SURVEILLANCE ROBOT WITH OBSTACLE AVOIDANCE CAPABILITIES AND PIR SENSOR

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ABSTRACT

Self-propelled patrolling vehicle can patrol periodically in the designed area as a surveillance robot to ensure the safety like men do. The proposed robot based on the self-propelled vehicle not only can save manpower but also ensure the operation of surveillance being well performed in restricted forests. Due to the limitation of manpower and the fixed camera positions, using surveillance is different from the traditional patrolling system. The paper proposes a self-propelled patrolling vehicle which can move automatically to a wider range and record the monitored video of human activity to improve the performance of the traditional patrolling system. The robot can move in and around the restricted areas, sense the presence of human beings and alerts the security booth through an alarm. The record the activities of the human is sent to the security station.

Keywords: surveillance, PIR sensor, video transmission, robot

I. INTRODUCTION

Robotics has been a staple of advanced manufacturing for over half a century. As robots and their peripheral equipment become more sophisticated, reliable, and miniaturized, these systems are increasingly being utilized for entertainment, military, and surveillance purposes. A remote controlled surveillance robot is defined as any robot that is remotely controlled to capture images/video for specific purposes. Mobile robots that are controlled remotely have important rules in area of surveillance and military.

For specific purpose, vision-based surveillance robot that can be run autonomously and be able to acquire images from its dynamic environment is very important, for example, in rescuing disaster victims in Indonesia. In this paper, we propose architecture for intelligent surveillance robot that is able to avoid obstacles using 3 ultrasonic distance sensors based on back propagation and a camera for face recognition.

Dealing with varied terrain places extra demands on the mobile robot’s propulsion system, among other systems. Power management and new generation drive-train systems utilize advanced materials and highly efficient transmissions to obtain higher speed, accuracy, and durability to work in a wide range of environments. Enhanced power management comes through more advanced fuel cells and newly designed battery and charging systems.

Dealing with varied terrain places extra demands on the mobile robot’s propulsion system, among other systems. Configuring a robot to ascend and descend obstacles in unstructured environments with ease is a design challenge and uses more power. The system must be able to overcome both regularly shaped obstacles such as stairs and those of an unspecified shape such as rocks, downed trees, and other miscellaneous objects. Engineers must consider the center of gravity, torque requirements to ascend inclines, mass, and payloads when designing mobile robotic systems for military purposes. In military applications, wearable robotics helps soldiers carry a heavy pack load. A robot acts like a packmule, is fully autonomous, and carries a large amount of supplies.

II. BLOCK DIAGRAM

III. DESIGN OF SURVEILLANCE ROBOT WITH OBSTACLE AVOIDANCES CAPABILITIES

There are many microcontrollers in the market consisting of various types of capability from basic input output to high end microcontroller. These various types of microcontroller are purpose-made for general application. In this research, we propose architecture for Raspberry pi based robot that can be controlled using ultrasonic sensors.

A passive infrared sensor is used to indentify human movement in restricted area and gives alert to the security booth through alarm report. Face detector algorithm is used in order to recognize the face of human being. The recording of video starts once the robot identifies an human activity in restricted area. Besides, the surveillance robot can be connected to the mobile device or website on Internet at anytime and anywhere. A GPS is used in the robot which is used to intimate the security guard about its current location once in every 3 minutes. The GPS location which is been sent to the security booth also indicates the presents of robot inside the restricted area.
to non holonomic constraints. Figure 1 is a proposed block diagram of very low cost mobile robot for heavy load that consists of Raspberry pi, distance sensors, and Arduino, 5A driver DC motors, and DC motors with wheels. For the driver of DC motor, we use MOSFET with the low resistance of the drain-source. The output of AV port of Raspberry pi connected to 2.4GHz transmitter for video transmission. Additional lamp is used for lighting the area in front of robot; this is very useful for face recognition.

Ultrasonic sensors work at a frequency of 40 KHz and have a deviation angle maximum of about 30̊, so usually robots need more than one sensor to be able to measure the distance of an obstacle in its vicinity (Figure 2). The main weakness of this type of sensor is the interference between different sensors and the limited ability to identify the obstacle. The advantage of this type of sensor is that it is usually able to detect the obstacle at a distance ≥ 3 cm, something a vision sensor is not able to do.

Sensor detects objects by emitting a short ultrasonic burst and then “listening” for the echo. Under control of a host microcontroller (trigger pulse), the sensor emits a short 40 kHz (ultrasonic) burst. This burst travels through the air, hits an object, and then bounces back to the sensor. The PING))) sensor provides an output pulse to the host that will terminate when the echo is detected; hence the width of this pulse corresponds to the distance to the target.

IV. DESIGN OF PIR SENSOR FACE DETECTOR ALGORITHM FOR SURVEILLANCE ROBOT

The PIR (Passive Infra-Red) Sensor is a pyro-electric device that detects motion by sensing changes in the infrared (radiant heat) levels emitted by surrounding objects. These PIR sensor do not generate or emit any radiations for detection purpose. Human beings have body temperature above absolute zero, these radiations are invisible to human eyes. This temperature can be detected by checking for a sudden change in the surrounding IR pattern. When an human body is detected the PIR sensor outputs a high signal on its output pin. This logic signal can be read by a microcontroller or used to drive an external load. When human being movement is detected by PIR sensor, the recording starts in the camera present on the robot and the robot stops moving.

Face detection is a computer technology being used to identify human faces in digital images. Detection of skin color in color images is a very popular and useful technique for face detection. Many techniques, have reported for locating skin color regions in the input image. The camera present on the rover detects the face of the unauthorized person entering the restricted areas. The recording of the video starts once robot encounters the presence of human. Human could also stand at the back of the camera and hence the recording starts once PIR sensor produces a positive output. The recorded video is sent using wifi to the security booth with alarm. The video which is sent to the security booth is also stored in the robot through the memory unit in raspberry pi.

V. GPS POSITION SENSOR FOR ROBOT

The GPS position sensor is a critical component of every GPS tracking device. This is because the GPS position sensor determines the longitude, latitude, altitude, and horizon velocity of the robot’s position. Locating position information with GPS is a relatively simply process. Through the GPS position sensor; a signal is sent from the device, to a satellite, then to the robot. Once this signal reaches its target, the positioning data will be transmitted back to the device through the satellite. This process in commonly known as triangulation. In order to gauge the longitude, latitude, altitude, and horizon velocity of any robot’s position, the GPS position sensor will calculate how far the target is away from the satellite through the use of time.

A GPS position sensor can also be used to determine the longitude, latitude, altitude, and horizon velocity of any immobile or moving robot. Locating position information with GPS for this situation is also relatively simple. Even though robot may be moving,
the triangulation process will take place between the GPS position sensor, the satellite, and the vehicle. This is possible because the satellite will transmit new data to the GPS position sensor every time the target switches location. The location of the robot is sent to the security booth once in every 3 minutes and also when the robot encounters an human being.

VI. CONCLUSION

This paper presents a new method of surveillance robot with human being detection with PIR sensor and face detector. This robot is autonomous with obstacle avoidance capabilities. The sensors are very cheap since we use only three sensors for obstacle avoidance. The robot does not emit any radiations or sound that will alert the unauthorized person. For future work, we will improve this robot with face recognition techniques.

REFERENCE


