

Career Episode 2

Introduction:

CE 2.1

RFID vehicle tolling/tracking system was my final year project while I was doing my under-graduate degree. The duration was 6 months after which a demo of the working model was shown for assessment. This project was done by myself and my friend/group-member Anand Menon. The final assessment's outcome can be seen in the transcript (last unit) - unit name – Project Work.

Background:

CE 2.2

One of the main reasons I took up this project was to gain experience in the field of RFID controlled devices. I had done small projects before this on RFID to control different motors so I could gear up for my final semester project. The basic idea was to implement RFID in tolling system and extend this system to track vehicles. RFID was chosen as it covers the optimal range with minimal power consumption and the vehicle does not have to stop at the gate. The same equipment is also used to track a car. The inherent idea is to retrieve the vehicle's registration number.

CE 2.3

Though implemented system's range was one to two metres the power can easily be increased with the active tags operating at higher power and the reader's range subsequently increases. I was able to find the field strength from calculating receiver amplitude, antenna factor, attenuation factor and amplifier gain.

CE 2.4

Technically the areas I had to sharpen my knowledge was micro-controller programming, interfacing electronics circuits with computer. I had to master circuit-theory to trouble-shoot and device the connection between interfaces, I had to study the basics of Computer networking later in the development phase.

Personal Workplace Activity:

Research and Analysis:

CE 2.5

The basic-circuit diagram for control was provided from Global Technology Chennai, India. This however had to be modified to suit our needs. We approached Video Technics, Chennai, India, for assistance with testing and manufacturing equipments. Since they were interested in development of RFID products they funded us.

CE 2.6

We had looked into active and passive tags. I got a few passive tags just to asses the range. From the test that I ran the coverage of passive tags were almost nil unless it is forced over the reader. This makes it difficult since the vehicle can't be in contact with reader physically. So we had to switch to the active tags. The active tags were also customisable by us since we had the microcontoller programmer to flash its chips to store the vehicle's data. The higher range also enabled the possibility of vehicle tracking.

CE 2.7

The Tolling system we designed had one entry point and one exit point, a RFID reader at each end. This was then duplicated to facilitate a tracking mechanism for a car. The initial implementation did not involve computers. This was added later to the project in the final 2 months. Testing was done at various stages of the development with every addition feature that we put in, like linking the 2 computers that were connected and exchange the data so it can show the cars location in a background.

CE 2.8

Most of the difficulties faced were in interfacing these modules. The RFID reader and tag worked perfectly but when the data was fed via RS232 to computer the input signal was did not return the expected values as per interfacing board. So we mapped the output when a active tag is read based. This simulates the possible inputs we could get. We were storing only the vehicle's number and balance initially.

RFID Specifications:

CE 2.9

The reader was in 915 MHz as was the active tags.

Both the reader and tags were connected to EEPROM.

A supply voltage of +12v was given to the reader with +9v for the tags.

The connection to PC was via Serial RS232 port.

Construction and Operation:

CE 2.10

The PCB board was designed in Easy PCB software and submitted to Video Technics for PCB manufacturing. The Components were then mounted and soldered. A multi-meter was used to remove small errors in the board after hand soldering like short-circuits and was then fitted into a customisable casing and the supply was given to the circuit.

CE 2.11

Having some experience in reading the RFID tags in my earlier implementation of stepper motor control. I could quite easily handle the RFID signals in this project. I could identify the components that are to be used in this project and designed the interfacing circuits and the powering circuits.

CE 2.12

These operations involving simple math were programmed into the micro-controller. Every time the vehicle passes through the toll one unit will be deducted from the active tag. Once the tag is registered the duration is set for the tag and its number is stored in an array for that period. Once time expires the tag will then be deducted again.

CE 2.13

The in the second phase of implementation i.e, after successfully connected to the computer, tracking was possible. For demo purposes 2 computers were connected with a cross-over cable and I wrote a small code in bash to send data between each other.

CE 2.14

Two sets of the same RFID reader were constructed and placed at about 3 metres apart connected to the computers. The area was divided into 3 zones for 2 readers. 2 exclusive zones to the reader and 1 over lapping zone. The overlapping zone was an issue when only 8051 micro-controller was used. Since both of the readers pick up the tags and deduce the amount. With computers connected this issue was resolved as each zone check every other zone for same tag number.

CE 2.15

Finally I measured the power usage for the realtime proposal. Also documented the operating voltage and range details.

Real Time Proposal:

CE 2.16

The proposal was presented in the end of the demonstration to depict the true potential of this project in a real-time-large-scale. Some of the key features involve:

Active tags can be directly powered by the car instead of relying on separate power source also the tag can be customised so larger vehicles are charged more.

Automatic fining can also be implemented with low range RFID scanners for parking in a no-parking zone.

Replacement of the current ticketing system, mainly in public areas where the outgoing traffic after events will not have to stop the car and create a jam. There is no real check-out The vehicles in the zone are scanned

Summary:

CE 2.16

At the end of this project a presentation was done to my fellow graduates and the assessing authority and was greatly appreciated. I gained an extensive knowledge technically and professionally. I had also formed a large network in the professional arena in the field of RFID in the later stages of my assignment. A demo was also done for both the organisations I had done the project with.