EE322: Embedded Systems Design - Project

Coin Sorter and Calculator

Project Proposal

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E/17/146 : Jayawickrama J. P. D.
E/17/234 : Pandukabhaya V. K. M.
E/17/371 : Warnakulasuriya R.

Page Index

List of Figures

List of Tables

Coin Sorter and Calculator

Introduction

During the daily life of the average working citizen, there are numerous occasions where purchases are made with coins, often repeated routinely by masses of people. Purchasing tickets for public transport at a station, buying coffee while on a break are simple examples for such occasions. Automation can make this process faster than when handled manually, while also removing the need for direct contact between individuals, which can be crucial in light of the current pandemic situation. Since this simple task is carried out repeatedly by a large number of people each and every day, the accumulated effect of its automation can potentially be game-changing.

Problem Identification

The current practice is to exchange coins through a shopkeeper. Sometimes the shopkeeper might be able to give the exchange but most of the time it is not guaranteed. Hence, manually performed transactions of change/coins when taken together are not time or energy efficient. Furthermore, they require interaction between individuals, which increases the chances of disease carrying pathogens spreading from one person to another, worsening the pandemic situation currently faced by many countries worldwide. Therefore, there is a necessity of an automated coin exchanger system which can provide coin change in desired combinations of coins.

Proposed Solution

As a solution to the identified problem, our idea is to develop a device to get coins of necessary types and then store them for a user asking for exchange in a desired combination of coins. Our solution in this semester under EE 322 is to design a device that can be used to accept a set of coins from the user, and sort them into different piles based on their currency value. As a continuation of this product we would like to extend its design to a full implementation of the machine where it will debut as a product, in the next semester.

Market Analysis

As a developing country, Sri Lanka is not fully operational in the online transaction mode in most aspects of the supply and demand chain as well as in the service industry. For instance, the delay one has to tolerate in order to buy a train ticket due to lack of change coins is something that is experienced by a majority; and it is needless to mention that the use of this kind of automation paves the way for most ordinary people to experience faster transaction methods.

Methodology

The proposed method is to use the weight of coins to compare the currency values and distinguish between coins. To measure the weight of the coins, a strain gauge attached to a rubber membrane would be used. The signal generated from the strain gauge will be sent to the microcontroller after passing through a voltage level mapping circuit. This will then be compared against the preset values stored in the microcontroller from previous calibrations to determine the value of the coin and sort coins valued 1 Rupee, 2 Rupee, 5 Rupee and 10 Rupee into their corresponding piles. A tiltable platform mechanism made using two servo motors will be used to sort each coin into a container corresponding to its value.

The components that are expected to be used in this project are indicated in the list below.

Components

Electrical and electronic components:

1. PIC16F84A microcontroller
2. Strain gauge sensor module
3. 3 servo motors
4. 4 MHz crystal oscillator
5. 2 22 pF capacitors
6. 18-pin DIP IC base
7. Dot board
8. Circuit wires

Mechanical components:

1. 4 containers to hold sorted coins
2. 2 circular platforms

A block diagram that depicts the proposed connection of electronic components of our device is given in Figure 01. In addition, a diagram indicating the proposed arrangement of the coin sorting mechanism is shown in Figure 02.

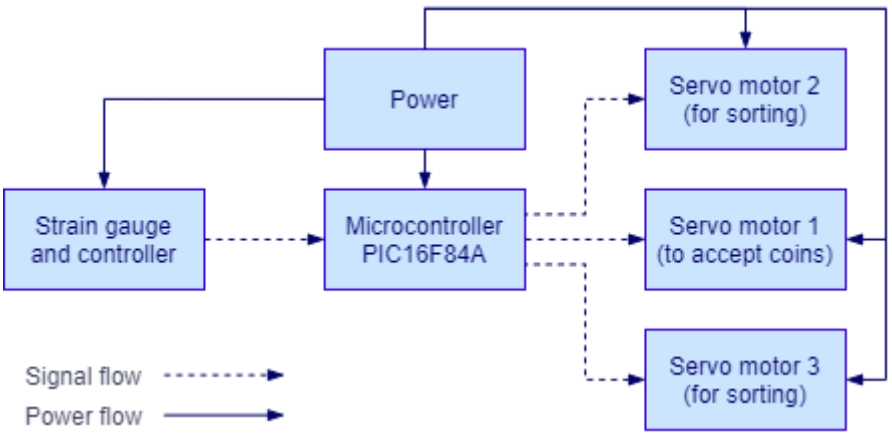

Figure 01: Component connectivity diagram

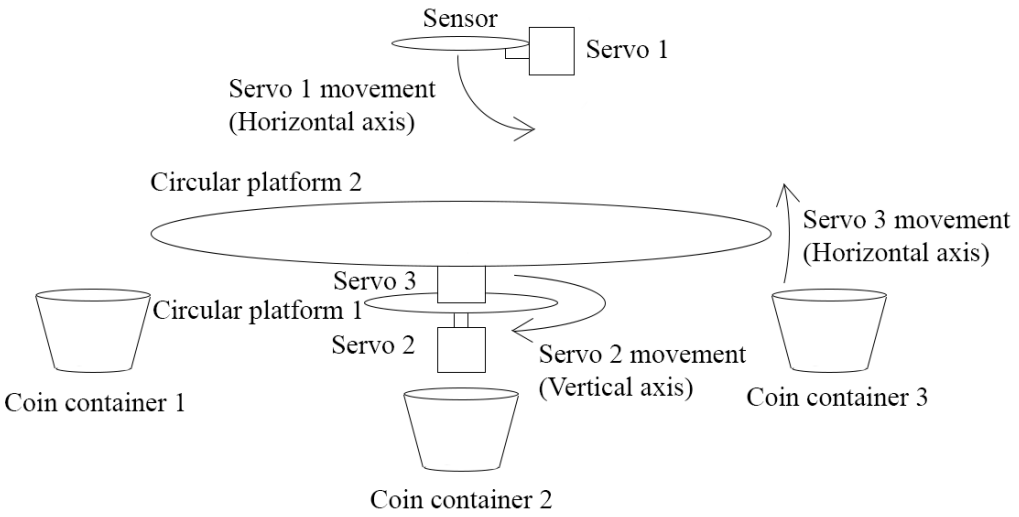

Figure 02: Sorting mechanism

Cost Analysis

An estimated budget for our proposed solution is given in Table 01.

Table 01: Estimated budget

Component	**Quantity**	**Unit Price (Rs.)**	**Total price (Rs.)**
PIC16F84A microcontroller	1	600.00	600.00
Strain gauge sensor module	1	950.00	950.00
Servo motor (SG90)	3	280.00	840.00
4 MHz Crystal Oscillator	1	15.00	15.00
22 pF capacitors	2	2.00	4.00
18-pin DIP IC base	1	10.00	10.00
Dot board	1	200.00	200.00
Circuit wires	6 m	15.00	90.00
Soldering lead	2 m	15.00	30.00
Mechanical components			500.00
Total			**3239.00**

Timeline

The tentative timeline for our project is given in Table 02.

Table 02: Tentative Timeline

	Activity	2021											
		June				July				August			
1.	Project start and submission of the proposal												
2.	Analysis and designing												
3.	Simulation												
4.	Hardware implementation												
5.	Report writing and project completion												

References

1. Microchip Technology Inc., “18-pin Enhanced FLASH/EEPROM 8-bit Microcontroller”, PIC16F84A datasheet - DS35007B
2. SG90 9 g Micro Servo datasheet
3. MPASM Assembler Documentation
4. https://www.teachmemicro.com/pic16f84a-beginner-microcontroller/ 08/06/21