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Automatic Traffic Overtaking Restrainer using RFID Technique

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Abstract- This paper represents a logically simple and efficient electronic technique for restraining overtaking of vehicles on bridge automatically where overtaking is strictly prohibited. For this purpose we have proposed Radio Frequency Identification (RFID) technique. To accomplish this every vehicle should carry a RFID tag containing some specific information about the vehicle. RFID readers will collect information from the tag in two different points on the bridge and control logic unit will compare the information, manipulate them and make necessary decision to restrain the vehicle. The additional circuitry will then execute the decision of control logic unit. This is an effective and flawless approach for controlling the overtaking and the terrible consequences. Moreover this technique is very handy and easy to implement which can work in any atmospheric condition.

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I. Introduction

As the days go human dependencies on automobile increases. Safe driving of these vehicles not only makes us efficient but also offers us a comparatively faster way to have things done .But erroneous operations or anomalous attitudes of human while driving may lead to a serious accident leaving loss of life, and many other malignant aspects. We used here "anomalous attitude" to mean a special phenomenon named overtaking [1] which is very common and verily the most dominant cause of almost all accidents. In our rudimentary consideration we have focused on restraining overtaking on a bridge. Overtaking is the act of one vehicle going past another slower moving vehicle, travelling in the same direction, on a road. There are some rules of overtaking which should be strictly followed to avoid accidents. In case of a bridge mostly it is prohibited to overtake while passing through the bridge. One of these initiatives is the poster saying "no overtaking" with or without a specified speed limit. In fig.1 no overtaking symbols used in Canada (a), Belarus (b) with a speed limit of 50 and Japan (c), are shown. But unfortunately there are very few drivers who care about these symbols. Indeed, there is no existing way to make it mandatory and force the drivers to follow the symbols consequently leaving deadly accidents. That is why we have tried to make an automatic way which ensures that the miscreant is ceased.

Figure 1 : (a) Canada, (b) Belarus and (c) Japan

II. Block Diagram Representation

Here we have summarized our scheme using the block diagram representation. First two blocks read the data from the vehicle. For this purpose we have used RFID tags [2] attached to the vehicle. Data obtained from the vehicle will be stored in the tag and then retrieved by a reader situated in the first station and stored in local computer. The computer is connected to the server. When the vehicle passes station 2 having the same settings as previous one data will again be retrieved and stored then sent to the server. Data from these two computers will be manipulated in the server and decision will be made. If the two signals are congruent then analyzer unit says that no overtaking took place otherwise it says that an overtaking took place and vehicle leaving the station 2 is the wrong doer.

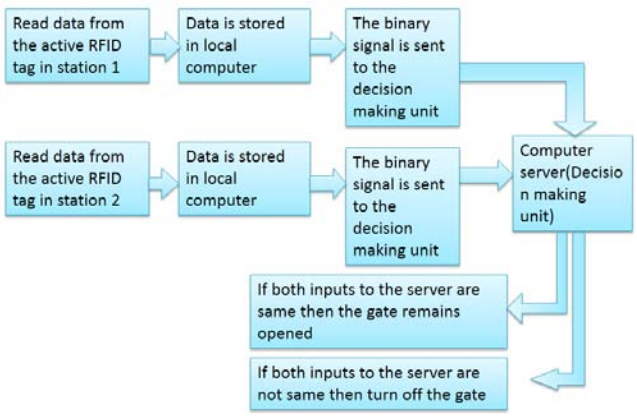

Figure 2 : Block diagram

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III. Operation of RFID System

Radio-frequency identification (RFID)[3] is a technique for transferring data by means of radio-frequency electromagnetic fields. Information is stored in devices commonly known as RFID tags or labels and retrieved by readers [4] also known as interrogators. RFID tags and readers can either be active or passive [5]. Active tags are powered by an additional power source but passive source does not require one. For this reason passive tags are smaller and cheaper as compared to active tags. But they are required to be energized by a power level much stronger than transmitted signal. On the other hand the transmission range is shorter than active tags. For these reasons we have proposed active RFID tag and active reader. With the necessary circuit arrangement data can be transmitted and received efficiently at a range of 300fts. Usually RFID tags consist of an integrated circuit and an antenna. The integrated circuit is used for storing and processing information, modulating and demodulating a radio frequency signal and antenna is used for receiving and transmitting signal. The information retrieved from the tag is stored in a non-volatile memory of reader which can also be stored in the computer. Different types of information can be stored in RFID tag like a unique serial number or chassis number of vehicles or an account number etc. An active tag can contain maximum 2kB of data [6]. In our proposed system every vehicle shall be provided with an active RFID tag having a unique number. A reader will be situated at station 1 in the fig.2 .The battery powered active tags transmit radio signal in every 1 second. When the vehicles will pass the station the reader will receive the signal and retrieve the

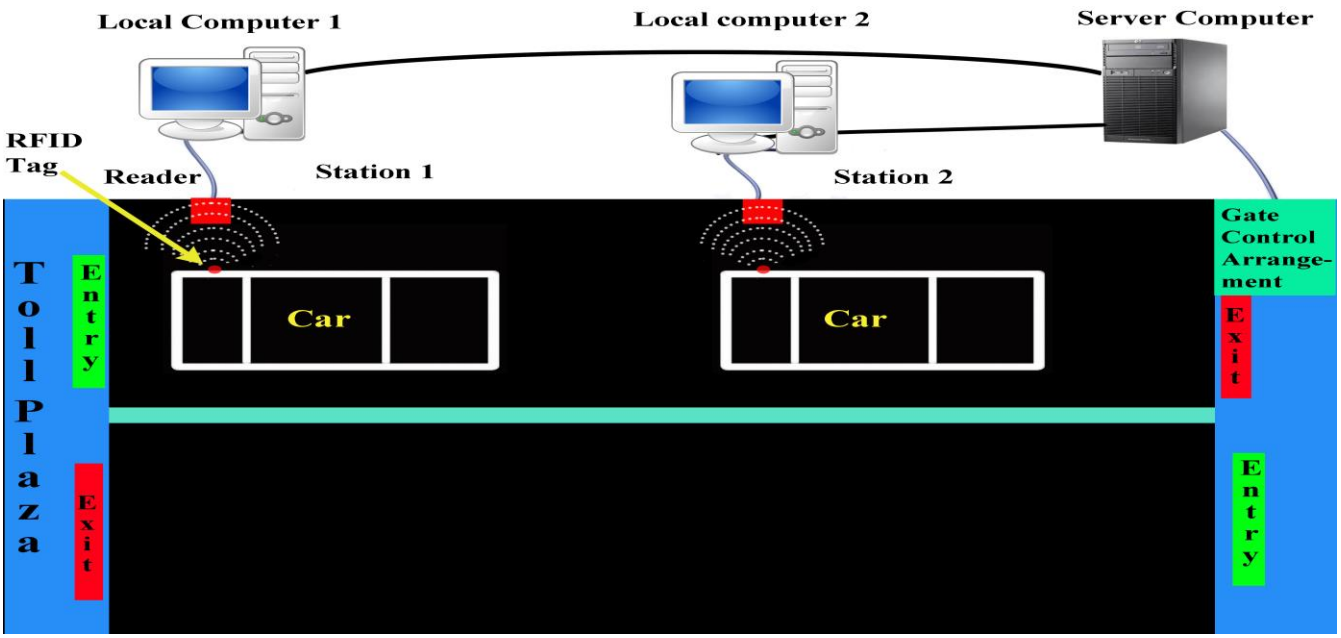

Figure 3 : Schematic arrangement of the proposed system

information and store in the local computer. The computer in the station 1 is also connected to a server. The server will be fed by the information from computer in station 1.Another station (station 2 in fig.2) will be situated near to the end of exit point. Here the RF signal transmitted by the active tag of the vehicles will be received and decoded again. The retrieved information will be stored in a local computer which is also connected with the same server. The data from the two computers will then be compared in the server. If no overtaking occurs on the way then server will make the decision to let the vehicle pass. But if the data from the computers are not same which is an indication of overtaking, the server will block the path restraining the vehicle to pass. The decision of server will be executed using microcontroller, relay circuitry and gate control arrangement. The system will also work perfectly if overtaking occurs in front of reader. As the RFID reader is much sensitive to incoming signal and the transmitter transmit signal very frequently so data can easily be gained.

IV. Flowchart

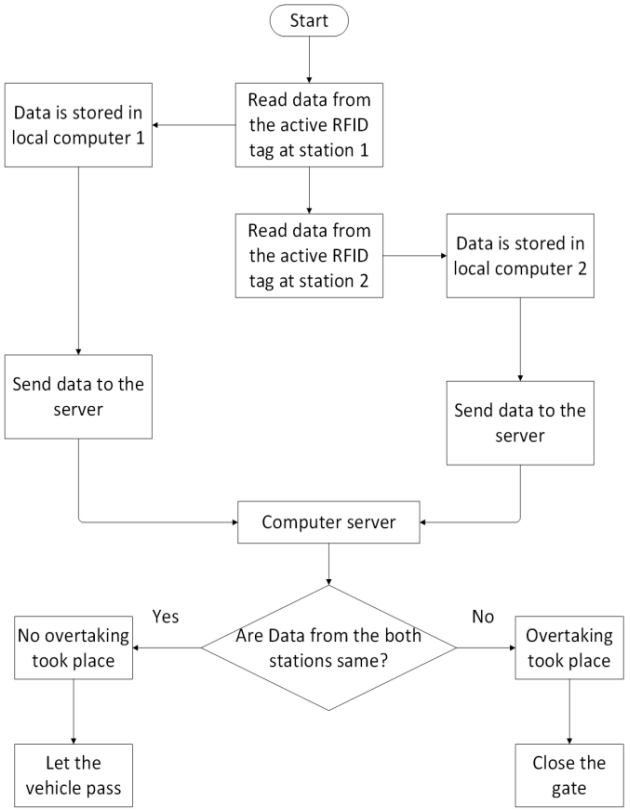

Figure 4 : Flowchart of entire system

V. Microcontroller Operation

A microcontroller can be interfaced with the sever output signal. As the server gives sequence of 0 or 1 depending on whether overtaking took place or not, a microcontroller is needed to create corresponding voltage level to bring the relay [7] in operation. A low cost microcontroller ATMEGA8 can be used. As any port of the microcontroller can be programmed as an input or output port we can program port B as an input port which receives signal from the server and port C can be programmed as an output port. When no overtaking take place server gives microcontroller such a signal that microcontroller generates a zero voltage as output. But if overtaking take place server output is different from the previous output and corresponding microcontroller output is a 5 volt which is directly fed to the base of the transistor of the transistor controlled relay and is sufficient to bring the relay in operation.

When the base of the transistor [8] get a high voltage it switches the coil of the relay. The coil gets energized and attracts the arm of the relay. The arm changes its position from NC (Normally Connected) to NO (Normally Open) position as shown in fig.5. As a result the gate controlling arrangement gets power for restraining the vehicle a freewheeling diode [9] is connected in parallel with the coil of the electromagnet. Otherwise destruction of the transistor and the entire arrangement may occur due a very high voltage generated by the inductive energy stored in the relay coil as soon as the base voltage of the transistor goes low.

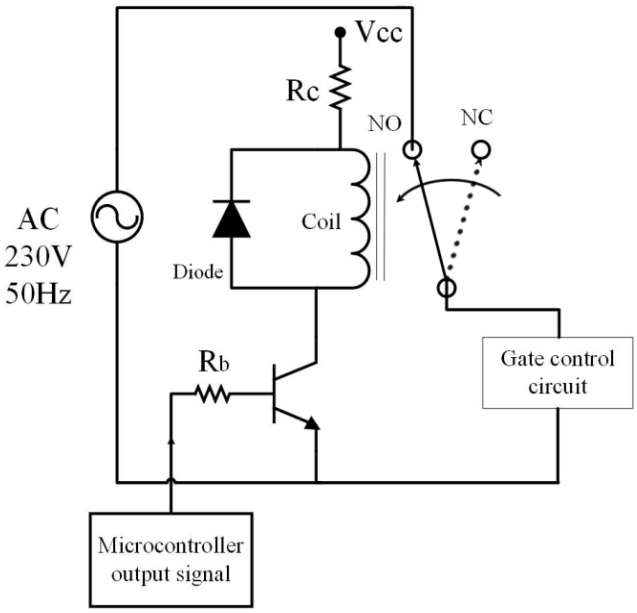

Figure 5 : Relay operation

a) Low running cost

b) Less design complexity

c) More advanced features can be added

d) Less chance of failure

e) Automatic fining can be made possible for overtaking

f) Can operate in any atmospheric condition

g) Proposed components for implementing circuit are available in market

As the purpose of our proposition is to restrain overtaking that may leave serious accidents and it is a low cost approach we can say it is very important to implement. Besides there are several scopes for future development in conjunction with our proposition. As an elementary approach we have taken only the situation of a bridge in our consideration but it can be further implemented also in accident prone areas. Automatic tolling system requires almost same type of components. As a result implementation of this proposal will be very easy and cost effective one. Considering all the aspects finally we can conclude saying that ours is a viable proposition.

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