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ORIGINAL ARTICLE

Automatic Recycling Waste Receive System in Public Areas

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ABSTRACT
Nowadays, solid waste is one of the problems with serious risk that have encountered human society health on the one hand and the environment on the other hand. Waste material production has become more diverse and more complex. With urban development, population growth, variety and number of activities, and accordingly collecting, transporting, disposal or recycling of waste should be based on scientific principles and environmental rules and standards. Science waste dispersal especially in public and tourist places is considered as one of the environment problems, clearly. Hence it is necessary of equipment of waste management systems in these areas to use updated technology. The current system has been designed and is based on separation in the origin which includes separated containers for receiving dry wastes in 4 boxes. This system senses the quantity and type of waste materials automatically and has been designed so that, weighs received wastes and can award a gift to participant according to recycled-received waste quantity and additionally compacts waste and makes them low volume in separated positions. Based upon design which has been done, this system has the capability of sending a report on its current status such as filling rate, malfunctioning, low power and environmental movements and so on to solid waste management control center.
Keywords: Solid waste, smart system, Stability container, recycling system design

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INTRODUCTION

Human being has always been faced with waste disposal problem and this has been always forced him to remedy to deal with it [5]. In recent years, human has realized properly that loss of environment is synonymous with lose of human life on the Earth. In this regards, one of the issues which seriously threatens the environment are solid waste materials left behind of different human society activities which without a correct management will have bad effects on environmental factors namely weather, soil and particularly on water. Since some decades ago, planning on different fields of solid waste materials management has been started seriously in the world and there have been lots of developments in this area [2]. On the other hand, with respect to existence of valuable materials in the composition of waste materials, sometimes it is considered as the black gold that unfortunately is collected by heavy costs and often is disposal which could recycle different materials from waste materials by applying correct and technical planning which is based on precise and reliable information [3]. Planning with an emphasis on the separation in the origin has been done for the first time in the former West Germany and was about wastes of residential center. This project demonstrated that applying such programs can have significant economic and environmental benefits [12]. The process of recycling and converting of the materials provides economic benefits and contribute to revival of national resources and in addition causes a considerable reduction in quantity of collected and disposal wastes. In fact, urban solid waste recycling as one of the techniques of urban solid waste disposal is an important issue from both ecologists' points of view on environmental protection and from economist's points of view on reducing cost of extraction and production of materials [1].

This system has capability of recycling in the origin with volume reduction in a smart manner and also causes motivation on citizens on separating and recycling. Designed and established high quality machine can improve lots of recycling problems in different areas particularly in Public areas and tourist attractions and also can help to development the performance of recycling system. This system as an urban dry solid waste materials recycling smart machine, has been designed and established for the first time in our country to prevent environmental pollution and to protect the nature's clean up.

MATERIALS AND METHODS

Design process and how implementing the system based on robotic systems have been modeled. In the robotic systems a first step is designing central control system that embedded in the central computer that is the bridge between the user and robot. The second step is connecting the car robot with the central computer that it's the sender is a central system. The final step is designing a robot or machine. The system is also designed to resemble the robot is designed in three parts:

Software program designed in GIS.

For establishment of an online link in waste collecting control centre with waste holding smart fixed systems designed in GIS by network analysis that shows location of each basket in 3D space, we made a link between GSI and Arc Objects software. Then, we edit related functions with Vector Binary Model [7, 4, 8]. Also, we installed a program on designed system to receive information from each one of waste separation boxes (Figure: 1).
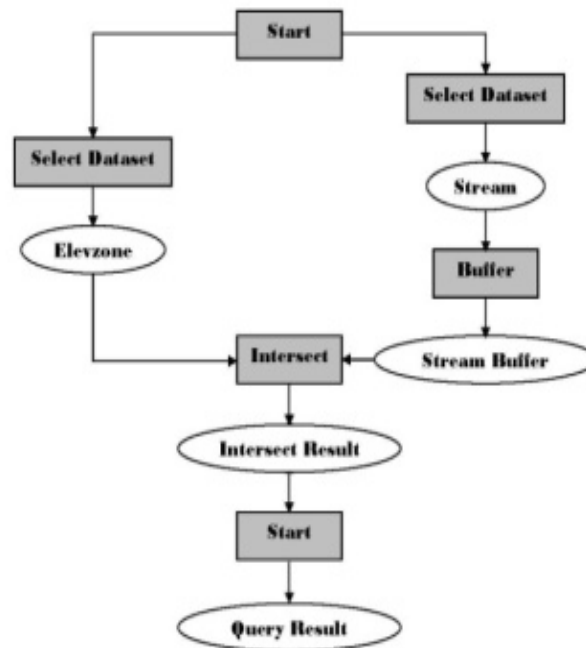

Figure1. Macros modular structure diagram of Vector Binary Model

Transmitter and receiver control circuit and connecting bridge between computer (GIS Software) and waste holding smart containers.

In fact, this system is a bridge between receivers- transmitters and GIS software. By using this system, it is possible to control planning of waste holding systems in a remote control manner, so that, one can apply any changes in the waste holding container system through waste smart containers collecting control center. By this method, it is possible to plan again by applying changes on software and converting to binary numbers and sending that information with sending modules to waste holding containers. In order to serve this purpose, a sending and receiving system has been designed (McDonnell, 1998, [6, 12]. For security reasons, password is needed to login to the system (Figure 2). By this system, it is possible to be informed of even volume of waste in each one of container boxes, on time. To apply an optimum management on the system in GIS environment, each waste basket has an identification code (Figure: 3).

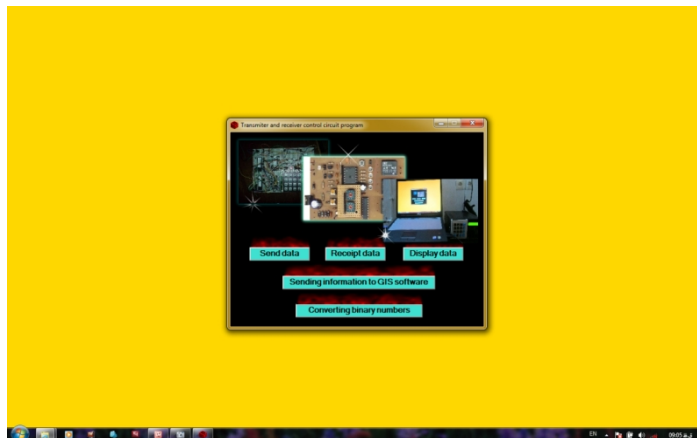Figure 2: Transmitter and receiver control circuit

Figure 3: GIS software program designed for communication between the transmitter and receiver circuit

Waste recycling smart containers.
These holding cases are completely smart and can sense all of environmental movements and send them to the server. Capabilities of these containers are:
- They can send their current status such as filling rate, malfunctioning, low power and environmental movements and so on to the server.
- Attracting social contributions in recycling issue by means of reaction with a voice message to a person who delivers waste.
- Weighing receiving waste and awarding a gift (CD) to the participant. That is, this system takes the wastes in a smart manner and according to received determined volume (weight) of recycling materials, gives a gift to the participant.
- It has an umbrella shaped shield to be protected against destructive effects of sun and rain.
- It can compact receiving wastes.
- It includes separated containers to dry wastes in four categories which are paper and cardboard, plastic and cerecloth, pet and metal.

As it was mentioned in above lines, there are two methods in this system to receive the waste materials. In first method, a person separates the wastes and then they enter to the system and in second method, the wastes is entered to the system one by one and then the system separates them in a smart manner.

This system contains 8 levers which 4 of them are in upper part and the other 4 levers are in lower part of the internal case of the system. The system has also sensors to detect the weight of the dry waste materials so that while sensing the materials (particularly weights with adjustable program), these sensors start to work and lever's motor turns on and guides recycling materials toward the system. To ensure this, a knife has been embedded along with every one of the levers (Figure 4).Then the lower lever is activated automatically to press the waste into separated containers.

This system instead of received recycling materials, awards a CD (preferably CD about environmental entertainments or a blank CD that can be selected by the participant) as a gift and additionally it has a particular alarm to gratitude and thanks the participants by speaking alarm. All of parts are water proof to protect system against rain or snow and a plate has been added in gable roof form to increase system's safety factor. Electric power of this system is determined according to the size of the system and is

installed on the system, itself which there are possibilities of utilizing AC power, Solar Energy and battery. Size of the system varies according to the amount of waste in different areas. This system has been designed in a smart manner, so that, these levers are working in harmony with each other and do not effect on performance of each other. When containers of the recycling materials are full, the lamp of the related container is turned on and its operator can take the materials out of boxes. These materials can be used in different factories as raw materials.

The waste recycling smart container is composed of circuits including the following items:

a. Circuit to send and receive data

It includes two circuits and has the capability to send all of information to the central server in each corner of the world.

b. Thermometer and humidity gauge circuits

b.1. Thermometer Circuit

We used an automatic thermometer's circuit in this system. This thermometer can measure temperatures between -50 °C to +150 °C (Figure5).

b.2. Humidity Gauge Circuit

This circuit has sensors which can send environment humidity to the control circuit to take necessary action when it is needed (Figure6).

c. Control Circuits

These circuits are counted as the brain and navigator of system which includes two main circuits, so that, they receive all of commands and data and then process them and in correspondence to each data, send a response to different parts of the system (Figure7).

d. Alarm Circuit

This circuit act as a thank giver and a guide. When a person starts to work with the machine, this circuit helps him in each stage by speaking guide and gratitude and awards a gift at the end.

e. Pressure and quantity sensor

We have two types of sensor installed in this system. The first one is pressure sensor which has been fixed on levers of paper, plastic and metals and indeed measures volume of the wastes and sends data to the control circuit. The second sensor is the sensor of quantity which has been fixed on pet's lever and measures quantity of receiving pets to the machine and sends obtained data to control circuit to analysis the data.

f. Thermal Elements

We used thermal elements in this system as facilitator to compact wastes. With a soft heat in compact levers which are remotely controllable by central system, we utilized these elements to have better compacting of pet and plastic. These elements are related with thermometer circuit and significantly improve system efficiency in compacting process.
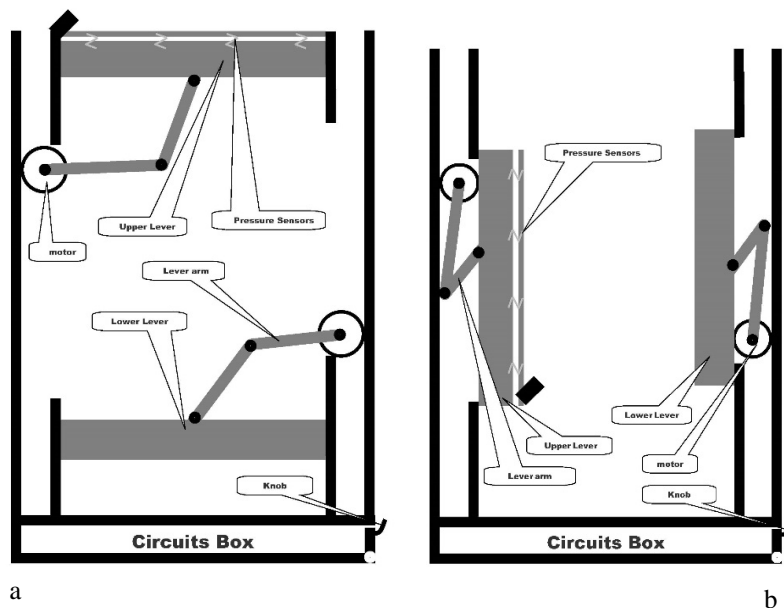

Figure 4: different parts of the system.
a: Normal Situation. b:Accumulated Situation
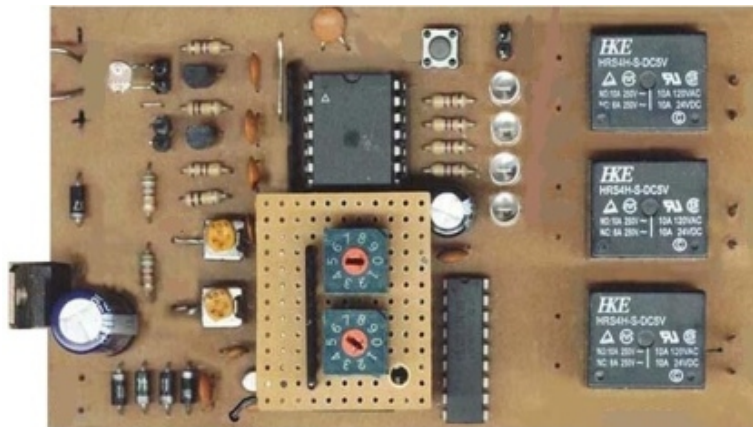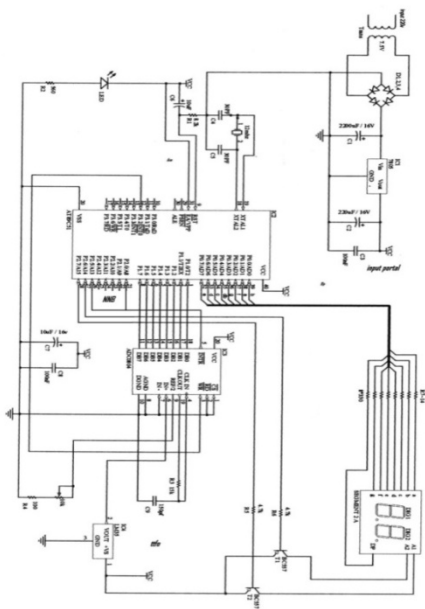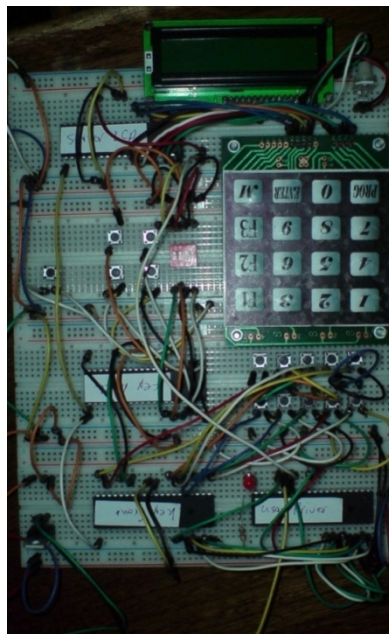
Figure 5: Thermometer Circuit.

Figure 6: Humidity Gauge Circuit.

a

b

Figure 10: Command Circuit.
a: Technical drawings. b: Design Circuit

DISCUSSION
Machine for separating waste at source, especially in busy town centers and tourist centers have been designed. Superior intelligent reservoir samples similar to those who give the gift of trash to the size of the device can be specified. This could play an important role in motivating people to be participating in the recovery from the origin places. Also, this system can be installed on a system via a display and show environmental awareness.

According to surveys conducted and with searching in UN articles in other websites this system designed for the first time. Also the similar of this system not designed. For example we can hint to similar sample in cited in USA that reservoir can send or transfer to server progress state of the filling state by SMS or through a phone line. In other similar sample designed in Germany this system can receive just garbage's separately and put in the boxes. Due designed system besides having the capability of other systems is unique and participation of people in recovery from source. And we can use it as a new system can be used in the main centers of cities and tourist areas.

CONCLUSION
Prevent environmental pollution and environmental protection and clean-up, particularly in Public areas and tourist attractions counts as a main dilemma. Since designed system has performances like receiving dry and separated waste and recycling materials, smart reaction in the form of speaking voice message and awarding a gift to establish its culture and to increase contributions of people in recycling in the origin, compacting dry waste to increase holding volume, capability of planning about volume of received waste, possibility of remote control, therefore, based upon these advantages, this system can be installed in public and tourism places as a valuable system which can be replaced with current containers in cities, provided that, it succeed and come to mass production .development of this system is an important step on environmental protection, preventing environmental damage and promote participation in environmental beautification and clean-up.

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