

Design of Powered Artificial Knee

The objective of this project is to design a motorized artificial knee that allows persons with above-knee amputations to perform level ground walking, stair ascent/descent, and incline ascent/descent. Generate and provide a detailed design of powered artificial knee including mechanical design drawings, materials, circuit design, control algorithms, and prototypes.

Functional Specifications:

- A. The motorized knee must generate enough joint torque to support a person with ≤ 350 lbs of body weight
- B. The controller of the knee must robustly manipulate the knee joint for level ground walking, stair ascent/descent, and incline ascent/descent. The design must ensure the safety of the user. The function of the design should match the function of Power Knee®, a competitive product (<http://www.ossur.com/pages/2749>)
- C. The designed knee unit should fit in an existing commercial available prosthetic knee frame.
- D. The knee will be battery powered and be able to function continuously for 12 hours without interruption.
- E. The weight of the knee will be less than 4 lbs.
- F. The final prototype must be self-contained.
- G. The final prototype should be tested on able-bodied subjects and patients with above-knee amputations.
- H. The developmental cost of the prototype must less than \$10,000.

Required Skills: We are looking for a team of five students: mechanical engineer, computer engineer, biomedical engineer and two electrical engineers.

- (1) Knowledge of feedback control and digital control
- (2) Knowledge of mechanical system design and modeling; experience in using mechanical tools, such as a drill press, lathe, band saw, grinders, and miscellaneous hand tools required for small scale assembly.
- (3) Knowledge of human locomotion and human movement control
- (4) Electronics and Microcontroller (5) C/C++, MATLAB, CAD or Solidworks