Patrolling Robot for College Security Surveillance

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Abstract - The purpose of this project is to develop a "patrolling robot for college security surveillance". The important role of this patrolling robot is to provide security on college campuses in daily life. In this work, the patrolling robot system comprises the Raspberry Pi 3 B model, Wireless camera, and sound sensors. When the patrolling robot detects any object, it will capture the picture with the help of a pi camera and store it on the desktop. On the other hand, it will also stream the live video. As well as the smoke and sound sensors are installed on the robot so that the robot can find the fire and sound. The movement of a robot is also controlled automatically through obstacle detecting sensors to avoid a collision. To maintain safety and security, the conventional surveillance system relies critically on human attention, action, and intelligence.

Keyword – Raspberry pi, Internet of things, surveillance, security and patrol.

I. Introduction

In today's world the robotics field is growing exponentially and some of the popular robotic products are used largely by the industries, defence, academic and research communities. Robots play a vital role in helping humans, some robots will replace humans in their work and some robots will act as assistive devices. In our proposed system a single camera is installed on a robot and the robot can move all directions to take pictures from different angles. The ultrasonic sensor detects the obstacle and then moves on the plain surface. This system is very flexible to monitor any living object with the help of the camera and it is more suitable for surveillance systems. The internet technology is used for all other purposes like images or videos captured by the robot and shared via the internet [8]. It has the ability to monitor sound in the premises. The robot will also detect the fire with the help of the smoke sensor and alarm will starts after detecting fire. The capture images are store on the firebase database. According to this system, the whole area monitoring is conducted using the pi camera and even automated system when the sound is detected by the robot will automatically send the notification that it can capture the live video of the area where the data can be stored or the video can be live streaming, because the camera used is a pi camera, the security system can benefit from streaming Video using IOT technology.

The main goals pf this research is:

1. To secure the campus from suspicious human activities.
2. Make comfortable for human and it is user friendly.
3. Considering COVID-19 scenario keeping watch on body temperature of every human roaming in the campus.

II. Related work

The Authors [1] developed a Raspbian operating system-based platform with remote monitoring and control algorithm through Internet of Things (IoT). The living objects detected by PIR sensor and are sent to the users through the web server and pi camera capture the moving object which is posted inside the

webpage simultaneously. The intelligent robots can perform preferred tasks in unstructured environments with or without human direction. A robot can be controlled in two methods by hardwired control and wireless control. The wireless control provides additional benefits including increased flexibility and reduced installation cost. User only run the code and leave the Robot to navigate freely based on the sensor status and also user can control the moving to a specific direction by the Laptop Keyboard.

The Authors [2] proposed mobile robot localization by GPS observations and appearance- based place recognition. This was able to locate a robot current position from reference images of appearance-based place recognition with global position information attached. In general, Global Positioning System (GPS) was been used to know its position. Mobile robots utilize it as a means to recognize their own position in global coordinates. On the other hand, it is well- known approach that appearance-based place recognition methods are efficient to recognize the robot position in urban areas. A mobile robot localization system using multiple observations.

The Scholars [3] have designed and implemented a robot which was able to provide information to the customers about the mall, and to possess a strong appearance, without inducing fear to humans. In order to reinforce the humanoid appearance, the eyes are based on a matrix display LEDs which produce several expressions. The robot can express various emotions to the clients inside the mall by changing the shape of its eyes. They included the addition of artificial intelligence for face recognition, speech recognition, text-to-speech and cognitive computing. They ensured a safe performance; it uses a laser sensor, webcam, ultrasonic sensors and a 3D depth camera. They also used the screen to display ads from either the mall or the Security Company, and show a map of its location as well as a list of frequently asked questions whenever the user touches the screen. The robot was able to perform security patrols during the night while functioning as a guide during the day.

The Authors [4] autonomous robot decides by simulating in detail the much possible detection of events and the various actuations of motors by which each robot could travel to all of the possible event locations. In our system, cameras provide events as three- dimensional positions and orientations with their associated uncertainties. Once it has been noticed that a person is trespassing or that there is other relevant human activity, the system generates and transmits a corresponding

Meta event to the mobile robots.

The Authors [5] includes autonomous loping a reconfigurable autonomous security robot which can be used in household or office purposes. Their idea consists of four main parts: Multiple Sensor array, communication system (Bluetooth and GSM), motion planning (autonomous patrolling) and software application for mobile interface. Autonomous security robots which was a new ground breaking innovation in advanced security and surveillance technology. They contributed in the process and theoretical design of the SPR. It also describes the flow of instructions and system architecture. The SPR utilizes numerous sensors to detect security risks. The sensor gives digital outputs which in initial condition displays 0 and when in condition with motion displays.

III. Material and Implementation Details

In this proposed system Raspberry Pi 3 B model is used. Raspberry pi is installed with the camera which helps the system to go for the automation and help to find the human or

any problems detected using the sound and DHT11 sensor and capture the image and send it to user using IOT technology. The whole process is works on the microcontroller board which is Raspberry Pi.

The robot process:

1. Connection of the raspberry pi

2. Connecting all the sensors, motors and other requirements to the raspberry pi board.

3. Writing the code in the python for all the devices.

Basically, two four motors are sufficient to produce the movement of spy robot and the motor driver module is used to supply enough current to drive four motors which protects the Raspberry-pi module from the damage.

Robot has ultrasonic sensors which are used to sense the obstacles coming in front of the robot path. It will move in a particular direction and when the obstacle coming in its path, it will turn to the opposite direction. There is a sound sensor mounted on the robot. This sound sensor will sense the sound with the particular frequency and after sensing the sound if any the robot will move towards the sound recognized side and the and the camera will record the video. This live video will be monitored by the controller or operator who is keeping watch in the control room.

The spy robot is designed with Raspberry-pi 3 module

which having an inbuilt wireless controller, pi camera support. The user will be observing this image data on the web page at the control room. User unit communicates with spy robotic unit with the help of Internet.

The website is created for the process. It is developed by HTML. Through Pi camera operator can watch all the activities on web page. The proposed system has limitation which is more suitable for almost flat surface on which the robot can operate. This design of the robot would not be suitable for rough

terrain environments like rocky or hilly terrain due to their wheeled mechanism.

L293N motor driver control both speed and spinning direction of DC motors.
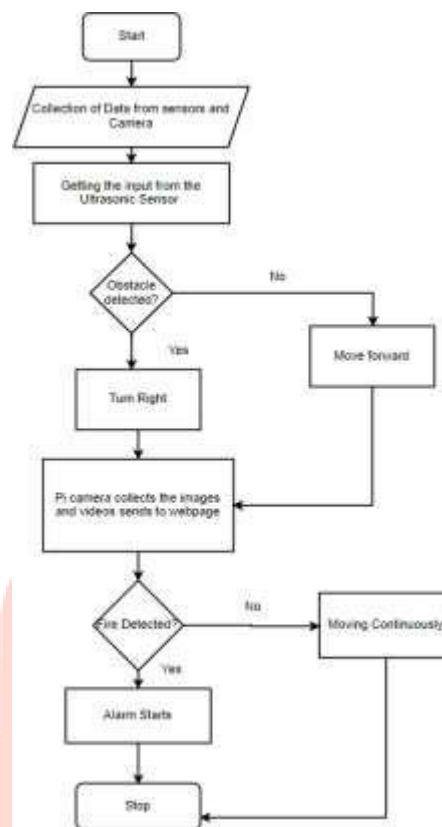
Flow Diagram:

Fig1. Flow Diagram

IV. Result and Discussion

In this section we describe the result of our model (reported in Figure 2). The proposed system is experimented by using raspberry pi. The pi camera, ultrasonic sensor, DHT11 sensor, sound sensor and L293N motor driver are mounted on the vehicle. When the vehicle is patrolling, the pi camera patrols and captures the pictures and controller would keeping watch on the live video streaming in the temporary memory into web page that one can access in any device that has a browser and is connected to the same network the Pi

just by entering IP address as an URL, respectively. The whole set of commands are done on VNC Viewer terminal.
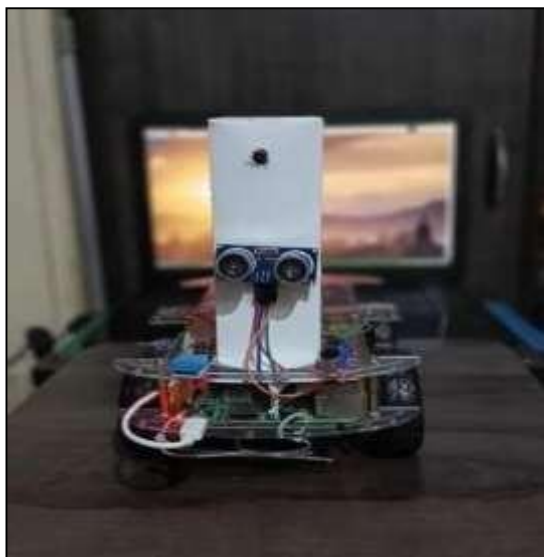

Fig2.Working Model

a) Pi Camera Module

To access video streaming on web server by just entering IP address at: http://**<Our_Pi_IP_Address>**:8000. Replacing with our own Raspberry Pi IP address, in our case **http:// 192.168.0.111:8000**.

Fig3. Live Streaming by camera

b) DHT11 Sensor

By using DHT11 sensor the robot will detect temperature and humidity of the humans whenever any person gets in front of vehicle. Sensor detects temperature of surrounding and

whenever a person comes toward the robot the humidity level increases accordingly.

Fig4. Output of DHT11 Sensor

c) Ultrasonic sensor

Ultrasonic sensor measures the distance of a target object which comes in between while patrolling and can be kept watch by pi camera. The range of the object can be taken.

Fig5. Output of Ultrasonic Sensor

d) Sound sensor

Sound sensor module is used to detect the sound. This system uses a microphone to provide buffer data, peak detector, and an amplifier. This sensor detects a vibration and processes a microcontroller's voltage signal to o/p and gets result as "Sound Detected" if any.

Fig6. Output of sound sensor

e) L293N motor driver

By commanding the motors through the L293N motor driver towards forward,

backward, and by controlling the speed from high to medium to slow.

Fig7. Output of motors rotating

V. Conclusion and Future Scope

The purpose of establishing this patrolling robot is that to keep the college campus secure. Camera will send a signal to the Raspberry Pi model when a human - being is in the ambient of the Robot. In turn the camera module immediately to capture an image and send it to the web page. The robot will detect sounds as well in its surrounding with the help of sound sensors. It captures and sends the images directly to the control monitor room, for further actions. The robot can be used for variety of purpose, such as fire alarm, burglar alarm, temperature monitoring.

Humans will be replaced by robots in some jobs and complemented by them in many others. Robotics has the potential to positively transform lives and work practices, raise efficiency and safety levels and provide enhanced levels of service. Robotics technology influences every aspect of work security. Robots are going to be a part of our society in the future. The robots may be for good and bad they will help us on doing things we can't do Robots are likely going to help us in securing our surroundings. At present security-related roles can see significant risk to workers reduced by implementing robotic guards in their place.

VI. References

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