest and detects any kind of illegal activity (tree smuggling) based on sensor data and alerts the nearby security control unit and remote location. In this present work a control algorithm has been developed with image processing techniques for human detection. A 433mhz RF signal is used to carry the information regarding human infiltration. The RF signal is transferred to a distance of 100meters and to provide uninterrupted monitoring RF power module is located in dense forest, which is used to carry the information to remote control room. A DTU Lora Modbus Gateway Wireless data transmission Transmitter/Receiver of 433MHz RF Module IOT devices GPS track is used as RF power transfer module.

5. CONCLUSIONS

The robotic surveillance is very necessary, especially in environments like forests to track Maoist movement and smugglers. The surveillance of dense forest with spy robot is implemented with the proposed methodology of 8km communication with RF signal. The human detection is performed with image processing technique in comparison with captured image and the memory image. The robotic movement is controlled based on sensor data. This Idea can be further implemented to develop a real product in the future with wifi based image transfer.

6. ACKNOWLEDGEMENTS

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