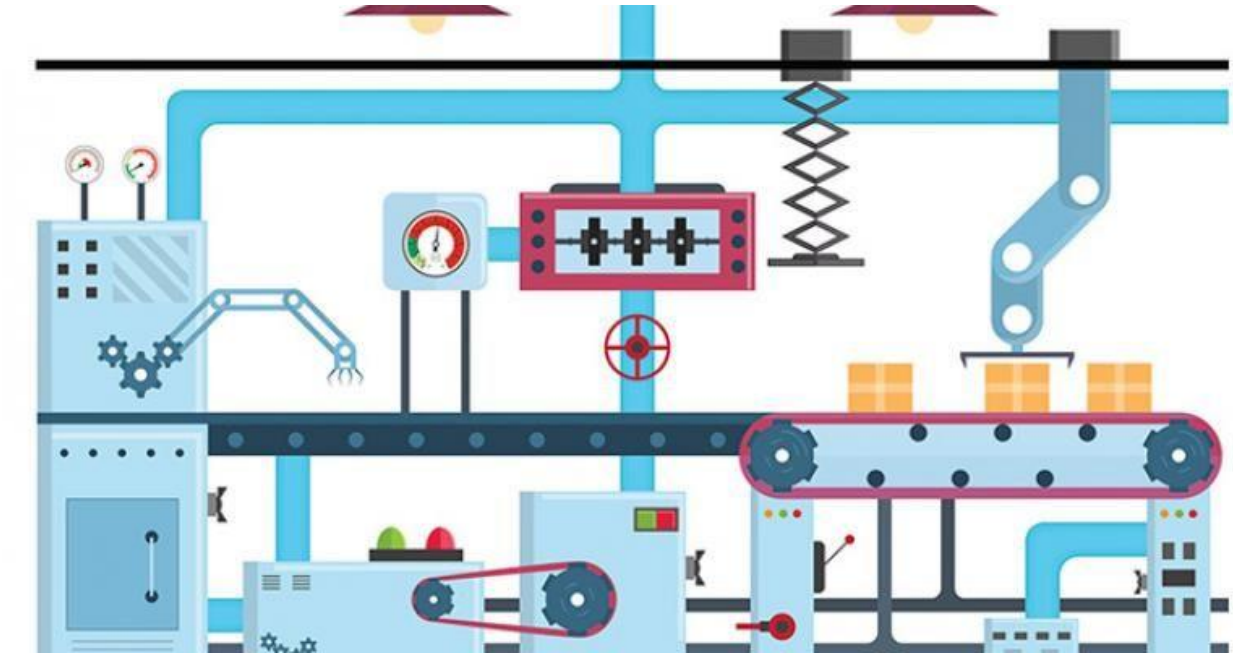

Automation with PLC

Lab Report

Course Name: Microcontroller Laboratory Exercises BMEVIAUAC08

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Supervised By: Kovács Gábor

Date of the Lab: 12th April 2022

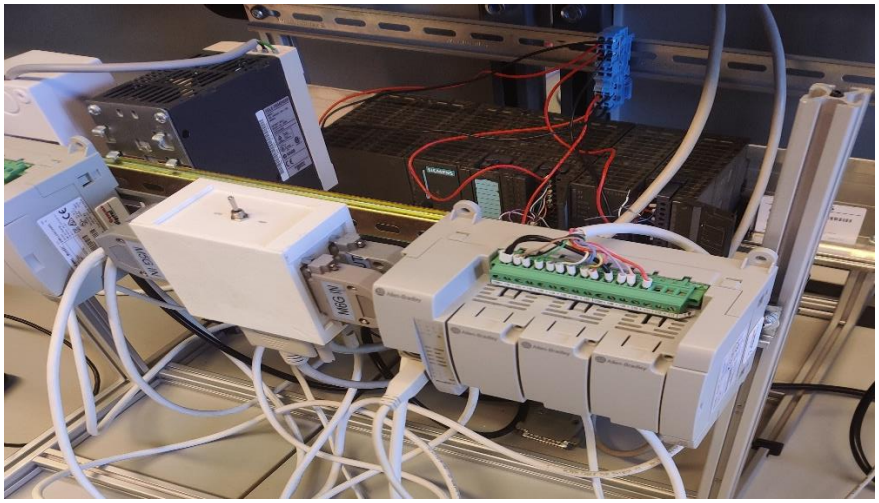
MŰEGYETEM 1782

The objective of this PLC laboratory exercise is to get familiarity with the various aspect of Ladder diagram using a real time industrial machine. The industrial machine is connected to the PLC and we can program the PLC using the PC application through ladder diagram.

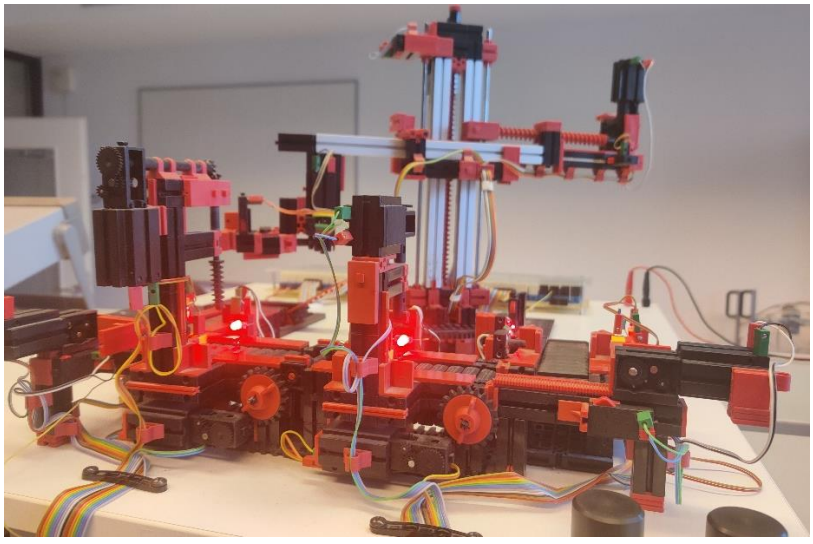
The objective of the industrial machine is to start in a certain condition and take an object through a milling and drilling machine and at the process it for further use.

Throughout this laboratory, while using the application to program the PLC we will use state transition systems.

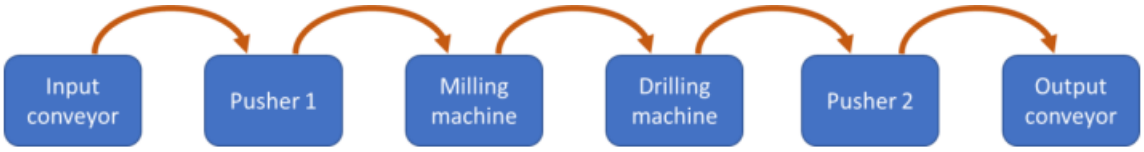
In the lab we used a PLC 2080- LC30 – 24QBB manufactured by Allen Bradley:



And we worked on this structure:



We had to implement the following procedures:



Basically, we have implement three main steps, because the functionality of input and output conveyer, pusher 1 and 2, milling and drilling machine are same.

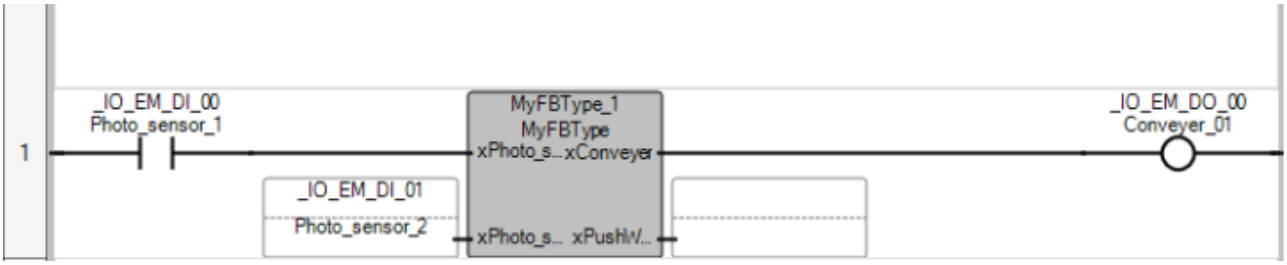
But the problem solving is divided into four parts. First, input conveyer, then the first pusher, then the milling and drilling machine and finally the output conveyer.

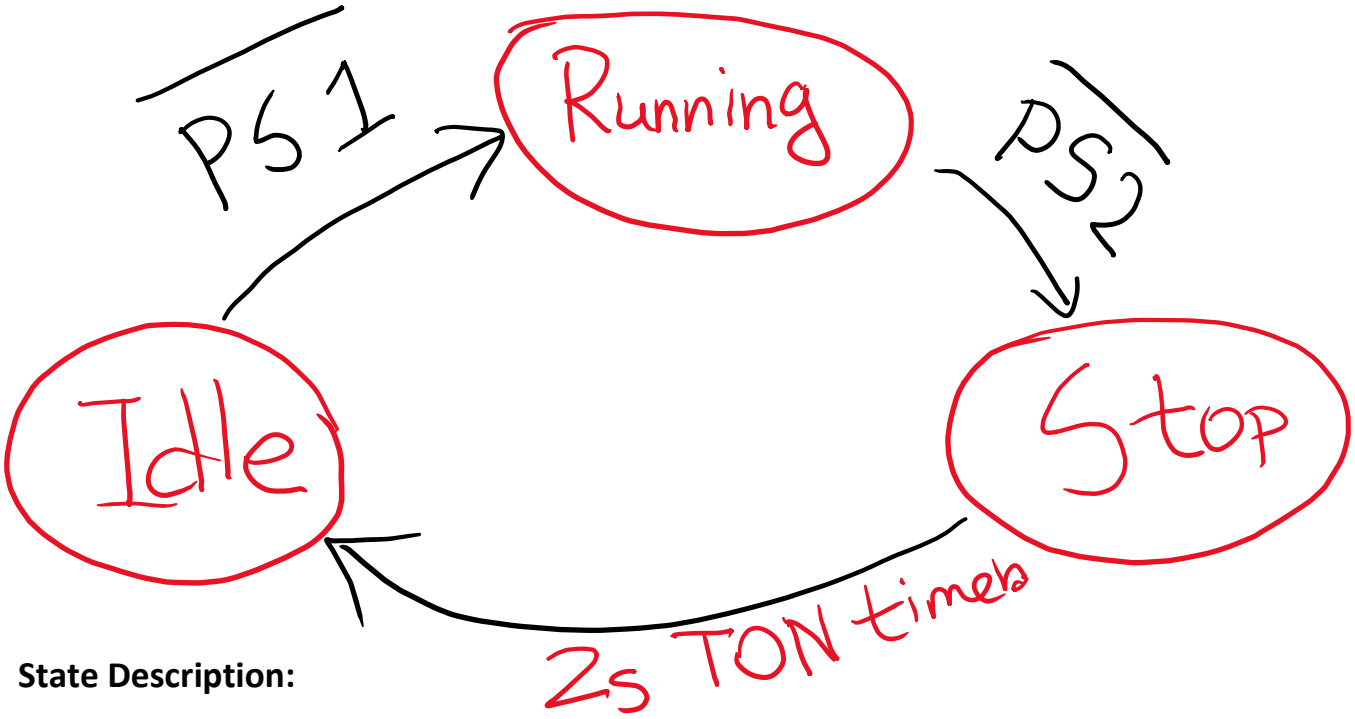
First and Second Part:

The first part of the exercise is fairly direct.

When a piece is placed onto the input conveyor, sensed by the 1st photo sensor, the conveyor shall be started and forward the piece to the pusher. The conveyor shall run for 2 seconds after the piece has reached the 2nd photo sensor. The pusher shall be then fully extended (until the front limit switch is reached) and then retracted to its rear position.

For the first part we need to write a function block for taking the object until the pusher 1. To do that we can use three transition states to fulfill the operation.

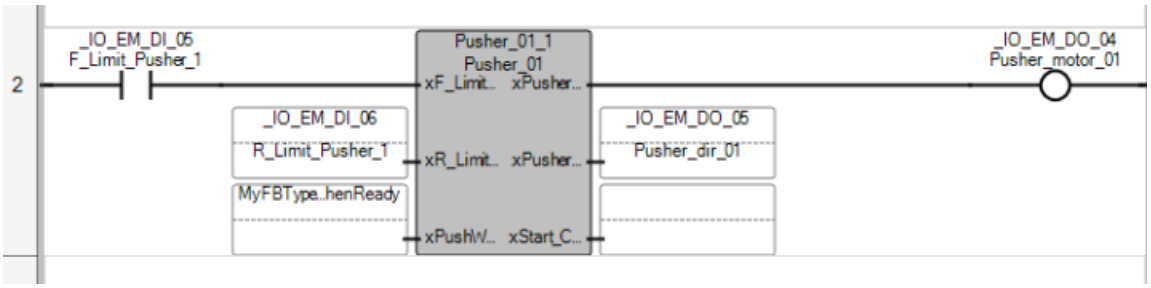


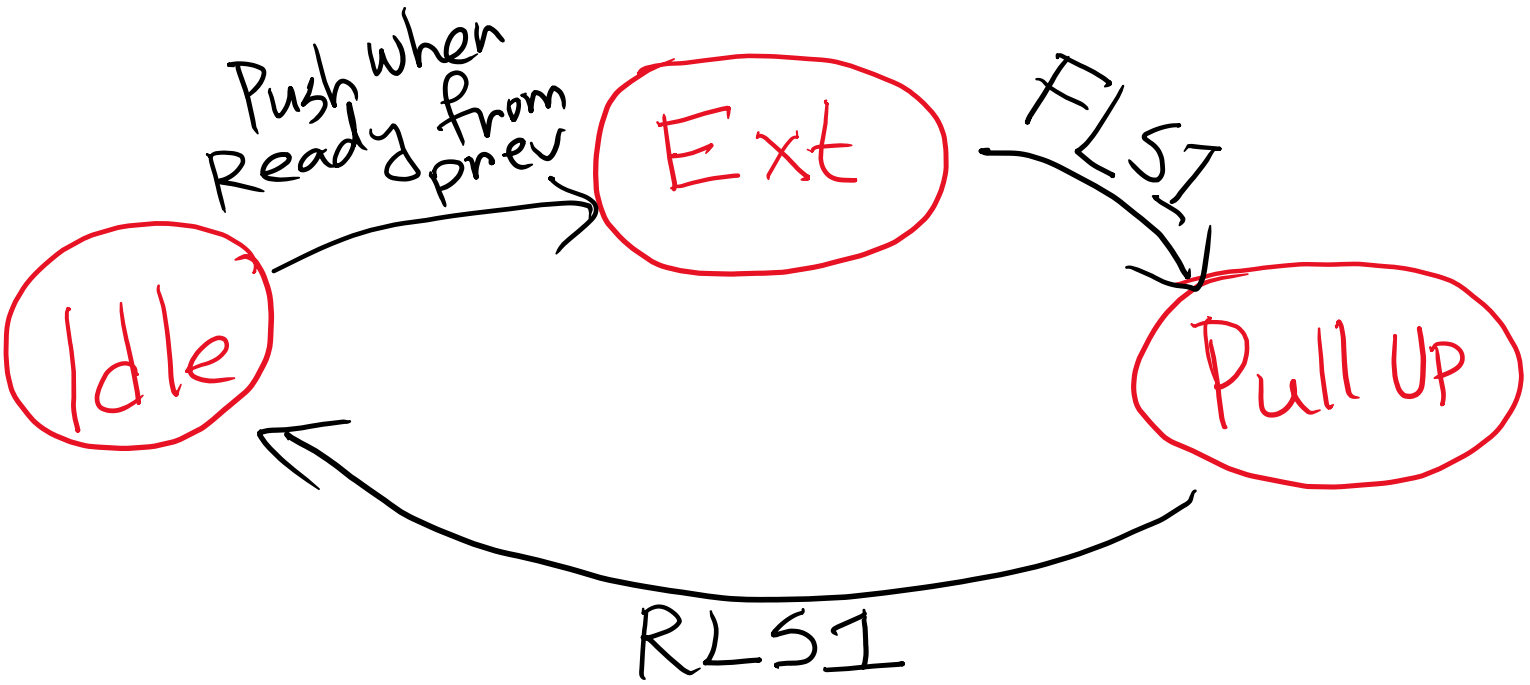


State Description:

- Idle – Will Do nothing. Will start after the PS1 is inactive
- Running – Will run the conveyer. As soon as PS2 is inactive, will go to Stop
- Stop – Stop the process and set to idle again. (Which means that the object has reached to the pusher 1

For this part, we have to make a function block for the pusher which can also be used at the end of the session as well. To make the pusher work, we will introduce four states in the function block for the pusher. Since we have four conditions, we can differentiate the operation in four states.





State Description:

- Idle – Will do nothing, will go to state Ext as soon as PushWhenReady is active from the previous Ladder in the main block of the program
- Ext -- Will extend the pusher and keep pushing until the forward limit switch is on.
- Pull up – When the Forward limit switch is active, we will take back the pusher, which means we will retract the pusher until read limit switch is active.

After that we will go to idle mode again.

There are some additional output variables which needs to be set according to the states.

For First Part:

- Conveyer -- 0 (when Idle)

  -- 1 (When Running)

  -- 1 (When Stop)

For The Pusher Part :

- Pusher_Motor -- 0 (when Idle)

  -- 1 (When Ext)

  -- 1 (When Pull Up)

- Pusher_Direction -- 0 (when Idle)

  -- 1 (When Ext)

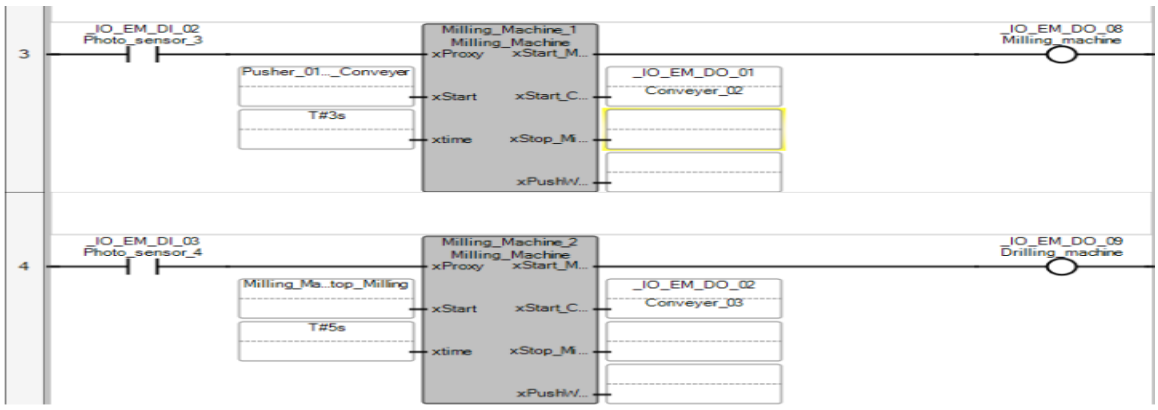
  -- 0 (When Pull Up)

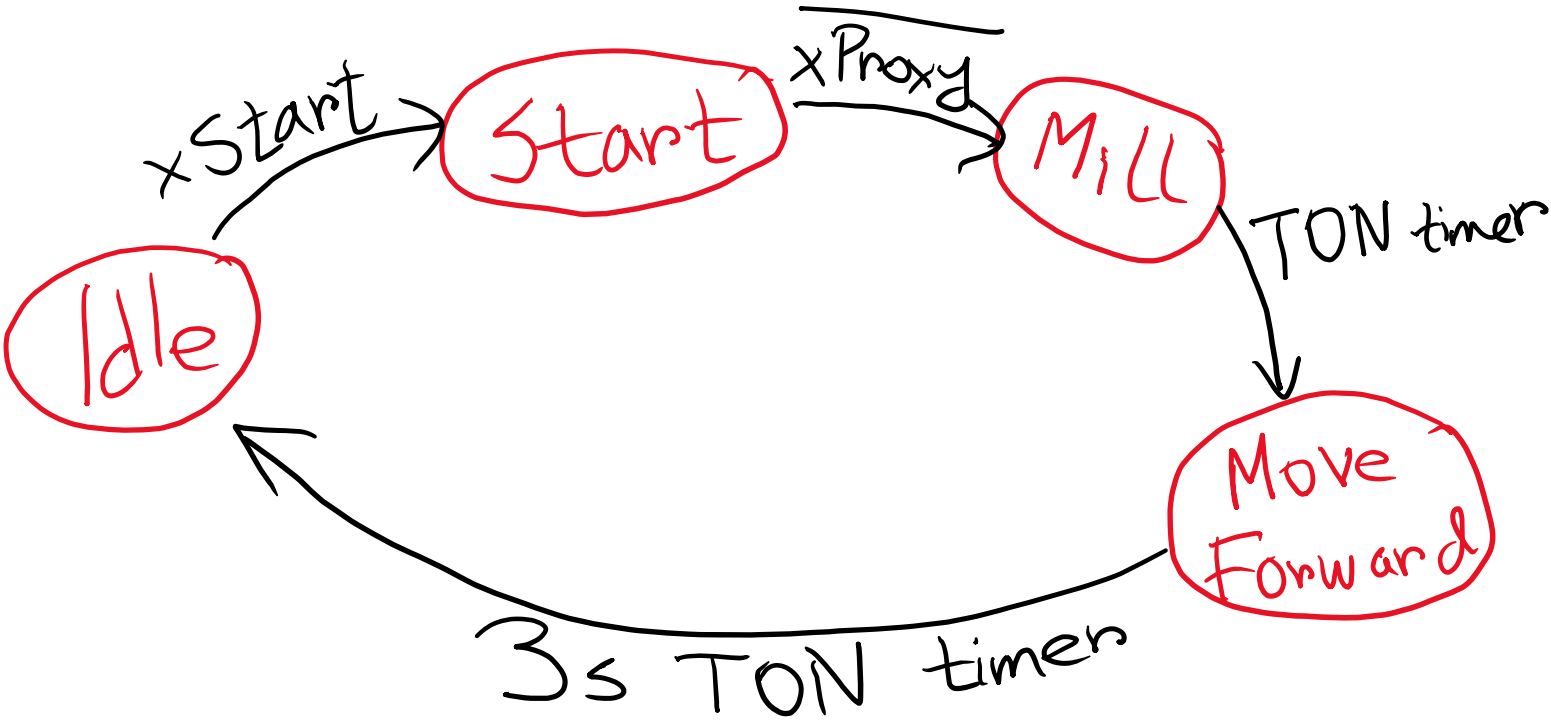
Third Part:

In this problem we will be working to create the function block for the milling machine, the same function block with a minor modification will be used for the drilling machine as well.

The conveyor of the milling station shall be started when the pusher starts moving forward and shall run until the piece arrives to the machine (sensed by the 3rd photo sensor). The machine shall be operated for 3 seconds, then the conveyor shall be turned on again for 3 seconds.

According to the description we can create yet another state transition system to make the function block for the drilling machine.





State description:

- Idle : Will do nothing, will start the conveyer after the start is active from thee previous block of ladder which outputs “pusher1 conveyer”. So when the pusher 1 conveyer is active and (photo sensor 3 is active [which is in the main ladder block]) we will start the milling.
- Mill: starts milling when the proxy is inactive and moves to the next state after a TON timer delay.
- Move Forward: After a delay, moves forward to the drilling machine and the milling machine goes to again in in active mode or idle mode.

Output variables state transition :

- **xStart_Milling** -- 0 (when Idle)

  -- 0 (When start)

-- 1 (When Mill)

-- 0 (When Move Forward)

- **xStart_Conveyer_Milling_Machine** -- 0 (when Idle)

  -- 1 (When start)

  -- 0 (When Mill)

  -- 1 (When Move Forward)

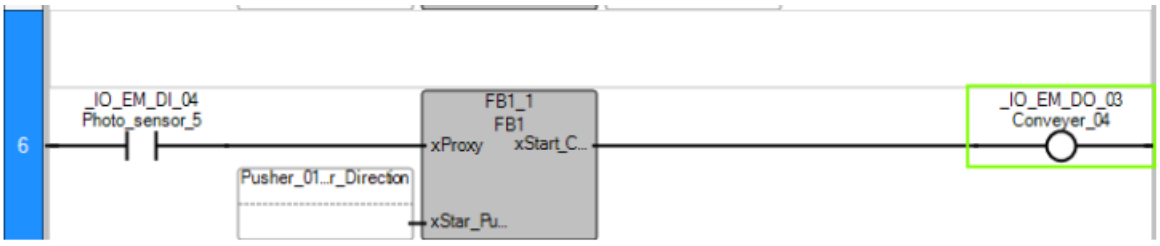
We can also use this function block with a minor modification to use it as drilling machine, since most of the conditional statements for this operation is same.

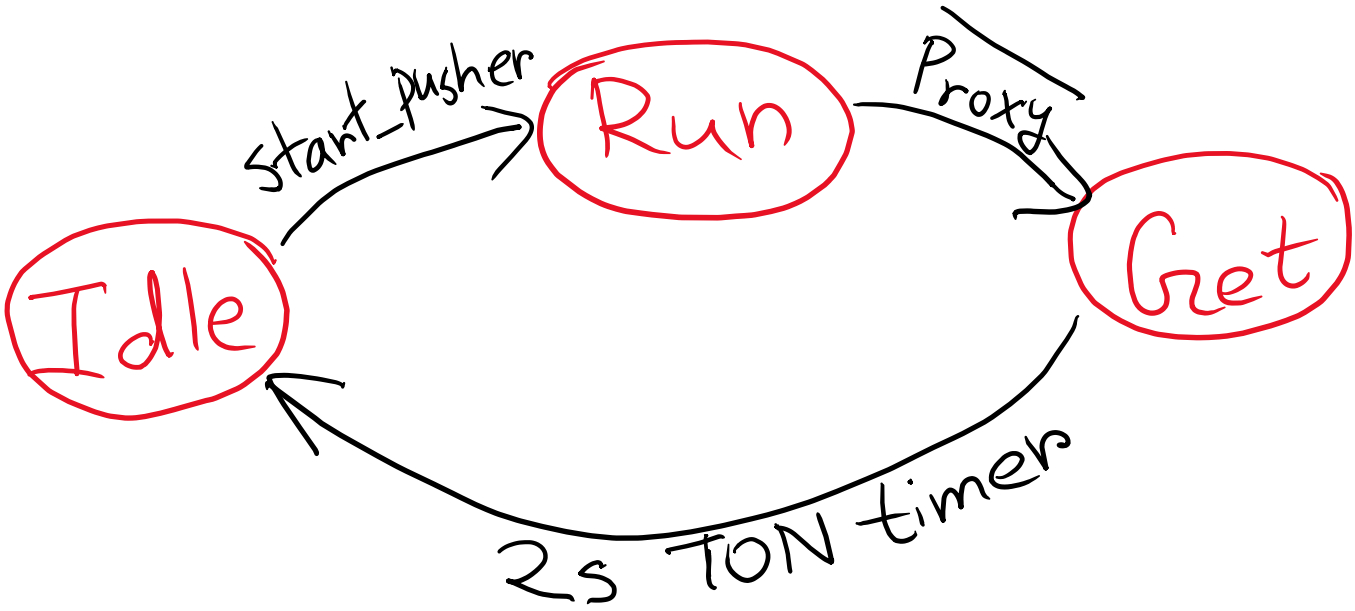
Last part:

The last part of the problem is:

The second pusher operates the same way as the first one, and it shall be started when the conveyor of the drilling station is stopped. The output conveyor shall be started when the second pusher starts moving forward and shall be stopped 2 seconds after the piece has been sensed by the 5th photo sensor.

In this problem we will use yet again three transitional states.





As we can see the transition is almost like the pusher 1. So the state description is also similar to that.

Output variable assignments:

- **xStart_Conveyer** -- 0 (when Idle)

  -- 1 (When Run)

  -- 1 (When Get)