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## Railway track patrolling bicycle

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**Abstract :** In India majorly, the transport is done by the trains. Hence, we have a large railway network spread throughout the country. Due to its large use maintenance of the railway track has to be done on a regular basis. Because of which, we have huge number of patrolling and monitoring staff workers in the Indian Railways. These workers have to travel a long distance onto the tracks to reach the site location. At places where there are no side roads on sideways of the railway track these workers have to walk to the site. Hence to provide them ease and helping them in reaching the site location quickly we have introduced this Railway Track Patrolling Bicycle, which is the modified version of railway bicycle currently in use. This bicycle will also help the workers to detect any type of crack on the railway tracks. The Track Pedal contains an ultrasonic sensor that will automatically detect the cracks on the track. This report gives you a brief introduction about the Track Pedal. It runs at maximum speed of 15 kmph. It weighs less than 30kg. The report contains literature review in detail. The report also explains about the problem statement of the project. The main objectives of this project is also listed in the report. The appropriate solution to the problem statement is been provided in the proposed methodology chapter. The report contains various figures including some CAD model image which give the complete visualization of the project. Finally, the conclusion of the project is covered in the last chapter. At the end there is a list of references from where the important information it is been collected.

**Keywords**– Railway Bicycle, Sensors, Bi-Fold Mechanism.

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### I. INTRODUCTION

This project is a modification of an innovation of rail bicycle by the Indian Railways which will help railway staff in inspection, monitoring and track repair. These rail bicycles will run on railway tracks at an average speed of 10 km/h. These bicycles move at a maximum speed of 15 km/h and can be easily lifted as they weigh only 30 kg. They can also be easily used by one person.

#### 1.1 Project Background:

##### 1.1.1 Existing Model:

The Indian Railways has introduced rail bicycle for their patrolling and monitoring staff members to travel down the track. This rail bicycle contains a normal bicycle with some special modifications. This bicycle contains a steering wheel arrangement that has a mini rail wheel. These mini rail wheels will run on the rail tracks. There is side wheel arrangements attached to the front wheel and rear wheel which will reside on other side.



Fig.1.1: Existing Railway Bicycle.

### 1.1.2 Modification:

The side wheel arrangement in the existing model (Fig.1.1) contains two straight pipes. It is difficult for operator to disengage this side wheel arrangement from the track alone. This type of side wheel arrangement also increases the total weight of the model. In the new model these straight pipes are replaced by a bi-folding mechanism. This bi-folding mechanism can be easily engaged and disengaged by a single person. This bi-folding mechanism can be fold by 90°. The weight of this bi-folding mechanism is less than the existing straight rod mechanism. The existing straight rod mechanism is connected to the front as well as the rear wheel, but the bi-folding mechanism is only connected to the rear wheel. The steering wheel arrangement in the new model contains springs that will bullet back to its position when the engagement is not required. The existing model do not contain any spring due to which the steering wheel arrangement has to be tied to the handle when the engagement is not required. The new model can detect cracks in the railway track. This type of system is not available in the existing model.

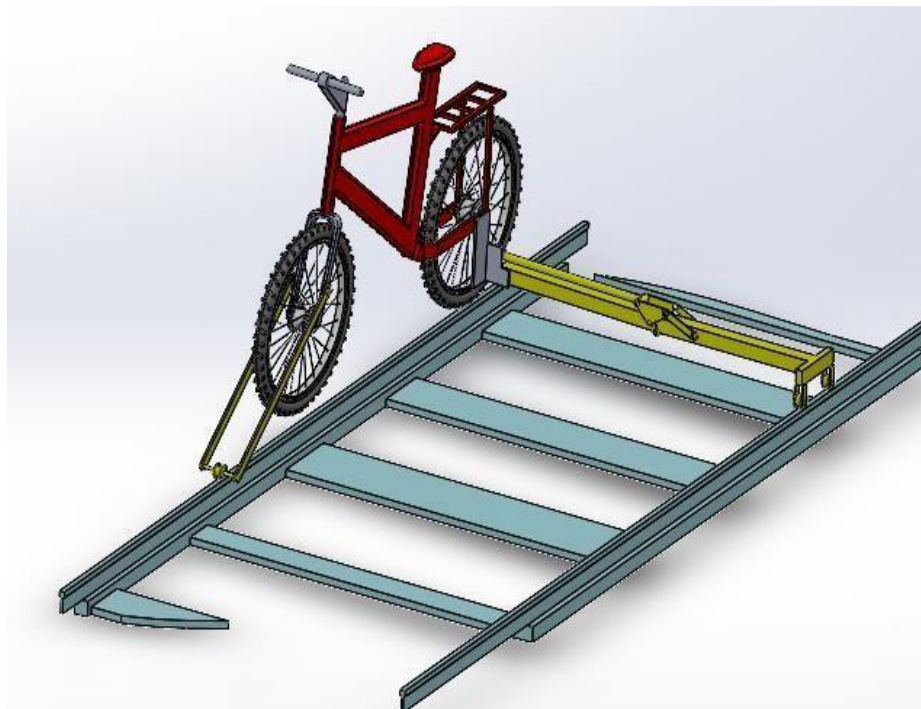


Fig.1.2: CAD design of Modified Railway Bicycle.

## II. PROBLEM DEFINITION

### 2.1 Problem Statement:

The places where there is no side roads to the sideways of the railway track the railway workers who are responsible for patrolling and monitoring of the track have to walk down the track for a long distance. In order to help them to reach the site quickly with ease these problems had to be solved immediately. In existing model, it is difficult to handle the Bicycle by single person as due to its extra added mechanism which increases the weight of Bicycle. Mechanism is too long when it is folded which again increases the problem of handling it alone. The front Track wheel engagement and disengagement is not proper, it needs to be Tied up with rope to the steering be disengaged. It is also important to check for the cracks on the track, which is not possible when staff will be riding Bicycle and existing model only provide travelling facility, it doesn't have any extra feature. So, we are adding a Crack detector using ultrasonic sensor and Arduino which will detect the crack and alarm will notify the staff if crack is detected. In case if it's a fish plate joint gap, then staff can check if it is bolted properly or not.



Fig.2.1: Lifting Bicycle with whole mechanism.

### 2.2 Objectives:

- To help the railway workers to reach the site quickly.
- To provide them any ease in travelling such a long distance.
- The new model will be simple to operate. Hence anybody can engage and disengage the cycle on the railway track.
- Bicycle can also be used as a normal cycle which can ride on road.
- To reduce the weight in the new model of the bicycle then the existing model.
- To reduce the cost of the existing model.
- To carry two persons at a time.
- To detect cracks in the railway tracks.

### III. METHODOLOGY

#### 3.1 Adding Bi-folding Mechanism

Bi-fold is a mechanism in which two linkage are folded simultaneously. One link will rotate by 90 degree while the next link will rotate 180 degree, which makes a system operation easy for handling as we need to rotate our power only one link. Hence it is known as Bi-folding Mechanism. Following CAD model has bi-fold mechanism which is used to engage and disengage side supporting Track wheel from the Track. It Makes requires less force comparing to the existing model of bicycle having folding system. Since, the mechanism reduces the Material requirement, Cost is also reduces and weight also reduces. And handling of Bicycle become easy.

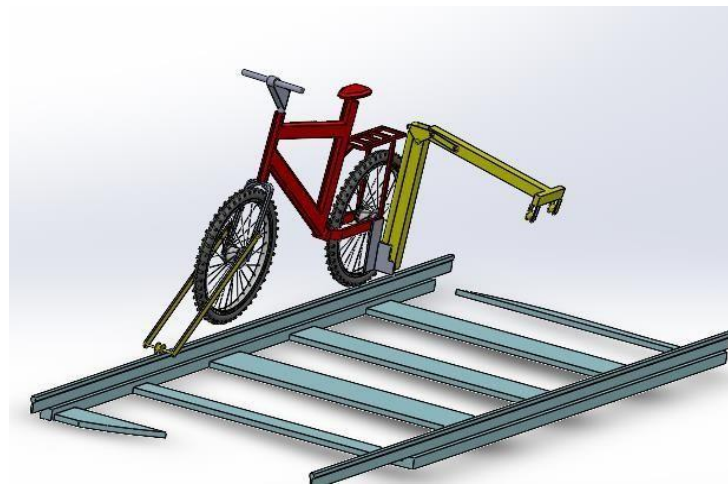


Fig.3.2: CAD model with Bi-fold Mechanism.

#### 3.2 Adding Spring

Adding spring to the steering wheel mechanism which will help the mechanism to stay at engaged or disengaged till operator want it to be as it is.

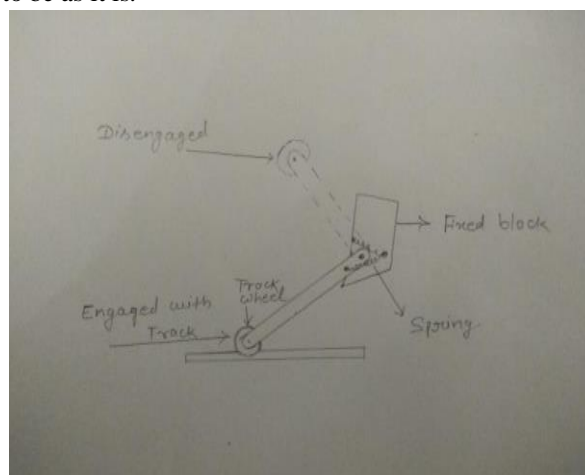


Fig.3.3: Spring in front track wheel.

### 3.3 Crack Detecting System

An Arduino controlled Ultrasonic sensor system will be in the Bicycle in such a way like, one Sensor will be detecting one track and second sensor will detect in another track. As soon they detect crack, signal will be received by arduino which will further send it to the buzzer alarm. And Buzzer will start ringing by which staff will stop the Bicycle and will do the rest of things required to be done.

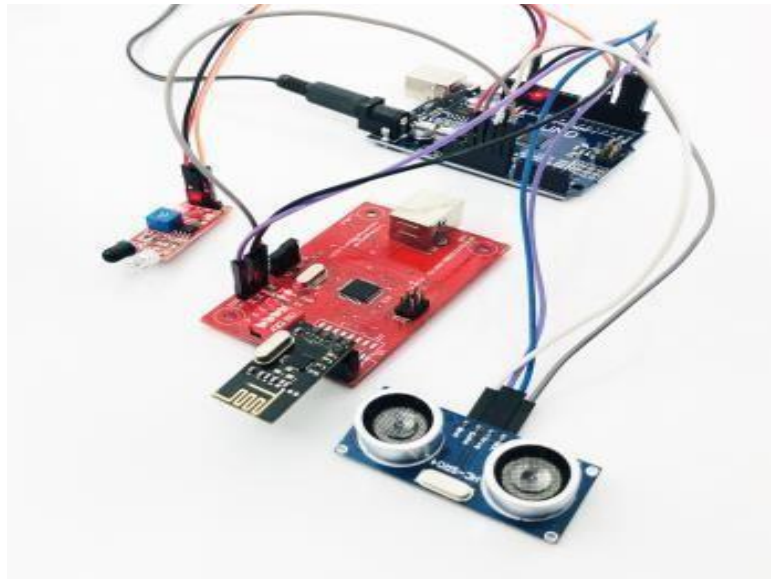


Fig.3.4: Crack Detection System.

Table 3.1: Rail Inspection Technology that are already in use.

Technology	Application
Rail Inspection Using NDT Ultrasonic Technology	NDT methods are used for detecting failure of track. The length of track are specified before using this method. It prevents accidents.
Rail Inspection by flexible EMAT	EMAT emits and receives ultrasound on a conducting Material without contact between them and it is kept within 3 mm lift-off from the material surface, to achieve a sufficient signal to noise ratio. Hence, it detects the crack in Track and prevents accidents.

## IV. CONCLUSION

This project is been selected by our group in order to provide ease to the railway workers to travel down the track. Our team has worked in finding the cost of different materials and also work on finding which material would be lighter, So that we can get a perfect material to use in our model. We have collected different materials and practically did the strength test onto those materials. This design will have two seats, will be less in weight, easy to handle, will be able to detect crack in the Track.

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