Accessible Incontinence Control Device
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Introduction:
Urinary incontinence is a condition that affects millions of men and women. Between 10 and 30% of adults are afflicted with urinary incontinence, or about 13 million Americans. Urinary incontinence occurs more commonly with an increase in age. Patients who suffer from urinary incontinence sometimes develop it as a result of other diseases such as multiple sclerosis, spinal cord injuries, brain trauma and also as a side effect to medications. Urinary incontinence occurs when patients have a dysfunctional bladder, sacral nerve, or urinary sphincter. A dysfunctional bladder may cause overflow of urine or partial release of urine from the bladder. An overflow of urine from the bladder occurs when an inactive bladder muscle doesn’t fully contract occurring in a less active bladder resulting in swelling or stretching of the internal sphincter. When the urinary sphincter is dysfunctional it causes unwanted leakages leading to embarrassment and discomfort of the patients. A dysfunctional sacral nerve results in urinary retention which in turn will eventually lead to urine overflow. The overflow of urine causes skin irritation and external infection. The partial release or no release of urine from the bladder often results in urinary tract infection and internal infections causing the patients to be in a lot of pain. In addition to clinical problems associated with urinary incontinence, patients suffering from this condition face public embarrassment, greatly altered lifestyle, and general decreased quality of life.

Summary of Impact:
The purpose of the device is to assist any patients with a dysfunctional bladder by controlling the flow and release time of urine from the body. This device is designed so that the patient or caregiver will be able to control urine flow on demand. The incontinence device is discrete, durable, and easily used by patients with disabilities. The device provides an accurate status of the bladder by receiving stretch readings from the bladder and converting the readings to a proportional bladder volume percentage. This percentage will is then displayed to the patient on an LCD screen located in the user remote control. The device will be completely implantable with the exception of the user remote, and will not cause any adverse tissue effects, toxicity to cells, or necrosis of surrounding cells. The device will not absorb any proteins, and will be completely biocompatible with body fluid, pH, and temperature. The urinary incontinence device will be light weight, cost efficient, environmentally friendly, and most of all user friendly.

Technical Description:
The Accessible Incontinence Control Device will consist of many sub-units that will work together to accomplish incontinence control and bladder status indication. The external components of the device are contained in the user remote unit. The user remote unit contains and LCD touchscreen for the user to input commands. It also displays the status of the bladder
when the user requests it. The LCD touchscreen user remote unit is the CuTouch from Comfile Technology. The CuTouch contains its own PLC embedded inside it, and it was programmed using Basic and the Cubloc Studio Software. The user remote communicates with the implantable portion of the device via Bluetooth wireless communication.

The implantable portion of the device controls urine flow by using a modified artificial sphincter, the AMS 800 from American Medical Systems. In this device the AMS 800 has been automated by adding a micro pump. When the micro pump receives a signal from the user remote unit it turns on thus pumping fluid out of the sphincter cuff, allowing urine to flow through the urethra. The sphincter then self-regulates and the cuff re-inflates within 3 to 5 minutes. A manual pump has also been included as a safety feature in case the micro pump of any of the implanted electronics experiences failure.

Status indication is accomplished by a variable resistance stretch sensor implanted across the bladder. As the resistance values across the stretch sensor change they are passed through an A/D conversion circuit and into the microprocessor, Comfile Technology’s CB220. The CB220 converts these A/D values to volume percentages and sends them wirelessly to the user remote unit. The CB220 was also programmed in Basic using Cubloc Studio.

**Cost of Parts and Materials:** Approximately $1129.40.