Motor Control of a Stiff Arm Oscillating Pendulum

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Functional Description: Motor Control of an Oscillating Pendulum

Objective: To design and build a motor controlled oscillating stiff arm pendulum that will be capable of initiation and termination of the oscillation based upon the user command, as well as achieve various heights and speeds to be selected by the user.

Description: We have decided to design and build a motor controlled oscillating pendulum. The initial design will include only one height, however, if time permits the user will be allowed to select the swinging height of the pendulum which will be dependent upon the number of sensors. The user will also be allowed to select the start and the termination of the oscillation system. The general block diagram for the system can be seen in Fig 1. The pendulum will be controlled by short bursts from a DC motor. We will design the burst of the motor to occur when the pendulum swings past the equilibrium point by placing a sensor at our equilibrium point to act as the burst sensor. Once the pendulum has reached the predefined height (through feedback from the sensor at that predefined height) the pendulum will continue to oscillate at that frequency until the user selects the option to terminate the oscillation, at which time, the pendulum will slowly return to equilibrium. Our initial design will have a predefined height with only one sensor. If time permits we will place several sensors along the oscillation of the pendulum. A 12 Volt DC motor will be used to generate the oscillation of the pendulum. However the pendulum will be selected in order to place strain upon the DC motor. For example, if the motor has a maximum torque of 20 oz/in, then a pendulum will be selected that will require 25oz/in. Also, the motor will be underpowered with respect to the power supply. Circuitry will have to be designed in order to store power between the motor bursts. A more detailed full system block diagram can be seen in Fig 2. The software will be used to send the signals to the motor in order to control the bursts according to the input of the user and the feedback of the sensors. A software flow chart can be seen in Fig 3. In addition to the single stiff arm pendulum, we will place a second stiff arm pendulum that will hang from the first in order to place a greater load on the DC motor as well as complicate the control of the system.

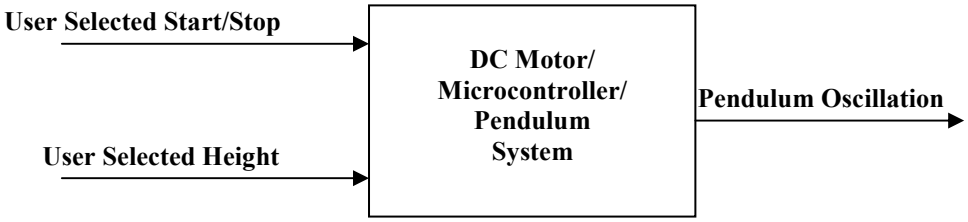

Fig. 1: Block Diagram of the Oscillating Pendulum System

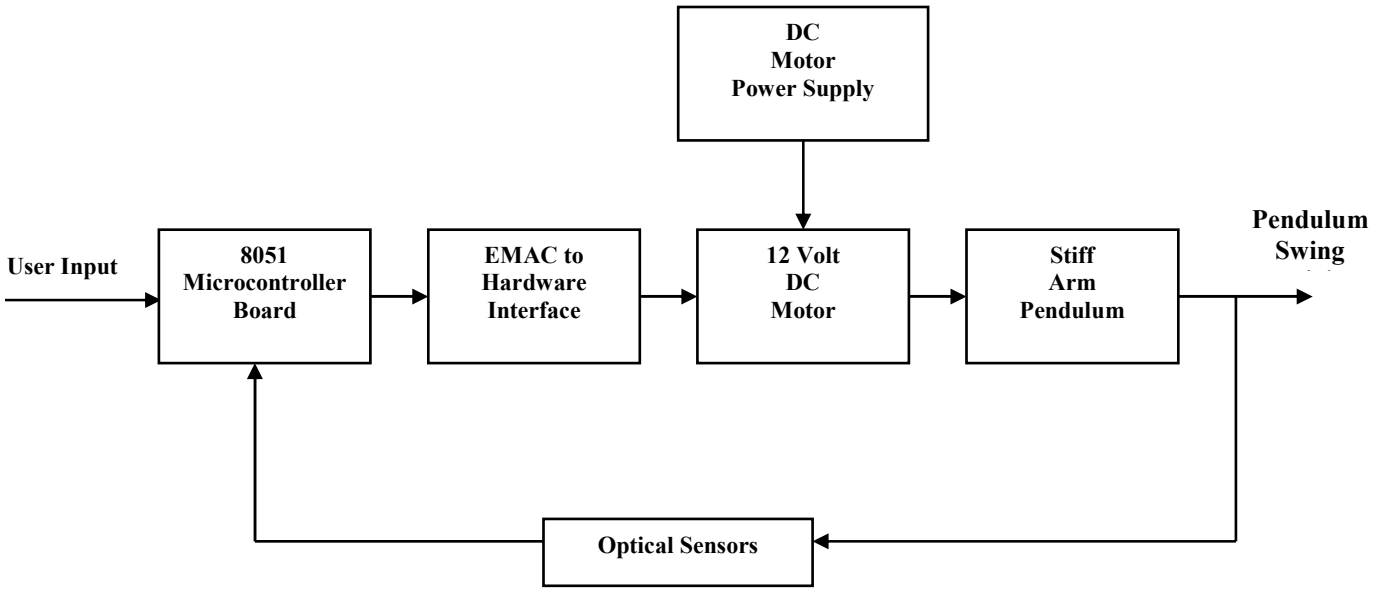

Fig. 2: Full System Block Diagram

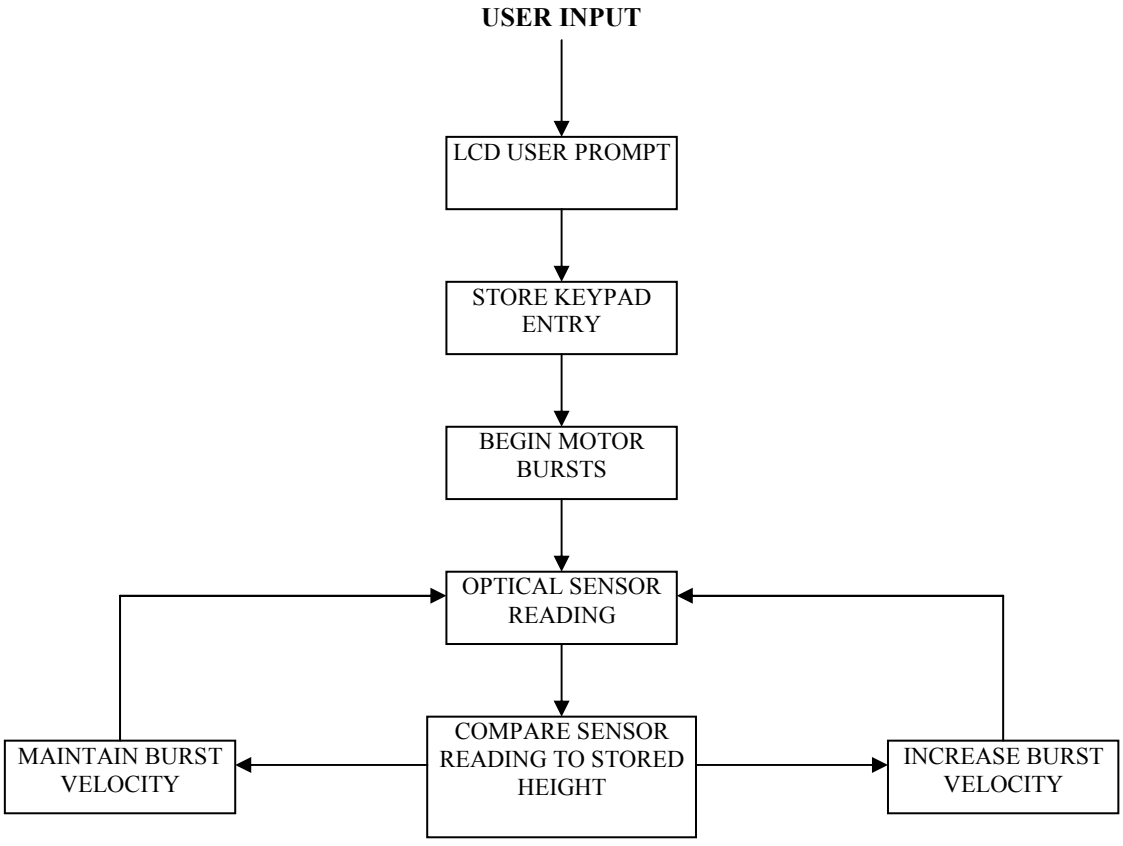

Fig. 3: Software System Flow Chart