Indian Institute of Technology Kanpur
www.iitk.ac.in/ipr
Contact No. 6178

Intellectual Property Disclosure Form

1. Title of the invention: Bidirectional tactile communication glove for the deafblind using Braille.

2. Innovator(s) who have contributed or conceived an essential element of the invention, either independently or jointly with others during evolution of the technology concept or reduction to practice:

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Inventors are requested to provide their Full Name (without initials**), Position (**e.g Professor / Associate Professor / Assistant Professor, Post Doc / Phd / M. Tech / B. Tech Student**), Phone Number (**Personal**), Email ID (**Official along with Personal**)*

Students are advised to provide their **home address as well.*

3. Non-Confidential description of the invention in layman's Language:

A. *Abstract in 100 words*

A glove enabling real-time, two-way communication for deafblind individuals through tactile input and feedback. It combines touch sensors and vibration motors for intuitive interaction, converting spoken input from a mobile app into Braille-based tactile feedback. The Specially abled user can respond by tapping electrodes corresponding to Braille characters, enabling seamless communication. Ergonomically designed with breathable materials, the glove ensures comfort and freedom of movement, while an embedded microcontroller provides wireless connectivity for efficient data transfer. This wearable facilitates effective, reciprocal communication between unimpaired and deafblind users.

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B. Use Case

The present subject matter described herein relates to a two-way communication glove for deafblind individuals, and more particularly, the invention relates to a tactile communication glove based on Braille that enables real-time, reciprocal interaction without requiring a translator. The glove incorporates capacitive touch sensors and vibration motors, providing a Braille-based interface that promotes independent communication. Its breathable, ergonomic design, along with a shape that supports natural hand movement, ensures comfort and ease, allowing users to carry out daily tasks without restriction. With real-time language feedback facilitated through wireless connectivity to a mobile application, this invention enhances inclusivity for the deafblind, enabling seamless and autonomous communication with others.The glove could also be used as a training device for those with progressive deaf-blindness to communicate.

Please consult examples provided in Annexure-1 for filling this section

C. Keywords

Deafblind Communication + Tactile Communication Glove + Two-Way Communication + Ergonomic Wearable + Braille Communication + Assistive Wearable

Please be noted that the above keywords will be utilized by the IPR Cell for preparing Patent Search Report

Note: *Please note that the above Information alone will be circulated to several agencies for technology commercialization purposes once the patent is filed. Thus the fields should be self-explanatory to highlight commercialization potential.*

4. How does this invention relate to new processes, machines, compositions of matter, etc.? Please cover the following points:

(a) Describe the invention in detail for technical evaluation. Please use additional sheets for sketches, drawing, photographs and other materials that help to illustrate the description.

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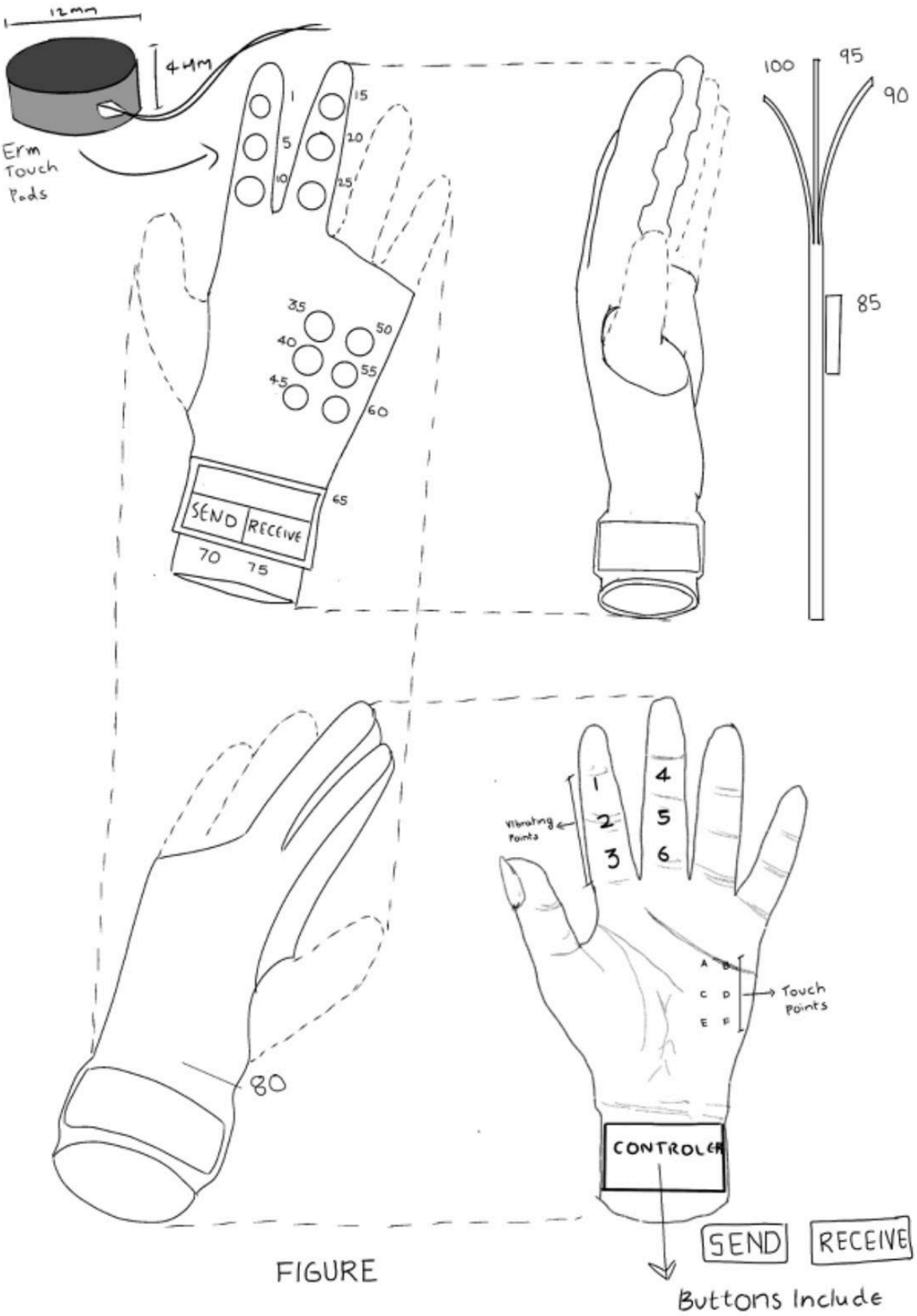

FIGURE

Figure 1

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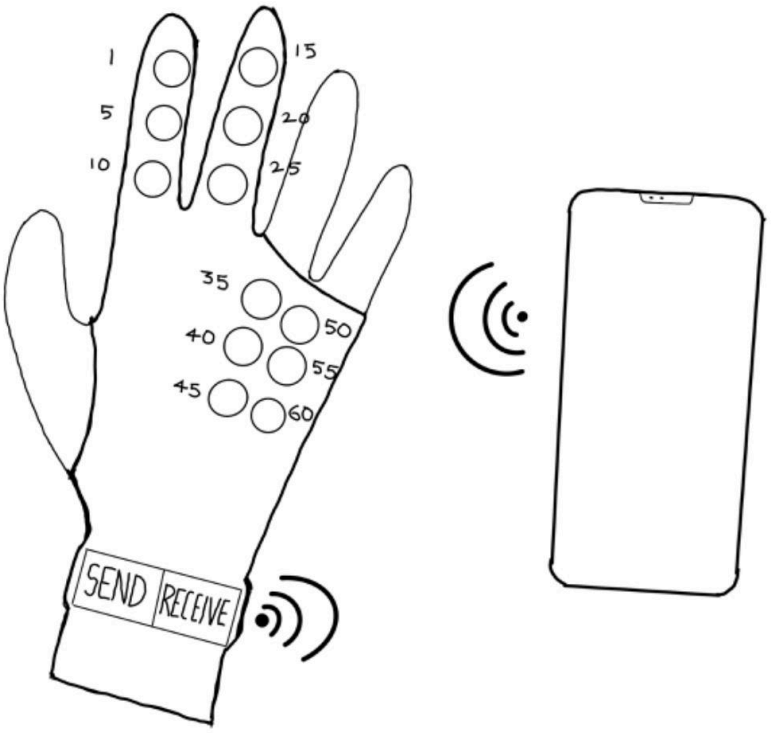

Figure 2

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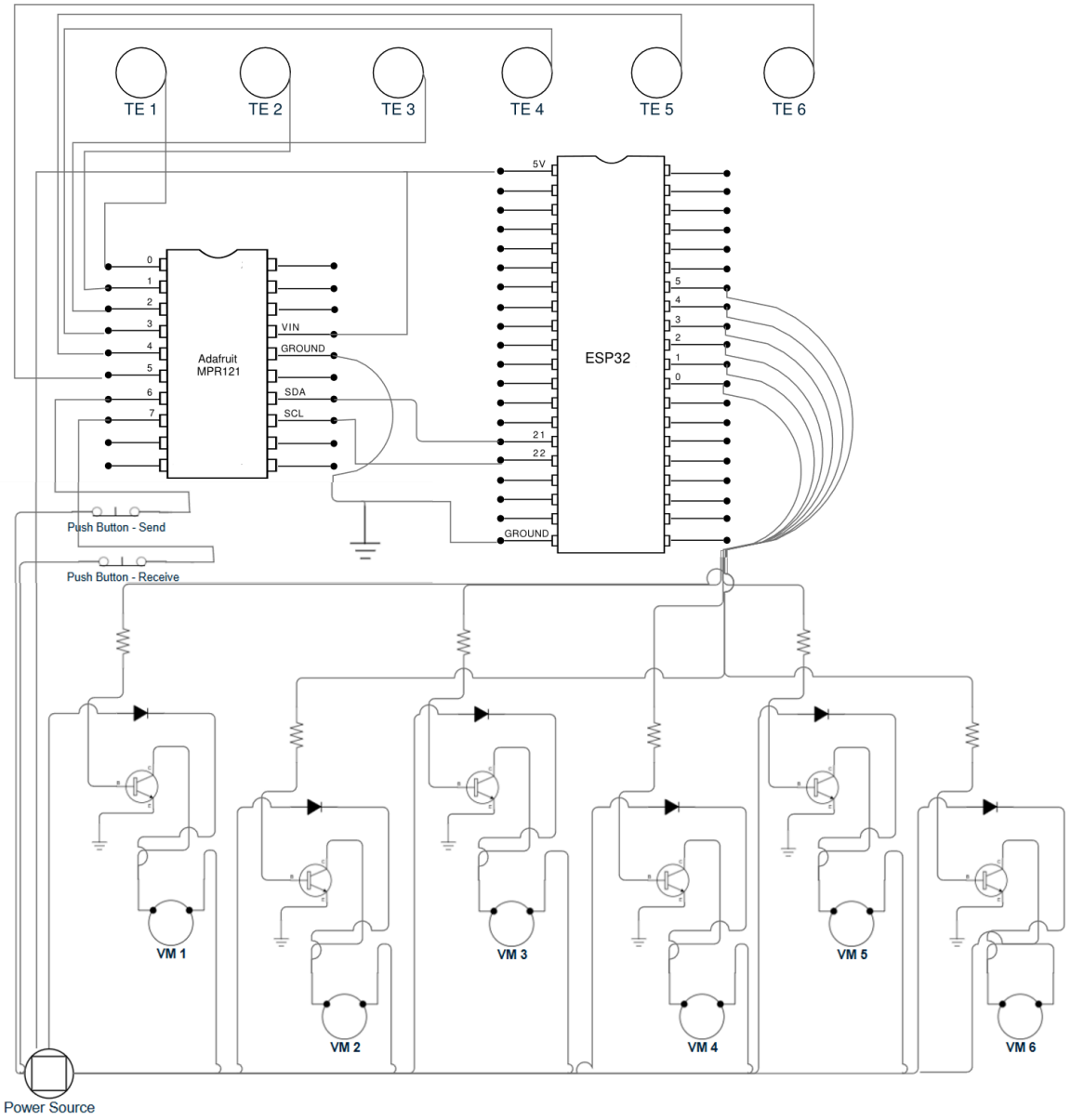

Figure 3

Fig.1 is a detailed view of the glove as seen from the front, back and sides along with a cross section view of the fabric.

Fig.2 is a schematic representing how the glove communicates with the smartphone.

Fig.3 is a circuit diagram showing the detailed electrical connections needed to reproduce this device.

The tactile communication glove (80) enables real-time, two-way communication for deafblind individuals through the braille language. It consists of two distinct zones , one for touch input and the other for vibration output. The touch input unit is positioned on the outside of the glove fabric while the vibration output is attached to the inside of the glove. there is a intermediate fabric in the middle through which all wires are routed. A wrist housing unit contains a padded microcontroller, capacitive touch unit (65) and a circuit board, , with a case ensuring durability and protecting sensitive electronics. The wrist portion

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of the glove is made elastic to secure the glove without restricting hand movement. Wiring is carefully routed between the glove's layers to avoid interference, while flexible copper electrodes connected to a capacitive touch sensing module ensure precise touch detection, even with active actuators. The motors are connected with capacitors and transistors so as to provide the required voltage effectively to each of the vibration motors. These electronic connections are all constrained within the wrist portion of the glove , providing ample freedom of movement to the users hand.

The glove has two modes, a send (70) and a receive (75) mode, which enable easy switching between so that the user can choose when to send messages and when to receive. The default mode is receive; however, the unimpaired user can switch to the send mode when they wish to by pressing the send button.

The glove connects to a smartphone app that translates spoken language into Braille vibrations on the glove and Braille inputs back into speech. When the unimpaired person speaks, the app converts the speech to text and sends it over wifi to the microcontroller in the glove. The microcontroller activates six vibration motors simultaneously, 5, 10, 15, 20, 25) in a specific pattern according to the braille alphabet to generate braille patterns on the hand of the especially abled user, allowing the deafblind user to interpret the message.

For outgoing communication , the impaired user presses the capacitive touch sensors (35, 40, 45, 50, 55, 60) in a specific pattern to indicate a letter of the braille alphabet. The user then presses the send button (70), which sends the details of the specific character spelt out to the smartphone of the unimpaired user. The text is then converted to speech , enabling real-time communication with the specially abled person. .

In this embodiment, the vibration motors are placed as is inside the glove, however in another embodiment, each vibration motor is covered with a flexible dome made of silicone or any other soft like material, which softens vibrations and provides a more natural tactile sensation. In another embodiment, this could be a cover made of TPU polymer to provide the experience of a person pressing it. The glove's software architecture allows for future updates, including additional tactile languages like the Lorm alphabet or the British sign language.The glove could also be made with more compact electronics. This compact, ergonomic glove offers a practical solution for independent communication, suitable for personal, educational, and social applications. Its durable design, precise feedback, and adaptability make it an effective tool for enhancing accessibility for deafblind users.

The foregoing descriptions of specific embodiments of the present invention have been presented for purposes of illustration and description. They are not intended to be exhaustive or to limit the invention to the precise forms disclosed, and obviously many modifications and variations are possible in light of the above teaching. The embodiments were chosen and described in order to best explain the principles of the invention and its practical application, to thereby enable others skilled in the art to best utilize the invention and various embodiments with various modifications as are suited to the particular use contemplated. It is intended that the scope of the invention be defined by the claims appended hereto and their equivalents. Further, it is intended that the figures provided herein be regarded as illustrative rather than restrictive.

(b) What is <u>Novel</u> in the invention?

This invention introduces a wearable glove that provides real-time, two-way communication for deafblind individuals through a Braille-based tactile interface. Unlike most existing devices, which are limited to one-way communication, this glove allows both message reception and response.

1. **Two-Way Communication:**
    - The glove supports full bidirectional communication, allowing the user to receive messages via Braille vibrations and respond by inputting Braille characters. This function enables direct interaction without a translator.
2. **Distinct Receiving and Sending Modes:**
    - Separate Braille dots for feedback (receiving) and capacitive touch sensors for input (sending) create clear, dedicated modes for receiving and sending messages, enhancing usability and reducing confusion.
3. **Compact and Lightweight Design:**
    - The glove is lightweight and breathable, with electronic components positioned near the wrist for unobstructed hand movement. This compact design allows for comfortable wear and easy integration into daily activities.
4. **Natural Tactile Feedback:**
    - Encased vibration motors provide a “skin-like” tactile experience, improving the clarity and ease of interpreting Braille feedback.
5. **Real-Time Wireless Connectivity:**
    - A WiFi-enabled module with a microcontroller connects to a mobile app for instant translation between spoken and Braille text, facilitating timely message exchange.
6. **Ease of comfort during Day to Day tasks:**
    - The glove is constructed from durable materials and designed in a unique shape to facilitate ease of use in daily activities.

(c) What is the “inventive” step in your invention? Is the step non-obvious to a person from related fields?

The current invention has several inventive steps, & the steps involved in the development of this invention are non-obvious to a person skilled in related fields. The current invention has several parts with abbreviations & functionality as mentioned above already. The process of integration of components is non-obvious, as is the process of designing the glove keeping in mind accessibility.

(d) What are the advantages of the present invention over comparable inventions available in patent literature? Please attach a summary of your patent search*.

(e) NOTE: The inventors should go through the Patent Search report carefully and write the difference between his/her invention and each contents of the patent search. For Patent search please contact ipr@iitk.ac.in

(f) Has the invention been tested experimentally? Are experimental data available?

No

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(g) Technology Readiness Levels (**TRL**) description (mention the applicable stage of TRL given below). Please Mark as Appropriate with adequate justification.

☐ **TRL-1**
Research Idea
(Potential Application/Basic Principles observed)

☐ **TRL-2**
Applied Research Idea
(Hypothesis testing and initial proof of concept is demonstrated in a limited number of trials)

☐ **TRL-3**
Project Plan
(Device Characteristics documents & project proposal completed, Proof-of concept phase)

☐ **TRL-4**
Design and Development
(POC & Safety of device demonstrated by prototype design)

☐ **TRL-5**
Standardization
(Validating the result of the prototype by testing in simulated environment)

☐ **TRL-6**
Preclinical Evaluation
(Clinical trials of functional prototype)

☐ **TRL-7**
Technology Transfer
(Technology transfer of the developed system)

☐ **TRL-8**
Clinical Evaluation
(Evaluation of the system by clinical trials or demonstration)

☐ **TRL-9**
Commercialization
(Commercialization & Post Market Surveillance)

(h) Need and Demand
(Technology gaps addressed in domestic & international markets, pain points of Industry which are being resolved)

There is a clear need and demand for assistive communication devices specifically designed for deafblind individual. There are currently very few solutions for deaf-blind users in the market, even though they constitute a significant percentage of the disabled population. Of the exisiting solutions, current solutions often lack two-way interaction, portability, or ease of use. Deafblind individuals face communication barriers and often require interpreters to communicate with the world outside the. They also frequently rely on intermediaries or

specialized tools that can be bulky, unintuitive, or limited to one-way messaging. A device that enables real-time, autonomous, tactile-based communication would enhance independence and inclusion, allowing for seamless interaction in various contexts. With a growing global population of deafblind individuals and an increased focus on inclusive technology, demand for user-friendly, wearable solutions that support reliable, bidirectional communication is expected to increase. This glove meets these needs by offering an accessible and versatile communication tool, enabling deafblind users to communicate freely without intermediaries. The device can also be used to train users unfamiliar with braille in the braille sign language, serving a dual purpose of improving accessibility and also dissolving barriers to create a more inclusive world.

(i) Market Access Information
(Current Global & domestic Scenario, market size & CAGR)

The market for assistive technology in India, particularly focused on deaf-blind individuals, is part of a larger global trend in disability support. In 2022, the global assistive technology market was valued at approximately USD 48.68 billion and is expected to reach USD 86.91 billion by 2030, representing a compound annual growth rate (CAGR) of 6.55% This growth is largely driven by an increasing aging population and the rising prevalence of disabilities, creating a significant demand for assistive devices and technologies that enhance mobility, communication, and quality of life . In India, the assistive technology market is projected to grow at a CAGR of about 4.8% during the forecast period . The specific segment catering to the deaf-blind population is crucial, given that approximately 1 million people in India are classified as deaf-blind, which underscores a considerable need for specialized assistive devices

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(j) Future Developments
Future developments for the communication glove could prioritize miniaturizing electronics with flexible components, creating a more compact and comfortable design. Expanding support for additional deafblind communication protocols, such as the Lorm alphabet and British Sign Language, would enhance its versatility and accessibility across different regions. Improved waterproofing would boost durability, safeguarding components for reliable use in various environments. Additionally, designing the glove to be one-size-fits-all would increase convenience and accessibility. Together, these advancements aim to make the glove a more adaptable, resilient, and universally accessible tool for deafblind communication.

(k) Application/s of the invention
(Please refer to Appendix-I)

The glove is designed for use by deafblind individuals seeking independent, real-time communication, eliminating the need for a interpreter. It is also valuable for those with progressive deafblindness as a training tool, caregivers facilitating interaction, and educators in specialized programs.

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5. IPR Ownership

(a) Was the intellectual property created with the significant use of funds or facilities of IITK?

(b) Yes

(c) Please describe any source of funding for the invention (Name of the funding agency and copy of agreement, letter of intent if any, must be enclosed with this form).

(d) What is the source of Salary/Remuneration of inventor/Co-inventor?
IITK

(e) Have you presented in any conference, seminar, etc., if yes, please give details?
No

(f) Have you published full/part of this invention, if yes, please give copy of publications?

(g) Was the intellectual property created in the course of or pursuant to a sponsored/consultancy research agreement with IITK? If yes, please enclose a copy of MOU with concerned project.

(h) Was the intellectual property created as a part of academic research leading towards a degree or otherwise?

(i) **REVENUE SHARING AMONG INVENTORS:** Please disclose the extent of contribution of each inventor in the invention in percentage terms for revenue sharing.

Name	Percentage Share	Signature
Dr. Nachiketa Tiwari	12.5%	
Chawan Leela Krishna	12.5%	
Divyansh Mittal	12.5%	
Mokshagna Prattipati	12.5%	
Paki Gupta	12.5%	
Shreya	12.5%	
Shruti Ramchandra Dalvi	12.5%	
Varun Sappa	12.5%	

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. * If this column is not filled and signed then it will be assumed that all inventor(s) have equal contribution

6. Commercial potential

Give brief description of potential commercialization by specifying

a) Why should the individual(s)/organization may consider procuring this innovation?

b) These questions are related to the question (i) above:

i. In your opinion what are the steps/processes must be undertaken by the procurer to commercialize the use of this innovation?

ii. How long may it take to reach the commercial stage by the procurer?

c) Please give specific list of companies and contact details of concerned person who can be contacted for initiating Technology Licensing

Sr. No.	Name of the Companies	Name of the contact person	Contact no.
1.	*Dextroware Devices*		94876 50321

(**Unsigned & Incomplete IPDF forms shall not be accepted*).

d) Do you want to file Patent under PCT Route in other countries?

Yes ☐ *No* ☐

*PCT & Foreign filing is subject to monetary support from the inventor(s) Project / Personal Account. If the above option is marked "yes", kindly provide the Project Account Details from which the filing cost could be reimbursed.

Project Account Name:
Project Account No.:

***The institute shall file patent under PCT route only in those cases wherein industry/company has exhibited interest for commercialization.**

Disclaimer: *I/We declare that before the submission of this disclosure form or/and during the process of filing this invention as an IPR prospect, I/We will not publish the above information in public domain.*

I/We also give consent to IIT Kanpur being the applicant of this IPR prospect, that they may use this disclosure upon their discretion, which will not be limited to publication on e-auction website, Industry meets & different portals for promotional & licensing purposes.

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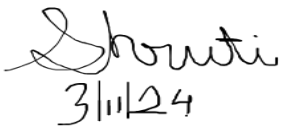
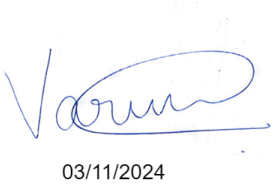
03/11/2024

Signature of Inventor with date

Signature of Inventor with date





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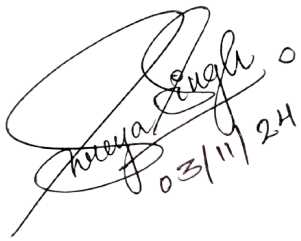
Signature of Inventor with date



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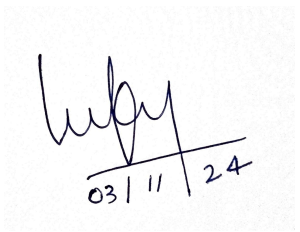

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Annexure- I

Illustrated examples for mentioning use case of Product/ Process

1. ***"Classification of Hard and Soft Taps on Capacitive Touch Screen" having application in below mentioned use case:***

   We all use capacitive touch screens, on a series of devices starting with smart watches, smartphones tablets laptops and desktops. The only thing you can do on the present touch screens is to indicate a location, by touching it there. It doesn't matter whether you touch it hard or lightly - the touch is definitely not 3D. iPhone X has atte mpted to introduce this feature (force touch) by including expensive special pressure-sensitive hardware. We adopt a different approach, that requires you to only install an app on the existing device. With this the same touch screen that you have been using now becomes sensitive to at least two levels of pressure, light and heavy. Every other app developer can now exploit this feature and provide more sophisticated user interfaces which can distinguish levels of touch. The possibilities are limited only by the imagination. As the technology matures, a larger number of levels of touch is likely to be supported.

2. ***"Antibacterial Nano breathing Nasal Filter" having application in***

   Many people use face masks for breathing pollution free air, but the main constraint in breathing is a decrease in breathing flow rate. The innovation described herein relates to a nasal air filter, and more particularly, the invention relates to a nasal air filter based on nanotechnology for breathing by human beings that has antibacterial features, which can mimic the natural breathing process i.e. 12-15 lpm and is comfortable to use. The nasal filter will be useful for people living in polluted cities as well as persons having allergy and suffering from Asthma & Bronchitis.

3. ***"A method of measuring BMP signaling using BMP responsive reporter cell line" having application in***

   Bone Morphogenetic Protein (BMP) signaling is necessary and sufficient for bone formation. It is present in several biological sample measurements of which may have diagnostic value. However, at present there is no sensitive method of detecting BMP proteins in a biological sample. In this disclosure we describe creation of a cell line based sensitive and accurate method of estimating BMP proteins in any specimen.

4. ***A unique device for plasma processing to simulating magnetospheres in the laboratory***

   The dipole plasma device would be helpful in industry for plasma processing of samples such as in the semiconductor industry, where energetic electrons (or ions) are required to impinge on a substrate and to bring about desired changes in the substrate such as plasma assisted ion doping, etching, or creation of nanostructures on metallic surfaces, the device would be helpful in understanding the physics of plasmas confined in a magnetic dipole.

5. ***Large area micro-texturing on free-form surfaces using flexible-electrode through-mask electrochemical machining***

   Surface micro-texturing deals with the issues pertaining to various fields of engineering for enhancing the essential functions such as tribological, wetting, biocompatibility, sustainability, cleanliness etc. Among all the aforementioned sectors, micro-texturing of free-form large areas is getting huge attention, e.g. micro-textures on artificial biomedical implants enhance sustainability and life cycle by better implant-tissue interface, cell-adhesion and cell proliferation. Micro-textures on cylindrical surfaces (both internal and external) of bearings, piston rings, and hypodermic needles assists in reducing the coefficient of friction and facilitating lubrication.

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