REMOTE SURVEILLANCE BOT

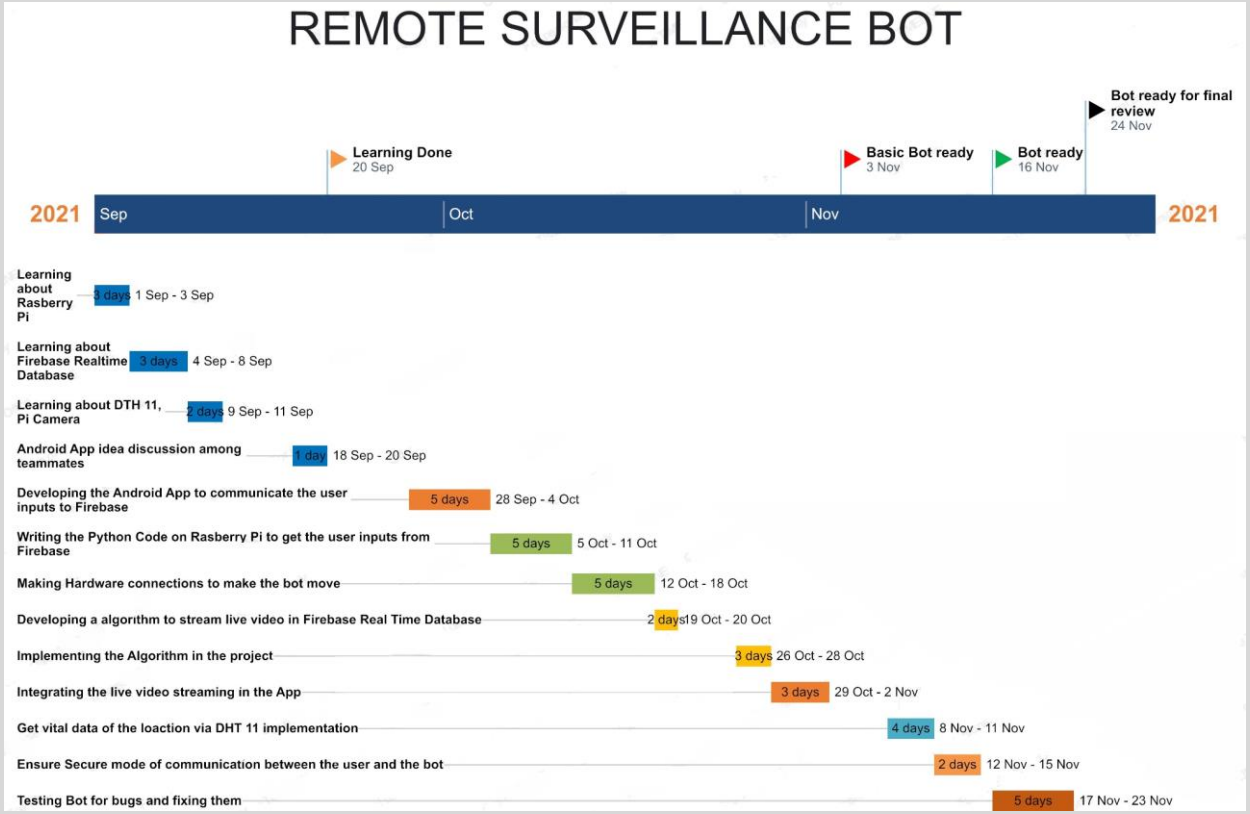
Mayukh Ghosh (18BCE0417)
Saksham Goyal (18BCE2196)
Rohan Allen (18BCI0247)

Introduction

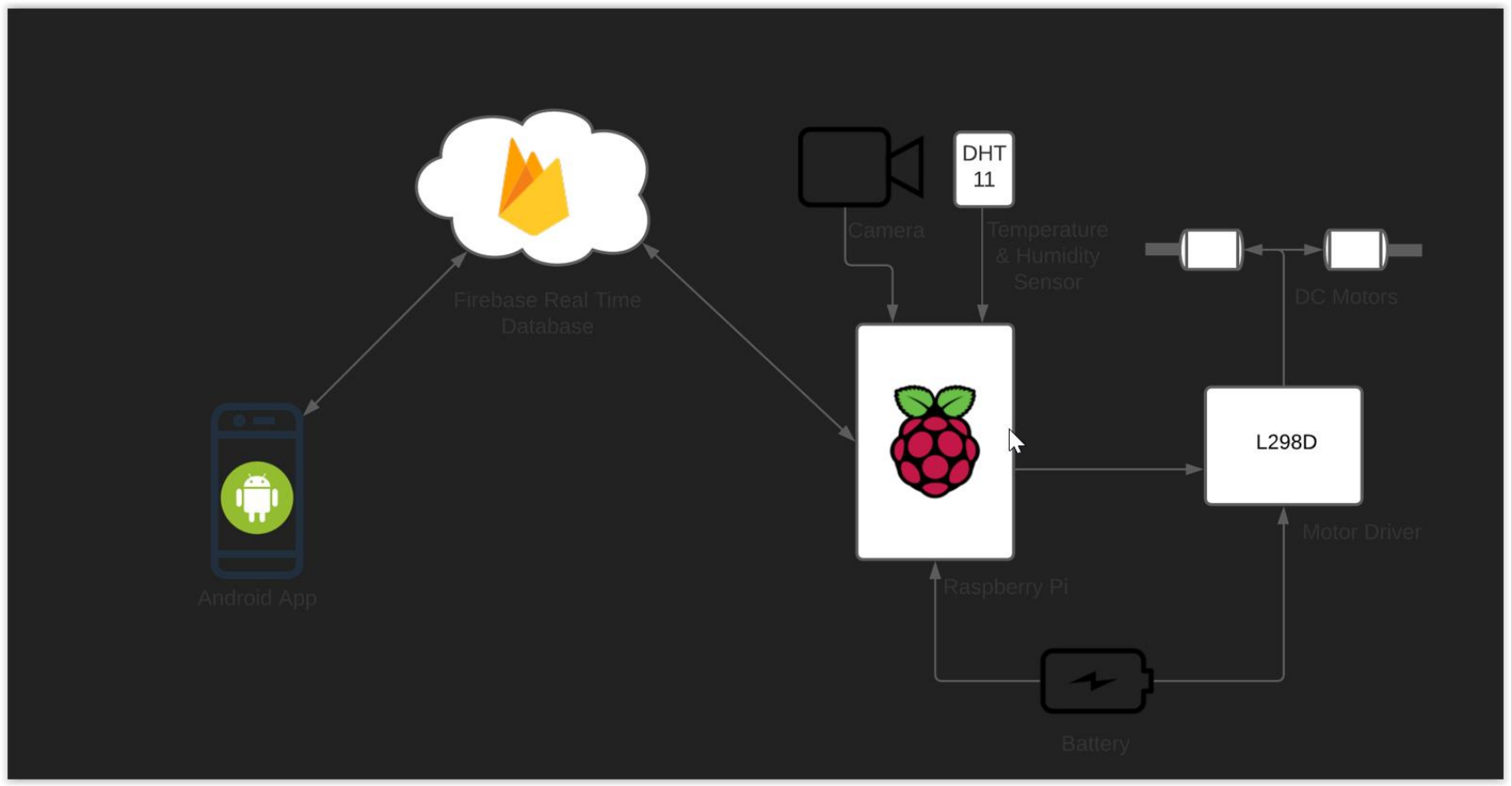
In modern world security is one of the largest priority of people. But every camera has its blind spots. Through this project of ours we plan to cover such blind spots along with providing users with the ability to better detect hostility. Through this project we also provide the ability to provide visual input to user in regions where the person can't reach manually. Also, our project could be used in both government civilian and private sector. This flexibility which is provided by this bot is the reason why we decided to make it.

- Live video in real time is the most difficult assignment in the field of surveillance, as it isn't much secure what's more, the data is extensively huge. However, Firebase, being a protected cloud stage, live video in real time utilizing its continuous data set hasn't been done at this point. We will be designing a mechanism for live video streaming through Firebase. A robot will additionally be created, which will be controlled with the assistance of an android application to transfer live video using the developed mechanism/ algorithm, consequently guaranteeing high security and low information use.

Gantt Chart


REMOTE SURVEILLANCE BOT
Bot ready for final review
24 Nov
Learning Done
20 Sep
Basic Bot ready
3 Nov
Bot ready
16 Nov
2021
Sep
Oct
Nov
2021
Learning about Rasberry Pi
3 days
1 Sep - 3 Sep
Learning about Firebase Realtime Database
3 days
4 Sep - 8 Sep
Learning about DTH 11, Pi Camera
2 days
9 Sep - 11 Sep
Android App idea discussion among teammates
1 day
18 Sep - 20 Sep
Developing the Android App to communicate the user inputs to Firebase
5 days
28 Sep - 4 Oct
Writing the Python Code on Rasberry Pi to get the user inputs from Firebase
5 days
5 Oct - 11 Oct
Making Hardware connections to make the bot move
5 days
12 Oct - 18 Oct
Developing a algorithm to stream live video in Firebase Real Time Database
2 days
19 Oct - 20 Oct
Implementing the Algorithm in the project
3 days
26 Oct - 28 Oct
Integrating the live video streaming in the App
3 days
29 Oct - 2 Nov
Get vital data of the loaction via DHT 11 implementation
4 days
8 Nov - 11 Nov
Ensure Secure mode of communication between the user and the bot
2 days
12 Nov - 15 Nov
Testing Bot for bugs and fixing them
5 days
17 Nov - 23 Nov

Block Diagram



Overview

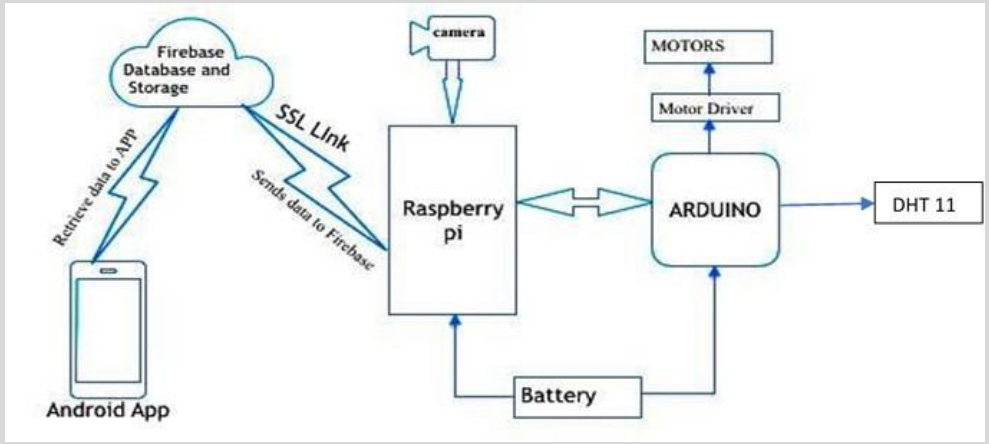
- The Raspberry Pi is being utilized as the core controller for the surveillance robot, and a USB camera is being used to capture video for live streaming. The Raspberry Pi was connected to the camera. Arduino uno was used to control the forward, backward, right, and left motions. The L293D motor driver was used to operate the motor from the Arduino. The Raspberry Pi sends control signals to the Arduino. The information is sent to Arduino via GPIO pins on the Raspberry Pi. The 1800mAh LiPO battery that powers the robot has a 5v output. The motor was powered by a 12v external battery. The key challenge in prior surveillance bots made with Raspberry Pi or Arduino was establishing a secure connection between the bot and the controlling system.

Overview

- This difficulty is solved by establishing a link between the bot and the controlling device in order to transfer control signals and video streaming using Firebase Real-Time Database. Google's Firebase is a safe and secure cloud platform. To operate the bot, we will use an app created in Android Studio. In Android Studio, we're building an app with the flutter SDK framework. We will develop the app to communicate with Firebase and deliver control signal information to the robot. In addition, the video data must be retrieved and stored in an app. On Firebase, secure user authentication is performed so that only the authorized person has access to the intelligence information and can control our bot.

Overview of Product

We will develop an android application using android studio that will be like the remote of the bot. We will give it joystick-like keys through which the bot can be controlled. The rotation/ movement of the keys will change the data (angle and magnitude) in the cloud storage, and through cloud functions, any change in the data will trigger a data transfer to the raspberry pi. The raspberry pi will process the data and accordingly send signals to arduino to move the bot via the motor drivers. The bot is fixed with some sensors like DHT11 and camera. The camera captures the surroundings and sends the data to raspberry pi. In the raspberry the date is processed using the algorithm mentioned below and is uploaded to the cloud. The temperature and humidity details from the DHT11 sensor is received by arduino and is sent to raspberry pi which is uploaded to the cloud from there. The android app receives the temperature details and humidity details of the terrain from the cloud and it is displayed to the user. The image is uploaded to the firebase's Realtime database in theform of a string of base64.



Hard Ware Requirement

- **Raspberry Pi**

The Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python.

- **Arduino UNO**

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc.

- **Raspberry Pi camera board**

The Camera Module can be used to take high-definition video, as well as stills photographs. ... It supports 1080p30, 720p60 and VGA90 video modes, as well as still capture. It attaches via a15cm ribbon cable to the CSI port on the Raspberry Pi.

- **L298 Motor Driver Module**

It is a high voltage, high current dual full-bridge driver designed to accept standard TTL logic levels and drive inductive loads such as relays, solenoids, DC and stepping motors.

Hard Ware Requirement

- **DHT11 Sensor**

The DHT11 is a basic, ultra-low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed).

- **Bot chasse**

Chassis is very essential in robots as well as many mechanical devices. Robot chassis is particularly designed for robots and other mechanical devices. These accessories handle PCB, components and parts that are interfaced and connected to it.

- **2 DC motors**

Simplest type of motors which work on direct current.

Software Requirement

Firebase Realtime database

Google's Firebase is a safe and secure cloud platform to store and host data. On Firebase, secure user authentication is performed so that only the authorized person has access to the data.

- **Android Studio**

Built on JetBrains' IntelliJ IDEA software and customized exclusively for Android development, Android Studio is the official integrated development environment for Google's Android operating system.

Algorithm to Live Stream by Firebase

◦ The camera captures the video of the surroundings and gives it to raspberry pi.
◦ Raspberry pi, using OpenCV library takes frames of those videos and converts them to text format
◦ The text format used is the base 64 string format. The string is then uploaded to the Realtime database.
◦ The android app fetches the base 64 string from the Realtime database and converts it into image format.
◦ The image along with the analysis is then displayed into an image viewer in the android app.
◦ By frequently repeating this process (1-6) we will give the illusion of live video display to the user operating the bot.

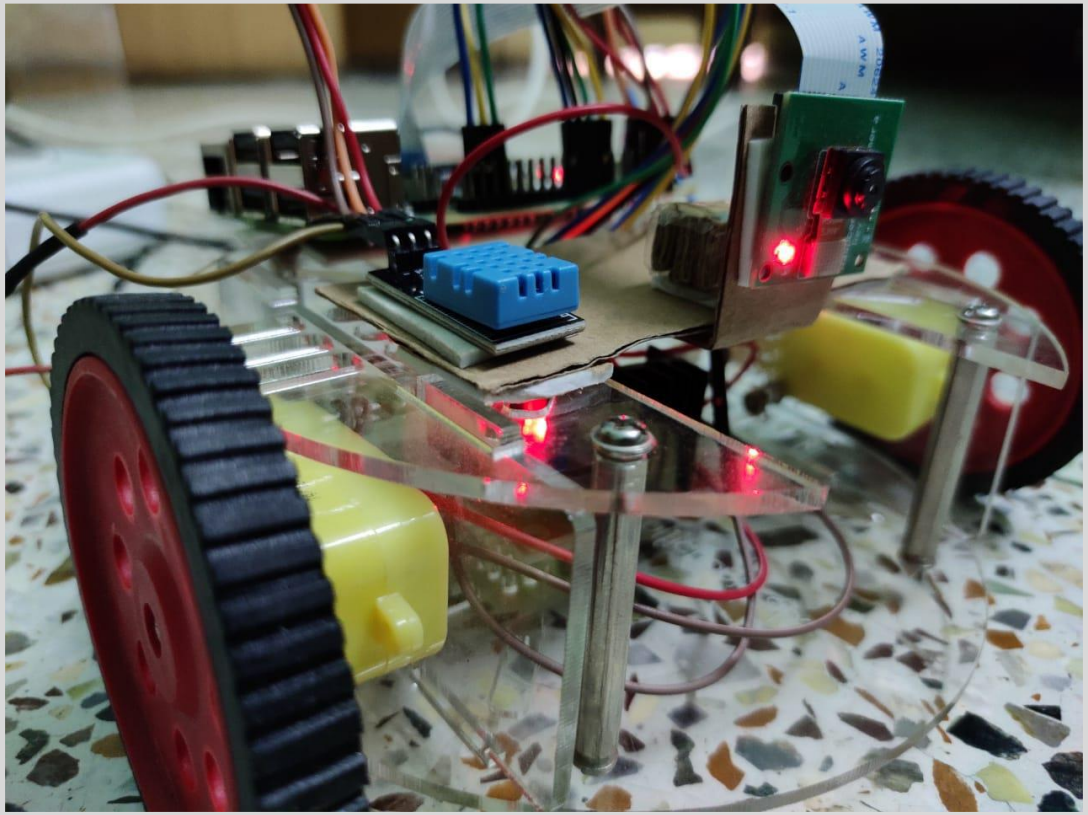
Algorithm to Control Bot

- Input the position of the joystick from the android app.
- Upload the positional value of the joystick if the position changes into the Realtime database of Firebase.
- The data is triggered via a cloud function whenever it gets changed to the raspberry pi. Raspberry Pi receives the data from the cloud and accordingly sends instructions to the arduino to operate the dc motors via the motor driver.
- In exactly the same way the DHT 11 sensor sends back temperature and humidity data to the android app via the cloud platform.

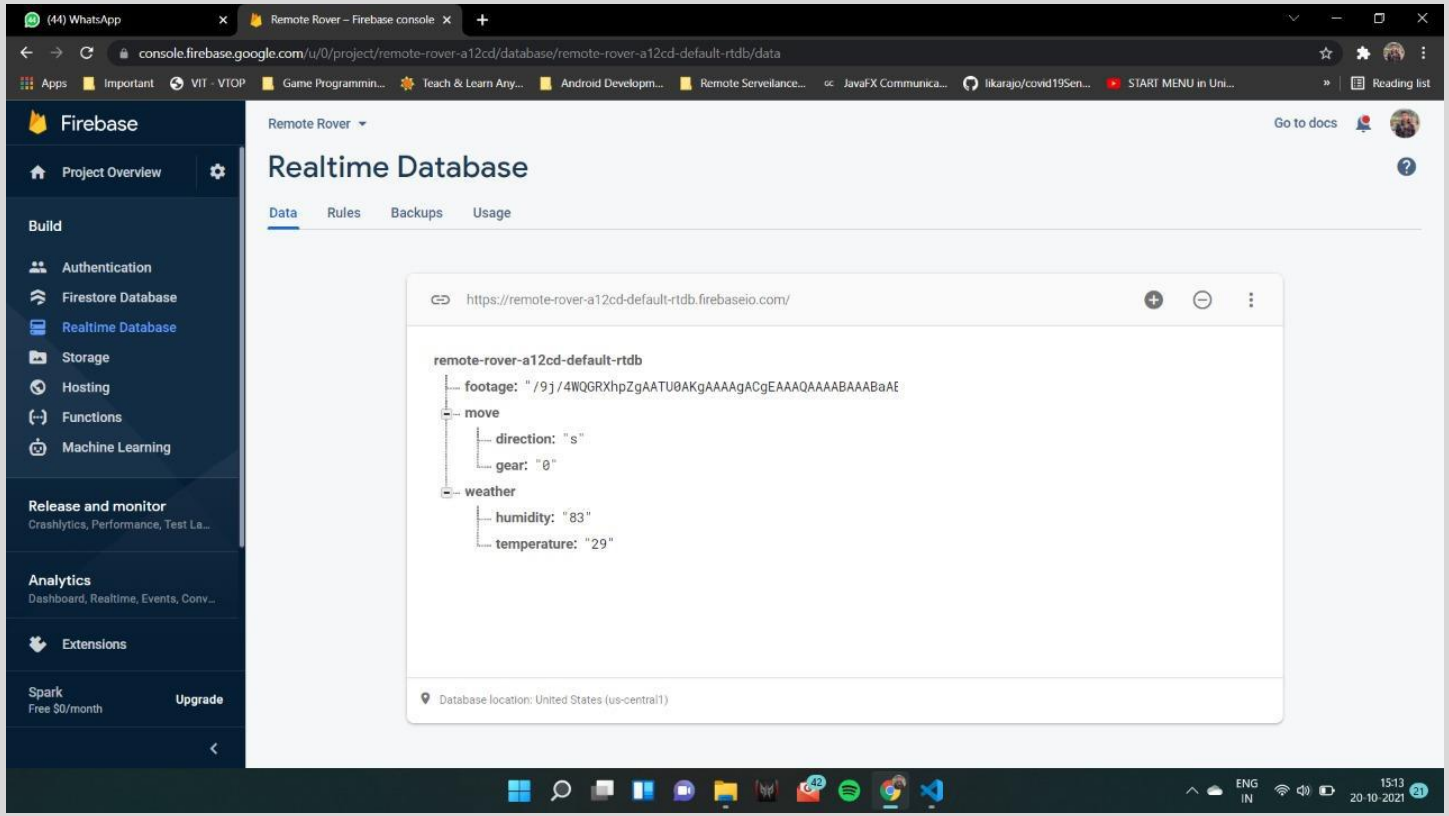
About App

The app will be developed in android studio. It will have a very user-friendly interface and simplistic design. It will have two joystick buttons to control the bot. And a screen in the middle to show the live video from the environment. The panel will also give the details of the temperature and humidity. If some human faces are detected in the video, it will also alert the user with its UI, as it will prove to be an important feature in rescue, spying and explorations operations.

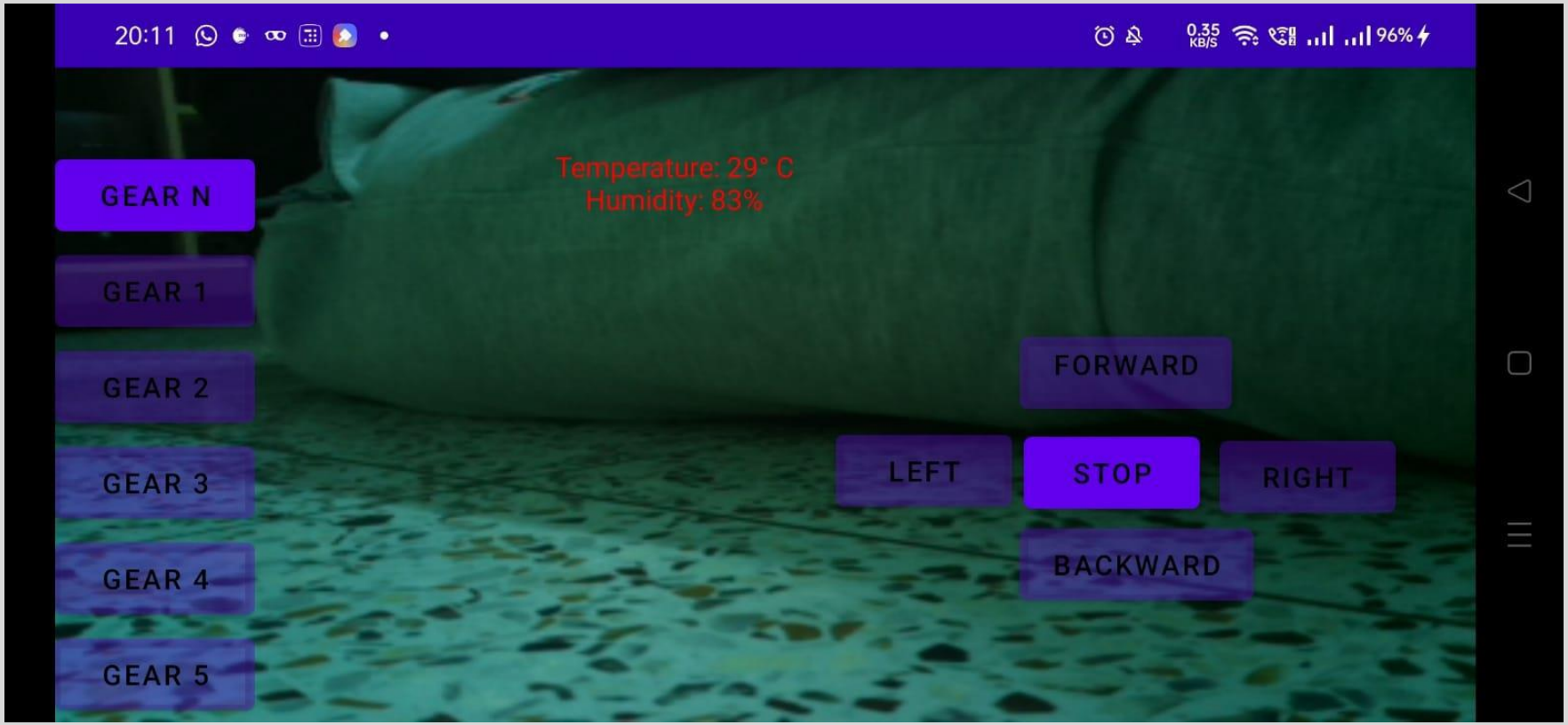
Picture of our Bot



Real-time Database of the Firebase.



Screenshot of Android App



- Video Demonstration of our Remote Surveillance Bot:

Final Picture of all Components

Conclusion

- The final objective of our project is to create a fully functional product, i.e., a movable can move thus can cover all the areas in contrast to CCTVs remote surveillance bot with a tiny Camera mounted on it. This can be used for numerous tasks, varying from spying, reconnaissance, information gathering, terrain exploration, border patrolling, etc. To eliminate the range problem of modern-day bots we will be controlling the bot over the internet. The bot can thus cover all the areas in contrast to CCTVs. This bot will be operated on the Wi-Fi network, thereby giving it, a much greater mobility of range and it can be controlled from anywhere as long as they are communicating on the same network, which is a great convenience. This bot does not require radio signals or Bluetooth signals, hence there is no range limit as is the case for the majority of the products in the market. The bot has a camera that will give us the live stream of the location. This bot can be useful for home security. This bot can even be deployed in army and can be operated in any territory where internet is available. This will be a low-cost bot as all the components used, are extremely cheap and easily available, thereby adding considerable value to the product

THANK YOU

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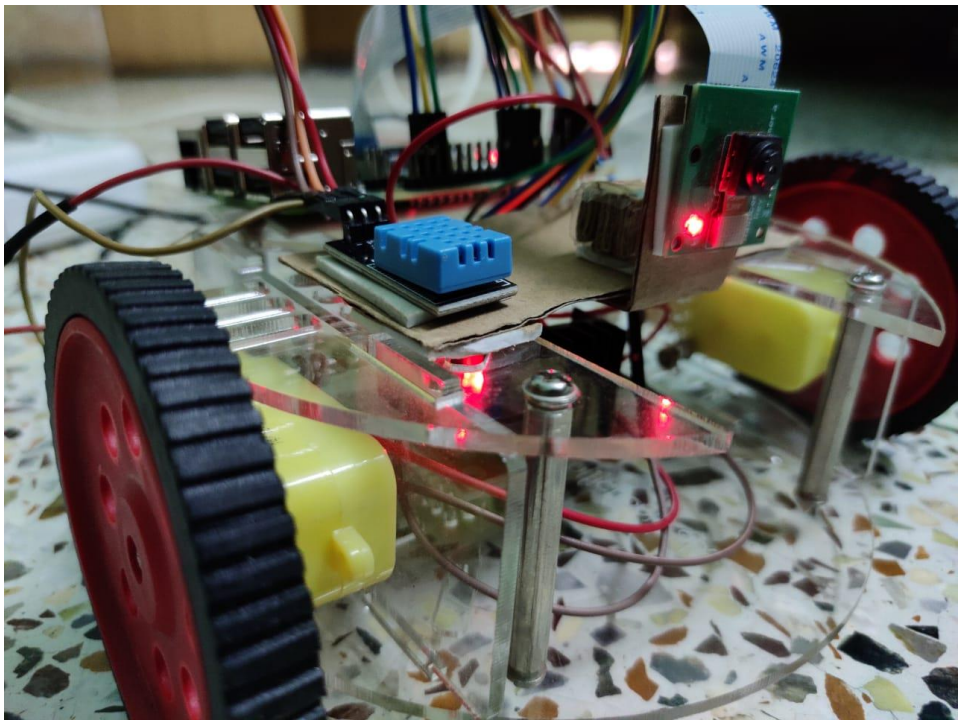

The video demo of the bot can be seen in the link below:

https://drive.google.com/file/d/1f93gnEgdF9KD89zgha-H9lmyZD8qhhPZ/view?usp=sharing

(The code screen-shots bot's image are to the end of the document)

HARDWARE REQUIRED:

Raspberry Pi
The Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python.

Raspberry Pi camera board
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SOFTWARE REQUIRED:

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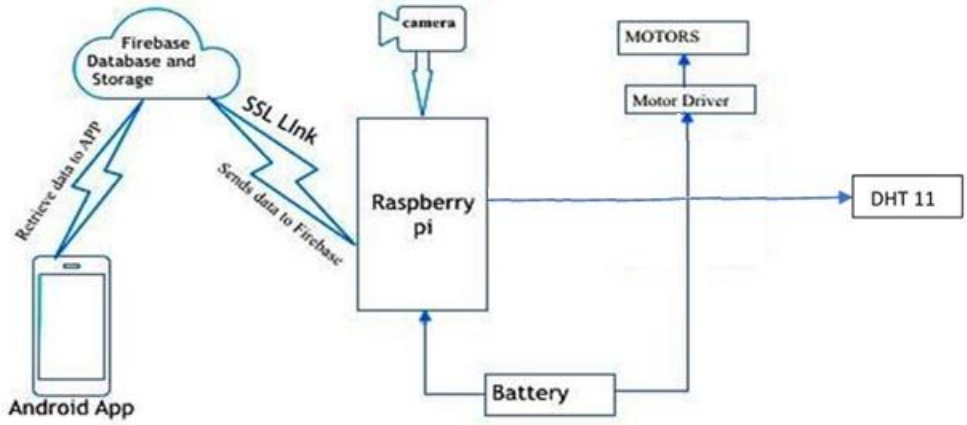
Android Studio
Built on JetBrains' IntelliJ IDEA software and customized exclusively for Android development, Android Studio is the official integrated development environment for Google's Android operating system.

TensorFlow
TensorFlow is a machine learning and artificial intelligence software library that is free and open-source. It can be used for a variety of applications, but it focuses on deep neural network training and inference.

OVERVIEW OF THE PRODUCT:



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The android app receives the temperature details and humidity details of the terrain from the cloud and it is displayed to the user.
The image is uploaded to the firebase's Realtime database in the form of a string of base64. The application converts it back to the image from that format. Then the ML analysis is done over that image to give users more details about the terrain. And the image is shown to the user with the ML analysis.

ALGORITHM TO LIVE STREAM VIDEO VIA FIREBASE:

Firebase is a cloud platform by google. It is secure and scalable. It has many components, but we will be using its real time database. The real time database is designed to stream real time text data in the cloud platform. We in our project will use it in an innovative way to stream live video.

1. The camera captures the video of the surroundings and gives it to raspberry pi.
2. Raspberry pi, using base64 library takes frames of those videos and converts them to text format
3. The text format used is the base 64 string format. The string is then uploaded to the Realtime database.
4. The android app fetches the base 64 string from the Realtime database and converts it into image format.
5. The image is then analysed using the ML algorithm as described below.
6. The image along with the analysis is then displayed into an image viewer in the android app.
7. By frequently repeating this process (1-6) we will give the illusion of live video display to the user operating the bot.

ALGORITHM TO CONTROL THE BOT REMOTELY OVER CLOUD:

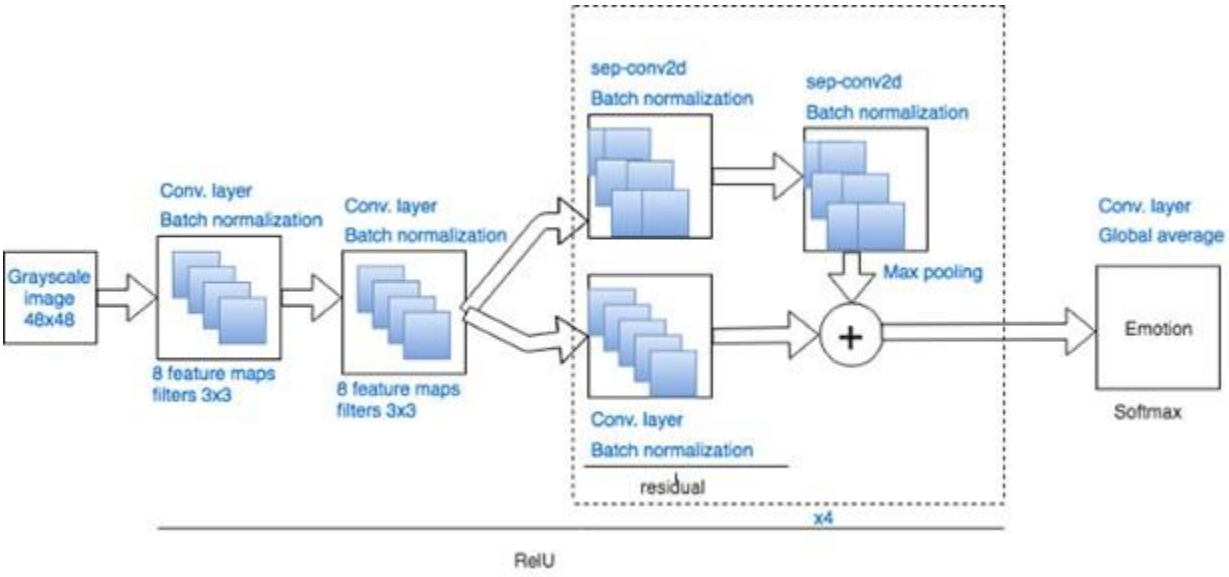
For this functionality also we will be using the firebase. We will take data from the app and send it to the bot for its proper

functioning.
1. Input the position of the joystick from the android app.
2. Upload the positional value of the joystick if the position changes into the Realtime database of Firebase.
3. The data is triggered via a cloud function whenever it gets changed to the raspberry pi. Raspberry Pi receives the data from the cloud and accordingly sends instructions to the arduino to operate the dc motors via the motor driver.
4. In exactly the same way the DHT 11 sensor sends back temperature and humidity data to the android app via the cloud platform.

ALGORITHM TO DETECT HOSTILE ENVIRONMENT USING ML:

Deep learning for Emotion Recognition

With respect to engineering of the CNN, a concise hypothetical presentation is given. In the wake of attempting a few models, the one proposed in ended up being the most incredible as far as precision and preparing effectiveness. In Figure 2 the engineering is addressed.



A few developments are done in this Convolutional Neural Network with the goal that a precision improvement is accomplished.

Above all else, is the idea of remaining modules. Remaining modules are a method to facilitate the preparation of organizations, and they change the ideal planning between two ensuing layers,

so, the learned provisions become the distinction of the first component map and the ideal features.
Also, profundity savvy distinct convolution which is a type of factorized convolutions which factorize a standard one into a profundity astute convolution and a 1 x 1 convolution called a point-wise convolution. Accordingly, there are two fundamentals layers in every convolution, which intend to isolate the spatial cross-connections from the channel cross-relationships.
Profundity insightful convolutions are utilized to apply a solitary channel for each information channel (input profundity).
Point-wise convolution, a basic 1 x 1 convolution, is then used to make a straight blend of the yield of the profundity savvy layer.
Despite they are incredibly productive contrast with standard convolutions, it doesn't consolidate the sifted channels to make new provisions. That is the place where the new layer comes up, the point-wise layer is utilized to register a direct blend of the yields of the profundity savvy convolution. More or less, profundity savvy divisible convolutions decrease the calculation regarding the standard convolutions, with the goal that the preparation stage is quicker.
Thirdly, as the preparation interaction with the past network was famously hard and subsequently soaked with a nonlinearity, otherwise called inner covariate shift, an answer found is normalizing the contributions of the layers. This is called Batch-standardization, and it additionally goes about as a regularizer staying away from in specific cases the utilization of dropouts. This method plays out a simple activity which is applied to enactment x over a scaled down clump.
At long last the idea of regularization applied in certain layers. Regularizers focus on sum up the conduct of the net. Explicitly in this engineering, along with other currently referenced, l2-regularization (otherwise known as weight rot) will be executed in certain layers. The possibility of L2 regularization is to add an additional term to the expense work, called the regularization term. For instance, utilizing the cross-entropy work the speculation term is added as follows:

$$C = -\frac{1}{n}\sum_{x}[y \ln y' + (1-y)\ln(1-y')] + \frac{\lambda}{2n}\sum_{w} w^2$$

The initial term relates to the actual capacity, and the subsequent one is the term, wherein the amount of the squares of the multitude of loads in the organization is done, scaled by a factor, where λ is the regularization boundary. For this situation the scale factor utilized is 0.01.
Hence, our last design, as displayed in Figure 2 is a completely convolutional neural organization comprising of 2 convolutional layers of 8 components. ReLu actuation, 3x3 with a portion regularizer, trailed by a group standardization. Then, at that point there are four modules wherein a remaining is carried out (Convolutional layer, 1x1, trailed by a bunch standardization) and added to the distinct convolutional layer, 3x3 with portion regularization, trailed by a group standardization also. The size of these convolutional pieces are expanding in every module, beginning in 16 and finishing in 128. At last, the actual arrangement is brought out through a convolutional layer with the size equivalent to the quantity of feelings to be anticipated, trailed by a Global normal pooling layer with Softmax enactment.

ABOUT ANDROID APP:

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And a screen in the middle to show the live video from the environment. The panel will also give the details of the temperature and humidity. If some human faces are detected in the video, it will also alert the user with its UI, as it will prove to be an important feature in rescue, spying and explorations operations.

INNOVATION / NOVELTY:

Unlike traditional surveillance bots our bot uses WIFI Technology for communication purposes. This not only offers a much superior range as compared to Bluetooth or radio frequency enabled devices but also is more secure. Movement is not hindered or restricted in any fashion due to the extremely versatile and sleek Arduino UNO motor. It also incorporates cutting edge Machine Learning algorithms to detect human facial features and also possess the state-of-the-art DHT11 sensor which relays real time temperature and humidity data, something which is extremely

invaluable. The key challenge in prior surveillance bots made with Raspberry Pi or Arduino was establishing a secure connection between the bot and the controlling system. This difficulty is solved by establishing a link between the bot and the controlling device in order to transfer control signals and video streaming using Firebase Real-Time Database. Google's Firebase is a safe and secure cloud platform. To operate the bot, we will use an app created in Android Studio. In Android Studio, we're building an app with the flutter SDK framework. We will develop the app to communicate with Firebase and deliver control signal information to the robot. In addition, the video data must be retrieved and stored in an app. On Firebase, secure user authentication is performed so that only the authorized person has access to the intelligence information and can control our bot.

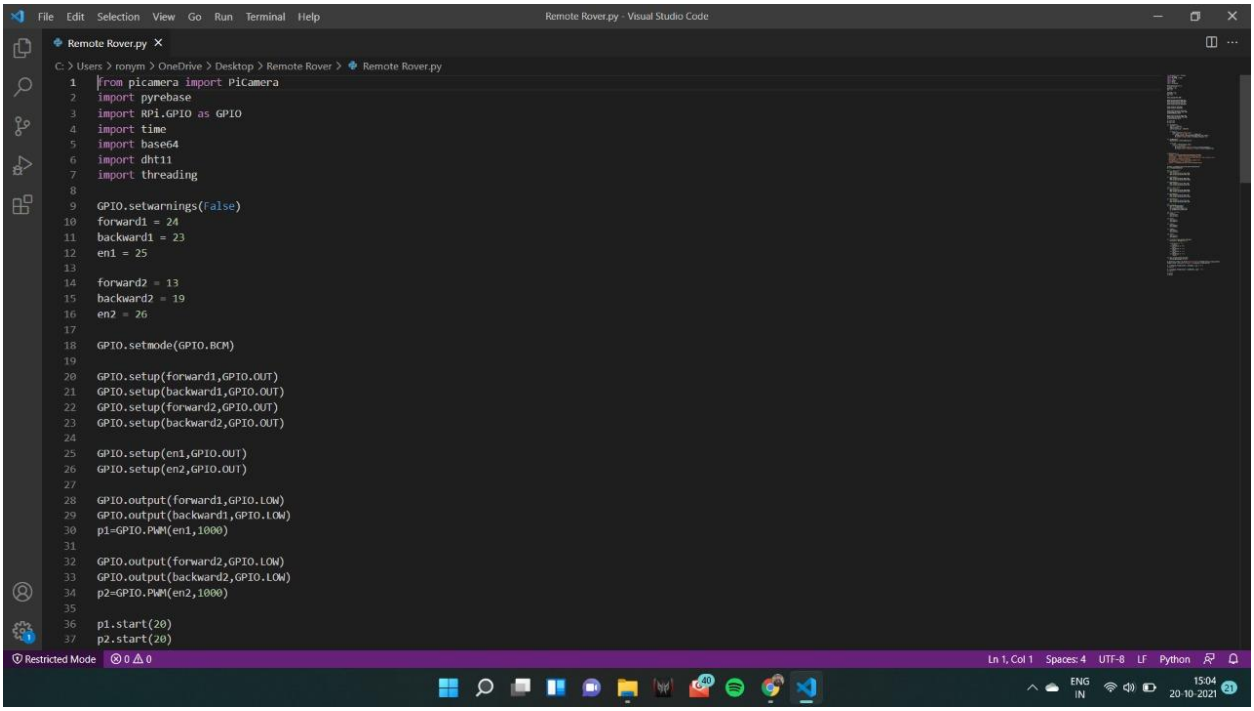
Project Outcome

The final objective of our project is to create a fully functional product, i.e., a movable can move thus can cover all the areas in contrast to CCTVs remote surveillance bot with a tiny Camera mounted on it. This can be used for numerous tasks, varying from spying, reconnaissance, information gathering, terrain exploration, border patrolling, etc. To eliminate the range problem of modern-day bots we will be controlling the bot over the internet. The bot can thus cover all the areas in contrast to CCTVs. This bot will be operated on the Wi-Fi network, thereby giving it, a much greater mobility of range and it can be controlled from anywhere as long as they are communicating on the same network, which is a great convenience. This bot does not require radio signals or Bluetooth signals, hence there is no range limit as is the case for the majority of the products in the market. The bot has a camera that will give us the live stream of the location. This bot can be useful for home security. This bot can even be deployed in army and can be operated in any territory where internet is available. This will be a low-cost bot as all the components used, are extremely cheap and easily available, thereby adding considerable value to the product. Raspberry-pi is at the heart of the system, and it is responsible for all of the system's operations. We will also create an Android based application which will be used to control the bot. It will have buttons to control the camera and the range of movement of the bot. It can move in any of the four cardinal directions namely, north, south, east and west, thereby enabling three sixty-degree range of mobility. The application will also be embedded with machine learning algorithms

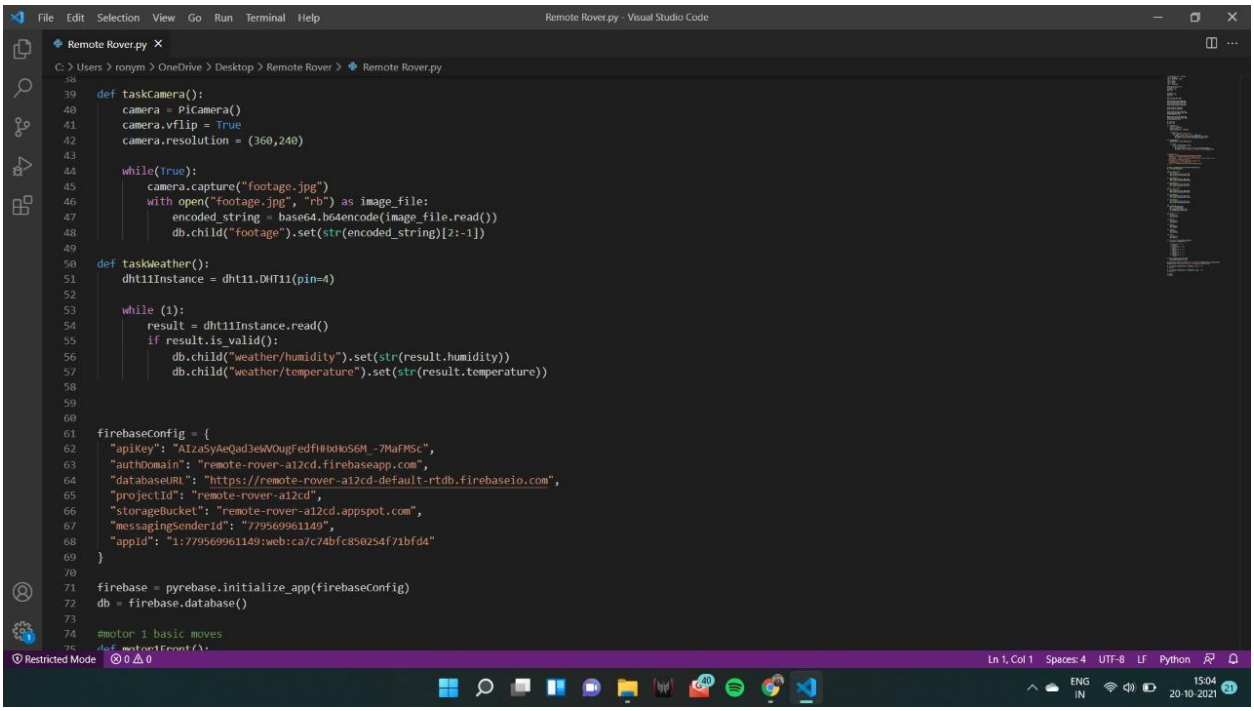
which will be beneficial in recognizing human faces very easily and detect the hostility level of different approaching targets.
The Raspberry Pi is being utilized as the core controller for the surveillance robot, and a USB camera is being used to capture video for live streaming. The Raspberry Pi was connected to the camera. Arduino uno was used to control the forward, backward, right, and left motions. The L293D motor driver was used to operate the motor from the Arduino. The Raspberry Pi sends control signals to the Arduino. The information is sent to Arduino via GPIO pins on the Raspberry Pi. The 1800mAh LiPO battery that powers the robot has a 5v output. The motor was powered by a 12v external battery. The key challenge in prior surveillance bots made with Raspberry Pi or Arduino was establishing a secure connection between the bot and the controlling system. This difficulty is solved by establishing a link between the bot and the controlling device in order to transfer control signals and video streaming using Firebase Real-Time Database. Google's Firebase is a safe and secure cloud platform. Firebase offers a real-time database that may be used to broadcast data in real-time. Data that has been posted to a cloud server can be retrieved in real-time using this method. Firebase provides a variety of tools to programmers, including RTD, Information Storage, and Machine Learning Kit. Real-time databases, or RTDs, are a type of database that is updated in real-time. Firebase is one of the greatest platforms for creating a database that can fetch information in real - time without causing any delays in the end system. Firebase is secure since it establishes an SSL connection. As a result, the connection between the host and the server is secured. We're using a Raspberry Pi to get live footage from a USB camera in this example. The data is then pre-processed and encoded before being sent to a real-time Firebase database and retrieved by an Android app using our algorithmic method. We're using an android phone as a remote, and we're using an android app that we built with Android Studio and the Flutter SDK. The control signal was received from Firebase using a Python program on the Raspberry Pi, and the signal data was sent to Arduino through GPIO. The Arduino then processes the control signal and instructs the robot's motors to move. Raspberry Pi is a single-board computer chip that runs on a 1.2GHz Broadcom processor and contains 4GB of RAM. It also features 40 GPIO pins for connecting to sensors and other devices. As the robot's core controller, we're employing a Raspberry Pi. A USB camera and an Arduino were used to connect the Raspberry Pi. The core application was written in Python 2.7 and runs on the Raspbian Jessie operating system. The Raspberry Pi must be connected to the internet in order to interact with the Firebase cloud. To connect to the internet, we used the Raspberry Pi's built-

in WIFI card. We need more computing power than an Arduino or other microcontroller can provide, so we opt with the Raspberry Pi. Arduino is an Atmega microcontroller-based development board. Even while the Raspberry Pi has a fast processor, it isn't fast enough to do numerous tasks at once. As a result, we relied solely on the Arduino to control the mobility and the bmp180 sensor. The Arduino is in charge of the robot's movements. GPIO pins of the Raspberry Pi are used to send input to the Arduino. The Arduino then processes the information and sends it to the L293D motor driver, which turns on the appropriate motors. To operate the bot, we will use an app created in Android Studio. In Android Studio, we're building an app with the flutter SDK framework. We will use the Dart programming language to develop the app to communicate with Firebase and deliver control signal information to the robot. In addition, the video data must be retrieved and stored in an app. On Firebase, secure user authentication is performed so that only the authorized person has access to the intelligence information and can control our bot.

Code:



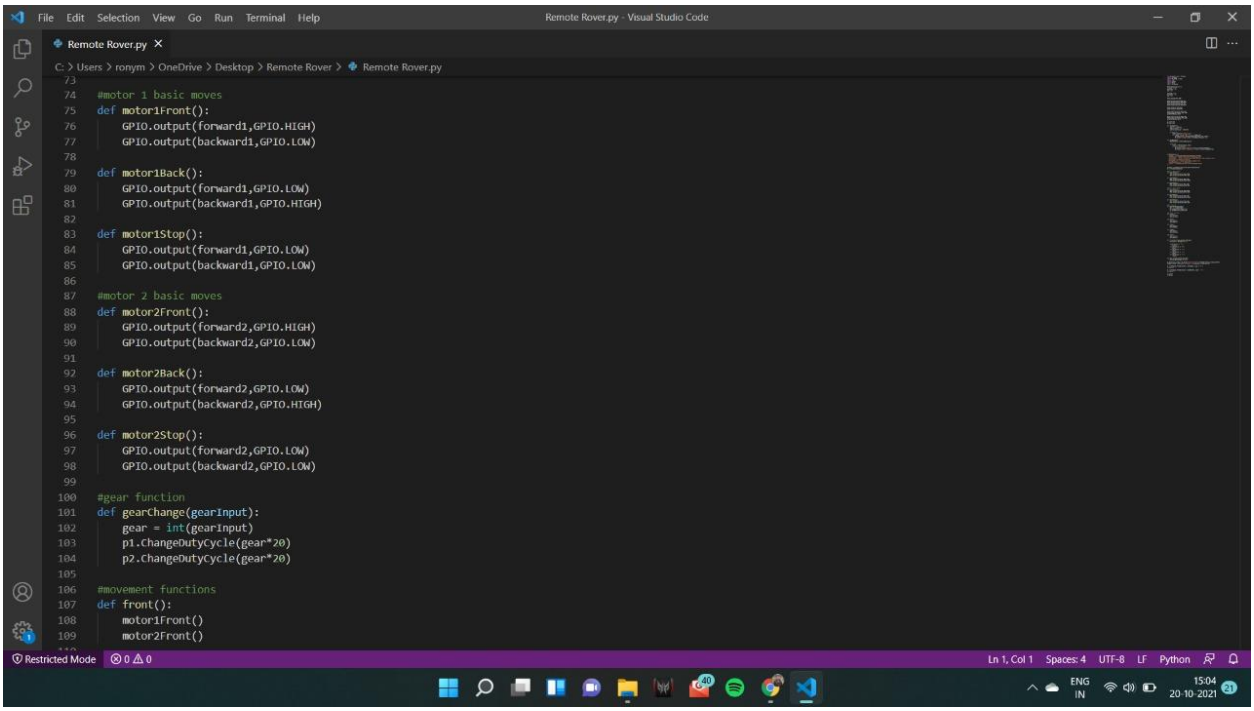
Code to include the heard files and configure the GPIO pins



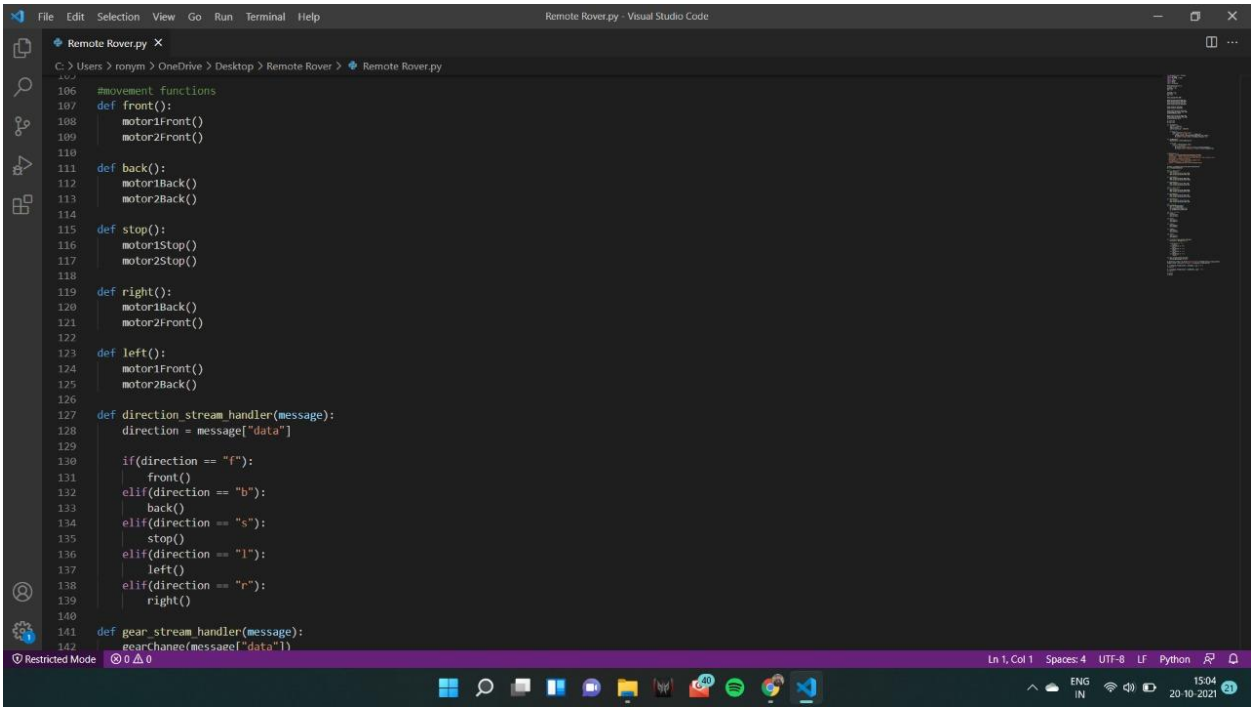
In the above code snippet, the first function does the functionality to capture the image, convert it into the base64 string and upload it into firebase

The second function gets the info of humidity and temperature from the sensor and uploads it to firebase

‘firebaseConfig’ variable stores the details to connect the project with the firebase real-time database.



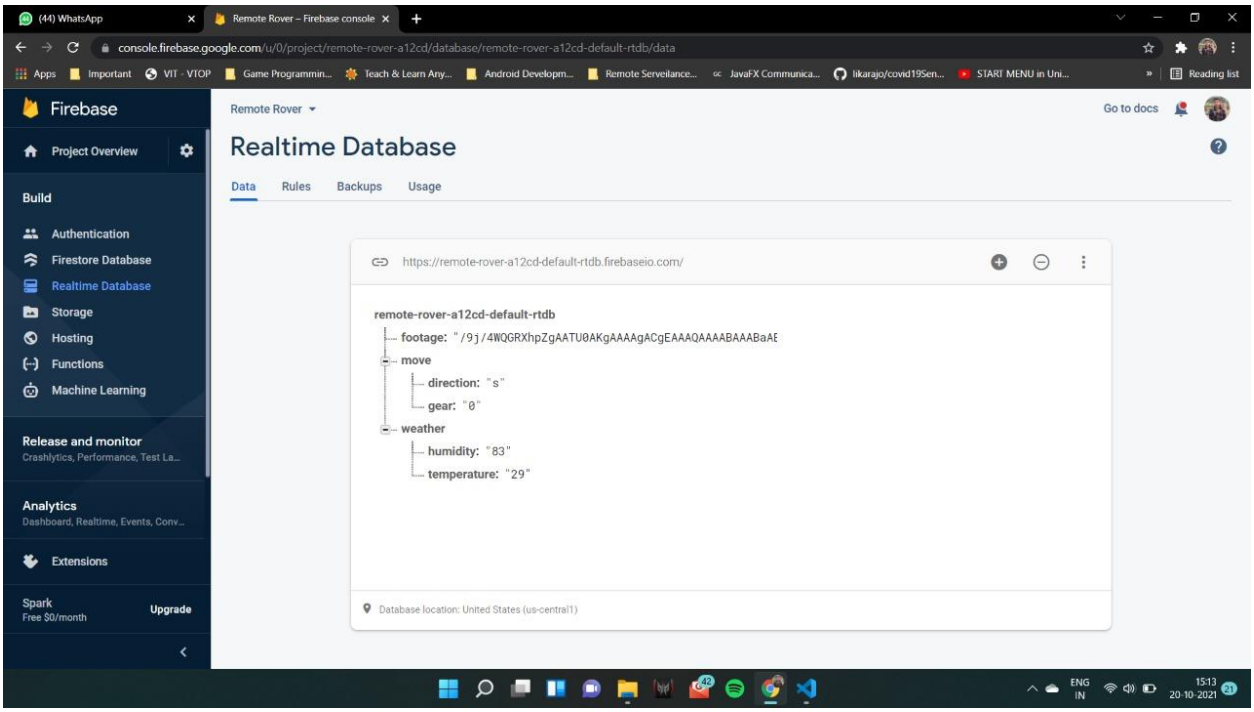
The above code snippet defines the basic motor movements of the two DC motors i.e forward, backward and stop



The above code snippet uses the different combination of the basic movements of the motors to result into movements of the bot.

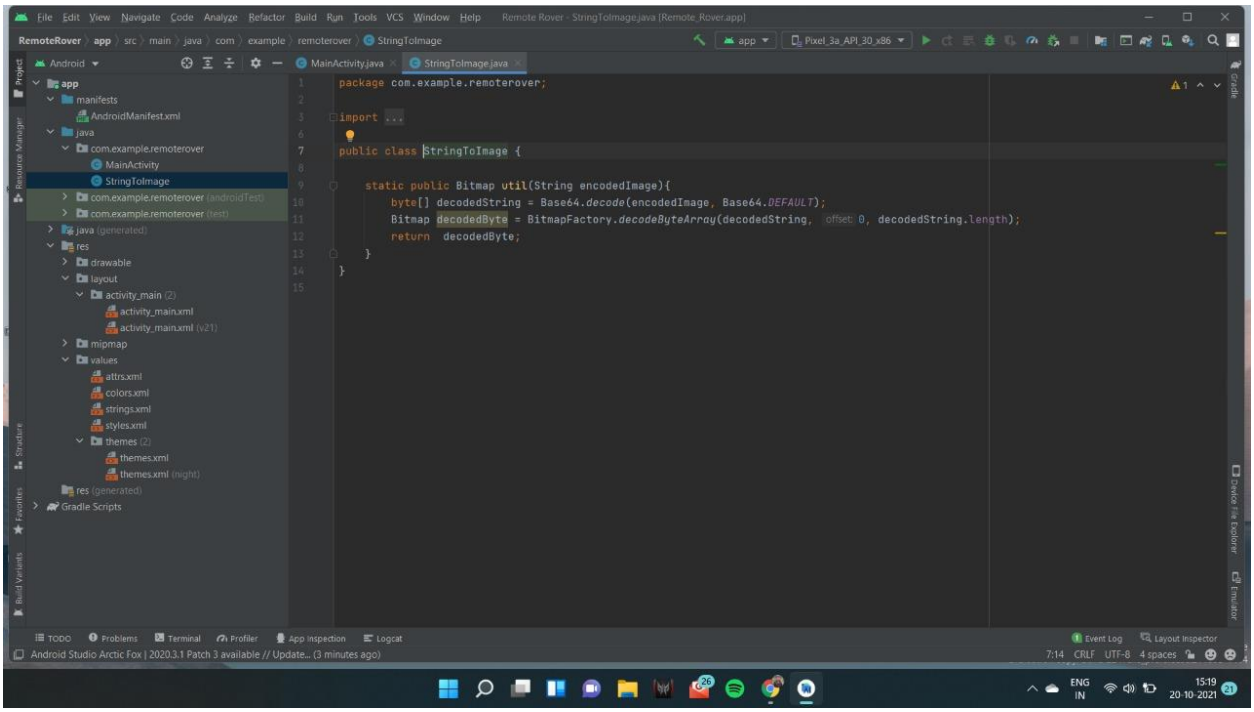
The ‘direction stream handler’ and ‘gear stream handler’ handles any change to the gear and direction branch of the firebase.

The code has been written in such a way that all the 4 cores of Raspberry Pi 3 is used simultaneously to get the maximum efficiency and least lag.

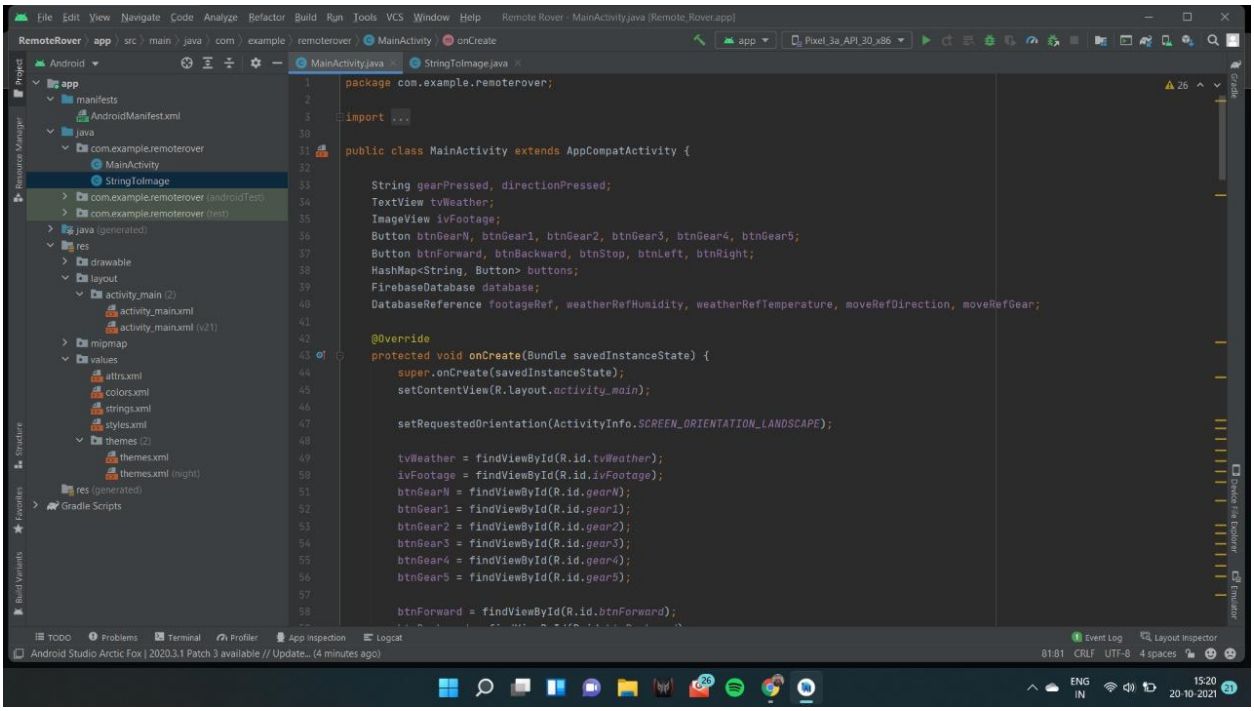


The above screenshot is of the real-time database of the firebase.

The screenshot of the android app

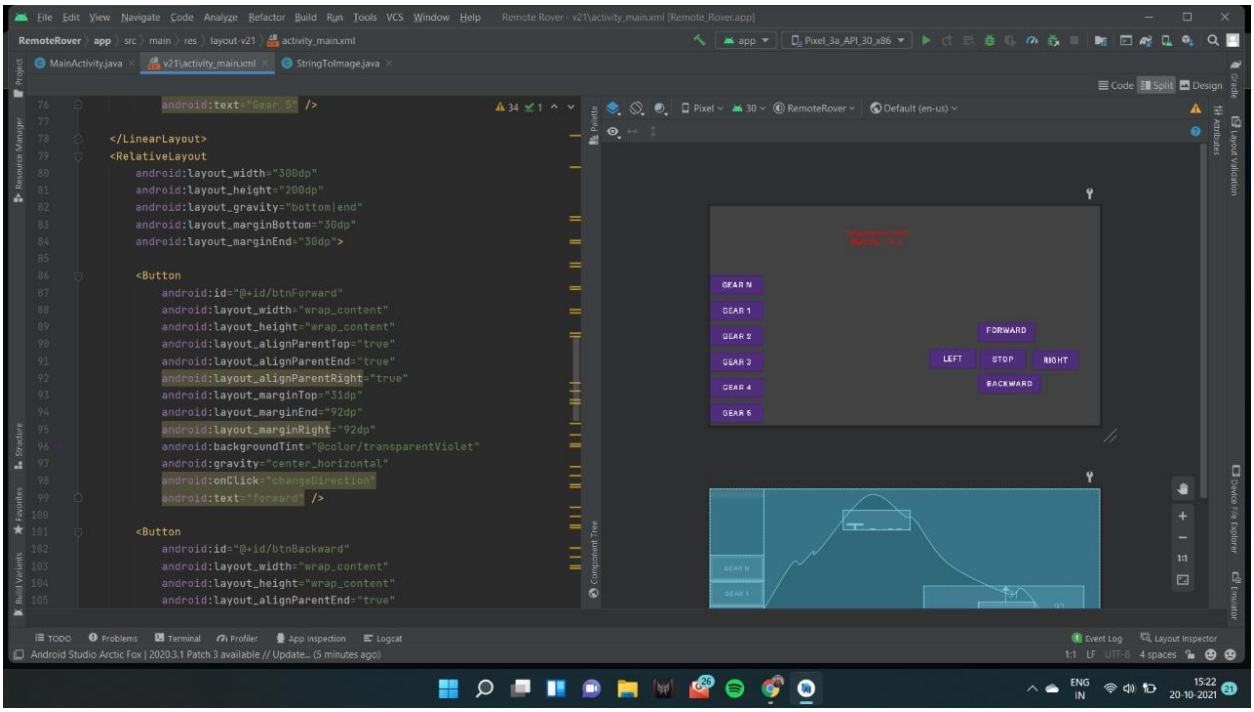


The above code snippet the string it fetches from firebase to image for the android app



```
package com.example.remoterover;

import ...

public class MainActivity extends AppCompatActivity {

    String gearPressed, directionPressed;
    TextView tvWeather;
    ImageView ivFootage;
    Button btnGearN, btnGear1, btnGear2, btnGear3, btnGear4, btnGear5;
    Button btnForward, btnBackward, btnStop, btnLeft, btnRight;
    HashMap<String, Button> buttons;
    FirebaseDatabase database;
    DatabaseReference footageRef, weatherRefHumidity, weatherRefTemperature, moveRefDirection, moveRefGear;

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main);

        setRequestedOrientation(ActivityInfo.SCREEN_ORIENTATION_LANDSCAPE);

        tvWeather = findViewById(R.id.tvWeather);
        ivFootage = findViewById(R.id.ivFootage);
        btnGearN = findViewById(R.id.gearN);
        btnGear1 = findViewById(R.id.gear1);
        btnGear2 = findViewById(R.id.gear2);
        btnGear3 = findViewById(R.id.gear3);
        btnGear4 = findViewById(R.id.gear4);
        btnGear5 = findViewById(R.id.gear5);

        btnForward = findViewById(R.id.btnForward);
```

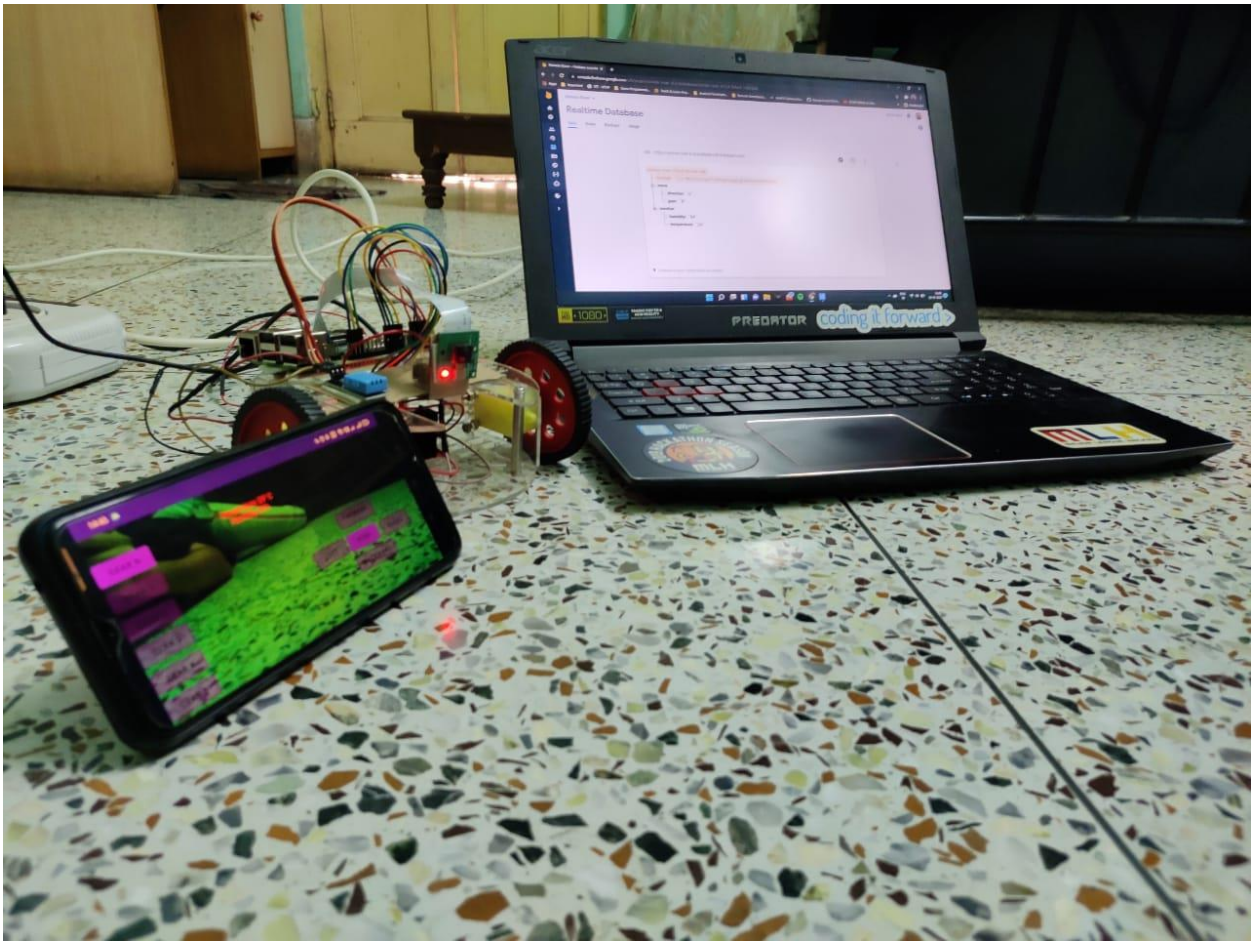
The above code snippet is of the main activity of the android app.



```
            android:text="Gear 5" />

    </LinearLayout>
    <RelativeLayout
        android:layout_width="300dp"
        android:layout_height="200dp"
        android:layout_gravity="bottom|end"
        android:layout_marginBottom="30dp"
        android:layout_marginEnd="30dp">

        <Button
            android:id="@+id/btnForward"
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:layout_alignParentTop="true"
            android:layout_alignParentEnd="true"
            android:layout_alignParentRight="true"
            android:layout_marginTop="31dp"
            android:layout_marginEnd="92dp"
            android:layout_marginRight="92dp"
            android:backgroundTint="@color/transparentViolet"
            android:gravity="center_horizontal"
            android:onClick="changeDirection"
            android:text="forward" />

        <Button
            android:id="@+id/btnBackward"
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:layout_alignParentEnd="true"
```

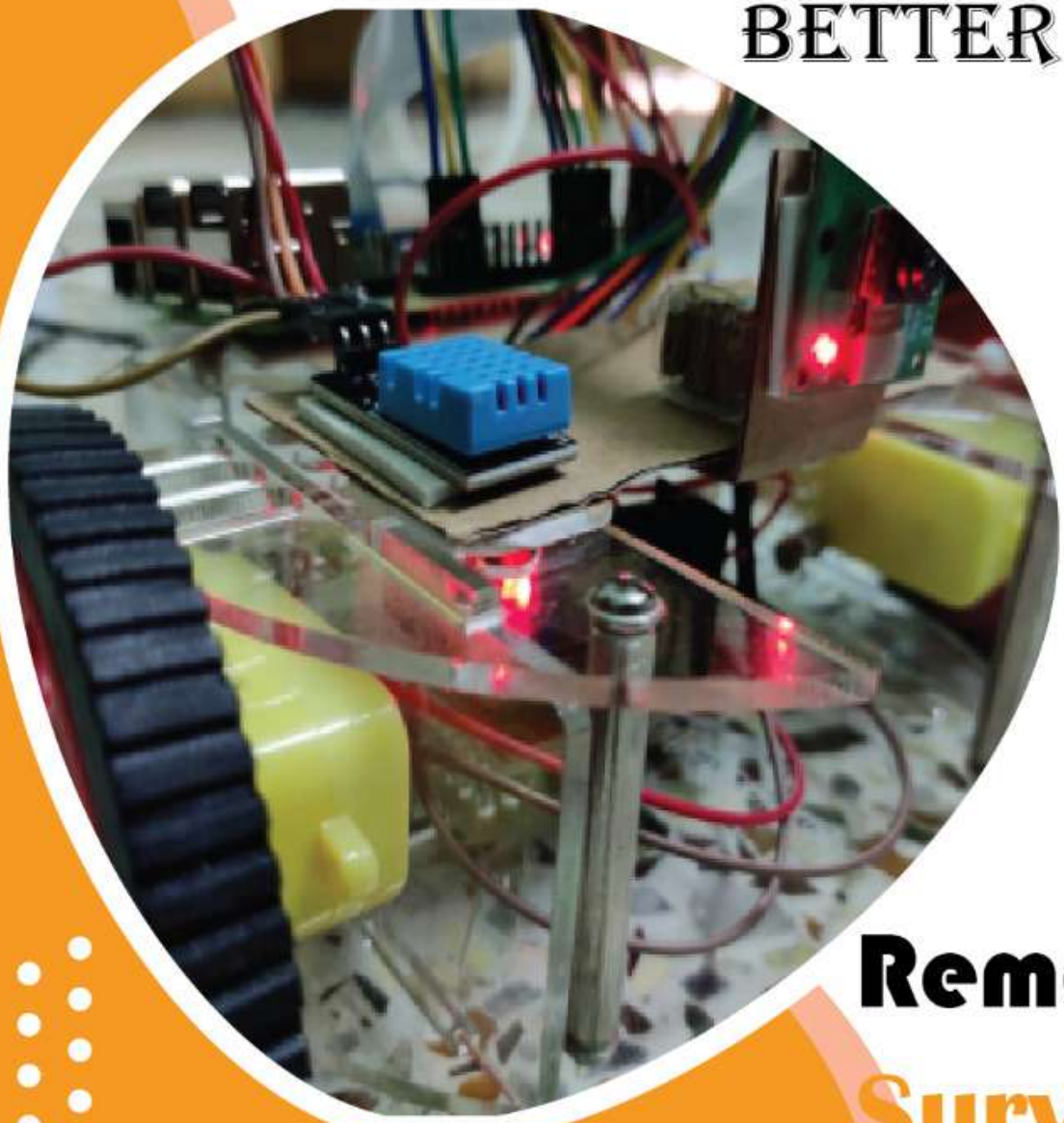
The above code snippet is the xml code which was used to design the UI of the android app.

The final Bot looks like this:



The above image shows the android app, the bot and the firebase real-time database on the laptop.

BETTER SAFETY
BETTER SOCIETY



Remote SurvieleInce Bot

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Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

TARP – CSE3999

RESEARCH PAPER

REMOTE SURVEILLANCE BOT

Mayukh Ghosh (18BCE0417)
Saksham Goyal (18BCE2196)
Rohan Allen (18BCI0247)

Abstract

To create a live streaming surveillance bot for the purpose of remote surveillance along with added features to detect hostility among different approaching targets. The bot will inspect the location's temperature and humidity as well. This bot can be used for surveillance, home security and rescue operations as well as spying in remote areas.

Introduction:

In modern world security is one of the largest priority of people. But every camera has its blind spots. Through this project of ours we plan to cover such blind spots along with providing users with the ability to better detect hostility. Through this project we also provide the ability to provide visual input to user in regions where the person can't reach manually. Also, our project could be used in both government civilian and private sector. This flexibility which is provided by this bot is the reason why we decided to make it. Also, its ability to use it while using the processing power of android device for further ML processes. Like face recognition, emotion recognition, and manual

controlling. Keeping the overall cost of the bot within reaches of majority consumers.

Live video in real time is the most difficult assignment in the field of surveillance, as it isn't much secure what's more, the data is extensively huge. However, Firebase, being a protected cloud stage, live video in real time utilizing its continuous data set hasn't been done at this point. We will be designing a mechanism for live video streaming through Firebase. A robot will additionally be created, which will be controlled with the assistance of an android application to transfer live video using the developed mechanism/ algorithm, consequently guaranteeing high security and low information use.

These days, numerous advancements are there for information transmission and much more are under research. As advancements increment, the dangers which are likewise the insight of programmers also got expanded. Consequently, the security of information transmission turns into an issue of inquiry, while it is the main essential for observation applications. In, a surveillance robot is controlled using web. The robot has a USB camera associated with Raspberry Pi to get the video and that Raspberry Pi is used to host the video in certain IP, which is open to anybody having that specific IP. Accordingly, the security isn't ensured. In, that the information from the camera is shipped off the android application utilizing MJPG which utilizes enormous data use while web-based video through web. When live HD video is shipped off cloud, there it uses more data for additional preparing as in self-governing vehicles. In this way security and measure of information utilization are the significant attributes to be considered in the event of live video web based utilizing observation robots.

Motivation

In modern world security is one of the largest priority of people. But every camera has its blind spots. Through this project of ours we plan to cover such blind spots along with providing users with the ability to better detect hostility. Through this project we also provide the ability to provide visual input to user in regions where the person can't reach manually. Also, our project could be used in both government civilian and private sector. This flexibility which is provided by this bot is the reason why we decided to make it. Also, its ability to use it while using the processing power of android device for further ML

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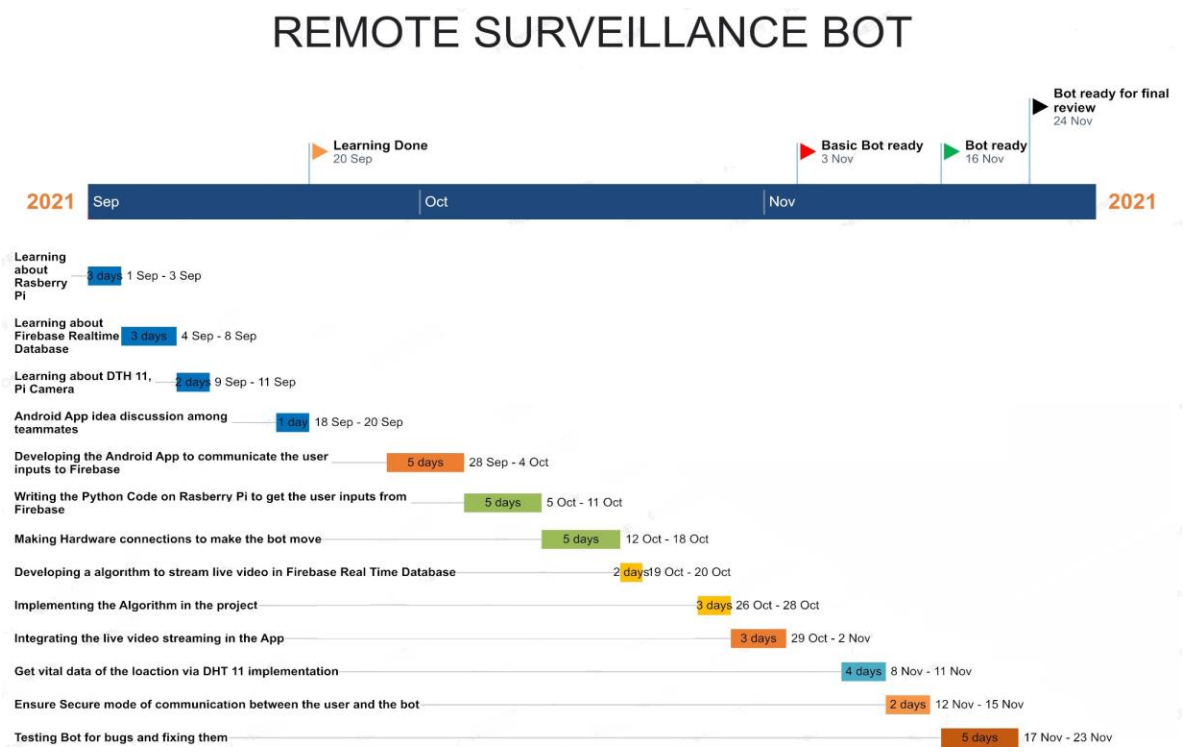
Live video in real time is the most difficult assignment in the field of surveillance, as it isn't much secure what's more, the data is extensively huge. However, Firebase, being a protected cloud stage, live video in real time utilizing its continuous data set hasn't been done at this point. We will be designing a mechanism for live video streaming through Firebase. A robot will additionally be created, which will be controlled with the assistance of an android application to transfer live video using the developed mechanism/ algorithm, consequently guaranteeing high security and low information use. These days, numerous advancements are there for information transmission and much more are under research. As advancements increment, the dangers which are likewise the insight of programmers also got expanded. Consequently, the security of information transmission turns into an issue of inquiry, while it is the main essential for observation applications. In, a surveillance robot is controlled using web. The robot has a USB camera associated with Raspberry Pi to get the video and that Raspberry Pi is used to host the video in certain IP, which is open to anybody having that specific IP. Accordingly, the security isn't ensured. In, that the information from the camera is shipped off the android application utilizing MJPG which utilizes enormous data use while web-based video through web. When live HD video is shipped off cloud, there it uses more data for additional preparing as in self-governing vehicles. In this way security and measure of information utilization are the significant attributes to be considered in the event of live video web based utilizing observation robots. To meet those qualities, we will foster an algorithm, which will be founded on FCP (Firebase Cloud Platform). Firebase offers part of innovations to the designers like RTD (Real Time Database), Data stockpiling, ML unit. RTD are in any case called as constant data set. Firebase is a standout amongst other stage to offer a data set which can have the option to recover the information progressively right away in the end gadget. To foster a reconnaissance robot, we need to build up a safe association between the robot and the controlling gadget, that is the primary issue in past observation robots which are created utilizing Raspberry pi or Arduino. In this we beat that issue by building up the association between the robot and the controlling gadget to move the control signals and the video web based through Firebase Real time Database. The motivation behind why firebase is secure, it makes an SSL interface. Subsequently the association is host to worker and worker to customer scrambled. In this we are utilizing raspberry pi to get live video from the usb camera. Then, at that

point we pre-process the information and encode that information then, at that point sends the information to constant data set of firebases and recovered the information to an android application utilizing our algorithm. Here we are utilizing an android gadget as a controlling gadget, for that we are utilizing an android application which we will be creating utilizing android studio. The control signal will be recovered in raspberry pi from firebase utilizing a python program and convey that message information to Arduino by means of GPIO. Then, at that point Arduino measure the control sign and controls the engines of the robot to make a movement. By utilizing our algorithm, we can be ready to transfer a live video in firebase. In the algorithm, the data utilization while streaming live video was diminished somewhat. The robot likewise has sensors like DHT11 to sense temperature and humidity.

During a rescue mission we don't have idea about the specific current environment circumstances for those spots first we can send our robot to observation the region and discover whether the climate is reasonable for us to send a human for the relieve activity. Utilizing those ascribes we can foresee the climate of the spot which the robot is under observation, we can utilize this during salvage tasks.

Gantt Chart:



Literature Review

1) Wireless Controlled Surveillance Robot

Description

A mobile robotic is a machine that is essentially place or mounted on a movable platform and can be with the help of positive commands. In today's global numerous fields use mobile robots. Many of the complex robots that we now see have originated from the simpler mobile robots. This technology has improved many new applications within the industry. The mixture of mobile gadgets and robots are leading to new thoughts in lots of fields. The cellular devices at the moment are being used in many of the business programs that is particularly because of the purpose that they may be portable and feature a longer battery existence in comparison to a pc. Also, they have data plan through a mobile cellphone carrier that is convenient as we will engage with the mobile robot as soon as the connection is hooked up.

Mobile Robots: The mobile robots may be labeled into differing types. The music track is the robotic that uses tracks to move around. However, such robots are pricey to build. Also, they are not as bendy as the wheeled robots. The wheeled robots are the robots which use wheels for transferring. Such robots can pass handiest on easy flat surfaces. The third kind is the legged robots which might be primarily based on human shape. They have legs which helps them to transport around. These robots are very tough to design.

Proposed System

The new age of innovation, for example, Android, GSM has re-imagined correspondence. The vast majority these days approach cell phones and subsequently the world to be sure has turned into a worldwide town. Out of the blue, a specific individual can be reached with the cell phone. New

advancements and thoughts can be produced from it that can additionally upgrade its abilities. Advancements, for example, Infra-red, Bluetooth, Wi-Fi which has created as of late goes to show the very truth that upgrades are indeed conceivable and these enhancements have facilitated our life and the way we live. Remote administration of a few home and office machines is a subject of developing interest and as of late we have seen numerous frameworks giving such controls. Versatile robots will be robots which can move around and collaborate with their current circumstance and not simply pivoted to a specific spot. There are numerous labs and examination bunches from different colleges and ventures which are totally committed on investigating portable robots, due to their tremendous potential and shifted application in industry, military, security, and diversion. The robot is exceptionally intended for reconnaissance reason. The control instrument is given along video transmission office. The video transmission is basically accomplished through fast picture transmission. At first, the robot will be furnished with an Android advanced mobile phone which will catch the situation before it will move the pictures to the worker on which the client will be controlling and watching the live feed.

Pros

1. Infrared LED: 8pcs infrared LED, automatic operate in dark environment Resolution: VGA (640x480)/ QVGA(320x240)/ QQVGA(160x120)

2. Motion detection to trigger alarm

Cons

1. Restricted Frequency Range: The recurrence range utilized for commonplace RF correspondence is close with regards to 3KHz-3GHz. The utilization of channel separator builds the unwavering quality however de wrinkles the real usable working recurrence range.

2. Restricted Functions: The predetermined number of channels causes a smaller number of blends and consequently there are less quantities of accessible capacities.

3. Restricted Working Range: The functioning scope of RF circuits with transmitters and beneficiary is tiny. It begins from a couple of meters to a couple of kilometers. The working shifts from circuits to circuits, yet essentially relies upon the upsides of actual parts utilized in the circuit. Essentially Wi-Fi and Wi-Max remote administrations are utilized in RF transmitter and collector circuits. The accompanying table shows the real working scope of various remote norms that can be utilized in remote correspondence.

4. Dependability of Operation: The RF circuits are exceptionally inclined to blunders because of outer conditions like EMI (Electro-Magnetic Interference), medium immersion, assimilation because of dull reflections from surface. Subsequently the yield recuperated isn't generally what is generally anticipated. This may be a significant issue when working with logical trial parts.

5. Security reasons: This is the primary weakness of utilizing a RF circuit and the principal motivation behind why RF circuits are not favored today. The RF recurrence band is accessible for practically every one of the clients for information correspondence. So, there may be a situation where more than one client is attempting to oblige channel for its own correspondence. In such case the recurrence band might get impedance from another client. Or on the other hand most pessimistic scenario would be, some client purposefully attempting to stick our correspondence organization. The RF jammer circuits are exceptionally simple to plan; henceforth the subject of safety emerges when RF circuit is utilized in the circuit. This security proviso can be extremely risky when the robot is being utilized for exceptionally secret purposes. In spaces of military these security dangers can deliver heartbreaking results.

How we overcome Those problem in Project

1. Wi-Fi connection is used for the operation of robot.
2. This gives the high security.
3. It also provides much more reliability of operation working range it also includes Wi-Fi.
4. N type Wi-Fi is used for higher security purpose as well as for better range.

2) Surveillance Security Robot with Automatic Patrolling Vehicle

Description

The word reconnaissance might be applied to perception from a distance through electronic gear (like CCTV cameras), or capture of electronically sent data, (for example, Internet traffic or calls). It might likewise allude to basic, somewhat no-or low innovation techniques like human insight specialists and postal interference. Observation is extremely helpful to governments and law requirement to keep up with social control, perceive and screen dangers, and forestall/examine crime. Nonetheless, numerous social liberties and security gatherings, like the Electronic Frontier Foundation and American Civil Liberties Union, have communicated worry that by permitting nonstop expansions in government observation of residents we will wind up in a mass reconnaissance society, with very restricted, or non-existent political and additionally individual flexibilities. A programmed watching vehicle goes about as a security patroller in the security framework, which can screen those no man's lands of the conventional fixed reconnaissance framework. The far-off checking capacities can likewise be improved by utilizing the remote organization. Also, the face recognition framework is adjusted to record and break down the intruders.

Pros

1. Image Sensor: 1/4" CMOS
2. High image video quality, two-way audio monitoring

3. Infrared LED: 8pcs infrared LED, automatic operate in dark environment
4. Resolution: VGA (640x480)/ QVGA (320x240)/ QQVGA (160x120)
5. Compression format: H.264
6. Allow remote Pan/Tilt control: 350Â in pan, 60Â in title
7. Motion detection to trigger alarm
8. KDM-6706AL is wireless model, Wi-Fi compliant with wireless standard IEEE 802.11b/g
9. Light weight
10. Omni directional coverage
11. High resolution images
12. Active participation in communication

Cons

1. Limited for only single stair
2. Limited angle detection (not able to detect faces under critical angle)
3. System itself having some limitations of capturing

How we overcome Those problem in Project

1. Movement is not limited or restricted as we used arduino robot
2. High quality camera is used for better capturing of videos
3. Light weight compression for edge point 264 is used for better compression

3) Android Based Security and Remote Surveillance System

Now day mobile devices are integrated with our everyday life. The security and remote surveillance system are increasingly prominent feature on the mobile phone. The modern home is integrated with many automation technologies. The user can control door lock, light, air conditioner and other devices using remote control. According to Khan, The Access control system used to allow only authorized members while the user away from their house. When the system gets wrong password in three times than it signals to the door alarm. But this technology is very effective when using internet capable mobile devices. Developments in cloud computing and mobile technology

allow internet communication in automation and security systems to improve flexible and fast communication, such as Yale's Locks Hardware new device. This project exploits Near Field Communication through Wi-Fi direct. Using X10 technology, the mobile device can control home security system. Priyare and tazil. Developed the home automation system through Bluetooth remote control. Sarijari et al. Implemented smart home system through zigbee communication. This system relays data and command via SMS message. Noor Azah Samsudin. Developed the food ordering system by using the Wi-Fi communication to order items with real time feedback. Saliyah Kahar presents comparative study of different wireless technology usage for mobile robot controller such as Bluetooth, Wi-Fi or Wireless LAN and 3G. Saliyah Kahar, Riza Sulaiman. implements the mobile controlled robot, communicates through 3G technology to use advantages of multimedia features and internet speed. The 3G technology offers fast communication than 2G, is used for efficient multimedia data transmission. For long term communication, the 3G communication participate in important role. The 3G can access high speed data rate at 2mbps. As in, applications created include performance-based wireless web, email, as well as video conferencing and multimedia services that blend voice and data streams. This paper discusses the development of security and video surveillance system, which communicates via Wi-Fi direct protocol. Android is currently leaded on mobile market share. This proposed system allows user to lock, unlock a door within short range only. The user can also monitor the house. The attached motion detector and CMOS camera is used for remote surveillance. The mobile application requires password to increase the security of the system. The hardware on the door contains the AVR ATmega16 microcontroller to control a linear actuator for locking mechanism and to provide a link between camera and Android mobile. The Wi-Fi direct protocol was chosen as communication protocol because it is advanced Wi-Fi protocol, operate as adhoc network. The Wi-Fi direct protocol has large cover area, compared with Bluetooth. It can be used to communicate up to 200 meters away. The protocol incorporates data encryption for security and interference avoidance.

Pros

1. Omni directional coverage
2. Wi-Fi compliant with wireless standard IEEE 802.11b/g
3. Automatic operate in dark environment 4. Remote Pan/Tilt control: 350Â in pan, 60Â in tilte

Cons

1. Limited Working Range
2. Security reasons
3. Limited angle detection
4. Less reliability of Operation

How we overcome Those problem in Project

1. Wi-Fi connection is used for the operation of robot
2. his gives the high security
3. It also provides much more reliability of operation working range it also includes Wi-Fi
4. Movement is not limited or restricted as we used arduino robot 5. High quality camera is used for better capturing of videos

4) Smart Phone Controlled Robot Using ATMEGA328 Microcontroller

Android is a mobile application stack that consists of an operating system and important applications. Android apps give users access to a variety of essential APIs and tools for creating rich applications. Android also comes with a comprehensive range of tools that allow developers to work more efficiently and gain a deeper understanding of their programs. Bluetooth is a radio frequency (RF)-based short-range connectivity technology with an open standard specification that is revolutionizing technology and wireless communication. The information from the Android smart phone is transmitted into the controller via the Blue-tooth module. As a result, the controller uses the Android phone to operate the DC motors, allowing the bot to move in all four directions.

The circuit is made up of an ATmega328 controller, HC-SR04 ultrasonic transmitter module, JYMCU BT Bluetooth module, L293D (IC1) motor

controller, M1 and M2 DC motors, and a few common components. The circuit is powered by two 9V cells, one for the ATmega328 controller and one for the motors. The ATmega328 controller provides a regulated 5V supply for the rest of the circuit. The existence of an electrical supply is indicated by an LED on the board.

Pros:

1) It is mobile and flexible.

2) It may be controlled wirelessly/remotely;

3) Does not require manpower.

4) It can be employed in a variety of important situations.

Cons:

1)There is no capability for video streaming,

2) There is no specific app.

3) Use an application that has previously been developed to control the situation.

How our project overcomes this:

1) We created our own app to control the bot over WIFI network.

2) Video streaming capabilities are provided via a USB camera mounted on the robot.

3) Includes ML to detect hostility level

5) Smart Surveillance Monitoring System Using Raspberry PI and PIR Sensor

The Raspberry Pi is a little computer about the size of a credit card. It's almost as if it's a computer. There are a variety of surveillance systems available, including cameras, closed-circuit television, and so on. The individual who is immobile and positioned in that particular location can only

watch what is happening in that particular region in these types of monitoring systems. Alternatively, even if the user moves from one location to another, he or she can keep track of what is going on in that location. Another benefit is that it provides privacy on both sides because just one person is viewing it. Another significant benefit is that it is a straightforward circuit. Raspbian OS is the operating system in use here. The Raspbian operating system must be installed before the image can be sent to the phone.

Pros:

1) Extremely quick processing
2) Vast range

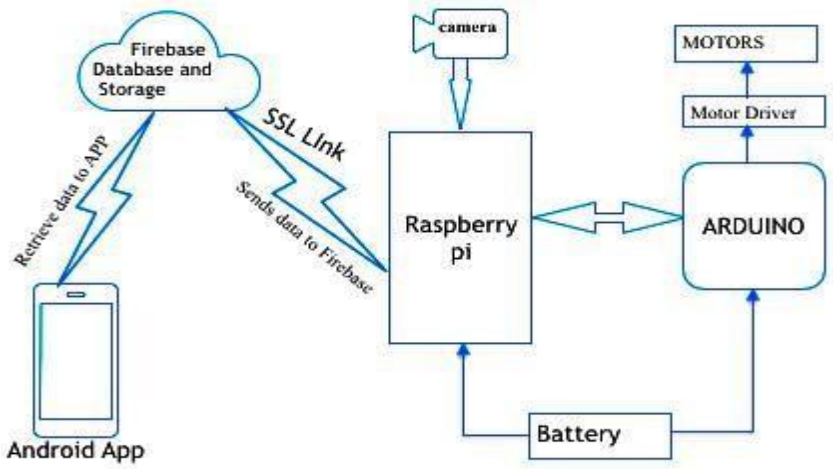
Cons:

1) Lack of a website/application to streamline control of the bot
2) Lack of video streaming capabilities
3) Expensive

How our project overcomes this:

1) We will develop our application to control the bot wirelessly
2) Video streaming capabilities are included
3) Includes ML to detect hostility level

Block Diagram:



Overview:

The Raspberry Pi is being utilized as the core controller for the surveillance robot, and a USB camera is being used to capture video for live streaming. The Raspberry Pi was connected to the camera. Arduino uno was used to control the forward, backward, right, and left motions. The L293D motor driver was used to operate the motor from the Arduino. The Raspberry Pi sends control signals to the Arduino. The information is sent to Arduino via GPIO pins on the Raspberry Pi. The 1800mAh LiPO battery that powers the robot has a 5v output. The motor was powered by a 12v external battery. The key challenge in prior surveillance bots made with Raspberry Pi or Arduino was establishing a secure connection between the bot and the controlling system. This difficulty is solved by establishing a link between the bot and the controlling device in order to transfer control signals and video streaming using Firebase Real-Time Database. Google's Firebase is a safe and secure cloud platform. To operate the bot, we will use an app created in Android Studio. In Android Studio, we're building an app with the flutter SDK framework. We will develop the app to communicate with Firebase and

deliver control signal information to the robot. In addition, the video data must be retrieved and stored in an app. On Firebase, secure user authentication is performed so that only the authorized person has access to the intelligence information and can control our bot.

HARDWARE REQUIRED:

Raspberry Pi

The Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python.

Arduino UNO

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc.

Raspberry Pi camera board

The Camera Module can be used to take high-definition video, as well as stills photographs. ... It supports 1080p30, 720p60 and VGA90 video modes, as well as still capture. It attaches via a 15cm ribbon cable to the CSI port on the Raspberry Pi.

L298 Motor Driver Module

It is a high voltage, high current dual full-bridge driver designed to accept standard TTL logic levels and drive inductive loads such as relays, solenoids, DC and stepping motors.

DHT11 Sensor

The DHT11 is a basic, ultra-low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed).

Bot chasse

Chassis is very essential in robots as well as many mechanical devices. Robot chassis is particularly designed for robots and other mechanical devices. These accessories handle PCB, components and parts that are interfaced and connected to it.

2 DC motors

Simplest type of motors which work on direct current.

SOFTWARE REQUIRED:

Firebase Realtime database

Google's Firebase is a safe and secure cloud platform to store and host data. On Firebase, secure user authentication is performed so that only the authorized person has access to the data.

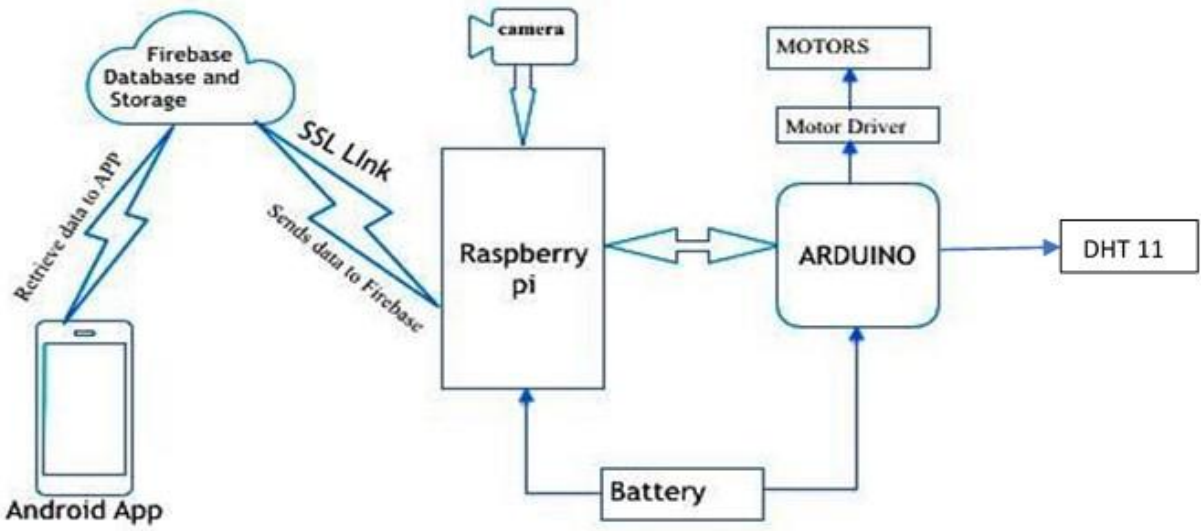
Android Studio

Built on JetBrains' IntelliJ IDEA software and customized exclusively for Android development, Android Studio is the official integrated development environment for Google's Android operating system.

Tensorflow

TensorFlow is a machine learning and artificial intelligence software library that is free and open-source. It can be used for a variety of applications, but it focuses on deep neural network training and inference.

OVERVIEW OF THE PRODUCT:



We will develop an android application using android studio that will be like the remote of the bot. We will give it joystick-like keys through which the bot can be controlled. The rotation/ movement of the keys will change the data (angle and magnitude) in the cloud storage, and through cloud functions, any change in the

data will trigger a data transfer to the raspberry pi.
The raspberry pi will process the data and accordingly send signals to arduino to move the bot via the motor drivers.
The bot is fixed with some sensors like DHT11 and camera. The camera captures the surroundings and sends the data to raspberry pi. In the raspberry the date is processed using the algorithm mentioned below and is uploaded to the cloud.
The temperature and humidity details from the DHT11 sensor is received by arduino and is sent to raspberry pi which is uploaded to the cloud from there.
The android app receives the temperature details and humidity details of the terrain from the cloud and it is displayed to the user.
The image is uploaded to the firebase's Realtime database in the form of a string of base64. The application converts it back to the image from that format. Then the ML analysis is done over that image to give users more details about the terrain. And the image is shown to the user with the ML analysis.

ALGORITHM TO LIVE STREAM VIDEO VIA FIREBASE:

Firebase is a cloud platform by google. It is secure and scalable. It has many components, but we will be using its real time database. The real time database is designed to stream real time text data in the cloud platform. We in our project will use it in an innovative way to stream live video.

1. The camera captures the video of the surroundings and gives it to raspberry pi.
2. Raspberry pi, using OpenCV library takes frames of those videos and converts them to text format
3. The text format used is the base 64 string format. The string is then uploaded to the Realtime database.
4. The android app fetches the base 64 string from the Realtime database and converts it into image format.
5. The image is then analysed using the ML algorithm as described below.
6. The image along with the analysis is then displayed into an image viewer in the android app.
7. By frequently repeating this process (1-6) we will give the illusion of live video display to the user operating the bot.

ALGORITHM TO CONTROL THE BOT REMOTELY OVER CLOUD:

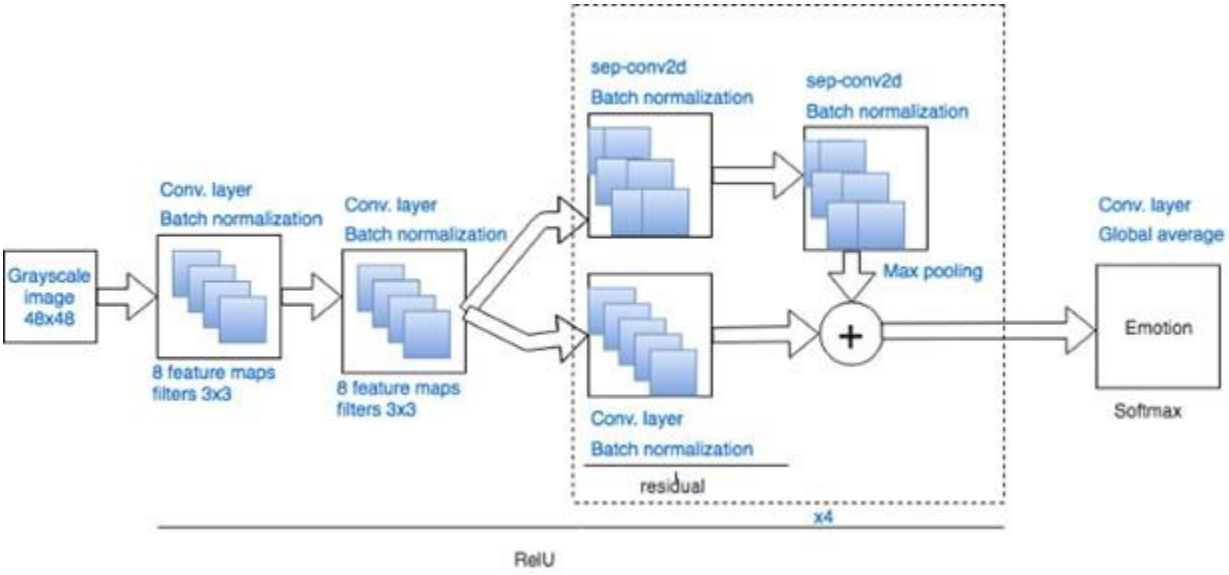
For this functionality also we will be using the firebase. We will take data from the app and send it to the bot for its proper functioning.

1. Input the position of the joystick from the android app.
2. Upload the positional value of the joystick if the position changes into the Realtime database of Firebase.
3. The data is triggered via a cloud function whenever it gets changed to the raspberry pi. Raspberry Pi receives the data from the cloud and accordingly sends instructions to the arduino to operate the dc motors via the motor driver.
4. In exactly the same way the DHT 11 sensor sends back temperature and humidity data to the android app via the cloud platform.

ALGORITHM TO DETECT HOSTILE ENVIRONMENT USING ML:

Deep learning for Emotion Recognition

With respect to engineering of the CNN, a concise hypothetical presentation is given. In the wake of attempting a few models, the one proposed in ended up being the most incredible as far as precision and preparing effectiveness. In Figure 2 the engineering is addressed.



A few developments are done in this Convolutional Neural Network with the goal that a precision improvement is

accomplished.
Above all else, is the idea of remaining modules. Remaining modules are a method to facilitate the preparation of organizations, and they change the ideal planning between two ensuing layers, so, the learned provisions become the distinction of the first component map and the ideal features.
Also, profundity savvy distinct convolution which is a type of factorized convolutions which factorize a standard one into a profundity astute convolution and a 1 x 1 convolution called a point-wise convolution. Accordingly, there are two fundamentals layers in every convolution, which intend to isolate the spatial cross-connections from the channel cross-relationships.
Profundity insightful convolutions are utilized to apply a solitary channel for each information channel (input profundity).
Point-wise convolution, a basic 1 x 1 convolution, is then used to make a straight blend of the yield of the profundity savvy layer.
Despite they are incredibly productive contrast with standard convolutions, it doesn't consolidate the sifted channels to make new provisions. That is the place where the new layer comes up, the point-wise layer is utilized to register a direct blend of the yields of the profundity savvy convolution. More or less, profundity savvy divisible convolutions decrease the calculation regarding the standard convolutions, with the goal that the preparation stage is quicker.
Thirdly, as the preparation interaction with the past network was famously hard and subsequently soaked with a nonlinearity, otherwise called inner covariate shift, an answer found is normalizing the contributions of the layers. This is called Batch-standardization, and it additionally goes about as a regularizer staying away from in specific cases the utilization of dropouts. This method plays out a simple activity which is applied to enactment x over a scaled down clump.
At long last the idea of regularization applied in certain layers. Regularizers focus on sum up the conduct of the net. Explicitly in this engineering, along with other currently referenced, l2-regularization (otherwise known as weight rot) will be executed in certain layers. The possibility of L2 regularization is to add an additional term to the expense work, called the regularization term. For instance, utilizing the cross-entropy work the speculation term is added as follows:

$$C = -\frac{1}{n}\sum_{x}[y \ln y' + (1-y)\ln(1-y')] + \frac{\lambda}{2n}\sum_{w} w^2$$

The initial term relates to the actual capacity, and the subsequent one is the term, wherein the amount of the squares of the multitude of loads in the organization is done, scaled by a factor, where λ is the regularization boundary. For this situation the scale factor utilized is 0.01.
Hence, our last design, as displayed in Figure 2 is a completely convolutional neural organization comprising of 2 convolutional layers of 8 components. ReLu actuation, 3x3 with a portion regularizer, trailed by a group standardization. Then, at that point there are four modules wherein a remaining is carried out (Convolutional layer, 1x1, trailed by a bunch standardization) and added to the distinct convolutional layer, 3x3 with portion regularization, trailed by a group standardization also. The size of these convolutional pieces are expanding in every module, beginning in 16 and finishing in 128. At last, the actual arrangement is brought out through a convolutional layer with the size equivalent to the quantity of feelings to be anticipated, trailed by a Global normal pooling layer with Softmax enactment.

ABOUT ANDROID APP:

The app will be developed in android studio. It will have a very user-friendly interface and simplistic design. It will have two joystick buttons to control the bot.
And a screen in the middle to show the live video from the environment. The panel will also give the details of the temperature and humidity. If some human faces are detected in the video, it will also alert the user with its UI, as it will prove to be an important feature in rescue, spying and explorations operations.

INNOVATION / NOVELTY:

Unlike traditional surveillance bots our bot uses WIFI Technology for communication purposes. This not only offers a much superior range as compared to Bluetooth or radio frequency enabled devices but also is more secure. Movement is not hindered or restricted in any fashion due to the extremely versatile and sleek

Arduino UNO motor. It also incorporates cutting edge Machine Learning algorithms to detect human facial features and also possess the state-of-the-art DHT11 sensor which relays real time temperature and humidity data, something which is extremely invaluable. The key challenge in prior surveillance bots made with Raspberry Pi or Arduino was establishing a secure connection between the bot and the controlling system. This difficulty is solved by establishing a link between the bot and the controlling device in order to transfer control signals and video streaming using Firebase Real-Time Database. Google's Firebase is a safe and secure cloud platform. To operate the bot, we will use an app created in Android Studio. In Android Studio, we're building an app with the flutter SDK framework. We will develop the app to communicate with Firebase and deliver control signal information to the robot. In addition, the video data must be retrieved and stored in an app. On Firebase, secure user authentication is performed so that only the authorized person has access to the intelligence information and can control our bot.

Project Outcome

The final objective of our project is to create a fully functional product, i.e., a movable can move thus can cover all the areas in contrast to CCTVs remote surveillance bot with a tiny Camera mounted on it. This can be used for numerous tasks, varying from spying, reconnaissance, information gathering, terrain exploration, border patrolling, etc. To eliminate the range problem of modern-day bots we will be controlling the bot over the internet. The bot can thus cover all the areas in contrast to CCTVs. This bot will be operated on the Wi-Fi network, thereby giving it, a much greater mobility of range and it can be controlled from anywhere as long as they are communicating on the same network, which is a great convenience. This bot does not require radio signals or Bluetooth signals, hence there is no range limit as is the case for the majority of the products in the market. The bot has a camera that will give us the live stream of the location. This bot can be useful for home security. This bot can even be deployed in army and can be operated in any territory where internet is available. This will be a low-cost bot as all the components used, are extremely cheap and easily available, thereby adding considerable value to the product. Raspberry-pi is at the heart of the system, and it is responsible for all of the system's operations. We will also create an Android based application which will be used to control

the bot. It will have buttons to control the camera and the range of movement of the bot. It can move in any of the four cardinal directions namely, north, south, east and west, thereby enabling three sixty-degree range of mobility. The application will also be embedded with machine learning algorithms which will be beneficial in recognizing human faces very easily and detect the hostility level of different approaching targets.
The Raspberry Pi is being utilized as the core controller for the surveillance robot, and a USB camera is being used to capture video for live streaming. The Raspberry Pi was connected to the camera. Arduino uno was used to control the forward, backward, right, and left motions. The L293D motor driver was used to operate the motor from the Arduino. The Raspberry Pi sends control signals to the Arduino. The information is sent to Arduino via GPIO pins on the Raspberry Pi. The 1800mAh LiPO battery that powers the robot has a 5v output. The motor was powered by a 12v external battery. The key challenge in prior surveillance bots made with Raspberry Pi or Arduino was establishing a secure connection between the bot and the controlling system. This difficulty is solved by establishing a link between the bot and the controlling device in order to transfer control signals and video streaming using Firebase Real-Time Database. Google's Firebase is a safe and secure cloud platform. Firebase offers a real-time database that may be used to broadcast data in real-time. Data that has been posted to a cloud server can be retrieved in real-time using this method. Firebase provides a variety of tools to programmers, including RTD, Information Storage, and Machine Learning Kit. Real-time databases, or RTDs, are a type of database that is updated in real-time. Firebase is one of the greatest platforms for creating a database that can fetch information in real - time without causing any delays in the end system. Firebase is secure since it establishes an SSL connection. As a result, the connection between the host and the server is secured. We're using a Raspberry Pi to get live footage from a USB camera in this example. The data is then pre-processed and encoded before being sent to a real-time Firebase database and retrieved by an Android app using our algorithmic method. We're using an android phone as a remote, and we're using an android app that we built with Android Studio and the Flutter SDK. The control signal was received from Firebase using a Python program on the Raspberry Pi, and the signal data was sent to Arduino through GPIO. The Arduino then processes the control signal and instructs the robot's motors to move. Raspberry Pi is a single-board computer chip that runs on a 1.2GHz Broadcom processor and contains 4GB of RAM. It also features 40 GPIO pins for connecting to sensors and other devices. As the robot's core controller, we're employing a Raspberry Pi. A USB camera and an

Arduino were used to connect the Raspberry Pi. The core application was written in Python 2.7 and runs on the Raspbian Jessie operating system. The Raspberry Pi must be connected to the internet in order to interact with the Firebase cloud. To connect to the internet, we used the Raspberry Pi's built-in WIFI card. We need more computing power than an Arduino or other microcontroller can provide, so we opt with the Raspberry Pi. Arduino is an Atmega microcontroller-based development board. Even while the Raspberry Pi has a fast processor, it isn't fast enough to do numerous tasks at once. As a result, we relied solely on the Arduino to control the mobility and the bmp180 sensor. The Arduino is in charge of the robot's movements. GPIO pins of the Raspberry Pi are used to send input to the Arduino. The Arduino then processes the information and sends it to the L293D motor driver, which turns on the appropriate motors. To operate the bot, we will use an app created in Android Studio. In Android Studio, we're building an app with the flutter SDK framework. We will use the Dart programming language to develop the app to communicate with Firebase and deliver control signal information to the robot. In addition, the video data must be retrieved and stored in an app. On Firebase, secure user authentication is performed so that only the authorized person has access to the intelligence information and can control our bot.

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