Smart Sock Feasibility Study

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EPIC

European Union
European Regional Development Fund

Introduction

Touch Craft Ltd undertook a feasibility study to understand the market position, technologies and user requirement for a smart sock sensing system designed to help monitor foot problems for people living with diabetes. The proposed system would involve a non-invasive, low-cost approach to gathering and measuring skin and foot data considering parameters such as pressure, temperature and activity levels. The smart sock sensing system would enable both clinicians and patients to have a broader view of foot health and assist in improving the quality of life for patients and their carers'.

Project Aims

The aims of the feasibility study were to:

- Test and prototype a sample of appropriate technology and fabrics for a smart sock.
- Review the current market, research competitors and define smart sock features.
- Work with clinicians and users to understand their needs and more nuanced requirements not addressed by existing products.

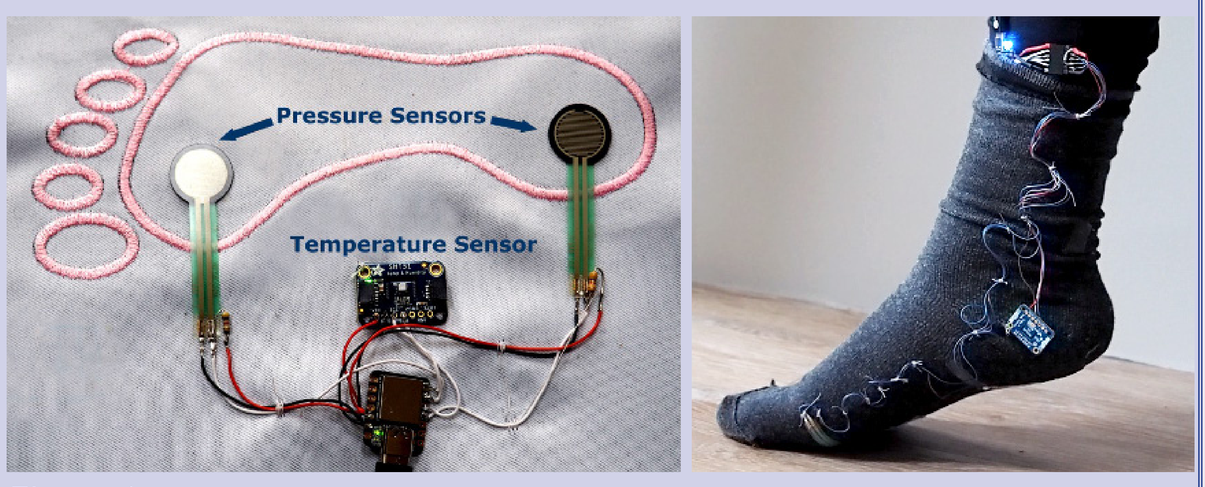

Figure 1

Preliminary Prototypes

The study produced preliminary prototypes, see figure 1, using off the shelf technologies to present an initial proof of concept to help demonstrate the possibilities of a wearable 'Smart Sock' to physiotherapists and orthopaedic clinicians'.

Further funding would support the development of more refined, robust prototypes if the project were to move to future studies. At this stage the preliminary prototypes are presented as rough 'sketches' using low fidelity, off-the-shelf technology to prompt discussion and help outline more specific features and functionality. A feasibility study is not extensive enough to test all the different fabrics and sensors that could be used to construct a smart sock. Prototyping helped the team understand the possibilities, limitations and outcomes that could then be experienced by clinicians and patient groups.

Printed Electronics

Touch Craft Ltd worked with Marina Toeters from Fashion Tech Farm to develop the preliminary prototypes and demonstrate the use of printed electronics, shown in figure 2, that could further refine the technologies in future versions of a smart sock.

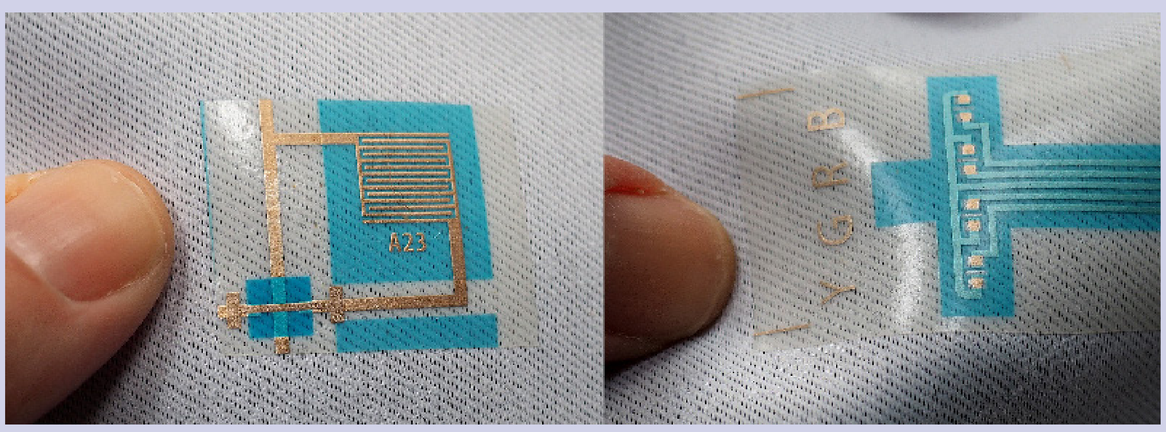

Figure 2

Method

Public and Patient Involvement and Engagement is a method of engaging patients and public in research to gather their views and opinions.

Barts Lay Panel Group
The researcher used PPIE methods to collect data from the Lay Panel at Barts Hospital in London, which consists of 25 members, to advise on clinical research and developments affecting the diabetic population and help refine the design of research studies.

Clinical Data Collection
Researchers engaged with a diverse group of clinical and healthcare professionals to gather feedback on the preliminary prototypes.

Data Visualisation

The diagram in figure 3 visualises data taken from temperature and pressure sensors. At this stage in the project the range of pressure is limited to two discrete pressure sensors located at the bottom of the foot, on the ball and heel. The pressure sensors deliver data demonstrating an indicative general range of force being applied to the foot, shown in red (ball of foot) and blue (heel of foot).

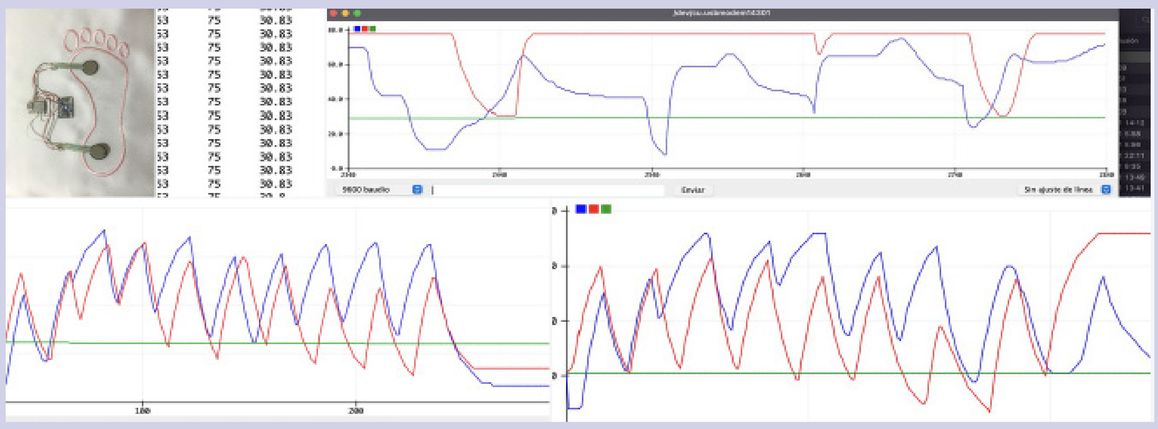

Figure 3

Results

A summary of themes that emerged from interviews and questionnaires are presented below.

Remote Consultations
Patient groups wanted to maintain in-person consultations with clinical teams as a move against the increased interest in remote sensing.

System Design, Hardware and Technical Features
Many respondents wanted to know if a smart sock could detect excesses of foot heat, cold, numbness, sweat, smell and fragrance.

Development
More information about methods of funding smart sock development was requested by respondent and if the idea would provide value for money.

Data Capture and Transmission
Patient groups were concerned with issues of intermittent signal or loss during data transmission and communication with clinicians.

Practical Considerations, Design, Ergonomics and Fit
Patient groups wanted a smart sock to be comfortable to wear and a good fit.

Foot Health, Mobility and Compliance
Clinicians were keen to stress the importance of patients taking a more active role to identify and deal with problems relating to their own foot health.

Conclusion

The feedback indicated that many in the patient group were interested in the possibility of collecting foot information and biofeedback to signify issues around foot health. They mentioned an interest in developing something similar to a 'digital health assistant' to assist with foot care.

In summary, the technical and practical elements were important themes from both patient and clinical perspectives that demonstrated a concern with designing a sock to maximise comfort and fit.