Implementation of Smart Garage

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ABSTRACT
Nowadays our garages needs to secure the cars and entrance of the residences for the demand of high security and automated system. This system provides a sophisticated secured car parking garage. This gives peace of mind to the owner that they shut the door after leaving their garage. The system is operated by using Field Programmable Gate Array (FPGA) as the main control unit. Security is provided by reading the number plate of the motor. Data is stored in the device to keep track of the vehicles in-out timings. Radio Frequency Identification (RFID) system is provided for automatic door opening. Smartness of garage is enhanced by providing automatic car wash with high water pressure. Separate automatic rotating slab is provided to facilitate home washing. In this system the garage door will be opened only for vehicles which are already registered in the RFID reader. Moreover, the system maintains an update database of the cars that have left and entered into the garage within a particular duration.

General Terms
Security, Automation

Keywords
FPGA, RFID System, DC Motor, Camera, Water Pump

1. INTRODUCTION
All the daily essential equipment in our life is becoming automatic which saves a lot of time and energy as well. Garages are also becoming automatic. The security system of garages is one of the important issues in our offices and residences. The security problem of a garage has been investigated for the last decade [1]. However, it is clear that efficient garage security system today involves interdisciplinary research areas. Many researchers have proposed various methods of security systems [2]. Each of these systems has its own advantages and disadvantages [3]. Themodern garage needs security systems to detect vehicles authentication at the time of entering and exiting [4].

Our objective of the work is to develop a security system for an automatic garage door and providing car washing system. The security system identifies the car and, if the car is authorized to enter the garage, the door opens and lets the car to move in. The garage door automatically gets closed after some time delay when car is completely parked inside. The door operates similarly when car moves out of the garage. This system gives new concept of provide automation in daily life which gives accuracy and with less human effort and interference. The system consists of FPGA which controls auto locking door with the use of RFID system. RFID cards are used to open the door of garage. Use of FPGA makes the system flexible, i.e. can increase system functionality. We are here using a camera which captures the number plate of car and stores it in database. The system can be improved by adding different washing liquid. And transmission of data (number plate) to the garage owner, this will improve communication. This system gives advantages like Low engineering cost, Accuracy, High speed, Flexible can add/subtract functionality as doesn't have fixed hardware structure due to use of FPGA. This system gives an automated, secure garage system.

2. RELATED WORK
This type of secured car parking system is implemented using microcontroller, digital image processing (DIP), programmable logic controller (PLC).These systems provide controlling and security. Some intelligent parking design and transport management system has been proposed in [5-6]. We are proposing a secured car parking system with automatic car washing inside the garage and having data storage for in-out timings of vehicle. This paper uses VHDL design using FPGA to implement the system. Some of the papers which give secured garage system with different technologies are as follows.

RamneetKaur and BalwinderSingh, proposed the system for car parking.in this car parking system the LCD display shows whether car parking space is available or not .the door for incoming car is open only if there is space is available for parking. The space availability information is transmitted and received by RF module .so according to RF Module's output information LED's glow and LCD displays. According to information driver can park the vehicle [7].

AfazUddin Ahmed, Taufiq Mahmud Masum, Mohammad MahburRahman, gave a" Design of an Automated Secure Garage System", which uses optical character recognition (OCR) method and licensed plate recognition (LPR).OCR is used to implement LPR method. The camera on the top of the garage captures the image of number plate which has to be licensed. The characters on the number plate are recognized. This is done by comparing each character with the data base. This recognition is implemented by MATLAB program.

3. BLOCK DIAGRAM DESCRIPTION

3.1 FPGA
Field programmable gate array (FPGA) is an integrated circuit designed to be configured by a user or a designer after manufacturing thereby called "field-programmable". FPGAs are generally configured by hardware description language(HDL) which isquite alike to that used for Application Specific Integrated Circuit (ASIC) [8]. FPGA consist of an array of programmable logic blocks, and a

hierarchy of reconfigurable interconnects that keeps the blocks to be "wired together", like many logic gates that can be inter-wired in different configurations. Logic blocks can be configured to perform complex combinational functions, or merely simple logic gates like AND and XOR [9]. FPGAs are programmable devices consists of an array of configurable logic blocks (CLBs) the interconnections between logic blocks and input output blocks (IOBs). These CLBs typically comprise various digital logic components, which are lookup tables, flip-flops, multiplexers, etc [9]. FPGA includes our components as well such as input/output pin driver circuits (I/Os), memory, and digital-clock management (DCM) circuits [10]

We are here using Spartan 3 FPGA family. We are using XC3S200tq144 FPGA module, here X stands for Xilinx, C is for CMOS technology, 3S denotes Spartan-3,200 shows the 200K gates, tq denotes thin quad flat package(TQFP) and 144 is number of pins in the module. Voltage requirement of FPGA are +3.3V, +2.4V and +1.8V.The oscillator frequency is 20MHz. Joint Test Action Group (JTAG) is used for program loading

3.2 RFID

RFID isradio frequency identificationin which RF stands for "radio-frequency" and ID for "identifier" whichallows an object, for example a car for this system, to be identified, accessed, reprogrammed, stored and communicated by use of radio waves .RFID is a generic term for non-contacting technologies that use radio waves to automatically identify people or objects [11]. There are various methods of identification.RFID systems store a unique serial number for identifying a person or an object in a microchip which is connected to the antenna. "RFID transponder" or "RFID tag" consists of both antenna and microchip works with "RFID reader" which is also called as "RFID interrogator".

RFID system includes a reader and one or more tags. Interrogator or reader is a two way radio transmitter and receiver that send a signal to the tag and read its response.
This signal is used to power up the internal circuitry of the tag. The tag will then modulate the electromagnetic waves generated by the reader in order to transmit its data back to the reader [12]. These modulated waves are received by RFID reader which converts it into digital data.

RFID tags are of three types: active, passive or battery assisted passive. This system uses a passive type of tag for implementation as it is easier to use. Passive tags are also handy and easy to carry. The tags and readers are tuned in the same frequency enabling communication between them. Frequency here means the size of radio waves.RFID system is an inexpensive technology that enables wireless data transmission.Identification of persons is always important in places like Airports, railway stations, theatres, etc. Identification can be made automatic using auto-identification [13].

Table 1. Specifications of RFID

Sr.no.	Parameters	value
1	Operating Frequency	125KHz
2	Input Voltage	+5V DC
3	Operating Range	Max 7 cm contact Less

3.2 BLOCK DIAGRAM

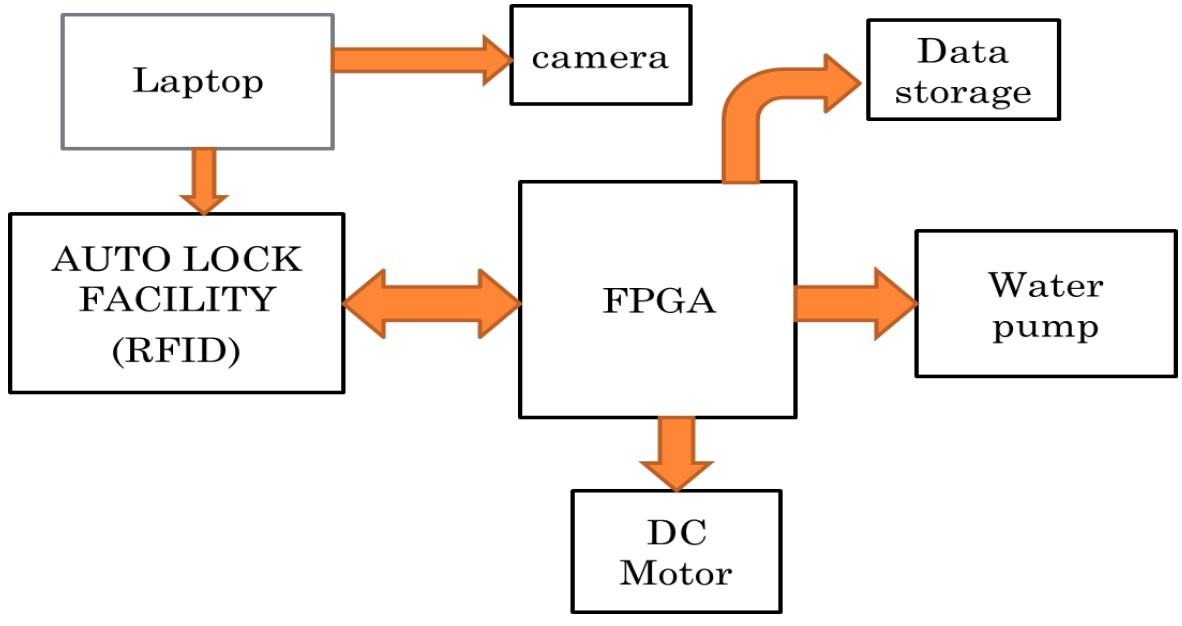


Fig 1: Block Diagram of proposed system

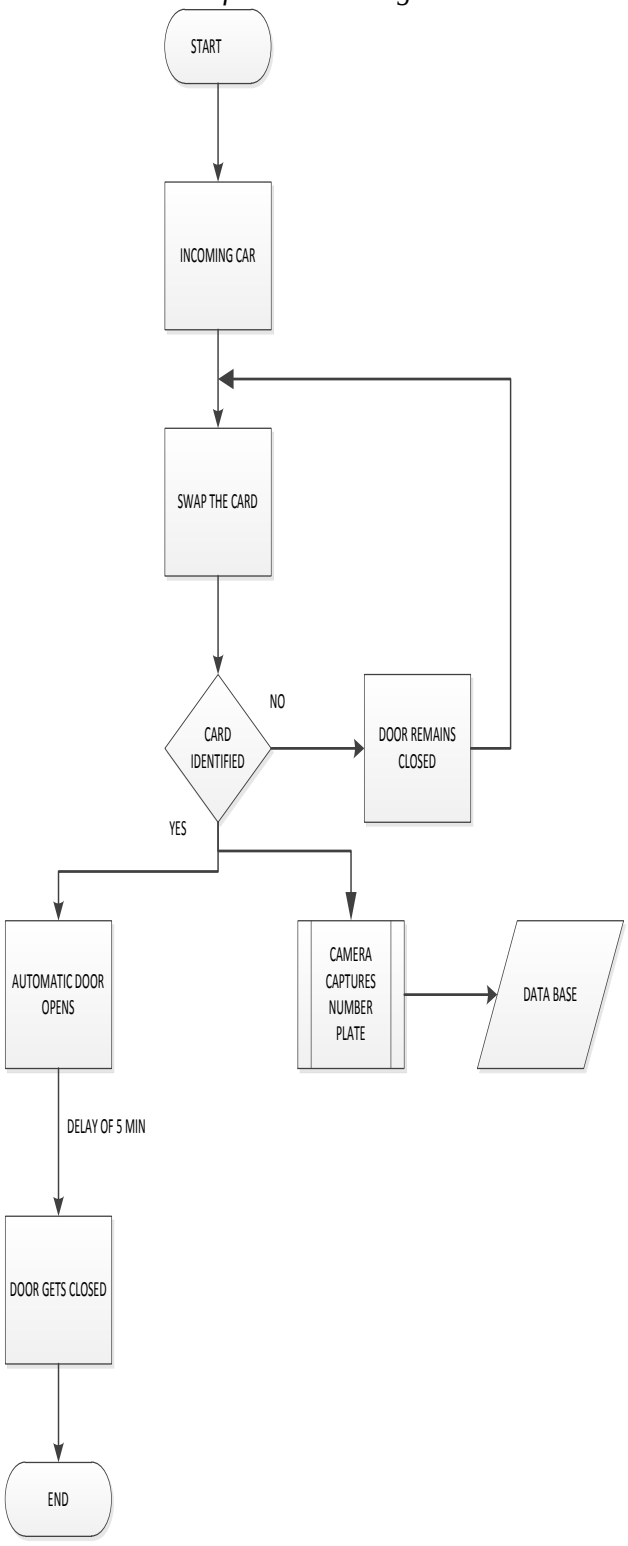
4. METHODOLOGY

We are using FPGA to implement our system for smart, secure, automated garage. The FPGA is programmed in Xilinx 8.1 suite to configure the system. FPGA is interfaced with RFID, camera, DC motor and water pump. In this proposed system making use of FPGA can further improve the system without changing hardware design in the future. Also, use of FPGA gives the system speed, reliability and parallel implementation of program which gives provision of working two or more devices simultaneously without any error.

The incoming car enters the system, the driver swaps RFID card in the RFID reader if the card is already registered one and gets identified by the reader the garage door automatically opens, at the same time the camera which is kept at the top of the door captures the number plate of the car/vehicle. This image is stored in the database. This can be accessed by the owner to know the in and out time of vehicle.

4.1 Flow Chart

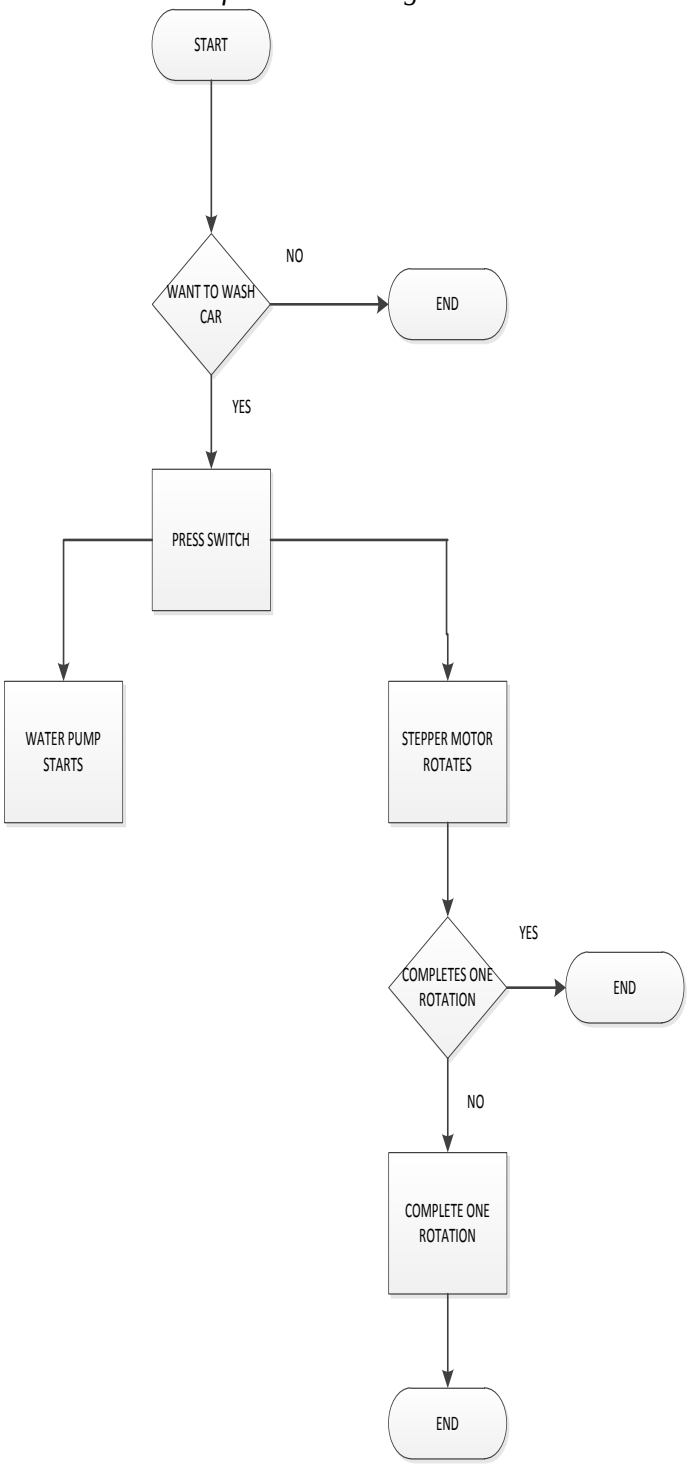
4.1.1 Flow Chart for Car Parking



If the RFID card is not identified, the door remains closed. This system also has automated car wash service. When the switch for car wash is turned on the water pump starts and washes the car. To wash the car from all sides we have a DC motor which will provide two or four step rotation andcomplete its one rotation. The DC motor is kept below the slab where the car will be kept.

4.2 Flow Chart

4.2.1 Flow Chart for Car Washing



5 CONCLUSION

The main aim of this project is to implement the card swapping method to establish a secured garage system. Though, the system use RFID card matching other advance technologies/methods can provide better performance. When the camera captures, the number plate of vehicle there will be no motion of vehicle thus making the system more reliable. The data base of the cars, going in and out of the garage is stored in the laptop. The automatic doors reduce the human interaction or effort of door opening making system automatic. Use of FPGA in project provides excellent design flexibility and low engineering costs. As the FPGA has more numbers of pins as general purpose input output,more functionality can be provided in future. This implementation of automated garage with FPGA and RFID system as basic units, can provide better local garages having reasonable pricing and features.

6 FUTURE SCOPE

- Finger print identification can be used instead of RFID system.
- Heat or smoke detectors can be used to detect any fire accidents.
- Robotic hand wipers inside garage for dry cleaning car
- Giving unique identification for unique car
- Data can transmit using Bluetooth, Zigbee, GSM,etc.
- Providing central alert system

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