Automatic Level Crossing Barrier Control System using Arduino on a Model

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Abstract *—Automatic systems are now used in almost all areas and facilitate life. Arduino-based systems have begun to be widely used and have begun to be preferred. Arduino-based automatic systems are programmed to perform a task, both reducing the error rate and is safe.It also offers great advantages in terms of cost. Railway transport is one of the reliable and fast vehicles all over the world. High-speed trains used in transporting passengers in many countries. Passenger demand clearly shows this condition.In addition to passenger transport, trains are also preferred because of their high freight transport, which allows them to transport at the same time. Therefore, the railways always safe enough.Security is especially important at intersections with roads (level crossing).Because trains stop too long distance because of carrying the heavy load.not have any dangerous situations on the railway.There should no dangerous situations on the railway in the crossings.The shutdown of the highway by an automatic system barrier system before the train arrives and the reopening after the train has passed, will provide very large security. In this study, a sample model was designed using Arduino card. The error-free operation of the system shows that it be applied in level crossing. For the system to operate, electric infrastructure is a necessary prerequisite. After that the system should be further improved by increasing the number of sensors.*

Keywords— *Automatic systems,level crossing, railway, barrier systems, Arduino card, sensors.*

I. INTRODUCTION

Level crossing are areas where roads and railways intersect and therefore areas where safety is very important[1].There are two types of level crossing; manned and unmanned[2].

Manned ones controlled mechanically by manuel but. unmanned systems without the human defined as the automatic controlled level crossing system.In automatic barrier systems, sensors send signals to control system for barrier closed when train reached crossing area, by utilizing electric energy without human factor.The system evaluates the incoming signal and closes the barrier system. However, in mechanical manual control barrier systems not used sensor. The barrier is operated by a motion officer for 24 hours [3].

Automatic running systems provide great benefits in terms of cost and safety. Automatic systems operate without problems as long as they have 24 hours of electrical energy.For mechanical manual control systems, at least three operation officers are required to operate 24 hours a day without interruption.This poses a negative situation in terms of cost.

In addition, because of the human factor, the error rate increases and accidents happen. Accidents are unwanted events in terms of life and property safety. The accidents are mostly caused by the presence of a carriage on the rail at the level crossing where the train arrives.Statistical data show that railway accidents started to increase after 1960. Many countries started to stop this situation, build electronic systems. This systems that control technologies that detect vehicle locations and finding secure route are called intelligent transport systems(ITS) [4].

According to the report published by the House of Commons Transport Committee in 2014, it is stated that the accidents caused by pedestrians and vehicles on the railways are much more than just caused by railway accidents [5].

Many of the railway system accidents happen in the past.Rail systems are preferred because they are cheap and fast, especially preferred for heavy cargo transportation[2].

II. ARDUINO SYSTEMS

Arduino has a structure that easily learned. It is a programming language and development interface developed by researchers called Casey Reas and Ben Fry. Because the results of the written codes are visualized, It is popular. Arduino structure is based on Wiring and Processing. With regard to programming, people with limited knowledge can easily design [6].

The Arduino programming interface has the same syntax as c and c ++. Variable values are the sameand it located in the description section. These variables are global variables and can be used in the

whole program. All Arduino programs have two functions, setup() and loop().

Written Arduino programs are compiled before they be converted into machine language, then loaded into the card, now the program can work in the card structure [6].

When the card energized, the program is fully working state [6].Fig.1, shows the design of the system.

Below a pseudo code of a program interface.

```
variables
void setup()
{
Serial.begin(9600)
}
void loop()
{
Sensor_input_value
if (control)
    {
operations
    }
else
    {
operations
    }
}
```

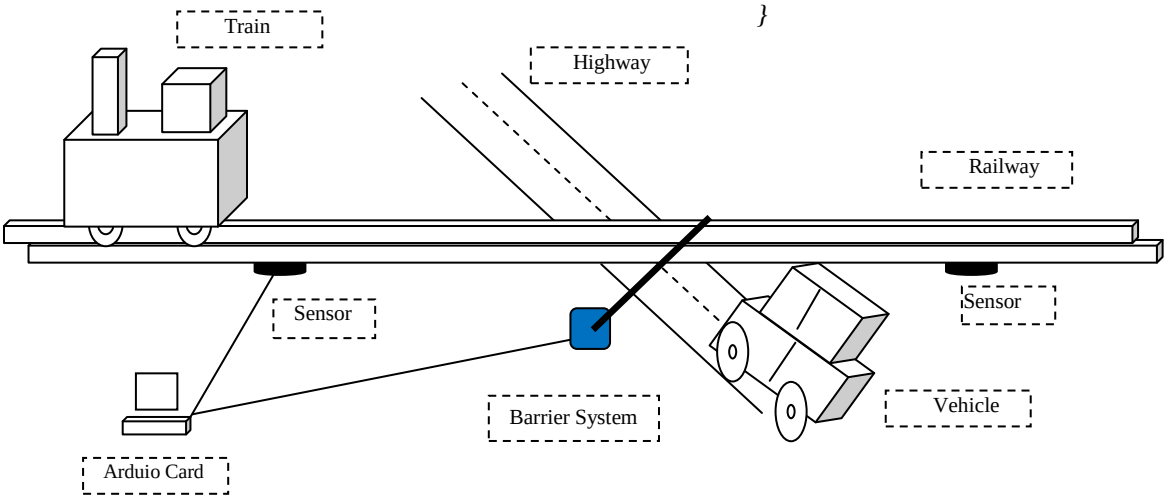


Fig. 1: Automatic System Desing

III. IMPLEMENTATION OF DESING SYSTEM

In this study, a prototype system was designed. An automatic barrier system was installed so that it would run to the edge of the road without reaching the railway. Barriers are working using DC motors. Barrier system; when the train moving on the rail, the driver closes automatically when the driver approaches a certain distance. It is detected with the help of ultrasonic sensors. The ultrasonic sensors mounted between the rails. Fig.2, shows the model of the system.

System always working position if energy as long as enough.Environmental arrangements made on the designed system and a close environmental established.Arduino card software control of the system; expressed by the following mathematical formula;

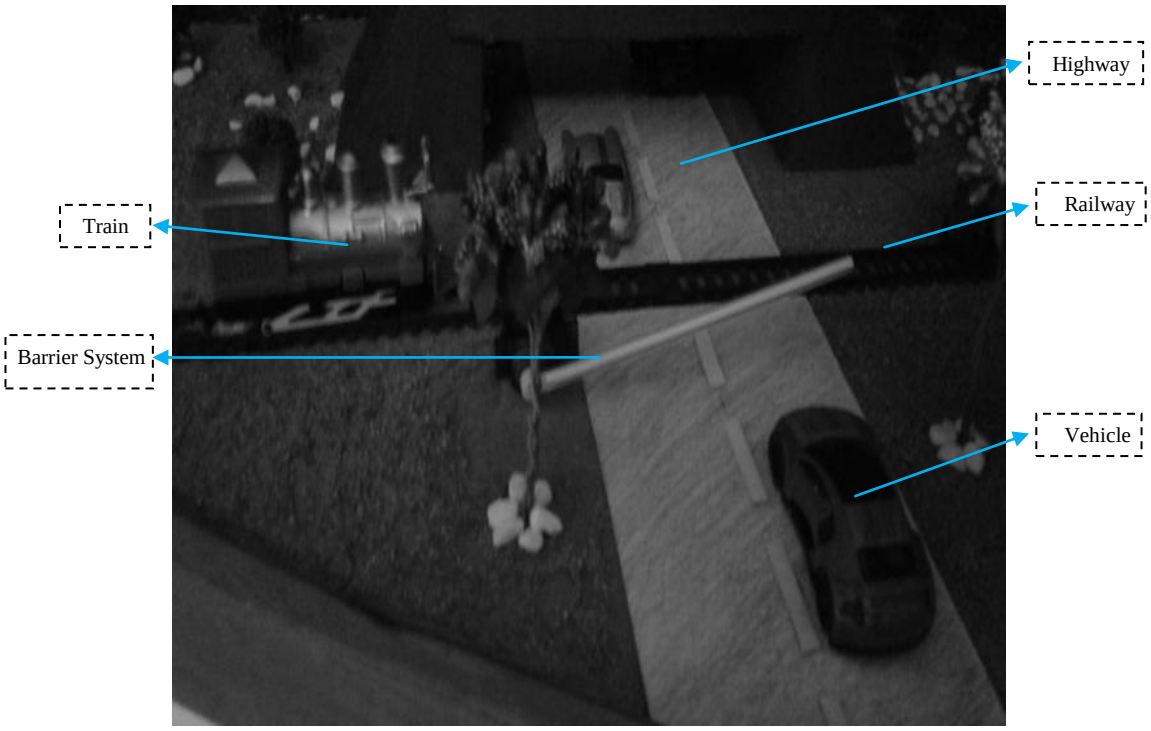
$f(output_signal)$to be a result function;

$$f(output_{signal}) \begin{cases} input_{signal} = 0 \\ else(input_{signal} = 1) \end{cases} \quad (1)$$

If $f(output\_signal) = 1$, the DC motor is started. If f$(output_signal) = 0$, no signal is sent to the DC motor.

Arduino systems used many sensors. In this study; The signal from the ultrasonic sensor is sent to the DC motor and the barrier closes. After the train passes, the other sensor sends a signal to the DC motor and opens the barrier. As long as there is no signal from the sensors, the Arduino cart will not send a signal to the DC motor.

In this study, ultrasonic sensors were mounted on both sides of the level crossing between the rails at a certain distance.



a-)

b-)

d-)

c-)

Fig. 2: Model of system a: General structure and processing system, b and c: ultrasonic sensor, d: DC servo motor of barrier system

IV. CONCLUSION

In this study, an automatic controlled bypass system applied and it has been shown safe. The system demonstrated that Arduino systems can be used without error and offers a solution for real-life passages.

Here, it shows that the system can be safer by putting another sensor under the barrier system and by making the ultrasonic sensors less affected by environmental factors. In this system, energy demand is the most critical point.

If the battery or generator used against the power failure, the system operates continuously for 24 hours. Today it is very important that railway transport that many being level crossings is a normal condition. The cost of having an officer in charge at all times is very high. In addition, manned controlled passages also cause more accidents. The safety of pedestrian crossings will prevent accidents at great speed. Therefore, it is of great importance for error-free using automatic controlled level crossing systems.

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