CHAPTER THREE

SYSTEM DESIGN AND IMPLEMENTATION

3.1 Introduction

In this chapter, the Hardware architecture and software development of proposed automated smart parking systems is presented. Small area and simplicity of design, also the rotation process and stages of parking. Figure (3.1) illustrate an overview about the automated parking system

Figure 3.1: overview about the automated parking system

3.2 System Architecture

Assembling process can be done within two steps, by collecting the mechanical body (main body), then attached by the electrical components.

Our prototype design contain the frame body which represent the main part of design .it connects with tow pillars and carry the whole design . Also it provide the suitable shape of the input. This allows cars to get in easily. as mentioned the frame body carry the whole body (itself and the rest of body). This because the rest of body is connected to the tow pillars which connected to the frame body. The tow pillars connected to the rest of body (gears, chains، stages) through gears. Also the tow pillars provide the rotary motion of the stages set. This motion is become more slightly by using the wears between the frame body and the tow pillars. Every pillar have two Gears connected with it by welding .this gears used for transferring the motion from master pillar (that connected with motor) to slave it. The every two analog gears connected by chain. These two chains guarantee the motion between gears simultaneously. Also it carries the stages. In our design we use 6 stages in order to carry the cars.

The next step in the assembly process is connecting the electronic devices (sensors, LEDs, motor and the controller). We use IR sensors to ensure that the Car is parked in the right position to get safety parking and give start order to motor, moreover that we know the (empty and full) stages by these sensors.

The client can use the system service by using keypad interfacing module which attached to the parking station. When a car arrives at the entrance, it will be stopped at the main gate and the driver de-boards the car by entering password saved with the number of car parking space. The motor is connected to the pillar directly which is fixed in frame body. The movement is transferred to gears and chain which hold the stages.

We choose motor to correspond to size and weight of design. There is driver makes the motor start and stop

All these devices are connected with the main microcontroller which is responsible for making decisions (star motor, LEDs on, display on LCD ….. etc.)

Also connecting with power supply to provide energy for operating process. By collecting all these components and connecting with each other we get an automated system which has been illustrated in figure 3.1.

3.3 Block Diagram

Figure (3.2) illustrates the block diagram of the system which explains the main parts and the branches.

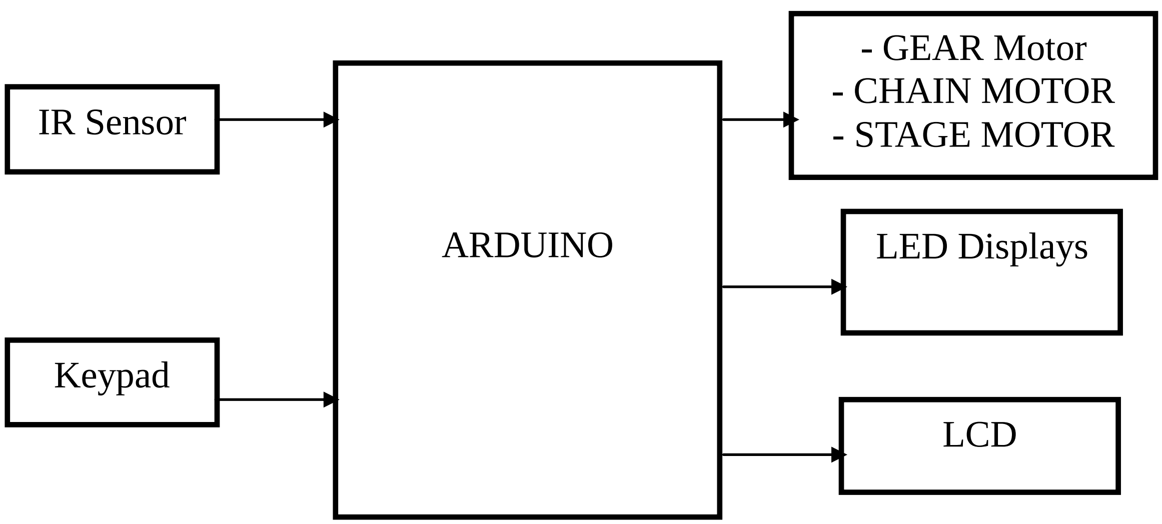

Figure 3.2: Block Diagram of proposed System.

As shown in figure 3.2, The Arduino interacts as the brain of the system and it is prepared to control this system, here we have a four LEDs (two are red and two are green) two of them illustrate the availability the parking, when the client comes to the parking system he looks to the

LEDs when the green led is on that mean (you can park), when the red led is on that mean you cannot park here try another parking system. The other two LEDs ensure the correction of the parking position (for safety parking the green LED is on, red LED means incorrect stop or deviation in position) inside the stage depending on IR sensors.

LCD is an output device (user interface) which shows all possible user options of parking (storage or retrieval) and show the acknowledgement of the password, also the waiting message appears on LCD.

IR sensors used to ensure the car parking process (interring in the stage), the car must be get inside its specific stage following the correct steps in the required position. Assuring safety motion for stages.

Keypad is an input device (secondary user interface and integrated with LCD) that insert the password to (get or park) the car.

The stage moving is controlled by motor moving, which is connected with the chain through gears, stages are welded with the chain and moved depending on motor movement.

The system sequence illustrated in the flowing flow chart , shown in figure (3.3) .

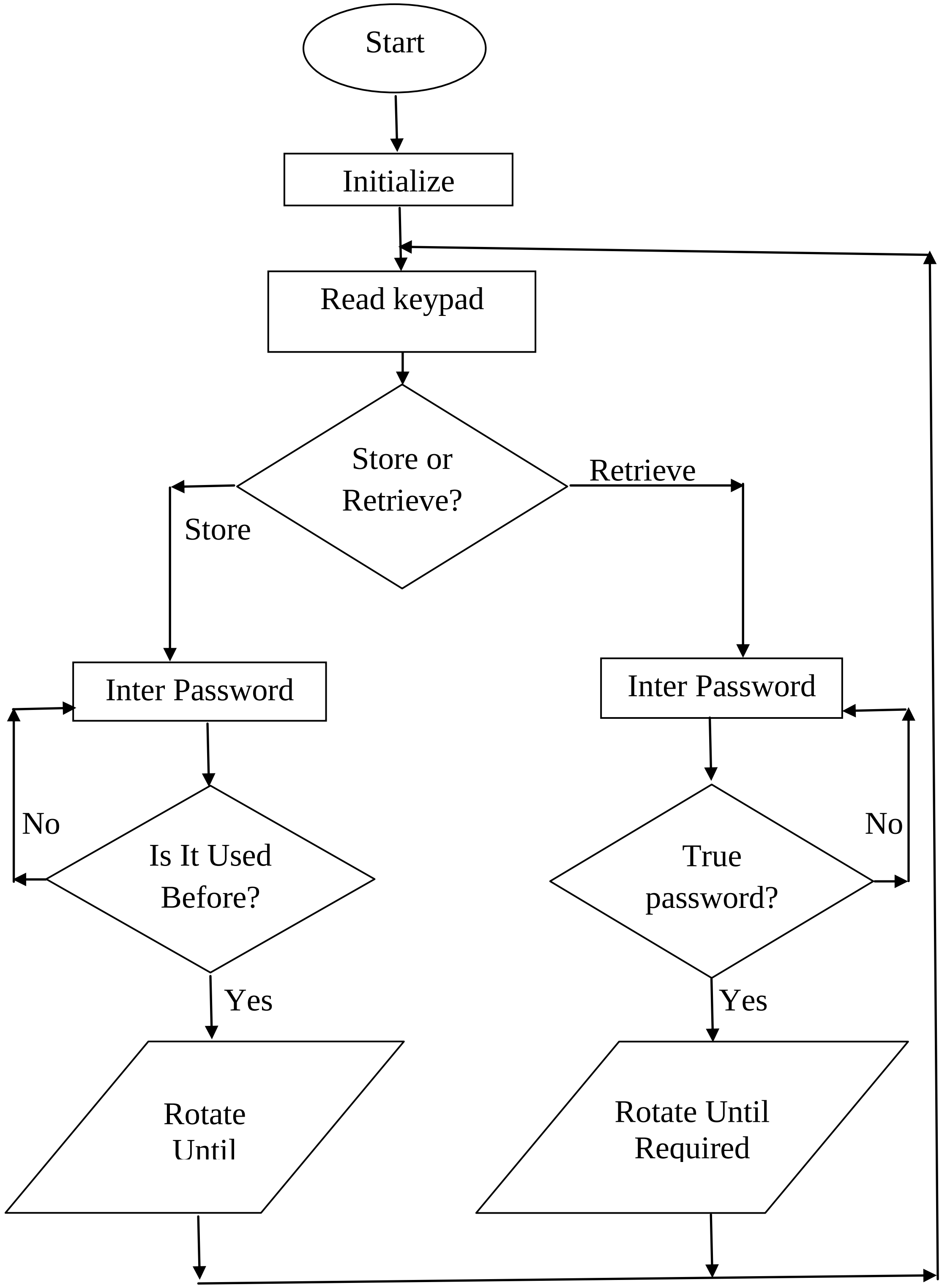

Figure 3.3: Flow chart of System.

3.4 Tools and Components

In this section we describe the hardware tools which used to design and implement this project.

3.4.1 Arduino MEGA

Arduino MEGA is an open-source electronics platform based on easy-to-use hardware and software. Arduino MEGA boards are able to read inputs light on a sensor, a finger on a button, or a Twitter message - and turn it into an output activating a motor, turning on an LED, publishing something online shown in figure (3.4) .

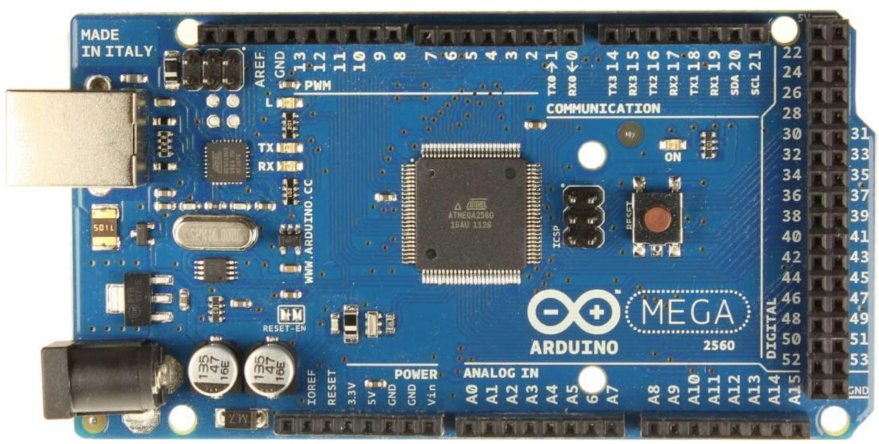

Figure 3.4: Arduino MEGA.

3.4.2 Stepper motor

A stepper motor or step motor or stepping motor is a brushless DC electric motor that divides a full rotation into a number of equal steps. The motor's position can then be commanded to move and hold at one of these steps without any position sensor for feedback (an open-loop controller), as long as the motor is carefully sized to the application in respect to torque and speed.

Switched reluctance motors are very large stepping motors with a reduced pole count, and generally are closed-loop commutated , shown in figure (3.5).

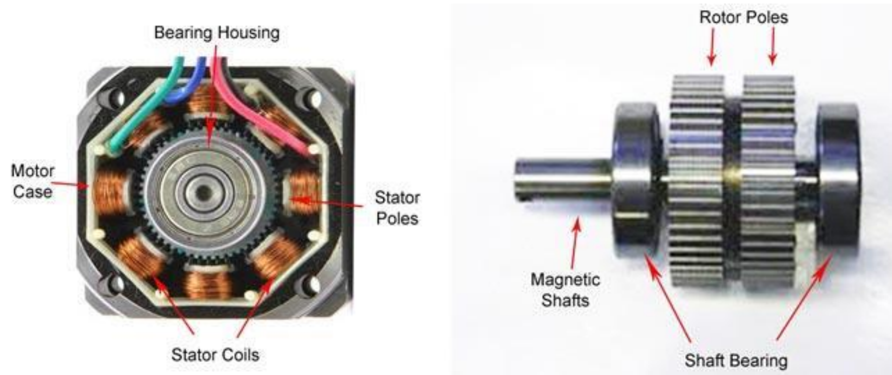

Figure 3.5: Stepper Motor

3.4.3 IR Sensors

An infrared sensor is an electronic device that emits in order to sense some aspects of the surroundings (as shown in figure 3.6). An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measures only infrared radiation, rather than emitting it that is called as a passive IR sensor .

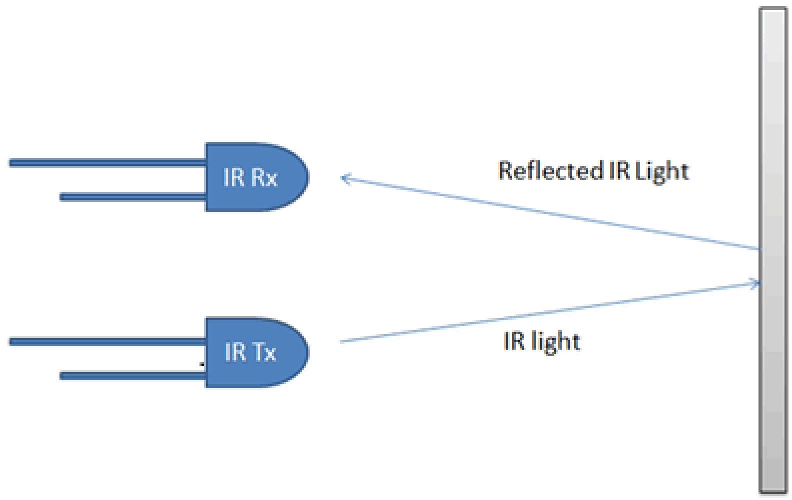

Figure 3.6: IR Sensor.

3.4.4 Bearing:

A bearing (0.6m^3) is a mechanical element that constrain a relative motion and reduce friction between moving parts. It may prevent a motion by controlling the vector of normal forces that bear on the moving parts. Figure (3.7) shows the bearing.

Figure 3.7: Bearings

3.4.5 Gears:

A gear is a rotating pars having cut teeth which mesh with another toothed parts to transmit torque geared devices can change speed, torque, and direction of power source , shown in figure (3.8) .

Figure 3.8: Gears

3.4.6 LEDs

A light – emitting diode (LED) is a two – lead semiconductor light source. It is a p-n junction that emit light when activated. When a suitable voltage is applied to the lead, electrons are able to recombine with electron holes within the device, releasing energy in form of photons shown in figure (3.9) .

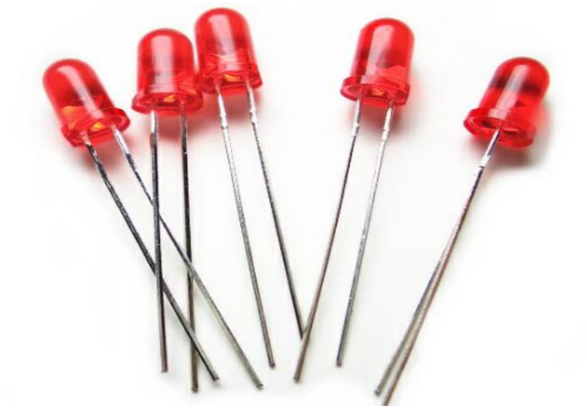

Figure 3.9: LEDs

3.4.7 LCD

A liquid - crystal display (LCD 2*40) is a flat panel display or other electronically modulated optical device that uses the light – modulating properties of liquid crystal shown in figure (3.10) .

Figure 3.10: LCD

3.4.8 Keypad:

A keypad is a set of buttons arranged in a block which bear digits, symbols, or alphabetical letters. Pads mostly containing numbers are called numeric keypad shown in figure (3.11) .

Figure 3.11: Keypad

3.4.9 Pillars

An armature is the power – producing component of an electric machine. The armature can be either the rotor or the stator of electric machine shown in figure (3.12) .

Figure 3.12: Pillar

3.4.10 Easy Driver

The Easy Driver (shown in figure 3.13) is a simple to use stepper motor driver, compatible with anything that can output a digital 0 to 5V pulse (or 0 to 3.3V pulse if you solder SJ2 closed on the Easy Driver). The Easy Driver requires a 6V to 30V supply to power the motor and can power any voltage of stepper motor. The Easy Driver has an on board voltage regulator for the digital interface that can be set to 5V or 3.3V. Connect a 4-wire stepper motor and a microcontroller and you've got precision motor control. Easy Driver drives bi-polar motors, and motors wired as bi-polar

This Easy Driver V4.5 has been co-designed with Brian Schmalz. It provides much more flexibility and control over your stepper motor, when compared to older versions. The micro step select (MS1 and MS2) pins of the A3967 are broken out allowing adjustments to the micro stepping resolution. The sleep and enable pins are also broken out for further control.

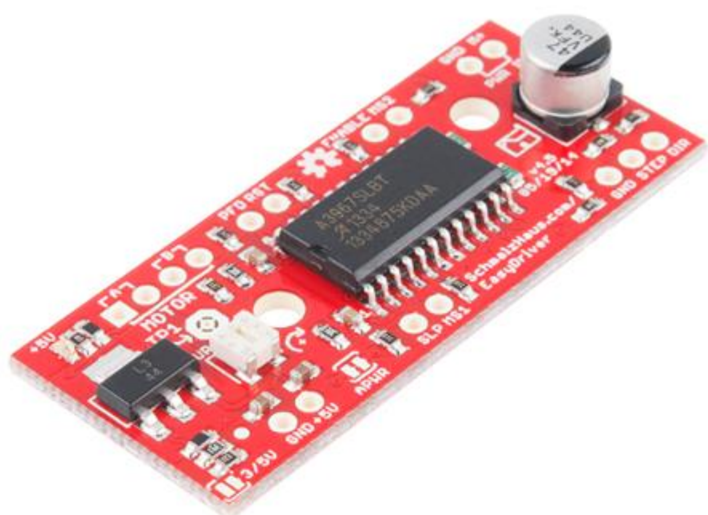

Figure 3.13: Easy Driver.

3.5 Simulation

The main points of the project are done shown in figure (3.14) . Here we will mention main points:

1. Every client must choose his own password.

2. Every password associated with client car.
3. The controller must detect and be sure every client has individual password
4. The controller generates the motors signals for store and retrieval cars from parking station.
5. The parking showing the status of parking station in LEDs and LCD displays.
6. The controller communicates with sensor for safety option.
7. The chosen controller here is Arduino mega 2580. For following reasons :
    1. Easy programming language.
    2. More number of available pins for the chip.
    3. It is economic choice; Depends on the number of available pins one Arduino mega 2580 can do the job of two or three AVR or PIC micro controllers.

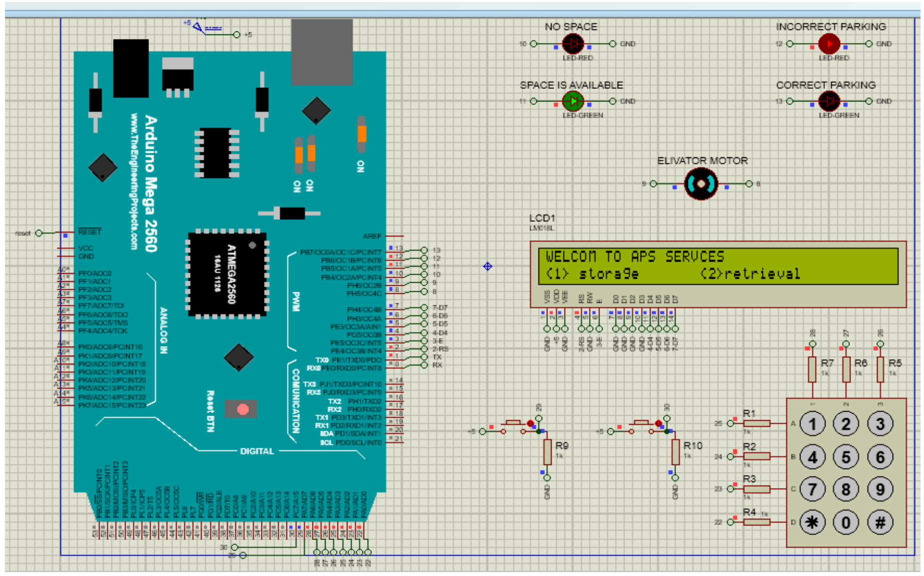

Figure 3.14: Simulation Design