In order to evaluate the error probabilities, the output voltage, \( V_o(t) \), and the mean square receiver output noise \(<n(t)^2>\) are required, and these, in turn, depend upon the received pulse shape, the type of preamplifier employed, the associated noise power spectral density, and the type of equalisation filter employed.

As with digital PPM, DIPPM system suffers from three types of errors, wrong-slot, erasure and false-alarm:

- **Wrong-Slot Errors:** These types of errors occur while the noise presents on the rising edge of a detected pulse, the pulse appears in adjacent time slots, before or after the rent slot.

- **Erasure Errors:** An erasure error occurs when the noise level is larger than the pulse signal and reduces the peak signal voltage below the threshold level, thus giving incorrect detection.

- **False-Alarm Errors:** The false-alarm error occurs when the noise causes a threshold-crossing event in an unoccupied data slot.

The output received pulse and its slope are required as the basic signals to evaluate the performance of optical communication systems. A mathematical model have been developed for a DIPPM system over an optical indoor link. Thus output received pulse and its slope have been determined and illustrated by using MathCAD software.

The main further work is to investigate the performance of the optical DIPPM system over a dispersive indoor optical wireless channel via diffuse link. Thus output received pulse and its slope have been determined and illustrated by using MathCAD software.

Keywords: DIPPM, Optical Wireless, Diffuse Link, ISI, Error Probability and MLSD

It is the purpose of this project to investigate and analysis the performance of DIPPM modulation technique, as a novel coding scheme, applied over an indoor optical wireless via diffuse link using a ceiling bounce model (for the first time) and optimising the system performance in comparison of the relative values of DIPPM and a similarly performing digital PPM system.

**Main Objectives:**

- Understand general knowledge of indoor optical wireless system and DIPPM technique.
- Investigate DIPPM scheme over dispersive optical channel using ceiling bounce model.
- Develop a system mathematical model for this investigation.
- Analyse a DIPPM system through the use of mathematical models.
- Illustrate received pulse shape and its slope using MathCAD.

- **DiPPM Coding Scheme**
  - DiPPM is a very attractive simple coding scheme for coding and implementation. There are four slots used to transmit one bit of PCM. In diode technique, when the data transitions from logic zero to logic one are coded by positive (+V) and transitions from logic one to logic zero are coded by (-V) and if there is no change in the PCM signal zero pulse is present. However, in DiPPM, as shown in Fig.3.1, two signals SET and RESET are converted into two pulse positions in data frames. If no data transition is present, there is no pulse, while if transitions occur from zero to one or one to zero; there are SET(S) and RESET(R), respectively. If the PCM data is constant, no signal transmitted.

- **DIPPM over Indoor Optical Wireless Channel via Diffuse Link**
  - In order to evaluate the error probabilities, the output voltage, \( V_o(t) \), and the mean square receiver output noise \(<n(t)^2>\) are required, and these, in turn, depend upon the received pulse shape, the type of preamplifier employed, the associated noise power spectral density, and the type of equalisation filter employed.

- **Conclusion**
  - The main further work is to investigate the performance of the optical DiPPM system over a dispersive indoor optical wireless channel via diffuse link with the view to understanding its benefits and limitations in terms of:
    - Error probability.
    - Variation in the bandwidth of preamplifier filter.
    - Variation in the bandwidth of a third-order Butterworth filter.
    - Using a Maximum Likelihood Sequence Detection (MLSD).
    - Optimising the system performance in comparison of the relative values of DiPPM and a similarly performing digital PPM system.