

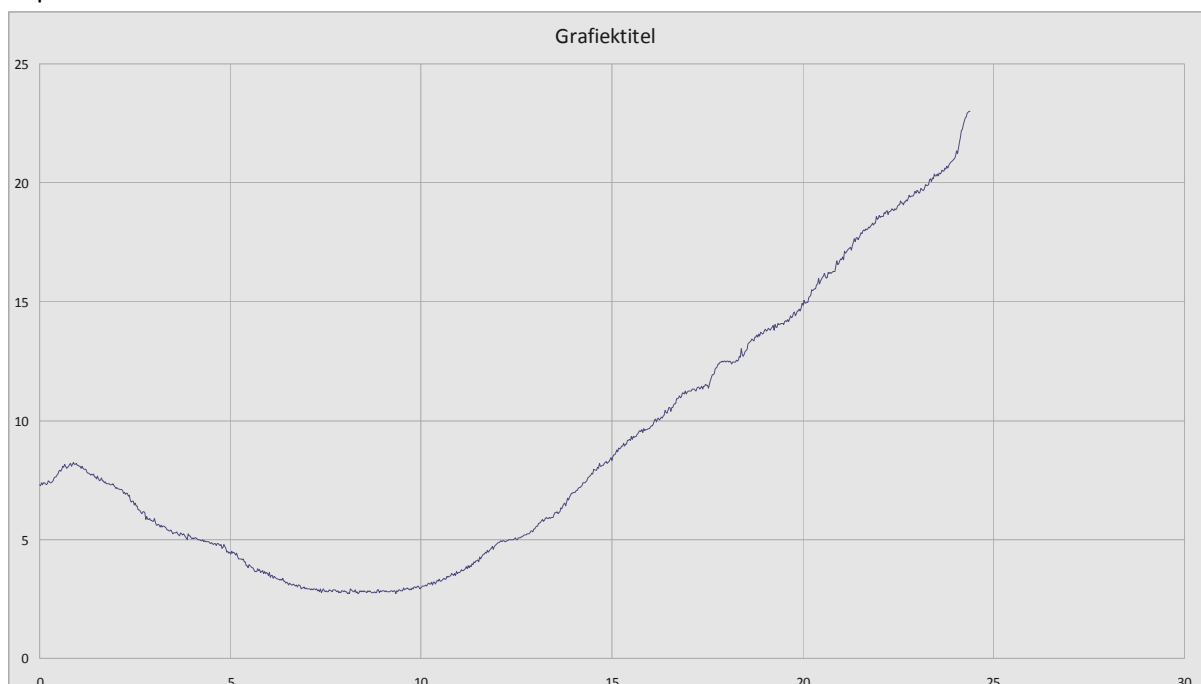
IR_Reflection_distance_sensor

The sensor system:

The sensor system makes use of an IR LED and a 38 kHz IR remote control receiver TSOP2138. The signal is processed in a software routine running on an Arduino Uno.

The software routine consists of a Timer interrupt routine in which the reflection distance is calculated from the values of a tuned IR LED output pulse frequency and a function distance(). The IR LED output frequency is repeatedly adjusted in a range of about 20 discrete frequency settings on the edge of detection of the signal by the 38 kHz remote control receiver. The IR receiver border of signal detection is in part depending on the actual signal frequency and the band filter characteristics of the remote receiver. If there is no signal detection, the IR LED output frequency is lowered in discrete steps towards the centre frequency of the 38 kHz band pass filter until the signal is detected by the IR remote control receiver. On detection, after a brief pause, the frequency is again raised in steps until the signal is no longer detected. Then after a brief pause the frequency is again lowered, and so on. The resulting IR LED output signal frequency continuously jumps around the border of detection. The differences of the used output frequencies from the centre or resonant frequency of the 38 kHz band filter are sampled in an Infinite Impulse Response filter. The resulting value relates to the actual distance of reflection of the IR signal. The second order response of the 38 kHz band filter in the IR remote control receiver allows for the interpolation of the relative position in relation to the discrete IR LED output frequency settings. The transmission characteristic of the 38 kHz band filter has a square relation to the frequency difference from the centre frequency, also the intensity of the reflected infra red signal has a square relation to the distance of reflection. As a result of these relations the proposed IR reflection sensor arrangement has a more or less linear characteristic in the range of practical use. The actual span and offset needed can be calculated in the distance() function in the software.

A test has been made, driving the IR LED with about 30 mA current. Reflection off a square foot of chip wood board:



Characteristic of the reflection sensor setup: Horizontal axle, reflection distance in cm. Vertical axle, values recorded in the serial monitor from the Arduino Uno.