The Auto-Locking Knee Brace provides a support system for those with weak or otherwise unreliable knees. It functions by detecting sudden changes in direction and locking the brace into place to help prevent a fall. The knee brace is worn regularly and programmed to be able to identify the difference between normal movement and a fall risk. When a fall risk is detected the knee brace is programmed to lock into place preventing the fall. If a fall is falsely detected, or after stability is regained, the knee brace contains a lock-release mechanism. All the user has to do is pull up the rod to return to free motion.

**Introduction**

The Auto-Locking Knee Brace provides a support system for those with weak or otherwise unreliable knees. It functions by detecting sudden changes in direction and locking the brace into place to help prevent a fall. The knee brace is worn regularly and programmed to be able to identify the difference between normal movement and a fall risk. When a fall risk is detected the knee brace is programmed to lock into place preventing the fall. If a fall is falsely detected, or after stability is regained, the knee brace contains a lock-release mechanism. All the user has to do is pull up the rod to return to free motion.

**Materials & Methods**

- Raspberry Pi 3 Microcomputer
- 2 Adafruit MMA8451 Accelerometers
- Neo G Adjustafit Knee Brace
- DC Motor Driver
- 9 Volt Battery
- UPS Hat Board for Raspberry Pi Power
- 3D Printed Main Rod
- 3D Printed Locking Push-Pin
- Solenoid Motor

**Results**

- The accelerometer establishes communication with the raspberry pi and the accelerometry data is displayed on a monitor.
- Data is logged properly for use in determining a fall threshold.
- A fall threshold is determined.
- Software is written using PWM (Pulse Width Modulation) to get the Knee brace to lock into place when a fall is detected.
- The locking mechanism responds to the software command to lock into place.
- The lock release successfully releases the knee brace from a locking position and grants the user free motion.

**Conclusions**

The use of a microcomputer for fall detection and avoidance is a viable option. Combined with the use of accelerometers, it provides the capability to detect changes in movement and distinguish a fall from normal movement. It provides evidence that fall detection and fall avoidance is possible to prevent further injury in the future. While GPU processing and Neural networks are a plausible option, due to time constraints it was determined that for my purposes a microcomputer and using my own learning was the best course of action for this project.

**Applications**

- Post-Operation Support—After surgery when the knee nerves are numbed or deadened people often attempt to get up to go to the bathroom or the like and their knee gives out risking further injury.
- Nursing Homes—The knee brace provides support from knees at a risk of giving out due to arthritis or other knee issues.
- Hospitals—for use right after surgery or before surgery after an injury has occurred so that the knee is not stable.
- Weak Knee Support—An extra support system for those with weak knees who have wobbly knees or whose knees often give out.
- Physical Therapy—For use by those undergoing physical therapy in between visits, to help prevent further damage.

**Acknowledgements**

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