

Human Detecting Robot for Rescue Operations

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Abstract—The paper presents the project Human Detection Robot for rescue purposes. The project human detection robot can be classified into three modules. The robot module, the human detection module and auto navigation module. As a rescue robot, it detects humans that are trapped in debris during the earthquake, flood and fire attacks and implement rescue methods. Human detection is made possible by MATLAB software as well as using a PIR sensor. The PIR works when the robot has to travel among the debris or without light. Applications are mainly in defense and rescue operations, surveillance systems etc.

Index Terms—PIR, MATLAB, RF Transmitter and Receiver, ATMEGA 328, IR

I. INTRODUCTION

The purpose of implementing this project is to achieve a human detection robot that is used for the detection of humans during the times of earthquakes, fire attacks, flood and other natural and manmade calamities. The rescue robot is capable of detecting the humans under severe weather conditions that will risk the lives of humans who are going for rescuing as well as the victims who are affected by these conditions. This robot helps in the detecting humans and is also able to send the GPS location of the humans that are in trouble to the rescuers who are in safer zones. The robot also has a laser that act as a rope during the times of flood and water in times of fire and shoots a straight ray where the human is detected. Thus increasing the efficiency of the rescue operations and also decreasing the chances of the human life to be at risk or in danger.

MATLAB using Viola and Jones algorithm is used for the detection of humans with the help of a wireless camera and a PIR sensor is used a backup where the light conditions does not let the camera work effectively. MATLAB using Viola and Jones algorithm is a technique that is discussed in this project. The video is taken using a camera and it is processed using the help of the MATLAB software. The Viola and Jones algorithm is an inbuilt algorithm inside the MATLAB software and it is mainly used to detect upper body of a human. The features of a human are already stored inside the software and are called as Haar-like features. Once the video input matches these features then a human is detected. PIR sensors are sensors that detect the infrared radiations that are emitted by the humans. These sensors does not emit any radiations and only detects radiation making it more effective. The PIR sensor attached to the robot detects the radiations once it is on the field and hence the humans can be detected.

II. HUMAN DETECTION USING MATLAB

In recent decade, facial expression recognition has become a progressive areas of research. There are many applications and algorithms that use facial expressions to evaluate human nature, feelings, judgment, opinion. These expressions are produced as a result of distortions of facial features due to the contraction of facial muscles. Facial expression recognition is not an easy task because of circumstances like illumination, facial occlusions, face color, face shape etc. Facial expression is a prominent posture beneath the skin of the face.

During the past years face recognition has received significant attention as one of the most important applications of image understanding and analysis. Many algorithms have been implemented on different static and non-static conditions. Static conditions include static and uniform background, identical poses, similar illumination, neutral frontal face. Non static conditions include position, partial occlusion orientation; varying lightening conditions and facial hair which make recognition process a complex problem. All these factors influence face recognition process. The mainstages for face recognition include face detection, feature representation and classifications. Researchers have described distinct approaches for face recognition. A new technique for Face Detection based on Viola and Jones algorithm and principal component analysis is used in this paper. This algorithm detects the upper body while in line of sight. The proposed system is implemented in MATLAB(Matrix Laboratory) version 7.1.4.0.739 (R2012a).[1]

Fig.2.1 shows the detection of a human hand using Matlab Software.

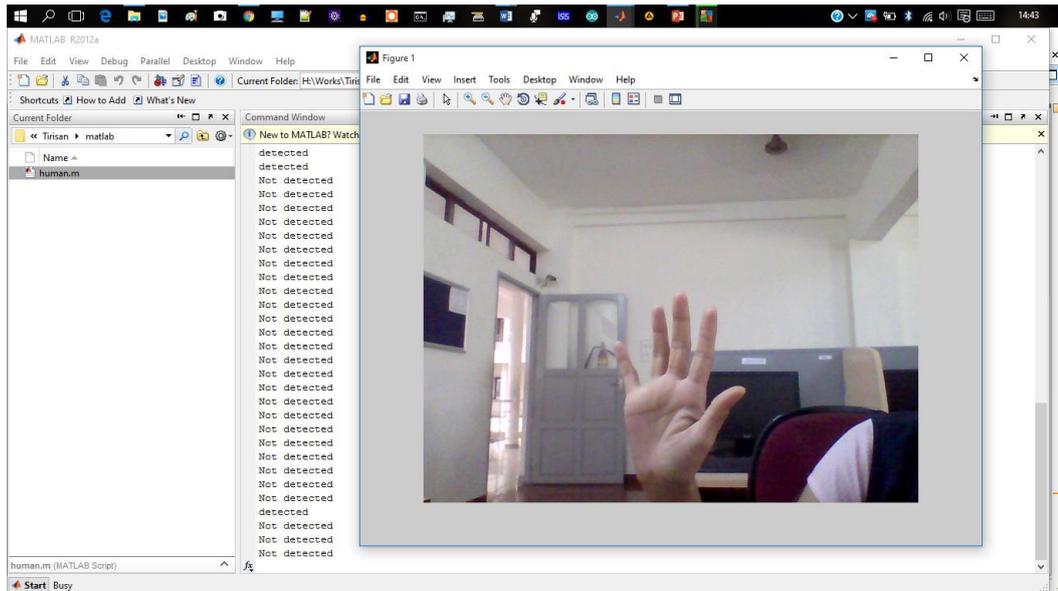


Fig 2.1 Human detection using MATLAB

III. HUMAN DETECTION USING PIR

Recent years, indoor positioning systems (IPSs) have become a growing field of research involving theoretical and applicative challenges. Object detection and tracking are the basis of many applications, such as surveillance and activity recognition. Numerous techniques have been proposed. To implement human indoor positioning, device-free techniques are more suitable, because that means the human target does not have to wear any device. Recent advances in CCD technologies, processing speed and image understanding have been driving the development of the camera-based positioning systems. However, some disadvantages of continuous surveillance by video cameras are difficult to overcome. It is susceptible to light illumination, and its computational load for continuous surveillance is high. Most importantly, it is inevitable to violate the privacy, which will make the human target feel uncomfortable.

Human indoor localization system using ceiling mounted pyroelectric infrared (PIR) sensors. The field of views (FOVs) of the PIR sensors is modulated by two degrees of freedom (DOF) of spatial segmentation. The localization algorithm is proposed to fuse the data stream generated from different sensor nodes within the wireless network.[2].

A passive infrared sensor (PIR sensor) is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. They are most often used in PIR-based motion detectors. All objects with a temperature above absolute zero emit heat energy in the form of radiation. Usually this radiation isn't visible to the human eye because it radiates at infrared wavelengths, but it can be detected by electronic devices designed for such a purpose. The term passive in this instance refers to the fact that PIR devices do not generate or radiate any energy for detection purposes. They work entirely by detecting the energy given off by other objects. PIR sensors don't detect or measure "heat"; instead they detect the infrared radiation emitted or reflected from an object.



Fig.3.1 PIR Sensor

IV. GPS LOCATION TRANSFER

The Global Positioning System (GPS) is a space-based radionavigation system owned by the United States government and operated by the United States Air Force. It is a global navigation satellite system that provides geolocation and time information to a GPS receiver anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites. The GPS system operates independently of any telephonic or internet reception, though these technologies can enhance the usefulness of the GPS positioning information. The GPS system provides critical positioning capabilities to military, civil, and commercial users around the world. It is freely accessible to anyone with a GPS receiver.

Once a human is detected the software sends the message to the robot using the RF data modem. A level shifter is used to convert the voltage difference between the computer and the RF data modem. The RF data modem inside the robot receives the message and further process of acquiring the GPS location and notifying the relevant people using a GSM module is done using the help of the micro controller.

V. AUTO NAVIGATION AND RESCUE OPTION ON HUMAN DETECTION

Our robot is having hybrid navigation where it can be controlled manually by a RF bit transmitter and it avoids collisions by sensing the obstructions forth using Infrared sensor. The bit transmitter gets the function to be carried from the user through the controller, encodes it and transfers to the bit receiver. The receiver decodes the bit and controls the dc motors through ATMEGA 328 microcontroller



Fig.5.1 Bit Transmitter with power source

VI. BLOCK DIAGRAM OF THE PROPOSED SYSTEM

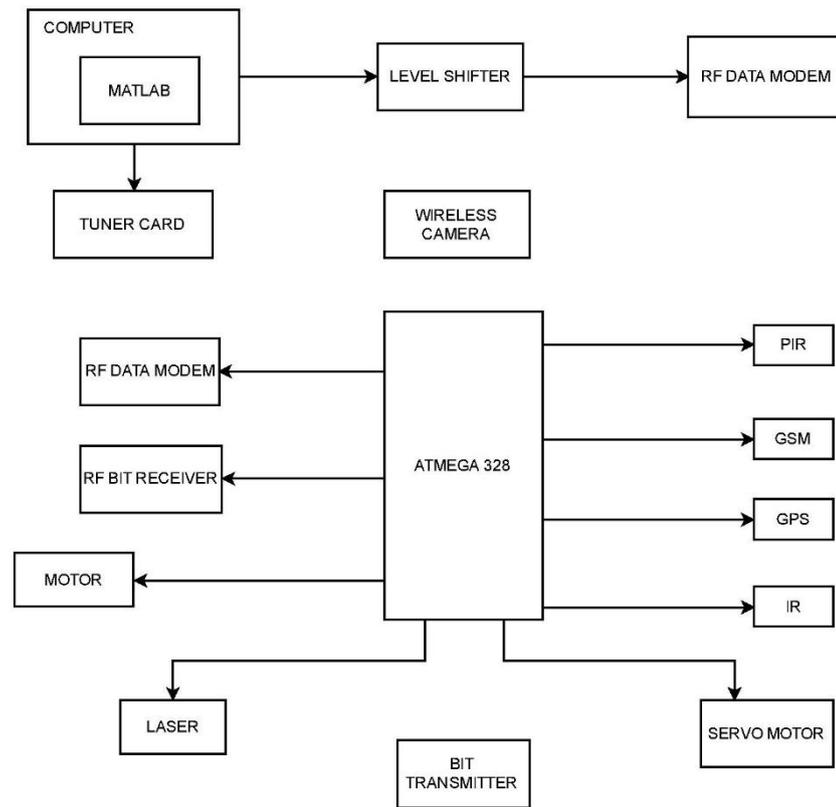


Fig 6.1 Block Diagram

VII. ACKNOWLEDGMENT

The project we started for the purpose to build a Human Detection Robot for rescue operations was a success in spite of some issues. First we thank Almighty God for all the blessings endowed on us and extend our sincere gratitude to our parents for the guidance and financial support, seminar guide Asst. Prof. Mrs. Deepa Maria, Dept. of CSE for guiding us and all our friends and institutions who were a great help.

VIII. CONCLUSION

In this paper three modules were discussed mainly. Human detection in MATLAB using Viola Jones algorithm and PIR, auto navigation with rescue operation and GPS location transfer. Viola and Jones algorithm is the first object detection algorithm that uses features to detect the features of humans that are already stored inside the algorithm. The MATLAB software is used to detect the humans from the video input that is acquired from the wireless camera inside the human detection robot. Once a human is detected using the MATLAB software, the software notifies the microcontroller using a RF data modem. PIR sensors are used as a backup in case of the less effectiveness of the wireless camera in the areas of low light. PIR sensors detect the heat radiations that are produced by the humans. Once such range of radiation is detected by the sensor then it confirms as a human detected and notifies the microcontroller. The microcontroller then does the necessary steps of acquiring the GPS location as well as the notification of the relevant people using a GSM module. The RGB-D sensors were really effective but these sensors are costly and the increased maintenance cost caused this technique to be opted out from the project. Human detection was done using different techniques. Each technique had its own pros and cons. So in order to limitations and to increase the efficiency two techniques are combined in the project.

This system can be implemented in defense of our nation, surveillance cameras etc. The cameras can be turned on while a human is detected thus saving memory and power consumption

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