

# Reverse Poverty: An Automated Recycling Reverse Vending Machine

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## ABSTRACT

As grateful as we should be for the development of science and the advances made in technology which triggered the rapid growth of the human race in all manners, we are overlooking a very crucial problem that is threatening our very existence; the environmental crisis. We face the effects of poverty such as hunger, AIDS, malaria, etc. It is difficult to fully comprehend the complexities and implications of poverty. In order to really support those who live in poverty, we must try to come up with an innovation, something never been attempted.

In this paper, we present Reverse Poverty which uses reverse vending machines (input machine) that accept used empty biodegradable items. The generated money from the accepted recycled material will be automatically forwarded through our software to the output machine. Underprivileged people could then log to vending machines (output machine) in set locations and collect food for free.

## Categories and Subject Descriptors

J.0.1 [Business and Education]

C.0.0 [Hardware/software interface]

## General Terms

Design, Hunger, Poverty, Environmental Sustainability, Algorithms, Experimentation, Languages, Programming.

## Keywords

Computer Science, Environment, Poverty, Recycling.

## 1. INTRODUCTION

Recycling, recovery and reprocessing of discarded materials for use in new products rely on basic phases of recycling, such as collection of waste materials to allow their processing or manufacture into new products, and the purchase of those products, which may then themselves be recycled. Typical materials that are recycled include iron and steel scrap, aluminum cans, glass bottles, paper, wood, and plastic. The materials reused in recycling serve as substitutes for raw materials obtained from such increasingly scarce natural resources as petroleum, natural gas, coal, mineral ores, and trees. Recycling can help reduce the quantities of solid waste deposited in landfills, which have become increasingly expensive. Recycling also reduces the pollution of air, water, and land which are caused by the immoral disposal of waste [2][5].

About 25,000 people die every day of hunger or hunger-related causes, according to the United Nations. This is one person every three and a half seconds. Unfortunately, it is children who die most often. Yet there is plenty of food in the world for everyone. The problem is that hungry people are trapped in severe poverty. They lack the money to buy enough food to nourish them. Being constantly malnourished, they become weaker and often sick. This makes them increasingly less able to work, which then makes them vulnerable to poverty and hunger. This downward spiral often continues until death for them and their families [4][8].

This paper examines some problems related to poverty. It then explores the architecture and design of Reverse Poverty. The paper, next, discusses Reverse Poverty as it is used. Finally, the research closes with an overview of related work and further enhancements.

## 2. BACKGROUND

### 2.1 Current Situation

#### 2.1.1 Statistics about Recycling

According to The Public Recycling Officials of Pennsylvania, for every ton of paper that is recycled, the following are saved:

- 17 trees
- 275 pounds of sulfur
- 350 pounds of limestone
- 9,000 pounds of steam
- 60,000 gallons of water
- 225 kilowatt hours
- 3.3 cubic yards of landfill space

Almost every hour, nearly 250,000 plastic bottles are dumped. It is not surprising that plastic bottles constitute close to 50% of recyclable waste in the dumps. Aluminum is one of the easiest and fastest elements to recycle. Aluminum cans can be recycled and reused within 60 days. Recycling aluminum saves money, energy, and manpower because preparing aluminum products from pure metal consumes close to 100 times the power required to recycle aluminum. If all aluminum produced is regularly recycled, the energy saved is enough to light up a medium-sized city for close to five years [9].

#### 2.1.2 Survey

We conducted a survey among people in Kuwait (via Twitter and Facebook) to understand their knowledge of current events in Kuwait and the World. 61 people have submitted their answers to our survey. By building diversity in our survey, we have selected people from different age groups, gender, and educational background. The results were as follows:

- The majority think that Kuwait does not have a healthy environment.
- For the question “Where do you throw an empty can/bottle?” most of the people said that they would throw it in a trash can since there are not enough recycling bins.
- 94.55% of the people who took the survey believed that there are not enough recycling bins.
- People showed that they actually care about the 25,000 people who die of hunger everyday.
- 96.37% were surprisingly interested in a project that saves the environment and people from hunger.

The accumulated results from the survey showed that the people are actually aware of the problem and they are willing to help.

### 2.2 Solution

Reverse Poverty uses reverse vending machines that will be distributed in public places. People will start contributing and instead of receiving money from the reverse vending machine, people will protect the environment and raise awareness through social networks, advertisement, and word of mouth. The recycled materials will be delivered to a recycling company and we will receive money from the company. The collected money will allow us to provide food for underprivileged people to reduce hunger. Distributing vending machines around the world will initiate the “End of Poverty” revolution. In addition, Reverse Poverty is a project that aims to create a better environment and saves underprivileged people only by recycling, collecting the cost of recycled items, and spreading awareness. Furthermore, one important issue we address is raising awareness among people that don’t understand the importance of recycling and how it helps the environment. Participants will gain awareness of environmental needs at the same time as they help to take the pressure off the environment and helping us respond better to biodiversity loss and climate change while fighting global poverty. As a result, undernourishment could be alleviated, and most nutrient-depleting illness could be prevented and/or controlled [6].

## 3. Reverse Poverty DESIGN

### 3.1 Use Case

Figure 1 shows the Use Case diagram of Reverse Poverty. The project has three main users:

- Contributors can both register and deposit the recycled material or deposit without any registration.
- Underprivileged people can login via access cards then take a meal if it was provided for them.
- Administrators will be looking after the software that controls the flow of the whole process starting from collecting the money to providing food

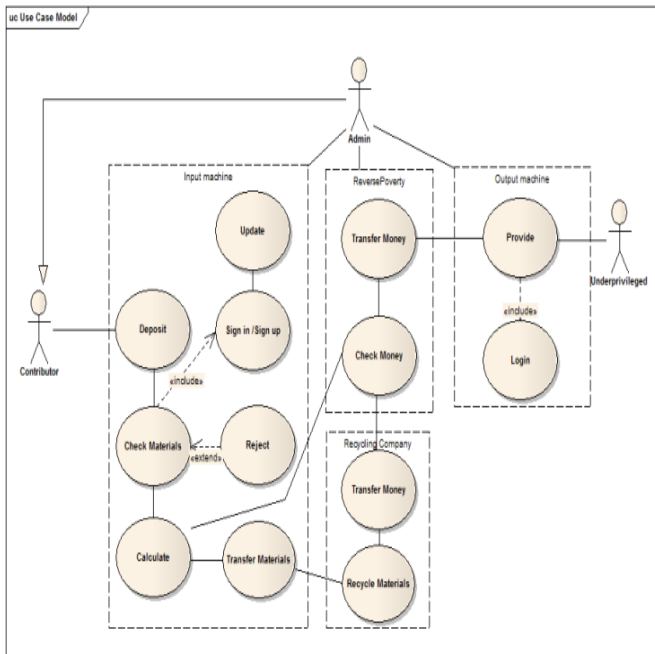


Figure 1: Use Case diagram of Reverse Poverty

### 3.2 Architecture and Major Components

Figure 2 shows the overall architecture diagram of Reverse Poverty. The diagram includes three layers, the input machine, the software, and the output machine.

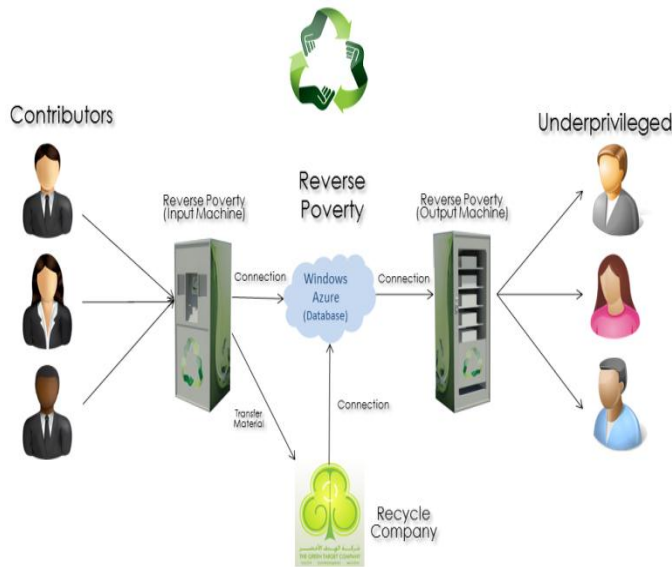


Figure 2: Architecture Diagram of Reverse Poverty

### 3.3 Used Software Resources

- Microsoft Visual Studio 2010 Professional Edition: it is a powerful IDE that ensures quality code throughout the entire application lifecycle, from design to deployment.

- C#: C Sharp is the programming language that we have used in the creation of Reverse Poverty.
- Microsoft Windows 7
- SQL Server
- Mobile Devices: they will be used for contributors to check their profile and for underprivileged so that they can be notified when a meal is ready for them to collect.

### 3.4 Activity Diagram

Figure 3 shows the Activity diagram; we can see the process of Reverse Poverty. The user will be prompted to scan the barcode of the material that will be deposited. The input machine receives the recycled material to examine them and either reject or accept the material based on the validity check that we have created. We created a simple algorithm that calculates an approximate cost of the recycled material based on the costs we have received from The Green Target recycling company. Then the user is prompted to sign in or sign up so we can update the account. After that, the material will be transferred to the recycling company. Reverse Poverty's software now receives the money collected from the recycling company and it will be transferred to the output machine where the underprivileged will be notified to collect their meal by using a barcode that is written on an access card that they have.

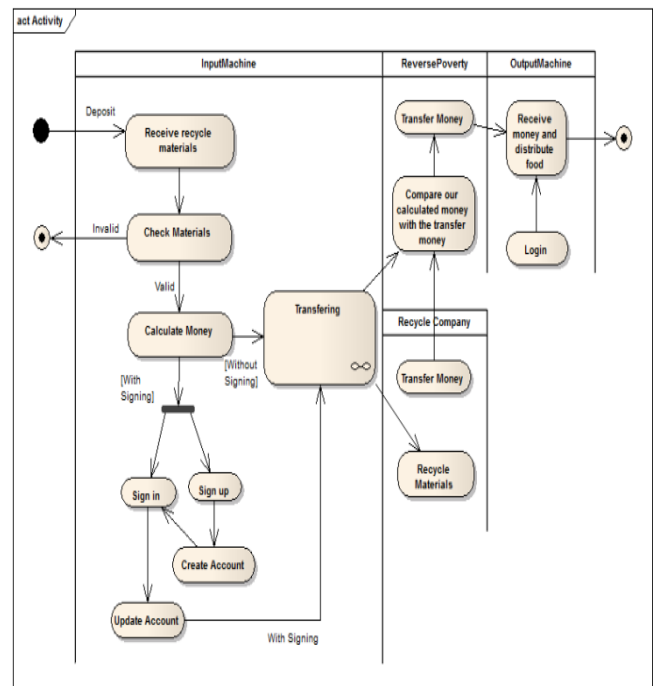


Figure 3: Activity diagram of Reverse Poverty

### 3.5 Major Classes

Figure 4 shows the relationships among Reverse Poverty project's 5 main classes. First is an InputMachine class that controls everything related to contributing. In addition, a Material class assigns the different types of material that the Reverse Poverty "Input" machine accepts. Furthermore, ReversePoverty class that represents our software appears alongside a RecycleCompany class, which will control the process of receiving the materials, processing them, receiving the money back from the Recycling Company, which is The Green Target, then provide food for the OutputMachine class. Finally, as it is shown in Figure 3, the OutputMachine class will verify whether the underprivileged people have food provided for them or not.

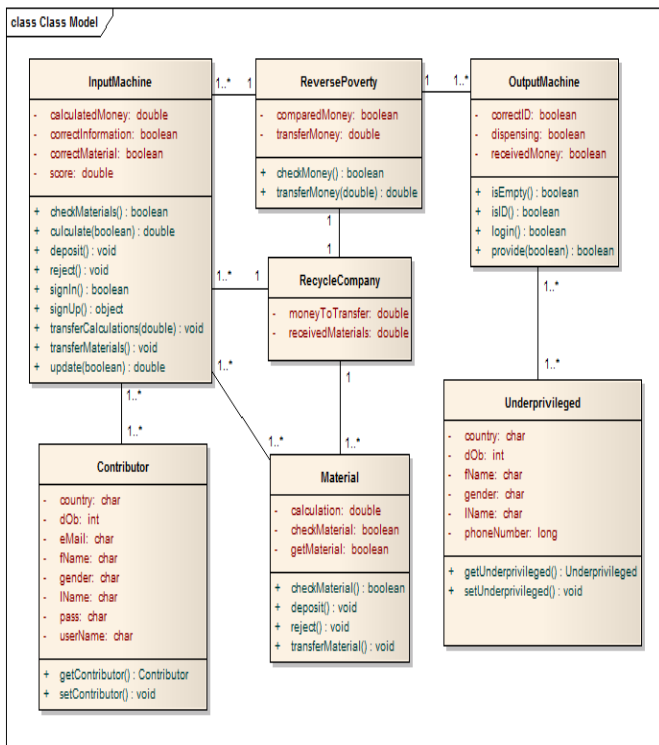


Figure 4: Class diagram of Reverse Poverty

## 4. USING Reverse Poverty

### 4.1 Scenario 1: Contributing

Figure 5 shows the sequence diagram of the contributors using the Input Machine.

- Contributors will start with depositing the materials using a barcode reader we installed and the barcode number of the material.
- If the material was valid, the software will ask them to sign in or sign up to connect them with their profile.
- An update will occur on the contributor's profile depending on the deposited materials.

- The money will be calculated and the material will be transferred to the recycling company.

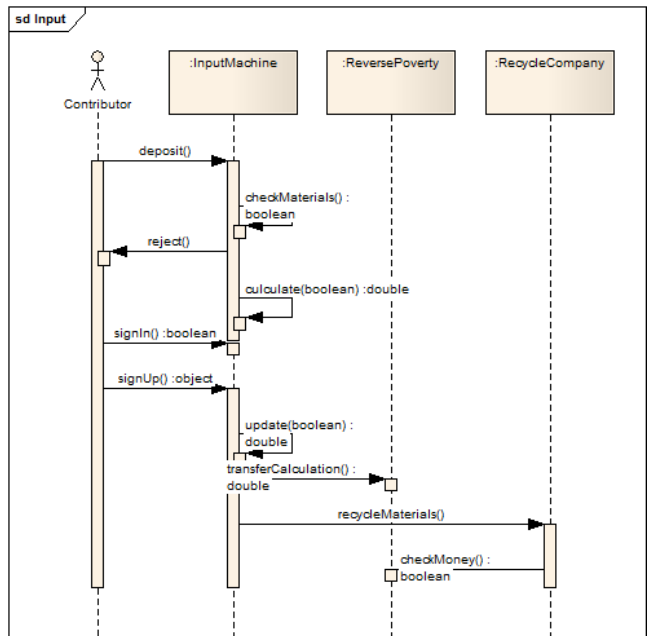


Figure 5: Sequence diagram for using the Input Machine

Figure 6 shows the home screen in the Input Machine. The users will have the choice of signing in, signing up, or contributing without registration.



Figure 6: The "Home" screen of the Input Machine.

### 4.2 Scenario 2: Registration an Underprivileged and Checking their Profiles

Figure 7 shows the sequence diagram for an underprivileged person using the Output Machine after being registered in the software. This basically illustrates how an underprivileged person is able to check for the availability of an outcome for him/her.



What we will explain is how an underprivileged person will be registered and checks if there is a meal available or not.

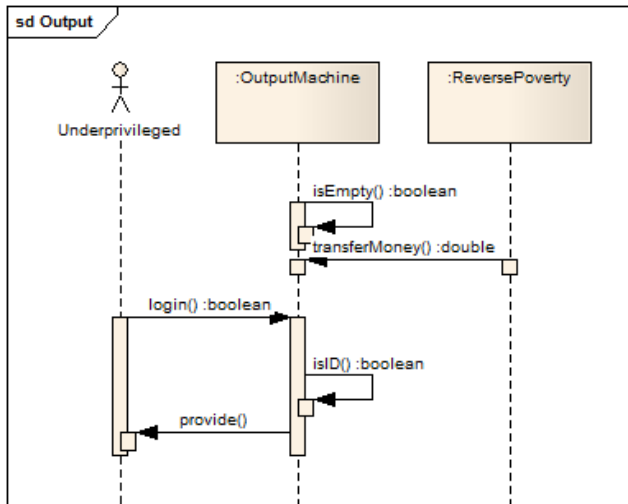


Figure 7: Sequence diagram for using the Output Machine.

Figure 8 shows the home screen in the Output Machine. A member of Reverse Poverty will have the authority of registering an underprivileged person to be part of our project.



Figure 8: The “Home” screen of the Output Machine.

### 4.3 Assessment

The following images in figure 9 are our first prototype to Reverse Poverty. Showing on the left is the input machine and on the left is the output machine:



Figure 9: First prototype

Some of the people left comments after the trials we have conducted to evaluate Reverse Poverty. These are some examples of the comments they left:

- “This would be a great idea to help the environment and the needy people at the same time.”
- “I would definitely be part of this project to save our environment and underprivileged people. The success of such kind of a project will help us to live in a better world.”
- “I am an environment lover and the fact that Kuwait and Kuwaiti’s in general don’t care enough about recycling is a huge disappointment. Any project which spreads awareness or participates in recycling and creating a better environment I would proudly be a part of...”
- “If there were proper education early on about the importance of recycling and the great effect it has on the environment, then people would be more inclined to recycle than to just throw trash elsewhere. Also, we don’t have a lot of recycling bins here in Kuwait, so the only option is trash cans most of the time. Thank you and good luck!”
- “to be honest everyone could help in recycling but the problem in Kuwait is that there are no recycling bins around nor any recycling known project because for example millions of cans/bottles are being thrown out every day if we had the privilege of having those recycling boxes then we have helped...”

## 5. SIMILAR WORK

### 5.1 PepsiCo's Dream Machine

PepsiCo's Dream Machine recycling initiative, created in partnership with Waste Management, was developed to support PepsiCo's goal of increasing the U.S. beverage container recycling rate from 34 percent to 50 percent by 2018. According to research conducted by Keep America

Beautiful, only 12 percent of public spaces are equipped with recycling receptacles, highlighting the clear need for greater public access to recycling bins. Since the Dream Machine launch on Earth Day 2010, PepsiCo has formed partnerships that will make the kiosks available in a number of highly trafficked public locations across the U.S. However, the aim for this project is to focus on helping the environment only, but with Reverse Poverty our goal exceeds their imaginations [1].

## 6. Business Viability

### 6.1 Calculations

In our research after we have checked with a well-known recycling company and a Charity Commission, we have found the following:

- 1 ton of plastic bottles equals to 20 KWD
- 1 ton of steel cans equals to 70 KWD (According to The Green Target Company")
- A meal per day equals to 0.015 KWD
- A meal per year equals to 5.400 KWD (According to Direct Aid")

According to XE - Universal Currency Converter, 1 KWD is equivalent 3.57718 USD.

### 6.2 Costs and Benefits Analysis

Next is a costs and benefits analysis based on the calculations we have collected. All the numbers are in Kuwaiti Dinar.

All prices in KD	Year0	Year1	Year2	Year3	Year4	Year5
<b>Costs:</b>						
Input Machine	500	500	500	1,000	1,000	1,000
Output Machine	500	500	500	1,000	1,000	1,000
Network	300	300	300	300	300	300
Food		600	600	600	600	600
<b>Total Costs:</b>	<b>1,300</b>	<b>1,900</b>	<b>1,900</b>	<b>2,900</b>	<b>2,900</b>	<b>2,900</b>
<b>Benefits:</b>						
cans	-	840	1,680	2,520	3,360	4,200
bottles	-	240	480	720	960	1,200
<b>Total Benefits:</b>	<b>-</b>	<b>1,080</b>	<b>2,160</b>	<b>3,240</b>	<b>4,320</b>	<b>5,400</b>

The following is the cumulative costs and benefits:

Years	0	1	2	3	4	5
Costs	1300	1900	1900	2900	2900	2900
Cumulative Costs	1300	3200	5100	8000	10900	13800
Benefits	0	1080	2160	3240	4320	5400
Cumulative Benefits	0	1080	3240	6480	10800	16200

Finally, in Figure 10 we have calculated a payback period analysis. The payback period is 4 years.

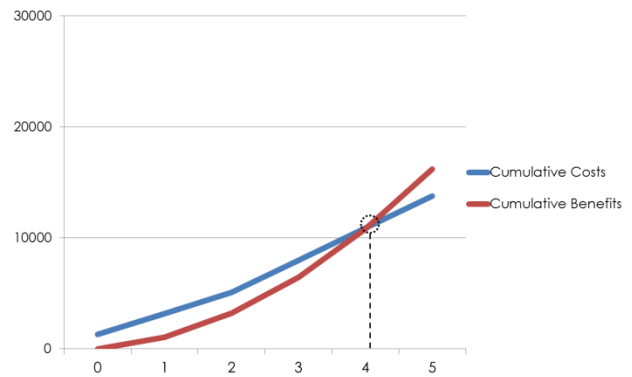


Figure 10: Payback period graph

## 7. CONCLUSION AND FUTURE WORK

Regarding Reverse Poverty's future, we would like to start to expand the recycled materials such as adding paper and glass. In addition, we would like to add educational resources and medicine as an outcome to the underprivileged. Finally, we would like to grow to be globalized (worldwide).

In this paper, we presented Reverse Poverty which is a Project which attempts to improve the lives of people in our community, country, and world by addressing the very serious environmental and economic challenges that confront us only from recycling and the cost of recycled items. Now, we need to ask ourselves, why is it important for us to fight Global Poverty? It is because of that sense of interconnection, combined with the need to preserve human dignity. In addition, where does the end of poverty begin? It begins with each of us. It begins here and it begins now! Hunger could virtually disappear. Undernourishment could almost vanish, and most nutrient-depleting illness could be prevented or controlled. At the same time, it would take pressure off the environment, helping us respond better to biodiversity loss and climate change.

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