International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 05 | May 2020 www.irjet.net p-ISSN: 2395-0072

Voice Controlled Surveillance Car

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Abstract - *Nowadays smartphones are being used for a variety of different operations which are intended to help the users in diverse applications. Also, the increase of robot's interference in human life arises the dire need of a healthy interface. It is much easier to control a robot via voice commands for both domestic as well as industrial users. In this project, we present a prototype of a surveillance car which is controlled and manipulated by human voice. The surveillance car provides features like control over the direction of the vehicle i.e. it can move in front, back, right and left directions, Camera live stream and recording & Obstacle detection and avoidance. The car is controlled using a smartphone, Google Assistant, IFTTT mechanism, and Adafruit.io platforms. It can also detect and avoid obstacles in its path over a Wi-Fi network. Also, a GPS tracker is mounted on the vehicle to detect the location of the car at any instant and the flame sensor notifies the user in case of a fire. This is a speaker independent surveillance car which can be used for spying and surveillance purpose, which means, it does not require a specific person to give the commands to the car.*

Key Words: Google Assistant, Wemos, Wi-Fi, Surveillance, IFTTT, Adafruit.io, Voice, Obstacle Detection and Avoidance

1. INTRODUCTION

Due to furtherance in technology, nowadays, various newly designed business sectors make use of Wi-Fi enabled robot for various applications. They are mostly used for security purpose. By using just a single device, the car can be moved easily from one location to another. For the security purpose, camera can be installed. Also, to make the robot self-dependent, obstacle detection is introduced to identify any hurdles in its path and also a mechanism to avoid those hurdles can be added. In this project, we will hash out on how to control the car through Google Assistant based on IFTTT mechanism. Also, we will deliberate on how to control this robot car using RC controls on a smartphone. This vehicle reduces the manual work benefitting many users in various sectors. It also reduces the risk of endangering human lives in places where human presence is dangerous, preventing humans from entering risky locations.

The car will be moving according to the voice commands given by the user. This car is designed using a Wemos D1 R2 microcontroller. This can be moved in forward and reverse direction. Also, this car can take sharp, precise turnings towards left and right directions. By using voice, commands given by the user will be recognized by the Google Assistant. According to the different commands given by the user the car will move in front, back and left, right directions. This microcontroller provides all the functions of wireless control. In this project we are using H Bridge which would be helpful for the movement of the car. The H Bridge is used to control the direction of the motors used for moving purpose. This car takes the input from the Google Assistant, sends this data to Adafruit.io using the IFTTT Applet which is communicating through Wi-Fi and performs accordingly. Using IFTTT (If This Then That) we create our own applets and connect them with the Adafruit.io cloud server. A trigger is created and then connected to an action to perform our specific task. The input from the user is taken through Google Assistant. A camera is used for live video monitoring and to control the robot's direction. This camera is connected for detection of objects that is then streamed to the user's smartphone or monitor display.

In daily life such robots can be used for navigation and for control guidance to a certain position, surveillance and security purposes.

2. PROBLEM DEFINITION

The aim of this project is the design & development of a voice-controlled vehicle based on Wemos D1 R2 microcontroller. The proposed system is designed on Wemos Board using Google Assistant, IFTTT Mechanism and Adafruit.io Servers, which will be connected to the smartphone via Wi- Fi. The camera mounted on the vehicle will stream live video on the user's smartphone or monitor display. The ultrasonic sensor detects any obstacle in the vehicle's path and avoids collision. The GPS tracker locates the position of the vehicle on the satellite map and the Flame Sensor notifies the user in case of fire.

3. LITERATURE SURVEY

Various researches have been made by different researchers in developing this kind of projects. However, they already serve a different application and have different technologies and implementation methods. Some of those papers are mentioned below stating their technologies and application.

The paper titled "Voice Control Robot Using Android Application" presents the project which is designed to manipulate a robot by speech commands and manual controls for remote operations. An ATMEGA32 micro controller is used along with a Bluetooth device to compute

the control unit for sensing the signals transmitted by any Android application. It passes control commands through Bluetooth. The Bluetooth has definite features like controlling the motor's speed, sensing and distributing the information with smartphone. It also passes information about its direction and distance from the nearest hurdle [1]. The paper titled "Voice Control Robot using Android Application" in the International Journal of Engineering Innovation & Research uses an android app which is used to identify human speech which is transformed to text. This text is further processed and used to manipulate the robot car. This text is transferred to the robot car using Bluetooth technology which is further processed by the micro controller to direct the robot accordingly. Using this system, we performed various studies on control mechanism for robots [2]. In the paper "Voice Command Based Robotic Vehicle Control" the robot is a locomotive robot vehicle whose locomotion can be controlled by the user by giving definite voice commands. The speech received by the microphone is processed by the voice module. When a command for the robot is identified, then voice module passes out a command message to the robot's microcontroller. The microcontroller reviews and analyzes the message and takes corresponding actions. The aim of this project is to bring out hearing AI sensor and also the speech recognition to the robot such that it is competent to interact with users through Spoken Natural Language (NL) [3]. The paper titled "Speech Recognition System for A Voice Controlled Robot with A Real Time Obstacle Detection and Avoidance" puts forward a contrivance which can be used in manipulating a robotic vehicle through voice input. The voice recognizer platform is an Android mobile phone which interacts with the robot using Bluetooth. This method allows for precise recognition and uninterrupted data transfer. Additionally, the robot also has the capability to detect obstacles and notify the user. Our proposed mechanism will be useful for applications such as assistive robots for people with disabilities or in industrial applications such as work robots [4]. The paper titled "Implementation of Voice Controlled Robot Using Android Application" involves a system where the human voice is a main root to control devices. With the help of an android mobile app, human voice commands are identified and are then processed to achieve the corresponding control of any real-world device. By the easy use of an efficient control system using the Arduino microcontroller board, the HC-05 Bluetooth module and a simple user interface based android mobile phone; voice application the control of the robot is achieved [5]. The paper titled "Voice Controlled Robot" involves the way a robot works when the voice input is given. This paper expands on how a robot interfaces with user with voice command given by the user. It elaborates on how the whole process happens and suggests the use of an android smartphone to control a robot via voice commands [6]. In the paper titled "Remote Voice Controlled Robot" the robot will move in accordance to the voice commands given by the user. This robot is designed using Raspberry pi 3 and it is controlled by an android mobile. This can be moved in forward and reverse directions using 60 RPM geared motors. Also, this robot takes sharp turnings towards left and right directions. By using a voice commands given by the user will be recognized by the android application. This robot takes the instructions from the android mobile which is communicating through Bluetooth and act accordingly. A camera is used for live video monitoring and to control the Robot direction [7].

4. WORKING

4.1. CREATING AN APPLET ON IFTTT

Firstly, an applet is created in IFTTT app. For this applet, a voice command is created that will make the robot move in a given direction. Following are the steps to create an IFTTT applet:

1. Click +This.
2. Type "Google Assistant" on Search service text box and select Google Assistant widget.
3. Select the phrase with both a number and a text ingredient trigger. It creates a trigger that shoots every time you say "Ok Google" followed by a phrase with a text ingredient and a number ingredient.
4. To complete the trigger, you have to define the phrase you want to say. IFTTT allows you to define more than one phrase as a trigger. The text ingredient is represented by $ and # the number ingredient. We defined the following commands: Turn $ # degrees, Move $ #.
5. Also define the message it will say in response if it understands your command. We have configured it to Say "Turning $".
6. Now choose +That.
7. Type "adafruit" and select Adafruit > Send data to Adafruit IO. This sends data to a feed in your Adafruit IO account whenever the trigger you defined previously (+This) is fired.
8. Configure "voice command" as the Feed name. Choose "Add ingredient" in the "Data to save". Also add the TextField and NumberField. Add ":" between them.
9. Applet is ready to be launched.

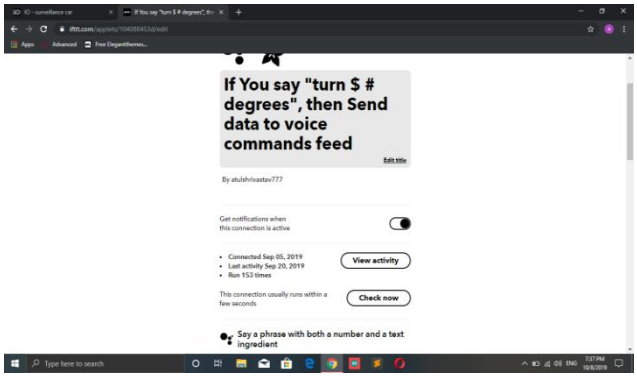

Fig -1: Successful creation of Applet

4.2. CONFIGURING ADAFRUIT.IO FEED

Under Feeds > Create a new Feed
Add a new feed named "voice commands". It will create a database, and it will be used to store the commands received by the gadget.
The idea is very simple here- IFTTT has some commands which are preconfigured and it will send some data to Adafruit.IO platform when a particular given logic is true. The data stored in the gadget will be able to read in a given feed on Adafruit.IO, execute some logic and perform some actions.
Also copy the Adafruit.IO key, which will be later used for allowing your device to access the database.
Navigate for Settings > Then view AIO key and then copy the active key code.
After updating the parameters like IO username, IO key, Wi-Fi SSID, and Wi-Fi password, upload the Arduino code and run it.

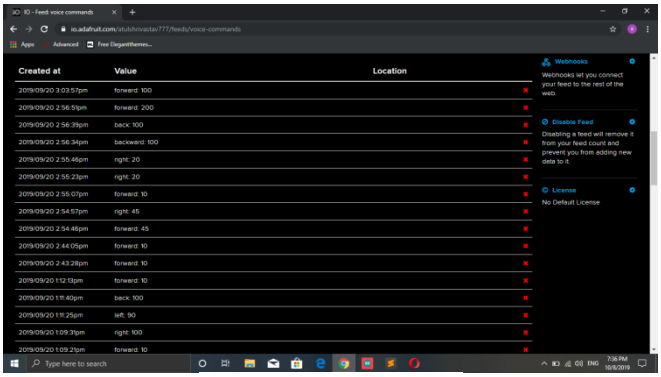

Fig -2: Adafruit.io Feed

4.3. TESTING THE CAR

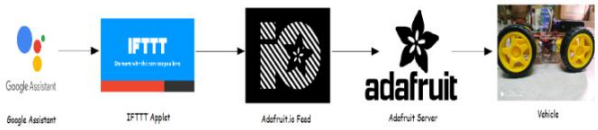

Fig -3: Working

After configuring the Adafruit.io feed, and configuring IFTTT, launch the Google Assistant on your smartphone. After pressing the microphone icon on the app or by just saying "Okay Google", it will start listening to your commands.

Say one of the phrases that were configured before- Move (forward/back/right/left) (number). If Google Assistant understands what you've said, it will send a message to an Adafruit.io feed using IFTTT app. The ESP8266 board will listen to the feed to see if a new message has arrived, if yes, then it will split it in two parts- a command and a number.

The command string will assume one of the following given values: left, front, back or right, and it will be used to select appropriate direction of each track. The number part represents the angle of rotation if 'left' or 'right' command was received or the distance it has to move if 'forward' or 'back' command was received.

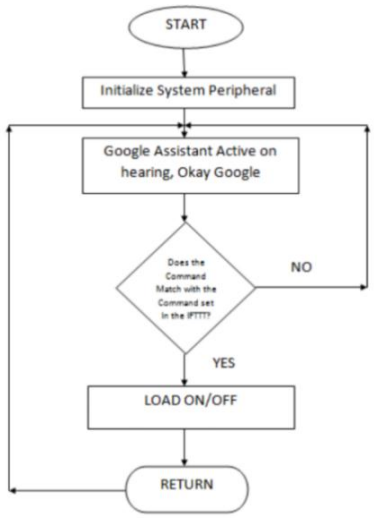

Fig -4: Google Assistant Mechanism

4.4. CAMERA SETUP

The Wi-Fi Camera is mounted on the surveillance car is a video surveillance camera used for the purpose of observing an area. It is connected to a recording device like a smartphone or a monitor. This mini Wi-Fi camera is used to detect motion if any, captures the picture. It can be used to remotely view live video from smartphone and PC. It has intelligent motion detection.

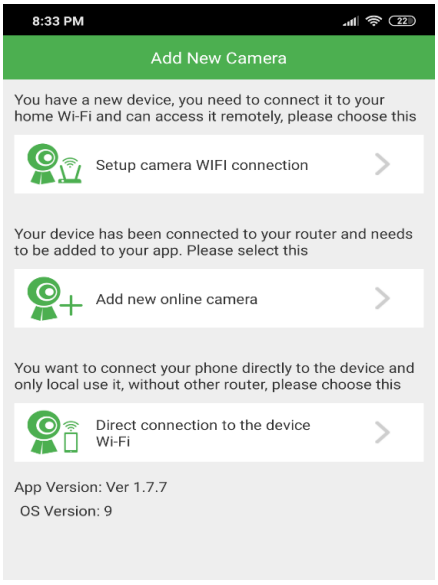

Fig -5: Camera Setup

4.5. CAMERA CONFIGURATION

The Wi-Fi camera which is used has its own Wi-Fi network which is to be connected to the device on which the live stream or recording is to be monitored. After connecting to the camera's Wi-Fi, we need to add a new camera which will allow the remote access to the device. It provides three

options to select from- Setup camera Wi-Fi connection, add new camera or direct connection to the device Wi-Fi.

After the camera is connected to the device, the user needs to open a mobile application named "HDMiniCam Pro". There it shows a screen where users can select from multiple screens to watch from or it can even be just a single window. Below on the screen, there are various options to select like – Live stream, recording, snapshot, alarm. After opening a specific screen, it leads the user to the actual live stream monitoring section where the user can see the exact location of the surveillance car, and what objects lie in front of it.

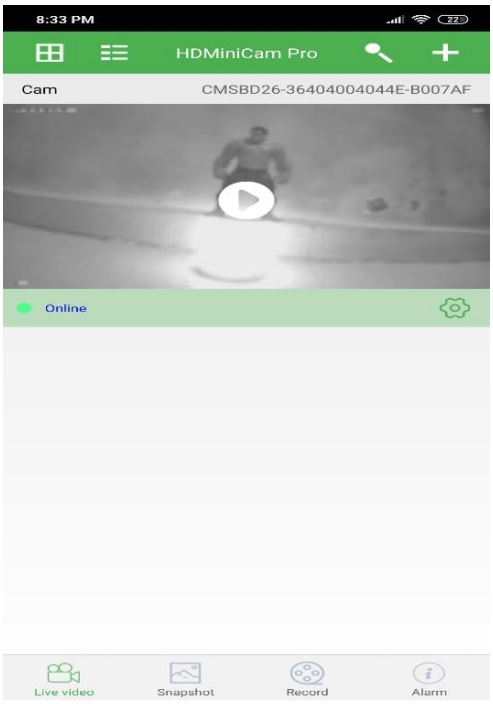

Fig -6: Features of HDMiniCam Pro

After opening a specific screen, it leads the user to the actual live stream monitoring section where the user can see the exact location of the surveillance car, and what objects lie in front of it. One can also record the complete live stream and use it for future references. It can also click a snapshot of a particular screen for saving any possible proof or evidence. This camera has an added advantage i.e., it has inbuilt night vision. So, if this car has to enter some dark area, it can still transmit the live stream without any inconvenience or without adding any kind of light emitting equipment.

Fig -7: Livestream on smartphone

Fig -8: Camera Working

4.6. OBSTACLE DETECTION AND AVOIDANCE

The intent of this feature is to secure the vehicle from any obstacles or hurdles in its path. For this purpose, an ultrasonic sensor is used. The ultrasonic sensors measure distance of any object by using sonar waves. The sensor emits the sonar wave and receives the wave reflected from the target object. It measures the distance to the target object by measuring the time between the emission and the reception.

This project makes use of 3 ultrasonic sensors to precisely identify any obstacles in the front, left and right side of the vehicle. All the three sensors have different connections and are used to navigate the vehicle automatically. After connecting all the three ultrasonic sensors to the Wemos board, the vehicle is ready to detect, identify and avoid obstacles in its path.

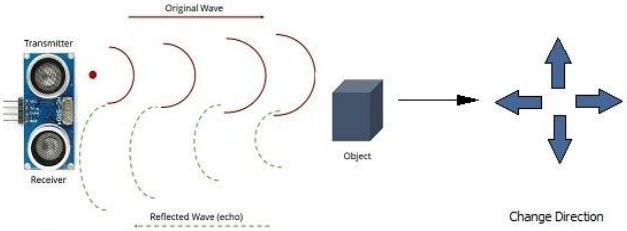

Fig -9: Obstacle Detection

4.7. LOCATION DETECTION

For the detection of vehicle's location, a GPS tracker is mounted on the vehicle. This GPS tracker will track the

position of the vehicle in real time. For this purpose, Google Maps integration on the Blynk is used. The location of the vehicle along with its longitude and latitude is displayed on the map.

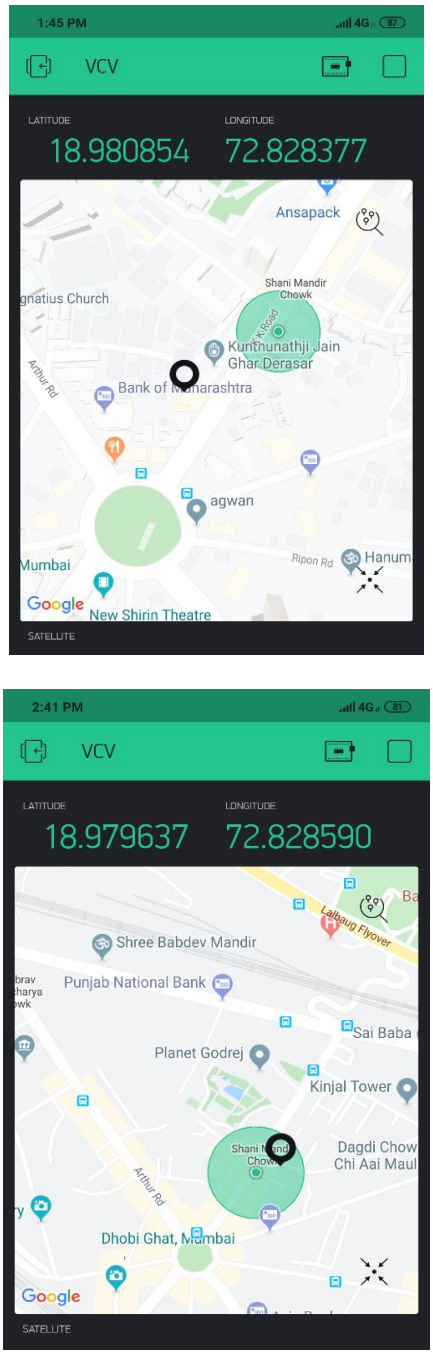

Fig -10: GPS Tracker

4.8. FLAME DETECTION

A flame sensor is a detector which is especially designed for detecting and also responding to the occurrence of a fire or flame. The responses depend upon its fitting. The response of those sensors is quicker also as more accurate compare with a heat/smoke detector due to its mechanism while detecting the flame. It monitors the heat radiation that is generated by fire and open flames, with a response time of roughly 3 to 5 seconds. As it works within the infrared spectral band, these flame detection systems have a sensitivity range between approximately 4.3 to 4.4 micrometers. It can detect flame or wavelength of a light source within 760nm~1100nm. The lighter the flame, shorter is the test's distance. The detect angle is 60 degree, which is very sensitive with flame spectrum.

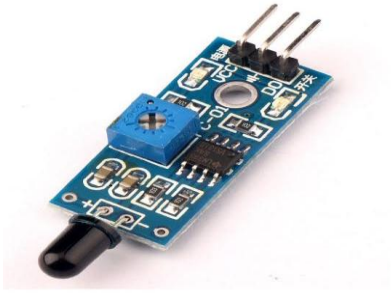

Fig -11: Flame Sensor

5. APPLICATIONS

1. **Radioactive Locations:** This surveillance car can reach in radioactive places, where humans cannot enter. Using the camera, it can transmit video. It can also be useful for research purposes.

2. **Near Harmful Gases:** The Robot car can enter places where the humans find it difficult to enter. For e.g. Places where harmful gases are spread in the atmosphere.

3. **Enter Prohibited Territories:** This vehicle can quietly enter enemy territories where human trespassing is prohibited. This helps in spying over the enemies and learning their strategies.

4. **For Industrial Purpose:** This voice-controlled car has important application in industries where user can control the robotic vehicle via voice commands. Also, it can detect any fire in case of an explosion.

6. RESULTS

The car moves in the forward, back, left and right directions on receiving the corresponding voice commands. The result was positive, and the system responded well. The diagram below shows the complete prototype implementation of the proposed system. This project presents the design and implementation of an intelligent voice-controlled car which is used for industrial purpose with live video monitoring. The camera also provides live stream with night vision for places with low light or no light at all. This night vision is an added advantage to this project which makes it a lot more flexible. The camera also has an inbuilt microphone which makes it possible to hear any kind of noises happening in that surrounding in a particular range. The advantage of this

feature is that if this car is sent to a terrorist camp or any kind of enemy territory, it makes it possible for us to hear any kind of strategies or planning that terrorist group is plotting, and accordingly we can strategize our defense mechanism. This represents for safety and security purpose for detection and video monitoring.

An Embedded C programming language is used with serial libraries. This project completely reforms the robotic vehicle and gives it a new dimension. It can easily recognize the voice commands and runs smoothly. We were successful in building this project in a very low cost and efficient way.

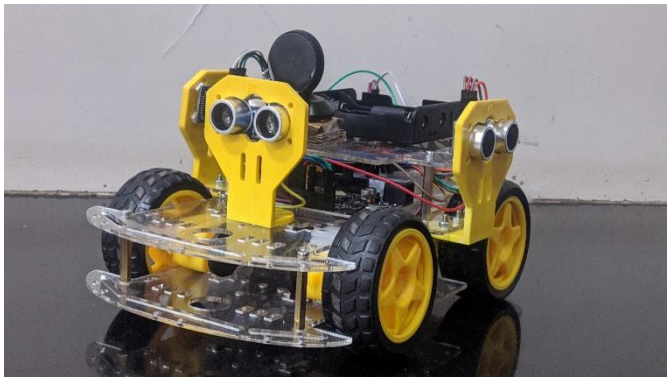

Fig -12: Actual representation of the vehicle

7. CONCLUSIONS

The proposed system shows how Google Assistant can be used as speech recognition software for this vehicle. Google Assistant along with IFTTT mechanism and Adafruit.io Feed as well as Server can be very effectively used to communicate with the car via Wi-Fi technology. The camera mounted on this car can record and snap pictures of any possible evidence as proof which can be utilized in surveillance process. Also, the live stream feature on this car can rule out possibilities of any future terror attacks. The proposed system also shows that how a robot can be used for obstacle detection and avoidance. The GPS sensor detects the location accurately on the map shown on the smartphone and the Flame Sensor also detects fire in the range of the vehicle and notifies the user.

The aim of this project was to propose a cost-effective voice-controlled surveillance car. The approach discussed was successful as the Voice Controlled Surveillance Car's design was successfully implemented. This system is highly reliable and efficient for the spying on places that one cannot reach physically.

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