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Intrusion Tracking, Recognition and Destruction for Surveillance and Security

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Abstract - *Here a complete independent system is used to automatically recognize, track and destroy the required object in predefined area under surveillance with the help of a controller via. Remote control. The developed system can be placed to work in various conditions where it is not easy to fight for a Human Soldier. Areas such as Line of Control which are entry restricted need to be safe from intrusions. The developed system can be placed at a suitable predetermined location from where the complete view of area under surveillance can be obtained through the camera placed on the system. Proposed system will be consisting of a battery powered computer which provides a live streaming of a specific area at a time. By viewing the video the controller will decide whether the object needs to be allowed to enter or it should be destroyed. Once decided to destroy the controller will move the position of the gun (Laser Gun Used in the Project for Demo purpose which performs the exact operation of the actual gun) and point it on the object. Once the object is pointed the controller will start firing on the object until it is destroyed. Thus it can assure very tight security and without endangering precious life of our Human Soldier. The system is simple from implementation point of view.*

Key Words*: *Object, Tracking, Recognition, Robot, Military Application.

1.INTRODUCTION

The system is responsible for giving live streaming of the area under surveillance and destroying the object. We have to fix this system in a predefined area, from where the entire live transmission can be obtained from the wireless camera placed on the system through RF Transmission. Proposed system includes of a wireless camera, Arduino board, two servo motors and other additionally required hardware. These are connected as shown in Fig.1. After some predefined interval of time, the controller can easily control the camera and capture images. Then every captured image will be processed for detecting intrusion. If it detects any intrusion, the controller will then point the laser gun on the intruded object and will continuously fire until the object is destroyed, which can be easily seen in the live transmission. The firing on the object can be made accurate by observing the laser gun light point which is visible on the object; by this the no. of fires can hit the object comparatively more than normal firing. And the object will be destroyed soon.

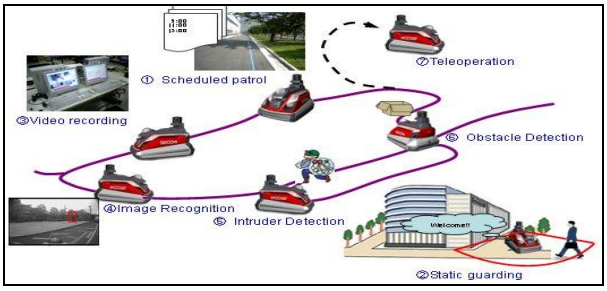
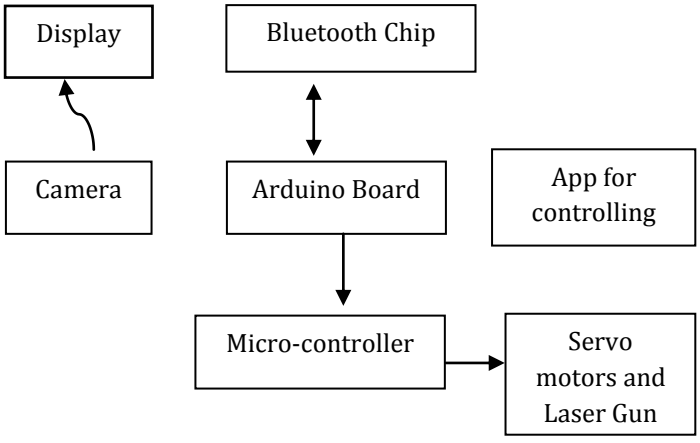


Fig -1: Overview of the system

2. Block diagram of the system

Here the complete block diagram of the system is given. The communication between the robot and the application inbuilt device is through the Bluetooth chip. While the real time video is transmitted wirelessly through RF communication and received at the receiver side which by connecting the USB Device into the laptop or desktop can be easily viewed or can be used as for capturing of images.



2.1 Camera

On the basis of the application, a USB Camera and camera with a night vision can be used accordingly. Camera placed on the Robot which carries at the desired location and the complete view of the area can be available on the display through the RF Receiver placed at controller side. For

making it feasible to be used in night we can connect high intensity LED's on the robot for vision and of camera and for avoiding collision with any be used. Other font types may be used if needed for special purposes. obstacle. The camera is completely operated by the battery supply on the robot. Basically the camera requires 5V-12V DC for operation.

2.2 Arduino Board

A microcontroller board with IC Atmega 2561 is used to run the process in terms of code which is burned in it? According to it we will move the position of the camera and the Laser gun in X-Y co-ordinates. After deciding the position and the angle of projectile the controller will start firing on the object continuously unless it gets destroyed.

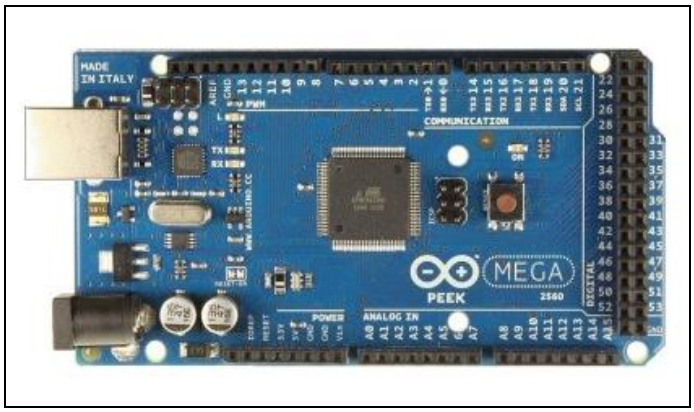


Fig -2: Arduino ATMEGA 2561 Board

2.3 Bluetooth Chip

The Bluetooth chip is the small chip mounted on the robot separately, and is powered by the batteries available on the bot. The range of the device is approximately 30mts and we can boost the range of the device by using an booster in the area of control.

2.4 Display

The Display used over can be a laptop, desktop or TV. Because as per the requirement and availability of the above the receiver can be used with any of the above devices easily. The viewing of the transmitted video can be used for recording or capturing images through a software named Honestech 2.5 in our computers.

2.5 App for controller

Besides, of making the controller a hardware one, I have kept it in a mobile application form. Which can be used for controlling the robot easily by pairing the mobile devices in which the application has been installed. The command keys are easily available in hands and can be used for the movement control and other application easily on a single click.

3. Image processing steps

Below are the steps used for processing of the image and gaining the detected object clearly.

3.1 Preprocessing

After camera is installed at its place, background image is captured and precaution must be taken that the background image is not altered. Background image is than subtracted with the current image to check intrusion. If the difference between the background image and current image is zero than there is no intrusion for sure. But if there is an intrusion than the difference will surely not be zero and the image is used for further feature extraction. But the image obtained after subtraction is not suitable for feature extraction and there is a need to preprocess the image before feature extraction.

3.2 Feature extraction

Shape of an object is calculated with the edges of the image at different predefined location. The referred location might be the centroid of any object, and it doesn't changes even if we rotate the object. Centre is the centroid of circle and the distance from the center of circle is all same. But in case of square it is not same. And the angles are taken from this center only. And hence we can calculate different shapes with a separation of 10 degrees. We can reduce the angle of separation in order to increase the accuracy. But this boosts the processing time. And hence there is a tradeoff in between the ability and accuracy of the developed system. Object though observed over large distance, will always differ in size and not in shape. Normalization is helpful for reducing the problems due to the distance between the image and the camera. This will be possible by dividing all the distances with the maximum possible distance. This results in formation of shape descriptors readings to range from 0 to 1. Shape descriptors are invariant to the rotation of object. Circular shifting of readings can also be implemented for making it starting point or making it rotation invariant. And hence enables us to try objects which are using various rotational orientations. So the system is rotational invariant and scale invariant. By this we obtain the shape descriptor of the object.

While observing any moving thing from distance away the Major features of that thing are considered instead of considering its minute details. If that thing is using mixture of various colors on its various parts, so at this stage the color occupying maximum area is considered, and we

can say that the thing is of that color. For determining the main color of the object we can logically AND the captured image with the predefined image or preprocessed image. And the resulting image will be in the HSV Format. We can obtain only the color information from the HUE plane of this HSV image. The values of the object lie between 0 and 1. Color is detected with respect to these values, for e.g., red, green and blue etc. Colors can be distinguished as in HSV plane as, red pixels have values >0.8 and <0.15, where green pixels have values >0.15 but <0.48, and blue pixels have values >0.48 but <0.8. By this we can detect the second gross feature of the intruded object. We can obtain both color and shape information from this resulting image. After doing all this we can use this image for determining the intrusion is true or faulty we can destroy the object.

3.3 Object tracking

When the match is found between image processed and the database object, the tracking is done by moving the camera on the system and pointing the object in front of the laser gun. Tracking is done to continuously monitor the intruded object and obtaining its movement.

3.4 Servo motor mechanism

Out of two motors, one is for controlling the motion of the cannon in X-direction and other is responsible for motion in Y-direction, both of them will decide projection angle. The rotatory angle for the servo motors can be changed by changing the PWM Signal produced by the Arduino board. The image obtained after transmission are used to determine the intrusion and hence we determine the angle of rotation, which in turns control the firing angle

4. Experimental setup

A complete setup with its all its additional accessories has been shown in the fig below. The system includes Arduino board, Bluetooth chip, DC Geared Motors, Wireless Gun, Laser Gun, Dry Battery 3.7 V DC, Driver IC's. The connection with the pins of the board and the component is done by using the datasheet. Testing at every instance is done for the required operation of the project and can be attained by proper arrangement of the components. Below is the figure attached showing all the connection and placements of the components which suits its best position.

Fig -3: Experimental setup of the system

5. CONCLUSIONS

The system was placed in an open area and the vision was available in the control room via. Wireless camera. Due to the vision the controller was able to continuously fire on the object by moving the motors and changing the position of the system by controlling dc motors. Out of 10 fires, 7 were hitting on the object and can be increased further with practice and control by the controller. Before controlling we have to connect the system by the remote controlled application through Bluetooth chip on the system. The connection is easy and the image can be seen below where it shows the name of the device in the app. And hence the connectivity is very easy and can be done within seconds.

Fig -4: Pairing the application with Bluetooth chip

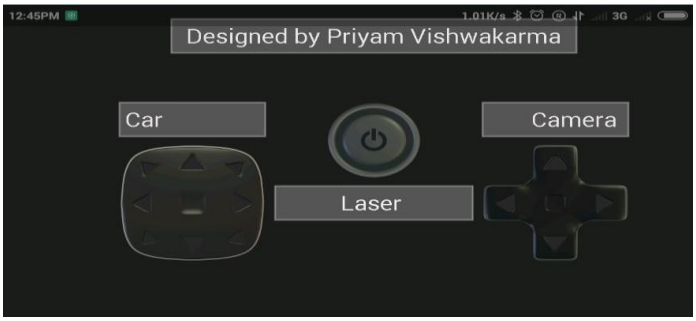


Fig -5: Remote control design with various keys

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