International Journal of Advanced Trends in Engineering and Management (IJATEM)
Vol. 2(01), January 2023, pp. 25-32

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Implementation of a Spy Robot for a Surveillance System Using Raspberry PI's Internet Protocol

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ABSTRACT

A rise in terrorist acts throughout the world has increased the necessity to control, monitor and quickly carry out appropriate reaction plans. By using Bluetooth, the robot in this study is controlled with less effort by a person. The user broadcast's live video of the activities going on surrounding a robot's position in all occasions using a wireless camera from the robot. A spy robot platform that uses Internet of Things (IoT) based remote control and monitoring techniques and runs on a Raspberry Pi. A spy robot's primary function is to wander freely through highly sensitive areas and transmit video data from a needed environment to a distant monitoring station. A spy robot system's components include Raspberry Pi, a small single board computer, a night vision pi camera, a metal detector sensor and a gas sensor. This robot's behaviour is controlled by a Raspberry Pi microcontroller model. To detect smugglers' infiltration, the proposed spy robot is deployed. In order to prevent collision, a robot's movement is also automatically regulated by a pi camera.

Key words: Raspberry Pi, spy robot, metal detector sensor, gas sensor.

1 Introduction

Robotics is a fast growing field in today's society and a large number of well-known robotic gadgets are used mostly by enterprises, military, academic institutions and research organizations. Designing and building a robot would be significantly less expensive than paying a career. Robots [1, 2] are much more quickly and easily reprogrammable. The robot is intelligent enough to cover the largest area while preserving security. Real time human body detection is critical for several systems, including communication systems, surveillance systems and home security systems. In order to follow human objects, surveillance systems [3, 4] are essentially constructed using a number of cameras that are positioned at various angles of view. It is difficult and expensive to set up an intelligent monitoring system with many cameras. Hardwired control or wireless control are the two ways to control a robot. Additional advantages of the wireless control include more flexibility and less expensive installation. These days, internet technology is employed for everything from movement control to sharing images and movies taken by robots online. The spy robot [5, 6] is mostly spherical in shape and it moves by rotating a pendulum, utilizing Bluetooth, Arduino and other electronic devices. The robot rotates using a DC motor and a servo motor. Audio and video data is transmitted to the remote station using wireless camera system in use. A computer board called Raspberry Pi

[7, 8], first announced in 2012, is compact, strong, affordable, hackable and designed with education in mind. It functions similarly to a regular PC and needs a power source, display unit and keyboard for command entry. There are four different kinds of protocols, however in this paper, internet protocol [9, 10] is used.

2 Recent Works

Jürgen Scherer et al [2020] [11] combines three convex grid network techniques with different planning horizons with a tree traversal method that has the potential to split non-convex grid graphs. Consider the challenge of multi robot persistent surveillance with connectivity constraints, where robots need to often link to base stations through many bounces. Formally explain a few instances of issues related to multi robot persistent surveillance with connectivity restrictions, such as connectivity constrained multi robot persistent surveillance (CMPS), connectivity constrained multi robot reachability (CMR) and connectivity constrained multi robot reachability with relay dropping (CMRD) and show that they are all NP hard on generic graphs.

Gayatri Joshi et al [2021] [12] suggests that a key role in the process of building construction is site monitoring and supervision. It can be quite challenging for humans to physically reach the appropriate area of site and monitor the job because of intricacy of modern structures. Lack of adequate supervision frequently results in inadequate work, which may cause structural breakdown or some other major accident. If individuals must access dangerous site areas like high elevation walls, high roof and ceiling structures, deep foundation pits, dark, confined spaces etc., then their lives are also at danger. The functionality of these robots also becomes considerably more versatile and user friendly when they are controlled by Android based smartphones.

Cameron K. Peterson et al [2020] [13] enables a decentralized routing system for managing a group of autonomous vehicles as they go to a prioritized revisit target list. For tractable route determination for each vehicle, the technique combines a Monte Carlo tree search with a block coordinate ascent algorithm. The outcome is a decentralized, computationally tractable and target prioritizing non-myopic algorithm for numerous vehicles.

Hu Teng et al [2020] [14] to assess the trajectories produced by provided trajectory planner, propose a multi objective fitness function based on energy consumption, flight risk and priority of surveillance region. A trajectory planner based on particle swarm optimization and a proposed surveillance area importance update method was developed in order to construct three dimensional optimal surveillance trajectories for multiple monitoring drones.

Juan Jesús Roldán et al [2019] [15] suggested the creation of an adaptable and immersive interface, along with a full range of tests to establish comparisons with a traditional one. The interface object of study has been constructed using virtual reality to engage operators in scenarios and enable natural robot operation. Furthermore, it can identify the mission's status

and provide operators with cues. Both indoor and outdoor settings were used for tests to simulate an intervention following a catastrophic infrastructure event.

3 Proposed System

A spy robot platform running on Raspberry Pi with IoT based remote control and monitoring algorithms. IoT was created to safeguard nation from attackers, save human lives and lower manual mistake. A spy robot's primary job is to rove through highly sensitive areas and transmit video data from needed environment to a distant monitoring station. This robot's behaviour is controlled by a Raspberry Pi microcontroller. To find smugglers' infiltration, the planned spy robot is deployed. The user in the control room might control the wheel driven robot by utilizing a website or a mobile device. A pi camera also automatically controls a robot's motion to avoid accidents.

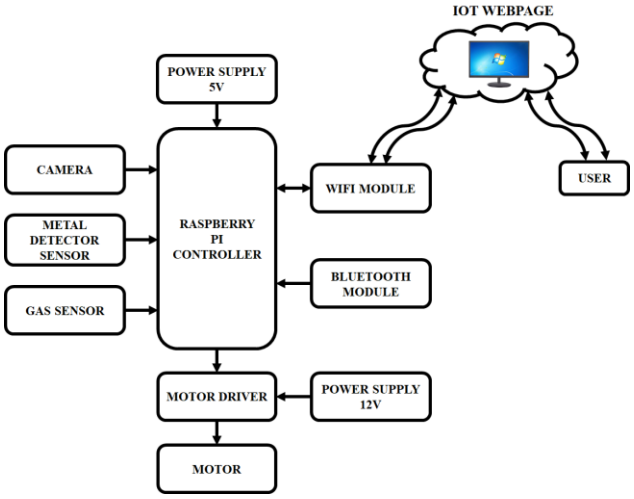

Figure 1: *Proposed system of raspberry pi camera module*

3.1 Raspberry Pi Camera Module

A high-end, fixed focus 8 MP Sony IMX219 image sensor was used in the development of Raspberry Pi Camera Module v2. It can play static pictures with a size of 3280 x 2464 pixels as well as video in the following resolutions: 1080p30, 720p60 and 640 x 480p90.Raspberry Pi may be connected to a board via one of the small ports on a top surface.

Figure 2: *Raspberry Pi Camera*

3.2 Metal Detector Sensor

A machine that searches for hidden or buried metal using electronics. They generally comprise of a hand held gadget with a moving sensing element that may be moved across the ground or over other surfaces. The presence of a metal is signaled by either a continuous beep or a moving needle on an indicator. Additionally, this gadget provides some feedback on presence of metal by beeping louder when it is close to metal items. The circuit for a metal detector is made up of an oscillator that generates alternating current and a coil that generates an alternating magnetic field.

Figure 3: *Metal Detector Sensor*

3.3 Gas Sensor

An analogue voltage is produced as a result of gas sensor's output measurement when gas is present in the atmosphere. The sensor's operating temperature range is -10 to 50 °C with a power supply of less than $150\ Ma\ to\ 5V$. A detection range between $0.04\ mg/L\ and\ 4\ mg/L$ is possible for the Breathalyzer.

Figure 4: *Gas Sensor*

3.4 Wi-Fi Module

A self-contained SOC with an integrated TCP/IP protocol stack, the ESP8266 Wi-Fi Module allows any microcontroller to connect to a Wi-Fi network. Either an application may be hosted on the ESP8266 or the entire Wi-Fi networking workload can be transferred to another application processor. This module has sufficient processing and storage power. Reduces the amount of work required in advance and runtime burden. This enables it to be integrated with sensors and other application specific devices through its GPIOs.

Figure 5: *Wi-Fi Module*

3.5 Motor Driver Module

The L298N is a dual H-Bridge motor driver which allows speed and direction control of two DC motors at the same time. The module can drive DC motors that have voltages between 5 and 35V, with a peak current up to 2A. Motor drivers acts as an interface between motors and control circuits. Motor require high amount of current whereas the controller circuit works on low current signals. So the function of motor drivers is to take a low current control signal and then turn it into a higher current signal that can drive a motor.

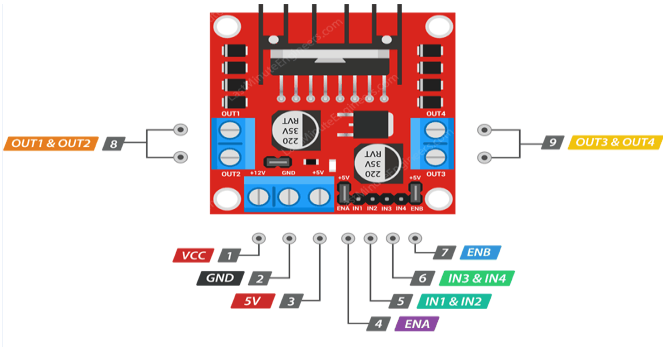

Figure 6: *Motor Driver Module*

3.7 Remote Controller Configuration

The remote control has six buttons, they are left, right, forward, backward, CCD left and CCD right. In addition, it has a 162 LCD for user command directions.

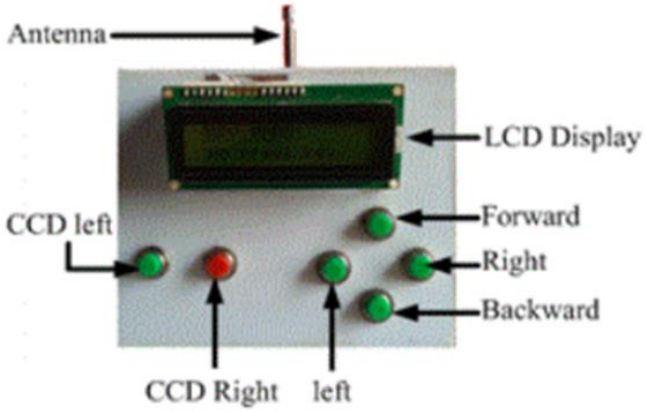

Figure 7: *Remote controller*

4 Results and Discussion

Mobile robots are controlled remotely for reconnaissance patrol and send back video picture to operator. The robot consists of metal detector for the protection of military and domestic applications with appropriate sensors and cameras to perform various responsibilities.

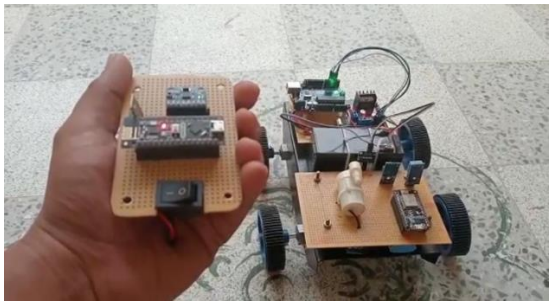

Figure 8: *Spy robot*

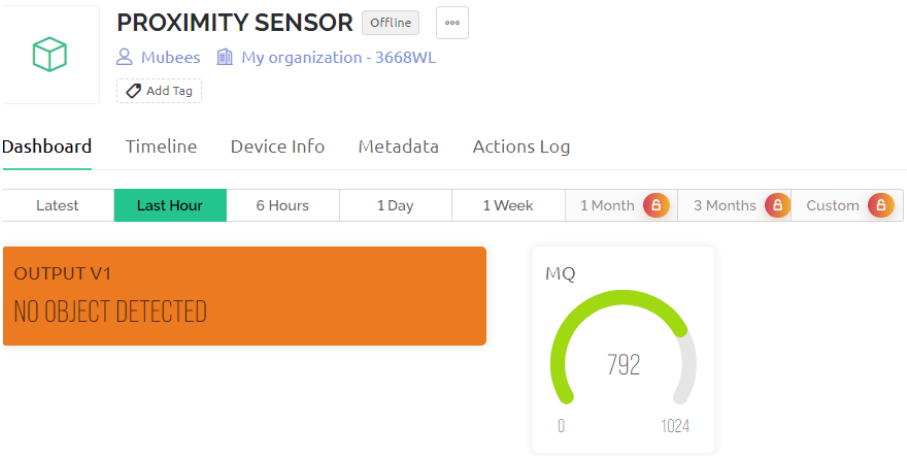

Figure 9: *Output Using Blynk*

5 Conclusion

In this paper, a spy robot is created for surveillance purpose with a number of benefits. The robot is equipped with a metal detector sensor that is used to search for metallic objects like guns, explosives, knives and other bladed objects. The Raspberry Pi receives a signal from metal detector sensor and uses it to look for nearby metal items. An electrical device called a gas sensor, which is fixed to the robot to find and classify various gases. Gas detectors are a crucial component of safety equipment since they can identify oxygen shortages, explosive atmospheres and a variety of toxic gases. In this robot Wi-Fi module is used which provides internet connection to the robot. DC motors' direction and speed are managed by a motor driven module. With the use of raspberry pi camera module, it is possible to record video or take pictures. Moreover, the proposed remote controller robot has an excellent night vision ability which is capable of capturing objects that are invisible to human eye. Thereby, contributing its significance as the best spy robot design for surveillance.

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