PINterface – custom pinball base system

About milliSoft

Motivation

- Create a custom pinball kit for individual pinball machines
  for games with themes no one has made yet
  (individual graphics, sounds, videos, rules)

- We have experience in both software development and electronics design

  →we can do it!

Where we are

- Located at a technology centre near the „Völklingen Ironworks“ (Unesco World Culture Heritage), Saarland, Germany

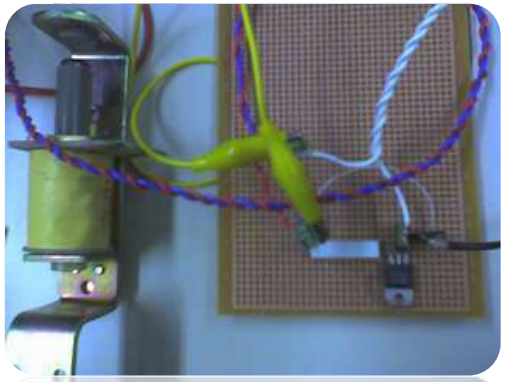
The PINterface system

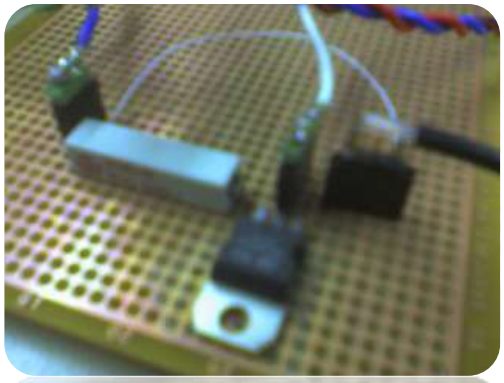
PINterface - general

- PINterface = „pinball interface“
- Over 2 years of development time as after office buisness
- Started in the kitchen and moved to our office in 2009
- Basic idea similar to Pinball2000 system design:
  - pinball logic realized in software on a PC
  - I/O is based on custom hardware design, custom rectifier power board
  - Using standard PC components for visual output (TFT display for graphics and video sequences), sound output (PC sound card)

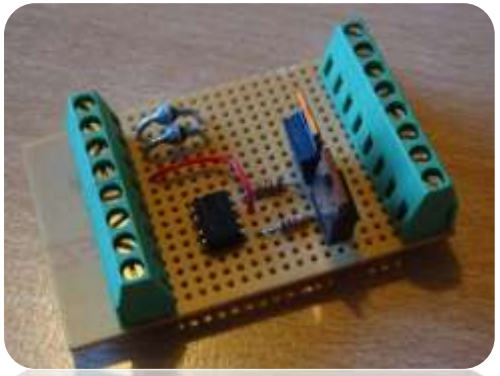
PINteface History

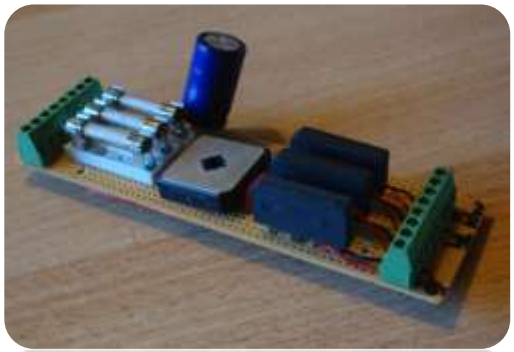
- First interaction with pinball mashine coils





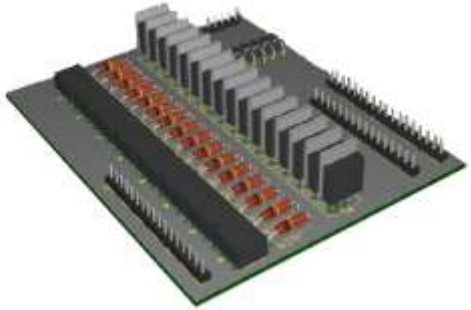
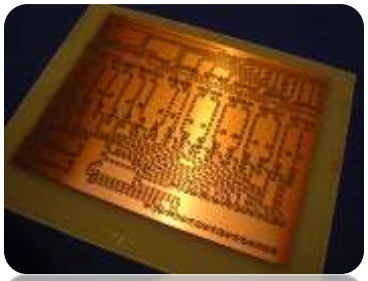
- Hand wired dual channel electronics



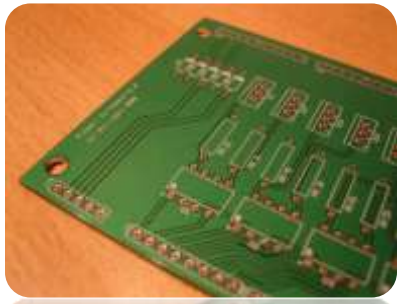


PINteface History

- Etched 8-port design (PINterface 1.0, internal) +
  Ipaq arcade controller with custom pulldown board

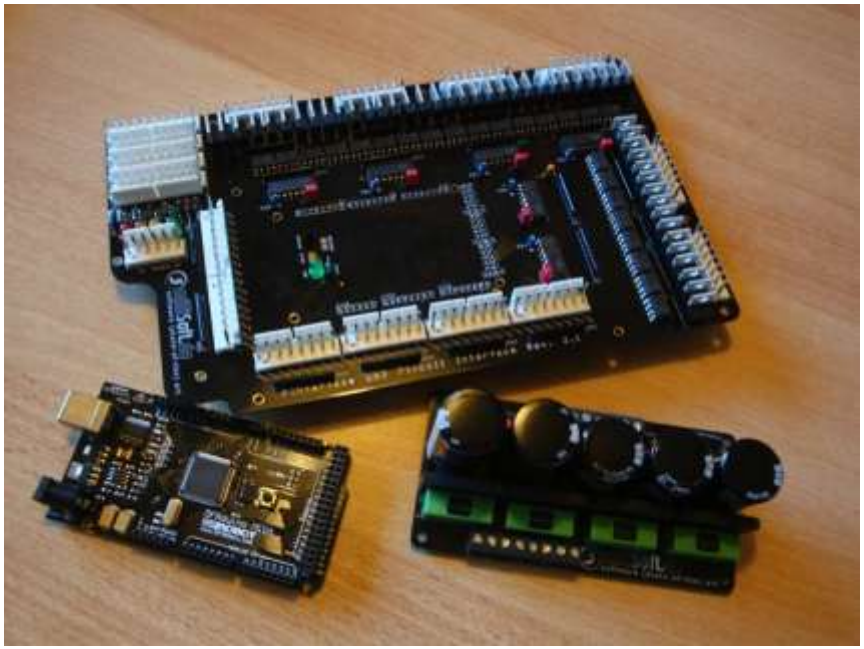

- 8-port design with thicker circuit paths (PINteface 1.1, internal)




PINteface History

- 48 input +48 output edition (PINterface 2.0, beta test version)

- 48 input + 48 output edition Revision (PINterface 2.1, release) with PINsupply

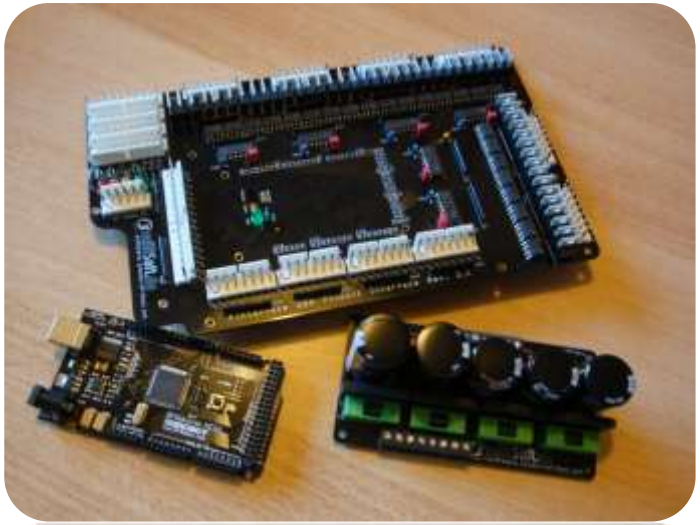


PINterface public release

- First public presentation was on „open german pinball championships 2010“, spring convention in May 2010

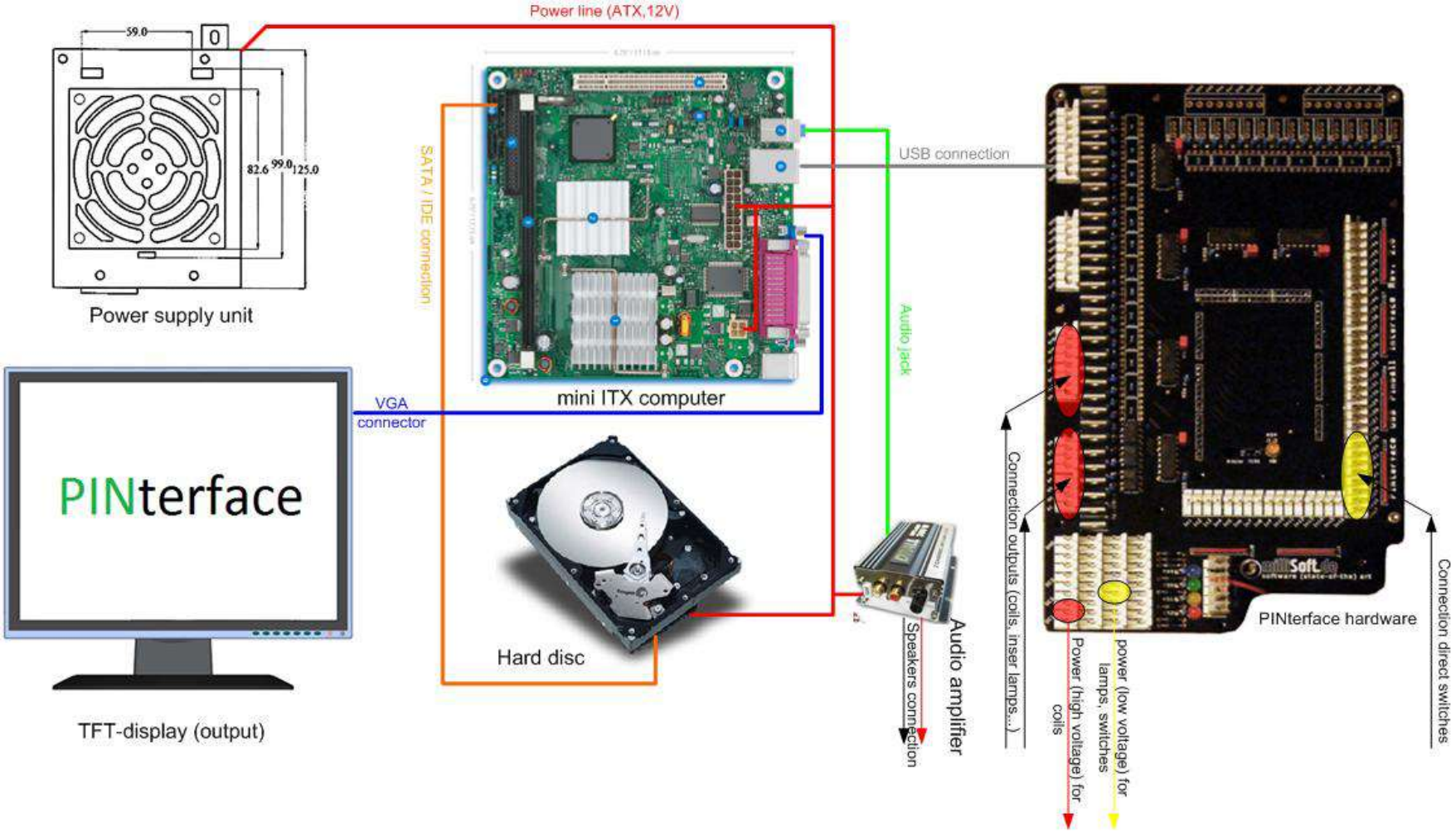
PINterface – the components

- PINterface includes:
  - I/O Board
  - Power supply (rectifier board)
  - Microcontroller board
  - Software (pinball operating system program, additional utilities)



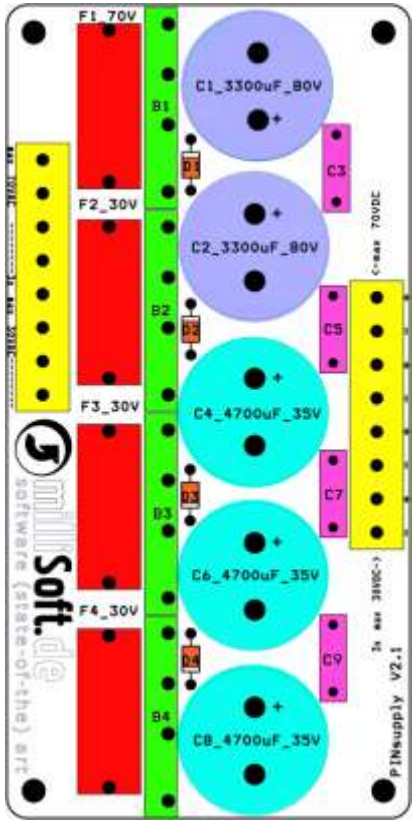
The PINterface hardware

PINteface – wiring diagram



PINterface component: power supply (rectifier board)

- Rectifier for AC->DC conversion
- Up to 4 voltages (e.g. 5V, 10V, 30V, 70V)
- Buffered power supply (up to 6600 µF)
- Includes fuses

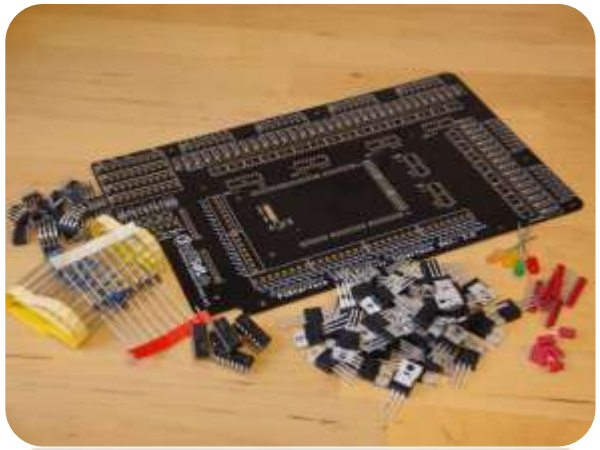


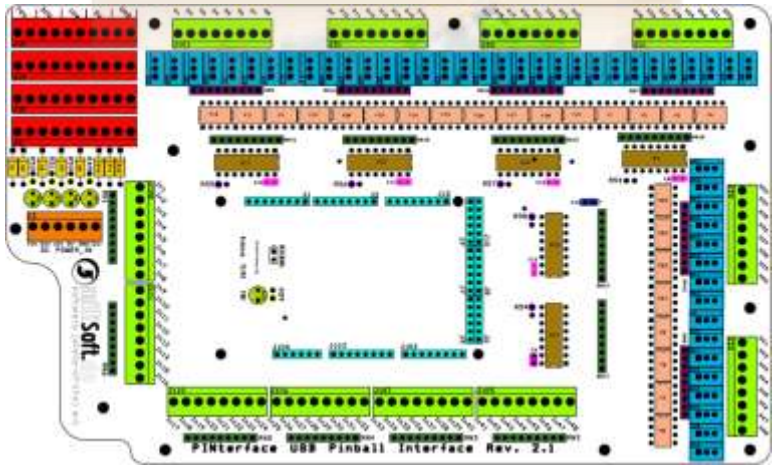
PINterface component: microcontroller

- Modified ATMega microcontroler board
- Preassembled
- 16 MHz
- Detecting input (incl. Debouncing)
- Controlling outputs
- USB virtual COM-Port communication

PINterface component: I/O board

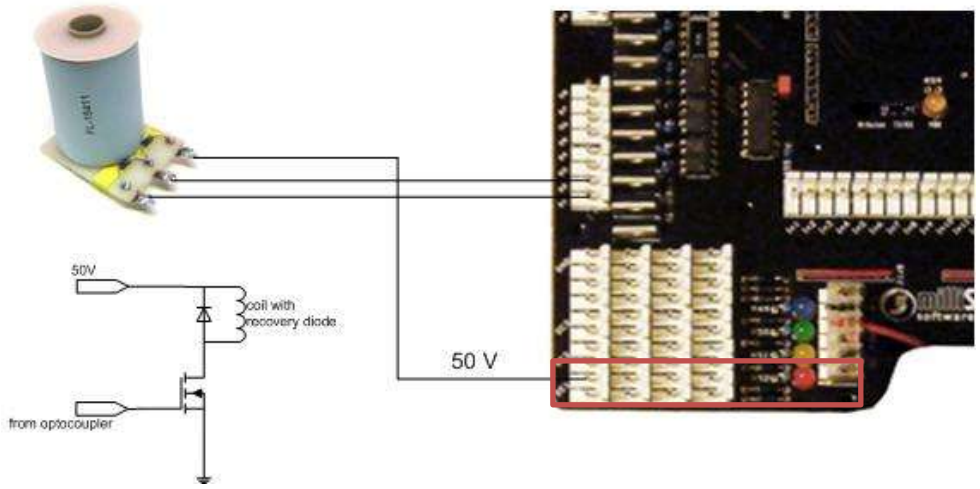
- 48 direct inputs (switches,...)
- 48 outputs for lamps and solenoids
- Power distribution
- Connection to microcontroller under the PCB by plug connectors
- Easy to solder, based on THM (through hole mounted) components



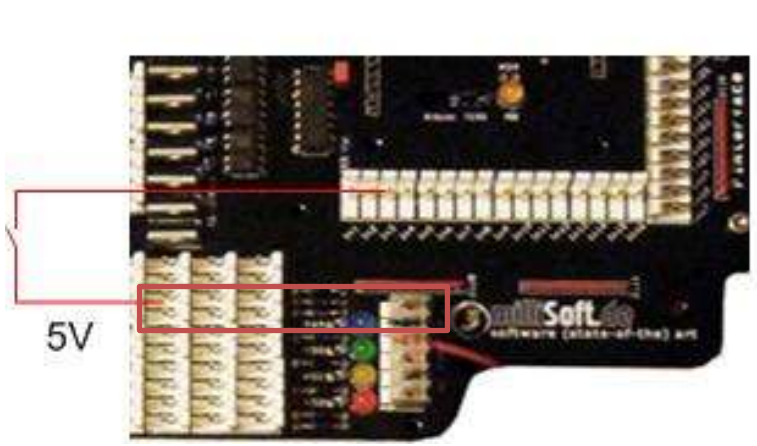


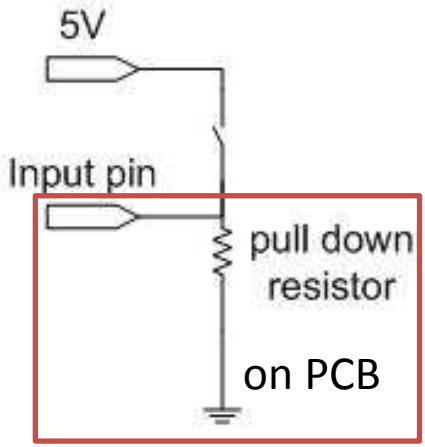
PINterface component: I/O board to components

- **Connecting outputs:**



- **Connecting inputs:**





The PINterface software

PINterface component: software

- Software for MS Windows 2000 or above, 32bit
- .NET Framework 2.0 or better
- Software package:
  - PINterface operating system program:
    the pc interprets a text based rule file
  - RuleSetConfigurator: graphical game definition editor
  - COMunicator: input/output test program

PINterface operating system program

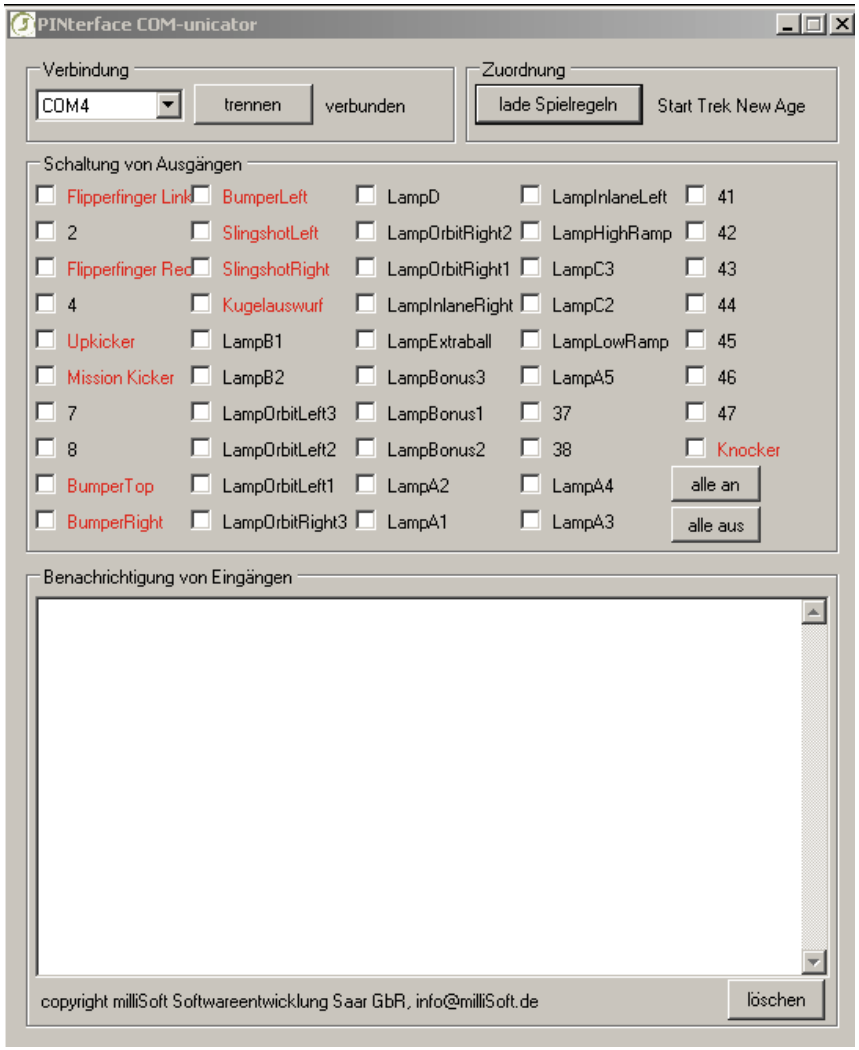
- Interprets the ruleset file (rules.xml)
- Communicates with the hardware over USB (input/output)
- Shows individual graphics/videos, plays music and effects

PINterface RuleSetConfigurator

- **Graphical editor for rule set creation**

PINterface software: COMunicator

- Input switching display, Output enabling / disabling
- Ruleset file can be imported for proper naming



PINterface game rule definition

- Definition in XML format (text based, graphical editor available):
  - General information
  - Coils
  - Lamps, Lampsequences
  - Variables
  - Mediaevents
  - GameModes, GameRules
- You don t have do edit the text file manually!!!!! There is an editor!

  ....but let us have a look at it to understand how it works

PINterface rule definitions – General Section

```
<General>
    <builder name="milliSoft.de"/>
    <theme name="Start Trek New Age"/>
    <output_debug_info value="0"/>
    <BallsperPlay value="3"/>
    <ConfigDate value="25.11.2009"/>
    <StartGameMode name="AttractMode"/>
    <FallBackGameMode name="StandardGameMode"/>
    <BackgroundImage value="../StarTrekNewAge/visuals/background.jpg"/>
    <Font name="Narkisim" size ="24"/>
    <ComPort value="COM5"/>
    <MenuKey name="open" value="MenuKey"/>
    …
    <StartButton value="StartButton"/>
    <Color name="PlayerScoresBack" value= "#202741" />
    …
    <VisualOutput position="455;98" size ="512;512" />
    <ExtraballScore value="100000" multiple ="1"/>
</General>
```

PINterface rule definitions – Coil definitions

```
<Coils>
	<Coil id="1" addid="2" name="FlipperfingerLeft"/>
	<Coil id="3" addid="4" name="FlipperfingerRight"/>
	<Coil id="12" name="SlingshotLeft"/>
	<Coil id="13" name="SlingshotRight"/>
	<Coil id="14" name=”BallOutput"/>
	<Coil id="5" name="Upkicker"/>
	<Coil id="6" name="Mission Kicker"/>
	<Coil id="9" name="BumperTop"/>
	<Coil id="10" name="BumperRight"/>
	<Coil id="11" name="BumperLeft"/>
	<Coil id="48" name="Knocker"/>
</Coils>
```

PINterface rule definitions – Switch definitions

```
<Switches>
  <Switch name="LeftFlipper" input="19" />
  <Switch name="RightFlipper" input="18" />
  <Switch name="DrainSwitch" input="23" />
  <Switch name="StartButton" input="17" />
  <Switch name="MenuKey" input="22" />
  <Switch name="SlingshotLeft" input="39" Score="50"/>
  <Switch name="SlingshotRight" input="40" Score="50"/>
  <Switch name="OutlaneLeft" input="14" Score="500"/>
  <Switch name="OutlaneRight"  input="10" Score="500”
….
  <Switch name="TargetC" input="32" Score="1000"/>
  <Switch name="TargetD" input="30" Score="250"/>
  <Switch name="Mission" input="31" Score="2000"/>
  <Switch name="Upkicker" input="26" Score="5000"/>
  <Switch name="BumperTop" input="27" Score="20"/>
  <Switch name="BumperLeft" input="28" Score="20"/>
  <Switch name="BumperRight" input="29" Score="20"/>
 </Switches>
```

PINterface rule definitions – Variable definitions

```
<Variables>
  <Variable value="0" name="VariableA"/>
  <Variable value="0" name="VariableB"/>
  <Variable value="0" name="VariableC"/>
  <Variable value="0" name="VariableLowRamp"/>
  <Variable value="0" name="VariableA5"/>
  <Variable value="0" name="VariableA2"/>
  <Variable value="0" name="VariableA1"/>
  <Variable value="0" name="VariableInlaneRight"/>
  <Variable value="0" name="VariableOrbitRight"/>
  <Variable value="0" name="VariableD"/>
  <Variable value="0" name="VariableOrbitRight"/>
  <Variable value="0" name="VariableMission"/>
  <Variable value="0" name="VariableUpkicker"/>
  <Variable value="0" name="VariableAllTargets"/>
  <Variable value="0" name="VariableMissionGetHit"/>
 </Variables>
```

PINterface rule definitions – Lamp definitions

```
<Lamps>
   <Lamp id="35" name="LampLowRamp"/>
   <Lamp id="32" name="LampHighRamp"/>
   <Lamp id="30" name="LampA1"/>
   <Lamp id="29" name="LampA2"/>
   <Lamp id="40" name="LampA3"/>
   <Lamp id="39" name="LampA4"/>
   <Lamp id="36" name="LampA5"/>
   <Lamp id="15" name="LampB1"/>
   <Lamp id="16" name="LampB2"/>
   <Lamp id="34" name="LampC2"/>
   <Lamp id="33" name="LampC3"/>
   <Lamp id="21" name="LampD"/>
   <Lamp id="31" name="LampInlaneLeft"/>
   <Lamp id="24" name="LampInlaneRight"/>
</Lamps>
```

PINterface rule definitions – Lamp Sequences definitions

- **A simple sequence with the lamps going around:**

```
<LampSequences>
  <LampSequence name="AttractSequence" duration="4220">
    <Lamp name="LampExtraball" delay ="0" duration ="300"/>
   <Lamp name="LampBonus1" delay ="300" duration ="300"/>
   <Lamp name="LampBonus2" delay ="600" duration ="300"/>
   <Lamp name="LampBonus3" delay ="900" duration ="300"/>
    .....
</LampSequence>
```

- **Highlight the ramps during a game mission by blinking:**

```
<LampSequence name="MissionRampsBlink" duration="610">
    <Lamp name="LampLowRamp" delay ="0" duration ="300"/>
   <Lamp name="LampHighRamp" delay ="0" duration ="300"/>
</LampSequence>
```

PINterface rule definitions – multimedia output definitions

- **Mediaevents just define the multimedial output**
  - **Sound file**
  - **video file**
  - **text output**

```
<MediaEvent name="Mission1Stage2">
      <filename_video value="../StarTrekNewAge/video/mission1_hit1.mov"/>
      <filename_audio value="../StarTrekNewAge/audio/impressive.mp3"/>

    <alternate_text value=”That’s a hit!"/>
    <balance value="b"/>
</MediaEvent>
```

PINterface rule definitions – game modes definitions

- **The game modes describe the current state of the pinball machine**
  - **E.g. AttractMode, StandardGameMode, MissionMode,…**

```
<Mode id="10" name="Mission1">
        <ScoreMultiplier value="2"/>
        <IgnoreFlippers value="0"/>
        <ModeTime value=”60"/>
        <Timer value=”15" Variable="VariableMissionGetHit” action =“Increase”/>
        <BackgroundMusic value="../StarTrekNewAge/audio/mission1.mp3"/>
        <BackgroundPicture value="../StarTrekNewAge/visuals/warp_field.jpg"/>
      <LampSequence name="MissionRampsBlink" replay="1"/>
</Mode>
```

PINterface rule definitions – game rules definitions

- Game rules are interpretet at runtime by the PINterface OS
- Consist of triggers and events
- A rule is applied if all triggers are met
- A simple gamerule for hitting a switch:

```
<GameRule name=“TargetA1HitMedia">
    <Trigger>
     <Switch name="TargetA1"/>
    </Trigger>
    <Event>
     <MediaEvent name="HitTargetA1"/>
      <Lamp name ="LampTargetA1" state="1" />
    </Event>
 </GameRule>
```

PINterface rule definitions – game rules definitions

- **Other triggers and events:**

  getting an extraball

```
<GameRule name="ExtraBall">
    <Trigger>
        <PointsReached value="1000000"/>
    </Trigger>

    <Event>
        <MediaEvent name="ExtraBall"/>
        <AddBonusMultiplier/>
        <AddExtraBall />
    </Event>
</GameRule>
```

PINterface rule definitions – game rules definitions

- **Other triggers and events:**

  using a counter and activating solenoids

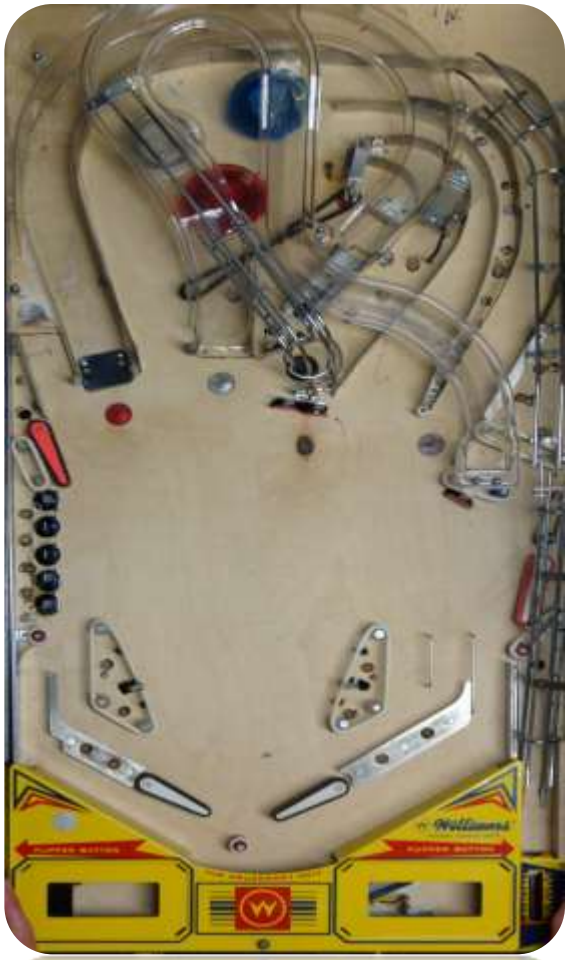
```
<GameRule name="Upkicker">
    <Trigger>
        <Switch name="Upkicker"/>
    </Trigger>

    <Event>
        <FireCoil value="Upkicker" delay="1000" duration="150"/>
        <MediaEvent name="Upkicker"/>
        <Variable name ="VariableUpkicker" action="increase" />
    </Event>
</GameRule>
```

A PINterface example

PINterface demonstrator

- Internal demonstration unit…..
- Hardware:
  - 4 flipper fingers, 2 ramps, 3 bumpers, slingshots, upkicker, orbits
  - 12 outputs used for solenoids, 26 outputs used for insert lamps
  - 28 switches used for inputs
- Software
  - 68 rules used to define game
  - 21 variables used



PINterface demonstrator

- …became a demonstration unit with a science fiction theme (realized and owned by a customer)

Making of...

- It all started with...

Making of...

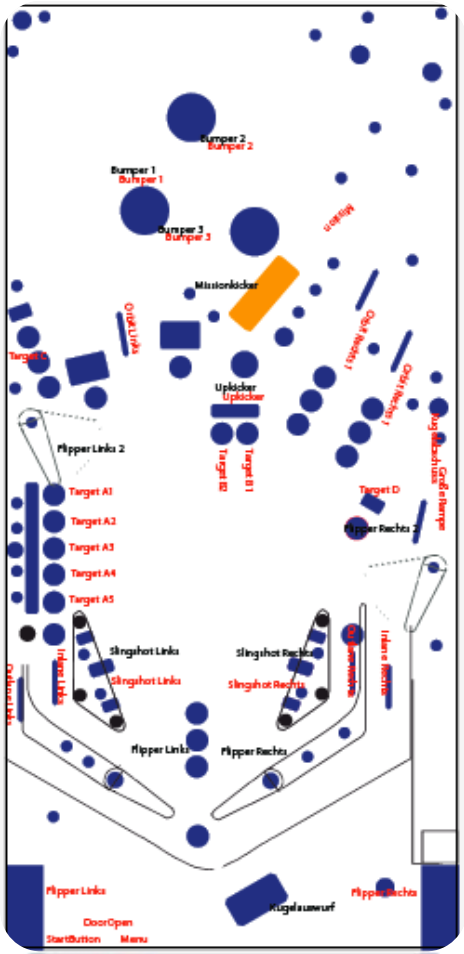
- Cabinet and backbox wood work
- Applying filler and varnish
  →high reflective cabinet

Making of...

- Preparing the cabinet
- Cabinet and playfield art is taken from Comics and vectorized
- Printing the vinyl for cabinet costs about £ 150 at a local printing service (ask your favorite car advertisement decorator)
- Bringing the vinyl on the cabinet with some water

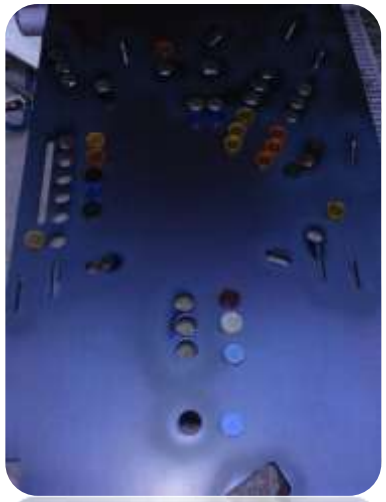
Making of...

- Whitewood planning on PC using a vector layout
- Playfield wood is 19mm printing plate (multilayer) wood (craftmens shop) → playfield vinyl ready
- 2 iterations of whitewood game layout
  (a perfect machine may take more layout step)



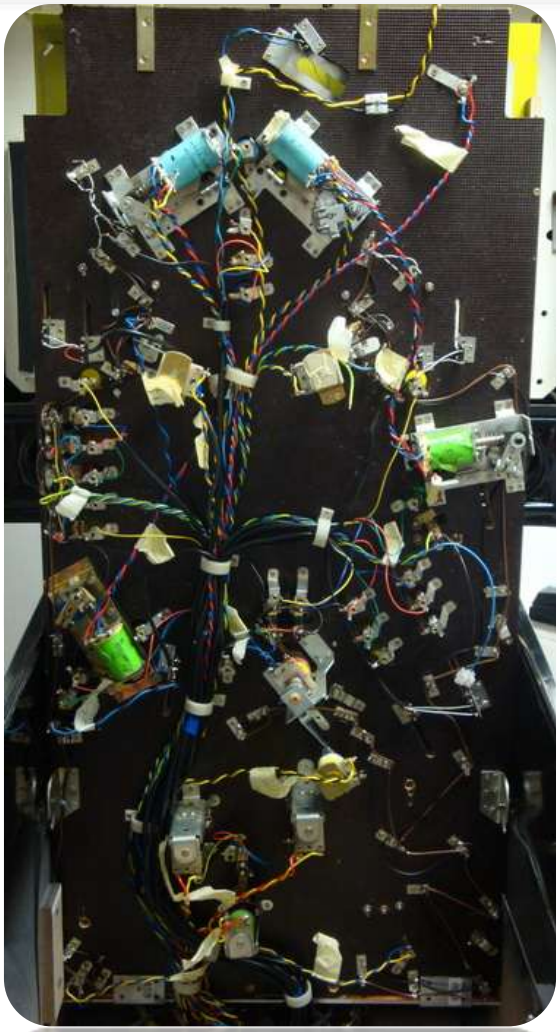
Making of...

- Adding inserts and holes to the wood (...if you do not have a CNC)
- Drilling the insert holes with a 25mm „forster drill“ for usage of 1-inch inserts (25,4mm) → they fit very well
- Drilling the long holes with a router and some guidance woods on the backside



Making of...

- Wiring everything together took about 2 evenings



Future improvements and features for PINterface

- We are adding stuff per request if it is possible...but it takes some time
- Use switch matrices and lamp matrices for more inputs/outputs
- Software support for stacked I/O boards (multiple boards on ein PC using several USB connections)
- Development of 7-segment or alphanumeric displays for classic style games (without TFT and video output)
- .....

Getting a PINterface kit

Buying the PINterface kit

- we offer an introductory discount: 349 EUR (£ 295)
  (399 EUR regular prize beginning with September)
- Interface board and rectifier board are not assembled, soldering required!
- Available on the website: www.milliSoft.de and the online shop shop.millisoft.de (language can be changed to english on top or right side)