CYSTIC FIBROSIS DETECTION

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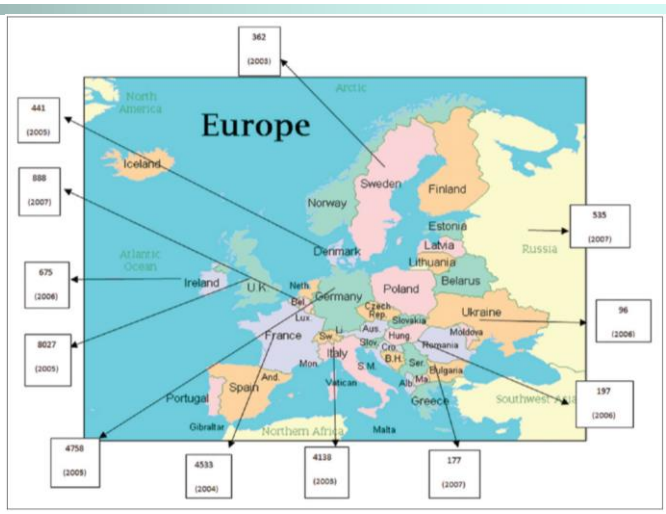
Introduction: Cystic fibrosis (CF) is an inherited chronic disease, primarily affecting the lungs and digestive system. This lifelong condition usually becomes more severe with age and affects both males and females in equal proportions. The symptoms and severity of CF vary from person to person, but the majority of people with the disease have both respiratory and digestive problems. It is one of the major health problems that affect the Irish population. It is almost 3 times the average rate in other EU countries and the United States. On average, 1 in 19 Irish people are said to 'carry' one copy of the altered gene that causes Cystic Fibrosis. From the understanding that early detection of a disease provides a better chance of benefiting from treatment, we thought of developing an app for aiding the early detection and monitoring of Cystic Fibrosis.

Scope :It mainly affects the digestive system and the lungs and causes them to get clogged with thick and sticky mucus. The continual build-up of mucus in the lungs acts as an ideal breeding ground for bacteria and thus the patients are prone to recurring Chest and Lung infections. Cystic fibrosis can cause the mucus obstructs the pancreas and stops natural enzymes from helping the body break down and absorb food and thereby causing malnutrition and in some cases causes infertility, osteoporosis and diabetes as well.

In comparison with other continents, Europe is reported to have the highest level of CF. The high prevalence of CF in Europe has caused countries in the continent to carry out severe screening programs for this disease. With the establishment of the European CF Society (ECFS) in 2004, the process has been speeding up. The high level can be as a result of proper registry and strong clinical awareness. In Europe, there is a very well organized registration system maintained by the ECFS. The distribution of CF is more dramatic in northern, northwestern, and central Europe. The highest birth rate of CF (1 in 1353 people) in Ireland.

There is no cure for CF, however, life expectancy has increased steadily over the past 20 years due to better disease understanding, treatment advances, and earlier diagnosis.



Distribution of Cystic Fibrosis Patients in Europe

Problem: About 25 new cases of cystic fibrosis in Ireland are diagnosed each year. Around 55% of the CF patient population in Ireland is aged 18 or older. The predicted median age of survival for a person with CF is early and mid 30's in Ireland. This is mainly due to the late detection of CF. Lack of continuous monitoring and precautionary steps can lead to other diseases like Diabetes, Osteoporosis, Infertility, etc thereby worsening patient health and decreasing life expectancy.

Prototype of product

Solution: Designing a smart watch with a Galvanic Skin Response (GSR) sensor to monitor activity of sweat gland. High levels of chloride in sweat is an indicator of Cystic Fibrosis hence GSR sensor can be used to measure the concentration of chloride in sweat. The smartwatch is paired to a customized app for recording and analyzing the patient's data.

Major features of the app include:

- **Special diet charts for helping them to deal with malnutrition and digestive disorders.**
- **Monitoring the glucose levels of patients helping them with diabetes.**
- **Tracking menstrual cycles to monitor reproductive health.**
- **Exercise plans for strengthening muscles and joints and thereby aiding patients with osteoporosis.**

Benefits and Impacts: Regular monitoring helps in tracking the progression and aids in understanding the present health condition of the patient. Earlier detection helps to relieve the symptoms of cystic fibrosis considerably through diet and exercise.

Most of the patients are unaware of the diets and precautionary steps they have to follow so as to avoid aggravating their condition. Since the severity varies, the app can be customized to provide assistance in this regard depending on the patient's present health condition. It can further help in reducing patient trauma by continuous monitoring which avoids delay in getting treatments and to some extent even increase life expectancy.

Reference : PIC Microcontroller. 2020. *MAXREFDES73#: Wearable, Galvanic Skin Response System*.