



Object Detection and Tracking Robot using Android, Arduino and Open CV

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Abstract—The following Project aims to implement a robot which can detect motion and follow an object at the same time. This can be considered as a prototype for developing advanced models based on automated home security systems. The project will be implemented with the help of Arduino nano board integrated with bluetooth support with dc motors for the steering and movement of the robot. The application interface for the steering can be implemented using open cv libraries and an application for android.

Keywords— Arduino Nano, Open CV, Android, Servo Motor, Detection, Tracking

I. INTRODUCTION

The Common use of technology has led man to create new ideas everyday with the currently existing eco system and the resources. With the most common technology available with everyone is the smart phone. Most people intend to use the android smart phones nowadays because it is affordable and available with different models and manufacturers.

This also shows us the importance of how much we are using an open source technology in our lives every single day. This project is created mainly to show that using common technology available to the common people we can create a robot which can be used for detecting objects and tracking them.

The above process seems a bit costly when you hear the word Robot, Object detection and tracking . However this project utilizes the most efficient, affordable and easy to use and learn modules to create a robot which is capable of detecting an object and moving back and forth all by itself.

The common idea is to create an android application which is built using the native java language and uses libraries given by Open Computer Vision, Or Open CV. These libraries provide a wide variety of modules which are integrated into the application to implement object detection and tracking in real time.

Secondly comes the hardware components which are commonly found in a lot of electronic shops as well as with online retailers. We use an Arduino Nano which is efficient, Portable and easily affordable among most Arduino boards available. An Arduino is an open source Micro controller board which can be programmed according to the programmer or user's necessity. We use the Nano with a Blue tooth module which will pair the Android device containing the application. Once paired, a camera interface on the phone becomes the eyes and the brain of the entire robot, and basically the other wheels and motors become its body parts.

II. LITERATURE REVIEW

Most of the robots created nowadays are using complex hardware which are non user friendly and considerably costly.

1 Android Application Development - Yevheniy Dzezhyts (Business Information Technology) 2013 depicts "Nowadays, the gadgets are rolling the world. Many people cannot imagine even one day without their favorite mobile device. We use them for everything: find information, stay connected with our friends and families, find the way around, decide what to do, and many other things. But very often we come to the point when we would like to have an application for particular situation or for certain need, but there is no such one. Developing of an application usually takes lots of time and needs professional knowledge of software. And then as people do not find the application they tend to wait until somebody is developing one, or they have to go to the web and ask people to implement their ideas. On different forums there are tons of brilliant ideas but they will wait until developers will see them. On the other hand there are lots of enthusiastic developers who are looking for ideas to implement them. "

2: Wiradani, Md Ali (2010) Motion Tracking System Using Computer Vision With Opencv Source Software. Project Report. UTeM, Melaka, Malaysia.

"Nowadays motion tracking widely used for some field, especially autonomous field. The motion tracking also has been used for securities. At the Oversea for example United States of America use the motion tracking in army usage. This project purpose is to do the motion tracking using the OpenCV software. The motion tracking is the camera will detect and track the object movement. This project will include the research for the related previous work as a reference to done the motion tracking method. The related previous work will cover in the literature review, the method used are research based on the scopes of this project. This scopes project is only cover the color based, optical flow and feature extraction image processing technique. The methodology chooses for this motion tracking use is edge detection under the optical flow technique and the color based will used the segmentation technique. The methodology chooses is based on the research has been done and the techniques is efficiencies and many of the work done by using this techniques."

III. PROPOSED PLAN

A. Architecture

In the following diagrammatic architecture we use an Arduino Nano Board to an L298 Motor driver shield which is connected to two motors namely left and right. There is a bluetooth module mounted on the Arduino nano which enables a user to connect a smart phone with the Open cv application installed on it.

EXPECTED ELECTRONIC CIRCUIT SETUP FOR THE PROJECT

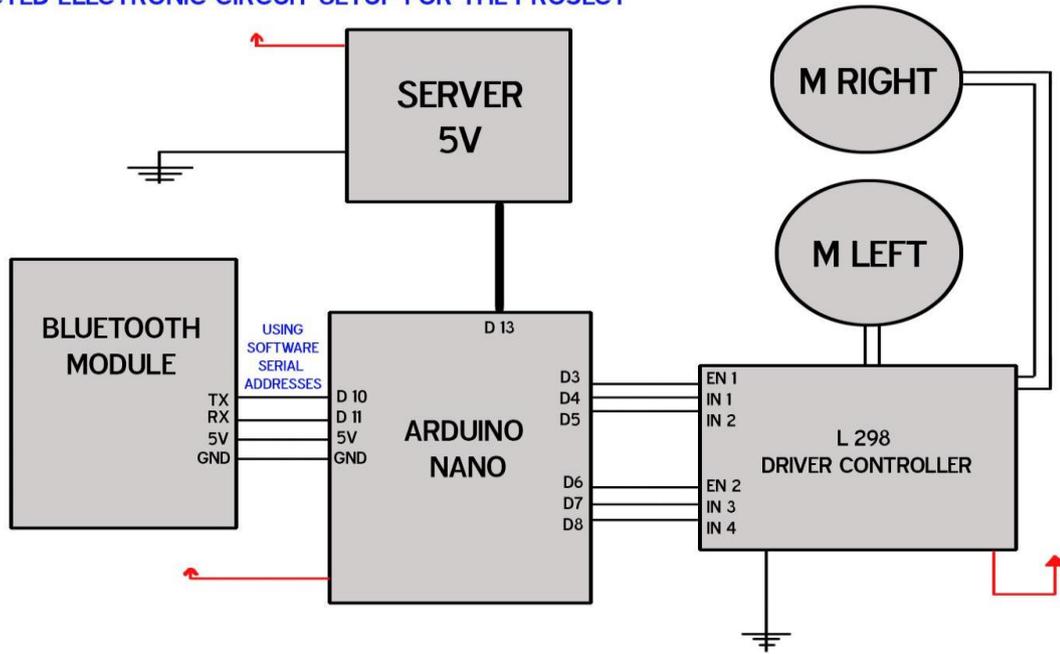


Fig.1 System Architecture

1. *Pairing the Blue tooth device with the android smart phone*The Bluetooth module mounted onto the robot is turned on, and concurrently the bluetooth of the phone is turned on to scan and pair the nearby devices, this scanning is done by opening the application which is developed for object detection and tracking .

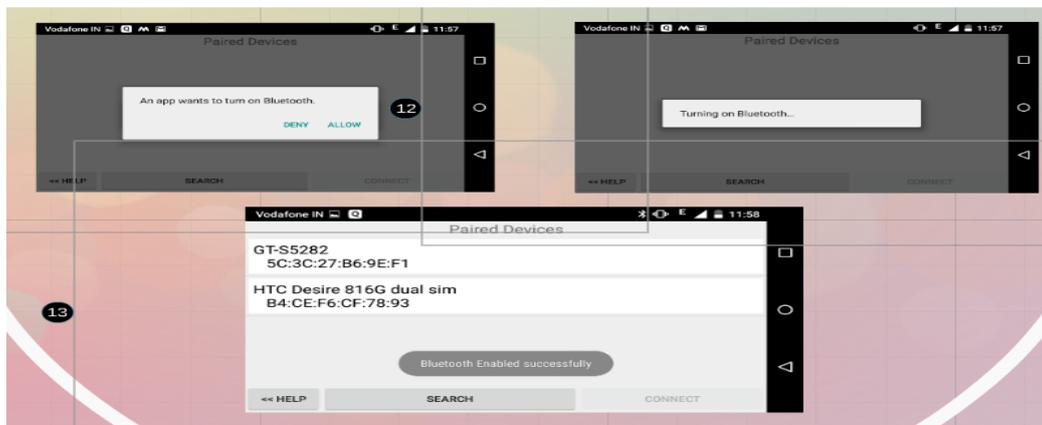


Fig.2 Screenshots for Blue tooth pairing.

2. Detection

In this module the object is detected by the robot in its camera interface, and it will determine a contour area of the object by tracking down the color and size of the object by the HSV Spectrum analysis module provided by the Open cv libraries inside the android application.

3. Tracking

In this module the object’s distance is calculated and taken as float values and is followed until the object is close enough for the robot to stop tracking. I.e. if it is too close to the object the robot will stop at its current position to avoid collision.

4. *Object Lost*

This module enables the robot to detect the object as lost. If the object is too fast to track , or it is lost due to unavoidable reasons the robot will stop at its position and make a turn of 360 degrees , indicating the user that the object is no longer under tracking.

5. *Multiple Objects On the Screen*

If there are multiple objects on the camera screen, the robot will still be following only the detected object and it will not track any other objects in front of it unless there is a change in the decision by the user. (Ie to track another object)

This is basically achieved because of the Open CV library where a small contour or area of the object to be detected is analyzed by the robot by referring the objects size and color from the HSV color spectrum. However once it has detected the object these contour values are added into an array which is stored in a cache funtion and tracked until another object is given as the newer object to track. The advantage of the cache module here is to preserve the current object and isolate the detection of other unwanted objects which has the same color or size which appears on the camera screen.

B. *Code for Bluetooth*

```
private class SearchDevices extends AsyncTask
<Void, Void, List<BluetoothDevice>>
{
    @Override protected List<BluetoothDevice>
doInBackground(Void... params)
{
    Set<BluetoothDevice> pairedDevices = mBTAdapter.getBondedDevices();
    List<BluetoothDevice> listDevices = new ArrayList<BluetoothDevice>();
    for (BluetoothDevice device : pairedDevices)
    {
        listDevices.add(device);
    }
    return listDevices; }
```

C. *Users of System*

1. *User*

The user just has to mount the phone into the top of the mounting space of the robot. The camera interface opens as soon as the bluetooth devices are paired.

to detect an object, Simply touch on to the object that is displayed in the camera interface of the smartphone mounted on to the phone. The rest of the operation will be automatically done by the robot.

D. *Advantages*

1. Portable, Easy to use and implement
2. Open source and flexible to adapt to new changes and implementations
3. Most traditional Robots intended for tracking and detection are Costly and have bulky Hardware, whereas in our case the robot is built using common electronic components widely available.

E. *Applications*

1. Covering Harsh Terrains for Research Work
2. Home Security and Monitoring
3. Open Computer Vision Development and Research on Portable Platforms
4. Can be used for Educational purposes in institutions to Teach about Robotics and Open Source Application Development.

IV. CONCLUSIONS

This research paper consists of the contents which highly gives the importance and the power of open source development and architecture. This project is intended for educational as well as research and development on Arduino Based Robotics with Computer Vision. In this research paper we have covered the uses, the importance and advantages of all the modules used, as well as igniting the power of Open source development.

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