IOT BASED VOICE CONTROLLED HOME ASSISTANCE HEXAPOD

NIKHIL SUBRAMANIAN|SHANJU SHRI MN| ROHITRAM V| DR SRIHARIPRIYA KC| SENSE

Introduction

The IoT based hexapod is designed in such a way that it acts as a companion to humans while performing tasks for them. Hexapod robots have 3 pairs of legs which is an advantage compared to wheeled robots since this robot can easily navigate even through rough and uneven surfaces. Google Assistant is connected to the system to accept voice commands from the user. Voice based navigation is an added advantage for old aged people. An important feature of this robot is surveillance, the camera attached to the hexapod helps in monitoring the home from anywhere using video streaming. Automation of electronics is done based on the commands given by user for which Adafruit and IFTTT platforms are used.

Motivation

The project aims at building an automated six legged hexapod that responds to voice commands to perform tasks.The movement of the hexapod is controlled by an arduino using the servo motors attached to each leg. The Lidar is used to collect data about the obstacles lying around the home while mapping the whole house.For mapping, the hexapod is manually controlled using a joystick. Google Assistant intakes the voice commands given and processes it before passing it to the NodeMCU which then pushes the data over to the Adafruit Platform by using the MQTT protocol..Adafruit along with the IFTTT platform is used to automate the electronics in the house based on the voice command received from the user. Live video is also streamed for surveillance purposes.

Methodology

A. Mapping

The shortest distance between the start point and the target point is calculated using a map based planning method in which the shortest distance is chosen based on the lowest movement cost. The detailed mapping of the house is done using a LIDAR mounted on the top of the hexapod. The LIDAR sensor works based on the pulsed light waves that it emits into the environment from a laser. These pulses then enter the sensor after bouncing off from nearby objects.The hexapod is manually operated using a joystick to navigate through the maze to draw a predefined map of the rooms as shown in Fig.5.

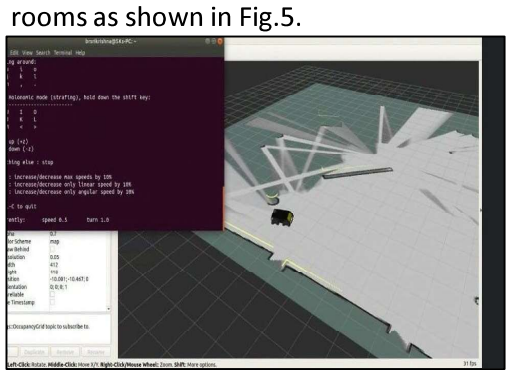

Fig. 5. Mapping the rooms by manually operating the hexapod.

Fig. 6. Image of dining room captured

Fig.7.Image of entrance of bedroom captured by the hexapod camera

B. Surveillance and live streaming

The surveillance is done using a Raspberry Pi camera module. The camera is mounted on top of the hexapod for a better Field of view. Camera module is enabled in the Raspberry Pi in order to use the camera. The camera is connected to the Pi CSI port. After setting up the camera, the video streaming web server is accessed at the Raspberry Pi's IP address to monitor the house from anywhere and at any time.

C. Voice navigation and automation

Fig. 8. Adafruit dashboard.

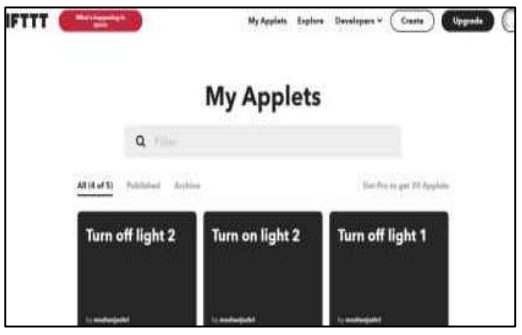

Fig. 9. Applets created in IFTTT.

In the Adafruit platform a new dashboard named 'Automation' is created and two triggers are added to it. The triggers are named Light 1 and Light 2 with values 0 and 1 for switching ON and switching OFF respectively. The Fig.8 shows the dashboard with two triggers. The Fig.9 shows the applets created in the IFTTT platform which triggers the functions to turn on and off the lights based on the given commands.

Result

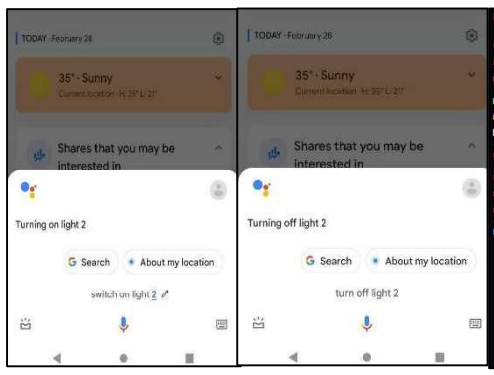

Fig. 15. Voice commands given to Google Assistant to turn on and off light 2.

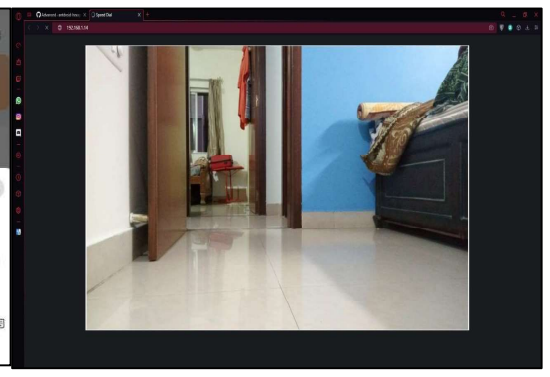

Fig.14 Live streaming

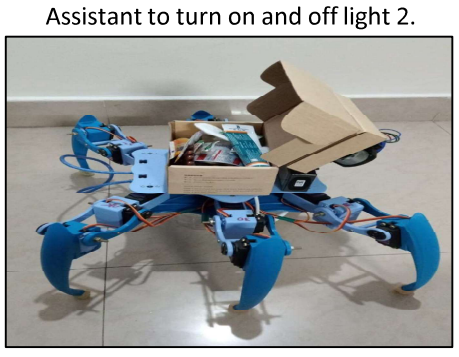

Fig.13 Hexapod carrying medicines to the user.

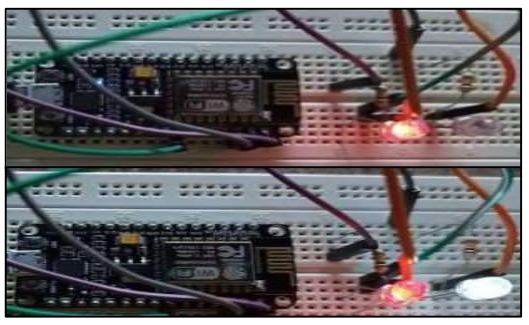

Fig. 16. When one of the LEDs is turned ON.

Fig. 17. When both the LEDs are turned ON.

- The hexapod functions successfully and expected results are obtained. The hexapod reaches the target destination to work on the task given as command. The hexapod moves easily through rough terrains in a stable way even when it's carrying medicines as shown in Fig. 13. Thus, it is able to carry things without them falling off the hexapod.
- The camera in the hexapod captures the images and video is streamed in the website. The following image Fig.14 represents the screenshot of the live streaming page. Thus the user can monitor the house from anywhere.
- The voice commands are given using the Google Assistant to turn on the lights in the room. Google Assistant passes the commands to the system and responds to the given commands as shown in Fig.15.
- LEDs represent the electronics in the rooms. When the user commands the LEDs to turn ON and OFF, the tasks are performed accordingly. Fig.16 and Fig.17 represent when light 1 is turned ON while light 2 is turned OFF and both the lights are turned ON respectively.
- Home Assistance Hexapod shows some similarities in developing and controlling the robot, but the features and application are vastly different from the previous works. This robot is specifically built to act as an assistant for people at home with features like carrying things, automating electronics and surveillance. Unlike the sensors used in other works, Lidar has a large measurement range and the accuracy is also very good.

Summary

The home assistance hexapod acts as a perfect companion and assistance for people at home, especially for sick and elderly people to meet their needs. The main objective of this system is achieved by integrating the Internet of Things with robotics successfully. The camera attached to the robot works effectively for monitoring the home even when the user is not at the site. Voice controlled automation proves to make the hexapod more user-friendly.This work can be further improved by integrating it with more sensors like moisture sensor, temperature sensor, gas sensor to detect the moisture level in the soil to notify the user regarding watering plants, to automate turning on/off air coolers, and to notify users in case there is a gas leak. Machine learning algorithms can also be applied on the captured videos to identify faces and allow people inside the house.

Contact details

rohitram.v2018@vitstudent.ac.in, nikhil.subramanian2018@vitstudent.ac.in, mn.shanjushri2018@vitstudent.ac.in

Reference

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