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DETECTION OF LUNG DISEASES THROUGH ARTIFICIAL INTELLIGENCE AND THE INTERNET OF THINGS

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ABSTRACT

Currently, society has been involved in a contingency due to a virus that affects the respiratory system; Therefore, patients need a quick and accurate diagnosis of their respiratory disease to know in which area they should be transferred and thus avoid contagion, a prototype application was developed to solve a problem at international level and that speeds up the detection process of 3 respiratory diseases (SARS-CoV-2, bacterial pneumonia and viral pneumonia) or even corroborates that the patient is healthy, all this by reading radiographs automatically showing the percentage of probability of suffering from any of these diagnoses, at the time it is entered we can also see an alert through LED bulbs that works thanks to the programming of the microcontroller Particle photon (IoT) for a better understanding either for the patient or the doctor and that can proceed to a protocol to help the patient. In addition, it monitors in real time the times an X-ray is entered to keep track of the data.

KEYWORDS: respiratory, IoT, X-ray, bacterial pneumonia, viral pneumonia.

1 INTRODUCTION

Researchers are studying how to use AI to analyze large amounts of health data to find patterns that could lead to new discoveries in medicine and other ways to improve individual

diagnoses.[1] One of the most promising areas of health innovation is the application of artificial intelligence (AI) in medical imaging, which includes, among others, image processing and interpretation.[2]

With the SARS-CoV-2 pandemic that affected the world, cases of lung disease skyrocketed considerably leaving millions of people with sequelae making them more prone to either relapse into a disease or develop a new one that could put their health at risk, we rely on these health problems to create this idea that can be of help to anyone who needs it.

The process to be performed is focused on analyzing a set of data previously supervised by Stanford University, which we have trained through epochs, based on this we can decrease the risks of error and have a more accurate result. Thanks to the Internet of Things in combination with AI it is possible to realize this kind of tools, in this case we can help both radiologists and clients to have a percentage of help and that in turn reduce the analysis time, thus achieving in this way to optimize the diagnosis to get more reaction time for the client in case the result is positive. This project is intended to create an opportunity to help in the area of medicine and not only can be implemented here but it is possible in other different areas that can help us to advance, evolve and optimize different points of life.

2 MATERIALS AND METHODS

2.1 MATERIALS

The following materials/software were needed for the development of this application and the monitoring station: IoT micro-controller "Particle photon", Google Teachable Machine, P5*JS, P5 Serial Control, LED bulbs and images allusive to the diseases represented.

2.1.1 PARTICLE PHOTON MICRO-CONTROLLER

Particle combines a powerful ARM Cortex M3 microcontroller with a Broadcom Wi-Fi chip in a small, miniature-sized module called PØ (P-zero).

To get you started quickly, Particle adds a robust 3.3 VDC SMPS power supply, RF and user interface components to the PØ on a small, single-sided printed circuit board called Photon. The design is open source, so when you are ready to integrate Photon into your product, you can do so.[3] The development board is shown in Figure 1.

The Particle Photon device is an Internet of Things device, where it can control the LED bulbs according to the disease or healthy state, also can measure the quantity of X-rays analyzed in real time.

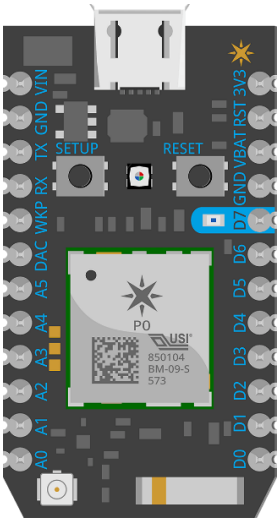

Figure 1: Particle photon.

2.1.2 GOOGLE TEACHABLE MACHINE

Google Teachable Machine is a web-based tool that makes it possible to create machine learning models quickly, easily and accessible to everyone. Set up a computer to recognize your images, sounds and postures without writing machine learning code. Then use the model in your own projects, sites, applications, etc. Currently you can prepare Teachable Machine with images (from your webcam or image files), sounds (with one-second fragments captured with the microphone) and postures (the computer detects the position of your arms, legs, etc. from an image). Teachable Machine uses TensorFlow.js, a machine learning library in JavaScript. It allows you to prepare and run the models you create in a web browser.[4] Figure 2 shows the Google teachable machine page.

In Google Teachable Machine is where the AI model is trained. The model was training with 532 images, 133 for Bacterial pneumonia, 133 for Viral pneumonia, 133 for Healthy state and 133 for SARS-CoV-2.

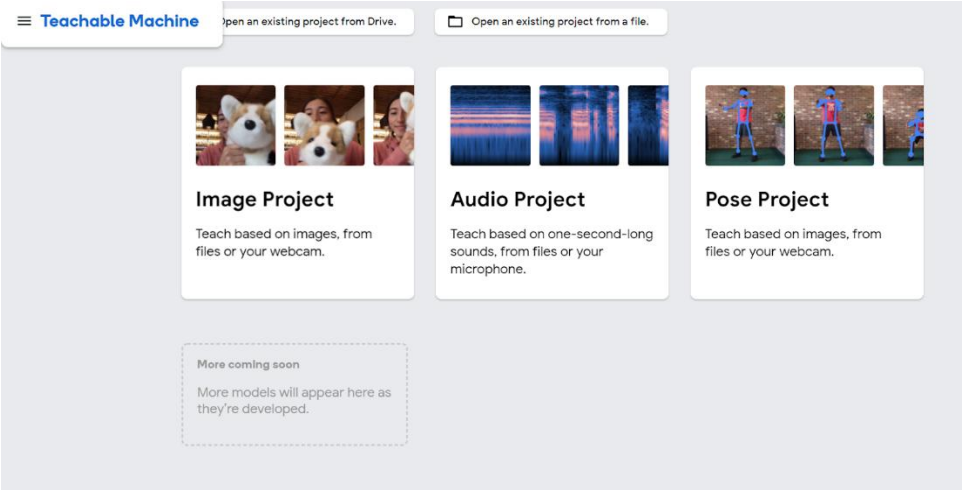

Figure 2: Google Teachable Machine.

2.1.3 P5*JS

P5.js is a JavaScript library for creative programming, which seeks to make programming accessible and inclusive for artists, designers, educators, beginners, and anyone else.[5] Figure 3 shows the P5*.js website.

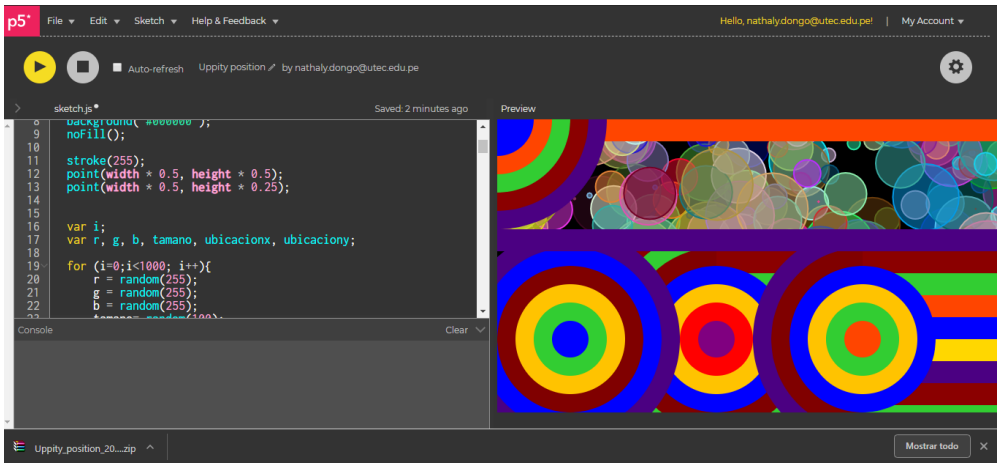

Figure 3. P5*.js.

P5.js is where the web page was programmed for capturing the X-Ray images and send the activation to P5 Serial Control software to turn LED Bulb on through Particle Photon device.

2.1.4 P5 SERIAL CONTROL

Web browsers do not usually have access to a computer's serial ports. For your browser-based applications to communicate with a serial microcontroller, you need a program that can serve HTML/JavaScript pages and communicate with the serial port. When you are doing projects with P5.js, you can accomplish this by using the P5.serialport library and the

P5.serialcontrol application by Shawn Van Every (updated by Jiwon Shin). When you use the p5.serialport library, you communicate with the p5.serialcontrol application, a WebSocket server that gives you access to serial devices connected to your computer.[5] Figure 4 shows the p5.serialcontrol application.

The P5 Serial Control is is the intermediary between the web page and the device.

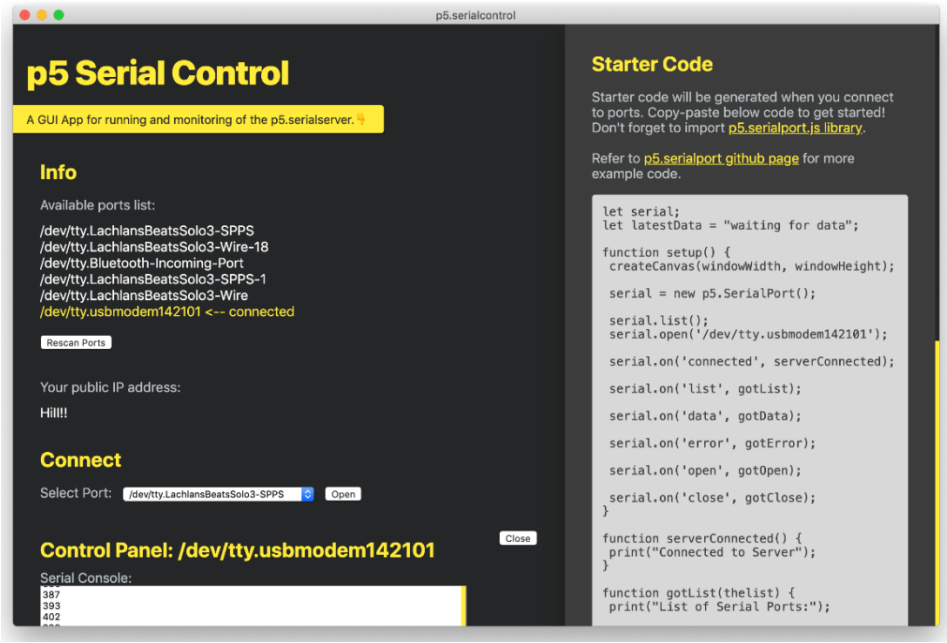

Figure 4: p5 serial control.

3 RESULTS AND DISCUSSION

3.1 RESULTS

X-rays of the 3 different lung diseases or healthy patients were uploaded to a web page, where through AI training model was identified the lung disease or healthy state, and according to the disease was turned on a LED bulb and sending in real time to the Ubidots application where those same data were displayed in the form of bar graphs.

With this, the project's objective of detecting lung diseases through artificial intelligence and the internet of things was achieved in order to speed up the process and provide an accurate diagnosis in a matter of seconds.

Figure 5 shows web application when uploading an X-ray image of SARS-CoV-2 and the disease is automatically detected.

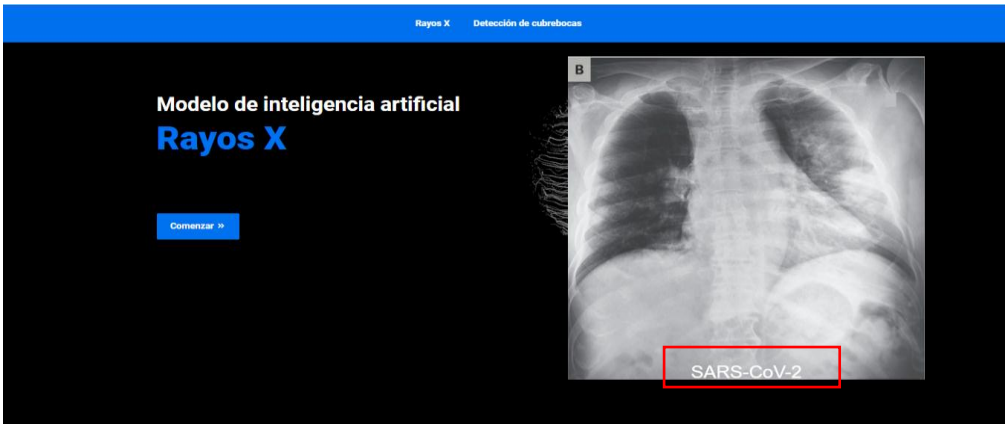

Figure 5: Web application when uploading a SARS-CoV-2 image.

Figure 6 shows LED on

Figure 6.

Figure 7 shows web application when uploading an X-ray image of bacterial pneumonia and the disease is automatically detected.

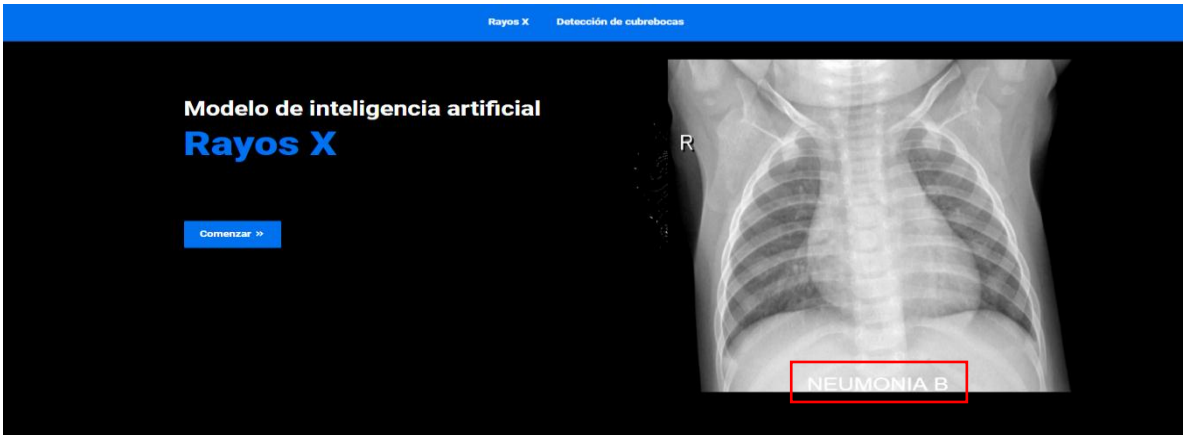

Figure 7: Web application when uploading an image of bacterial pneumonia.

Figure 8 shows LED on

Figure 8.

Figure 9 shows web application when uploading an X-ray image of viral pneumonia and the disease is automatically detected.

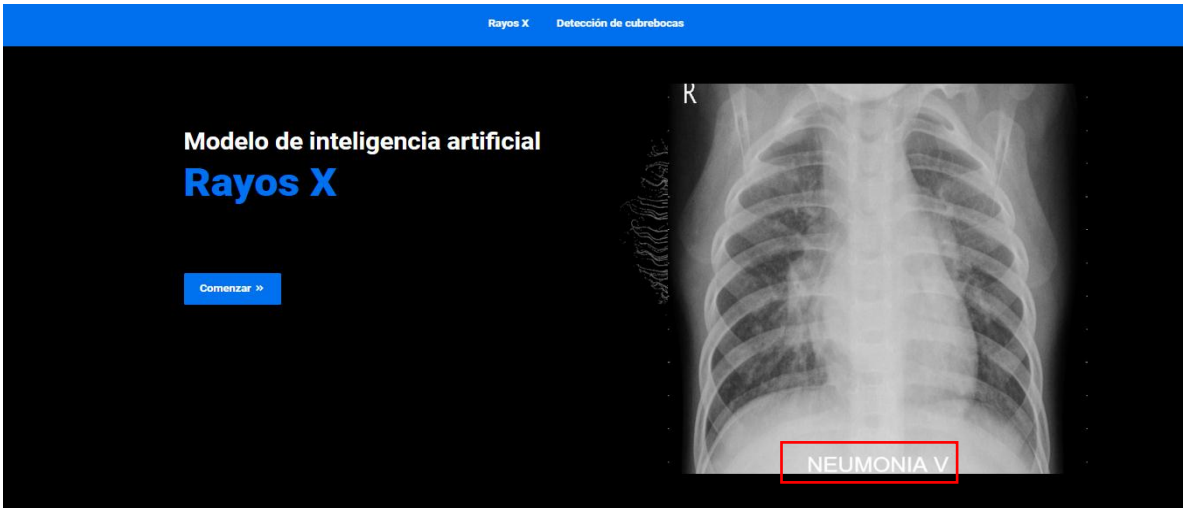

Figure 9: Web application when uploading an image of viral pneumonia.

Figure 10 shows LED on

Figure 10.

Figure 11 shows web application when uploading an X-ray image of healthy person and the state of health is automatically detected.

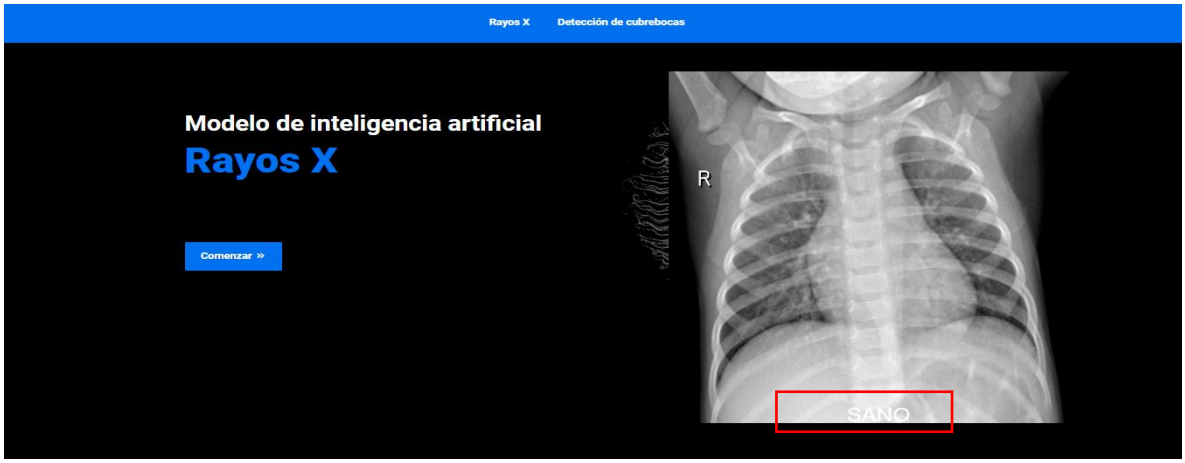

Figure 11: Web application when uploading an image of a healthy patient.

Figure 12 shows LED on

Figure 12.

Figure 13 shows real-time data collection.

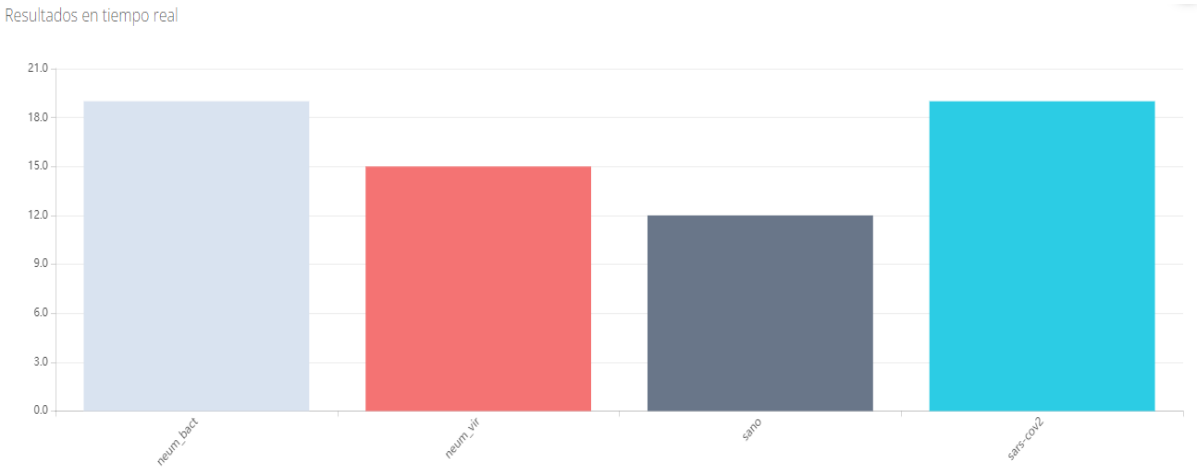

Figure 13: Graph showing diseases, where the x-axis is the diseases and the y-axis represents quantity of images loaded.

CONCLUSION

An application has been implemented where images of X-rays are collected, capable of giving a quick and accurate diagnosis of 98%, which in turn through programming sends the data to turn on each led according to the diagnosis given, and an IoT monitoring station capable of collecting data in real time that are displayed through a web application to keep track of them.

REFERENCES

1. Pesapane, F., Codari, M. & Sardanelli, F. Artificial intelligence in medical imaging: threat or opportunity? Radiologists again at the forefront of innovation in medicine. Eur Radiol Exp 2, 35 (2018). https://doi.org/10.1186/s41747-018-0061-6
2. Lakhani P, Prater AB, Hutson RK. (2018) Machine learning in radiology: applications beyond image interpretation. Mayo 31, 2022, de SpringerOpen Sitio web: https://www.jacr.org/article/S1546-1440(17)31287-5/fulltext.
3. Author Unknown. (Without Date). Particle Photon. Mayo 31, 2022, de Particle Sitio web: 3. https://docs.particle.io/reference/datasheets/wi-fi/photon-datasheet/
4. Author Unknown. (Without Date). Google teachable machine. Mayo 31, 2022, de Google Sitio web: https://teachablemachine.withgoogle.com/faq
5. Author Unknown. (Without Date). P5js. Mayo 31, 2022, de P5 Sitio web: https://p5js.org/es/