Digital motor output

Digital motor output refers to the use of digital signals to control and drive motors or actuators in various devices and systems. It involves converting digital commands or data into specific motor movements or actions. Digital motor output is commonly used in a wide range of applications, from simple consumer electronics to complex industrial automation.

Here's how the process generally works:

Digital Control Signals: The control signals originate from a digital device, such as a microcontroller, computer, smartphone, or programmable logic controller (PLC). These signals can be in the form of binary data (0s and 1s) or other digital representations.

Motor Controller: A motor controller is an electronic circuit or component that receives the digital control signals and processes them to regulate the motor's behavior. The motor controller acts as an interface between the digital system and the motor.

Motor or Actuator: The motor or actuator is the physical component that converts electrical energy into mechanical motion or action. Depending on the application, different types of motors may be used, such as DC motors, stepper motors, servo motors, or brushless motors.

Motor Movement: The motor controller interprets the digital signals and applies the appropriate voltage or current to the motor's terminals, causing it to move or perform the desired action. The movement can be rotational (in the case of motors) or linear (in the case of actuators).

Applications of digital motor output are diverse and include:

Robotics: Controlling the movement of robotic arms and wheels. Consumer Electronics: E.g., adjusting camera focus, controlling printer mechanisms, etc. Home Automation: Controlling smart curtains, blinds, and other automated systems. Industrial Automation: E.g., assembly line robots, conveyor belts, etc. Automotive: Controlling various vehicle systems like power windows, mirrors, etc. Aerospace: E.g., adjusting aircraft flaps or control surfaces. Healthcare: Controlling medical devices like robotic surgical instruments. The use of digital signals allows for precise control and automation, making digital motor output an essential part of modern technology and industrial processes. It enables sophisticated functionality, efficiency, and accuracy in a wide range of applications.

In recent years, the majority of the population has become increasingly reliant on continuous and independent control of smart devices to conduct activities of daily living. Upper extremity movement is typically required to generate the motor outputs that control these interfaces, such as rapidly and accurately navigating and clicking a mouse, or activating a touch screen. For people living with tetraplegia, these abilities are lost, significantly compromising their ability to interact with their environment. Implantable brain computer interfaces (BCIs) hold promise for restoring lost neurologic function, including motor neuroprostheses (MNPs). An implantable MNP can directly infer motor intent by detecting brain signals and transmitting the motor signal out of the brain to generate a motor output and subsequently control computer actions. This physiological function is typically performed by the motor neurons in the human body. To evaluate the use of these implanted technologies, there is a need for an objective measurement of the effectiveness of MNPs in restoring motor outputs. Sawyer et al. propose the concept of digital motor outputs (DMOs) to address this: a motor output

decoded directly from a neural recording during an attempted limb or orofacial movement is transformed into a command that controls an electronic device. Digital motor outputs are diverse and can be categorized as discrete or continuous representations of motor control, and the clinical utility of the control of a single, discrete DMO has been reported in multiple studies. This sets the stage for the DMO to emerge as a quantitative measure of MNP performance [1].

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Sawyer A, Cooke L, Ramsey NF, Putrino D. The digital motor output: a conceptual framework for a meaningful clinical performance metric for a motor neuroprosthesis. J Neurointerv Surg. 2023 Jul 31:jnis-2023-020316. doi: 10.1136/jnis-2023-020316. Epub ahead of print. PMID: 37524520.