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AUTOMATIC RAILWAY GATE CONTROLLING USING IR SENSORS AND MICROCONTROLLER

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Abstract: Many people lost their lives in train accidents at rail crossings, mostly as a result of human gate control and a lack of automation. This project highlights the need for using an intelligent automated railway gate control system to prevent accidents at rail crossing gates (a 100% safety guarantee) by showcasing its high (about 100%) accuracy and precision in operation. The system is built to regulate the gate without the assistance of a human or any other external force. Two IR sensors are employed at both far end positions to detect the Rail approach near the Crossing Gate. In the standby and working (gate opening or shutting) states, the system needed 24 ma, 4.824 A current, and 0.288 W, respectively. The buzzer, however, used just 14.17 mA current while the siren and traffic light indicated the matching condition to alert oncoming traffic. For system design and simulation, "Proteus ISIS 7.7 professional" is used, while "Code Vision AVR v2.5 professional" is used to develop the programme code and burn the ATmega16 microcontroller. The transient reaction and system behaviour, which are superposed to the goal of this project at a very high degree of affectivity, are plotted out using the built-in oscilloscope.

I. INTRODUCTION

One transitional method that is crucial for transferring both people and freight is the railway. Yet, compared to other transportation incidents, railway accidents are more hazardous [1]. Railways are favoured above all other forms of transportation because they are the least expensive. Further work is thus required to increase its safety [2, 3]. This system's abstraction aims to make a cutting-edge control system universally accessible [4]. The sensor installed close to the gate in the automated railway gate control system detects the train [5, 6]. According to statistics, there were around 2321 fatalities caused by railway accidents at rail crossings in Bangladesh between 2010 and 2017, as shown in Fig. 1.

As level crossing accidents are beyond of our control, they are a serious cause for worry. In Bangladesh, an excessive number of people have died at railway crossings due to worn-out rail lines, frequent mechanical and human errors, and antiquated signalling systems [7].

Hence, an automated standalone railway gate control system is vital to ensure road users' safety by lowering the number of accidents that often result from negligence and mistakes made by gatekeepers, particularly during manual operation [8]. The system has to be automated so precisely and accurately that the gate will shut whenever a train is about to pass it. Moreover, the traffic light will flash yellow to warn of the approaching train and subsequently change red to prevent any passing vehicles. This shutting

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operation will be announced by the siren. After the train's departure, the gate will move from its closed position and become green while the siren continues to blare until the gate is completely open for vehicles to pass.

II. LITERATURE SURVEY

Proteus is used to mimic the operation and distinctive behaviours of the planned system, and the simulation's findings are then compared to the anticipated outcomes that are predicted theoretically by the program's code and operating principles. [10]. Fig. 4 depicts the schematic for the system.

Two IR sensors are deployed at a distance of 15 kilometres, on top of 10 feet high poles on either side of the crossing gate. When any of the sensors detects the presence of rails, the gate closes with a continuous siren and traffic signals change from Yellow (for 2 seconds) to Red. This is how the block diagram in Fig. 2 depicts the general concepts and configurations of the solar-powered standalone system. In contrast, the gate opens with a siren alarm when the rail moves beyond any of the two sensors. After the procedure is finished, the signal changes from Red to Green. For gate closing and opening operations, two unipolar stepper motors located on each side of the crossing were driven by two motor drivers, each of which was controlled by an ATmega16 processor.

Due to its benefit over greater power and torque requirements, unipolar stepper motors have been used. [9].

III. WORKING PRINCIPLE

The simulation results (both operational and transient) are summarized below in brief:

- The total system is automated, intelligent and controlled without any intervention of human interruption.
- The system has a very high sensitive nature as found in the transient response; and in the simulation of system operation.
- When any of the IR Sensor is HIGH in the presence of Rail, the crossing gate turns close through the clock wise rotation of two motors on both end of the crossing. Traffic light alerts in the sequence of Yellow to Red with continued siren.
- Again, when both of the IR sensor is LOW in the absence of Rail, the crossing gate turns open through the counter clock wise rotation of two motors on both end of the crossing. The siren continues till the gate is fully open. Then, traffic light signals Green and siren turns off. And, the operation continues in an infinite loop. The system accuracy and precision are very high (approx. 100%) .

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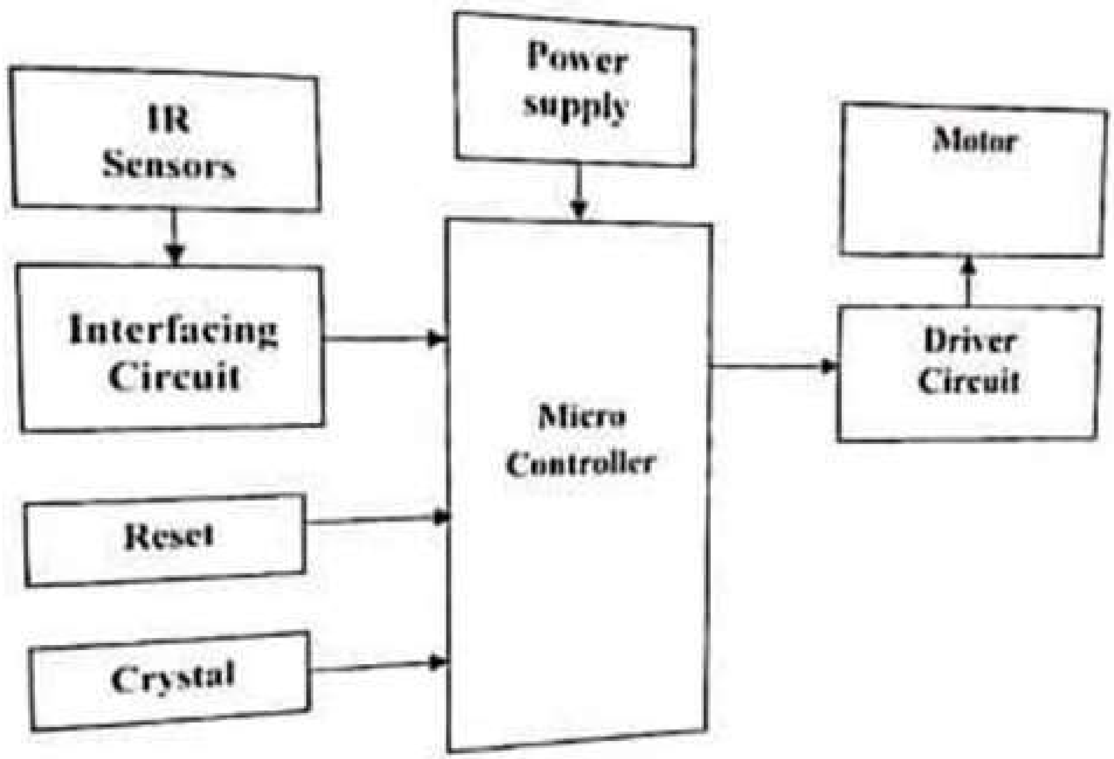
- The results obtained by operational and transient response shows that, the operation and control behavior of the system is in the sequence; as instructed in the algorithm and program code. Also, the data obtained by measuring various changes in circuit parameters (current, voltage, power, etc.) with respect to the change in 'IR sensor', 'Traffic light signal' and 'Gate control' are given in Table III..

IV. BLOCKDIAGRAM



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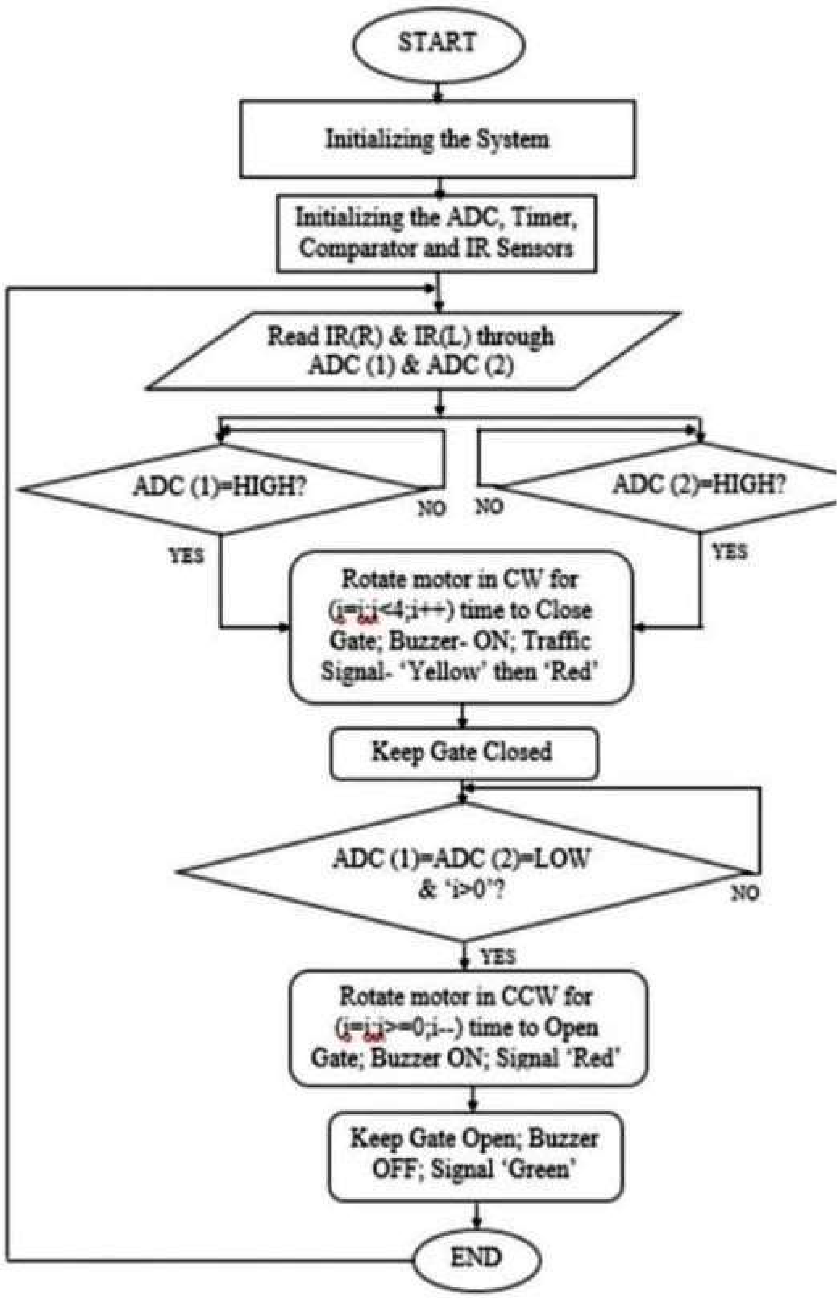
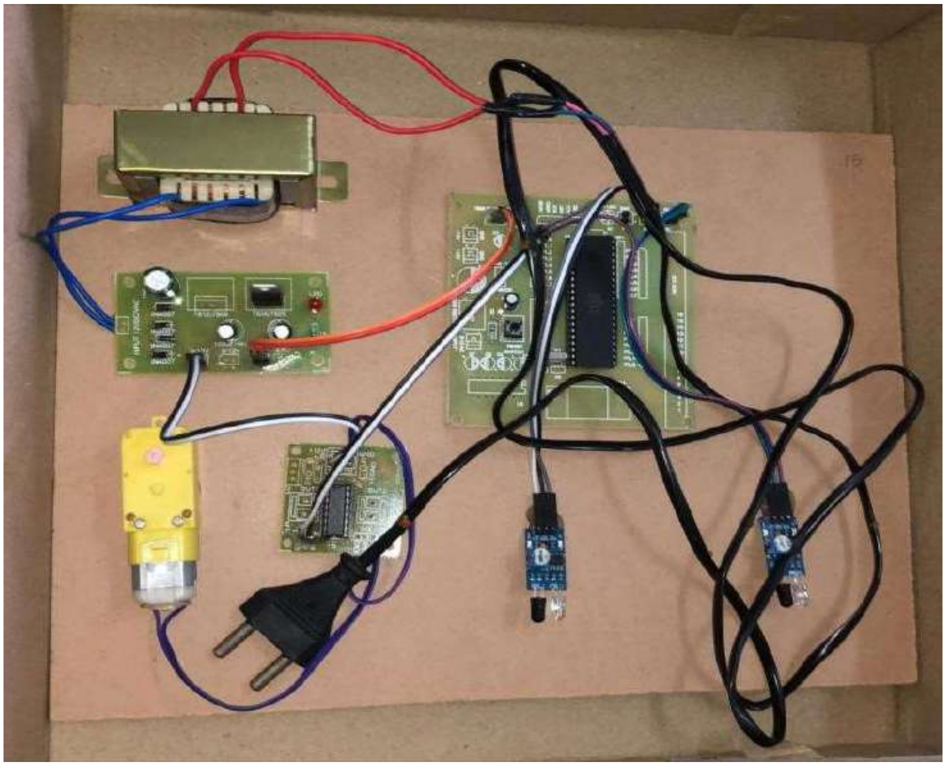
V. FLOWCHART



VI. RESULT & DISCUSSION



VII. CONCLUSION

The system functions as a standalone solar-powered low-cost, energy-efficient controller for an automated railway gate and has several noteworthy discoveries. To ensure an automatic railway gate opening and closing operation, along with siren and traffic signals, two different inputs taken from widely separated IR sensors were interfaced with ATmega16's ADC ports; this shows a robust control in greater precision and accuracy (approximately 100%) to significantly reduce the amount of railway crossing accidents. Maximum current and power requirements for the system were 4.824 A and 58.08 W, respectively, whereas standby mode only needed 24 mA and 0.288 W in the absence of a rail. Motors used 0.12 uA and less than 1.44 uW at idle and 1.2 A current and 14.4 W while under load. Moreover, Buzzer had 14.17 mA of current while it was active and 5.26 pA when it was idling. Other areas of use might include GPS-GSM based integrated communication between trains by automating the cross rail tracks and putting in place track continuity prevention measures to prevent accidents caused by uprooted or disconnected rail lines, among other things.

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