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RFID Based Automatic Toll Collection Systemfor Dynamic Charging Vehicles

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ABSTRACT
In order to find a solution to stop and wait charge for electric vehicles and also to maintain transparency in toll gate system, we are providing automatic toll collection for electric vehicles which are using wireless power generating track. Thus by providing continuous charging path that allows the vehicle to charge continuously while it is in motion and it maintaining transparency in tollgate system by scanning RFID tags under RFID sensor, hence
the name RFID based automatic toll collection system for dynamic charging vehicles is introduced. This project focuses on automatic toll collection system which uses radio frequency identification (RFID) technology to identify a vehicle specifically for collecting toll. The proposed RFID system uses tags which are using the tag numbers as vehicle plate numbers of electric vehicles through which information embedded in the tags are read by RFID readers. It is possible to reduce the need for manual toll collection, also saves the time at toll gates and also helps the electric vehicles to get charge when they are in motion. For providing dynamic wireless electric vehicle charging we are using copper coils beneath the track, the track will generate wireless power to the electrical vehicles so that the vehicle uses wireless power for charging purpose while it is in motion. The track gets charging by an external battery and this external battery gets charged using solar energy.so that we can reduce the usage of petrol, diesel and other fossil fuels and we can also save the environment by reducing the usage of greenhousegases and also reduce global warming effect.
Keywords: *Arduino UNO, LCD, Push Button, Relay, RFID Sensor, LC Tank circuit, RFIDtags, servo motor.*

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I. INTRODUCTION

In the present scenario as the technology become advanced the usage of vehicles for transportation also involved to change i.e., they are shifting to the usage of electric vehicles. As these electric vehicles need charging stations for charging purpose it will take some time to stop and charge. For establishing these charging stations to power up the electric vehicles we require charging stations and it takes time to Charge the vehicle. The problem with electrically charged vehicles is, they can be charged only when they are in stationary mode and they are charged only for short distance and range. They don't have sufficient volume of battery storage also. So, we are going with dynamic vehicle charging which charges the vehicle when it is in motion. So, providing dynamic charging to the electric vehicle through transmitting coils which are mounted underneath the track is a better solution to avoid bulky battery structures, shorter range problem, and limited power transfer issue. In this proposed system RFID reader will read the RFID tags by taking the tag number as vehicle plate number and then it will either give access or it won't allow any electric vehicle to use that wireless power generation track. This process will entirely depend on database of the tag. As there is no need for vehicles to stop and toll authorities to manually collect the tolls, the system eliminates the traffic jam and possible human errors that normally happen in a toll system making it a more efficient process. The wireless power generating track will also be helpful and useful in reducing the usage of fossil fuels and also reduces the emission of greenhouse gases. This wireless power generating track will receive power from natural source of energy i.e., solar energy which is environmentally friendly without causing any pollution.

II. LITERATURE SURVEY

In this system the ideology can drain the prevalent botheration of bouncing the audit action at the check-posts and also decrease the pausing time, fuel burning of all vehicle in thetoll-plaza, due to self-regulated checking and automatic detection of tax amount. The crime vehicle can be discovered when a grievance had

updated in data bank and intimate the lackingbalance to pay for tax, in the time of crossing of each toll- plaza system. Distant queue, congestion, fuel and time burning is decreased abundantly by this advance. This ideology willarrange a smoother and guarded exploration for the voyager.[1]

In this prototype, when we gave an input voltage of 30V DC we were able to get an output voltage of 5V with 700mA at a distance of 20mm. We can improve the efficiency by following methods, that is by a lever mechanism we can adjust the distances between receivingand transmitting coils which Will increase the power transmission between the coils, by increasing the frequency level to MHz range, by making the system to magnetic resonance coupling, Increasing the no of turns of the coils by proper coil design. The prototype is madeof lower efficiency because the power input given to the prototype is used for meeting the constant loss as well as magnetic leakage.[2]

In this system presented technology is a complete solution which includes power transfer, foreign object detection, live objects protection and required communication capabilities. Developed technology is very flexible, easy to use and can be easily adopted forvarious cars. And this system, building of a fully automated Wireless charging System is established which uses the charging method using wireless Power Transmission technology itis able to charge E Vehicle very safely with minimal use of human actions as everything will be done automated by this system and also the protection from battery overcharging can be achieved.[3]

In this system the input stage is the conversion of grid supply AC into DC and DC in tohigh frequency AC. As this is a two-stage process there is scope to implement direct AC-AC conversion to reduce size, cost, losses, and control complexity. The system showed improvement in performance during misalignment and gap variation, but there is still scope to improve the performance during misalignment and gap variation. Even though asymmetrical coils with greater transmitting coil inner diameter than the receiving coil outer diameter are less sensitive to misalignment, the coefficient of coupling decreases. Study on asymmetrical coils with equal outer diameter in both coils and variation in the inner diameter of the coils is required for a high coefficient of coupling and misalignment tolerance.[4]

In this system the main problem of highway is the long queue at the toll gates due to tollfee payment transaction. Instead of cash payment at manual toll gates, automatic toll gates (GTO) use debit cards to do payment faster. Regardless the gates are manual or automatic, every vehicle should stop for a while to finish the transaction. Further, the conventional payment method at the toll gates makes this situation even worse. Toll gates officers or automatic printers will give a small piece of paper as successful payment notification. These notification papers, however, are not really cared by the drivers and further become trashes around the toll gates. This research aims to improve the quality of service of the toll gates by developing a queuing free environmental friendly automatic toll gates. Instead of debit card to identify the toll customers and do the payment, the proposed system uses a noncontact technology that commonly referred as Radio Frequency Identification. The vehicle is identified by the systems just as it is passing through the toll gate. This method eliminates the queue at the toll gate since the payment is donein fly. Next, a payment notification is sent to the driver's hand phone via short message service.[5]

III. IMPLEMENTATION

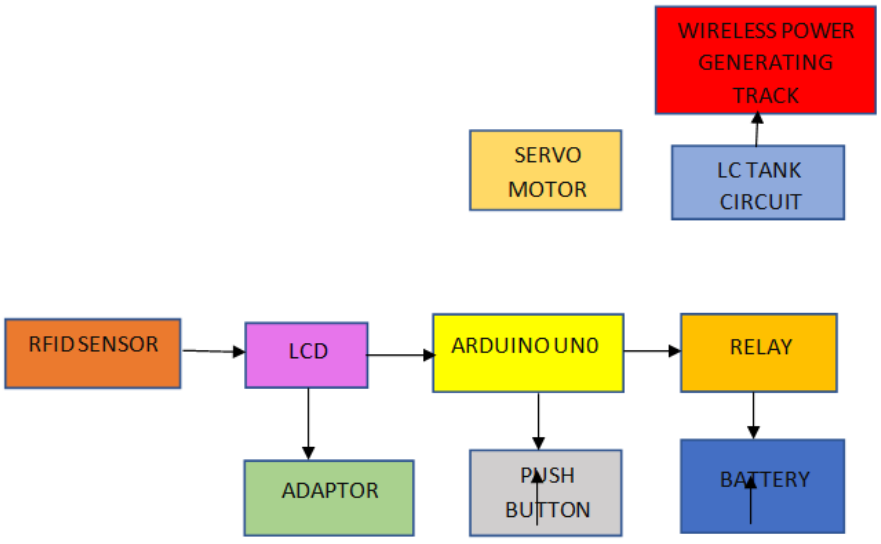

Figure 1: Block diagram

The block diagram represents RFID based automatic toll collection system for dynamic charging vehicles. An adaptor is connected to Arduino uno through DC barrel jack pin of Arduino. This Arduino receives power supply from adaptor. RFID digital pins and power pins are connected with Arduino digital pins and power supply pins. Arduino power pins are also shared with LCD board. From LCD board the power supply is given to both LED and push button and also to servo motor and relay. This entire set up is for RFID based automatic toll collection. Coming to the wireless power generation to the electric vehicles i.e., a battery is used to charge the entire track. The power supply to battery is given by the solar panels. The supply from battery is given to relay. To make the power off track on and off relay is used. From relay the power is supplied to the track through LC tank circuit. This LC tank circuit stores the charge through the element's inductor and capacitor. And from that the power is supplied to the track. The track contains copper coils beneath it so that any electric vehicle which is entering that track can use that dynamic charging track. In this wayRFID based automatic toll collection system for dynamic charging vehicles is used.

Initially, an external battery source is connected to the hardware kit. The hardware kit consists of an LCD display, Arduino Uno, RFID module and servomotor. Here the external battery source used is an adaptor. Adaptor takes input of 90-270v with 50/60Hz and produces voltage of 12volts and a current of 1Amps. This voltage and current values are sufficient to provide power supply for the automatic toll collection system kit. Then adaptor is connected to the DC barrel jack of Arduino UNO. From that Arduino Uno the power is transferred to RFID module, LCD board display and also to the servo motor. On the other hand, another external power supply is used to power up the track. For that a battery source is used, which is capable of producing 12V and 1.3Ah. As four coils are used under the track, the power supply produced by this battery is enough to power up the track. But in real time project it requires huge amount of power. As this battery is rechargeable, a solar panel of power 10Wp and voltage of 18V is used and it produces of current of 0.55A. The tolerance of this panel is + or – 3% using this solar panel the battery source gets power. After switching on the power supply of adaptor, the power reaches the Arduino UNO through DC barrel jack of Arduino, and for the RFID module to receive power from Arduino Uno connect a 3.3v pin to the 3.3v pin of Arduino. For LCD board to receive power from Arduino Uno connect 5v pin from power pins of Arduino Uno to the positive power supply of the LCD board kit. From that LCD board, the servomotor is connected through power supply pins of LCD board, as shown in the below figure. Using the external battery, power supply is given to the LC parallel resonance circuit through a 5v relay. And from that LC circuit the power is transferred to the track, as the track needs power to activate its four coils, in order to supply wireless power to the vehicles entering the track.

In those three, the two tags are authorized and the remaining one is unauthorized. The two authorized tags are named as AP31 2124 and the other tag is AP362421.Whenever one authorized tag is kept under RFID sensor it will access that card and then the display will shows a message as "in access granted" for the vehicle. It might be for AP31 2124 or AP36 2421 it depends upon the tag that is placed under the RFID sensor. For example, if a tag i.e., AP31 2124 the servo motor will give access to the car to use that track by lifting the pole 90 degrees. In those three, the two tags are authorized and the remaining one is unauthorized. The two authorized tags are named as AP31 2124 and the other tag is AP362421.Whenever one authorized tag is kept under RFID sensor it will access that card and then the display will shows a message as "in access granted" for the vehicle. It might be for AP31 2124 or AP36 2421 it depends upon the tag that is placed under the RFID sensor. For example, if a tag i.e., AP31 2124 the servo motor will give access to the car to use that track by lifting the pole 90 degrees. If the same tag is used which has been already used i.e., AP31 2124 then the display will show a message like vehicle already entered.so it means only one vehicle can access only one tag.

To remove that particular vehicle in the track then use that particular car tag by placing that car tag in the RFID module and simultaneously press pushbutton. Then the display will show a message like "out access granted" for the vehicle which was tagged in the RFID module. For the out access the servomotor again lifts its pole 90 degrees to allow the vehicle outside the track. To know whether a vehicle is present in the track then the LED will glow, if there are no vehicles present in the track then the LED will glow off. In this way the RFID tags are used to access the permission for the vehicles to use the wireless power generating track. In this way wireless power to the electrical vehicles is provided through the concept of dynamic charging system by using automatic toll collection system.

IV. RESULTS

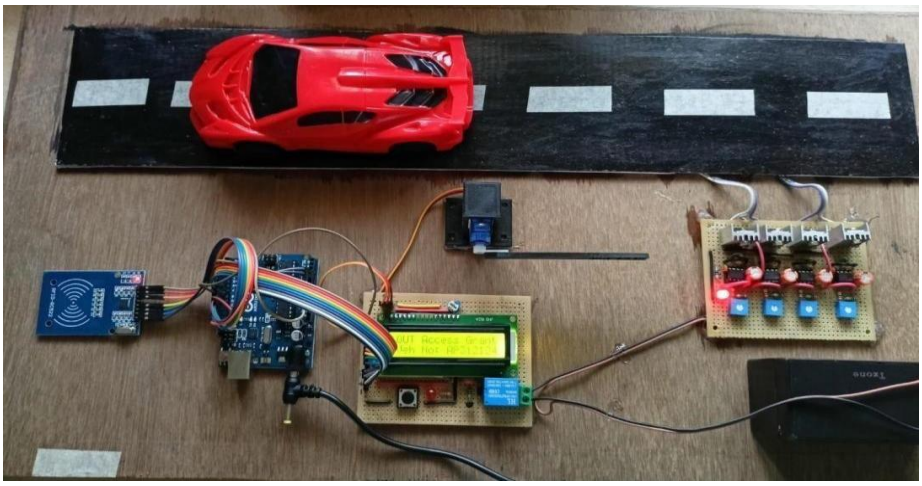

Figure 2: RFID Based Automatic Toll Collection System for Dynamic Charging Vehicles

In this project the automatic toll collection system which is based on RFID sensor gives access to the electric vehicles only which are authorized and denies the access for unauthorized vehicles .This can be possible only by using RFID tags at toll gate systems .This toll gate system is especially for electric vehicles which are going to use wireless charging i.e., dynamic vehicle charging .Hence the name RFID based automatic toll collection for dynamic charging vehicles.

V. CONCLUSION & FUTURE SCOPE

5.1 Conclusion

The system which is introduced can be used to develop a completely digital and smart toll collection system for electric vehicles as it provides automatic toll collection system only for the electric vehicles which are using dynamic charging track through dynamic wireless charging system. In our country, manual toll plaza causes a lot of traffic as it involves manual toll collection. Besides, corruption in the toll plaza is an open secret. This toll collection system can solve these problems efficiently. This RFID based toll collection system mainly depends on the RFID tags and RFID sensors. As a result, it will not only save the valuable time but also eliminates the corruption in the toll plaza and also eliminates stop and wait charge problem by providing wireless power to the track so that the electrical vehicle gets charging when it is motion. By using this wireless power generating track it will save the time for charging and also reduces bulk battery structures which are required for travelling long distances. By using this system it simply provides automatic toll collection for dynamic charging vehicles. It reduces the risk of range and recharging for the electric vehicles which are travelling for long distances without the need of static charge and also the setup of bulk battery structures.

5.2 Future Scope

Moreover, in future using this system can reduce green house gases and also we can reduce emission of harmful gases from vehicles by using electrical vehicles. Also we can use renewable source of energy i.e., solar energy to generate wireless power to provide wireless charging to the track .so that is becomes easy for the electrically charged vehicles to get charged while they are in motion and no need to stop and wait for charging. Here the implemented toll gate system helps to save time for the paying tolls and also it will helps in tracking information about the particular vehicles which are using this dynamic charging track. But the problem with this system is .For the entire track power will be wasted even if a single vehicle is present on that track. So, in future it will be recovered by using the IR sensors concept. By using IR sensors we can activate only front and back coils of the track as the track will have coils beneath it .So only front and back coils in which the vehicle is present on the track are activated

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