Chapter Four

System Design

Overview

In this chapter, the system scenario is discussed. Basically, this project is divided into two major parts: Software Design and Hardware Design.

4.1 System Scenario:

The design contains a RFID reader, the RFID reader used as Arduino input, DC motor connected with wheel, servo motor connected with forklift .the motor moves according to the output of the Arduino. Infrared sensor used as Arduino input.

When the RFID reader reads tag from item and compares it with saved tag IDs. According to the result of comparison the robot pick up the item and decides where to store it.

Case 1:

New tag = = tag 1 OR New tag = = tag 2 the LCD display message "tag no   user found" then   the robot will moves according to the path in the database of item1or item 2. When robot reach the prescribed destination, the robot testing if the shelf is empty using infrared sensors:

If value of sensor ==1 this means the shelf is empty then the robot drop the item and back to home.

If value of sensor ==0 this means the shelf is not empty then the lifter move up to second shelf using servo motor and drop the item and back to home.
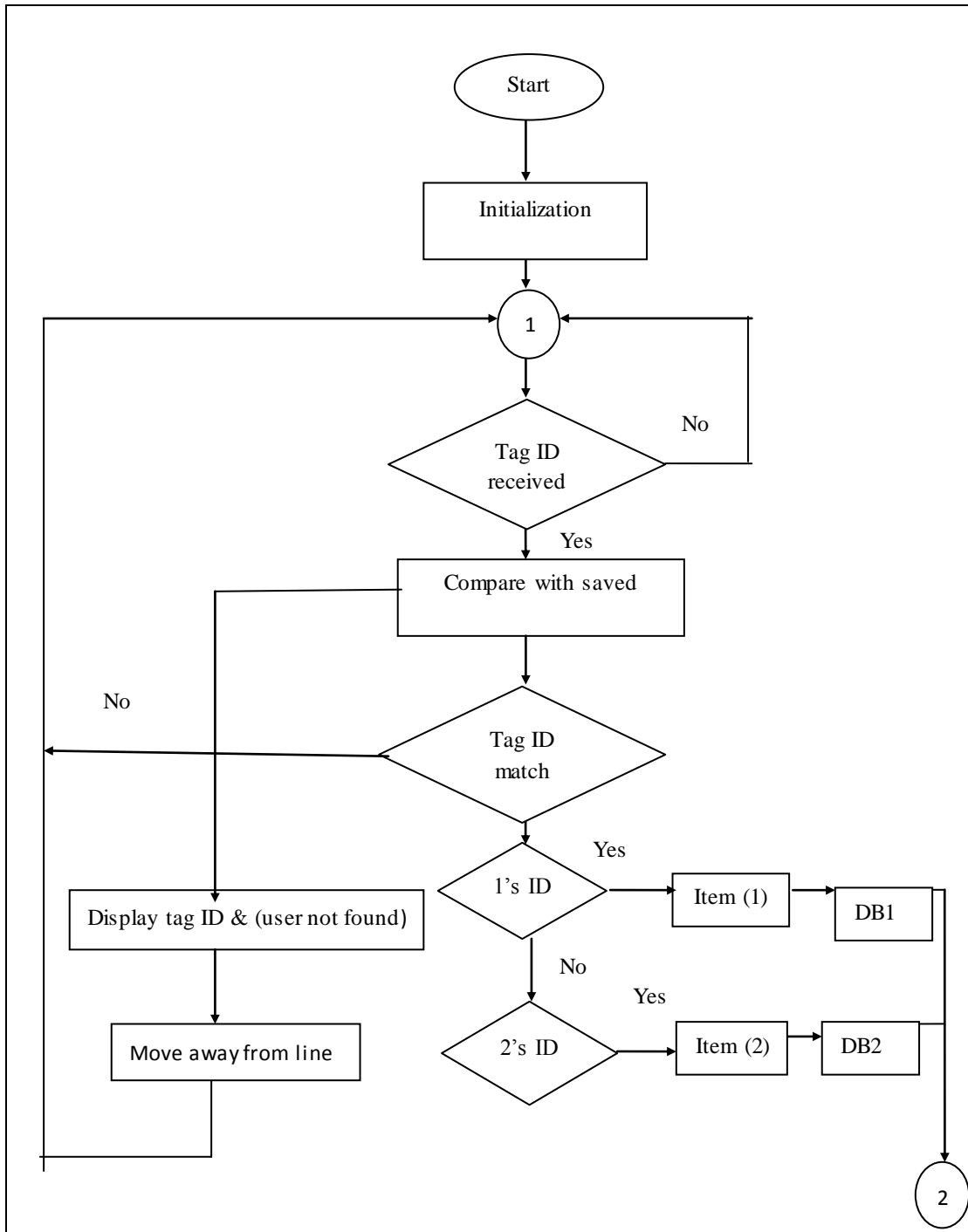
Case 2:

New tag =! Tag 1 OR New tag=! Tag 2 the LCD display message "tag no user not found" the robot will moves according to the path in the database of item. When robot reach the prescribed destination, the robot testing if the shelf is empty using infrared sensors:
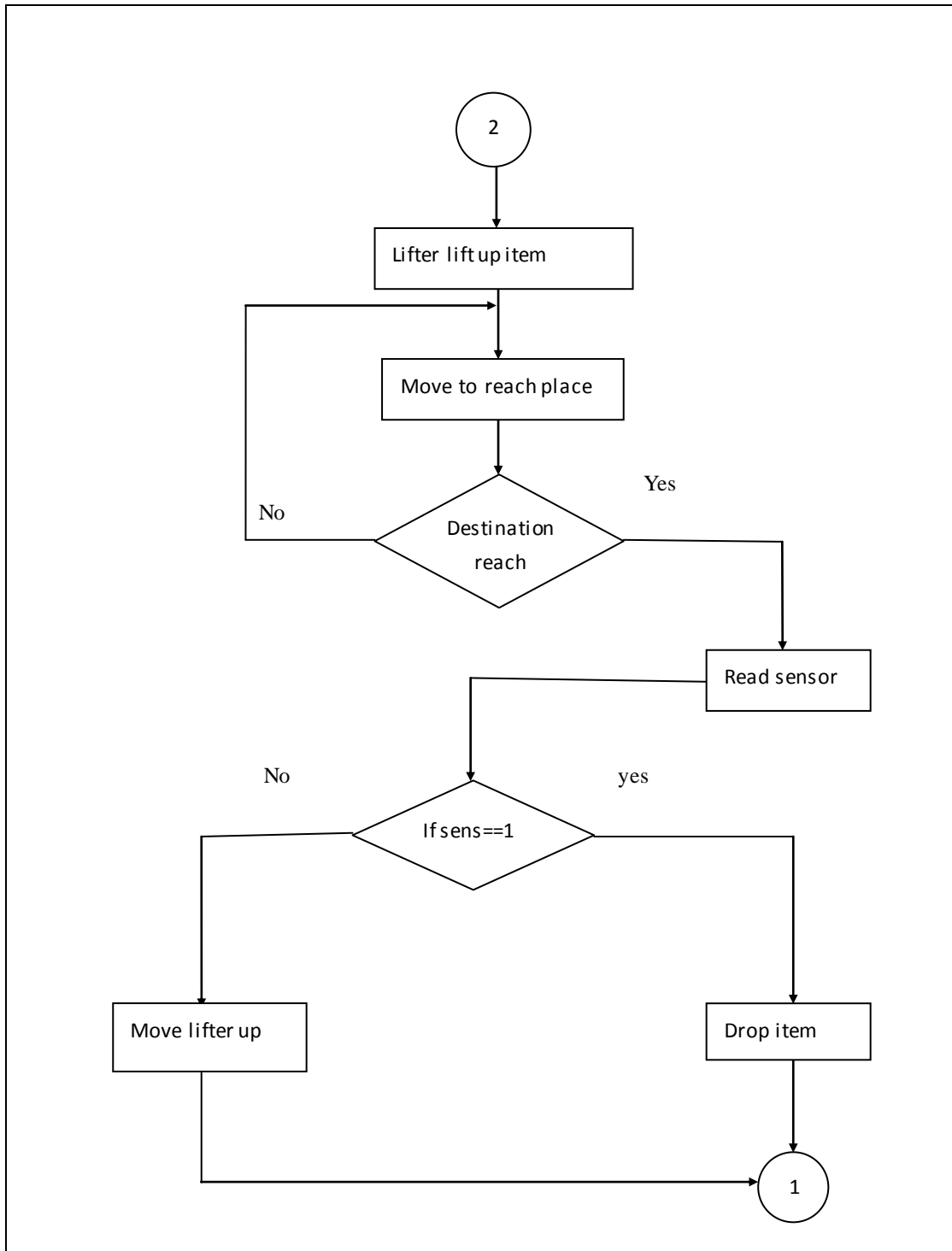
If value of sensor = =1 this means the IR sensor (receiver) on the robot receives signal from IR sensor (transmitter) on the shelf, and this led to the shelf is empty then the robot drop the item and back to home.

If value of sensor = =0 this means the IR sensor (receiver) on the robot cannot receives signal from IR sensor (transmitter) on the shelf, and this led to the shelf is not empty then the lifter move up to second shelf using servo motor and drop the item and back to home.

4.2 System Flow Chart

Figure 4-1 shows the System operation is described in the following flow chart.

Start

↓

Initialization

↓

1

↓

Tag ID received → No

↓ Yes

Compare with saved

↓

Tag ID match → No

↓ Yes

1's ID → Yes → Item (1) → DB1

↓ No

2's ID → Yes → Item (2) → DB2

Display tag ID & (user not found)

↓

Move away from line

2

```
                              ( 2 )
                                |
                                v
                      +-------------------+
                      |  Lifter lift up item |
                      +-------------------+
                                |
        +-----------------------+
        |                       |
        |               +-------------------+
        |               | Move to reach place |
        |               +-------------------+
        |                       |
        |                       v
   No   |                  /          \          Yes
  <-----+-----------------<  Destination  >--------------+
        |                  \    reach   /                |
        |                       \      /                 |
        |                                                v
        |                                       +-------------+
        |                                       | Read sensor |
        |                                       +-------------+
        |
   No                                yes
                  /          \
  +--------------<  If sens==1  >-------------------+
  |               \           /                     |
  |                \         /                       |
  v                                                  v
+----------------+                            +-------------+
| Move lifter up |                            |  Drop item  |
+----------------+                            +-------------+
  |                                                  |
  |                                                  v
  +----------------------------------------------->( 1 )
```

4.3 Hardware Design

Basically, the hardware design includes the mechanical design and electronic circuit design of the robot. In mechanical design, Google Sketch is used to conceive the fundamental design of the robot. The design of fork lifter mechanism is also sketched out. While in electronic circuit design, Proteus will be used to design the connection of the circuit, which is divided into several boards.

4.3.1 Mechanical Design

The material used to construct the robot includes Perspex, Teflon, wood and plastic.

1.   Perspex:

Is a derivative of plastic. It is a trade name of Lucite International and is polymethyl methacrylate (PMMA) acrylic sheet which is manufactured from methyl methacry late monomer (MMA).figure 4-2 shown the Perspex material.

Figure 4-2: the Perspex material.

The main advantages of Perspex sheets are:

- High shock, abrasion and flex resistance.

- Excellent weather and UV resistance (applies to clear only).

- Low density / light weight compared with glass.

- Clear sheet offers excellent optical clarity.

- Comprehensive range of colors and finishes.

- 100% recyclability.

2. Teflon:

Teflon is the registered trade name of the highly useful plastic material poly tetra fluoro ethylene (PTFE). PTFE is one of a class of plastics known as fluoro polymers. A polymer is a compound formed by a chemical reaction which combines particles into groups of repeating large molecules. Many common synthetic fibers are polymers, such as polyester and nylon. PTFE is the polymerized form of tetrafluoroethylene. PTFE has many unique properties, which make it valuable in scores of applications. It has a very high melting point, and is also stable at very low temperatures. Figure 4-3: shown the Teflon material.

Figure 4-3: the Teflon material.

3. Wood:

Wood is a porous and fibrous structural tissue found in the stems and roots of trees and other plants. It has been used for thousands of years for both fuel and as a construction material. It is an organic material, a natural composite of cellulose fibers (which are strong in tension) embedded in a matrix of lignin which resists compression. Figure 4-4: shown the wood material.

Figure 4-4: The wood material.

Environmental Advantages

- Wood is the only material that reduces the **CO_2 emission**, as play an important role to slow down **Climatic Change**.
- Timber needs less energy in its manufacturing process, so has an environmental impact lower than other materials in their life service cycle.
- Wood is an important **drain of CO_2** meanwhile the products keep their life service cycle.

- Wood is a **natural resource, renewable**, whose consume help the local sustainable management of forests and environmental protection.

- **Sustainable forestall management**, timber industry could continue it activity in the future, also strengthen the sense of social and environmental responsibility.

- Timber products make easier to carry out the commitments of the **Kyoto protocol**.

Figure 4-5 shown the design dimensions which used to construct the design.
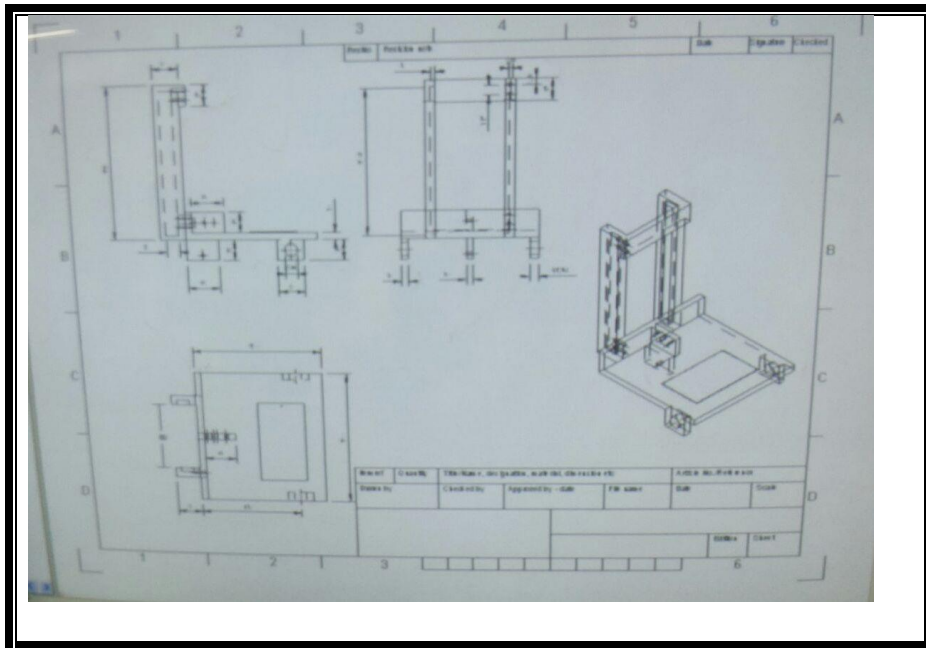

Figure 4-5: The design dimensions.
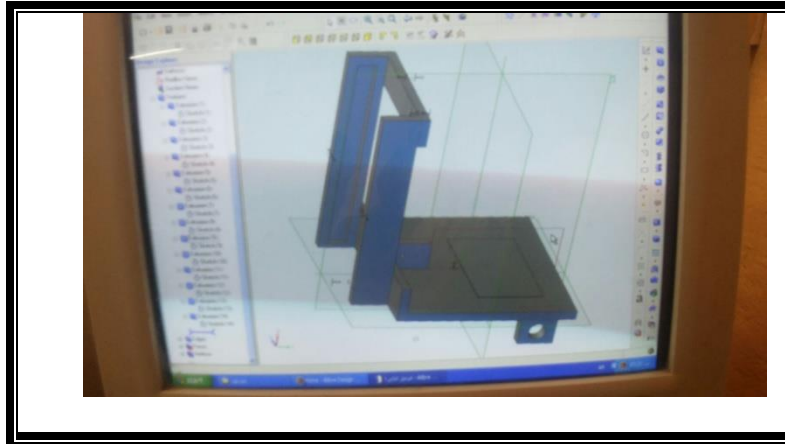
The figure below show the full picture of mechanical design in 2D.

Figure 4-6: the fundamental design of the robot.