Approach 1: Determine the precise distance between the key and the car:

Advantages of UWB over RFID

UWB UWB is based on sending ultrashort pulses (typically <1 ns), with a low duty cycle (typically 1 : 1000). On the spectral domain, the system, thus, uses an UWB (even >500 MHz wide). UWB location has the following advantages [32]. Unlike conventional RFID systems, which operate on single bands of the radio spectrum, UWB transmits a signal over multiple bands of frequencies simultaneously, from 3.1 to 10.6 GHz. UWB signals are also transmitted for a much shorter duration than those used in conventional RFID. UWB tags consume less powerthanconventionalRFtagsandcanoperateacrossabroad area of the radio spectrum. UWB can be used in close proximity to other RF signals without causing or suffering from interference because of the differences insignal types and radio spectrum used. UWB short duration pulses are easy to ﬁlter in ordertodeterminewhichsignalsarecorrectandwhicharegeneratedfrommultipath.Atthesametime,thesignalpasseseasily through walls, equipment and clothing. However metallic and liquid materials cause UWB signal interference. Use of more UWB readers and strategic placement of UWB readers could overcome this disadvantage. Short-pulse waveforms permit an accuratedeterminationofthepreciseTOAand,namely,theprecise TOF of a burst transmission from a short-pulse transmitter to a corresponding receiver [33], [32]. UWB location exploits the characteristics of time synchronization of UWB communication to achieve very high indoor location accuracy (20 cm). So it is suitable for high-precision real-time 2-D and 3-D location. 3-D location positioning can be performed by using two differentmeasuringmeans:TDOA,whichismeasuringthetime difference between a UWB pulse arriving at multiple sensors, and AOA. The advantage of using both means in conjunction is that a location can be determined from just two sensors decreasing the required sensor density over systems that just use TDOA. More UWB knowledge and products are given in7 and their related references.

Blutooth:

Bluetooth operates in the 2.4-GHz ISM band. Compared to WLAN, the gross bit rate is lower (1 Mbps), and the range is shorter (typically 10–15 m). On the other hand, Bluetooth is a “lighter” standard, highly ubiquitous (embedded in most phones, personal digital assistants (PDAs), etc.) and supports several other networking services in addition to IP. Bluetooth tags are small size transceivers. As any other Bluetooth device, each tag has a unique ID. This ID can be used for locating the Bluetooth tag. [74]. The BlueTags tag is a typical Bluetooth tag.12

References

Hui Liu, Student Member, IEEE, Houshang Darabi, Member, IEEE, Pat Banerjee, and Jing Liu, Survey of Wireless Indoor Positioning Techniques and Systems,

Mbed decawave library:

<https://developer.mbed.org/users/manumaet/code/DecaWave/docs/b6120c152ad1/main_8cpp_source.html>

Arduino library:

DW1000 by Thomas Trojer <http://platformio.org/lib/show/364/DW1000>

<https://github.com/thotro/arduino-dw1000>

Integrating the decawave with arduino study:

<http://khjtony.github.io/project/2015/05/15/Test-DWM1000-UWB-Module-with-Arduino.html>

Approach 2: Determine if the key is in close proximity by a different technology. The key will have 2 transcievers, one for long range and another for short range.

Requirement:

* A wireless communication between the key and the car
* The receiver should be able to say if the key is inside or outside the car
* Door should be unlockable from upto 100m distance