What is the 'interlocking' system, a change in which led to the crash?

By IASToppers | 2023-06-06 15:20:00

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Minister for Railways has recently clarified that a **change** in the “**configuration**” of the **track** had led to the train accident.

[ref- metro rail news]

What is meant by 'interlocking' in railways?

- **Interlocking** in railway **signalling systems** is a safety mechanism used in the operation of **train movements** on **railway tracks**.
- Interlocking ensures that **train** movements continue **without** any **conflicts** with each other and prevent **accidents**.
- There are **three** main components that comprise an **interlocking system**: the **point switch**, the **track** occupancy sensing devices, and the **signal**.
- The **Interlocking** system coordinates the functions of these 3 components to control **train movements**.
- The **Interlocking** is designed to ensure that there is **no** possibility to display a **signal** to proceed for a **train** unless the route to be used is safe and clear.
    - **Example**: interlocking will prevent a **signal** from being changed to **indicate** a **diverging route**, unless the **corresponding** points/switches have been changed first.

What is the function of each of these three main components?

- **Signals**- are lights of **green**, **red**, and yellow colour and are installed along the **tracks** to indicate the **status** of the **track ahead**.
- **Track circuits** are **electrical circuits** that detect the **presence** of **trains**.
    - **Track circuits** are also known as **track-occupancy sensing devices.**
    - Track circuits help to **verify** whether a particular route is clear or occupied and if it is safe for a train to **proceed**.
- **Point switch** allow trains to **change tracks.**
    - The **location** from where a train is taken from **one track** to another is known as '**point'**.

How do the points work?

- The points or '**switch rails'** are **movable rails** that guide the **wheels** of a train towards either a **straight** or a **diverging track**.
- The points are placed at the **point** of **divergence** of **two tracks** going in different directions.
- If a train has to **change** lines, the **switch point** is **activated** ahead of time and the **point** is **locked** at a **particular position**.
    - This means that once a direction is set, the point cannot **budge** until the train has **passed**.
- The **digital interface** of this system is a **computer screen** (or multiple screens) that shows the full view of the **station layout** and the **live** (real-time) **movement** of trains on tracks, the **signals**, and the position of the **points**.
    - This is the **configuration** that runs all **trains everywhere**.
    - This computer interface is called a **data logger**.

Point machines:

- A point machine is a device used for **locking point switches**.
- The **electric** "**point machine**" helps in **railway signalling** for quick **operation** and "**locking**" of **point switches**.
    - The **point machine** plays the key role in the **safe running** of trains.
- Failure of the **point machines** affects the train movement, and any **deficiencies** created or left **unaddressed** at the time of **installation** of the system can result in **unsafe conditions**.

How does the system sense whether a track is occupied?

- There are various kinds of **track-occupancy sensing** devices.
- **Sensors** are installed on the **tracks** that detect the **passage** of **wheels** on the rails.
- Sensors are also called **axle counters**.
- Sensors count how many sets of **wheels** or **axles** have passed over them in order to **determine** whether the **entire train** has passed through.

How is this whole system configured?

- Interlocking system are fed **information** on how **safe trains** work.
- Interlocking system are controlled **remotely** from the **station**.
- **Manual levers to control the Interlocking system:**
    - A **pointsman** would **physically** operate the **point** to change its **direction** for an incoming **train**, and to **lock** it.
    - This was done traditionally.
    - Someone would then physically **flag** a **green signal** for the train after checking that the track is clear of any **obstacle**.
    - The driver would watch the **flag** and **proceed**.
- **Electronical levers to control the Interlocking system:**
    - The **control** and **supervision** of train movements is carried out through **software** and **electronic components**.
    - It utilises **computers**, programmable **logic controllers** and communication networks to manage and coordinate **signalling**, **points** and **track circuits**.

    - This system makes sure that **signals** are cleared to proceed only when the route ahead is **safe** and **clear**.

How safe is this system?

- If any of the 3 components (**signals**, **points**, and **track occupancy sensors**) does **not** correspond to the overall '**safe'** logic fed into the computer, the system will work to stop the **oncoming train**.
- If the point is **not locked**, or **not** set to the **desired direction**, and/ or if the **sensing device** detects that the track is **not** clear, the signal will automatically turn **red**.
    - This indicates to the **oncoming train** that something is wrong and that it should **stop**.
- This is called a "**fail safe" system** or the one that errs on the side of safety even if the system fails.

Who operates and monitors the interlocking signalling system?

- The interlocking system is operated and monitored by **trained personnel** from the **signalling and telecommunications department** in Railways
    - They are often known as '**signallers'** or signal operators.
- The **signal operators** are responsible for **setting** the signals, **monitoring** track circuits, and ensuring the **safe movement** of trains.

Are interlocking signalling systems used worldwide?

- Yes, **interlocking systems** are used in **railway networks** worldwide.
- Countries may have variations in their **signalling practices** and **technologies**, but the underlying **principle** of preventing **conflicting** train movements remains the same.

Learn more about the other Railways based safety systems:

