Night Surveillance Robot Controlled using an Android App

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Abstract: The most important monitoring aspect concerns monitoring border areas, industries, banks and shopping malls. Not everything is always questioned. In this case, the required solution could be a robot that automatically detects suspicious activity or condition and reports it to the control unit. In our plan, we attempted to design a rover that combines modern technology with human assistance so it can roam the area, and scout the area. With the use of a night-vision camera this surveillance robot could even be used in dark areas to take photographs and videos. The ultra- sonic sensors installed on this robot can detect and avoid objects. This robot communicates and collects data via Wi-Fi, and alerts the control room once anything unusual has been observed.

1. Introduction

As the world steadily moves towards modernization, more and more people are looking for innovative ways to improve their quality of life. Technology in the security industry has made progress in development but has not yet been fully accepted by security professionals. The rise of civilization has always been accompanied by problematic activities that undermine socio-economic stability. Cross-border and terrorist attacks are examples of these problems. In many cases, law enforcement officers are unable to reach the crime scene in a timely manner, and monitoring these situations is very judgmental. Moreover, even if successful, a fatal counterattack can occur.

As the demand for relatively new markets changes, it is relatively new for companies in the security sector to integrate robotics. Not only are the available robots expensive and limited in functionality, these robots have the disadvantage of being susceptible to damage from external factors. This research aims to solve the problem by building security robots at a fraction of the price, using devices and equipment readily available on the market. As a result, this robot will possess the advantage of not being susceptible to damages from an external factors.
The Night surveillance robotic is an unbiased rover, equipped with ultrasonic sensors at each the front and back, placed at angles that permit for 360-diploma sensing. The ultrasonic sensors permit the robotic to turn out to be autonomous, detecting barriers and heading off them in line with algorithms programmed into the Raspberry Pi, the robotics' brain. The actions of the robotic rely totally on barriers and coffee stumbling blocks at the manner to the vacation spot as set via way of means of the user. The robotic has the gain of the usage of a nighttime-imaginative and prescient camera, having the capability of mortal discovery, shadowing, and nighttime imaginative and prescient, and it is able to be managed wirelessly through an app, making it smooth to apply and cowl big areas. This robotic may be managed in patterns ingrained manage or wi-fi manage. The wi-fi manage gives introduced blessings along with multiplied flexibility and decreased set up cost.

2. Literature Survey

Robotics is a cutting-edge technology that is changing people's lives. This is the most discussed topic today, and scientists and governments are working together to revolutionize. Robotics is becoming more important in virtually every industry. Security is the latest sector of interest. In countries like India, robot safety is becoming more and more important due to rising populations and rising wages. These robots incorporate a security system that benefit the society in the form of night patrols. The robot is trained to use night vision to detect social anomalies, alert the control room to problems, and upload videos or images to the server for analysis.

In 2021, Farabee Khalid, Itmamul Haque Albab, Dipto Roy, Azad Prince Asif and Kawshik Shikder made simple to build security robots at a fraction of the price using gadgets and equipment that were available in the market. they implemented a

robot. The robot was an autonomous rover with ultrasonic sensors on both the front and back, arranged at an angle capable of 360-degree detection. Ultrasonic sensors helps the robot become autonomous, detect obstacles, and avoid obstacles according to algorithms set by the robot`s brain, which is raspberry Pi and the movements of the robot depends only on the obstacles until it reaches the goal set by the user using the GPS module, and in some cases, it depends on the obstacles. Robots have the advantage of being able to use smart cameras with human detection, tracking and night vision capabilities that can be controlled wirelessly via the app, making them easier to use and monitor.

3. Implementation

The robot uses Raspberry Pi as the main component and functions as the brain of the system. In Fig. 3.1, you can see that the component on the left side of the Raspberry Pi is the input and the component on the right side of the Raspberry Pi is the output. The Raspberry Pi is powered as an input from an external 5V and 3A power supply.
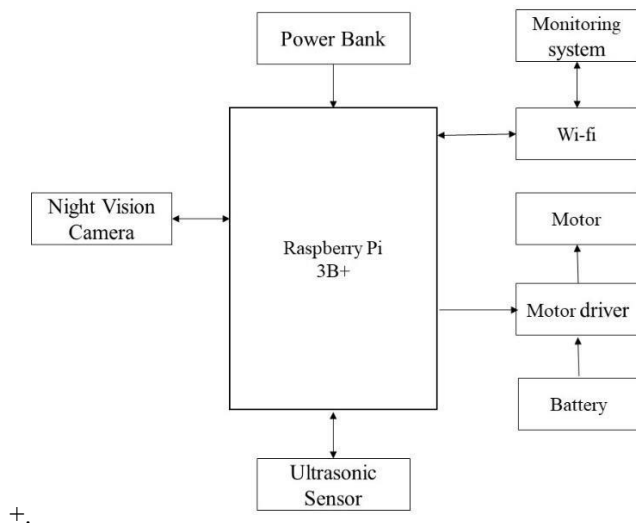

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Fig. 3.1 Block Diagram

A motor driver is an intelligent device that can be used to control a motor, which is used to control the rotation of the motor, which act as a bridge to the battery and can damage the battery instead of damaging the motor itself. We see that the motor driver is connected to the Raspberry Pi so you can program it to the speed you need. The input on the Raspberry Pi is an ultrasonic sensor used to avoid obstacles by the robot and the main aspects is of the investigation in night vision with a night vision camera that broadcasts and records live feeds and detects intruders on the server via WIFI via an image processing system. Information is sent to the control room via the server. The control room is run by security guards who direct all subsequent actions. From the data from the sensor and camera, the Raspberry Pi the main unit sends commands to the motor and servo. The servo is for moving left and right, and motor for moving back and forth. The robot has two separate power

banks, one which is connected to the Raspberry Pi and the other connected to motor driver. The robot can be controlled wirelessly and live video can be streamed through the website. With a dedicated Android application, the website uses the Raspberry Pi's onboard server running on the Apache server. This website was developed using PHP, HTML, CSS, and JS. The Apache server will continue to run in the background of the Raspberry Pi and will respond to all requests. Android applications were developed using MIT App Inventor. This app gets IP address information, receives a request and sends a response.

Another important feature is the GSM module with (connected SIM card) as input. It is used to provide an internet connection to the Raspberry Pi. This allows you to connect to the server and broadcast a live video feed. The GPS module locates the robot workstation and amplifies it to extract the robot's current coordinates during an alarm sent by the camera when the robot is in an emergency or when an intruder is detected. Used for sending.

4. Hardware Implementation

- Raspberry Pi 3 B+:
  The Raspberry Pi 3 B + is a compact single board computer developed by the Raspberry Pi Foundation. Supports 1.2GHz QuadCore ARM CortexA53, WIFI and Bluetooth connectivity, 1GB memory, 64-bit CPU, 40 general purpose I / O pins, and Ethernet jack for quickly connecting your Raspberry Pi to the Internet.

- Ultra-Sonic sensor:
  Used to measure the distance between an obstacle and a robot, the most widely used range is 40-70kHz. Frequency determines range and resolution. Low frequencies produce maximum coverage. At the commonly used frequency of 58 kHz, the measurement resolution is 1 centimeter (cm) and the range is up to 11 meters.

- Motor Driver:
  It controls the output power of each motor and protects the Raspberry Pi and other components. It is used to drive the two DC motors with same IC. One can possibly regulate the speed and direction. Motor voltage rages between [Vcc2 (Vs)] 4.5 V to 36 V. The maximum motor peak current is 1.2A. The maximum motor continuous current is 600m.

- Pi camera:
  Raspberry Pi high quality cameras offer higher resolution (5 megapixels) and sensitivity (about 50% wider area per pixel to improve performance in low light).

5. Software Implementation

- HTML:
  The acronym for HTML is Hypertext Markup Language, which is the standard markup language for documents and

contents viewed in web browsers. It is supported by different technologies such as cascading style sheets (CSS) and scripting languages like JavaScript.

- CSS:

  The acronym for CSS is Cascade Style Sheet is a language used to describe and style documents written in markup languages such as HTML. Stylesheets are used for design separate presentations of content such as layouts, fonts and colors.

- JavaScript:

  JavaScript, often abbreviated as JS, is a programming language alongside HTML and CSS, one of the core technologies of the World Wide Web. A large percentage of websites use JavaScript to make their web pages work on the client-side. Most of these sites also integrate with third-party libraries. There is a JavaScript engine in all of the major web browsers which allows code to be run on the device.

- PHP:

  PHP which stands for hypertext preprocessor it is a server scripting language which is a powerful tool through which one can create dynamic and interactive web pages. PHP is a widely used, efficient and free alternative for competitors like Microsoft's ASP.

- MIT App Inventor:

  MIT App Inventor makes it possible to develop web application as it is a web application development environment. It was originally provided by Google but now it is maintained by the Massachusetts Institute of Technology. With this tool one can develop android applications using a web browser or an emulator connected to a phone. Keeping track of one's project and saving one's work is easy with App inventor server.

6. Results

We have designed a robot that can be operated remotely over WI-FI. The robot has Night Vision capabilities and uses an ultrasonic sensor for object identification and avoidance. We've also developed a dedicated and specialized Android app for managing the robot and streaming live footage.

Fig.2 Test run of the robot without the chassis

Fig.3 Robot with chassis and component

7. Conclusion

Robot monitoring is extremely necessary, especially in dangerous environments. The main purpose of this project is to monitor the area and provide users with live video feeds. It uses Raspberry Pi 3B + as the main component and functions as the brain of the system. The robot is equipped with a night-vision camera and can monitor even in dark places. This safe and user-friendly project can also be used by governments to help businesses.

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