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Detection of Zebra Crossing Violation by Automotive using IoT automation

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Abstract - *The Internet of Things (IoT) is a new paradigm that has shifted people's lifestyles from traditional to high-tech. IoT has brought about changes such as smart cities, smart homes, pollution management, energy conservation, smart transportation, and smart industries. The number of road users, especially those who use automobiles, is steadily expanding. In order to guarantee traffic safety, these users must adhere to all road markings. However, there are still a lot of traffic offences. Pedestrian Crossing is getting more inconvenient and dangerous these days in spite of proper traffic signaling. This rule is not followed by the drivers/riders quite often. To avoid manual identification and intervention in such violations, the process of identifying such violators can be automated and necessary warning, penalizing can appropriately take place. In this study, we will investigate how vehicles can avoid violations by not crossing the zebra crossing line by automating the entire process. This study involves the automating the entire process by using different sensors such as IR sensor, Raspberry pi etc. As a result, we can analyze how the model works effectively in all the given conditions.*

Key Words: **IoT, Zebra Crossing Violations, Raspberry Pi, traffic safety**

1. INTRODUCTION

Traffic control systems around the world are becoming increasingly technology-oriented in the twenty-first century, and the advancement of such technology has reached the point of automation. Having said that, the automation process is only limited to wealthy countries or a few developing ones. It goes without saying that orienting and controlling traffic is a difficult work for a human to focus on 24 hours a day, seven days a week, and should be managed by automated systems for the best results. Despite their reliance on technology, many emerging and impoverished countries continue to rely heavily on the physical and tactical services of traffic management professionals. Despite good traffic signalling, traffic offenses are increasing on a daily basis.The knowledge gained in schools and high school education, driving schools, and repeated pleas by traffic cops are all being thrown out due to a lack of civic consciousness. The thumb rule reads, "When the signal for motor vehicles is RED, they are required to halt their automobiles, and especially the vehicles in the front row, should stop before zebra crossing". This rule is routinely ignored by motorists and cyclists. The process of identifying such offenders can be automated, and appropriate warnings and sanctions can be provided, avoiding manual detection and intervention in such violations. Apart from people's unwillingness to follow the rules, it's also worth noting that crossing highways at random is dangerous and can result in untimely and unexpected fatalities. So, in order to give a straightforward answer to this day-to-day and vexing problem, this study presents an automated method that takes into account a few key characteristics.

2. BACKGROUND STUDY

The field of traffic control system has gotten a lot of attention throughout the years. One such project was completed in 2013; the system has the potential of checking for vehicle violations of traffic rules, including how a red light should never cause an automobile to cross the zebra crossing line. Some of the initiatives where the automation's main objective was to create a system that was safe for them also included work on disabled persons, especially blind passengers. Using bipolarity segmentation and projective invariant-based recognition, similar work has been done for blind people. The majority of embedded system research has used genetic algorithms, and genetic algorithms are regarded to be the next step in program evolution.

Road traffic monitoring has become a popular subject in statistical computing research, and it was one of the sources of inspiration for this thesis. The effort of automatically finding inaccessible walkways using Google street view, however, has inspired the most.

3. PROPOSED MODEL

The proposed system had to be correctly scaled before being implemented in a real-world setting in order for it to produce the perfect output in a controlled environment. A tiny model has been made for the prototype that was developed to demonstrate the system's capabilities and potential. Fig shows the block diagram of the model.

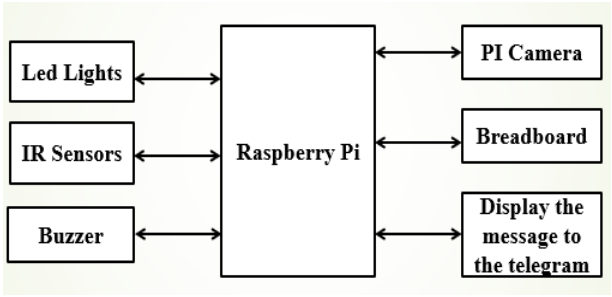

Fig -1: Block Diagram of the Model

For the prototype of the Automated Zebra Crossing system, the Raspberry Pi was used as the computing device, and the following devices were employed for input and output: LED lights, IR sensors, raspberry pi, buzzer, male-female jumper wires, etc.

The important modules used in the system:

Infrared radiation has a wavelength of 700nm to 1 mm and is an electromagnetic wave. Infrared sensors are devices that monitor or detect variations in radiation coming from either an internal or external source. Infrared light from an IR Light Emitting Diode (LED) is emitted, and a photodiode, phototransistor, or photoelectric cell absorbs it. The radiation is affected by the object of interest during the detection process, which occurs between the emission and reception processes. The received radiation in the receiver changes as the radiation changes. With the help of an accompanying electronic circuit, this attribute is employed to provide the desired output.

Electrical energy flowing through Light Emitting Diodes (LEDs) is instantly turned into light energy. Light is released when a voltage is applied to an optical semiconductor device. Only when there is a forward bias do they function. The LED's construction material and the forward current that passes through it affect how bright the light it emits is. We've utilized LEDs to simulate traffic lights in the colors RED, YELLOW, and GREEN.

The Raspberry Pi is a tiny, inexpensive computer about the size of a credit card that uses a regular keyboard and mouse and connects to a computer monitor or television. People of all ages can use this competent little gadget to learn about computers and programming languages like Scratch and Python.

A buzzer is a compact cylindrical mechanical device with an electrical connection for direct placement on a rigid printed circuit. The decibel level of such a buzzer is around 85 dB / cm. To work, it requires a DC voltage. We're utilizing a piezoelectric buzzer here. It consists of a single-housing assembly, a piezoelectric transducer, and an electronic control. Everything is then powered by a basic DC voltage, usually between 3 and 20 volts, with a current need of 10 to 30 milliamperes.

A cross-platform chat app with improved privacy and encryption is called Telegram. Secret Chat communications have end-to-end encryption, unlike the majority of messages, which only have client-to-server encryption. Group chats and self-destructing messages are also supported by Telegram.

The planned model was initially sketched onto a circuit design for the hardware implementation, and the complete hardware system was then created in accordance with the schematic. To make future maintenance simpler, we made an effort to keep the circuit as straightforward as possible. The proposed model is a tiny scaled representation of the real-world system and a real-world archetype, was created to better comprehend and demonstrate the capabilities of our planned system. The entire system was implemented using the above-mentioned equipment.

3.1 Circuit Detail of the proposed model

The hardware components were initially assembled based on the rough circuit schematic and tested for accuracy. After that, real people were used in the field test. The components were later added to the little prototype model.

3.2 Implementation of the proposed method

Proposed system is an improved version of the traditional method. The current approach is designed to address the challenges of the current approach, which involves manually carrying out the activity by issuing announcements. The raspberry pi is linked to the ir sensors' positive, negative, and ground (gnd) pins. A 10k resistor connects the raspberry pi to the red led light. To get the findings, the raspberry pi is then configured on the Telegram app using a Telegram bot. Once the connections are done the implementations were performed by first configuring the telegram bot using the telegram application through Botfather. Led light switches on when there is an object(car) on the zebra crossing line it detects the object and pi camera captures the image and sends the message along with the image of the car to the particular telegram app of that person who has violated the traffic rules.

By this implementation we are overcoming the manual process of announcing on the spot. The model was then put to the test to verify the findings. Fig. shows the hardware implementation model.

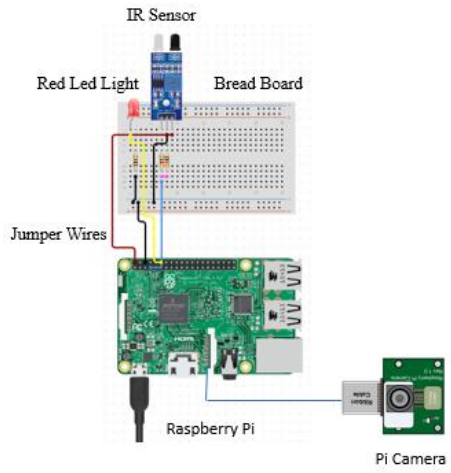

Fig -2: Circuit Diagram of the Model

4. RESULTS

The prototype of the suggested system was tested after construction to ensure that the findings were accurate. We evaluated the model in a single run to see if the message was sent to the Telegram application and if the photograph was taken while the automobile was on the zebra crossing line. Fig shows the car violating the zebra crossing rule when the led light is red.

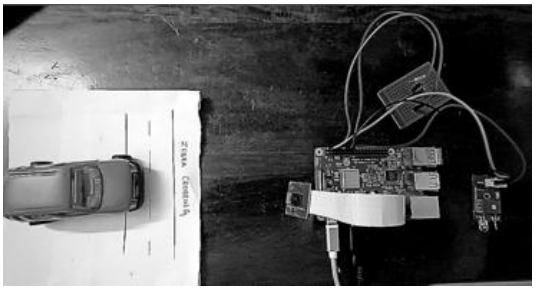

Fig -3: Model Prototype

5. CONCLUSIONS

One would find it very difficult to outsmart the suggested automated zebra crossing system so as to get an advantage over the system for themselves. This particular system's automation is totally dependent on the characteristics of the riders using the zebra crossing. The solution eliminates the police's manual method. It is affordable, and because of how straightforward the system is, it adds value to the point where it becomes a challenging project for poor and impoverished nations where traffic laws are rarely observed. Future enhancements can be performed by adding the voice module for making announcements on the spot by the police.

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