Students: Cristian-Nicolae Birla
Carla-Alexandra Olaru
Instructor: Claudiu Groza
Date: June 2018

Facial recognition camera

Detect the features of someone's face

1. Repository

The project history, schematics, diagrams and codebase are contained under the following git repository:

https://github.com/CristiBirla/MSProject

2. User requirements

1. The system must provide relevant information about a person that is in front of the camera.
2. The system should be open for extensions, eg. adding a LCD display.
3. The system should run in an environment that provides a 24/24 access.
4. The information will be sent as an email to a specific address.
5. The system must provide the in formation with a maximum latency of 10 seconds.
6. The system might provide access to all the pictures taken by the camera.
7. The system may provide a module for data interpretation.

3. System overview

The overview of the system is presented in Figure 1.

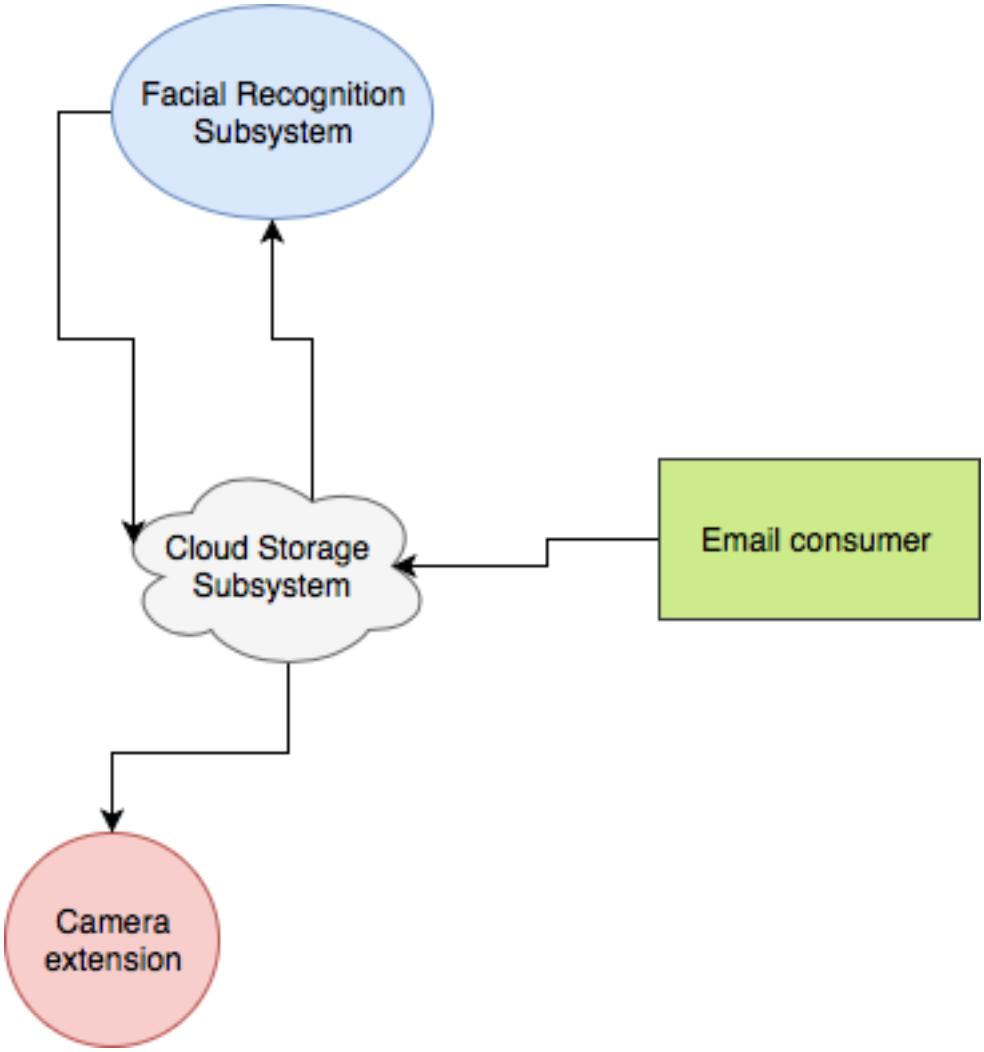


Figure 1: System overview diagram

Facial Recognition Subsystem represents the functionality of the camera. It's role is to gather information from it's extension and process it. Additionally it offers the possibility to interpret stored information.

Cloud Storage Subsystem stores the data pushed by the camera and the Facial Recognition Subsystem.

Camera extension provides an interface for taking pictures.

Email consumer provides a UI for the stored data.

4. Circuit design

The hardware view of the system is depicted in Figure 2.

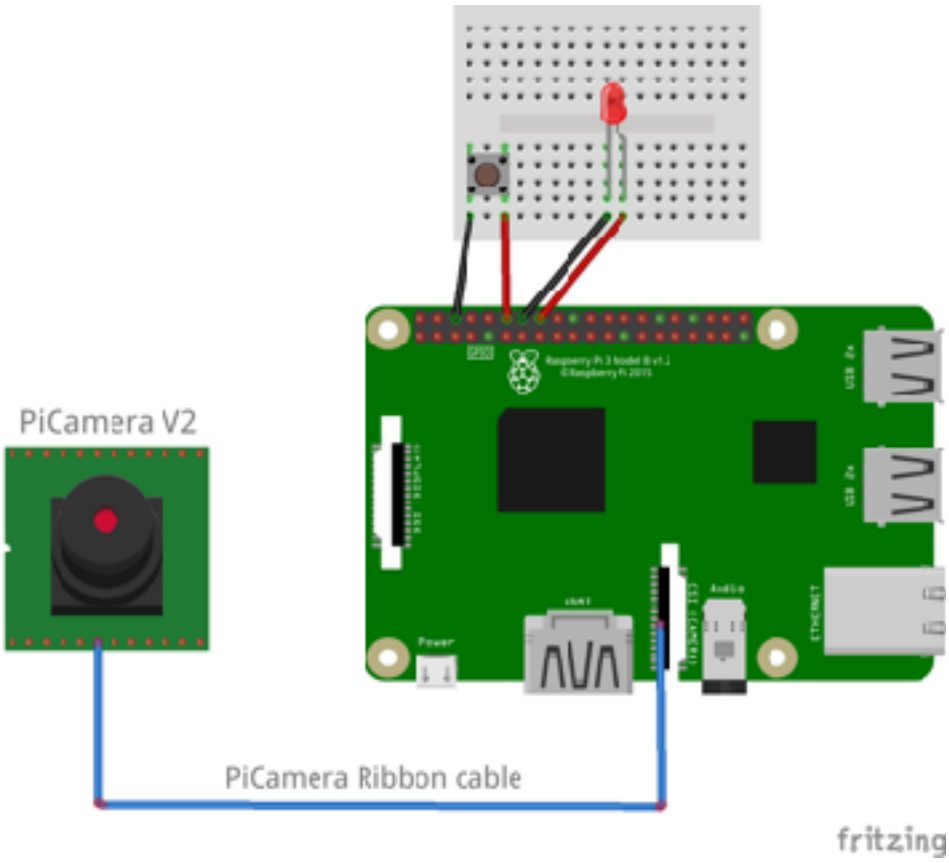


Figure 2: Circuit schematics

Raspberry Pi 3 provides support for quick prototyping. That makes it the perfect choice for quick prototyping but not adequate for real time applications.

The Raspberry Pi 3 Model B+ is the latest product in the Raspberry Pi 3 range, boasting a 64-bit quad core processor running at 1.4GHz, dual-band 2.4GHz and 5GHz wireless LAN, Bluetooth 4.2/BLE, faster Ethernet, and PoE capability via a separate PoE HAT, but also the the implicit possibility of communicating with other devices over the internet.

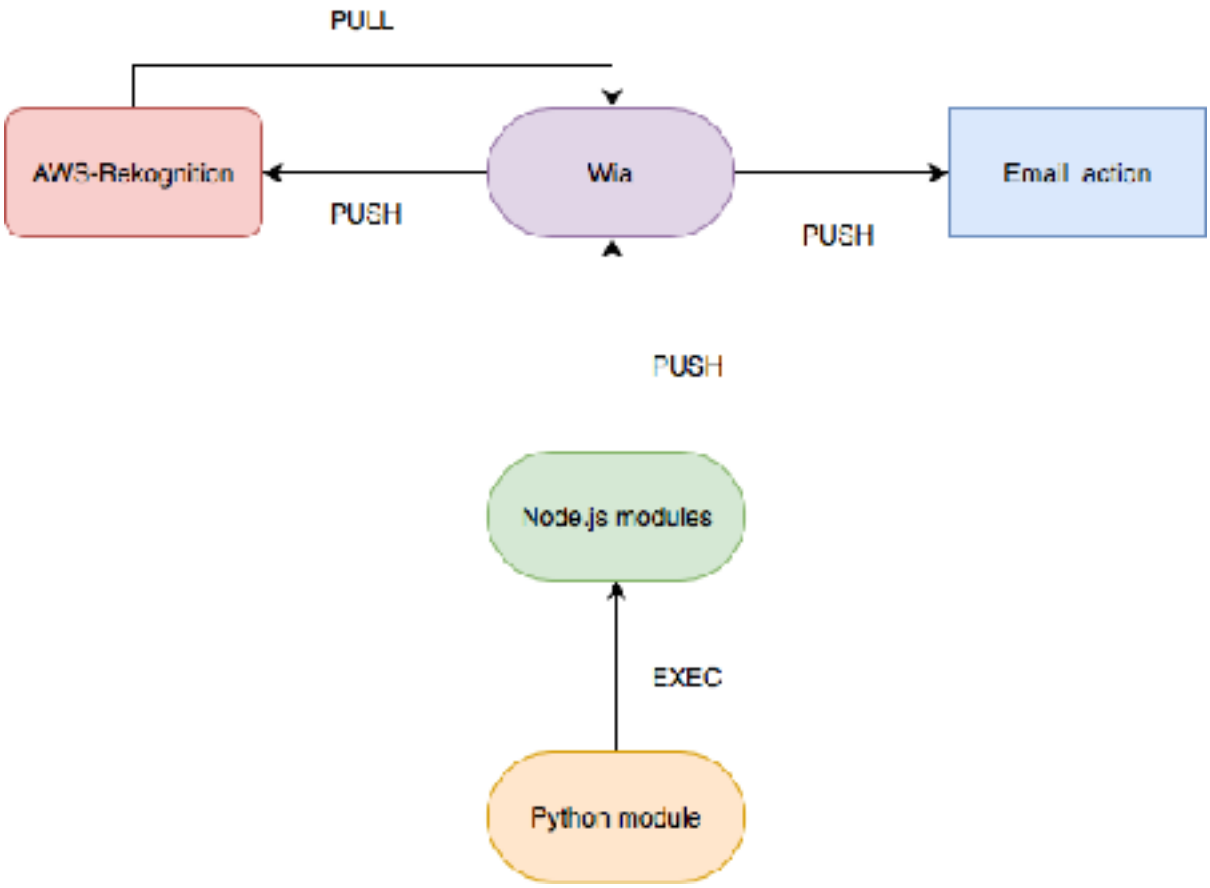
The Camera Module is a great accessory for the Raspberry Pi, allowing users to take still pictures and record video in full HD.

The push button is used to alert the device that an event has occurred.

The wiring of the components can be observed in Figure 2.

5. Software design

The software components and data flow directions are depicted in Figure3. Each of these will be presented in the following subsections.



5.1 Python module

call.py: Listens for an event to occur (the button to be pushed) and after it calls the execution of run_camera.js

5.2 Node.js modules

run_camera.js : Provides a quick way to access Wia and to push the photo taken by the camera to Wia. The following code section shows how to publish an event to Wia:

```
// Publish the photo to Wia
wia.events.publish({
  name: 'photo',
  file:  fs.createReadStream(__dirname + '/' + filename)
});
```

5.3 Wia

Wia is a cloud platform that enables users to build a scalable and powerful backend to launch their Internet of Things (IoT) solutions. This allows makers, startups and enterprise users to create a fully fledged, production ready solution in just minutes without having to worry about server management, data replication and storage. In addition to this, Wia offers users device management, events collection, analytics and highly customisable push notifications.

The following section of code represents how to connect to Wia:

```
var wia = require('wia')('your-device-secret-key');
```

Wia also offers a way to manage the flow of execution between the connected devices and services. In the Figure 3 it can be observed the execution flow for this application.

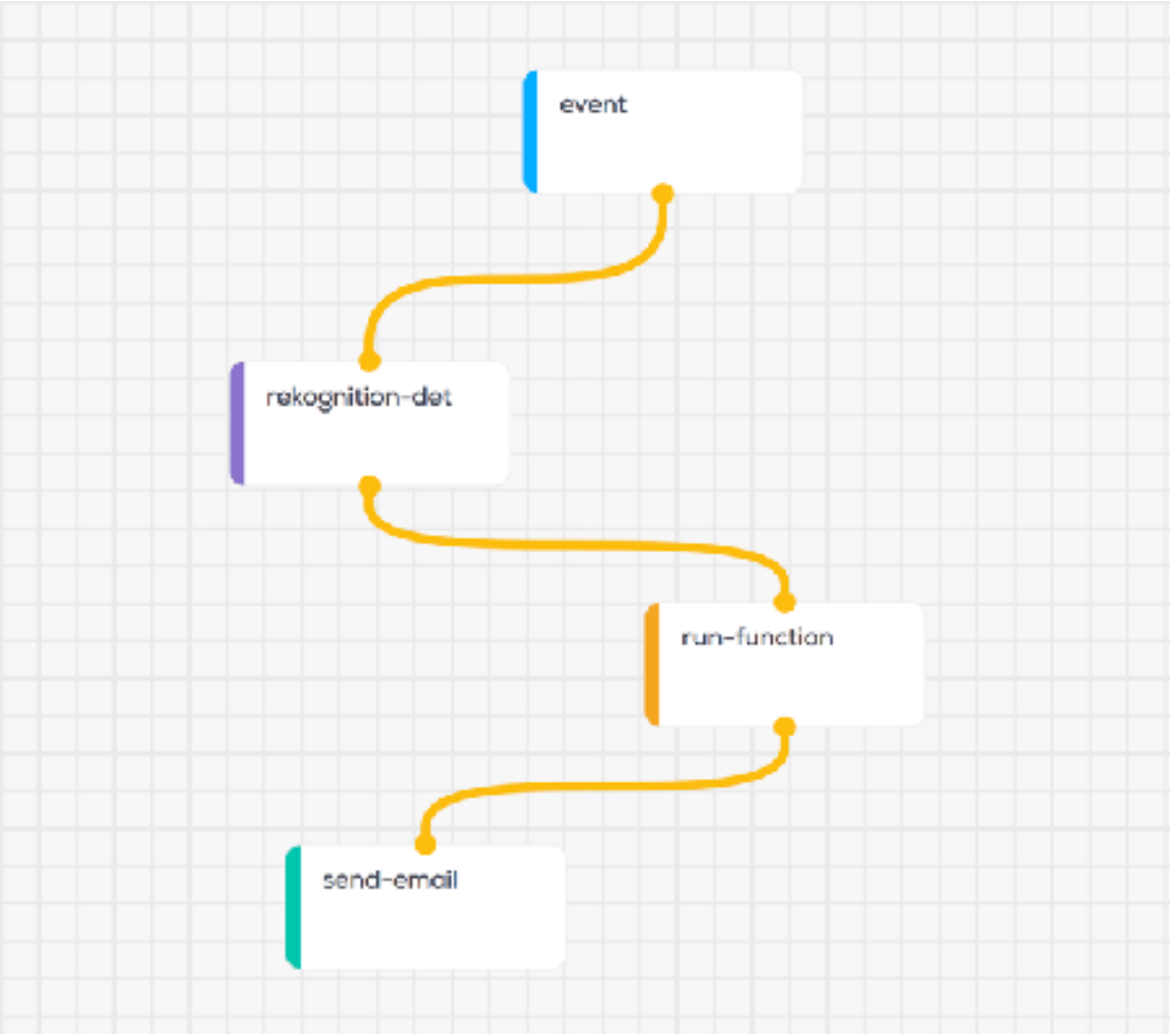


Figure 3: Execution flow

5.4 AWS-Rekognition

Amazon Rekognition makes it easy to add image to your applications.

You just provide an image to the Rekognition API, and the service can identify the objects, people, text, scenes, and activities.

Amazon Rekognition also provides highly accurate facial analysis and facial recognition. You can detect, analyze, and compare faces for a wide variety of user verification, cataloging, people counting, and public safety use cases.

5.5 Email action

An email containing relevant data after the facial recognition is sent to the user.

The email address, email subject and email content can be modified from the wia flow.

6. Results and further work

The current version of the project supports the following functionalities:

- Reliable recognition of a person in front of the camera
- Storing the pushed photo to Wia storage
- Emailing the data to a specific user

The following list of extensions and improvements was identified to be supported in the future:

- Reliable recognition of multiple faces

7. References

1. Draw IO https://www.draw.io

2. Fritzing http://fritzing.org

3. Raspberry Pi 3 Data-sheet https://static.raspberrypi.org/files/product-briefs/Raspberry-Pi-Model-Bplus-Product-Brief.pdf

4. Camera module documentation https://www.raspberrypi.org/documentation/hardware/camera/README.md

5. WIA and Amazon Rekognition https://developers.wia.io/v1.0/docs/integrations-aws-rekognition

6. Linkedin https://www.linkedin.com/company/wia-limited