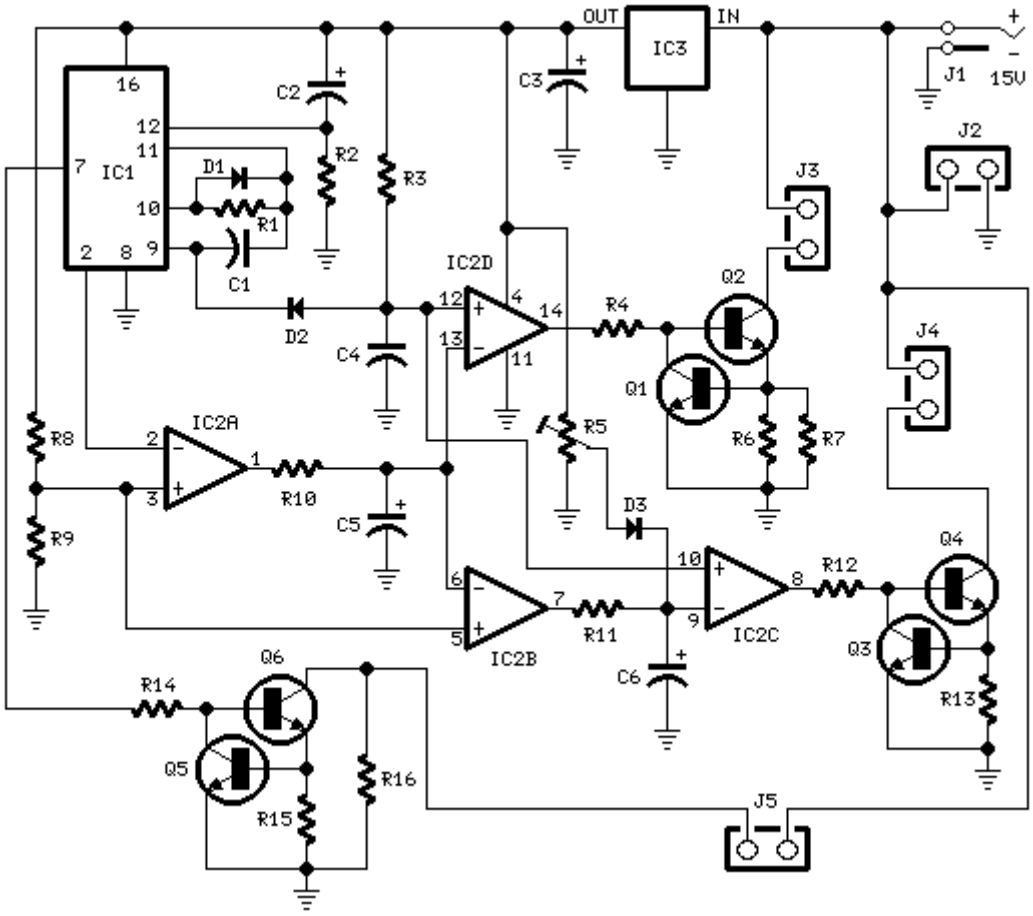
Automated Crib Lights

Low supply (12V) for children safety
Fully protected outputs

Circuit diagram:



Parts:

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R1_____________150K  1/4W Resistor
R2,R9,R14______22K   1/4W Resistors
R3,R11_________220K  1/4W Resistors
R4,R12_________10K   1/4W Resistors
R5_____________100K  1/2W Trimmer Cermet
R6,R7,R13,R15__1R    1/4W Resistors
R8_____________33K   1/4W Resistor
R10____________270K  1/4W Resistor
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R16___________47R  1/4W Resistor

C1,C4________100nF  63V Polyester Capacitors
C2,C6_________10µF  25V Electrolytic Capacitors
C3,C5________100µF  25V Electrolytic Capacitors

D1-D3_______1N4148  75V 150mA Diodes

IC1___________4060  14 stage ripple counter and oscillator IC
IC2___________LM324  Low power Quad Op-Amp IC
IC3___________78L12  12V 100mA Voltage regulator IC

Q1,Q3,Q5_____BC238  25V 100mA NPN Transistors
Q2,Q4,Q6_____BD681  100V 4A NPN Darlington Transistors

J1____________Miniature input socket,
              suited for commercial plug-in variable voltage power supplies
J2-J5________Two ways output sockets
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Device purpose:

This circuit is intended to drive the various lamps decorating the crib prepared during Christmas season at many homes, especially for children delight, in order to obtain realistic light-effects.

Features:

- Alternating day and night with lamps gradually dimming from full-on to full-off and the opposite.
- Slow turn on of model-houses interior as night approaches, and slow turn off as sun rises, with presettable intensity, thus imitating candles' light for a more realistic effect.
- Flickering ever-running circuit driving lamps for fires, firesides, lanterns effects etc.
- Total cycle duration: 2 minutes. Day duration: 1 minute, 15 seconds. Night duration: 45 seconds. (All values are approximate).

Load requirements:

- Input J1 is connected to a commercial wall plug-in power supply transformer with variable output settled to 12-15V, and a required minimum output capability of 600mA @ 12V. Using a good number of lamps the output capability must reach approx. 1.5A.
- Output J2 is connected to a permanently-on 12V 1W blue lamp(s) for night effect.
- Output J3 is connected to several 12V 2.2W lamps in parallel for sunlight effect. Max. output current: 1.2A (i.e. 6-7 lamps).
- Output J4 is connected to several 12V 1W or 1/2W micro-lamps in parallel for house-interiors lights. Max. output current: 600mA (i.e. 7-8 1W lamps, doubling in number if 1/2W).
- Output J5 is connected to one or several 12V 1W or 1/2W micro-lamps in parallel for fires, firesides, lanterns effects etc. Max. output current: 600mA (lamps number same as above).
- All outputs are current limited, and short-proof for a reasonable lapse of time.

Circuit operation:

IC1 oscillates at a frequency calculated to obtain a pin 2 level change approx. every minute. IC2A is then enabled to slowly charge and discharge C5 through R10 during a 2 minutes period. IC1 pin 9 drives D2, R3 & C4, generating a sawtooth for IC2C & IC2D comparators. IC2D comparing the voltage at pin 13 with the sawtooth, generates a squarewave with variable mark-space ratio driving the output darlington Q2 for daylight lamps. IC2B changes its output at a threshold voltage settled by R8 & R9, activating IC2C & Q4 that act like IC2D & Q2 driving model-houses lamps as evening approaches and turning them off at dawn. R11 & C6 provide slow turn on and off and R5 sets the basic brightness of these lamps. IC1 pin 7 drives the output darlington Q6 for flickering fires lamps and R16 prevents them to turn off completely for a more realistic effect. Q1-Q3 and associated Base resistors provide current limiting.

Notes:

- Total period length can be varied changing C1 and/or R1 values.
- Day-night ratio can be varied changing R10 value slightly.
- Threshold voltage of turn on and off of model-houses lights can be varied changing slightly R8 and/or R9 values.
- Turn on and off speed of model-houses lights can be varied changing R11 value.
- Current limiting can be varied changing Q2,Q4 & Q6 Emitter resistors.
- Heatsinks for Q2, Q4 & Q6 are needed if current limits are increased.
- Be aware that Motorola's 4060 oscillators run faster than others.
