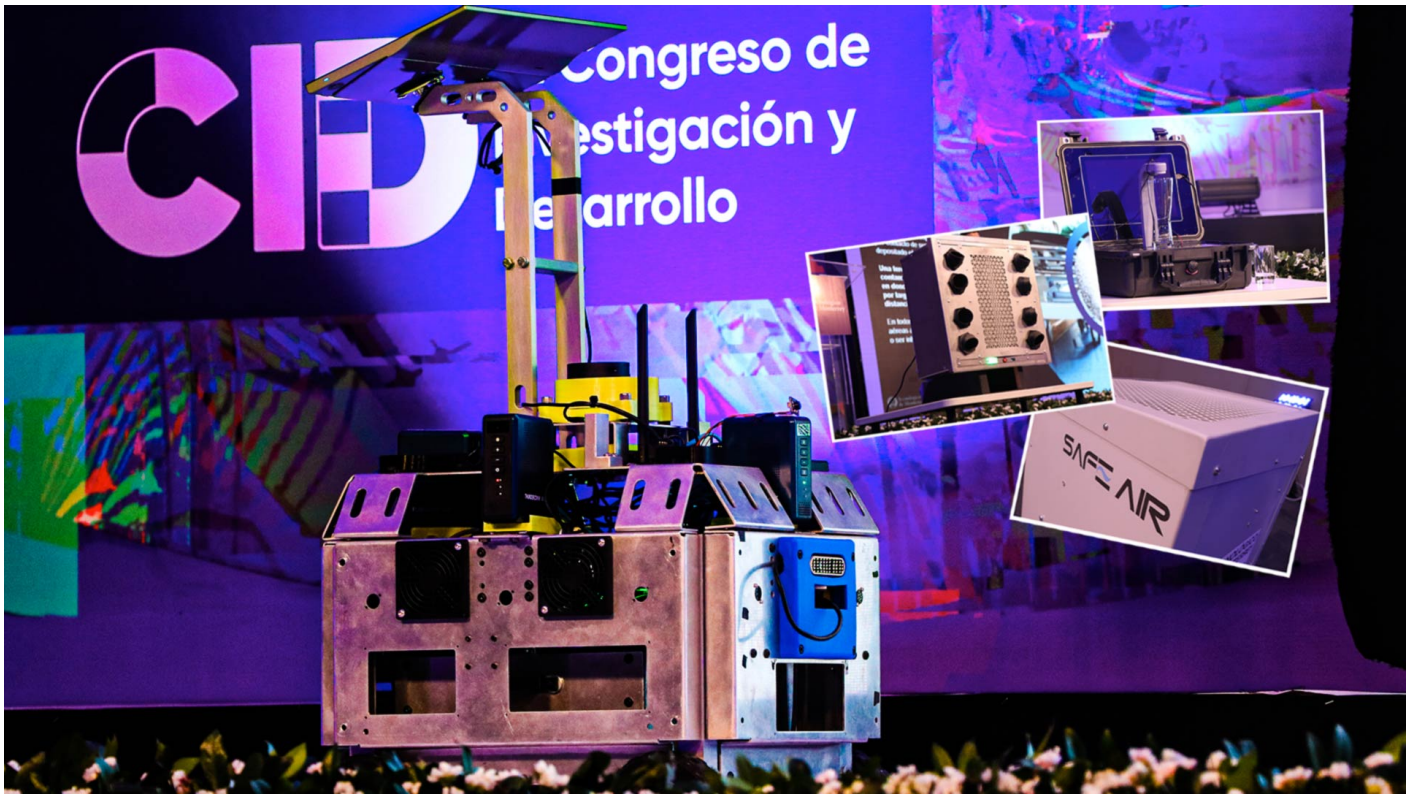


12 Tec projects that go from the laboratory to the real world



Some of the projects promoted by the **Borregos Tecnológicos** program include technologies for robotic assistance, **COVID detection with molecular technology** to calculate **capacity**, or for **purifying environments**.

*“The **program** was created by [Tecnológico de Monterrey](#) to accelerate development of **prototypes in 12 weeks**,”* said **Dr. Jorge Avendaño**, Director of Commercialization and Technology Transfer at the Tec.

This initiative operates through **calls** offering **financial resources** of up to **500,000 pesos** to the creators of these **prototypes** and providing them with time to develop their prototypes.

At [CONECTA](#), we show you the **projects** that were presented at the **Tec’s 52nd Research and Development Conference**:



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1. Autonomous mobile robot for biometric measurement

The PiBot autonomous mobile robot is built with a **set of sensors** that enable **navigation with biometric measurement capabilities**.

It can provide **medical assistance**, detect people not wearing **masks**, calculate a place's **capacity**, the distance between people, and locate people with **COVID**.

However, its functionality is not limited to the pandemic, as it can **help** in **commercial** and **workplace areas**, among others.

This **robot** has the **ability** to make **contact-free deliveries**, **interact** with **users** in **real time**, and navigate spaces autonomously. It contains a **touch screen** and a **web browser**.

This robot was developed by Dr. Jorge de Jesús Lozoya, Jorge Murrieta, Dr. Mauricio Adolfo Ramírez, and Juan Ángel González.

They are in the **process** of obtaining a **patent** and will later participate in the **Shark Tank** program in search of funding.



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2. Wastewater monitoring for detecting COVID

The **MARTEC** epidemiological monitoring system is used to detect cases of **COVID-19** through **periodic sampling** of **wastewater** in buildings and designated areas.

*“The wastewater network is like a **circulatory system**. It provides us with very useful **information** about people’s **state of health**, their activities, and other activities,”* said Dr. Eduardo Sosa, a researcher on the project.

Using **molecular biological technology**, the laboratory performs **reverse transcription** polymerase chain reaction (RT-PCR) analysis to locate the presence of ribonucleic acid (RNA) from the **SARS-CoV-2 virus**.

The system enables the **detection** of **outbreaks of infections** up to **10 days in advance**.

In addition to the process of **wastewater laboratory analysis**, the **MARTEC** team has implemented the use of a **traffic light** scheme to provide an alert level for the presence of the virus.

READ MORE:

<https://tec.mx/en/news/national/research/tec-presents-laboratory-detect-covid-19-wastewater>

3. Real-time body temperature diagnosis

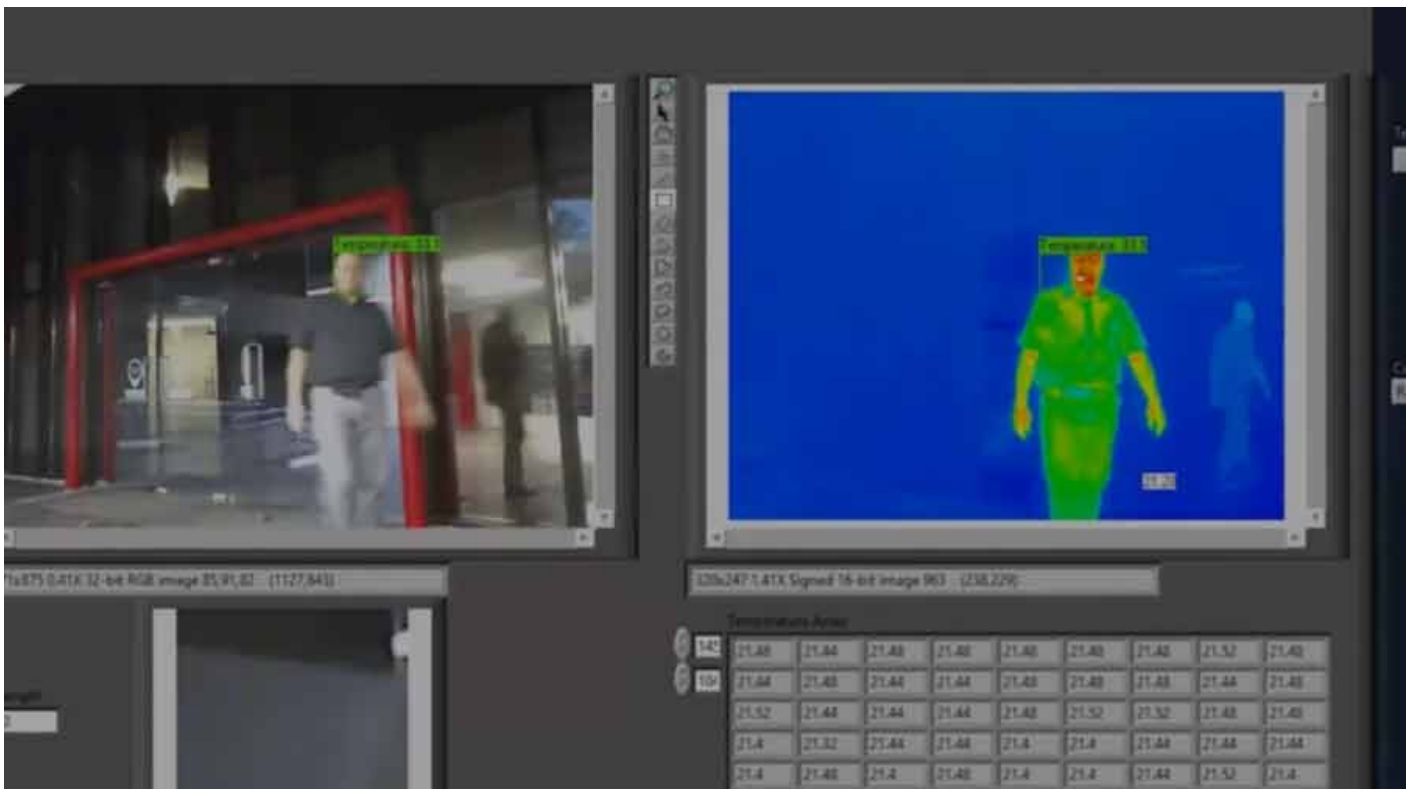
Tec researchers created this rapid **body temperature measurement** system to function without physical contact. It was designed to be installed at the **access points** to **buildings** and other **facilities** to **monitor people**.

This system is based on the use of **facial recognition algorithms** and thermal imaging cameras and systems that work in real time, as well as using a **distributed signal**, which allows it to be connected and monitored remotely.

*“With the return to on-site activities, **security** is very **important**, and one of the first problems is those **access filters**. The objective is to monitor in real time to avoid waiting lines and crowds,”* said Dr. Manuel Macías.

Through the **cameras**, the system can also activate **different alerts** by detecting, for example, the correct use of **masks** or other **accessories** such as **glasses** without affecting **facial recognition**.

By **detecting temperature changes**, it can pick up **variations** early in users who may present a **risk of infection** of **COVID-19** or other diseases.



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4. Air purification with Safe Air

This system can **purify** the **air** in crowded areas such as schools, government offices, and restaurants, removing **microparticles that are harmful to people's health** and **viruses** such as **SARS-CoV-2**, which causes **COVID-19**.

Safe Air was created by Fernando Delgado, Omar Campuzano, Enrique López, Alejandro Montesinos, and Michel Romero. Romero explains that one of its main features is **control** and **visualization via the web**.

*“You can have 500 devices and manage them from a single control center. You can **monitor them** at the same time, show their **location, temperature, humidity, and CO2 levels,**”* Romero said.

He also says that unlike with other similar devices on the market, **filters** can be obtained through a **large number of suppliers** at a **low cost**.

These devices are already being **used** at **Tecnológico de Monterrey**. The system’s creators are collaborating with the **University of California, Berkeley**, to develop other **similar technologies**.



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5. PUREX ultraviolet light air purification

This is an **air sterilization device** meant to be **installed** on room ceilings and uses **254 nanometers of ultraviolet light** to eliminate microorganisms such as the **SARS-CoV-2 virus**.

*“**Airborne infections** usually occur between people interacting inside a room, That’s the **problem** this **device** attempts to **solve,**”* said Azael Cortés, leader of the project.

*“We have a compendium of a **variety** of **microorganisms** for which we know the **dose** needed and the survival percentage of the pathogen,”* Cortés explained.

The equipment can filter up to **600 cubic meters per hour**, which means that it would change the air up to **4 times per hour** in **rooms** of approximately **100 cubic meters**.

“The most important thing about **our design** is that it’s made to **sterilize on contact**, which means that it eliminates 99.9% of pathogens in **less than 1 second** when air comes into contact with them,” he added.



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6. RoboCov autonomous assist robot

This robot is a **platform** with different **modules** that can be **added** to allow for different functionalities.

Among other features, the robot can be used to **transport material**, detect the correct use of **masks**, use an **ultraviolet light** module to **sanitize**, or be a **mobile hand disinfection station**.

The name of the robot alludes to the actions for **combating COVID-19**, but its creators point out that it can even serve as a **guide** for **visitors** at **Tec de Monterrey**.

*“It can (even) play **audio messages**. We’ve done **tours** on the **Mexico City campus**, and people **pay attention** to it.*

*“The robot is giving tours and even **sanitizing** at the **same time**,” said **Pedro Ponce**, leader of the project.*

7. Interface for distancing analysis through artificial intelligence

This project consists of an **interface** that utilizes **artificial intelligence** to detect the correct **social distancing** between **people** who **spend time together** in defined spaces.

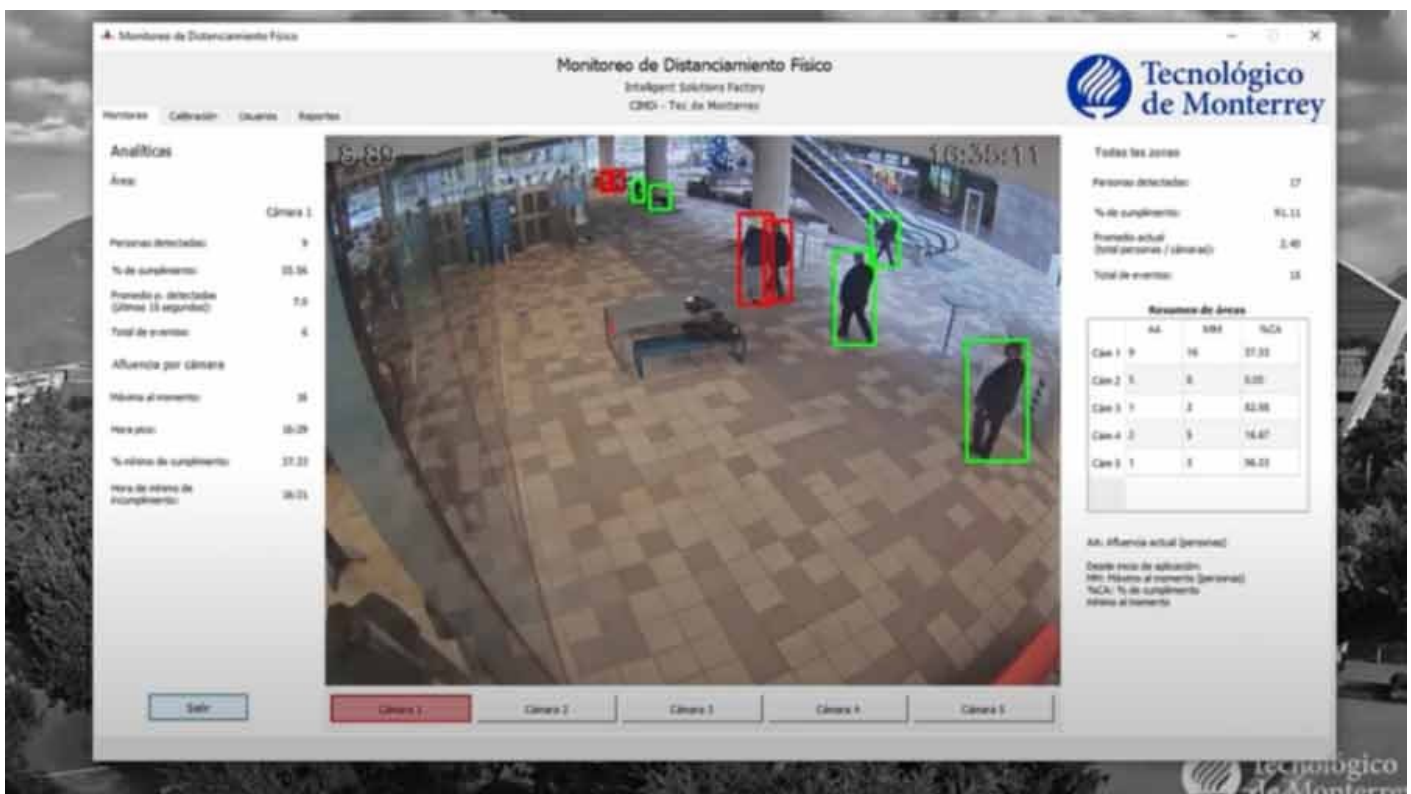
*“Different **preventive measures** have been applied during the COVID pandemic to **limit infections**. One of those measures has been **social distancing**,”* said **Roberto Munguía**, the project’s artificial intelligence engineer.

The project, led by **Dr. Sergio Uribe**, provides **assistance** in **automatic monitoring** of this **safety measure** implemented by the Tec and other institutions.

Through its cameras, the platform captures **images in real time** and can record **different metrics** such as the **number of people**, **non-compliance** in the area, and times when there are more people.

It identifies **people individually**, pointing them out with **green** and **red indicators** depending on whether or not they are complying with social distancing and how long they breach it.

*“**Audible** and **visual alerts** can be issued depending on the distance being detected,”* Munguia said.



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8. “Shazam” for filling containers

This project consists of a **prototype** that can **detect** a **vacuum** through the **sound generated** when it’s being **filled**, which can be used to **automatically** fill containers varying from a **glass** to a **silo**.

*“It uses **physics** to identify **cavities** which, in this case, are **receptacles with resonance frequencies** related to the geometry of empty spaces.*

“Their geometry varies, and we can determine the resonance frequency. That’s what we analyze,” said **Manuel Alejandro Trejo**, one of its creators.

This technology can **be used** in various **applications** from **movie theaters**, where the **filling of glasses** can be automated, to **bottling machines**, **grain silos**, or even **coffee machines**.

*“(The new) prototype can now identify the exact **type of container**. It’s like **Shazam** but detects the container to be filled,”* Trejo said.



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9. Autonomous vehicle automation system

The project incorporates both **hardware** and **software mechanisms** to give low-speed **vehicles** the ability to move **autonomously** through **controlled industrial environments**.

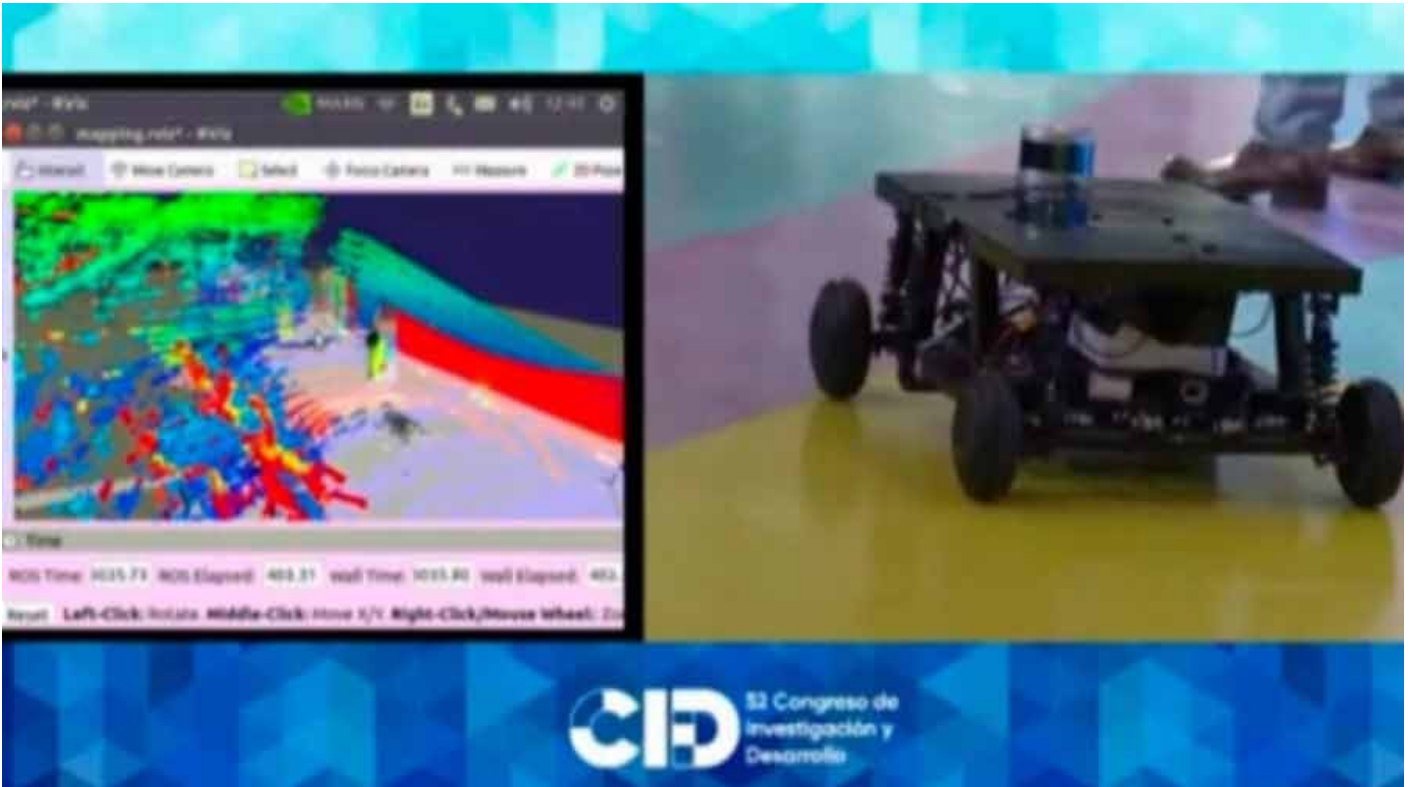
To do this, the development team offers the **integration** of a **robot** with **sensors** that can be added to different types of platforms such as **forklifts** and **golf carts**.

*“What we did was mount sensors, adapters, and processors to interact with some software that’s capable of making a **course plan for the vehicles**,”* Edgar said.

It has a **control** that aims for **autonomy** by controlling the **direction** and **traction** of vehicles at low speed.

There are **ultrasonic connectors** in the **software** part to ensure **safety** and verify that there are no **obstacles** in front of the robot, which has a **3D LiDAR laser scanner**, cameras, radar, and sensors to locate itself during **autonomous navigation**.

*“The **robot** can **recognize** everything **it sees**. It can differentiate different objects such as chairs, people, cars, or other robots, all to **safely plan its route**,”* he added.



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10. Capacity monitoring in collaborative spaces

Dr. Héctor Ceballos presented this technology that uses a **sensor** to detect the **presence of people** in spaces such as **meeting rooms** or **classrooms**, which is already being used at **Tec de Monterrey**.

*“These sensors collect **environmental information** that is sent to the **cloud** and presented on a screen in real time to indicate whether the room is full, half full, or empty,”* says Ceballos.

The doctor points out that, during the **pandemic**, it was **first** intended to identify whether or not there were people in a room. However, once the **levels of in-person attendance** were increased, they now want to determine current **capacity**.

The platform also allows **collection of data** so that **prediction models** of room use and capacity can be created using Artificial Intelligence.

*“This would allow the spaces to be **reconfigured**. (For example) based on what happened from Monday to Wednesday, we predicted low occupancy behavior for Friday,”* Ceballos said.

Ceballos adds that it can also be connected to **energy-saving systems** to reduce the use of **lights** and **ventilation systems**, among others.



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11. Body movement recording system

The project consists of a series of **sensors** that can be placed on people's **limbs** and other **parts of their body** and can then **record** and **graph joint movements** through an interface.

*"Understanding our own **movement**, our **body biomechanics**, can give us information to allow us to detect certain **pathologies** and even make **rehabilitation** more efficient,"* said Martín Bustamante, project leader.

The value proposal of the equipment is to offer a **low-cost** modular **movement acquisition system** that can be applied in **different areas**.

This **prototype** consists of a **module** with **inertial sensors** and an **elastic clamping** system so that it can be placed on the part of the body you want to capture the movement information about.

The development team also designed a **computer interface** that connects with the devices to **visualize and graph** the **person's movements**.

Potential customers for this **system** include institutions dedicated to **clinical** and **sports medicine**, **robotics** and **entertainment** institutions, and academic institutions.



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12. Algorithm for capacity calculation

This project seeks to replace **manual measurement** of the **capacity** of **universities, shopping centers**, and other spaces that measure the number of people who enter their facilities.

*“The way this counting process is carried out (at the Monterrey campus) is **manually**. If people pass through a campus access point, guards have a simple manual device they click.*

*“That obviously involves the **manual physical work** of someone who pays attention at all times to people entering and leaving,”* said **Cristian Mendoza**, director of the project.

Mendoza explains that they created a **device** that uses **cameras** and **algorithms** to detect **people entering and exiting** to **provide data** on the **capacity** of a space in real time.

This system also allows for the **creation** of **alarms** to signal when the **permitted capacity levels** are being reached or **exceeded**.



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The 52nd Research and Development Conference

The **Research and Development Conference** has been held annually since 1971. Now in its 52nd year, it will be held from **March 2 to 4, 2022**, at the Monterrey campus Conference Center.

*“For Tec de Monterrey, it’s crucial to continue developing a **culture of research and innovation**,”* said Neil Hernández Gress, Associate Vice-Rector for Research and Technology Transfer at the Tec.

*“To that end, **platforms, spaces, and activities** such as the Research and Development Conference are designed with the purpose of involving, sharing, and communicating scientific and technological research,”* he added.

READ MORE:

<https://tec.mx/en/news/national/research/nobel-prize-medicine-pandemic-affected-peoples-sleep-quality>