Border security and monitoring system by using Raspberry PI via Android device

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Abstract– **In today's life security plays an important role. In the area of school, hospital, house, military, business, IT industries ,etc and soldiers are dying due to terrorist attacks and we have to protect our soldiers. Nowadays technology is improving very fast and also it consists of some risks but we have to overcome these risks by utilizing new technologies. Till now we are seen different types of technologies it will provide border security. In this system we introducing an advanced robot for security it will gives live monitoring facility in the border area and protect our soldiers from intruder attack. We have developed a robot, in the robot we have installed a PIR motion sensor, camera, Raspberry Pi. A PIR sensor will detect human motion and the camera is used to capture the surrounding photos and also it captures live video data, all these processes is handled by the processor for next step. The robot having a laser gun that is used to point out the intruder and also we can shoot the intruder instantly. This action will come from the base station to protect our soldiers.**

Index terms – Raspberry Pi 3 model B, PIR Motion sensor, camera, laser, Android device.

I. INTRODUCTION

Nowadays robots play an important role in different fields and they will perform different types of tasks depends upon where we are using them. Robotics research mainly focused on the design and development of movable robots for military purposes, security purposes, home appliances, etc. Many robots are already developed by various countries, and some of them are used to give the security of the border area. Soldiers are the main pillar of our nation. They are protecting us so we have to protect our soldiers, this is the main responsibility and it is important also. Technology is going very fast so we have to utilize it correctly. Technology has both advantage and disadvantage, when technology increase, risk, and attacks also increase and this is challenging task to our soldiers. So the robot will perform an important in this situation where soldiers can't keep their eyes in the border The advanced robot can be used where human isn't able to of doing it. Observing remote places a robot can be structured with the required moiety correspondence [1]. This paper explains the autonomous robot for border security. The arrangements of components are financially very less compare to other robots [2]. This paper explains that how the robot will perform its function by using a PIR sensor with the help of GSM the robot will provide security to the border area and this model enables security at a low cost also. This can naturally identify the unknown person in the border area and illuminate the close of the client through the control unit [3]. The robot recognizes obstacles by using an ultrasonic sensor and it will capture the images by using the camera. A fire sensor is used to sense the flame and the

gas sensor is used to detect the toxic substances and finally, the temperature is detected by using a temperature sensor [4]. This paper uses a Raspberry pi to improve security and this system consists of a PIR sensor to detect human motion and an ultrasonic sensor which is used to detect an obstacle, the gas sensor is for the toxic gases, fire sensor which is used to detect flame or fire and temperature sensor is used to identify the temperature [5].

In our paper we explain an updated version of the robot for border security with the help of new technology that is web page connection and also we have used a PIR motion sensor, laser gun, real-time images captured by the pi camera, and also we have live video streaming and also we can control the robot, both in the android device and computer.

The remaining sections of the paper are as follows: Section II tells about the related work that has been done and the research going on in the field of border security. Section III discusses the various components used in the proposed system. Section IV describes the architecture and implementation of the proposed system. Section V shows the Experimental results of the proposed work. Section VI discusses about the conclusion and future scope.

II. RELATEDWORK

This section gives a brief description of the exiting solutions for border security

This method explains how the robot will provide [6] security for the border areas. The robot moves in the border area to find the intruder and the data is transmitted to the base station to take any action against the intruder and an authorized person will check the detected person for further action for security. This work explains about PIR Motion sensor which is used to detect movements of human then it alerts authorized person by sending messages by using GSM and the computer will capture the images by using a camera and images are transferred to authorized persons mail id using the android based application [7].

Author proposes survey of wireless sensor networks, for the security of the border and intruder detection. The main goal of this project is to use a more number of sensors which is developed by combining all different techniques of surveillance and intruder detection systems, different sensors are discussed in this like some sensors are used for detecting a human motion [8].

In this system videos are captured by using a surveillance camera and it will converts video to slots and extracting the features from it, this is the main study of this project. By using ROI features are extracted from an object tracking method [9].

This method of framework consists of human motion detection, most importantly this system consists of the face-recognizing method which is used to find out the face of the human. If the face is not detected, then the target detecting continuous their work [10].

This method explains about how intruder detection is carried out with the help of WSN technology. The main technology of this project is WSN technology; it will be placed on the border in a more number to give time-specific information and geographical data [11]. This work explains about SOBCAH (Surveillance of borders, coastline, and harbors) architecture of the project. The sensors will transmit the information to the SOBCAH and it will integrate that information, and this information is converted into a specific common standard data format. All the data will be stored in the database that will be called SSD (SOBCAH shared database) and all the data will come from the heterogeneous sensors [12]. This system consists of an IR sensor like an infrared sensor. This sensor works in a range of distance 1m and the IR sensor is truly based on the intensity of light that will be reflected from the object. Based on this sensor the result will be provided [13]. This method uses a Raspberry Pi and Arduino which is used to control the robot and also this system having a wireless sensor network. Raspberry Pi and Arduino controllers are used in IOT related projects and these are all open-source hardware platforms. Based on the hardware and software requirements will explain the clear architecture and working principle of the project [14].

III. COMPONENTS USED IN THEPROPOSED SYSTEM

The proposed system provides higher security to the border area and also it provides an effective result or solution to detect the intruder. Components used in the proposed system are as follows:

Raspberry Pi 3 Model B: The main component of our project is Raspberry Pi. The Raspberry Pi behaves as the main and DSI port, Audio jack 3.5, Ethernet port, 40 general-purpose input, and output pins and also this Raspberry Pi consists of inbuilt WIFI and Bluetooth model.

PIR sensor: The PIR sensor is one of the components of our project which is used to detect human motion. The PIR motion sensor's range is 2 meters and the angle is 360 degrees by this capacity the PIR sensor works. In our project, we are using this sensor to detect human motion in the border area.

DC Motor: In this project, we are using NR-DC-ECO Motor. It is a high-quality, low-cost DC motor. The capacity of the DC motor will be 12v. In our project we are using 2 DC motors, DC motor will be controlled by a DC motor driver.

L298 DC Motor driver: In our project, we are used an L298 DC motor driver, the L298 is an integrated monolithic circuit in a powerS020 and 15-lead multi-watt packages. And it consists of high voltage. The motor driver behaves as a mediator or an interface between the controller and the motor. The Motor operates 12v like a high amount of current but the controller operates a low current, for example, Raspberry Pi operates 3.2v with very less current. So here motor driver function is to convert low current to the high current control signal.

Laser: Laser also one of the components of our project. It releases a red laser beam and it is a light-emitting diode. Laser measures more accurately at high sample rates require strong reflection than the lower sample rates. In our project, we have used the laser to point out the intruder for shooting purposes.

Pi camera: And another component of our project is the Pi camera. This camera was very less weight so we can use this camera easily and it is normally used in surveillance projects. The pi camera is attached or fixed to the Raspberry pi hardware through a custom CSI interface. In our project pi camera performs to capture the images of the intruder.

SD card: One of the important components of our project is the SD card. Basically in Raspberry pi didn't have any inbuilt storage capacity so stored data like images, videos, code, etc are stored in the SD card. And it is a type of removable memory card.

SD card formatter: SD card formatter is a program it will give an easy way to access all memory card formats like SDHC, SD, and SCXC, so we can store the data in the SD card based on SD card formatter.

Advanced IP scanner: In our project, we are using an Advanced IP scanner which is used to scan the IP address. That IP address is browsing in the browser for further action of the robot. Memory allocation is not an issue in computers because the installation of the Advanced IP scanner is not required.

Putty: Putty is a software of Telnet and SSH terminal platform OS Unix and Windows and we can access the computer remotely by any users after enabling this software through the internet. It supports several network protocols and it is a free and open-source application. In our project putty software or by using putty software we have to put IP address to IP scanner. So this plays an important role in our project.

IV. ARCHITECTURE &IMPLEMENTATION

The architecture of the proposed system is shown in Fig 1.The proposed system is a smart border surveillance system which is very helpful for our border security. It has 24/7 video surveillance at any places where a human cant enter due to some climatic issue, geographical or any some reasons. The PIR Motion sensor is installed in the robot which monitors the border area for any intrusion. In our project, the Robot vehicle is left in the border places. First, we have to initialize robot components are Raspberry Pi, camera, motor, Email service, and power supply functions. After initialization, we will be checking robot random movements, in that time PIR sensor is activated and it detects human motion. The capacity of the PIR sensor is angle is 360degree and the range is two-meter, in case the PIR sensor detects any human motion at that time we can stop the robot random movements and we can take surrounding photos

And those photos will be sent to the defined mail id or already saved authorized mail id, in this way we will upload the images to the mail id.

Through the internet we will send the images like the internet is already connected to the raspberry pi because an inbuilt WIFI module is present.

The Authorized person will get the notification then an authorized person will check the mail and the person will monitor the images like that person is a known person or an unknown person by seeing the images.

If the person is a known person the robot will perform its normal work based on command will be sent by the authorized page connection, we can browse the web page in the computer as well as in android device, after browsing web page we can get the manual control of the robot by seeing the live video streaming and also we can handle the robot in the direction of right, left, forward and backward.

Once the robot moved near the intruder the authorized person can give a specific command for the robot movements and also by using a laser gun we can fire the intruder, the laser gun is fixed in the robot. We can rotate the gun 90 degrees to the left and 90 degrees to the right using a DC motor. The whole flow and working of our proposed autonomous robot are depicted in the flowchart presented in Fig.2.

In our project, the raspberry pi is a controller it consists of 4 USB ports, 1 HDMI port, 1 CSI port (camera serial interface), DSI (display serial interface), audio jack 3.5 and Ethernet port, 40 general-purpose input and output pins and also it consists of inbuilt WIFI and Bluetooth module and operating system of this project are raspbian Jessie and python version of 2.7 and 3.1.

And we are using a laser in this project which is used to point out the intruder that task will handle by us like user and coming to DC motor driver the operating voltage of raspberry pi is 3.2v and operating voltage of DC motor is 12v so to set up the voltage we used DC motor driver, coming to DC motor in our system we are using 2 DC motor 2 input pins of raspberry pi is connected to one DC motor and 2 output pins of raspberry pi is connected to another DC motor, in one DC motor driver we can connect 2 DC motor.

PIR sensor we are in our project using which is used to detect human motion only. If PIR sensor performs to detect human motion in the border area at the same time the pi camera captures the images of humans and that captured images are saved in the SD card raspberry pi doesn't have any storage capacity so we are using an SD card for storage purpose like code, data, images ,etc. firstly we have to insert OS to SD card so that we have to format SD card based on SD formatter by using software win32 disc imager, through this, we are going to install OS to the SD card, after installation we can connect the hardware.

In the operating system we have to enable secure shell by default it is not enabled so we have to enable secure

shell after enabling secure shell we can get the IP address, and we have to scan the IP address in Advanced IP scanner, here we have to put IP address to IP scanner by using putty software after scanning IP address we can get terminal and we can run the command.
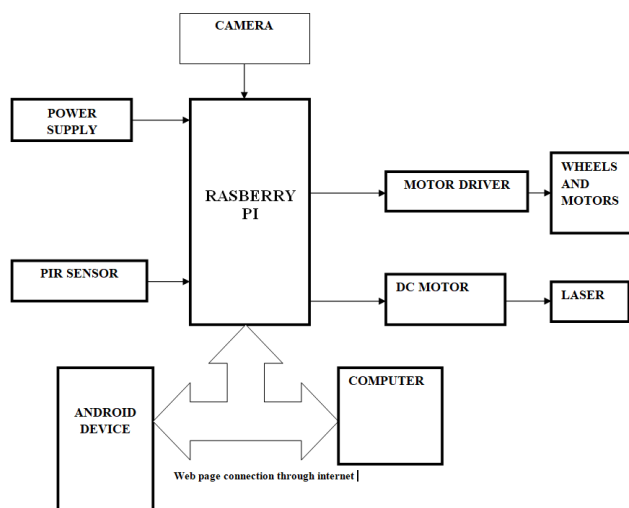

Fig.1.The architecture of the proposed system

Fig.2. shows the flow chart of our project. To start with, initialize camera, email, motor, raspberry pi after initialization the robot will perform its function like random movements in the border area, and then the PIR sensor is activated and it will detect only human motion in the border area if we get NO means human is not detects in that time robot will perform its normal work or YES means PIR sensor detects a human motion, the pi camera will capture the surrounding photos and the robot stops its movements and captured images are transmitted to already saved authorized persons mail id and an authorized person will check the person is known or unknown. If a person is an unknown person, that time authorized person will take manual control of the robot by browsing the PHP web page after browsing the web page we can view a live video by seeing the live video we can shoot out the intruder, in this way we can finish our task.
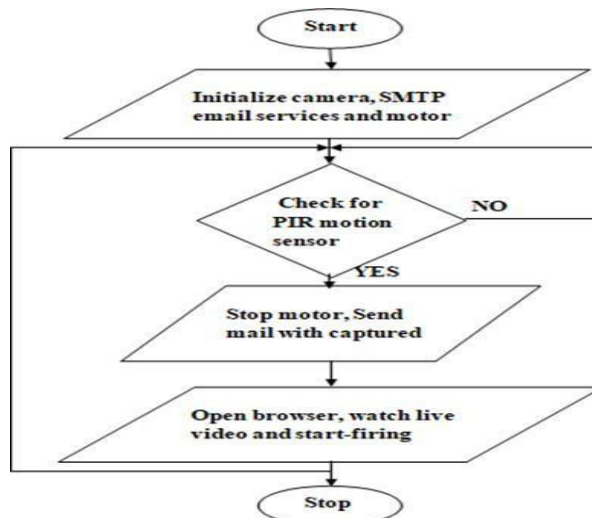

Fig.2.Flow chart of the proposed system

V.   EXPERIMENTALRESULTS

The working model of the proposed system is shown in Fig.3. the figure shows the hardware component we developed and this hardware consist of Raspberry Pi, DC motor, DC motor driver, pi camera, laser gun, power supply, and SD card by using these components we are developed hardware component that will be called a robot, this robot will plays in the border area and it will monitor the border.

Fig.4. it shows how the camera will capture the images by using the pi camera, the PIR sensor detects human motion when a human detects in the border area and the pi camera will capture the surrounding images of the border area and if human motion detects robot stops its movements. Captured images are transferred to authorize persons mail is that shown in fig.4.
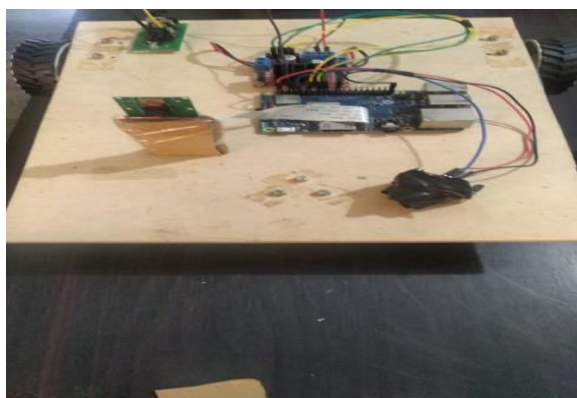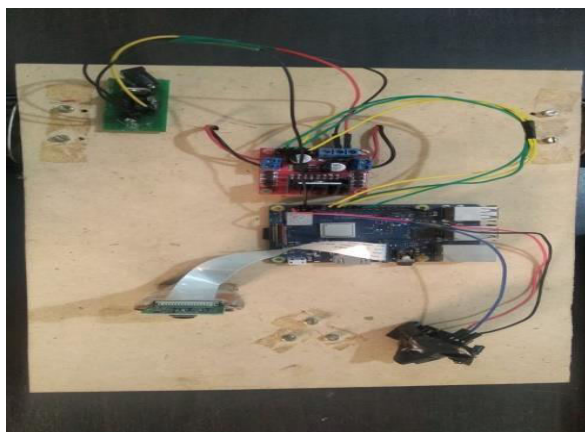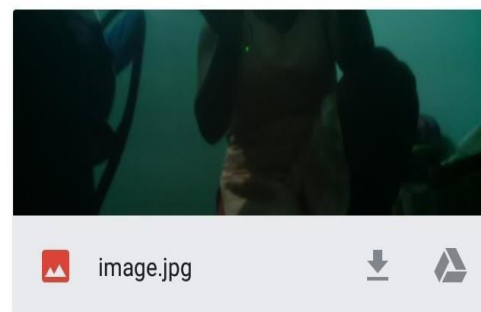

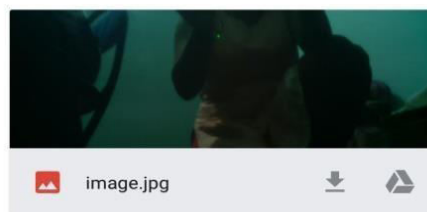Fig.3.images of the proposed system

Fig.4. pictures of the intruder that will be captured by the camera.

Fig.5. will show how the live video data page looks like. The camera will capture the live video data after browsing the PHP web page we can see this live video, by seeing the live video we can move the robot near the intruder, and also we can shoot the intruder by using a laser gun, the gun is attached to the robot. In the snapshot, we can see the option to open and close the camera and we have an option of gun symbol which is used to shoot the intruder.
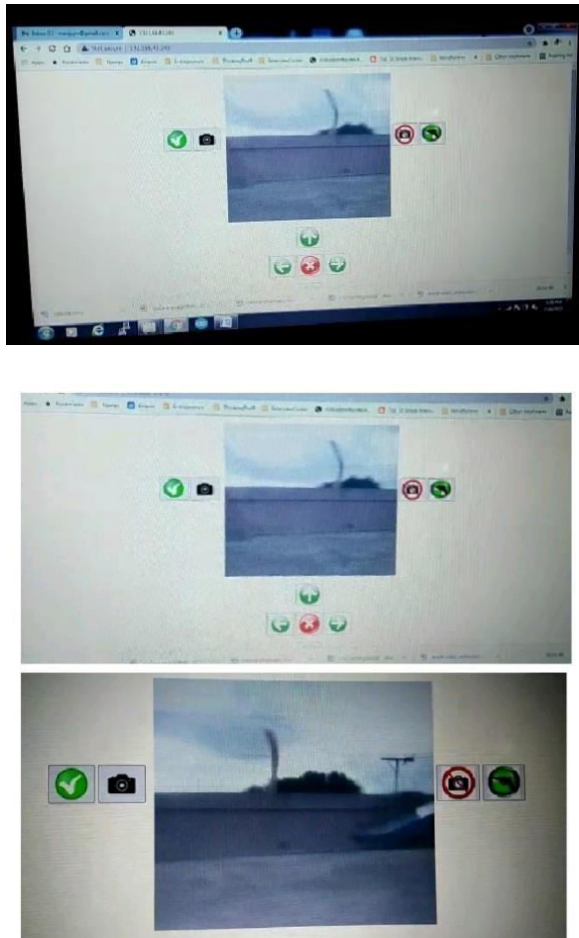
Fig.5. Snapshots of the live video streaming

VI. CONCLUSION AND FUTURE RESEARCH WORK

Border security is most important when it comes to security. To provide security to our soldiers and also to border areas is important. The proposed system has a PIR sensor that monitors human activity in the border area. The pi camera will provide live video streaming ensures that there is a continuous monitoring facility at the border. The Raspberry pi will be the processor of the model and the laser will perform to point the intruder for fire purposes. The result show the solution provided in this paper can save many lives of soldiers from the intruder.

In this proposed method, energy is the most important factor and the main source of energy is the battery, and the life of the battery is a major part. So monitoring the battery duration is prime when it comes to the robot. The disadvantage of this project is the battery turns off very fast. In future work, we can use solar energy for the functionality of the robot.

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