

Barcode Automation System Design with the New Generation Smart Car

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Abstract: - Today, there is no electronic environment that displays instant product information and total price for shopping in most markets. In this study, a new generation smart car barcode automation system was designed by adding a barcode reader system to the shopping carts and/or baskets in the markets, and the total price of all the products purchased and the prices of all the products purchased one by one without going to the cashier. In this way, both customers and cashiers will be saved from wasting time and market employees will be able to deal with customers more closely.

Key-Words: New Generation Smart Car, Barcode Automation, Arduino Mega

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1 Introduction

With the development of technology, the need for human and workforce is decreasing. In our rapidly developing world, there have been great technological developments in every field, production and stock areas have been equipped with semi-automatic or fully automatic computer aided work machines, and production capacities have been increased in large amounts every year compared to the previous year. In many markets in countries such as Japan and China, direct sales methods are preferred with smart grocery carts and/or carts. A supermarket chain in Turkey has worked on this subject before and shared the project with a certain customer. However, it was not implemented because it could not be effectively successful [1].

At the same time, similar to this study, Konya Selçuk University Computer Engineering Department students developed a system that instantly shows how much the products put in the basket and/or the cart cost, in order to eliminate the complaint of "overshooting the budget without realizing it while shopping". This system, which was patented in 2011, was implemented in 2013 and exported to major European countries by GM Information Technologies Inc. [2].

2 Market System

Static electric fields are fields created by static and inert electric charges. There is little laboratory study or epidemiological evidence of the link between static electric fields and health damage. While searching for the link between static fields and cancer, only the magnetic field component is seen as a threat to health.

Today, there is no electronic environment that displays instant product information and total price for shopping in most markets. There is a conventional system that displays the information and total price of the purchased products only when they go to the cash register [3].

2.1 Barcode

It is a method that consists of vertical lines and spaces of different thicknesses and is used to automatically and error-free transfer of data to another medium. The barcode consists of lines of varying thickness and the spaces between these lines.

2.2 Barcode Types

There are many 1D and 2D barcode types. Although different barcode types are used depending on the area of use, the most widely used barcode types today are EAN13, which is used for barcoding commercial products, and Datamatrix barcode types, which are used for barcoding drugs in Turkey [4].

2.3 Barcode Reader

Barcode printers are devices used to print barcodes. Barcode printers can do thermal and direct thermal printing. Barcodes printed with barcode printers are more durable and long-lasting. They can print faster. There are many different brands and models of barcode printers in the market. Depending on the model of barcode printers, they can be used either connected to the computer or independently of the computer. It can be printed from barcode printers by designing with a label program.



Fig. 1. Barkode reader

Barcode readers bring speed, convenience and accuracy to data entry. When a barcode is read with the appropriate reader, the reader converts black and white lines into electrical signals. The reader's decoders decode these signals and convert them into numbers or characters that we can understand. The electronic signals generated by the beam and barcode bars emitted by these readers are also detected by these readers and transferred to the computers as numbers or characters. Dark bars in the barcode absorb light, while gaps reflect light back. Thus, electronic signals are formed. Barcode readers can have different interfaces. They can be keyboard, serial port or usb connected. In addition to these, there are also radio frequency barcode readers. They are wireless and can instantly transfer the scanned barcode to the computer within their activity area [5].

3 Shopping Way in Market

3.1 Direct Selling

It is knowing only the prices of the products purchased by the customers and paying at the cashier by knowing the total price and detailed information about the product when they go to the cashier to make the payment.

3.2 Jet Cashier Sales

It is knowing only the prices of the products purchased by the customers, and the customer reads his own products at the cashier and makes his own payment by credit/debit card without the need for any cashier to make the payment.

3.3 Virtual Shopping

Virtual shopping is all kinds of shopping made over the internet by making payment with payment systems such as credit card, money order or paypal.

4 Special Circuit Elements of Barcode Automation System Design with the New Generation Smart Car

Many companies prefer the direct selling method. In this method, the customer makes one-to-one contact with the salesperson who is given responsibility by the company, and when the customer decides to buy one or more products, the salesperson receives this order. It reads the products one by one and determines the total price and collects it from the customer. This is because the queue in the market is very long some days and the market owner is worried that the profitability will decrease due to this situation. More than 10% of customers will not wait more than 10 minutes. This will include 10 minutes of both waiting and checkout time. It is aimed to eliminate this waiting time with the barcode system design to be created. The customer can determine how much he will pay before coming to the cashier. In this way, it will be prevented from buying products unnecessarily and exceeding the predetermined budget.

In this designed study, ARDUINO USB HOST SHIELD produced by ARDUINO company and 10-bit ARDUINO MEGA microcontroller were used. The ARDUINO card on which ARDUINO USB HOST SHIELD is mounted makes SPI communication with ARDUINO USB HOST SHIELD. barcode reader was added to ARDUINO USB HOST SHIELD and a barcode automation system architecture was created. With these technologies, the LCD SCREEN connection was established with ARDUINO MEGA, and the prices of the products read were displayed on the LCD screen. It will be ensured that the consumer can instantly see the products they buy and make a decision to buy/not buy within the scope of the campaign to be implemented by the market.

Some special circuit elements are used in the design of the barcode automation system with the new generation smart car. These; It is a manually controlled and driver-free barcode reader with 10K (ohm) potentiometer, 2x16 LCD screen, Arduino USB Host Shield, Arduino Mega 2560 microcontroller and USB output.

4.1.10 K ohm Potentiometer

It is a type of resistor (rheostat). But the biggest feature that distinguishes it from other resistor types is that the resistor value can be changed.



Fig. 2. Potentiometer

4.2 LCD (16x2) Display

It is a 16x2 (16 columns, 2 lines) LCD display that can be used in Arduino and other projects. It has black text on a green background. It has back LED lighting. It works with 5V voltage [6].



Fig. 3. LCD screen

4.3 Barcode Reader

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4.4 Arduino USB Host Shield

Arduino USB Host Shield is a functional board that enables the Arduino board to gain USB host feature, and when an external USB device is inserted in the Arduino board, it recognizes it and allows it to be used immediately. It is the integrated MAX3421E that acts as the USB peripheral/host controller on the Arduino USB Host Shield. With its internal logic and analog circuitry, the MAX342 IC complies with full-speed peripheral or full/low speed host USB 2.0 specifications [7].



Fig. 4. Arduino usb host shield

4.5 Arduino Mega 2560

Arduino Mega 2560; It is an Atmega2560 based microcontroller board. It has 54 digital input/output pins (15 of which can be used as PWM outputs), 16 analog inputs, 4 UART (hardware serial ports), 16MHz crystal, usb socket, power socket, ICSP connector and reset button. There is everything necessary for the operation of the microcontroller on the board. It can be easily connected to a computer via a USB cable, powered by an adapter or a battery [8].



Fig. 5. Arduino mega

5 System Architecture and Generated Codes

5.1 Arduino Mega and Arduino USB Host Shield Architecture

Since the pins on the Arduino Mega and the pins on the USB Host Shield are the same, the pins on the Arduino Mega should be placed in a way that coincides with the pins on the USB Host Shield. If the barcode reader USB output is plugged into the USB input of the Arduino USB Host Shield placed on the Arduino Mega, the system architecture is created.



Fig. 6. Arduino mega and usb host shield system architecture

5.2. LCD Connection Pins

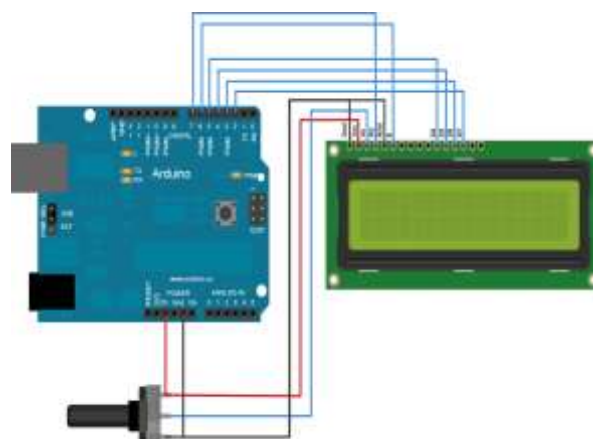


Fig. 7. LCD screen and arduino mega connection architecture

- LCD RS pin- digital pin 7
- LCD Enable pin -digital pin 6
- LCD D4 pin – digital pin 5
- LCD D5 pin – digital pin 4
- LCD D6 pin – digital pin 3
- LCD D7 pin – digital pin 2
- LCD R /W pin – ground
- LCD Ground-ground
- LCD V0-Potentiometer middle leg
- LCD Vcc-5V

6 Codes for Defining LCD Screen and Barcode Reader on Arduino Mega

6.1 Codes Generated for LCD Screen

```
#include <LiquidCrystal.h> //Library of LCD
screen has been added. #define DISPLAY_WIDTH
16 //column information of LCD screen is defined.
LiquidCrystal lcd(7, 6, 5, 4, 3, 2); // The pin
numbers where the legs of the LCD screen added to
the USB Host Shield are placed are defined.
```

6.2 Codes Generated for the Barcode Reader Library

The library of the USB Host Shield added to the Arduino Mega has been downloaded. . #include <hid.h> //Library definitions were made for the barcode reader [9].

6.3 Codes Generated for Barcode Reader Communication Protocol

First of all, you should run the example called USB_desc, which is available in the library of the USB Host Shield, which is included in the Arduino program and previously downloaded, and the information in the following table should be obtained in the output of the program [10]. If the communication protocol cannot be obtained as in the table below, it is necessary to select our barcode reader with a driver-free feature.

Table 1. Barcode reader communication protocol

Intf. Class	03
Intf. Subclass	01
Intf. Protocol	01

6.4. Codes Generated to Show the Total Price of Purchased Products

When the product information added to the database is read with a barcode reader, it shows on the LCD screen. In this, the codes showing the product information in the database and the total price of all the products purchased are written.

7 Conclusions

In this study, a new generation smart car barcode automation system was designed. High performance and fast ARDUINO MEGA microcontroller is used for control systems. Ease of design and operation for measurement and control processes, input-output port needs are met by this controller. USB Host Shield with USB input is used to activate the barcode reader with USB output for measuring and reading values in the system. In conclusion; The barcode automation system design with the new generation smart car realized solves the problem of long waiting at the checkout at the end of shopping and exceeding the shopping budget of the citizen.

In the later stages of the project; It is planned to provide access to devices with android operating system with bluetooth module. In this way, customers can shop with devices with android operating system, and also the receipt information of the purchased products can be delivered to the customers via e-mail instead of paper receipts.

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