

## **A Review Paper on IOT Device for The Tactical Military Environment Using Raspberry Pi**

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### **Abstract**

*As we know the surveillance is a difficult task of International border areas. It is not possible by the border guarding forces to watch the border at each and every moment. In this case the essential requirement is to have a system which automatically detects trespasser in the border and report nearby board security control unit. Nowadays, to carry out risky jobs the robots are used that cannot be done by the soldiers. In this present work, a Raspbian operating system-based spy robot platform with remote monitoring and control algorithm through Internet of Things (IoT) has been developed which will save human live, reduces manual error and protect the country from enemies. The system comprises the Raspberry Pi (small single-board computer), camera, PIR sensor and shooting gun. The Raspberry Pi is the brain of the system. Android app control the moving to a specific direction and camera for live streaming videos of required areas for tracing and attacking. And the PIR sensor are activated depend on external stimuli via IoT. The user is able to access the system with control buttons on the android app from control room.*

*Keywords— IOT, Raspberry Pi, 5 MP Pi Camera, PIR Sensor.*

### **I. INTRODUCTION**

In military fields they always tried to use new gadgets and weapons for reducing the risk of their casualties and to defeat their enemies. The robotics product is used largely by the industries, defense, academic and research communities and it is growing exponentially. The robots can be reprogrammed faster and more efficient and its design and implementation cost is very less than hiring a human caregiver. The robot has sufficient intelligence to cover the largest area to provide a secured space and perform preferred tasks in unstructured environments with or without human direction. For safety and security, real time object detection is essential in the remote monitoring such as intelligent home environments, consumer surveillance system, etc and the real-time human body detection is essential for 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. The tracking task is needed on cameras for dynamic objects which increases the number of cameras used in the system. In proposed system a single camera is installed to take photos and stream videos because an intelligent surveillance system with multiple cameras is complicated and costly. The PIR sensor is used to monitor any living object and it is more suitable for surveillance systems. A robot can be controlled in two methods by hardwired control or wireless control. The wireless

control provides additional benefits including increased flexibility and reduced installation cost. In latest the internet technology is used for movement control and all other purposes like image or videos capture by the robot and shared via internet. In proposed model the system's movement is controlled through android app.

## II. LITERATURE REVIEW

A robotic vehicle using Radio frequency (RF) technology for remote operation attached with wireless camera for monitoring purpose. The robot along with camera can wirelessly transmit real time video with night vision capabilities. Also, the Robot Vehicle is provided with the laser beam gun and Water sprinkler operation. This is kind of robot can be helpful for spying purpose in war fields. An 8051 series of micro controller is used for the desired operation. Robot has supported with the Laser gun for any destruction or so use, purposes, also the Robot has added a water sprinkler in advance for the fire safety as well are for extinguishing purposes, the Robot have a gun for shooting purpose which can load and reload accordingly. Also, a cutter for cutting tresses. This is kind of robot can be helpful for spying purpose in war fields. From this paper we came to know about how to make wireless robot also having shooting capabilities [1].

An autonomous ground Intelligence, Surveillance and Reconnaissance (ISR) system comprising of multiple distributed, wirelessly communicating smart sensors. The ISR system, in turn, is a part of a larger System of Systems (SoS) consisting of aerial, manned, etc. surveillance systems and information collection centers. The smart sensors of the ISR system perform environment monitoring using different modalities and exchange object detection and identification results to assess the situation and provide other SoS components with this information. In the paper we discuss using acoustic, magnetic and Passive Infrared (PIR) sensor information for target detection and identification. They also propose an approach to distributed acoustic source localization and a method of velocity estimation using PIR data [2].

A robot which is usually an electro-mechanical machine that is guided by computer and electronic programming. Many robots have been built for manufacturing purpose and can be found in factories around the world. The design of the robot is such that it is controlled by a mobile app. We use Bluetooth communication to interface Arduino UNO and android. Arduino can be interfaced to the Bluetooth module through UART protocol. According to commands received from android the robot motion can be controlled. The consistent output of a robotic system along with quality and repeatability are unmatched. This robot is capable of spying using a wireless camera. This robot can be reprogrammable and can be interchanged to provide multiple applications. The design of the robot is such that it is controlled by a mobile app. We use Bluetooth communication to interface Arduino UNO and android. Arduino can be interfaced to the Bluetooth module through UART protocol. According to commands received from android the robot motion can be controlled. Generally, many of the wireless controlled robots use RF modules. But our project for robotic control makes use of Android mobile phone which is very cheap and easily available. From this paper we came to know about the function of Bluetooth to control spy robot [3].

A Raspbian operating system-based spy robot platform with remote monitoring and

control algorithm through Internet of Things (IoT) has been developed which will save human live, reduces manual error and protect the country from enemies. The spy robot system comprises the Raspberry Pi (small single-board computer), night vision pi camera and sensors. The information regarding the detection of living objects by PIR sensor is sent to the users through the web server and pi camera capture the moving object which is posted inside the webpage simultaneously. The user in control room able to access the robot with wheel drive control buttons on the webpage. The movement of a robot is also controlled automatically through obstacle detecting sensors to avoiding the collision. This surveillance system using spy robot can be customized for various fields like industries, banks and shopping malls. The spy robot system comprises the Raspberry Pi (small single-board computer), night vision pi camera and sensors. The information regarding the detection of living objects by PIR sensor is sent to the users through the web server and pi camera capture the moving object which is posted inside the webpage simultaneously. The user in control room able to access the robot with wheel drive control buttons on the webpage. The PIR sensor and proximity sensors are activated depend on external stimuli via IoT. The control room collects this information for later reference [4].

A basic model of surveillance system which can travel in horizontal as vertical surface. SWAT which stands for Surveillance Wall Acclivitous Tracker is a wireless controlled surveillance system. The SWAT is powered from an AC voltage and the control inputs are coordinated through the PIC16F628. SWAT in reality resembles a lizard and scales the vertical surface using suction cups driven by suction motors. SWAT also has a night vision camera for capturing the details and the details are sent to the remote server in wireless channel supply and suction motor to support it, in future there are provisions for having them onboard [5].

A Wadaro (WATCH Dog ROBOT); an autonomous mobile robot for household surveillance in open-spaces like roof at night; but only shaded areas such as verandah during daytime. The robot has the capability to detect humans in near real-time round the- clock using passive infrared motion sensors and camera. The work cycle of the robot is divided into phases of human detection; tracking; recognition and alert-generation with simultaneous phase of self-protection. On detecting a human; it starts tracking to detect the face using Haar-like features based cascade classifier. Subsequent recognition is done using local binary pattern histograms approach to ascertain if the face matches with the face in database. In case of mismatch; an alert in the form of phone call to the mobile phone is generated. Self-protection ensures collision-free movements and prevent it from being stolen by generating an alert call on detecting its pick up from the ground. The experimental results demonstrate its successful operation [6].

A surveillance camera architecture using a one-bit motion detection algorithm for portable applications. The conventional surveillance system requires too many components and is too complicated for portable applications. In this paper, we propose a simple surveillance camera architecture with a motion detector that can detect changes of an object within its surroundings for low-power and low-cost applications. The proposed motion-detection algorithm uses one-bit images which are selected using a binary search algorithm that is decided by varying the reference voltage. They verify all the functions of the motion detector through the use of a user interface program on an FPGA board. Experimental results are also presented [7].

The system which complement the vulnerability. Purpose of this paper is loading Network Camera and tracking module of sound source in mobile robot based on embedded Linux for tracking intruder. The images obtained by Network Camera and the information of Sound Source Tracking Module are transmitted through Wireless Lan. Server grasps the mobile course of the object by extracting object's motion vector and gives the object's direction information to a robot by combining the course

data and direction data of the sound. They can track the intruder with this method. The robot tracks the intruder according to gets the effective image of an intruder. In compliance with this paper the system which is embodied protection system step of existing is effective and reliability all with the intelligent surveillance system which uses an image and the sound source in the mobile robot [8].

A intelligent war field surveillance system consist of raspberry pi processor interfaced with night vision camera capable of sensing environment, intelligent decision making, commanding capability and performing action on the environment. The Internet of things is used to inform concern authority about enemy status. This system includes night vision camera and raspberry pi module which can transmit videos of the war field sequentially to prevent any hurt and loss to human life. The system will be used as proper machine for the defence sector to decrease the loss of human life and also useful to decrease infiltrations at border regions. It works on the principle of optical flow algorithm for movement detection. The developed algorithm is implemented in real time by motion based moving object detection method [9].

Web-based and mobile app surveillance system is proposed using Raspberry Pi and its supporting components i.e., Pi Camera, PIR motion sensor, Ultrasonic sensor, web-based & mobile application. This proposed solution can be implemented over the internet using any computer and mobile devices from anywhere and anytime. The use of Raspberry Pi has given the ability to operate and control the motion detectors, distance of the intruders and video cameras for remote sensing and surveillance. The cameras automatically stream live video and the raspberry pi device will send an alert via email and SMS to the facility owners' computer or mobile devices [10].

### III. AIM AND OBJECTIVES

This prototype is based on IOT platform using raspberry pi for tracing and attacking enemies by live steaming of videos using camera with Android application controlled by the user.

- To design functional block diagram.
- To develop the hardware.
- To develop the software program.
- To design the android app.

### IV. METHODOLOGY

#### A. HARDWARE

The entire proposed system consists of a Raspberry pi 4 Model B board, PIR sensor, L293D motor driver, and chassis. The Raspberry pi is a credit card size single board small, inexpensive computer. Raspberry pi has included software such as Python, Java, Sonic Pi and more which enables users to teach programming and design animation, game, interesting video, etc. In addition, programmers can also develop scripts or program using the Python language and it is the main core language in the Raspbian operating system. Python language has been used in this project. The raspberry pi 4 model B is 4<sup>th</sup> generation Raspberry pi minicomputer with Broadcom BCM2711, Quad core Cortex-A72 (ARM v8) 64-bit SoC @ 1.5GHz, 1GB, 2GB or 4GB LPDDR4-3200 SDRAM (depending on model), 2.4 GHz and 5.0 GHz IEEE 802.11ac wireless, Bluetooth 5.0, BLE, Gigabit Ethernet, 2 USB 3.0 ports;

2 USB 2.0 ports, Raspberry Pi standard 40 pin GPIO header (fully backwards compatible with previous boards), 2 × micro-HDMI ports (up to 4kp60 supported), 2-lane MIPI DSI display port, 2-lane MIPI CSI camera port, 4-pole stereo audio and composite video port, H.265 (4kp60 decode), H264 (1080p60 decode, 1080p30 encode), OpenGL ES 3.0 graphics, Micro-SD card slot for loading operating system and data storage, 5V DC via USB-C connector (minimum 3A\*), 5V DC via GPIO header (minimum 3A\*), Power over Ethernet (PoE) enabled, Operating temperature: 0 – 50 degrees C ambient.

The Raspberry pi Camera is 5MP static sensitive type camera. It is a small PCB on which an Omnivision OV5647 camera module is connected to CSI port of Raspberry pi. When pi starts and logged in to monitor then type `raspistill -o image.jpg` command in prompt and press enter. The image will be storing as image.jpg and able to view in GUI which will confirm the running of camera. 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 PIR sensor has a bunch of supporting circuitries. The detected infrared pulses are passed to FET amplifier circuit 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 drain terminal, Pin2 corresponds to the output terminal of sensor, 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. The motors assembly includes the Robot chassis and two DC geared motors. The L293D IC is a dual H-bridge motor controller, which is typically used to control the motor speed and direction. This driver module is supplying a high current and high voltage to connected DC motors. It can drive up to two DC motors 1A each. The Raspberry pi 4 comes with inbuilt Wi-Fi and Bluetooth controller features. An inbuilt Wi-Fi controller is used for connecting Raspberry Pi to Wi-Fi router and the router is connected to the local area network (LAN) for providing internet connectivity to the Raspberry pi. Once the IP assigned to Raspberry pi and it establishes the internet connection with LAN through a router. The major intention of this system is live video streaming. The system is developed by using DC geared motors, which is controlled through the GPIO pins of the Raspberry Pi [4].

The Python programming language is used to operate the device. Furthermore, the action of device is control though IoT. The Raspberry pi camera continuously live stream and it is saved on the SD card of the Raspberry pi module. This video is displayed on the monitor. Buttons for every function have been created.

## B. DEVICE CONTROL



Overall device is controlled by an android app (WiFi Command Center) from control room.

The movement of the device in forward or backward, left or right direction, control of the gun and to stop the device is all controlled through corresponding buttons on this app.

## V. CONCLUSION

This proposed design used for security purpose can operate effectively in order to collect various types of information that required by users. The brain of the design is the Raspberry Pi minicomputer. Firstly, run the code and leave the device in the required area. Secondly, live streaming videos of required areas is obtained through camera for tracing and attacking Thirdly, control the moving to a specific direction by the Android app. And the PIR sensor are activated depend on external stimuli via IoT. Instead of normal camera, night vision camera can be used.

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