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**Electronic cane for people with visual
impairment — Requirements**

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Foreword

Rwanda Standards are prepared by Technical Committees and approved by Rwanda Standards Board (RSB) Board of Directors in accordance with the procedures of RSB, in compliance with Annex 3 of the WTO/TBT agreement on the preparation, adoption and application of standards.

The main task of technical committees is to prepare national standards. Final Draft Rwanda Standards adopted by technical committees are ratified by members of RSB Board of Directors for publication and gazettment as Rwanda Standards.

DRS 507 was prepared by Technical Committee RSB/TC 021, *IT and multimedia*.

In the preparation of this standard, reference was made to the following standard (s):

- 1) RS IEC 60601-1: 2005, *Medical electrical equipment - Part 1: General requirements for basic safety and essential performance*
- 2) IEC 60601-1-6: 2010, *Medical electrical equipment - Part 1-6: General requirements for basic safety and essential performance -Collateral standard: Usability*

The assistance derived from the above source is hereby acknowledged with thanks.

Committee membership

The following organizations were represented on the Technical Committee on *IT and multimedia* (RSB/TC 021) in the preparation of this standard.

Beno Holdings Ltd

Carnegie Mellon University Africa (CMU)

Continuity Group Ltd

IHAHA TECH LTD

Polyester Ltd

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Introduction

Consumer and medical technology have made significant advancements over the past 60 years. However, the functionality of canes for people with visual impairment (PVI) remains limited, relying on the user's ability to physically detect objects and forcing the user to be entirely responsible for their safety. This burden can be mitigated with the added security of an object detector. In addition, the standard white cane has no range of physical options. It places additional burden on the user by forcing a change in handle grip depending on how crowded the surroundings are. The white cane thus requires the user to adapt to the cane rather than having a cane that will adapt to the user.

To address these shortcomings, the electronic cane examines how canes can be technologically equipped to improve their functionality in a way that is also ergonomically accessible. The goal for the electronic cane standard is to eliminate this problem by requirements definition and analysis, design, coding, test and operation. This electronic cane utilizes computer vision and sensory technologies for object detection and share different environmental parameters with user friendly responses. Once the project is completed, the cane design will be quantitatively and qualitatively examined to determine its success as a product.

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Electronic cane for people with visual impairment — Requirements

1 Scope

This Draft Rwanda Standard specifies the requirements, sampling and test methods, for electronic cane intended to assist the individuals with visual impairment when in use.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

RS IEC 60086-1, *Primary batteries-Part 1: General*

RS ISO 2859-1, *Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

ISO 9999, *Assistive products for persons with disability — Classification and terminology*

ISO 28219, *Packaging — Labelling and direct product marking with linear bar code and two-dimensional symbols*

3 Terms and definitions

For the purposes of this standard, the terms and definitions given in ISO 9999 apply.

3.1

electronic cane

mobile intelligent sensor-based cane able to detect and share different environmental parameters with user friendly responses

3.2

visual impairment

sight loss that cannot be improved by corrective lenses

Note 1 to entry: Corrective lenses can be either glasses or contact lenses.

4 Product description

Electronic cane for people with visual impairment is an equipment capable of detecting distant obstacles ahead, able to determine whether it is day or night, provides remotely atmospheric pressure, humidity and ambient temperature. If needed privately, the following features among others may be added:

- a) accelerometer and gyroscope;
- b) GNSS geofencing and tracking, cellular connectivity, RFID, wireless protocol;

NOTE The features above are meant to help in short range data sharing.

- c) earphone plugin in crowded room/space as hearing aid;
- d) long lasting rechargeable battery;
- e) vibrator, speaker/buzzer;
- f) foldable light reflective aluminium cane; and
- g) rotating roller tip.

4.1 Classification

Electronic cane can be classified as foldable or unfoldable.

4.1.1 Unfoldable electronic cane

The handle may have a wrist loop on the end or a small crook, which can be used to store the white cane when not in use. The body of the white cane is covered with a white/red paint or reflective tape to provide visibility. Some white canes have a few inches of red paint or reflective tape at the tip indicating the user to have both vision and hearing loss.

4.1.2 Folding electronic cane

The folding electronic cane looks similar to a straight electronic cane except that it is broken up into several sections which are held together by an elastic cord running through the middle of the tubing, which allows it to be held tightly together when unfolded or folded away when not in use.

5 Requirements

5.1 General requirements

5.1.1 The electronic cane shall have a straight tubing with roller tip. It shall be made of light weight material with about 100 mm - 180 mm outer diameter to maintain light weight and straight tubing. The tip shall be made of durable material (e.g., nylon), it can vary depending on the design. The roller tip shall be flexible enough to roll in 360 °.

5.1.2 Length shall vary depending on end-user, for:

- a) minimum tall height: 155 mm;
- b) minimum medium height: 140 cm; and
- c) minimum short height: 70 cm.

5.1.3 The handgrip shall be durable (e.g., plastic or rubber) material which provides good for all types of electronic cane. Handgrip length shall be 180 mm - 250 mm, diameter: 250 mm - 350 mm.

5.2 Electronic cane materials

5.2.1 Shaft/Tube

5.2.1.1 Electronic cane materials shall be lightweight materials such as:

- a) aluminium alloy;
- b) fiberglass;
- c) carbon fibre; and
- d) seasoned timber.

5.2.1.2 These materials shall be parallel to the annual rings, free from knots, decay, insect bite and termite attack.

5.2.2 Grip

Grip shall have slight roughness and non-absorbent of heat and moisture.

5.2.3 Roller tip

5.2.3.1 The roller tip shall be a nonconductive material and detachable from the shaft. The roller tip shall be capable of giving auditory impulse.

5.2.3.2 The length of the roller tip outside the electronic cane shall be 30 mm - 50 mm. The roller tip shall have a peg hole at one end which shall be fixed into the other end of the shaft by either inserting it into the tube. The diameter of the roller tip shall be 12.5 mm minimum, and shall be half round at the bottom.

5.2.4 Electronic cane coating

The electronic cane shall be provided with a fluorescent coating which can give spellings in darkness. It shall be corrosion resistant. The electronic cane finish shall be reflective.

5.2.5 Inner elements

5.2.5.1 The inner elements shall be elastic.

5.2.5.2 They shall include the following:

- a) single cord or wrapped;
- b) nylon cord; or
- c) helical wires/cables.

5.2.6 Electronic cane joints

5.2.6.1 The electronic cane joints shall be such that it shall be easily fittable after disassembling. The joints shall be of taper type or peg type. In case of taper joint, one end of the shaft is tapering and the other is done shaped.

NOTE In case of peg type joint, either one end of the shaft is reduced in diameter by turning or a peg button is tightly fixed in the shaft to enable it to be fitted it in the female end of the shaft.

5.2.6.2 The male and female parts shall fit into each other firmly. The shaft shall remain attached to when a single or double elastic cord is passed through. The elastic cord shall be fixed at the grip and the other end at the peg hold at the tip.

6 Specific requirements

6.1 The electronic cane for people with visual impairment shall meet the specifications in Table 1.

Table 1 — Specific requirements for the electronic cane for people with visual impairment

S/N	Parameter	Specification
i.	Obstacle detection	15°-145°
ii.	Device Weight with Battery	550 g
iii.	Electrical Protection	Class II, Type BF
iv.	Operating Temperature	-10° C to +110° C
v.	Storage Temperature	-25° C to +70° C
vi.	Relative Humidity Range	0 to 100 % relative humidity range
vii.	Storage Humidity Range	0 % to 95 % (RH)
viii.	Barometric Pressure Range	260 to 1260 hPa absolute pressure range
ix.	Storage Pressure Range	100 hPa to 1060 hPa
x.	Ingress protection	IP22
xi.	Storage Temperature	-25° C to +70° C
xii.	Relative Humidity Range	0 to 100 % relative humidity range

xiii.	Storage Humidity Range	0% to 95% (RH)
xiv.	Barometric Pressure Range	260 hPa to 1260 hPa absolute pressure range
xv.	Ingress protection	IP22
xvi.	RGB LED Luminosity	180 mcd - 920 mcd, 20mA
xvii.	Average Vibration Intensity	0.8 m/sec ²
xviii.	Minimum Vibration Intensity	0.6 m/sec ²
xix.	Maximum Vibration Intensity	2.3 m/sec ²
xx.	Vibration frequency	130 hertz and 180 hertz
xxi.	Audible Alarms	> 65 dB(A)
xxii.	Cellular network	GSM 450 - PCS 1900 Frequencies
xxiii.	Wireless protocol	2.402 GHz to 2.48 GHz
xxiv.	Voice assistance	20 Hz to 20 kHz

6.2 Figure 1 below illustrates the electronic system of an electronic cane for people with visual impairment.

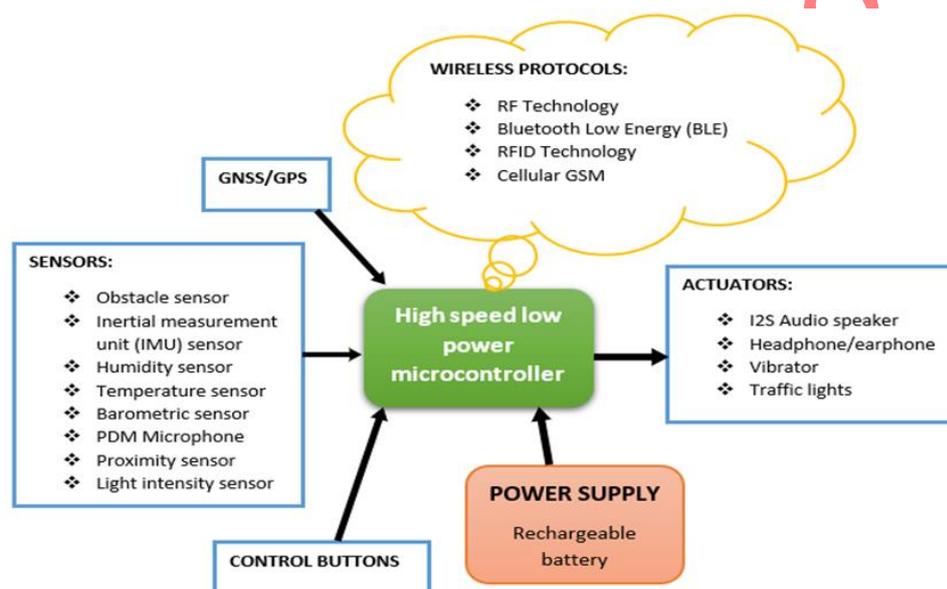


Figure 1 — Electronic devices for electronic cane system

7 Workmanship and finish

All electronic parts/components shall be fixed and tightened into the housing of the electronic cane for people with visual impairment. The functioning of the cane shall be smooth, to avoid sharp points, roughness and undesirable projections.

8 Marking

The electronic cane for people with visual impairment shall be marked in braille or in other language with the following details:

- a) manufacturer's name;
- b) initials or recognized trademark;
- c) total length of the cane below the grip; and
- d) serial number identification.

9 Packaging

9.1 The electronic cane for people with visual impairment shall be delivered fully assembled. All necessary accessories and spare parts shall be included in the package. If any special tools are required, it shall be included within the delivery.

9.2 Each electronic cane for people with visual impairment shall be delivered in an individual package with a label clearly stating the details of the product. The packaging shall ensure that the product is not damaged by delivery.

9.3 The packaging shall comply with ISO 28219.

10 Functional requirements

10.1 Technical information

10.1.1 Information on how to fold and unfold the electronic cane for people with visual impairment shall be provided. Instructions on how to assess, select, fit, maintain, service and repair shall be provided by manufacturers.

10.1.2 The information materials shall be available in braille and other language(s) in print and electronic formats.

10.2 Instructions for use

10.2.1 The user manual shall include information on safe navigation using the electronic cane for people with visual impairment with universal standard mobility techniques of how to store, clean, maintain, and repair the electronic cane.

10.2.2 The user manual shall be provided in the official language, braille and if applicable, in any other language. The user manual shall be provided in braille and other language in print and electronic formats.

10.3 Environment of use

The electronic cane for people with visual impairment shall withstand various weather conditions, including rain, dust, snow, ice and sleet, and shall be environmentally friendly.

10.4 Warranty

10.4.1 Provided normal heedful use, the manufacturer shall, during the warranty period and without extra expenses, repair parts which break on the product(s) delivered. This comprises all spare parts and labour, except for normal wear and tear of the product.

10.4.2 The manufacturer defects warranty period shall be at least two years after delivery of the product. The same shall apply for spare parts and accessories. Spare parts shall be made available for the duration of lifespan of the electronic cane for people with visual impairment.

10.4.3 The manufacturer shall cover all logistical expenses when repairing the electronic cane for people with visual impairment. Following a written complaint, the manufacturer shall investigate and see to the reasonable repair or replacement of the product within 30 days.

10.5 Lifespan

Under normal conditions of use, the electronic cane for people with visual impairment shall be designed for at least nine years and half of use.

11 Supply and service

11.1 Transportation

Information on how the electronic cane for people with visual impairment shall be transported and who shall pay for the transportation shall be provided by the manufacturer before purchase.

11.2 Delivery time

11.2.1 Delivery time can vary according to the order size, inventory of the manufacturer and applicable lead time. For international delivery, it can be affected by shipment method and the customs clearance procedures.

11.2.2 In general, after confirmation of order and payment arrangements, the delivery for domestic order should not exceed 30 working days and the delivery for international order should not to exceed 60 working days.

11.3 Accessories and spare parts

The following spare parts shall be provided:

- a) electronic cane tips;

- b) elastic cords (foldable electronic cane only); and
- c) travel charger.

11.4 Maintenance

The manufacturer shall provide information about hardware and software maintenance and repair of the electronic cane for people with visual impairment.

11.5 Test methods

11.5.1 Size

The measuring instruments used shall be:

steel ruler, the division value is 0.5 mm.

vernier calliper, the division value is 0.02 mm.

11.5.2 Length

The length shall be measured with a steel ruler. The accuracy shall be 0.5 mm.

11.5.3 Endurance test

The foldable electronic cane for people with visual impairment shall be folded and unfolded manually or by mechanical means for 1 000 times. After conducting the performance test, the electronic cane shall not have any defect.

11.5.4 Diameter

11.4.4.1 The diameter of round electronic cane for people with visual impairment shall be measured at one-half of the full length.

11.4.4.2 The diameter of the tip plane shall be measured with a vernier calliper at the smallest point of the tip.

11.4.4.3 The accuracy of the measurement shall be 0.02 mm.

11.5.5 Tracking

Tracking shall be done by using tracking software by matching physical location and software geographical data.

11.5.6 Battery and power management

Battery voltage and power ratings shall be measured in accordance with RS IEC 60086-1.

11.5.7 Sensory requirements

When the electronic cane for people with visual impairment is tested one by one, by visual inspection and sensor detection, it shall meet the requirements specified in Clause 6.

11.5.8 Sampling requirements

Sampling plan shall be performed in accordance with RS ISO 2859-1.

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