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# SMART TROLLEY SYSTEM USING CLOUD COMPUTING

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***ABSTRACT***

Shopping trolley is also called shopping cart which is like a carriage or basket that can be used by customers to transport their purchased product inside grocery shops or supermarkets. In European and Canada, the supermarket performs a coin locks system on the shopping carts in order to encourage the customers to return the carts themselves after use. In addition, the design of shopping trolley was concerned. This is because poor designed shopping trolley can cause potential musculus-skeletal injuries from manually pushing or pulling heavy loads. A market survey was conducted where the results shown that most of the users expected the shopping trolley to feature energy saving, pulling and pushing motion and adjustable height. In this project, a portable robot with human and line following functions was developed to assist customers to carry a heavy load while shopping in the supermarket. Meanwhile, a smart shopping system was also developed in order to identify the location of each item in supermarket in assisting customers to locate the desired items. Besides, the customer is informed of the current location of the shopping trolley through cloud server.

Keywords: Cloud computing, Robot, Shopping trolley, musculus-skeletal.

## *1.* INTRODUCTION

Recently, robot technology has developed greatly. However, most of the traditional robots are only used for industrial applications, such as in car assembly factories [1, 2]. The purpose of human following robot is to improve the relationship between people and the robot [3]. Nowadays, vision based robot has become a trend for navigation purpose. However, the tradition method of line following navigation still plays an important role in mobile robot technology. This is because a robot with line following capability has lower cost to build and is simpler in design [4]. It is a non-touching recognition system where it can tag and send tag data wirelessly at various distances [5]. In order to prevent objects collision, ultrasonic sensor was used in this project. Robot can react based on data collected from sensors such as detection of an obstacle close to the robot [6, 8]. Both of server and client system were programmed in Java programming language. This communicating system can work well and without limit either in local network or internet [7].

## *2.* USER's REVIEW

Shopping trolley is a convenience and necessary tool for customers who are shopping in a supermarket. They can put a lot of things inside without carrying themselves but just have to push the shopping trolley. However, there are some problems faced by managers of the supermarket nowadays. A manager from a Ward's supermarket claimed that they have probably three to four shopping carts missing per day. The workers of the supermarket have ever seen some of the customers take the shopping carts away after shopping. According to Sanitation officers, it is illegal of taking shopping trolley from a supermarket but it is hardly to control and take action on these people [8, 9, and 11].

## *3.* LINE FOLLWING ROBOT

A line following robot is a kind of robot that is designed to follow a predetermined line or path. Infra-Red (IR) line sensor equipped with IR transmitter and receiver to trace black line with white surface or vice versa on the floor. The sensor output will be fed to the microcontroller and thus the microcontroller can give a suitable command to motor driver in order to allow motor moving according to the command given.The microcontroller will be programmed to make the robot move in any direc-

tion based on the output of line sensor. Hence, a robot can move according to the line or path given. [12]

### *3.1* RFID technology

RFID is a very useful technology for position estimation in indoor environment. Although Global Positioning System (GPS) is one of the useful systems to get information of people, vehicles or other objects, it generally cannot work in indoor environment. This is because a GPS requires satellite signal attenuation .RFID technology can be used in various ways, such as detection needs, authentication needs or identification needs .RFID system consists of reader, tags and antenna. Reader has high-frequency electromagnetic energy. Reader can generate a query signal. Each tag has microchips that embedded information and has its unique Identification (ID) code. The antenna is used to send wireless signals to the tags and receive a message from the tags in a reachable range.fig 3.1 represents the RFID Technology. [13]

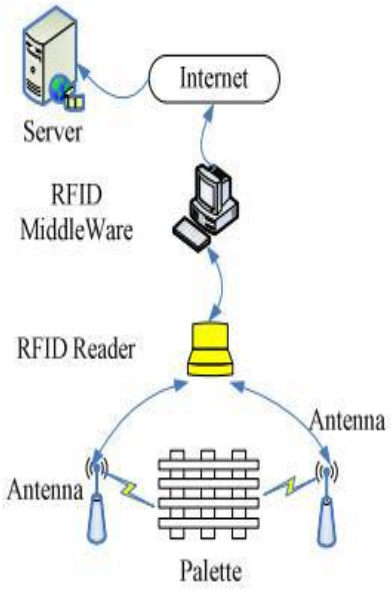



**FIG 3.1 RFID Technologies**

## *4.* EXAMPLES OF RELATED PRODUCTS

The following are the similar products obtained from reliable online sources. These similar products are different kind of available system that can be implemented into the shopping trolley for various purposes, such as providing the convenience for customers or prevent shopping trolley lost.[14-15]

### 4.1 Shopping Cart Retrieval System

This retrieval system is as shown in Figure 4.1. It is developed on shopping carts in order to detect stolen or misplaced shopping carts. A search team is assigned to detect and recover the missing shopping carts. A shopping trolley is installed with Very High Frequency (VHF) "beacon" radio transmitter. This radio transmitter can emit signal continuously when the carts leave the store. Meanwhile a search team is equipped with a radio receiver to receive the emitted signal. With this system, a missing shopping cart can be found at maximum range.

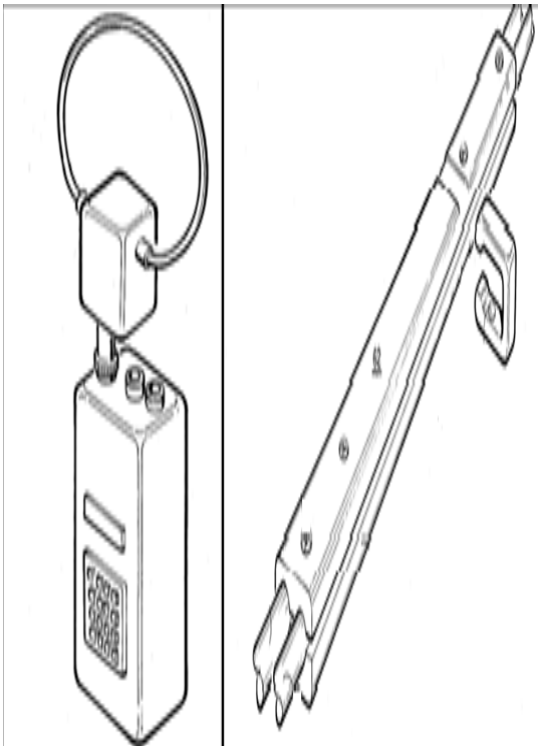


**FIG 4.1 VHF receivers and handle of shopping trolley are mounted with radio transmitter**

### 4.2 Shopping Cart Theft Prevention System

This product is as shown in *Figure 4.2.* The product is invented to prevent a shopping trolley to get stolen by a theft. A braking system for carts' wheel is developed where the wheel is mechanically coupled to a shaft. There is a generation of electric current when there is a rotation of wheel. When it is shorted, an electromagnetic force inhibits the rotation of shaft and this breaks the wheel. With this system, when shopping trolleys tend to move Outside a defined perimeter, braking system is applied to stop the trolleys from moving further.

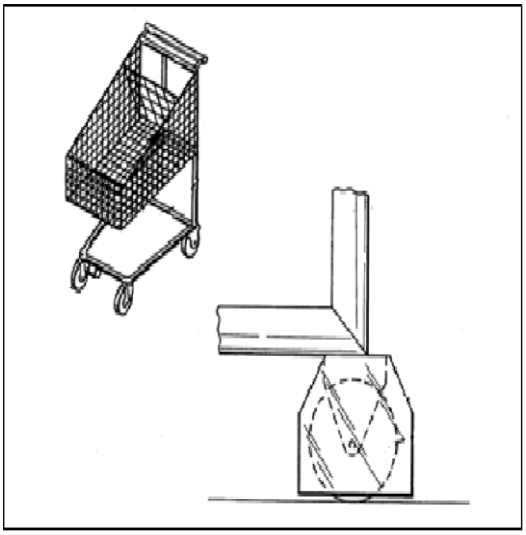


**FIG 4.2: Side view of rear wheel equipped with a shroud.**

## *5* SYSTEM DESIGN

### 5.1 Hardware Design

In hardware design, Arduino Mega 2560 was used as the microcontroller for the portable robot. All hardware used including RFID reader, ultrasonic sensors, Bluetooth module, auto-calibrating line sensor and motor driver were connected to Arduino Mega 2560. RFID reader was used to read tag cards and sent tag data to Android smartphone via Bluetooth module. Ultrasonic sensor was used for obstacle avoidance. Line sensor was used for robot line following purpose. Motor driver was used to drive electric scooter motor with gear. There was a robot base mechanism installed under shopping trolley. Microcontroller, RFID reader, Bluetooth module, auto-calibrating line sensor, motor driver and 12V acid battery were put on the robot base in order to control the shopping trolley. Meanwhile ultrasonic sensors were installed at each side of shopping trolley.

### 5.2 Mechanism of Mobile Shopping Trolley

Mechanism design for mobile shopping trolley was based on the portability concept. The mechanism can be attached under the bottom of shopping trolley and it can be taken out easily. Shopping trolley was implemented with differential wheeled drive. The two driven wheels are placed as middle wheels of the trolley. Therefore, it can move in every direction. Besides, suspension mechanism was designed by using springs so that the robot is able to touch with the uneven ground surface. This helps to increase the stability of the shopping trolley. *Figure 5.2* show the robot mechanism and shopping trolley with attached robot respectively.

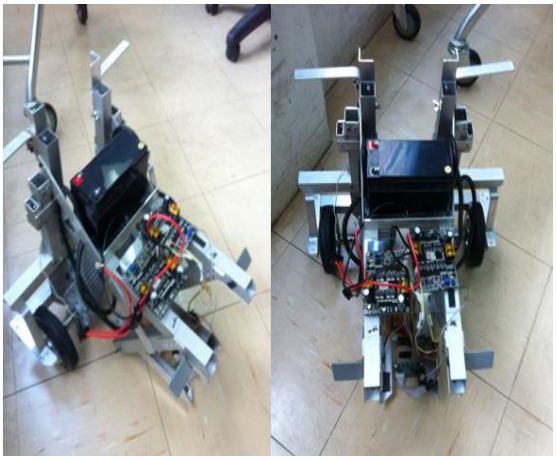


**FIG 5.2: Side angle view and top view of robot mechanism with hardware and components attached.**

## *6.* RESULTS AND DISCUSSION

The project involves both hardware and software. Each hardware was connected to microcontroller and the data was collected.

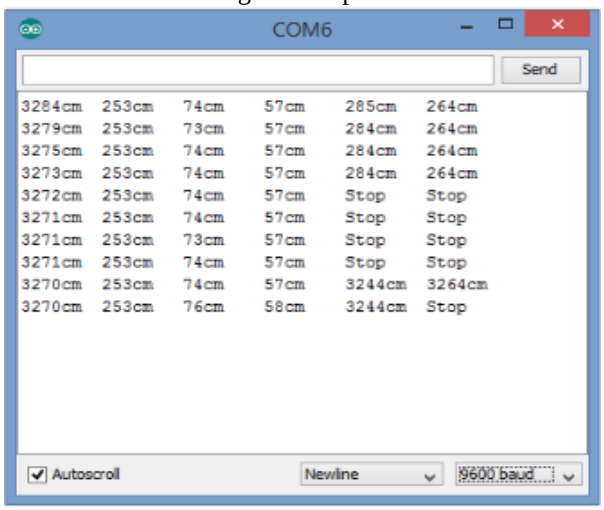
### 6.1 Hardware Development

**FIG: 6.1 Data collected from six ultrasonic sensors and the result was displayed in table form**

**By using serial monitor of Arduino IDE.**

First and foremost, ultrasonic sensor was connected with Arduino Mega 2560 board. There were six ultrasonic sensors used in the project. Figure 6.1 shows the snapshot of 6 ultrasonic sensors output program was displayed in table form by using

Arino IDE serial monitor.Secondly, line sensor was tested for line following function. Figure 6.1.1 shows a line sensor detected the black line and the related sensors were lightened up and its result was



displayed in serial monitor.

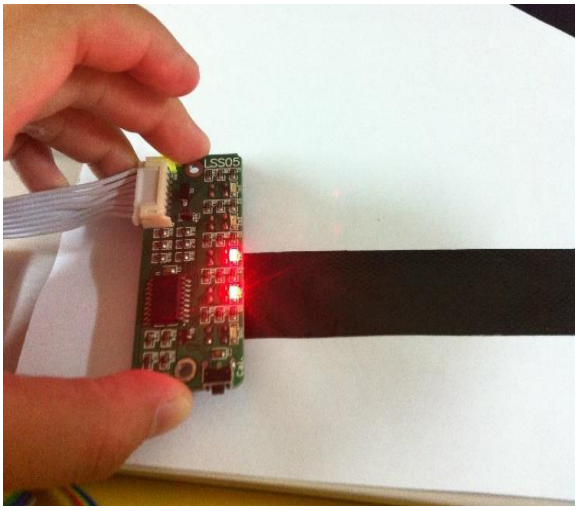


**FIG 6.1.1: Line Sensor detected the black line with white background. The LEDs for the corresponding sensors detected the black line were lightened up.**

RFID Reader RDM6300 was tested and its result was shown in Figure 6.2. Bluetooth module was also tested. The received tag number was sent to Android application and displayed in GUI via Bluetooth. On the other hand, Android application was also used to test to send data to Arduino Mega 2560 via Bluetooth in order to control the motion of motor.

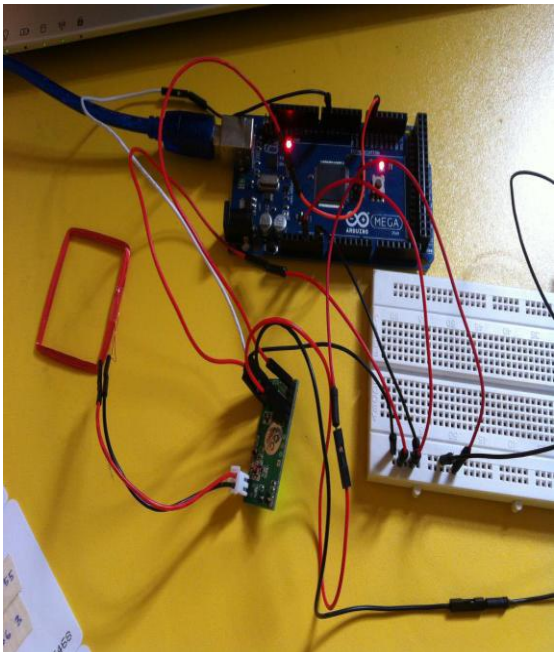


**FIG 6.2: RFID reader is connected to Arduino Mega 2560, where TX pin of RFID reader is connected to pin RX of Arduino Mega board. The message received after tagged will be displayed in serial monitor.**

All of the hardware and components are programmed in the main microcontroller. Two ultrasonic sensors are put in the front side of the shopping trolley in order to avoid obstacles in front of it. RFID tag cards that act as location indicator are placed on the cardboard along the black line or path. The communication between smartphone and robot is via Bluetooth connection. The movement of shopping trolley is controlled by using smartphone.

## 6. CONCLUSION

The framework we proposed is helpful for client and shopping centre administrator both. While building up this framework we have considered all issues identified with every one of the clients of the framework. Regardless of the possibility that any client doesn't know how to work brilliant telephone they can work it. The item is extremely easy to understand. To work this, it doesn't require any uncommon preparing. This framework can be actualized with ease. Our plan will make the trolley procedure through cloud computing is simple and furthermore demonstrate in sparing client's chance.

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