

Night Scanning Robot with Human Detection

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ABSTRACT: Night Scanning Robot with Human Detection is a security surveillance robot used to track and prevent the violations against women. During night the robot captures the screaming sound of woman using a microphone and moves to the source of sound. It then captures the video of the happenings and transmits the processed visuals to the control room so that immediate actions can be taken. Furthermore the robot can be used to detect the presence of alive humans who are trapped under the mud and debris during landslides using the PIR (Passive Infrared Ray) sensor. The robot is built using Raspberry pi 3B and classification techniques are used to recognize only the required sound (Female Screaming). The robot is capable of avoiding obstacles during its movement with the help of an IR (Infrared Ray) sensor. It captures the videos using a Raspberry pi camera module. Thus this project has a social relevance and is a cost effective technique for providing effective security and for human detection during disasters.

KEYWORDS: Random Forest Algorithm, Raspberry Pi 3B, Human Detection, Surveillance, PIR sensor.

I. INTRODUCTION

There has been an increasing threat to the security of humans especially women in the recent years. Also there has been an increase in the number of physical harassment against women particularly during night. Existing mechanisms for providing security surveillance are limited by their mobility. So there is an increasing need for an effective security surveillance system that could keep track of the real time incidents and attacks which can be used for taking effective measures for preventing such threats. Moreover we have witnessed the lack of an effective mechanism for rescuing people during landslides. Due to lack of such mechanisms it is difficult to find alive humans who are stuck under the mud and debris. This proposed project introduces a cost effective method for providing a mobile security surveillance especially during night. This robot is driven by its four wheels and makes use of sensors to sense the unusual sounds in the nearby surroundings. It has a surveillance camera that performs real time video capturing. The robot is provided with a PIR sensor that could detect the presence of alive humans in disastrous situations like landslides. An alarm is played on detecting an alive human. Thus it adds as an advantage in the rescue operations and provides a cost effective technique for security and rescue.

Paper is organized as follows. Section II describes the early works related to the surveillance system. The method of surveillance using classification technique and human detection using PIR sensor is given in Section III. Section IV presents experimental results showing results of robotic function. Finally, Section V presents conclusion.

II. RELATED WORK

The robotics basically is electro-mechanical machine or device that is controlled either by computer program or with electronic circuit to perform variety of physical tasks. With the gradual development in technology scientists came up with new ideas and inventions of robots. In today's life robot are becoming indispensable part of human life. [1] introduced a technique for preventing molestation against women. It consist of a Raspberry Pi, integrated GSM/GPS Shield along with a manually operated pepper spray. It also had a camera module which can be attached to strap of a backpack or any other suitable location. In [2], the authors proposed a system in which the person, who is facing a possible threat can request for assistance using a primary Title wearable gadget, which will send the GPS location to the control station. Then a UAV will be deployed to the target location which identifies and tracks the motion of the

person using a secondary wearable gadget. In [3] an Unmanned Aerial Vehicles (UAVs) equipped with optical and thermal sensors in conjunction with sophisticated image processing and computer vision algorithms, was used to detect suspicious activity or prevent the spreading of a fire. [4] introduces a technique that uses the security kit that consists of four ways (voice board, button, two sensors) to protect them. In any critical situation, by pressing the button or by saying the password, the microcontroller in this kit is activated and it sends the message to the predefined numbers in the program. The authors in [5] has implemented an integrated system with perception, recognition, reasoning, decision-making, and action.

The work in this paper is divided in two stages. 1) Surveillance in emergency situation 2) Human detection during disasters. Surveillance in emergency situation is done by constructing a classification system using Random Forest Algorithm and then detecting only the sounds like female scream and male scream. Human detection during disastrous situation is done by using a PIR sensor that detects alive humans.

III. METHODOLOGY

The robotic structure consists of a high quality four-wheel robotic chassis with four DC motors each with 300 rpm. The operating voltage of each motor is 5-12V. The motors are operated by connecting it to L293D motor drivers. Two DC motors can be connected to an L293D motor driver at a time. Thus two L293D motor drivers are connected to Raspberry pi 3B in parallel. The motor driver operates at 9-12V and 1A. Raspberry pi camera module is connected to raspberry pi for video capturing. An IR sensor will detect the obstacles during the robotic motion and allows the robot to change the direction of motion.

In our project the robot must only recognize emergency sounds like female scream and male scream. Thus there is a need for developing a sound classification model. Here we use random forest classification technique to construct sound classifier. Random forest is a supervised learning algorithm which is used for both classification as well as regression. But usually it is used for classification problems. As we know that a forest is made up of trees and more trees means more robust forest. Similarly, random forest algorithm creates decision trees on data samples and then makes the prediction from each of them and finally selects the best solution by the process of voting. It is an ensemble method which works better than a single decision tree. The main advantage of this Random Forest Algorithm is that it reduces the over-fitting by averaging the result. We can understand the working of Random Forest algorithm with the help of following steps: First, start with the selection of random samples from a given dataset. Next, the algorithm will construct a decision tree for every sample. Then it will make the prediction result from every decision tree. Then a voting will be performed for every predicted result. At last, select the most voted prediction result as the final prediction result.

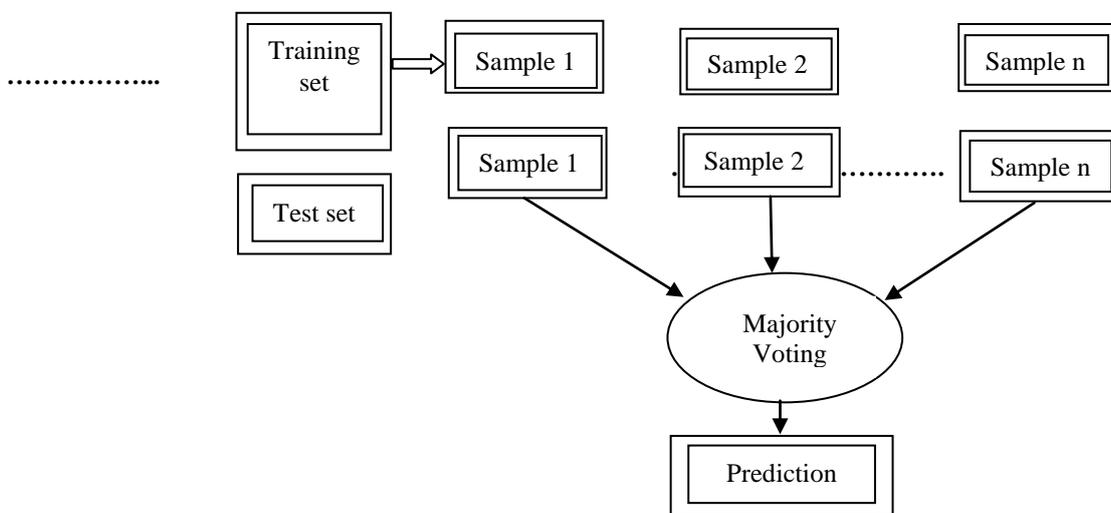


Fig. 1. Schematic Representation of Random Forest Algorithm

Sound is captured from the surrounding using a USB microphone with a plug and play mechanism. We will be then using the Python library ‘pyaudio’ to record and play audio data from the USB mic. This captured audio is sliced and provided to the classifier system. After recognising the class of sound, if it is an emergency sound the robot decides the direction of sound by comparing the sound intensities on the sound sensors located in the four directions i.e. East, West, North, South. The robot moves to the source of sound and on reaching the source it captures the real time videos using a Raspberry Pi camera and displays it on the screen by establishing socket connection.



Fig. 2. Raspberry Pi Camera

Human detection becomes possible using PIR sensor. A passive infrared sensor is an electronic sensor that measures infrared light radiating from objects in its field of view. They are most often used in PIR-based motion detectors. PIR sensors are commonly used in security alarms and automatic lighting applications. Technically, PIR is made of a pyroelectric sensor, which is able to detect different levels of infrared radiation. For example, everything emits varied level radiation and the level of radiation will increase with the increase of the object’s temperature. Actually, the motion detector is separated by two parts since motion change is what we want, rather than IR level. The output will swing high or low if one half sees different IR radiation than the other. The PIR sensor is connected to Raspberry Pi 3B. Immediately on detecting an alive human the buzzer alarm connected to the output of PIR sensor works, providing an indication of an alive human.

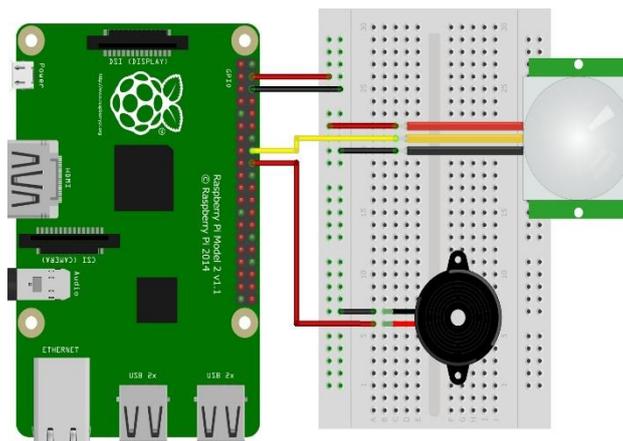


Fig. 3. PIR sensor circuit diagram

IV. EXPERIMENTAL RESULTS

During night time the robot is deployed in isolated areas. The USB microphone has a sensitivity of about 67dBV/pBar. On hearing sounds like female scream and male scream the robot moves towards the source of sound by determining the direction of sound using sound sensors and stops near the source of sound (by setting a particular intensity value). It

then captures the video of the happenings and transmit it to the control room. For real time use a cloud server can be used for storing the captured video.

During landslides and earthquakes the PIR sensor in the robot can be activated so that it can detect whether an alive human is present under the debris or mud particles so that effective rescue operations can be done. The robot on sensing an alive human using the PIR sensor stops at that position and plays the alarm to inform it. During the movement of the robot, it avoids obstacles with the help of an IR sensor that detects the obstacles and changes the direction.



Fig. 4. Video Streaming

V. CONCLUSION

From the above results it is evident that the robot is capable of capturing real time audio and recognise emergency sounds and provide effective security surveillance. It is also effective in capturing real time visuals. Also, this robot can detect alive humans using PIR sensor during landslides which is of great use in hilly regions. In future we can incorporate GPS setting for provided correct geographical locations of the happenings. Moreover this proposed system provides a cost effective technique for surveillance and human rescue. It is more efficient and less computationally intensive when compared to the already existing security system. By incorporating machine learning technique of classification that recognises only required sounds, the project has been found to be of saving cost and power.

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