IoT Based Facial Recognition Quadcopter Using Machine Learning Algorithm

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Abstract – *In this paper, a block diagram and algorithmic model is proposed on the basis of facial recognition and machine learning algorithm. The effectivity of facial recognition on Quadcopter is also shown in this paper. IoT is nowadays a very common word and anything can be controlled wirelessly from any global distance. Here the quadcopter is controlled using the internet of things so it is easy and flexible of range of control area. The implementation of the machine learning algorithm can make it faster and the processing efficiently of huge data for machine learning is also given in this paper.*

Key Words: **Internet of Thing (IOT), Raspberry Pi, facial recognition, machine learning algorithm, Quadcopter, Esp8266 etc.**

1. INTRODUCTION

The IoT is now the most common term in today's world. Here using this, the quadcopter can easily be controlled wirelessly the esp8266 is used for this, again raspberry pi has a build-in wireless connection module in it. Facial recognition algorithm needs huge processing power and applying machine learning algorithm on it needs a huge processor so the data is showed how it is sent to the server and the processing again the logical output for performing certain tasks.

1.1 EFFECTIVITY

The main purpose of this is that as it is IoT based controlled so it can freely move wherever it needed. Having a camera with facial recognition algorithm is mostly benefited is because it can move such a height and distance freely, it can also track any people, object easily where the normal camera is fixed in a particular position. Moreover, this can avoid obstacles where a normal camera is failed to avoid. The proposed model shows all the ins and outs of this quadcopter.

2. PROPOSED SYSTEM

The following figure shows the architecture of the project and its implementation.
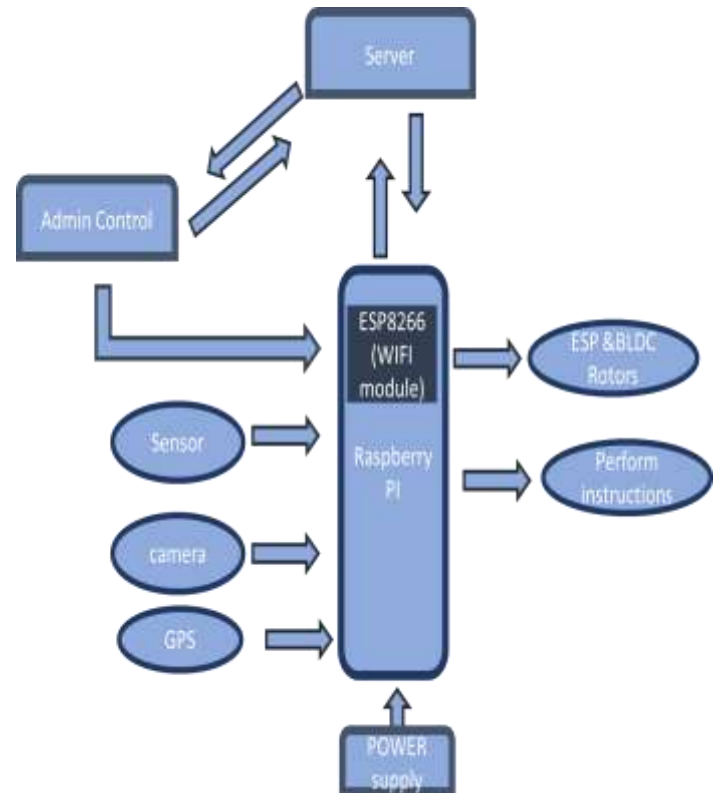
Block Diagram of Proposed System

3. WORKING METHODOLOGY

- In this proposed system the main processing power is raspberry pi. It is a very cheap computer that runs Linux and it also has GPIO (general purpose input/output) pins which allow controlling components. Here the quadcopter is controlled through these pins and all those logical instructions given from admin will execute by this.

- Raspberry Pi is Linux supported so it can easily run C, C++.Python language. Here Python is most efficiently used for this system. Because Python has many built-in machine learning and facial recognition algorithms. The most common facial recognition algorithm in python is Open CV. Therefore, using this library in python, the quadcopter can easily gain facial recognition ability. There is also a library in Python called NumPy. By

using this library, the image data is sliced into arrays and the images are nothing but 2D of arrays. So, all of these would be possible through Python.

- Raspberry Pi has a built-in Wi-Fi module which will help us to gain IoT control. Esp8266 can easily connect to Wi-Fi or the internet, so the quadcopter can be controlled from anywhere in the world. This module will be also used to transmit and receive data from the server. As images are a huge amount of data and the machine learning algorithm needs more processing power so in order to enable the full capability of the quadcopter the data needs to send to the server and process there.

- Control panel can easily control the quadcopter from the help of server or directly to the raspberry pi if it is in a certain range of the Wi-Fi module ESP8266.

4. COMPONENTS AND SOFTWARE

4.1 HARDWARE

a. Raspberry Pi:

The Raspberry Pi is a small pocket-size computer used to do small computing and networking operations. It is the main element in the field of the internet of things. It provides access to the internet and hence the connection of automation system with remote location controlling device becomes possible. Raspberry Pi is available in various versions. Here, model Pi 2 model B is used and it has quad-core ARM Cortex-A53 CPU of 900 MHz, and RAM of 1GB. it also has 40 GPIO pins, Full HDMI port, 4 USB ports, Ethernet port, 3.5mm audio jack, video Camera interface (CSI), the Display interface (DSI), and Micro SD card slot.[1]

b. ESP8266 Module:

The ESP8266 is a low-cost Wi-Fi module consists of a Wi-Fi chip with full TCP/IP stack and microcontroller chip manufactured by M/S Espruino [2]. ESP8266 uses serial transceiver (Tx/Rx) to send and receive data in Ethernet buffers, and serial commands to query and change configurations of the Wi-Fi module. It only requires two wires (Tx/Rx) to communicate between a microcontroller and a Wi-Fi module. It offloads Wi-Fi-related tasks to the module, allowing the microcontroller code to be very light-weighted. Wi-Fi Module is addressable over SPI and UART, making it easy to build an Internet of Things application. We use AT commands to connect to Wi-Fi networks and open TCP connections without the need to have TCP/IP stack running in our microcontroller. By just directing

connecting the microcontroller to this module, we can start pushing data up to the Internet (Central server). [3]

SOFTWARE:

a. PHYTHON:

There are a large number of reasons for python to be considered as a popular language for machine learning. As stated by Harrington (2012) Python is a simple and elegant language with clear syntax having extremely easy text manipulation and processing capabilities and a rich community of developers leading to the availability of ample documentation. Python also comes with an interactive shell that allows the programmers to examine and view elements of a program simultaneously while writing the code. Python has been equipped with high-level data types like lists, queues, tuples, dictionaries, etc. that make it easy to implement abstract concepts and do not need to be programmed explicitly by the programmer. Machine learning could also be easily implemented using other high-level languages like MATLAB that provides a number of built-in features for performing matrix mathematics but it is not an open-source language. Moving towards languages like C and Java, matrix math libraries are available for them as well but it requires a lot of code to perform simple things in these languages. These limitations have been overcome by python that is an open-source, clean, brief and easy to read language with the availability of a large number of libraries and packages that make python more popular in various domains including scientific and financial communities. Moreover, python does not require expert programming skills to catch up with its code, even non-programmers could easily learn and code in python.[8]

According to official python documentation, Scikit-Learn is a simple, efficient and powerful tool that provides various machine learning algorithms for classification, clustering, regression, model selection, etc. It is an open-source library easily accessible to anybody and usable in many contexts. To work with Scikit-Learn, NumPy must be installed along with SciPy and Matplotlib. NumPy is used to work with arrays; Matplotlib is used to plot graphs, Keras for Preprocessing image, NLTK for wordnet, Pandas for reading CSV data file, Pyttsx for text to speech, Text blob for sentiment analysis, chatterbot for chatting application and PIL for image manipulation.

Machine learning has improved the quality of life of humans by providing several applications to facilitate human living. Among the numerous

applications of machine learning in the field of health, science, industries, etc. is the timely detection of diseases such as cancer, glaucoma and other diseases which are claiming human lives at a jaw-breaking rate, the visualization of smart cars, effective web search which has made the internet searches easier, language translations are immensely helping in worldwide communications and limiting the great language barrier among countries, realization of fraud detection and face recognition systems to mention but a few are greatly helping to improve the quality of life of humans. It is in this regard that Machine Learning has remained significant over the years.[7]

b. OPEN CV:

OpenCV stands for Open Source Computer Vision Library and is designed in C & C++ specifically for increased computational efficiency and supported by most Operating Systems [4]. Example applications of the OpenCV library include Human-Computer Interaction (HCI), Object Identification, Segmentation and Recognition, Face Recognition, Gesture Recognition, Camera and Motion Tracking, Ego Motion, Motion Understanding, Structure From-Motion (SFM), Stereo and Multi-Camera Calibration and Depth Computation and Mobile Robotics [4]. The basic goal of the Computer Vision application is to make useful decisions about real objects in the scene.

Understanding any activity involves being able to detect and classify targets of interest and analyze what they are doing. In this PG project, a student demonstrates a process for detecting moving targets and extracting boundaries. The main purpose behind the project is to implement robust method to detect human if present in video under dynamic environment. This can be used as an efficient visual surveillance method. The software will monitor for movement or motion in a localized area. If motion is detected it will check for object whether it is human or nonhuman. We collected a total of indoor and outdoor video sequences captured from stationary cameras. The method implemented gives very good performance and detects human about 90% of time [5].

OVERVIEW OF THE UAV(Unmanned Aerial Vehicle) CHANNELS OF INTERACTION WITH THE PUBLIC COMMUNICATIONS NETWORK :

One or more UAV can be used for the tasks of data collection and transmission (figure 1). Autonomous UAV flight is performed on the basis of the flight task, which is pre-loaded into the controller (Kirichek et al. 2015). Although the full autonomy of the flight, the telemetry channel is typically used

for monitoring parameters of UAV and for supplying the emergency landing command. Given the fact that the maintenance traffic is transmitted in the channel – the channel utilization is about 60%, the channel resource remains small for efficient data transmission collected from WBAN.[9]
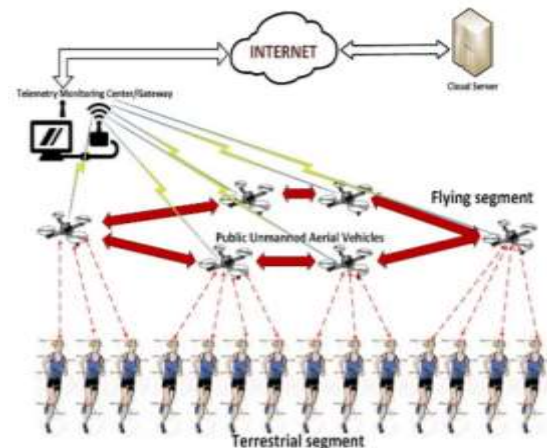

figure: Data Collection from WBAN Using One or Multiple UAVs

This shows how quadcopter can collect data and transmit it to server over a channel and get command and logical decision from the server.

MACHINE LEARNING ON SERVER:

Microsoft Machine Learning Server 9.4 includes specialized R packages and Python modules for developing and operationalizing solutions written in R and Python. Machine Learning Server 9.4 comes with version 3.5.2 of the open source R language engine and a run-time infrastructure for R script execution. On the Python side, it comes with an open source distribution of Python and run-time infrastructure for script execution. Machine Learning Server 9.4 also includes a rich set of highly-scalable algorithms such as RevoScaleR, revoscalepy, and Microsoft ML that can work on data sizes larger than the size of physical memory, and run on a wide variety of platforms in a distributed manner. Machine Learning Server bridges these Microsoft innovations and those coming from the open source community (R, Python and AI toolkits) all on top of a single enterprise-grade platform. Any R or Python open source machine learning package can work side by side with any proprietary innovation from Microsoft. Machine Learning Server runs on-premises and in the cloud on a variety of platforms, in a variety of deployments, and can support the need to have machine learning and analytics across multiple platforms, including clustered topologies for Apache Spark™ on Hadoop. On two data platforms, SQL Server and Apache Spark (on HDFS), the R and Python libraries from Microsoft can compute and analyze data locally, returning just the results, without the need to pull data across the network. This capability is called remote compute context. It requires the R

and Python libraries and interpreters from Microsoft on both client and server systems, but the client versions are free of charge [10]
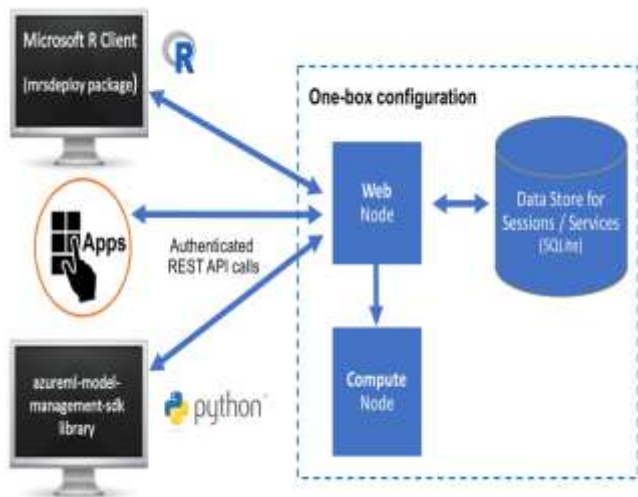

Figure: Machine Learning Server and its output[11]

3. CONCLUSION:

So, this IoT controlled quadcopter is more efficient in many ways. All these machine learning algorithms can be used in here by using this technique. As it transmits all its data to the server and the machine learning server will to all processing and just give a particular output to it .so the raspberry pi doesn't have to gain huge processing power it can just execute certain command send from the server or the admin. This can be used in such a huge extend of object finding, locating certain people. It can move freely and controlled globally so it can be used in large ranges. It is more effective than a normal CCTV camera to detect people and more efficient in obstacle avoiding. All those ways of how this model can be implemented are given in here. After all, it can extend the era of machine learning technology to such a great extent.

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