

Night Patrolling Robot with Facial Recognition

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Abstract—Abstract Here

Index Terms—Keywords

I. INTRODUCTION

II. LITERATURE REVIEW

One of the most important needs of modern times is security. The rise in population is directly proportional to the need for proper security. A night patrolling visionary robot would help achieve certainty, especially during the night. All the research papers have directed to the fact that the basic must-haves for the night patrolling systems are the logic for sound sensing, moving towards the area of target and back to the original location, image capturing and processing.

The night vision patrolling robot has the primary objective to ensure the safety of the people without putting any human life at risk. There are certain essential features needed in the robot, such as a night vision, obstacle detection, and motor driver circuits for controlling them [1]. All of these are controlled using a microcontroller board such as an Arduino UNO or raspberry pi. In addition, a wireless IR transceiver would be helpful in the navigation of the robot [2]. According to [1] the proposed system has the best advantage over disadvantage ratio if it uses an IR Camera with a wireless controller and some form of an obstacle detection system. Furthermore, optional features such as a GPS Module, GSM radios [2], sound sensor [1] will greatly help increase the productivity of the project. Journals have shown that a sound sensor and a smart camera are primary necessities for the system. Along with this according to the paper by N.Hemavathi the robot is built with a DC motor and transistors. The movement of the robot is handled by multiple logics operated on the transistors. These transistors allow the motion of the DC motor in the desired direction [3]. Bluetooth technology has also been used in the process for serial communication with the robot [4]. In another paper, the authors have mentioned the use of a special GPS for location tracking. Object detection algorithms have been designed for the robot to understand the route [5]. Technology is advancing at a rapid pace nowadays. These shifts are also visible in the robotics industry. As a result, the system suggested in the given papers reflects the current state of the field. The main objective of this is to offer ladies safety at night. Using a credit-card-sized Raspberry Pi and an open CV, the author

of this paper, created a night patrolling robot (computer vision). [6] To detect the face, the suggested system employs a Raspberry Pi camera. Anomaly detection is done using deep learning technologies [7]. As a result, the image is recorded using the pi camera and sent to the raspberry pi for face and human detection using OpenCV. The accuracy of this approach is around 83 percent [6]. The sensors used are IR sensors and sound sensors. According to this project, the entire territory monitoring is completed using a night vision camera and a programmed framework. When a sound is detected, the robot will follow a certain path to that space, capture the region, and send the picture to the user via IoT. Behind this project is a pre-programmed dazzling path for night vision viewing. [8] The proposed system focuses on the security of the place where it is implemented. It is specially designed to carry out the security assessment function at the night time when it will be dark all over the place. It is equipped with a night vision camera which will be used to capture the pictures of the spot if any suspicious activity takes place. It moves on a predestined path, and it moves in the direction of sound. It is also equipped with human face recognition technology. This system uses the LAN protocol of IOT, and it sends the recorded images to the responsible authority so that they can take any actions if necessary. It system uses a microcontroller, night vision cameras, sound sensors, Infrared sensor and Motor drivers. [9] This system is built to ensure women safety in remote regions and public places. IOT gecko is used for receiving transmitted snapshots and displaying them to people with alert sounds. This system consists of a combination of 2 HD cameras to monitor the environment sharply and closely. The hardware used in this system are HD infrared camera with night vision, Sound sensor, DC motor, IR Sensor, Ultrasonic sensor, LCD display, and a motor driver. [10]

Facial recognition is an important aspect in terms of the proposed system. This serves a greater importance in order to assess the threat and act accordingly. [11] Facial recognition is a subset of the highly expanding computer vision field. This field has been overly dominated by the areas of Machine Learning and Deep Learning from the very beginning [12]. Taking into consideration the scope of lighting in a night patrolling robot it is safe to assume that the best approach would be to perform IR recognition [11]. Thus according to [11] the best possible way of training the TIR based facial

recognition is to use a Deep CNN Classifier with substantial training data. The losses given by equation 1

$$\sum_i^N [\| \int (x_i^a) - \int (x_i^p) \|_2^2 - \| \int (x_i^a) - \int (x_i^n) \|_2^2 + \alpha] \quad (1)$$

Are the minimum and give the best possible output with a method called triple loss learning. [11] There are three main steps for facial recognition and tracking in real time [13]. The First Step is Detection of Faces to track them, the next being recognition of facial features, which is determined using equation 2

$$\Omega_{[w,h]}^m = \left(\left\lfloor \frac{m}{w} \right\rfloor + \left\lfloor \frac{m-1}{w} \right\rfloor + \dots + \left\lfloor \frac{w+1}{w} \right\rfloor + 1 \right) \cdot \left(\left\lfloor \frac{m}{h} \right\rfloor + \left\lfloor \frac{m-1}{h} \right\rfloor + \dots + \left\lfloor \frac{h+1}{h} \right\rfloor + 1 \right) \quad (2)$$

The last step is to begin tracking the face in real time.

Object detection bases the image processing. The image is seen in a digital form of the same. Process of Image processing, object detection majorly involves object recognition, object localisation, image classification. According to a survey for different processes for image processing, multiple techniques have been identified which present different accuracies for the same. The survey paper implies that numerous techniques have separate sets of specifications. For example, Deep CNN shows 85% sensitivity especially for medical cases, face recognition vendor test (FRVT) makes identifying a male easier than female. According to this paper, Deep neural networks and CNN which are AI based techniques are recommended for object detection [14]. Furthermore, another paper by Sandeep Kumar, has emphasized on the kind of image processed. It mentions the use of Convoluted neural networks, for static images with static background. After preprocessing, and feature extraction, single neural networks are integrated for image recognition and processing [15].

The author of this work presents several innovative models for all stages of a face recognition system. To perform the process of face detection efficiently, the authors suggest a hybrid model integrating AdaBoost and Artificial Neural Network (ABANN). The labeled faces detected by ABANN will then be aligned using the Active Shape Model and Multi-Layer Perception in the next stage. The author proposes a novel 2D local texture model based on Multi-Layer Perceptron in this alignment step. The model's classifier enhances the accuracy and robustness of local searching on faces with ambiguous outlines and expression variation. The authors of the research offer a way for boosting efficiency in the feature extraction step by combining two methods: geometric feature-based method and Independent Component Analysis method. [16]

III. METHODOLOGY

IV. RESULTS AND DISCUSSION

V. CONCLUSION

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