

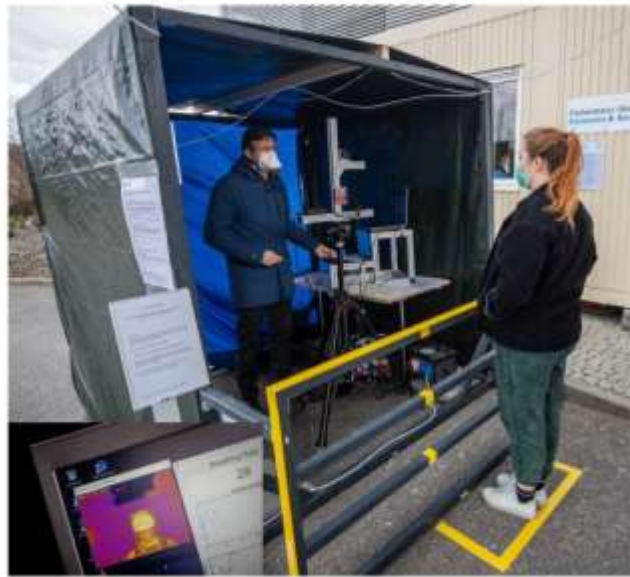
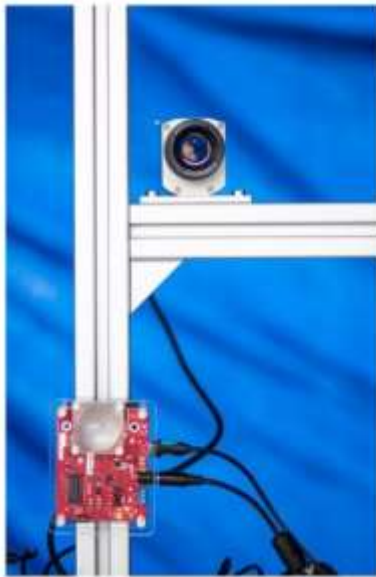
## Fraunhofer's fight against the pandemic Corona Virus (COVID-19)

The World Health Organization (WHO) has declared the outbreak of the novel Corona virus (COVID-19) to be “a public health emergency of international concern.” The COVID-19 pandemic is taking a toll on day-to-day life, on people's health, on businesses, on the domestic economy and on global trade. The current situation and the as-yet unpredictable trend across the World present all of us with major challenges.

Working at the forefront of the fight against the pandemic, Fraunhofer is supporting the efforts of industry and society to cope with the immediate effects and the consequences to come. We are now focusing on projects in the medical and health sectors of direct relevance to the coronavirus crisis, including the development of a vaccine, innovative diagnostic techniques, the development of new drugs, putting into place a powerful IT infrastructure, and prioritizing relevant pre-competitive research. We also provide support by assisting manufacturers who make components for personal protective equipment (PPE).

### **Access Checker: Remotely Measures Body Temperature in addition to Heart and Breathing Rate:**

An innovative measurement method is helping to detect people infected with coronavirus from a safe distance. It detects fever, increased pulse rates and fast breathing without endangering the person conducting the testing. The Fraunhofer Institute for Manufacturing Engineering and Automation IPA and the Fraunhofer Institute for Industrial Engineering IAO are currently testing the procedure at the Robert Bosch Hospital in Stuttgart.



The Hospitals are presently obliged to maintain entrance controls. Given the spread of coronavirus, it is essential to ensure that patients, hospital staff and visitors are not carrying the virus into the hospital and thereby endangering people who already have compromised immune systems. Our innovative method measures all the relevant parameters from a distance of one meter. The professional carrying out the test via a laptop is able to maintain the required minimum distance of 1.5–2 meters without a problem. As a result, they are not put at risk and do not need to wear any PPE. This is an invaluable advantage in these present times, when not even basic face masks are available in sufficient quantities. The test measures not only body temperature using an infrared camera but also heart and breathing rates by way of microwaves. To this end, a radar module featuring a micro-Doppler method is used. The aim is to soon integrate this technology into the hospital's admission process. We have even considered data protection: The patients' data is not stored but rather anonymously documented on a paper spreadsheet.

### **Mass Production of COVID-19 Test Systems:**

EUROIMMUN AG is one of the first European diagnostics companies to offer CE-marked antibody detection systems to support COVID-19 diagnostics. These tests can be used to identify people who have already come into contact with the virus. This is important since it offers a means of tracking down individuals who have already recovered from the infection and are thus highly likely to have developed immunity to a repeat infection with SARS-CoV-2. The Fraunhofer Research Institution for Marine Biotechnology and Cell Technology EMB in Lübeck, Germany, is supporting EUROIMMUN AG in its efforts to scale up the production of the new serological test systems for COVID-19 diagnostics to the levels required for large-scale, mass-market deployment.

### **3D Printed Emergency Ventilation System with Integrated Electronics and Sensors:**

The experiences with the development of the pandemic have shown that a case of emergency may occur quickly with a lack of available high-tech ventilators for patients requiring artificial respiration. For example, physicians in Italian hospitals had to decide by triage which patients will be treated using a life-saving ventilation system and which patients will not be treated this way. For this reason, the objective arose to develop a prototype for a 3D printed emergency ventilation system within a week. The prototype of a 3D printed emergency ventilation system has been realized based on a biocompatible and steam sterilizable plastic material. Electronics and sensors have been integrated in order to set and monitor the essential parameters of the mechanical ventilation. The system alerts the clinical users in case of an interruption. Using a lung phantom, physicians have tested the system successfully under realistic conditions. If there is a lack of high-tech ventilation systems in hospitals, these emergency ventilation systems shall be available to the physicians as a last resort.



### **3D Printed Respiratory Masks with Replaceable Filter:**

Currently the supply situation for professional respiratory masks is very tight. In particular, nurses, doctors and emergency medical services are relying heavily on virus-proof masks of the types FFP2 and FFP3. The researchers at Fraunhofer Plastics Technology Center Oberlausitz (FKO) in Zittau have developed and manufactured a reusable respiratory mask by applying a selective laser sintering process using polyamide. In order to realize a higher number of pieces, the Fraunhofer scientists are investigating the production of respiratory masks by injection molding.

Additively manufactured respiratory masks are available, including a replaceable filter. These masks are skin-friendly, resistant against disinfectants, and, above all, they can be reused. In contrast to the common FFP single-use masks, only the filter fleece is replaced (cost: less than 5 cents per filter). An exhalation valve is integrated into the mask, which prevents the filter from being soaked quickly by the respiratory air, which in turn would decrease its effect. The fleece has the same filtration effect for small particles ( $< 0.3 \mu\text{m}$ ) as FFP3 face piece respirators. Also Medical safety eyewear, disinfectant dispensers can be manufactured from 3D printers.

In a joint effort, 3 Fraunhofer Institutes namely Institute for Algorithms and Scientific Computing (SCAI), Institute for Molecular Biology and Applied Ecology (IME) and Institute for Intelligent Analysis

and Information Systems (IAIS), along with the Information Centre for Life Sciences (ZB MED), and other research partners have succeeded in providing the research community with a unique collection of analysis tools and data sources. Central offers are the Biomedical Knowledge Miner BiK>Mi, which gives access to a highly curated, knowledge based cause-and-effect model of COVID-19 and a search with the knowledge discovery service SCAIView in the research literature on COVID-19.