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Multipurpose Surveillance Robot

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***Abstract*— This paper proposes a Surveillance Robot system thatutilizes IoT technology and an Android application to enhancesecurity and surveillance measures. The system is powered by a solar panel and a 12V battery, providing continuous power supplyfor uninterrupted surveillance. The Surveillance Robot isequipped with a PIR motion detector that detects the presence ofany person and triggers a high audio alert to notify themonitoring authorities. The front end of the Robot features anESP32 IoT camera that provides a clear view of nearby imagesand war field status, with a laser used for shooting the person. The integration of IoT technology and the Android applicationenables the system to be remotely accessed and monitored, making it highly versatile and user-friendly. The proposedSurveillance Robot system offers an efficient and effectivesolution for enhancing security measures in various settings, with the potential to revolutionize the field of surveillance and security.**

***Keywords*— Solar photovoltaic (SPV), DC-DC boost converter, Maximum power point tracking (MPPT), Voltage source converter (VSC), Load balancing, Power Quality (PQ), Power balance theory (PBT).**

I. Introduction

The current era is characterized by the increasing importance of security and surveillance in various settings. With the advent of advanced technology, researchers and engineers are consistently exploring innovative ways to design and implement highly efficient and effective systems for enhancing security measures. The proposed system, a Surveillance Robot controlled through an Android application using IoT technology, is an exemplary development that can revolutionize the field of surveillance and security.

The Surveillance Robot system is equipped with several components that enable it to operate efficiently and reliably. A solar panel and 12V battery are used to power the robot, providing continuous power supply even in the absence of electricity. This ensures that the system operates optimally without interruptions, thereby providing continuous surveillance and monitoring.

The Surveillance Robot also comes equipped with a PIR (Passive Infrared) motion detector that detects the presence of any person in the vicinity. The detector is highly sensitive and can pick up even slight movements, which triggers a high audio alert that immediately notifies the monitoring authorities.The audio alert system serves as a critical feature of the Surveillance Robot system, allowing quick and timely action to be taken in the event of suspicious activity.

The front end of the Surveillance Robot features an ESP32 IoT camera that provides a clear view of nearby images and war field status. The camera is designed to capture high-quality images and videos that can be used to identify any suspicious activity or to monitor the overall situation in the environment. Additionally, a laser is used for shooting the person, providing an added layer of security and protection.

The integration of IoT technology enables the Surveillance Robot system to be controlled through an Android application, allowing for remote access and monitoring. The Android application provides the user with real-time access to the surveillance system, enabling them to control and monitor the Robot from anywhere in the world. This feature makes the system highly versatile and user-friendly, enabling it to be used in a wide range of settings and environments.

In conclusion, the proposed Surveillance Robot system offers ahighly efficient and effective solution for enhancing security measures. The system is designed to provide

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continuous surveillance and monitoring, even in the absence of electricity.The integration of IoT technology and the Android application makes the system highly versatile and user-friendly, while the PIR motion detector, audio alert system, and the ESP32 IoT camera make it highly reliable and efficient. This innovative development has the potential to revolutionize the field ofsurveillance and security, providing a reliable and effective solution for monitoring and securing various environments.

I. PROPOSED SYSTEM

This Surveillance Robot is controlled through Android Application using IOT. This Robot is powered using a Solar Panel and a 12V Battery to provide continuous power to Robot. It is Equipped with PIR motion Detector, which detect any presence of person and give a High Audio Alert to the Monitoring Authorities. A ESP32 IOT Camera is used in the Front end of this Robot, to get clear view of nearby image and War field status a laser is used for shooting the person. The following picture will show the proposed system.

Fig 1(a): Proposed System

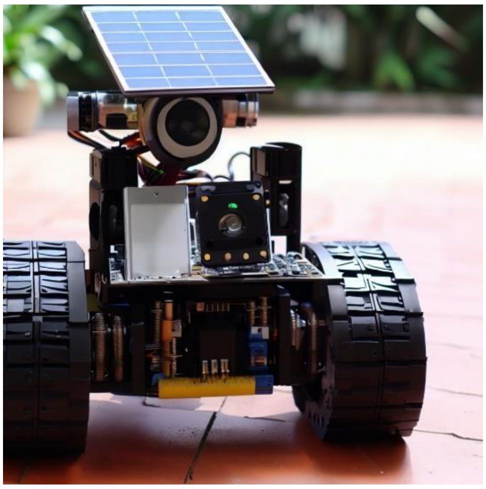

Fig 1(b): Proposed System

II. LITERATURE SURVEY

1. Raja et al. (2018) introduced a wearable device called MASS (Military Assistance and Surveillance System) that utilize

-es various sensors to monitor soldiers, including location, health conditions, and surroundings. It sends data to a base station, and the device also monitors pulse rate and transmits it to the base station using a GPS module.

2. Ghute et al. (2018) described a military surveillance robot system consisting of a single unit. It uses gyro sensors for

navigation in hilly areas and metal detection for landmines.

The system employs Bluetooth connectivity for wireless communication through a mobile application, limiting its range.

3. Prakash et al. (2018) presented a simple military surveillance robot controlled via remote commands. The Raspberry Pi 3 receives instructions and moves the robot accordingly. The

Kinect sensor acts as a camera with depth measurement capabilities, providing grayscale representations of objects

based on their distance.

4. Bolisetti et al. (2017) proposed an RF sensing-based target detector for energy-efficient target detection in harsh sensing environments. Sensor nodes make preliminary decisions before transmitting data to the control center, reducing the frequency ofdata exchange and increasing the lifetime of the IoT.

5. ElhajAbdalla et al. (2017) implemented a spy robot using a Raspberry Pi-based surveillance system with remote monitoring and control through IoT. PIR sensors detect living objects, and the information is sent to users via a web server. The Pi camera captures moving objects, which are simultaneously posted on a web page.

Majdghareeb et al. (2017) introduced a wireless robo-pi for landmine detection, aiming to replace human detectors. The detector wirelessly connects with a server to transmit the location of detected mines or images of the suspected area. The system can be made IoT-based for further communication.

1. Budiharto et al. (2014) designed a tracked robot with remotecontrol for surveillance. It uses a 2.4 GHz video transmitter to deliver video streaming from the Raspberry Pi output. The robot's performance and sensor system are cost-effective, but ultrasonic sensors have limitations in identifying obstacles and interference between sensors.

2. Claudi et al. (2012) proposed a mobile autonomous robot called MARVIN for video surveillance. Its main objective is todetect human faces and autonomously keep a face in the centerof the frame. The architecture of the robot achieves a balance between reactivity and accuracy, using real-time face-detectionalgorithms like LBP (Local Binary Patterns) for speed and accuracy.

3. Zheng et al. (2009) presented a miniature autonomous surveillance robot called BMS-1. It utilizes a flexible driving mechanism and spyroelectric sensors specifically

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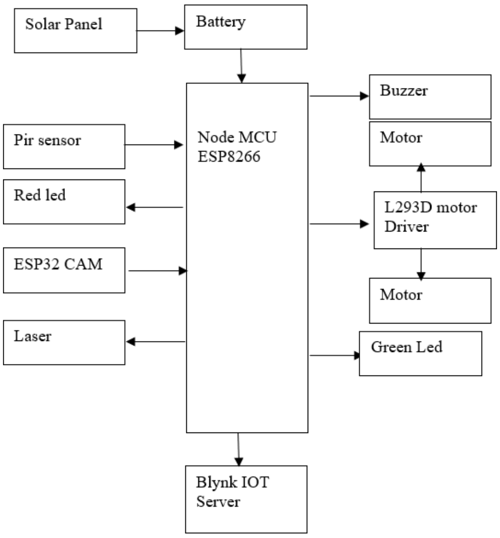
designed for human motion detection. Photovoltaic sensors help detect darklocations for the robot's covert operations.

4.



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III. BLOCK DIAGRAM

Fig 2: Block Diagram of Multipurpose Surveillance Robot

IV. HARDWARE COMPONENTS

The monitoring system contains several components like power supply, ESP32, etc. This chapter gives a detailed review of each of this part along with its working.

- Solar panel
- Rechargeable battery
- Node MCU ESP8266
- Buzzer
- L293D Motor driver
- Green LED
- Laser
- ESP32 CAM
- RED LED
- PIR Sensor
- Blynk IoT Server

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V. SOFTWARE

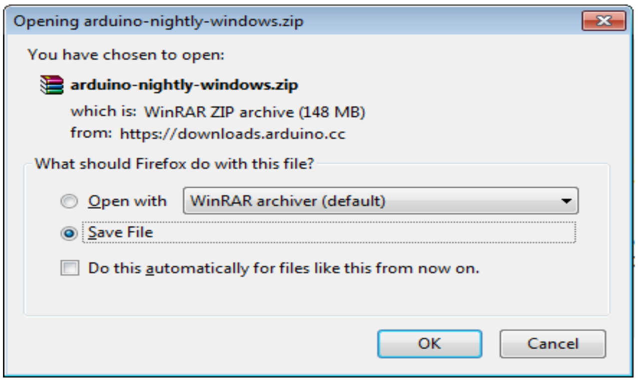
ARDUINO UNO INSTALLATION:

In this we will get know of the process of installation of Arduino IDE and connecting Arduino uno to Arduino IDE.

Step 1

First we must have our Arduino board (we can choose our favorite board) and a USB cable. In case we use Adriana UNO, Arduino Duemilanove, Nano, Arduino Mega 2560, or Diecimila, we will need a standard USB cable (A plug to B plug), t In case we use Arduino Nano, we will need an A to Mini-B cable.

Step 2 − Download Arduino IDE Software. We can get different versions of Arduino IDE from the Download page on the Arduino Official website. We must select wer software, which is compatible with wer operating system (Windows, IOS, or Linux). After wear file download is complete, unzip the file.



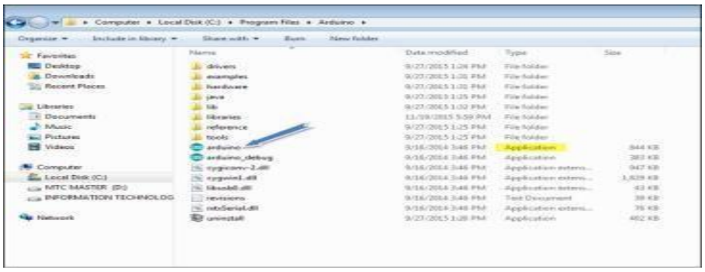
Step 3 − Power up our board.

The Arduino Uno, Mega, Duemilanove and Arduino Nano automatically draw power from either, the USB connection to the computer or an external power supply. If we are using an Arduino Diecimila, we have to make sure that the board is configured to draw power from the USB connection. The power source is selected with a jumper, a small piece of plastic that fits onto two of the three pins between the USB and power jacks. Check that it is on the two pins closest to the USB port.

Connect the Arduino board to wer computer using the USB cable. The green power LED

(labeled PWR) should glow.

Step 4 − Launch Arduino IDE.



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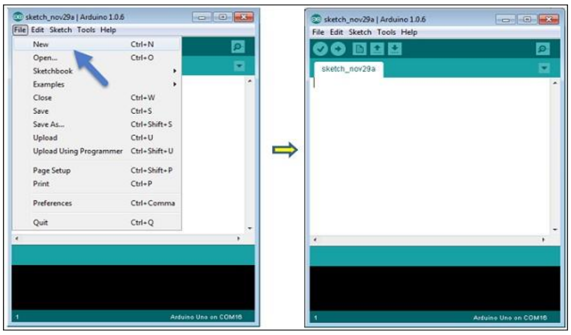
After our Arduino IDE software is downloaded, we need to unzip the folder. Inside the folder, we can find the application icon with an infinity label (application.exe).

Double click the icon to start the IDE.

Step 5 − Open our first project.

Once the software starts, we have two options

* Create a new project



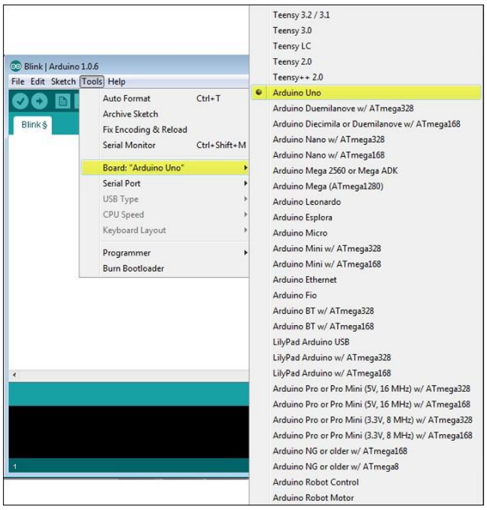
* Open an existing project example.

To create a new project, select File → New.

To open an existing project example, select File → Example → Basics → Blink.

Here, we are selecting just one of the examples with the name Blink. It turns the LED on and off with some time delay. We can select any other example from the list.

Step 6 − Select our Arduino board.



To avoid any error while uploading wear program to the board, we must select the correct Arduino board name, which matches with the board connected to wer computer.

Go to Tools → Board and select wear board.

Here, we have selected Arduino Uno board according to our tutorial, but we must select

the name matching the board that we are using.

Step 7 − Select wer serial port.

Select the serial device of the Arduino board. Go to Tools → Serial Port menu. This is likely to be COM3 or higher (COM1 and COM2 are usually reserved for hardware serial ports). To

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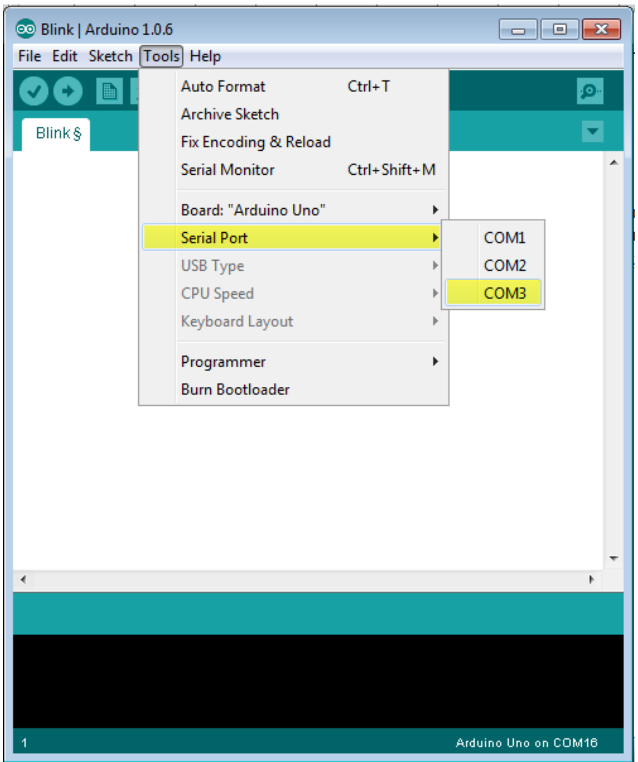
find out, we can disconnect wer Arduino board and re-open the menu, the entry that disappears should be of the Arduino board. Reconnect the board and select that serial port.

Step 8 – Upload the program to wer board.

Before explaining how we can upload our program to the board, we must demonstrate the function of each symbol appearing in the Arduino IDE toolbar.

Select the serial device of the Arduino board. Go to Tools → Serial Port menu. This is likely to be COM3 or higher (COM1 and COM2 are usually reserved for hardware serial ports). To find out, we can disconnect wer Arduino board and re-open the menu, the entry that disappears should be of the Arduino board. Reconnect the board and select that serial port.



Step 8 – Upload the program to wer board.

Before explaining how we can upload our program to the board, we must demonstrate the function of each symbol appearing in the Arduino IDE toolbar.

A – Used to check if there is any compilation error.

B – Used to upload a program to the Arduino board.

C – Shortcut used to create a new sketch.

D – Used to directly open one of the example sketch.

E – Used to save wer sketch.

F – Serial monitor used to receive serial data from the board and send the serial data to the board. Now, simply click the "Upload" button in the environment. Wait a few seconds; we will see the RX and TX LEDs on the board, flashing. If the upload is successful, the message

"Done uploading" will appear in the status bar.

Note – If we have an Arduino Mini, NG, or other board, we need to press the reset button

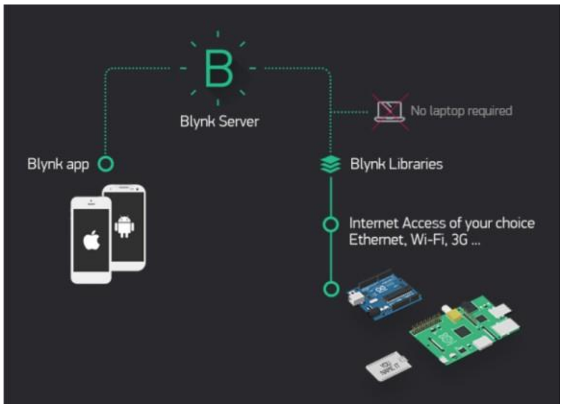
physically on the board, immediately before clicking the upload button on the Arduino Software.

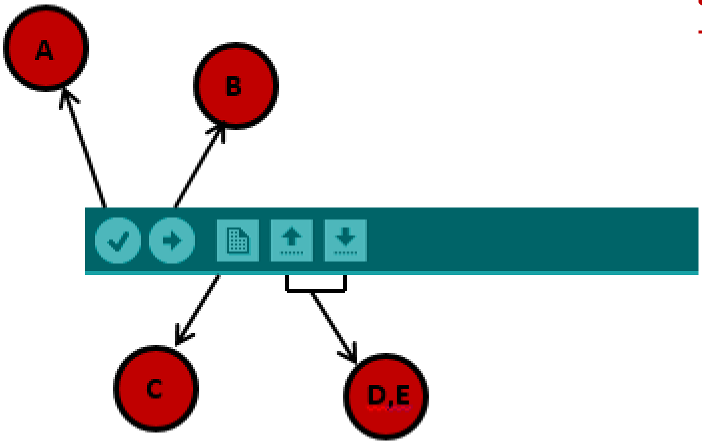
BLYNK APP

Blynk was designed for the Internet of Things. It can control hardware remotely, it can display sensor data, it can store data, vizualize it and do many other cool things.

There are three major components in the platform:

- **Blynk App** - allows to you create amazing interfaces for your projects using various widgets we provide.
- **Blynk Server** - responsible for all the communications between the smartphone and hardware. You can use our Blynk Cloud or run your private Blynk server locally. It's open- source, could easily handle thousands of devices and can even be launched on a ESP32.
- **Blynk Libraries** - for all the popular hardware platforms - enable communication with the server and process all the incoming and outcoming commands.





Features

Similar API & UI for all supported hardware & devicesConnection to the cloud using:
Wi-fi
Bluetooth and BLE
3. Ethernet
4. USB(Serial)
5. GSM

- Set of easy-to-use widgets
- Direct pin manipulation with no code writing

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- History data monitoring via super chart widget
- Device-to-device communication using bridge widget
- Sending emails, tweets, push notifications,etc.

1. Hardware**.**

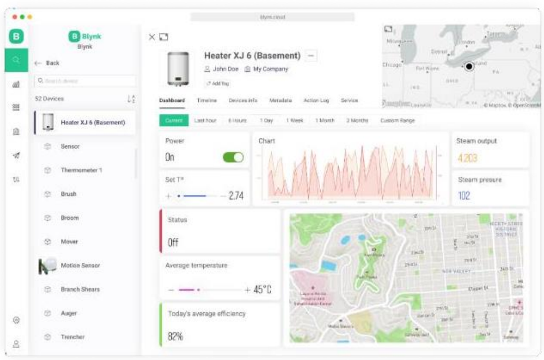
An Arduino, Raspberry Pi, or a similar development kit.

Blynk works over the Internet. This means that the hardware you choose should be able to connect to the internet. Some of the boards, like Arduino Uno will need an Ethernet or Wi-Fi Shield to communicate, others are already Internet-enabled: like the ESP8266, Raspberri Pi with WiFi dongle, Particle Photon or SparkFun Blynk Board. But even if you don't have a shield, you can connect it over USB to your laptop or desktop (it's a bit more complicated for newbies, but we got you covered). What's cool, is that the list of hardware that works with Blynk is huge and will keep on growing.

2. A Smartphone**.**

The Blynk App is a well designed interface builder. It works on both iOS and Android

Components of the Blynk IoT Platform
Blynk.Console



Blynk.Console

Blynk.Console is a feature-rich web application catering to different types of users. Its key functionalities include:

1. Configuration of connected devices on the platform, including application settings.

2. Device, data, user, organization, and location management.

3. Remote monitoring and control of devices

Blynk.Apps

Blynk.Apps
Blynk.Apps is a versatile native iOS and Android mobile

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application that serves these major functions:

1. Remote monitoring and control of connected devices that work with Blynk platform.

2. Configuration of mobile UI during prototyping and production stages.

3. Automation of connected device operations.

Applications made with Blynk are ready for the end-users. Whether they are family members, employees, or product purchasers, they can easily download the app, connect their devices, and start using them.

Blynk.Edgent and Blynk

LibraryEdge + Agent = Edgent

Blynk.Edgent is a packaged solution designed to simplify the connection of supported devices to the Blynk platform, providing access to all its advanced features without extensive coding.

Key features of Blynk.Edgent include:

1. Device claiming and Wi-Fi provisioning (bringing device online and authenticating them with a certain user).

2. Connectivity management for Wi-Fi,Cellular, and Ethernet.

3. Data transfer between device and the cloud.

4. API integration with Blynk.Apps and Blynk.Cloud features.

5. Over-the-air firmware updates for select hardware models

main.cpp

```
// Fill-in information from your Blynk Template here
#define BLYNK_TEMPLATE_ID           ""
#define BLYNK_TEMPLATE_NAME         ""
#define BLYNK_FIRMWARE_VERSION      "0.1.0"
#define APP_DEBUG

#include "BlynkEdgent.h"

void setup()
{
  delay(100);
  BlynkEdgent.begin();
}

void loop() {
  BlynkEdgent.run();
}


```

.Blynk.Cloud

Blynk.Cloud is a server infrastructure acting as the heart ofBlynk IoT platform binding all the components together.

Blynk Micro-Services

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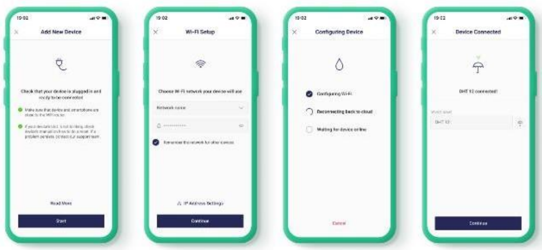
Blynk provides micro-services, which are software modules that work across products and perform specific functionalities. These micro-services include:

Blynk.Inject

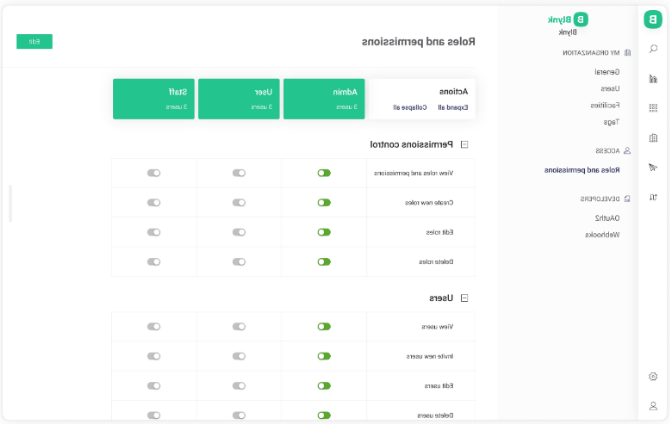


Blynk.Inject

A micro-service that facilitates:

- Claiming device ownership by users and organizations
- Provisioning devices with WiFi credentials so they can connect to the end-user WiFi networks.
- Managing Authentication Tokens
- UX flow to guide end-users through the process of claiming and provisioning with the help of Blynk.Apps

Blynk.R

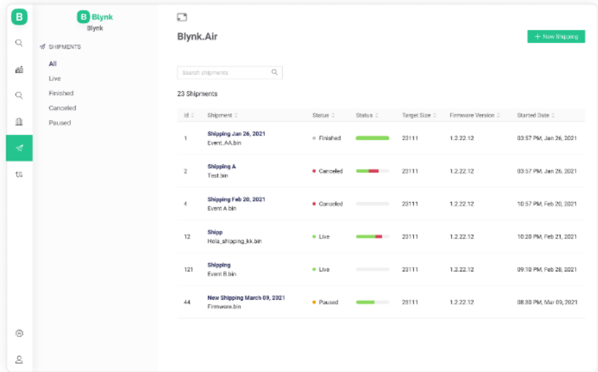


Roles and permissions

A micro-service for user management, covering:

- User registration with invitations
- Roles and permissions management
- Multi-tenancy

Blynk.Air



Blynk.Air

A micro-service focused on Firmware Over-The-Air(OVA)updates are responsible for:

- Managing OTA firmware update campaigns
- Installing new firmware on edge devices

Please note that additional documentation and resources foreach component can be found using the provided links.

VI. RESULTS AND DISCUSSION

This project is well prepared and acting accordingly (including all the hardware and software) as per the initial specifications and requirements of our project. Because of the creative nature and design the idea of applying this project is very new, the oppurtunities for this project are immense.

The practical representation of an experimental board is shown below

Fig: Practical Representation of Experiment

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VII. CONCLUSION

This robot was built by keeping military applications in mind. So, it comes with basic video surveillance and human detection so that it can detect underground persons etc. Further extensions are can be made in the same projects such as home automation, telemedicine system.The robot can be equipped with interactive voice feedback. It is possible to install ME (medical emergency) band in the robot to look after the health of an elderly person in the house.

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