Given: A repetitive task.

Issue: should its execution be delegated to a machine? (= Automation)

Explore if the task CAN be automated from a technical viewpoint

Figure out the structure of the task according to the following logic:

<table>
<thead>
<tr>
<th>Get desired-level</th>
<th>Goal Setter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read actual-level</td>
<td>Sensor</td>
</tr>
<tr>
<td>If (actual level = desired level) then Maintain actual-level</td>
<td>Comparator</td>
</tr>
<tr>
<td>Else Adjust actual-level until it matches desired level</td>
<td>Decision-Maker</td>
</tr>
</tbody>
</table>

Determine the type of function to be automated

- Automated input (Caller ID, Speech Recognition, Biometrics, webcam, …)
- Automated processing
- Automated output (Audio Output, Robotics, …)

Explore if the task SHOULD be automated from an economic viewpoint

<table>
<thead>
<tr>
<th>Fixed Cost</th>
<th>Variable Cost</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual</td>
<td>LOW Training</td>
<td>VERY HIGH</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Payroll</td>
<td></td>
</tr>
<tr>
<td>Automated</td>
<td>VERY HIGH Hardware</td>
<td>LOW (?)</td>
<td>Maintenance</td>
</tr>
<tr>
<td></td>
<td>Software</td>
<td></td>
<td>Upgrades</td>
</tr>
<tr>
<td></td>
<td>Communication</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Training</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Calculate the amount of time it takes for automation to pay for itself

\[
\text{Payback Period} = \frac{(\text{Cost Savings or Revenue Enhancement})}{\text{time period}}
\]

Is the payback period acceptable?

Explore if the task SHOULD be automated from a

- social viewpoint (Are the impacts of automation on people acceptable?)
- marketing viewpoint (Does “automated” have a positive image associated with it?)

http://en.wikipedia.org/wiki/Automation
http://www.domotics.com
## Automation Advantages and Disadvantages

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed</td>
<td>Limited Application Scope</td>
</tr>
<tr>
<td>Accuracy</td>
<td>Inability to Handle Exceptions</td>
</tr>
<tr>
<td>Availability</td>
<td>• “smart” = stupid!</td>
</tr>
<tr>
<td>• Convenience</td>
<td>Lack of Security</td>
</tr>
<tr>
<td>• Productivity</td>
<td>Heavy Upfront Investment</td>
</tr>
<tr>
<td>Long-Term Cost Reduction (?)</td>
<td></td>
</tr>
<tr>
<td>Privacy (?)</td>
<td></td>
</tr>
</tbody>
</table>
The Technical Logic of Automation

Components of an automated system:

I. **Goal setter** (defines the desired state of the system; set by humans and stored in the system)
II. **Sensor** (keeps receiving information from the external environment about the current level of performance of the system)
III. **Comparator** (compares the system’s current state vs. desired state)
IV. **Decision maker** (issue a command depending on the outcome of the comparison)
The Logic of ....................?

I

Establish Desired Speed

Get Desired Speed

II

Read Current Speed

III

Current Speed = Desired Speed

Yes

Maintain Current Speed

No

IV

Current Speed > Desired Speed

Yes

Decrease Current Speed

No

Increase Current Speed

Get Desired Speed
GET desired-speed

DOWHILE in operation

READ current-speed

IF current-speed = desired-speed THEN
    Maintain current-speed
ELSE (* traveling too fast or too slow *)
    IF current-speed > desired-speed THEN
        DOUNTIL current-speed = desired-speed
            Decrease current-speed
    ENDDO
    ELSE (* traveling too slow *)
        DOUNTIL current-speed = desired-speed
            Increase current-speed
    ENDDO
ENDIF

ENDDO
The Phases of Automation

**AUTOMATED INPUT**

Receiving input from the external environment without any human intervention

- Caller ID
- Speech Recognition
- Biometrics
- ........

**AUTOMATED PROCESSING**

Transforming inputs to outputs without any human intervention

**AUTOMATED OUTPUT**

Producing output for the external environment without any human intervention

- Audio output
- Robotics
- ............
Is all automation high-tech?

Steam

Engine