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Advanced Road Signal Tracking System

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ABSTRACT

Development of the advanced road signal tracking system (ARST) is required because of the fact that existing system requires significant amount of human intervention. Because of the human intervention to the existing system there is always chance of massive failure. The ARST system consists of an Arduino-Uno, ESP-8086 Wifi, RFID Sensors and PHP which provide automation to the system. The ARST system will able to deal with two basic problem of traditional road signal system: i) Automatic detection of signal breaking vehicles. ii) Searching for stolen vehicles.

Keywords: Arduino, RFID, Microcontroller, Decision Making System, Central Database Processing System

I. INTRODUCTION

In many modern cities around the world automobile traffic control has always been a massive concern for administrations. To achieve solution to this problem several attempts have been made to design efficient automated systems. To operate traffic signals, pre-determined timing circuits have been used by the most of the existing systems which are not very efficient because they do not operate in accordance to the current volume of traffic at road-crossings.

A more convenient and flexible technology is offered by RFID technology which is well suited for fully automated systems, directing human lifestyle towards automation and reality [1]. For tracking and localization solutions in wide range of industrial and commercial systems this technology has been widely deployed which helps in manufacturing, supply chains, agriculture, and library and healthcare services [2]. RFID tags are embedded to an object, from which data can be read. Direct printing of tags on objects is enabled by modern advances in the technology. Hence, information stored in the tag can be wirelessly transmitted to the RFID reader via reader antenna [3].

II. PROPOSED ARCHITECTURE OF ARST

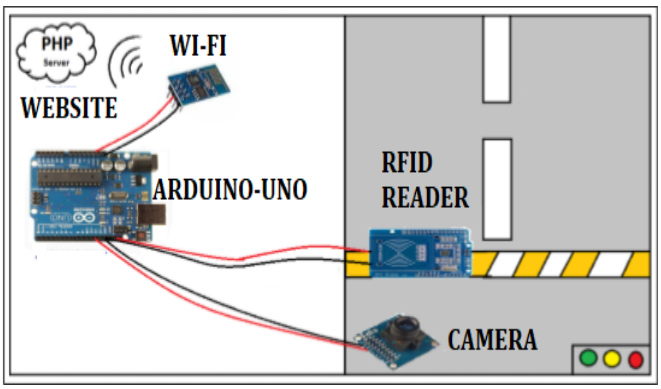

Figure 1. Proposed architecture of ARST

The ARST consists of a set of two RFID readers, separated by some distance, in each direction of a road crossing and a system to control them all. As soon as the vehicle passes by a reader, the vehicle is tracked through the RFID tag attached to it and its associated information is retrieved.

i) RFID Tags: RFID tagging is an ID system that uses small radio frequency identification devices for identification and tracking purposes.

An RFID tagging system includes the tag itself, a read/write device, and a host system application for data collection, processing, and transmission. In this system each vehicle contains an RFID tag on the Crèches of vehicle.

ii) RFID Reader: A radio frequency identification reader (RFID reader) is a device used to gather information from an RFID tag, which is used to track individual objects. Radio waves are used to transfer data from the tag to a reader. In this system RFID reader placed at the zebra crossing line to detect tags parallel.

iii) Arduino-Uno: Arduino/Genuino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller.

Simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. In this system Arduino uno contains the overall code and it control all the hardware.

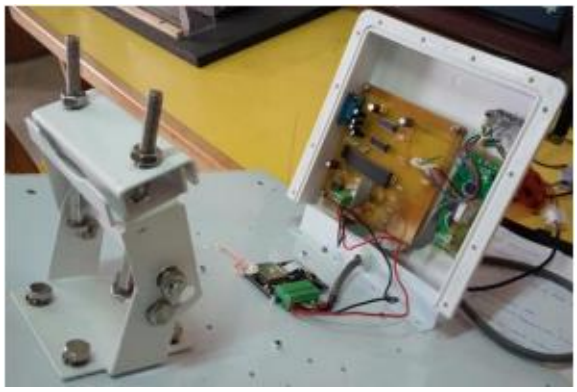

Figure 2. Re-engineered UHF RFID Reader [4]

III. CENTAL DATABASE PROCESSING SYSTEM

The database system comprises of two parts:

i) The records of vehicles currently passing the zebra crossing are temporarily stored in the dynamic database.

ii) The records of all vehicles that have passed the zebra crossing is stored in the permanent database. The dynamic database is divided into a number of parts. According to the vehicle's path and direction of travel the associated information of vehicle is arranged by the dynamic database. The two readers in the vehicle's path detects whether a vehicle moves towards the crossing or away from the crossing and the obtained information is conveyed to the Arduino-uno microcontroller with some time gap in between.

The data in different parts of the dynamic database is checked by the database processing system at each instant and volume of traffic for all roads converging at the zebra crossing is computed by the database processing system. The calculated data is then sent to the Decision Making Section (DMS) which operated the traffic signals in accordance to the current state of traffic.

IV. DECISION MAKING SECTION

A decision making algorithm determining how the traffic lights are operated is contained within the decision making section. The decision making algorithm looks after following factors:

The state of traffic as retrieved from the database processing system - In the direction of maximum volume of traffic green light is shown.

Since the state of traffic can change very rapidly, it is almost impossible to alter traffic signals based only on this factor. So, a minimum time is set for which the traffic signals remain constant before checking the state of traffic again. A maximum time is set after which a constant traffic signal must change regardless of the volume of traffic. This is performed to make sure that no vehicle has to wait too long at the crossing .

To handle emergency situations like an accident or failure of the system some interrupts are

incorporated. External interaction is enabled by the notification system attached to the interrupts, as an emergency cannot be automated and normally requires human intervention.

V. FLOW OF THE ARST SYSTEM

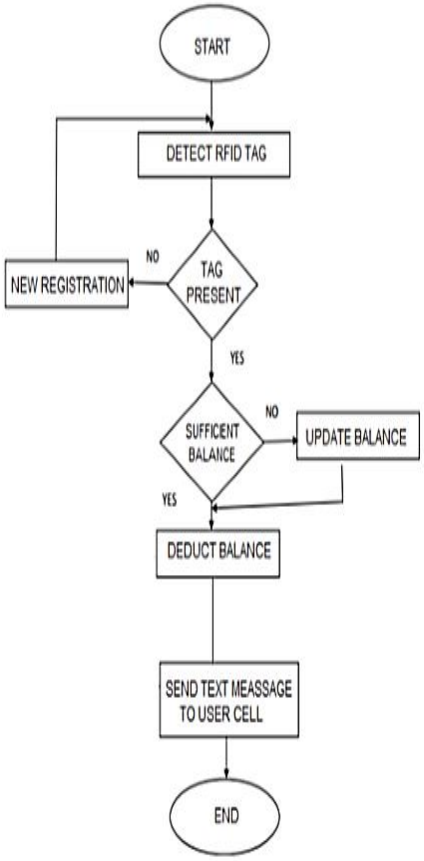

Figure 3. Flowchart of the System

VI. FUTURE ENHANCEMENTS

Some additional features can be integrated into the system. The system can still continue to perform if one of the reader in the path fails. In such scenarios, when the other reader in that path supervises the vehicle, the database processing system checks whether it has just crossed the readers in another path converging at the crossing or not. This can be helpful in getting the direction of vehicle. To achieve this, the handshaking acknowledgement signals with the readers must be shared regularly by the system to find out whether they are behaving properly or not.

The tags should be durable, impact resistant, waterproof, and the internal batteries (for active tags)Should have at least a lifespan of ten years or more. To detect intentional tag removal or to make sure that tag's authenticity in cases of tag cloning, spoofing, copying, duplicating or vandalism advanced security algorithms should be developed.

VII. RESULTS AND DISCUSSION

Based on the results and analysis, we can conclude that low to medium density vehicles has no effect on processing and accuracy of the ARST system. In a scenario, where there is large amount of vehicles there is a possibility that one or two vehicles might be missed by the RFID reader leadingto a failure in detection of the vehicles that are breaking the traffic signals. The ARST system will workin almost all types of conditions in terms of the weather unless there is an internal failure.

VIII. CONCLUSION

The Signal Tracking system in based on RFID, It has characteristics of low cost, high security, far communication distance and high efficiency, etc. RFID based Signal Tracking system is an effective measure to reduce management costs and fees, at the same time, greatly reduce noise and pollutant emission of toll station. This system of collecting tolls is ecofriendly and also results in increased toll lane capacity. Also an anti-theft solution system module which prevents passing of any defaulter vehicle is implemented, thus assuring security on the roadways and signals.

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