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SMART TRAFFIC CONTROL SYSTEM USING RFID

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Abstract - *Traffic problems include not just traffic jam because of gain vehicle tightness, also include difficulty fo emergency vehicles, red light traffic violation and accidents causing blockage of roads and loss of lives. Previously proposed systems for smart traffic management specialize in vehicle density based traffic light control and provision for emergency vehicle passage. These such systems are limited to at least one or two focus areas. so as to create a sensible city, a encompassing system for traffic management has to be built that addresses all traffic related issues, not just traffic jam . We propose a smart traffic control System (STCS) using radio frequency Identification (RFID).*

Key Words: Traffic congestion, Traffic density estimation, Traffic management, Traffic Control, RFID, Radio Frequency, Emergency.

1. INTRODUCTION

Traffic lights was in development since 1912, traffic lights contains three colored lights. Nowadays, many countries suffer from the traffic jam problems that affect the transportation in cities and cause serious dilemma. The rapid increase of the amount of automobiles and therefore the constantly rising number of road users aren't accompanied with promoted infrastructures with sufficient resources. Various solutions was offered by constructing new roads, flyovers and performing roads rehabilitation.

However, the traffic problem is extremely complicated thanks to the involvement of diverse parameters. First, the traffic flow depends on the time of the day where the traffic peak hours are generally within the morning and within the afternoon The weekends have minimum load while Mondays and Fridays have dense traffic and time of the year as holidays and summer. Secondly, the present traffic signal system is implemented with hard coded delays where the lights transition time slots are fixed regularly and don't depend upon real time traffic flow. The third point cares with the state of 1 light at an intersection that influences the flow of traffic at adjacent intersections. Also, the traditional traffic system doesn't consider the case of accidents, roadworks, and breakdown cars that worsen traffic jam. additionally, an important issue is said to the graceful motion through intersections of emergency vehicles of upper priorities like ambulances, rescue vehicles, fire brigade, police, and VIP persons that would grind to a halt within the crowd. Pedestrians crossing the road also tent to change the traffic flow.

RFID is a contact less wireless device consists of tag and reader. The complexity of RFID systems differ from one application to a different . RFID is extremely common in access control applications where access control information is typically stored in back-end database. Traffic signals operate in Hard coded (pre-timed), adaptive mode. Hard coded (Pre-timed) control consists of a series of intervals that are fixed in duration. They repeat a preset constant cycle. In comparison to Hard coded(pre-timed) signals adaptive signals have the capability to respond to the presence of vehicles or pedestrians at the intersection. Vehicle actuated signals require actuation by a vehicle on one or more approaches so as surely phases or traffic movements to be serviced. They are equipped with detectors and therefore the necessary control logic to reply to the demands placed on them. Vehicle-actuated control uses information on current demands and operations obtained from detectors within the intersection to change one or more aspects of the signal timing on a cycle-by- cycle basis.

Regulation of the signals is controlled by traffic need. Adaptive traffic control system is the latest period of traffic control system. The adaptive traffic light systems are operating with success in many countries since the first 1970. Adaptive traffic light control systems are normally complicated and include prediction and estimation modules. More than twenty Adaptive traffic light controls are available on the market. They are significant thanks to their relative acceptance within the field also because the relative extent of their world implementation. Almost widely deployed control systems are discussed here. In 1980, Nathan Gartner of University of Massachusetts at Lowell proposed a system called as Optimized Policies for Adaptive Control for the Federal Highway Administration. The Split Cycle Offset Optimization Technique (SCOOT) was also developed in the early 1980 by the Transport Research Laboratory in the United Kingdom. The Sydney Coordinated Adaptive Traffic System (SCATS) is slightly newer, having been created in the early 1990 by the Roads and Traffic Authority of New South Wales, Australia. The RHODES (Real- time Hierarchical Optimized Distributed Effective System) is the newest of these four systems, is being produced since mid-1990 at the University of Arizona at Tucson.

A decentralized adaptive traffic signal control method developed by Porche in 1997 known as Adaptive Limited Look-ahead Optimization of Network Signals – Decentralized (ALLONS-D). More recently, Yu and Recker (2006) developed a stochastic adaptive traffic light control model. An intersection traffic light control application additionally to the amount of states is typically very large. The dynamic programming algorithm to calculate the time could make a significant problem.

At first Radio Freqency Identification tags were developed to eventually substitute barcodes in supply chains. RFID transponders (tags) contains Microchip, Antenna, Case and Battery (for active tags only). We differentiate 3 types of RFID tags in relation to power or energy i.e. Passive, Semi-passive and Active. RFID tags fall under three categories in reference to frequency.

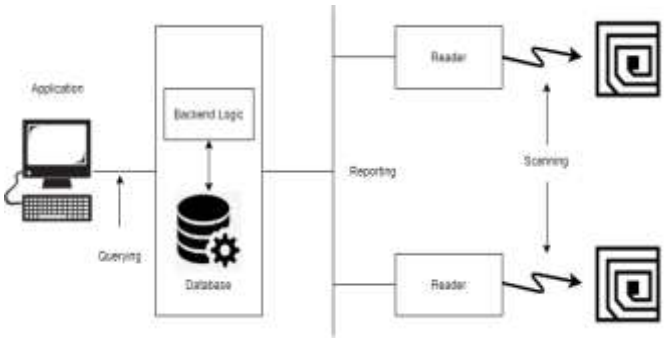

Fig-1: Illustration working of RFID System.

As shown in figure 1, when a tag enters a read region, its data is captured by the reader and then be transferred to a host computer or programmable logic controller for storage. The reader discharge Radio frequency signals to activate the tag and to read and write data to it. The reader emits radio waves in ranges of anywhere from 1 inch to 100 feet, based on its power output and the radio frequency used. On passing the RFID tag through the electromagnetic area, it identify the reader's activation signal. The reader decodes the data in the tag's integrated circuit and the data is passed to the host computer for processing. The data sent by the tag provide information, or specifics about the merchandise tagged, like price, color, date of purchase, etc. RFID technology has been employed by thousands of companies for a decade or more. . RFID quickly gained attention due to its ability to trace moving objects. Because the technology is refined, more pervasive and invasive uses for RFID tags are within the works. The simulated model used for the analysis of efficiency of traffic signal controller. RFID reader has been utilized in order to spot vehicles and hence we evaluate the typical speed of the vehicles, queue length and waiting time.

2. EXISTING SYSTEM

In general, our research cover the literature review from various sources based on traffic control and vehicle tracking. This method examine the adaptive fine tuning algorithm to create a set of design parameters of two well-defined mutually interacting modules of the traffic responsive urban control(TUC)strategy for the large scale urban road network of the city of China, Greece. Computer simulation outcome are given, demonstrating that the network performance in terms of the daily mean speed, which is attained by the proposed adaptive optimization methodology, is significantly better than the original TUC System in the case in which the-aforementioned design parameters are mutually fine-tuned to virtual perfection by the system operation [1]. The system will develop the traffic light configuration, which will be able to determine three street case (empty street case, normal street case and crowded street case) by using small associative memory. The experiments presented provides promising results when the proposed approach was applied by using a program to monitor intersection in penesa island in Malaysia. The program could determine the street cases with different atmospheric conditions depending on the stream of images, which are extracted from the street video cameras[2]. To handle congestion in urban traffic flow through next generation artificial intelligence techniques is an important research area. Various intelligent and approach have been developed using sot computing techniques to tackle with this problem. This paper is an attempt towards revisiting such approach in developing modern traffic control systems[3].

This study focus on the utilization of RFID as a way of traffic flow detection, which transmits collection information connected to traffic flow straight to a control system using an RS 232 interface, At the same time, the sensor analyzes and Judges the information using an extension algorithm designed to accomplish the subjective of controlling the flow of traffic. In add-on, the traffic flow condition is also transmitted to a remote monitoring control system through ZigBee wireless network communication technology. The traffic flow control system developed in this study can execute remote transmission and reduce traffic accidents. And it can also effectively control traffic flow while reducing traffic delay time and maintain the smooth flow of traffic [4]. The main subjective of this system is that to control the traffic congestion, allowing an ambulance to arrive at a particular location without it having to stop anywhere until the designation is reached. This system includes RFID technology and Lab view software. The RFID reader reads the Identification number from the related ambulance RFID tag and then it is sends the data to micro controller LPC 1768H, which is programmed, with the help of embedded C instructions. Those microcontroller is capable of communicating with input and output modules. The readers will provide the data to the micro-controller so it compaers the received ID with default ID‟s stored in its memory. If the readed ID gets matched with any of the pre defined ID‟s, then a green signal on the particular lane will be turned on untill the ambulance crosses the traffic signal. The signal will not change from green until the same tag is detected by the other reader in another route [5]. On the traffic incident management (TIM) makes a systematic effort to detect, response to, and remove traffic accidents. It aims to offer the rapid recovery of traffic safety and capacity and lead to

many measurable benefits, such as decrease in fuel consumption, accident duration, secondary accidents, and traffic jams. In the past thirty decades, ITS technologies were recognized as valuable tools and being used word wide in traffic accident detection, verification, response, and communication [6].

On preemptive and predictive methodology, i.e., IT strategy with reactive compensation (ITRC), to cut down network delay time and eliminate unneeded stops for vehicles. With anticipation for repetitive traffic flows based on historical data, nominal traffic signals are tuned by IT controller over repetitions. The reactive compensation, which is junction based model predictive control strategy (JMPC), makes adjustment on nominal traffic signals and compensates the no repetitive elements. Exact analysis provide adequate condition for guaranteeing the convergence of ITRC [7]. To offer the idea of traffic light control using wireless sensor network. It is a serious problem in the traffic congestion in many major cities around the world and in this it has become a nightmare for travelers. Conventional systems do not control changeable flows coming near junctions. In add-on, interconnection between adjacent traffic light systems is not implemented in the current traffic system of passage of vehicles, passage of emergency vehicles, and passage of pedestrians. This leads to traffic jams and hurried towards the crowd. Sometimes the high traffic density on one side of the junction request more green time than the standard allotted time. The system architecture is isolated into three layers; the wireless sensor network, the localised traffic flow model policy, and the higher level coordination of the traffic lights agents [8]. The strength of the approach is its formal separation between the low level image processing modules(used for extracting visual data under various illumination conditions) and the high level modules, which provides a general purpose knowledge based framework for tracking vehicles in the lane. The image-processing modules pull up visual data from the scene by coordinate system analysis during day time, and by morphologic analysis of headlamp at night. The higher level module is planned as a forward series of production regulation system, working on symbolic data, i.e., vehicles and their attributes (area, pattern, direction, and other) and exploiting a set of heuristic concept tuned to urban traffic conditions [9].

A. K. Mittal and D. Bhandari proposed a system that could provide clearance to any emergency vehicle by giving green signals on the path of the emergency vehicle. In this way, a vehicle passing through the lane will continue to receive green signals. However, in this system, the wave disturbances result in serious traffic problems due to lack of synchronization [10]. P Maheshwari et al. proposed a system in which cameras are installed at the red lights to estimate the traffic. Based upon the need if density increases, the vehicles in that lane were allowed to pass by adjusting the timer for efficient traffic flow [11]. M. Kumaar et al. used a obstruction gate and a GSM technology to design a density based traffic light control system. In their system the density of the traffic is used to alternate the signal timing automatically and microcontroller is used to provide the delay. However, this system fails to address the problem of emergency vehicle [12]. Ghazal et al. Proposed a PIC microcontroller based on traffic control system that uses IR sensors to determine the traffic density. So the dynamic time slots for different levels of traffic can be used and also control device is used to track the emergency vehicles. The disadvantage of this system is that the portable device is to be carried along with the emergency vehicle [13].

Vilarinho et al proposed a system which was based on multi-agent system in which each isolated intersection includes a multi-agent. These agents are configured for intersections for creating, managing, and evolving its own plans for traffic signal [14]. Younis and Moayeri proposed a system in which a dynamic traffic light control (DTLC) is located at the road junction to collect traffic data. It includes few protocols to handle congestion and facilitate efficient traffic flow by proposing low-overhead algorithms. Though this system with efficiency manages traffic rate of flow yet, it is not focusing towards the emergency vehicles [15].

Table -1: Comparison with previously proposed systems.

Contributors	Dynamic Traffic Control	Emergency vehicle	Tracking of Stolen Vehicle	Alert for the Topping up the credit for Tool Booth.
A. K. Mittal and D.Bhandari.[10]	✓			
P Maheshwari et al.[11]	✓	✓		
M. Kumaar et al.[12]	✓			
Ghazal et al.[13]	✓	✓		
Vilarinho et al.[14]	✓			
younis et al.[15]	✓			
Intelligent Traffic Control using RFID	✓	✓	✓	✓

3. PROPOSED SYSTEM

The solution we provide for Traffic management by reading the RFID tag of each car by a RFID reader at traffic junctions for real time traffic density calculation. It also concentration on changing the traffic lights according to vehicle tightness on the road, thereby intent at reducing the traffic congestion on roads. In turn, it'll reduce fuel consumption and waiting time. In case of emergency vehicle like ambulance Radio Frequency module will be used so that red traffic light signals will be turned to green in order to provide a clear way for the emergency vehicles.

It will also provide significant data which can help in future road planning and analysis. It is also used to detect or track stolen vehicle. It also alerts the owner of the

vehicle to top up the credit which is used in toll booth. In further time period multiple traffic lights are often synchronized with one another with an goal of even fewer traffic jam and free flow of traffic. The vehicles are detected by the system through RFID tag which is read by the RFID reader. RFID reader is present in some meters away from the signal and another RFID reader is placed alongside the traffic light. It will capture the number of vehicles in that particular lane. RFID is a better technique to control the state change of the traffic light since RFID is mandatory for all the vehicles in India. It shows that it can decrease the traffic jam and avoids the nonce wasted by a green light on an empty road. It is also more certain in estimating vehicle existence.

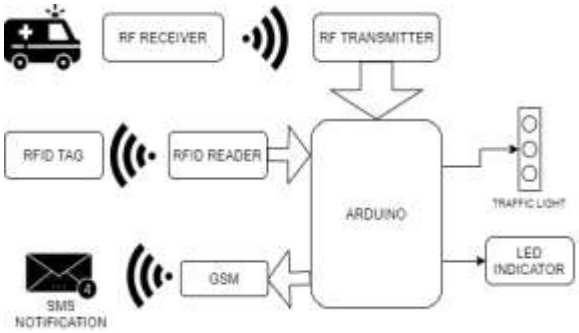

Fig-2: Overview of the Proposed System.

3.1 Dynamic Traffic control using RFID reader and tag

There are The STCS (Smart traffic control System) is comprised of a group of two RFID readers, separated by a long way , in each direction of a road crossing and have a central computing system (CCS) to regulate all of them. As a vehicle passes by a reader, it tracks the vehicle through the RFID tag affiliated to the vehicle and fetch its electronic product code (EPC) data. The EPC consists of the vehicular identification number (VIN). The VIN is an industry standard and every automobile features a unique VIN. Through a table look-up procedure the VIN could also be matched against individual vehicle records and every one details like type, weight, length, registration, pollution control status, and therefore the owner's identification are often retrieved. The data obtained is then sent immediately to the CCS by wireless or wired channels, as found convenient at that location. The CCS contains a central database processing system (CDPS) for processing vehicular data and a choice making section (DMS) for controlling the traffic signals.

The volume of traffic is not calculated simply by the number of vehicles but by a complex set of equations that take into account predefined factors (obtained by research) including:

• Vehicle type —whether it is a small vehicle like a scooter or a car, or a large vehicle like a bus or a truck.

• Priority allotted to the vehicle — each type of vehicle is allotted a particular priority based on its size, frequency of that vehicle at the crossing, time of the day, and other factors.

• Priority assigned to the path of travel—this factor becomes essential when both the roads intersecting at the crossing are not of the same importance (e.g., the intersection of a national highway with an ordinary road).

• Time—the time of the day and day of the week. The volume of traffic takes into account the priority assigned to each vehicle at the present time of the day and also the priority allotted to the two roads intersection at the crossing.

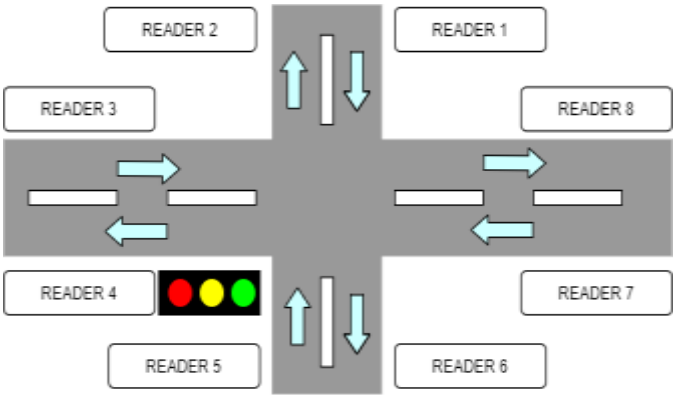

Fig-3: A signal junction with RFID reader.

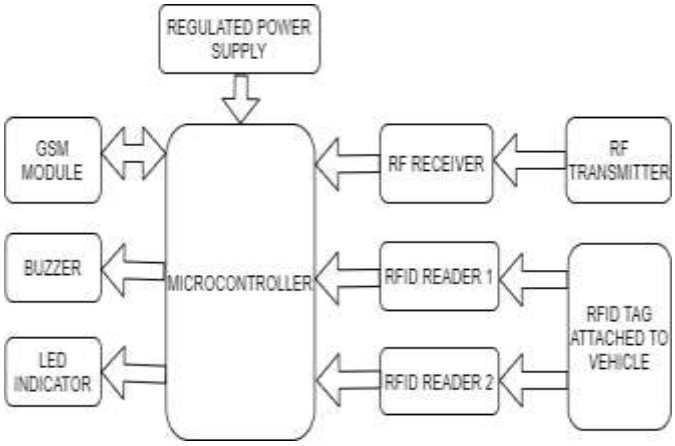

Fig-4: Block Diagram of the proposed system.

3.2 Emergency Vehicle Traffic clearance

Here, each emergency transport contains RF transmitter component and the RF receiver will be enforced at the traffic junction. The bell will be turned ON when the vehicle is used for emergency purpose. This will send the signal through the RF transmitter to the RF module receiver. This will make the traffic signal to change to green. Once the ambulance crosses the signal, the receiver no longer receives the RF signal and the traffic light is turned to red.

3.3 Identification of stolen vehicle

The Central Database will store all the Electronic Product Code (EPC) of the vehicle which is read by the RFID reader in the signal junction.It will store the In-time as well as the Out-time of a particular vehicle in that junction. If a vehicle is reported stolen the Traffic Department can access the database and search the vehicle using Vehicle Identification Pin which is in EPC. Here the information about the particular vehicle is retrieved from the database so it is helpful for identification of the stolen vehicle.

3.4 Alerting owner for topping up credit

As the Government of India has implemented the E-Toll in all over the India as a result each vehicle will get a FasTag which is the RFID Tag. It will be linked to the bank account or to the wallet. Once the vehicle crosses the toll the amount is reduced from the bank account. At the Junction when a vehicle is reader by a RFID reader it will also check for the credits. If the credit is less than the minimum amount in the owner of the vehicle will get a message notification once in 12 hours.

3.5 Red light violation detection.

If any of the vehicle violates the red light the fine will be reduced from credit. While the signal is on red if any car passes the red light It will be captured by the RFID reader. The fine is placed automatically and the owner will get the message through SMS.

4. EXPERIMENTAL RESULTS

The hardware implementation consist of arduino UNO micro controller through which the RFID readers are connected internally. The GSM module for sending the SMS is also connected to the arduino. Both the arduino and the GSM module is powered with 1 Ampere regulated power supply each. A LCD panel was used to display the current situation the junction. RF receiver is connected to arduino to receive the signal passed from the transmitter in the ambulance. RF transmitter is powered with 9v battery. Four led lights is connected with arduino and used for simulating the traffic signal.

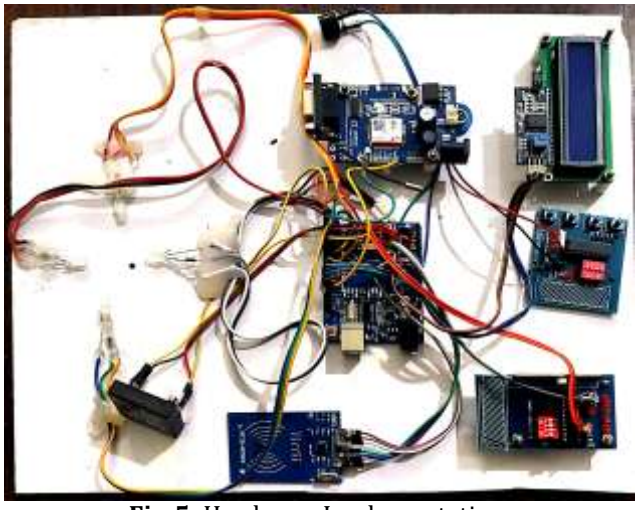

Fig-5: Hardware Implementation.

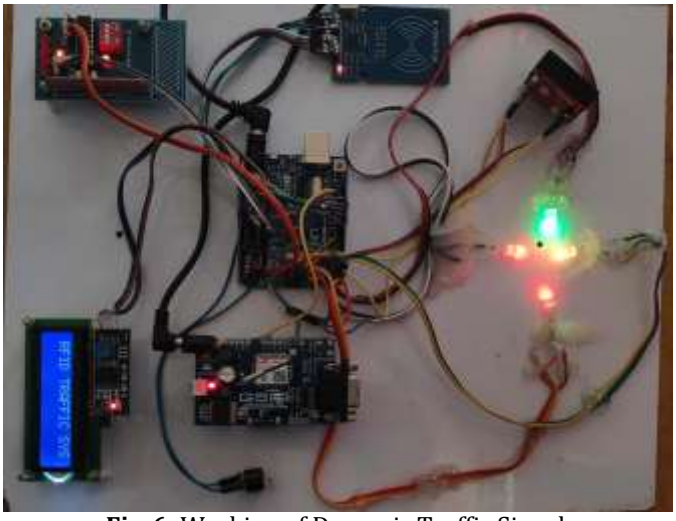

Fig-6: Working of Dynamic Traffic Signal.

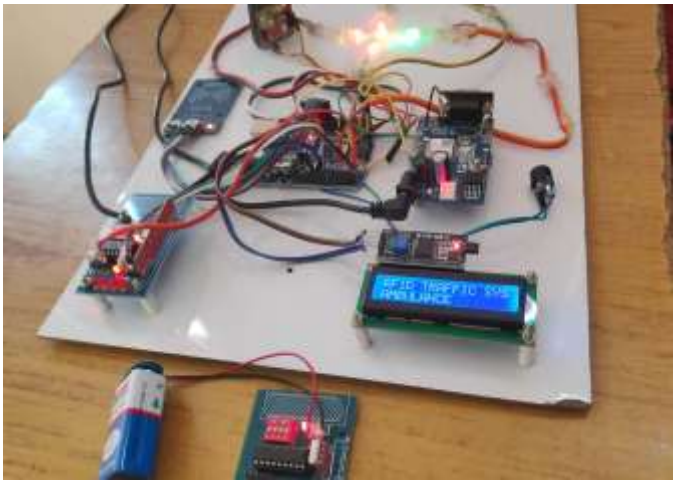

Fig-7: Working of Emergency Vehicle Clearance.

The results we obtained on the prototype is on showing two or more than two tag under the RFID reader it take it as a high density and allow the particular lane to have green signal for some extra time. A tag which is already denoted as the theft vehicle when the particular tag is

scanned in the RFID reader then it will make the beep on and off for three time and will send the SMS to the control room number and the vehicle owner number. When a tag is scanned it will also check for the Fast Tag balance if it is less then minimum balance the SMS alert will sent to the vehicle owner. When the signal is in red a tag is passes through another reader then it will be made as the rule break. The fine will deducted removed from the Fast Tag balance. Emergency vehicle has RF transmitter, on pushing the button it will pass the signal to RF receiver and make the particular lane green.

5. CONCLUSION

With automatic traffic light control supported the traffic density within the route, the manual effort on a part of the traffic policeman is saved. because the entire system is automated, it requires very less human intervention. The vehicle information is stored within the database so it's easy to trace the stolen vehicle. Also SMS are going to be sent in order that they will prepare to catch the stolen vehicle at subsequent possible junctions. Emergency vehicles like ambulance, fire trucks, got to reach their destinations at the earliest. If they spend tons of your time in traffic jams, precious lives of the many people could also be at risk. With emergency vehicle clearance, the traffic light turns to green as long because the emergency vehicle is waiting within the traffic unction. The traffic signal turns to red, only after the emergency vehicle passes through traffic signal. also as if any vehicle violate the red light is fined automatically. Further enhancements are often done to the prototype by testing it with longer range RFID readers.

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