Night Patrolling Robot With Sound Detection For Security Using IOT

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***Abstract*—**Safety is the biggest priority in the world. Reconnaissance and observation of our homes have seen a developing need in arising times. By means of this paper, we put forward the Development of the night patrol robot that is used to find the sound waves in the surroundings, and security patrolling services. The robot records and begins to relay photographs of the situation immediately after detecting the sound. These captured images are sent to the respective email and cloud through the Internet of Things (IoT). The robot is able to perform security patrols during the night while functioning while at the same time working as a guide during the day. We designed and implemented a patrolling robot which provides security in our surrounding areas, and easy to assemble. Here we are using IoT technology to receive the captured images and also cloud system, which provides the warning messages to the user. Our Project suggests that the robot is user-friendly and pleasing to the people, it can perform security for human beings.

Keywords—Security, Sound sensor, IoT.

I. INTRODUCTION

In today's world, the use of technology is increasing day by day. Robotic machines are getting used in many places. Since technology is upgrading, we humans are designing different categories of robots and implementing different kinds of programmable functions for them. At present, robots are getting used in different types of industries like defense, research, security, etc. Each robot functions its own task efficiently and it requires less cost for implementing these types of robots. These robots can be re-programmable and work faster when compared to humans and can perform in any kind of environmental condition. In this project, a patrolling robot is made for security purposes when and where a human can't monitor in their busy schedule. Generally, surveillance means monitoring our surroundings with our naked eyes. But, when it comes to machines, it's a kind of task that the robot has to perform according to the programmed functionality. Here the robot is build up with a camera that can capture or record in different angles of view to identify the unknown object or an unknown person. This project's main functionality is to perform patrolling services at the night by using a sound sensor. The sound sensor is used to recognize the sound and perform accordingly. We are using a miniature size of patrolling robot so that it can travel to any kind of place in the building. The proposed system classified into two sections mainly a robotic section and a remote control section. The robotic section consists of the webcam, sound sensor, and also the heart of the project, raspberry pi which is connected together with the PCB containing motor-driven IC and voltage regulatory systems. The remote control section consists of a computer or a laptop since we have to implement some kind of code into the raspberry pi through the raspbian operating system to perform the patrolling task for the robot. Another section is a remotely connecting section. This designed system is connected to a laptop wirelessly by using few applications such as Etcher, Advanced Ip Scanner, Putty, and VNC viewer. This wireless connection provides us extra benefits like more flexibility and reduces installation price. After following certain steps we can connect our desktop wirelessly through which the full controlling of the system response is finished. In this project, we are using the Internet of Things (IoT) technique to get transmitted images, and view them in the respective mail Id and warning messages to the user in the cloud. Hence we're putting forward a fully automatic security patrolling robot that runs persistently and monitors the surrounding areas to protect our building.

II. LITERATURE SURVEY

[1] Robots are widely utilized in various security and surveillance applications. Tahzib Mashrik, Hasib Zunair Maofic Farhan Karin proposed a surveillance robot that consists of a camera, Bluetooth, GSM module, and software application for mobile interface. The Robot is controlled manually by using Either Bluetooth or a GSM module and monitor through the camera. The robot is designed in such a way that there is no need for manpower at the location but to monitor and control manpower is needed. The main disadvantages are, the robot is not fully autonomous, and there is no cloud storage facility.

[2] James Mount and Michael Milford proposed the domestic service robot in such a way that lawn mowing and vacuum cleaning robots exist today. Whereas there are many robots for obstacle detection, but there is a chance that the robot will move or patrol in the same area. So, James Mount and Michael Milford designed the robot to 1D scan the environment. It works as an obstacle robot for the first run and makes its 1D scan and provides boundaries of every room. After the first run and 1D scan, the robot can patrol against any obstacles.

[3] The Robot named Night Rider is proposed by krik Mac Tavish, Michael Paton, and Timothy D. Barfoot. The robot is mainly based on Visual Odometry where it detects the motion from a sequence of camera images. A couple of

headlights are used as an alternate lighting source and the performance under all lighting conditions nearly 10km of driving over 30 hours.

[4] The Far infra-red cameras are suitable for the detection of objects that are warmer compared to the background by using this theory M. Bertozzi proposed the robot which patrols and detects all living beings around captures them. This proposed system captures every hot object compared to the background. Where it leads to the capture of unwanted information that is not related to security. If there are any two hot objects 180 degrees from each other when the robot camera has to turn around for every capture. But the advantages are it can detect the bodies that are on another side of the walls.

III. EXISTING METHODOLOGY

In the existing system, the robot uses a Passive Infra-Red PIR sensor that detects the level of IR radiation from living objects. This sensor passively detects the radiations i.e., infrared radiations which come from the human body in the surrounding area. Some systems have to be controlled remotely and some use a localhost webpage where the range of the control is limited to its network range. We can't monitor the sound.

IV. PROPOSED METHODOLOGY

The proposed system consists of a sound sensor. The sound sensor is used to recognize the sound in the surrounding areas. The Pi camera is installed within the raspberry pi so that the robot makes a fully automatic system. When the sound is detected, the pi camera which is connected to raspberry pi gets activated and starts capturing images. The captured images are sent to the respective Email using IoT technology. Concerning this, the warning message which contains the captured image time and date will be saved in the cloud. This alert message provides extra information regarding the image date and time so that the user can use this for further proceedings.

V. SYSTEM OVERVIEW

The below-mentioned figure 1 is an overview of our proposed system. The proposed system requires both hardware and software components for the design and implementation of our patrolling robot.

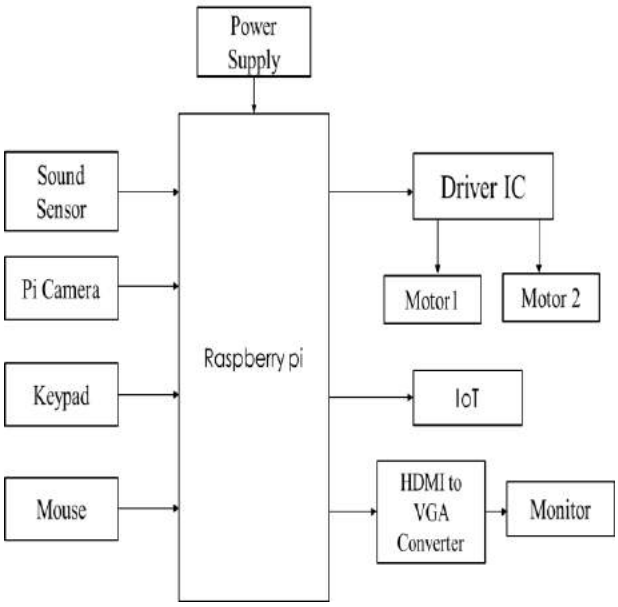

Figure1: Block Diagram of the Proposed System

5.1 HARDWARE REQUIREMENTS

- Raspberry Pi
- Sound Sensor
- Pi camera
- Motor Driver IC
- Bluetooth Module
- SD card
- DC motors
- HDMI to VGA converter
- Monitor

5.2 SOFTWARE REQUIREMENTS

- Raspbian OS
- Python

VI. HARDWARE COMPONENTS USED

The design and implementation of both hardware and software requirements of the proposed system are described in detail below.

Raspberry Pi 3 Model B+

Raspberry pi is a single board microprocessor circuit which is developed in the United Kingdom by Raspberry Pi Foundation. Raspberry pi 3 Model B+ is one of the latest upgraded versions of raspberry pi 2. This version is 50% faster than the previous versions.

Figure2: Raspberry Pi 3 Model B+

Specifications:

- CPU: Quad-core 64-bit ARM Cortex A53 clocked at 1.2 GHz
- GPU: 400MHz Video Core IV multimedia
- Memory: 1GB LPDDR2-900 SDRAM
- Contains 4 USB ports
- Video outputs: HDMI, composite video via 3.5 mm jack
- 10/100Mbps Ethernet and 802.11n WLAN
- 17 GPIO plus specific functions
- 4.1 Bluetooth
- 5 V via Micro USB or GPIO header- the source of power
- 85.60mm × 56.5mm size
- 45g of weight
- Low price & Low current
- High reliability
- Input-Output pins contain 35u gold plating

Pi Camera

The Raspberry pi camera we used here is a 5mp camera. It is capable of capturing still images with fixed focus and it can capture high-definition video. The pi camera is attached to Raspberry pi. The images captured are sent to mail through IOT module.

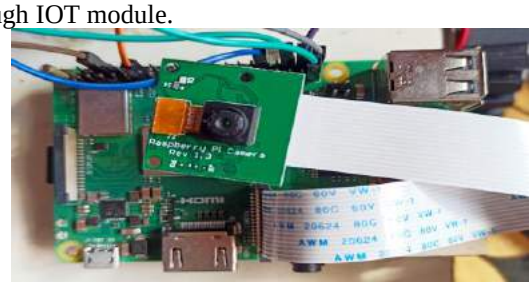

Figure3: Pi Camera

Sound Sensor

The sound sensor is a type of module which is used to detect the intensity of sound and convert it into electric signals. The sound sensor consists of 3 pins mainly VCC, Ground, and Output pin. This sensor consists of a microphone and it uses vibrations and changes it into the signal.

Figure4: Sound Sensor

Pin Configuration

- Pin1 (VCC): 3.3V DC - 5V DC
- Pin2 (GND): Ground pin
- Pin3 (DO): Output pin

Specifications

- Current : 4~5 mA
- Voltage gain : 26 dB
- Sensitivity of microphone : 52-48 dB
- Frequency of microphone : 16-20 kHz
- S/N ratio: 53 dB

Motor Driver IC

The Motor Driver IC contains the H-connect association needed for bi-directional control of the engine. This is fundamental for the robot to accomplish all headings of motion, to be specific, forward, reverse, left, and right. The force hotspot for the engines is a 12V battery which is provided fittingly to the engines utilizing the engine driver. This driver is controlled by utilizing the impelling signs from the microchip. The Motor driver utilized in this proposed system is the L293D. It is a double engine regulator, which means it can handle two engines at an equivalent time. For controlling 4 engines, we need to associate two engines corresponding to a similar space. It can give up to 2 amperes for each channel and it is a modest module to utilize. This board additionally includes an onboard 12v to 5v controller, IC 7805, which can be utilized to control up any board which requires it.

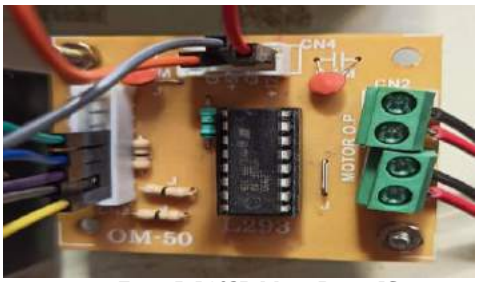

Figure5: L293D Motor Driver IC

Bluetooth Module

In Raspberry pi the Bluetooth is in-built. We are using Raspberry Pi 3 Model B+ where it consists of Bluetooth 4.1 version. The Bluetooth 4.1 consists of a wide range of connectivity up to 30 meters from the device. We are using this Bluetooth feature to operate Raspberry pi without connecting through HDMI cable.

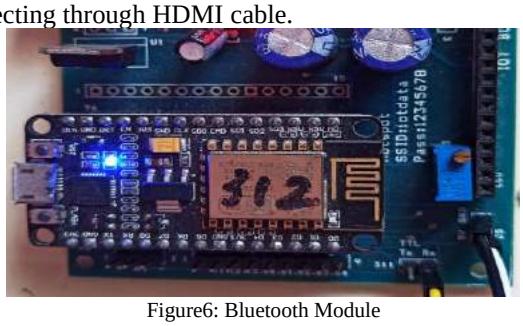

Figure6: Bluetooth Module

VII. SOFTWARE IMPLEMENTATION

In the proposed system, we are using raspberry pi as the main component. So for executing any code through raspberry pi, first we need to install Raspbian OS on our monitor. We have to follow certain steps before installing

the Raspbian OS on the computer. For this, we need an HDMI to VGA converter, a micro SD card, a keyboard, and a mouse.
We can't install this operating system on our laptop, since they are built-in with windows or mac operating systems. So it will be time-consuming and we can't carry our computers everywhere. To overcome this we are connecting Raspberry Pi to our laptop by using our smartphone's hotspot and by using few applications like VNC viewer, Etcher, Putty, and Advanced IP scanner.
Let me explain in detail, how to connect raspberry pi to the laptop without any HDMI cable or Ethernet cable.

- The things you will require for this is are a Raspberry pi model B+, a Micro SD card, a smartphone for making a hotspot, SD card adapter for connecting it to the laptop.
- In the hotspot network, we will bring both raspberry pi and laptop on the same network.
- First download Raspbian OS from the official site of Raspberry pi and in the meantime format the micro SD card using SD card formatter.
- As mentioned we need to install few applications on our laptop. The things we require
  i. Etcher: We will write the operating system into an SD card using Etcher.
  ii. Advance IP Scanner: We will scan the IP address of the raspberry pi using this.
  iii. Putty: We will use putty for doing SSH.
  iv. VNC viewer: We will use this to see the raspberry pi desktop.
- After installing these applications, dump the installed Raspbian OS into the micro SD card using Etcher. Open Etcher, the first thing is to select the zip file we have downloaded Raspbian OS and flash it.
- Now open the boot file on your laptop and create a new text file and save it as SSH.
- Go ahead to our smartphone and turn on the hotspot. Note down the hotspot's name and password.
- Now copy a file to the SD card, which contains a code to connect the raspberry pi to our phone's hotspot. Before copying the file, make sure to name the username and password of our hotspot.
- Remove the SD card from the laptop and insert it into a raspberry pi. Now give power supply to the raspberry pi by connecting the USB cable to the laptop or any power bank.
- Open an advanced IP scanner and run as administrator. Before running this application, connect your laptop to the hotspot you created with your smartphone. This is important that we need to bring our laptop and the raspberry pi into the same network.
- Know your laptop's IP address and search for the base IP address. Now scan the IP address mapping from 1to the base address in the Advanced IP scanner. The IP address of raspberry pi will be identified. Copy this IP address.
- Open the Putty and paste the IP address of the raspberry pi, select SSH and click open. Set the default username and password in Putty. Now enable few configuration tools like VNC viewer, etc., and click finish.
- Head over to the VNC viewer and paste the IP address of raspberry pi. Since we have enabled the VNC server, we will be able to connect to a raspberry pi. Click on enter and there you are. We got the desktop of the raspberry pi.
- Now change the default settings, select the country, and set a new username and password.

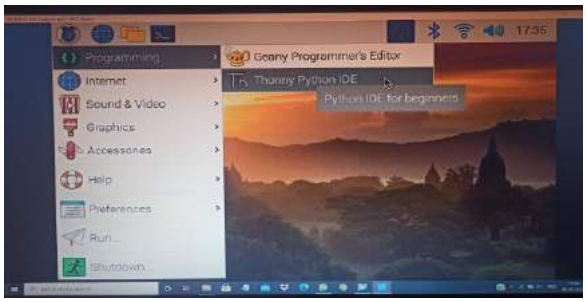

Figure7: Raspbian OS through VNC viewer

- Open Python IDE in the raspbian OS through VNC viewer and dump the code for this project and run the code.
- After successful execution, the robot starts moving and if any sound is identified, the Pi camera starts capturing images.

VIII. RESULT

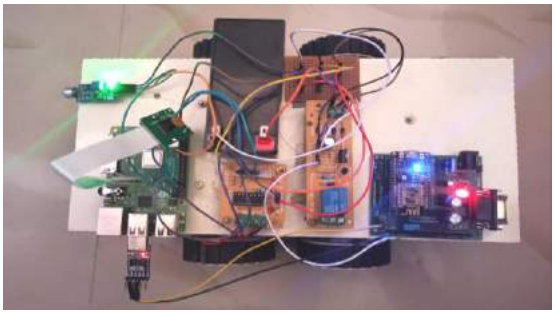

Figure8: Overview of the Proposed System

After setting up all the connections as shown in figure8, Turn ON the power supply to the robotic system and connect the raspberry pi and the laptop to the same internet. Now open the VNC viewer and provide login credentials as shown in figure 9.

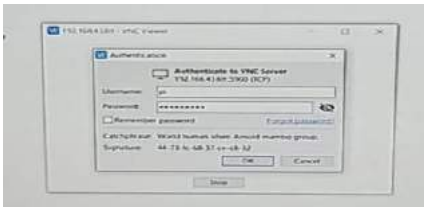

Figure9: VNC viewer login page

Figure10: Output Screen after successful execution of Python Code

Now open Python IDE in raspbian OS and enter the python code for the proposed system. Run and execute the code. After successful execution of the python script, the robot starts moving and once the sound is detected by the sound sensor, the Pi camera gets activated and starts capturing images as shown in figure10.

Figure11: Images received to Email

The captured images are sent to the respective Email by using IoT technology. The received images through Email are shown in figure11.

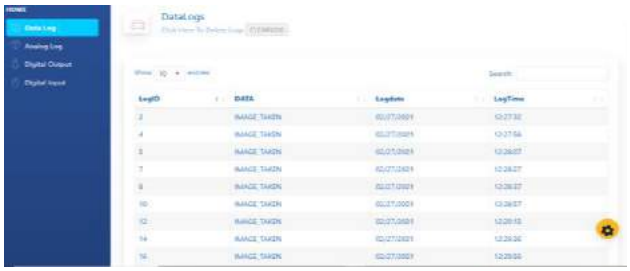

Figure12: Warning Messages with Date and Time

IX. CONCLUSION

This project concludes with a design of patrolling robot with sound detection for securing its premises. We developed the night patrol robot, which is used to find the sound waves in the surroundings, and perform security patrolling services. The robot moves at particular intervals in the same direction. The robot is equipped with a Pi camera and sound sensor which are connected to the raspberry pi. Raspberry Pi connected with the camera plays a crucial role in making an automatic robotic system. When the sound is recognized by the sound sensor, it records and begins to relay photographs of the situation immediately after identification of the sound in the surroundings. The captured images are sent to the respective mail id, for further actions. The warning message which contains the captured image time and date will be saved in the cloud. The main advantage of installing this type of robotic system in every household is that this robotic system provides peace of mind to the user about his premises even when he's not present at home. Even if a security camera has already been installed, this technique is often added thereto in order that it can provide extra security.

X. REFERENCES

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