Project Results

Personal Health Empowerment

A proactive approach to health

EXECUTIVE SUMMARY

Personalised coaching and recommendations can make a large impact on chronic disease management and workplace wellbeing. The ITEA project Personal Health Empowerment has therefore delivered a common architecture and algorithms for analysing user data and providing tailored health advice.

PROJECT ORIGINS

The welfare industry represents more than 5.3% of the world economy, with COVID-19 having expanded the digital healthcare market at a rate of 26.30%. However, digital healthcare is largely reactive: many applications simply provide basic information on a disease. As populations age and increasing suffer from chronic obstructive respiratory diseases (CORD), this approach is becoming inefficient and costly. Given that mental health problems cost US businesses around USD 440 million annually, a more personalised approach to work-related health issues could also improve quality of life for employees and commercial outputs for companies.

The ITEA project Personal Health Empowerment (PHE) is on a mission to transform individuals into active players in their own healthcare. It achieves this through a common architecture for user analysis which can be separated into distinct components depending on one's needs. Through this, it generates personalised health and wellbeing-related recommendations and objectives and is also capable of monitoring the routines and physical state of users in order to assist their goals. Within PHE's Healthy Workplaces use-case, Spanish partners have worked on general health and wellbeing, Belgian partners have aimed to prevent work absenteeism due to musculoskeletal problems and Turkish partners have looked at infection. Portuguese partners, meanwhile, have carried out a separate use-case on CORD management.

Personal Health Empowerment use cases.

TECHNOLOGY APPLIED

The main focus of PHE lies in intelligence and algorithms to analyse user data and provide personalised feedback. The key component of the common architecture is therefore the recommendation/coaching engine, which is split into two components: (1) a deterministic (rules-based) approach which is defined by experts and exploited in the CORD use-case, and (2) a data-driven approach which is exploited by the other partners. Each engine works independently and integrates into the larger coaching framework via services (such as coaching plans with measurable parameters and predefined actions). A CORD management app, for instance, uses smartphones and embedded sensors to measure a patient's health condition and complies with the FHIR

standard on electronic health records in order to guarantee privacy.

The basis for the system is two separate layers for user monitoring & analytics (including data processing and complex event processing) and system monitoring &analytics (featuring statistics and a dashboard indicator). The former takes care of data stream management when monitoring users and calculating high levels of information while the latter provides system functioning indicators such as services for measuring app adhesion. The raw and processed data are then applied in the coaching engine. A major accomplishment is the option for third parties to separately exploit the various layers/engines through an API. The generic data definition structure also allows both domain-

dependent and domain-independent information processing. The connection to external devices (such as fitness electronics) increases PHE's value by broadening its scope in relation to the current personal health market; GDPR compliance is assured via consent forms and authentication services in a separate external data management layer.

MAKING THE DIFFERENCE

PHE has seen immediate results in terms of both technology and usability. For user profile monitoring, 12 user segments have been defined (versus a starting position of just one), allowing a high degree of modelling customisation based on patient needs. The stream-based monitoring throughput and event-based monitoring throughput have separately reached 2636 and 4160 write operations per second using four threads, demonstrating the strength of the project's consistency mechanisms and access to large amounts of data. Improvements in technology have gone hand in hand with an increase in usability: two pilot studies in Spain and Turkey saw user satisfaction rise from 50% and 55% respectively to 70% each. Such figures are the key to user retention and long-lasting impact for the technology.

Three main pillars provide a basis for PHE's exploitation strategy: solutions with a common architecture and API, exploitation by individual partners according to their interests and exploitation based on the market context (i.e. monitoring other commercial or research initiatives to position the project accordingly). In Flanders, for instance, the workplace health service IDEWE monitors 696,592 employees (25% of the population) and the Belgian consortium aims to engage at least 2.5% of their clients. Conversely, Portugal has less than 10% of the total CORD-related apps available in medium to high income countries; PHE partners therefore stand to take a sizeable share of newly emerging digital health markets.

PHE has already resulted in three PhDs, one Master thesis and ten scientific papers. With the help of five dissemination partners, the project is collectively targeting the technological community, decision-makers and potential customers in order to increase uptake. The ultimate benefits lie with users, companies and society as a whole: personalised health management prevents sicknesses and improves quality of life for the individual, in turn resulting in a more productive and positive workplace and less strain on the overall healthcare system. This is the long-term vision of Personal Health Empowerment.

MAJOR PROJECT OUTCOMES

Dissemination
- 10 papers published along the project lifetime, e.g. WorldCIST 2020; Cardiff University Press 2020, EMBEC 2020, etc.
- Participation in more than 20 events, e.g. 12th International Conference on e-Health, PaCeIT meetings, etc.

Exploitation (so far)
New products:
- Health & Wellbeing Application: Mobile application that can be used as means of communication for companies to enhance employees health and make available their occupational health services.
- Stream-based data monitoring and Analytics System: A health data monitoring system based on a stream management approach that uses a message broker to provide asynchronous service-to-service communication between different components of the system.

New services:
- Dynamic Clustering Module: Allows to offer services in a personalised way and to accompany the user in their advances/progress.
- Rules Editor: Rules Editor developed for CORD Management Use-Case.

New systems:
- Reference architecture for interoperability: The proposed architecture facilitates the interoperability, incorporating diverse data sources and coaching services.

Standardisation
- FHIR Parser: Parser developed to translate data under FHIR Format.

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