Product Design Specifications

~Radiation Distance Safety Meter~

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Client: Dr. John Webster

Problem Statement: Patients treated with therapeutic doses of radioactive iodine (I-131) can be potentially harmful to those in close proximity when discharged. The radiation from the doses can be a threat to those less than one meter away from the patient, especially family members and healthcare providers who are in frequent contact. Our client, Dr. Sarah Hagi, from the radiology department at King Abdulaziz University Hospital, requested a device that alerts the patient if individuals are within one meter. A device will be created that provides acoustic and optical feedback to alert the patient of his or her proximity to others.

Client Requirements:

- Must sense a human within a one-meter range
- Must provide a feedback to alert the patient
- Must be comfortable enough to where on a daily basis

Design requirements:
1. Physical and Operational Characteristics

a. *Performance requirements*: The device must detect human presence within one meter for at least 6 weeks. Must provide feedback to alert user of human presence. Must function under mild radioactive conditions.

b. *Safety*: The device must have a sufficient feedback mechanism to warn user of unsafe distances with minimal discomfort. The materials must not become radioactive in the period of use. Electrical components must be concealed.

c. *Accuracy and Reliability*: The device must be battery powered and function accurately for at least 6 weeks. The device must detect distances within a 0.1 meter tolerance.

d. *Life in Service*: When the patient is discharged from the hospital after therapeutic radioactive iodine treatment, it is recommended he or she avoids coming within one meter of another person for 4-6 weeks. The device would have to be constantly active for this period of time. It is possible that the device could be recharged at night while the patient is sleeping. The device should hold a charge for at least 17 hours/day, 7 days a week, for 6 weeks.

e. *Shelf Life*: The device should be able to be stored for 10 years without using any of its functionality.

f. *Operating Environment*: The device will be operated in various interior and exterior environments throughout the world. For this reason, it should ideally be operational

at extreme temperatures (-25 – 50 degrees Celsius) and humidity (5 – 95 percent) ranges. It should also be water resistant in the event of rain or spilling.

g. *Ergonomics*: The device must be comfortable to wear throughout the day for up to 6 weeks.

h. *Size*: The device must be small enough to not disrupt the patient's daily activities.

i. Weight: The device must weigh no more than 0.5 kilogram.

j. *Materials*: The materials must not be affected by radiation from I-131. The device should not be made out of a common allergen, such as latex. Electrical components should maintain their electrical properties in the presence of radiation.

k. *Aesthetics*, *Appearance, and Finish*: The device should be aesthetically appealing to ensure the patient feels comfortable wearing the device.

2. Production Characteristics

a. *Quantity*: One prototype.

b*. Target Product Cost*: Around $100.00.

3. Miscellaneous

a. *Standards and Specifications*: The device must meet the requirements of the National Institute of Standards and Technology.

b. *Customer*: Therapeutic iodine radiation clinics and hospitals and the patients they treat.

c. *Patient-related concerns*: The device needs to be durable and comfortable.

d. *Competition*: There are no devices currently on the market targeted towards therapeutic radioactive iodine patients.