The MERLIN project addresses the global health issue of retinal diseases. The project team unites six scientific, medical and industrial partners across Europe, who jointly develop advanced retinal imaging technology.

Skyrocketing numbers of patients:

The retina is the sensory membrane at the back of the eye that detects light and converts it to neural...
signals. A healthy retina is key to clear vision. Unfortunately, retinal diseases affect 400 million people worldwide. The most common of these conditions, age-related macular degeneration (AMD) and diabetic retinopathy (DR), are major causes of visual impairment and blindness. These diseases have a serious impact on patients’ lives and represent a heavy economic burden on society (yearly cost of AMD is $343 billion). Due to population ageing and changes in lifestyle, the number of patients with altered retinas will double over the next 40 years.

Ongoing revolution in retinal therapies:
On the bright side, therapeutic science has achieved spectacular progress over the last two decades with effective drugs available for treating particular forms of AMD and DR, and multiple breakthrough treatments are now being evaluated for various retinal pathologies. Hopes for preserving patients’ sight are higher than ever, yet large proportions of patients remain undiagnosed: current estimates are 25% in AMD and over 50% in DR.

Widely adopted innovations in imaging tech:
These challenges have fostered the development of advanced retinal imaging modalities, each revealing a different aspect of the tissue and providing useful diagnostic insight. A technology called optical coherence tomography (OCT) has enabled doctors to distinguish the thin superimposed layers that form the retinal tissue, and thus better manage several diseases. OCT is now being massively adopted: over 10,000 OCT units are sold each year.

Why OCT is not enough:
However, state-of-the-art OCT devices are still limited in their ability to discriminate small details, with a resolution no better than 15-20µm. As a consequence, many diseases can develop “silently” for years and cause microscopic damage in the retina without being detected. Additionally, most treatments act at the level of retinal cells, which are invisible with current imaging techniques. Therefore, as therapies progress, there are needs as well as business opportunities for enhanced retinal imaging technologies.

MERLIN’s solution:
The ambition of MERLIN is to improve in-depth diagnosis and personalized healthcare in retinal ophthalmology. To do so, the project partners are developing a next-generation OCT device that overcomes current limitations in retinal imaging. The goal is to deliver earlier and more in-depth diagnostic information on the retina, using multiple imaging modalities with cellular-level resolution.

The MERLIN’s project system includes three imaging modalities:
- Scanning Laser Ophthalmoscope (SLO) gives images of the retina at high speed
- OCT provides detailed information on the layers of the retina
- Angiography (OCT-A) allows to analyze the 3D vascular system of the retina

These modalities can image the whole retina, or can be focused on small areas for precise analysis.
with cellular scale resolution. The work of the Merlin project consists in developing this innovative multi-modal, multi-scale retinal imaging system.

To fulfill the ambitious objectives of the project, three cutting-edge technology bricks have been integrated:
- Swept Source OCT to get high precision and sensitivity OCT, at high speed
- Adaptive Optics to image the retina with cellular level resolution
- Retinal Tracking to compensate for minute eye motions that blurs the OCT images

The challenge of Merlin project is to create a compact and highly usable system integrating all those elements. In the first part of the project, the system was specified to leverage the clinical advantage brought by the technology bricks and designed for clinical environment. 3 prototypes have then been manufactured and technically validated. 2 of them have been delivered to the Hospital late 2020 for successful clinical experimentations.

A first version of the device for research use is now ready for exploitation:
- all imaging modalities have been validated for healthy subjects and patients with rather good fixation
- it is protected by 5 patents (2 new patent applications have been filed during this project)
- the freedom to operate study exhibits positive conclusion
- clinical experimentation shows good results on retinal diseases
- Business plan foresees significant revenues
- documentation to get necessary approval to conduct research with the device is ready
- 12 peer review publications can be used for the promotion and Merlin device performances have already been presented in more than 23 conferences or workshops.

Reveal previously invisible retinal symptoms:
The main result of MERLIN imaging device is to deliver 2D and 3D OCT images of the retina with 25 times more details than state-of-the-art retinal imaging products. This new instrumentation now allows doctors to examine retinal cells and vascular detail, as well as microscopic lesions invisible to other imaging techniques.

Bring next-generation OCT into the hands of clinicians:
Although cellular-resolution OCT has already been experimented in a few research labs, MERLIN project the Merlin project has brought this technology to a pre-commercial level. First clinical prototypes have been delivered to 2 hospitals and they have been clinicaly tested in AMD and DR patients.

Develop sustainable business and create jobs:
The industrial partner of MERLIN intends to commercialize this new OCT imaging product for research soon after the completion of the project. As part of the worldwide OCT market ($800 million in sales per year and 16,000 jobs), the commercial exploitation of MERLIN has a strong potential for

Innowacyjność oraz oczekiwany potencjalny wpływ (w tym dotychczasowe znaczenie społeczno-gospodarcze i szersze implikacje społeczne projektu)

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Answer unmet medical needs:
After reaching the market, the technology developed in MERLIN is expected to generate significant impacts on global health:
- Detect diseases years earlier. The detection of microscopic signs of DR and AMD will enable to take timely measures before irreversible damage occurs. The benefit will amount to several years of clear vision for patients.
- A 5-fold acceleration in new drug trials. The detection of microscopic changes in retinal lesions will enable 5-time quicker readouts of the effectiveness of therapies. Drastic reductions in the cost and duration of clinical trials are thus expected. As a result, millions of patients will benefit from earlier access to new treatment options.
- Enable more personalized healthcare. In-depth phenotyping at the cellular level will enhance doctors’ ability to distinguish between multiple forms of retinal diseases in order to better adapt treatments to patients. With the widening range of therapies available, there will be a huge benefit in being able to choose the optimal treatment and dose for each individual.

Multibillion-dollar reductions in healthcare spending:
Conventional OCT has already saved Medicare over $ 9 billion since 2008. With MERLIN technology, preventing the transition to serious stages of retinal diseases – even in a small proportion of AMD and DR patients - will also result in multibillion-dollar (and euro) savings for health insurance systems.
examples of imaging modalities