PLASTIC INJECTION MOULDING USING ARDUINO

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Abstract:

Injection moulding is widely used for manufacturing a variety of parts, from the small components to body panels of cars. The plastic injection moulding process is used in industries to manufacture several plastic components such as water jars, bottles, wire spools, pocket combs, musical instruments, chairs, small tables, storage containers, mechanical parts. Molten plastic is fed into a heated barrel, mixed, and forced into a mould cavity, where it cools and hardens to the configuration of the cavity. In the moulding machine a threaded arm (screw) is actuated to push the molten plastic into the mould cavity. Our idea is to actuate this arm using an Arduino instead of pneumatic or hydraulic equipment's.

Introduction:

The threaded arm, whose melting point should be above the melting point of plastic, is threaded along its entire length which gives it a 3 way screw like appearance. The arm when moved forward makes the molten plastic to flow to the mould cavity. The screw delivers the raw material forward, mixes and homogenises the thermal and viscous

distributions of the polymer, and reduces the required heating time by mechanically shearing the material and adding a significant amount of frictional heating to the polymer. The material feeds forward through a check valve and collects at the front of the screw into a volume known as a shot. A shot is the volume of material that is used to fill the mould cavity, compensate for shrinkage, and provide a cushion (approximately 10% of the total shot volume) to transfer pressure from the screw to the mould cavity. Traditionally this screw is reciprocated by means of a motor and a hydraulic cylinder which consumes more power and also hydraulic applications are less safe. If an Arduino is used in its place the arm can be controlled accurately using a coded input. It also gives an advantage of very less noise.

Literature Survey :

The injection moulding though it has several applications and used in industries, it gives a three massive disadvantages. They are:

1. High power consumption

2. Noisy operation

3. Dangerous working

Let us take Toshiba Injection Moulding Machine. It has a clamping force of 100-300 tonnes. The power consumption of the machine is 80KW/hr which makes the cost of power Rs.3700 per day. The working of hydraulic cylinder generates a noise upto 100 dB. Also the hydraulic applications are dangerous to handle. An explosion, due to any factors such as human negligence, will have a worst impact on the shopfloor of the industry.

Problem Statement:

All the above said disadvantages can be overcome by using an Arduino controlled Plastic injection moulding. The clamping force can also be significantly reduced. The Arduino can be used to move arm to and fro

using coding. The force with which the arm is moved depends upon the shot volume i.e the size of the components. This variation is force may be provided using an electric motor.

Hardware requirements:

The following hardware components are required:

1. A plastic injection moulding machine
2. An Arduino board
3. A computer loaded with Arduino running software.
4. A motor driver
5. An amplifier

Software requirements:

Arduino software alone is required.

Implementation:

A plastic injection moulding machine should be altered to facilitate the idea. The hydraulic cylinder of the machine should be removed and the arm must be electrically connected to the amplifier. The coding of the Arduino must be such that when the arm is to be moved inwards it should generate a pulse to run the motor. The stroke length, which is the amount of distance to be moved, is determined by the intensity of the pulse generated by the Arduino which is constant for a particular product. Therefore the coding need not be changed for every cycle.

Once a particular product is manufactured upto the required number, the coding can be altered for manufacturing the next required product. The output from the Arduino is connected to the motor driver and then to the amplifier. The amplifier provides the motor the required power to run. The screw shown in the image is to be actuated

by the Arduino control. The injection cylinder can be removed and electrical circuits can be placed.

Feasibility:

The initial alternations in the machine would consume time. Once it is done, the machine operation will be easy, noise-less, more safe. The alternations involve the removal of hydraulic cylinder and will require some electrical circuits. This is practically feasible.

We have a done a prototype for this idea.