A measuring tape for future fashion.

“Have nothing in your home that you do not know to be useful or believe to be beautiful." – William Morris

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Fig. 1. Render

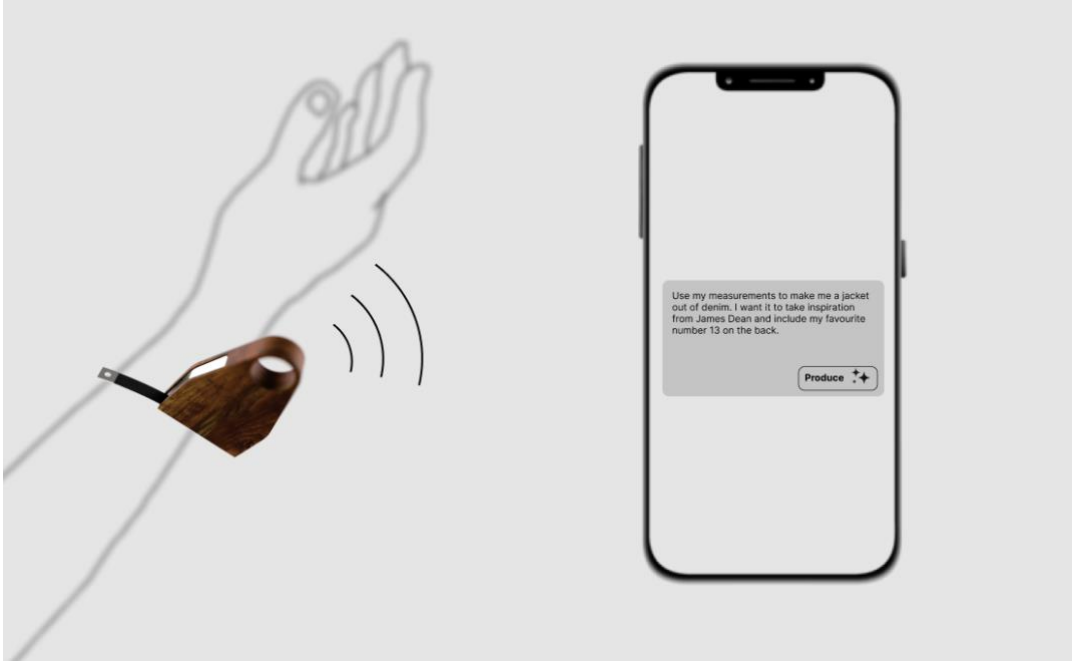

Fig. 2. System

Abstract*—What does the future of production look like? In this paper, it is proposed that a new measuring tape could be the first step in unlocking it. It introduces a future vision of the fashion industry, where robotics, AI and automation have enabled truly personalised, beautifully local clothing. This measuring tape is designed as the first human touchpoint of this system, where a user can input their sizes and request their desired clothing. The vision is that this will be sent to AI-enabled automated clothing production systems. In 2025 reality, this will be hand-sewing to begin with, to prove the MVP before scaling automation step-by-step. Importantly, there are several non-obvious benefits to designing a measuring tape for this system. For example, since the whole system is now contained, there is no need for the user to ever see a number. The measuring tape can send the data straight to the system, avoiding the issues with body image that come from societal pressure to be a smaller size. The measuring tape is also the perfect introduction to this shift of thinking and can be given away to initial users as a token they can carry with them and show to others, to grow awareness.

I. Introduction / Background

In the late 19th century, the Arts and Crafts movement shifted to mass production after the rise of industrialisation in the Victorian era. The effects of this shift are still in motion today. Companies like P&G, Temu & IKEA dominate global consumer markets using vertically integrated supply chains. They have a stranglehold on accessible, mass-produced goods.

This could change within the next ten years. Several key enablers are coming into play, which could lead to a return to locally produced, affordable "beautiful" things.

- AI will be able to transfer human sentiment into machine-executable instructions.
- Scalable humanoid robotics will start to automate tasks previously thought impossible.
- Geopolitical shift away from globalisation.

Whilst this will affect all consumer goods industries, the first that this paper focuses on is the fashion industry. This was decided because:

- The fashion industry is extremely unsustainable and desperate for change.
- I have experience sewing and an engineering background, so is quite "right place, right time".
- Clothing is a deep expression of who you are, it would enable people to be proud of what they wear and how it fits them.

II. Related Work

Measuring tapes have been around since Egyptian times and have been developed in various ways over the years to suit different applications. In this application, it is important that the measuring tape can connect digitally to a phone and can serve as an effective marketing tool.

Fig. 3. Slimpal Body Tape Measure, Amazon UK

The figure shows a typical example of digital clothing measuring tapes that are on the market currently that would fit this application. The measuring mechanism and data transfer would be similar technically, however, there are several big differences.

- The digital display displaying the numbers is not needed.
- The focus is not on weight loss; it is on producing clothes that fit well and promote body positivity.
- The design does not clearly communicate the function, nor does it serve as a marketing tool as desired for a new clothing production system.

III. Imagined or Existing Prototype Sketches/Drawings/Photos

A. Defining the prototype

TABLE I. MEASURING TAPE SPECIFICATIONS

ID	Specification
1	Retractable, loopable tape.
2	Measurement to mm accuracy.
3	Self-use.
4	Intuitive, no instructions needed.
5	Unique and marketable brand identity.
6	Data transfer to phone/laptop.
7	Integrated energy storage.

B. Prototype plans

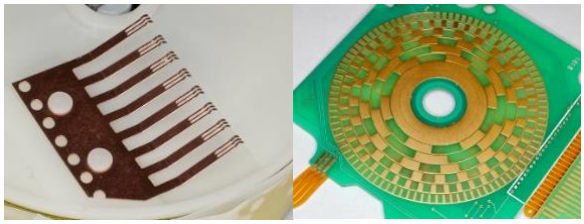

Fig. 4. Rotary encoder

This measuring tape doesn't need to reinvent the wheel in terms of specific mechanisms. The industry standard way of measuring the turns of the tape is an incremental rotary encoder. This can be built directly onto a PCB and has minimal moving parts, so it will last longer.

Fig. 5. Internal spring

A standard metal coil spring will be used to retract the tape.

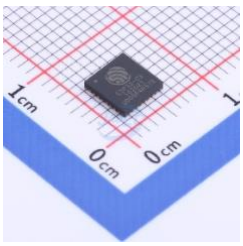

Fig. 6. ESP32-C3

The ESP32-C3 is a great fit for the microcontroller for this project. It's low power, affordable, and supports Bluetooth Low Energy for quick, reliable pairing to the user's phone/laptop. I can then build an app using React Native.

Fig. 7. Li-ion 3.3V 300 mAh

If the digital measuring tape is used for about 10 minutes per month, its power requirements are very low. Estimating the current draw at 30–50 mAh per month, a small 300–500 mAh Li-ion would easily power it for several months on a single charge, making it highly efficient and convenient for infrequent use.

Fig. 8. Render

The CAD model proposes an idea of what the CMF could look like, choosing a more Arts & Crafts aesthetic, to reflect the mission.

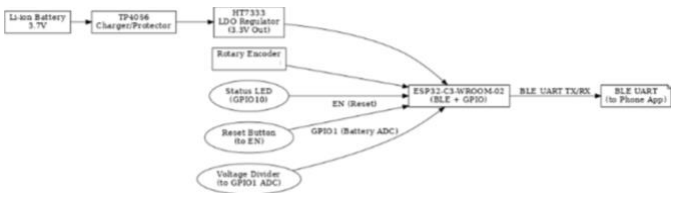

Fig. 9. System diagram explaining the circuit design.

Here is a system diagram explaining the overall planned circuit design.

C. *Evaluation and goals for Pro2*

This paper illustrates the prototype plans. The next stage is to produce a few working examples in real life. At Pro2, the goal would be to learn more about how to build the PCB and make sure that it is compliant with regulations before beginning testing with users.

IV. Responsible Innovation

One of the main inspirations of this work has been the "Solarpunk" movement, which I discovered during my Design Futures module at Uni last year from the video "Dear Alice" (search on YouTube!). "Solarpunk" envisions a sustainable and positive future, where technology has been used, in conjunction with ecological awareness, to serve humanity and promote social justice.

This concept reflects "Solarpunk," as it describes a future where automation technology is used for good, where clothes are produced thoughtfully and intentionally, and where we move beyond a society of fast fashion.

Additionally, the societal benefit of measuring systems without numbers cannot be ignored. Clothing sizing consistently causes massive issues for many reasons:

- Sizing can be wildly inconsistent.
- Clothing that is the same physical size gets a smaller size number over time.
- Sizing can cause body image issues, especially for women and people with eating disorders.
- Off-the-rack sizes rarely work if you are at any edge of the scale.

The proposed system will help to reduce this harm.

V. Author Bio(s) / Experiences

Christian Grose - MEng Design Engineering at Imperial

"Design engineering fuses creative design thinking with engineering within a culture of innovation and enterprise." – Peter Childs

I am a London student with experience across different domains. Currently, I am interning at AirEmail, a Outlook add-in for NHS staff; however, in the past, I have worked at the V&A as part of their Youth Collective and at TechCamp as a robotics tutor. Previous projects include electric bikes, hip replacement FEA simulations, IoT lamps, and even a robotic basil farm!

I have experience in hardware prototyping through many ESP32/Arduino projects, and have business experience from university modules and start-up work.

As a hobby, I also love to sew and am excited to explore fashion automation in my master's and beyond.

I am applying to the Pro2 to learn more specifically about creating a custom PCB for the first time, scaling hardware device production, and building a network that I can contribute to in the future.