Design and Implementation of Automatic Multifunctional Military Robot

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***Abstract* - Due to the rise in the intrusion of the enemies in today's world, the monitoring of border areas is essential. Many soldiers lost their lives due to unawareness about enemies' arrival in the border area. In the existing system, the actions are not reflex in nature as well as the quality of surveillance is not up to the mark. This paper proposes a system that will monitor the border area continuously and activates the laser torch once it receives the command from the control station. The robot is constructed using Raspberry pi 3, IR sensor, Raspberry Pi camera, and servo motor. The proposed system captures the image of the enemy which is required to get approval from the control station. Raspberry Pi 3 processor is the controlling unit of this robot. The captured image is sent to the control station through Wi-Fi. With the help of captured image control station, staff can decide whether to activate the laser torch or not. This robot is able to continuously monitor border areas for military applications with quick and responsible action, with an accuracy of 90% in results.**

Keywords - Military Robot, Survellience, Automated robot, Triggering unit.

I. INTRODUCTION

With the growing invention in Robotics and automation, it is very important for a project to aim for diverse and advance applications. So, this project aims to give a defense robot under this growing technology. The quality of monitoring in this era can be improvised with this approach as the surveillance is not that satisfactory which results in increasing the number of lives in danger hence it is necessary to improve the standard of surveillance through effective methods. With the aid of this idea, the people in defense can identify the position of the enemy without entering the war field. The robot which will monitor and gives the video feedback in the hazardous condition. Results say controlling of this robot is done by Raspberry pi 3 controller, it will also provide a skilled advantage in the hostile ground and also during hostage situation [1].

A Bluetooth module is used to send the controlled command. It has used the microcontroller ATMEGA16 as the control body and this controller is interfaced to the Bluetooth module through UART protocol [2].

Wireless sensor network [WSN] is used to detect movement of human or enemy in the zone of the region by recognizing the radiation of heat emitted by human and have also used a combination of sensors for surveillance purpose [3].

The Micro wireless camera is fitted to the robot where the voice and video are transmitted to the control room. Also, the motor and wheels for the movement of the robot and controlled with the facility of gear [4]

Launch of the missile towards the enemy or target is implemented by using the concept of position and orientation, tilt compensation [7]. Hence this paper was used to study this method and also use the idea of launching the missile towards the target, which in detail will be explained in the proposed work. It gave the solution to solve the problem of immediate response from the system to the control room via wireless communication [8]. The recording or capturing of the video or image respectively and transmitting it to the control room is implemented [11]. The major limitation was the loss of internet which in turn causes the nonfunctioning of robot.

In order to overcome the limitation of web surveillance, Wi-Fi based approach is used. Internet usage comes into the picture only when the e-mail has to be triggered. The microcontroller has various disadvantages over raspberry pi 3 with respect to speed and processing, this approach is more suitable and time complexity is a major concern [13]. The collective data from all these sources and many more have been used in order to develop a smart, efficient and multifunctional military surveillance robot.

This paper discusses about the robot which has capabilities of sensing the enemy, capturing the image, triggering the mail, and also hitting the target. A similar idea to [2] is used in this project in triggering the laser beam from the control unit. Looking into this complexity of the robot with respect to the movement and voice, the approach has been limited to the use of pi camera for surveillance purposes.

Aim: To design and implement Wi-Fi based multifunctional military robot.

Objectives:

- To design and implement a continuous camera-based surveillance robot to sense the movement of human beings and enemy missiles.
- To design and implement a robot that keeps track of the target and destroys it (indicated by a laser torch).

II. PROPOSED WORK

This multifunctional military robot has several units which have their own functionality. As technology is advancing, these robots are advent to using in border areas.

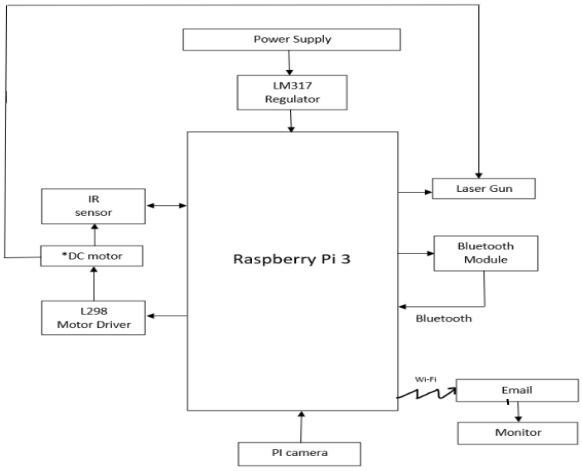

Fig 1:Block diagram

This system consists of four major units: Sensing unit, processing unit, rotating unit, triggering unit. Fig 1 illustrates the block diagram of the proposed system.

If the object comes in the line of sight of the obstacle detecting sensor, it detects and sends the signal to the Raspberry pi 3 processor. It is rotated using a DC motor thereby continuously monitoring the border area. Upon receiving the signal from the IR sensor, it instructs the raspberry pi camera to capture the image of the object. Then the captured image is mail to the control room via Wi-Fi, based on the command from the control room it activates the laser torch.

A. *Sensing unit*

- IR Sensor

Fig 2: IR Sensor

Infrared sensor is used as the sensing unit in this proposed system. It can sense up to the range of 3 meters. It will operate at the voltage of 5V with the current of 20mA.

- Raspberry Pi Camera

Raspberry Pi Camera of 5MP with the resolution of 2592x1944 pixels, is used as the image capturing unit.

B. *Processing unit*

The whole system function is controlled by the Raspberry Pi 3 processor. It is a 64bit quadcore processor with a 16GB SSD memory card, which operates at 1.2ghz frequency. It has 1GB RAM BCM43438 wireless LAN and Bluetooth Low Energy (BLE) on board with 100 Base Ethernet and40-pin extended GPIO 4 USB 2 ports. It also has a CSI camera port for connecting a Raspberry Pi camera, a DSI display port for connecting a Raspberry Pi touchscreen display, Micro SD port for loading your operating system and storing data, it comes with an upgraded switched Micro USB power source up to 2.5A.

Fig 3: Raspberry Pi 3 processor

Fig 3: Raspberry Pi camera

C. *Rotating unit*

DC motor operates at the voltage of 4.5v to 9v. It has the speed of 9000 rpm. It requires the current of 70mA at no load and the current of 250mA at loaded current.

Fig 4: DC motor

D. Triggering unit

It has an operating temperature of -10 - +40 ℃. The output power is 5 mW. Normal and maximum operating voltage is 2.2 and 2.7 respectively. The threshold current is minimum, normal and maximum condition are 15, 20 and 30mA.The operating current is 65 to 80mA.The wavelength is 650nm.

Fig 5: Laser torch

Flow Chart

This section includes the sequential representation of the processes involved in this project.

The major steps involved in this approach include the detection of an object, capturing of image, sending the captured image via email, receiving the signal from the control unit, and triggering of laser torch. The workflow of this approach starts with sensing the enemy using an IR sensor, if the object is detected then it captures the image and keeps the track of detected object using the pi camera. If not, then the sensor continues to detect the enemy from different angles. Next, the captured image is sent to the control room via email using wireless communication technology i.e. Wi-Fi. The person in the control unit checks the image received in the email and then verifies if it's an enemy. If it is an enemy then he will send a response back to the processor using wireless communication to trigger the laser torch towards the target. Once this loop is executed the system resets and this loop will execute similarly from the beginning.

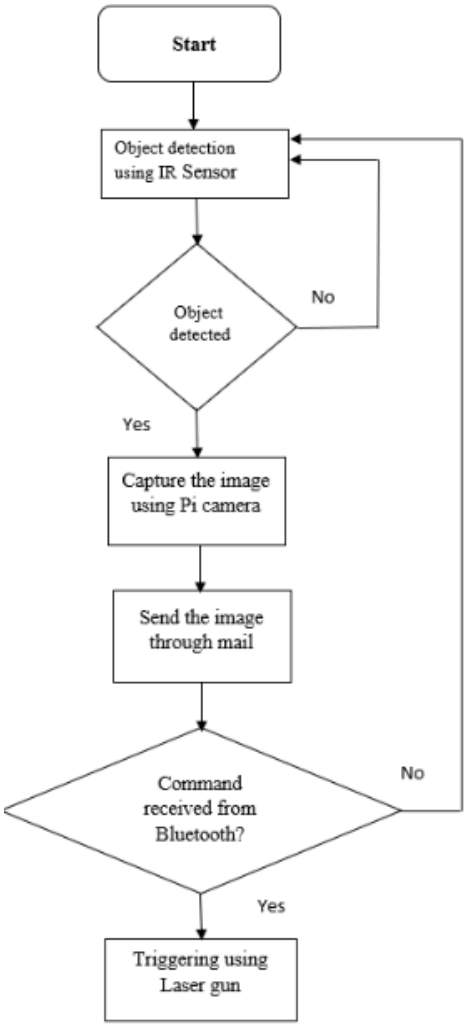

Fig 6: Flow chart

IV. RESULT

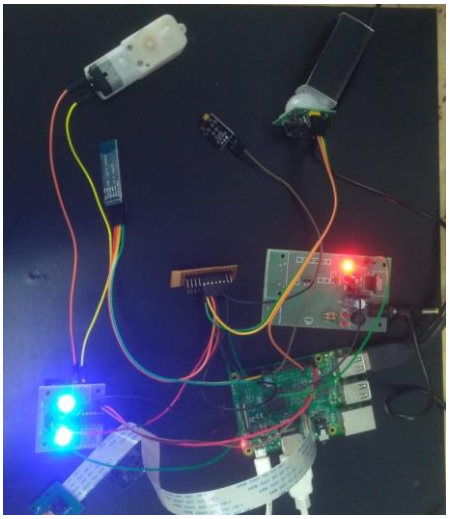

Fig 7: Circuit of the proposed model.

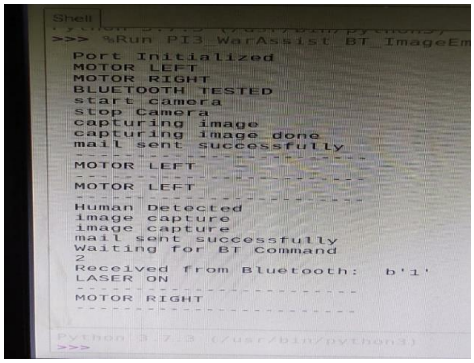

Fig 8 : Program output

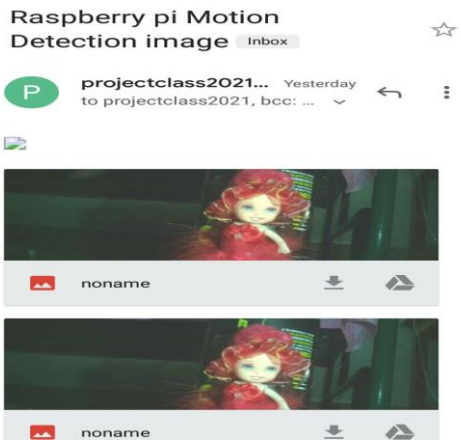

Fig 9 : Email received by the Control unit.

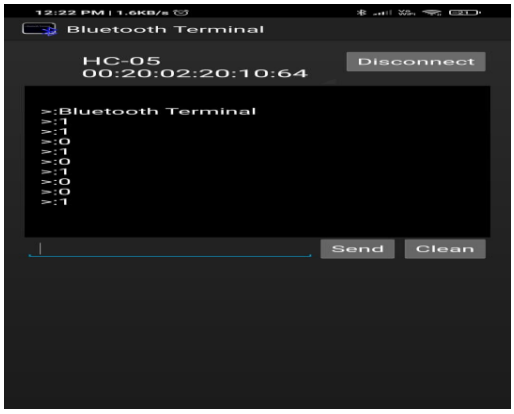

Fig: Command via Bluetooth

Figure 7 shows the Circuit design of Military robot. All the components have been integrated and tested. Figure 8 shows the output when the program was compiled and run and Figure 9 is the snapshot of the mail Received by the control room. Sending of command via Bluetooth is shown in Figure 10.

This robot consumes only 12V of DC power supply for the total processing. It has a wireless camera to observe the surrounding environment. This model provides an output with the accuracy of 90% for the room environment.

V. FUTURE SCOPE

This robot can be made more miniature in size irrespective of having so many features and advantages. Its efficiency can be enhanced by using wide range sensors and 360^0 rotations, also this can be improvised by using high-definition cameras for capturing the images and if possible, video processing can also be adjoined. With the facility of high-speed internet connection, the system can be automated and can be made more efficient. Image processing can also be added for obtaining the precise result but it complicates the process. This model can also be improvised by using the application of Satellite communication for faster processing of data.

CONCLUSION

This robot is built for military application. It has a pi camera to observe the environment. This robot gives alert signal by triggering the mail to the control unit within 2 seconds of capturing the image. For instance, in a single place, it can be used for spying purposes. This robot with different sub modules can be widely used as the surveillance robot for security purposes and also emergency operations where humans cannot foot pace and the person in the control unit will be able to get the alert. Thus, by installing these in the border area, the lives of the soldiers can be saved.

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