1. Introduction

Smart everything is on the rise. Increasingly, approaches to smart fabrics are being explored, offering new possibilities for materials that provide more functionality than their predecessors, such as actuation on a miniaturized scale, adjustable properties, or new sensing capabilities. Many approaches focus on deploying new sensors embedded directly into the fabric to enable measurements over the entire area of the fabric[15]. Distributed sensing is vital in the medical field, sports, robotics, and even our daily lives, for example, to support sign language translation[31]. Pulse, muscular activity, joint articulation, and pressure/touch sensing are just a few of the sensed properties that have been explored. We aim to provide an easily reproducible, adaptable, scalable, and modular approach to the distributed sensing of a fabric's articulation, specifically the degree to which it is stretched and bent in certain areas. If the articulation of a fabric is known, that offers many use cases: Very adaptable measuring of joint articulation of a broad range of robotic joints, measuring deformation of whole planes as in crash tests or medical chairs[26], connecting multiple moving robots and enabling them to know their relation to each other by connecting them with such a fabric.

This work will examine the existing literature and propose a novel approach to developing modular, scalable smart fabrics. This new approach focuses on the reading of sensor outputs throughout the fabric and passing them to a reader in a way that is more scalable than all currently available alternatives. To demonstrate the functionality of this approach, a small smart fabric is produced. In this context, a basic strain sensor is designed to measure its strain and bending angle. Additionally, a compute node prototype is developed and built to measure the fabric and communicate the results.