ANNEX E

OPERATION OF FUNDS AND PROGRESS REPORT

1. **Title of the Project:** Study of Performance and Safety Parameters of Wearable Compression E-Textile Products Used for Massaging Applications	**Project Number:** LITD 0064
2. **Name & Address of Project leader**: Dr. Tribeni Roy Birla Institute of Technology and Science, Pilani (BITS Pilani)	**Date of Commencement:** 25/06/2024

3. Details of Equipment Purchased (if any):

Name of the equipment	**Cost**	**Supplier**	**Date of purchase/ placing order for each item of equipment**
45˚flammability tester	89,670	Sri Balaji Chemical & Instruments	06.08.2024
Bursting Strength Tester	80,240	Sri Balaji Chemical & Instruments	06.08.2024

4. Fund received: Rs.2,98,000.

5. Expenditure made in Rupees: (Please provide the details)

Expenditure	Amount	Tax (as applicable)	Total
Manpower	0	0	0
Consumables	70845	0	21,748
Equipment	170000	0	0
Travel	57655	0	57655
Others	0	0	0
Total			79,403

6. Amount saved (if any) from the last instalment: **Rs 0.

7. Date on which scheme will complete its normal tenure of months: 25.12.2024.

8. Whether extension beyond normal tenure has been requested. ~~Yes~~ /No.

9. Constraints (if any) faced in the progress of work and suggestions to overcome them.

Data availability regarding e-textile massagers is quite limited. Currently, only Indian suppliers provide these products so, less accessible information and comprehensive datasets.

10. Any deviation from original plan with its nature and cause: NA

11. List of publications giving full bibliographic details accrued from this project (copies of the paper (s) should be enclosed): NA

12. Summary of work done (200 words).

E-textile massagers are advanced devices that integrate mechanical and electronic components within fabric, designed for applications in healthcare and wellness. A literature review was carried out on the progression of e-textile massagers and their therapeutic applications. We have formulated test procedures to determine the standard parameters of the e-textile base massagers. To ensure safety, textile quality, electronic integration and performance, we will follow the ASTM, IEC, and ISO standards. A market survey was also conducted to identify e-textile massagers in India, including electric hand massagers for body pain and stroke rehabilitation. We also visited the SITRA facilities for better understanding of the characterization parameters of the e-textile based massager. In the first phase of study we reviewed existing technologies, acquired products for analysis, and formulated test methods, focusing on targeted therapeutic benefits and standard requirements.

13. Proposed programme of work for the next month (1000 words).

We will follow some test methods to evaluate the performance and safety parameters. Some of the sample we will send to the Government registered testing facility lab (such as SITRA, BITRA) to characterize the e-textile based massagers.

1. **Wear Test:** This test method outlines a laboratory procedure to assess the wear of e-textiles using a pin-on-disk apparatus. The method provides insights into their wear resistance and frictional behavior in controlled laboratory settings. The test will be conducted under non-abrasive conditions.
2. **Tear Test:** The tear test helps ensure that the fabric won't easily rip or degrade over time, which is critical for both the longevity and safety of the device. This test method specifies the procedure for determining the force required to propagate a single-rip tear from a pre-cut in various fabrics using a falling-pendulum (Elmendorf-Type) apparatus.
3. **Abrasion Resistance:** This test method determines the abrasion resistance of textile fabrics using the Martindale abrasion tester. It applies to knit, woven, and nonwoven fabrics but may be limited by the material's thickness due to the capacity of the specimen holder. The procedure evaluates how well fabrics resist wear and tear from friction, making it suitable for various materials, including those used in apparel and upholstery. The method ensures consistent testing conditions for reliable results, helping assess the durability of fabrics across various industries.
4. **Material Stiffness:** This test method determines the stiffness properties of e-textile by measuring their bending behavior. The key parameter measured is the bending length, which indicates how far the e-textile extends horizontally before bending under its weight. Using the principle of cantilever bending, where the e-textile acts as a beam supported at one end, the bending length is recorded. Flexural rigidity, a measure of the e-textile's resistance to bending, is calculated from the bending length. This method provides insight into the e-textile's stiffness by analyzing its ability to support itself, which is essential for understanding drape and handling characteristics.
5. **Wear Comfort:** This test accurately measures surface texture that influences wear comfort, such as softness, flexibility, surface roughness, and elastic recovery. It provides insight into how fabrics interact with the skin and body movement. These measurements help optimize fabric design

for better comfort and offer detailed insights into how textiles interact with the skin and accommodate body movements.

6. **Power consumption**: This test method aims to conduct a comprehensive analysis of the power consumption associated with the electronic components integrated into a e-textile based massager. The massager operates with multiple vibration modes, each mode is expected to exhibit varying levels of energy consumption. Therefore, detailed monitoring of power usage across these modes is essential to understand operational behavior, energy efficiency, and the projected lifespan of the device. Understanding power requirements for each function will help improve the performance of massagers and guide ways to make them last longer and be more sustainable.

7. **Fall test:** This test will assess whether the product poses any risks in such situations. A fall test is important for e-textile based massager devices to assess their durability and performance when dropped or impacted. In real-life situations, if someone wearing a textile-based massager device falls or collapses, the device could be exposed to significant impact. The fall test helps determine whether the internal components of the device and the textile material can withstand such force without breaking or malfunctioning. It ensures that the device remains functional and intact, providing reliability and safety for users, especially in critical situations where the device may need to keep working after a fall.

8**. Insulation of wire:** An e-textile-based massager device gets sweaty while wearing it. As a result, the electronics' internal parts can be damaged, or electric shocks or burns may happen. So, proper insulation is essential for wearable devices to ensure user safety and comfort as well as it will improve the durability and performance of the devices. Additionally, good insulation keeps the device functioning efficiently while maintaining skin comfort during extended wear.

9**. Wire Integrity:** Several techniques now used or under development to detect wiring problems mostly involve reflectometry. Common to all these methods is the sending of a signal (a pulse, sine wave, or the like) down the wire and sensing the reflection that returns from the wire's end. They are most useful for detecting so-called hard errors, such as short circuits, but have not proven as useful for less obvious wire problems.

10. **Protection against Electrical Hazards:** Understanding the hazards of electricity, primarily electrical shock and fire. Electrical shock occurs when the body becomes part of an electric circuit, with severity determined by factors such as current, exposure time, and whether the skin is wet or dry.

11. **Pressure safety:** Ensuring that the product exerts the intended pressure safely without causing discomfort, injury, or skin-related issues. The Per Pressure test ensures that the massager provides effective pressure for muscle relaxation or pain relief without crossing the threshold where the pressure becomes painful or uncomfortable.

14. Detailed Progress Report enlisting the objectives in beginning briefly.

The details of the progress have been attached with this document.

Tribeni Roy

Signature of Project leader
Date: 25th October 2024

** Note: The equipment procurement and consumable approvals are currently in progress. These approvals have been included in this report.