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Design of an Automatic Postal Service System

by
Chia-Chuan Lin
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Approvals

Chief Advisor: Doug Cleminshaw

Date _97 DEC 12_

Associate Advisor: Craig McArt

Date _12/9/97_

Associate Advisor: Kim Sherman

Date _12·11·97_

Chairperson: Charles F. Lewis

Date _12-18-97_

I, *Chia-Chuan Lin* , prefer to be contacted each time a request for production is made. I can be reached at the following address:

63-2 Chu-Kuang Rd.

Panchiao, Taipei, Taiwan 220

LXC1766@rit.edu

Signature

Date _12.12.1997_

To

my dear parents

who always support me emotionally and financially.

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LIST OF ILLUSTRATIONS

LIST OF ABBREVIATIONS

AFCS	Advanced Facer Canceler System
AFSM	Automated Flats Sorting Machine
AMPO	Automatic Multifunction Post Office
ATM	Automated Teller Machine
BCS	Bar Code Sorter
CAP	Corporate Automation Plan
CFS	Computerized Forwarding System
COD	Collect on Delivery
CRT	Cathode Ray Tube
CSBCS	Carrier Sequence Bar Code Sorter
DBCS	Delivery Bar Code Sorter
EMS	Express Mail Service
EMSS	Electronic Mail Service System
FedEx	Federal Express
FMBCR	Flat Mail Bar Code Reader
FSM	Flat Sorting Machine
IBRS	International Business Reply Service
IMC	Image Capture Unit
INTELPOST	International Electronic Post
IPA	International Priority Mail
IRT	Integrated Retail Terminal

ISAL	International Surface Air Lift
MPBCS	Mail Processing Bar Code Sorter
MLOCR	Multiline Optical Character Reader
MPFSM	Multi-Position Flat Sorting Machine
MPLSM	Multi-Position Letter Sorting Machine
OCR	Optical Character Reader
OSS	Output SubSystem
PBCS	Package Bar Code Sorting System
PBSM	Postal Booklet and Stamp Machine
PCM	Postal Commodity Machine
POSTNET	Postal Numeric Encoding Technique
PVI	Postage Validation Imprinter
RBCS	Remote Bar Coding System
RCR	Remote Computer Reader
SBCS	Sack Bar Code Scanner
SLOCR	Single Line Optical Character Reader
SPBS	Small Parcel and Bundle Sorter
SPLSM	Single Position Letter Sorting Machine
SSPC	Self Service Postal Center
UPS	United Parcel Service
USPS	United States Postal Service
WRU	Weighing and Rating Unit
ZIP	Zone Improvement Program
ZIP+4	Zone Improvement Program (plus sector / segment)

GLOSSARY

Bar Code   Series of vertical bars and half bars representing the ZIP Code on a mailpiece.

Flat   A piece of mail which exceeds the dimension for letter-size mail (11-1/2" long, 6-1/8" high, 1/4" thick) but does not exceed the maximum dimensions for flats (15" long, 12" high, 3/4" thick). A flat may be unwrapped, paper-wrapped, sleeve-wrapped, or envelope.

Keying   Method of inputting information to direct a mailpiece towards a destination. Used on the Multi-Position Letter Sorting Machine (MPLSM), Small Parcel and Bundle Sorter (SPBS), and Remote Bar Coding System.

Parcel   Mail Which Exceeds the maximum dimensions for flat-size mail.

Presort   Form of mail preparation in which the mailer groups pieces in a mailing by carrier route or carrier walk sequence or other USPS-recommended separations in order to bypass certain postal operations and result in saving for the postal customer as well as the USPS.

Scheme   Systematic plan for the distribution of mail to its destination.

Sort Scheme   Computer program that tells automated equipment how the mail is to be sorted.

Stack / Bin / Pocket   Separation on the sweepside of a lettersorting, or similar mechanized or automated mail distribution equipment.

Sweeper   An employee who removes mail from a machine and places it into trays and/or carts for dispatching.

Sweepside   That side of the machine where the mail ends up after being processed by the equipment.

Throughout   The rate at which a machine processes mail, usually designated in pieces per hour.

Two-Pass   Method used in automation (Delivery Bar Code Sorter-DBCS-for example) to sort mail to sector segment or carrier walk sequence level.

CHAPTER I
INTRODUCTION

PREFACE

The postal system is the most important medium that I use to get in touch with my family and friends besides the very-very-expensive telephone system. After dealing with the post office for quite some time, I found there are many shortcomings in the Postal Service such as inconvenient office hours, location, and long waiting time. Many people who use the service have also felt the same way. As an industrial designer and user, I believe that I cannot just observe, but have to do something to improve it. Therefore, I chose the postal service system as the subject of my thesis.

BACKGROUND AND ISSUES

As telecommunication technology continues to develop, more people are using new electronic communication media such as fax or E-mail to replace the traditional mail system. However, the delivery of traditional mail is still very necessary and important in our lives. Therefore, how to ameliorate this postal system, and improve its service quality becomes a very significant matter.

The United States Postal Service has undergone a huge transformation that began with Postal Reorganization in 1970. Since that foundation for the future was laid 27

years ago, the transformation has continued[1]. Today, the Postal Service is still facing some challenges and bottlenecks. The market is changing fast. Customers demand higher service quality. New telecommunication technology and competition are beginning to have a significant impact on postal service business, and it is likely these factors will continue to challenge the status quo.

New technologies such as Optical Character Reader (OCR) and Integrated Retail Terminal (IRT) are changing the way the post office does business. They improve service and productivity in all facets of its mail processing and retail operation. For example, first-class letter-size mail can be sorted manually at a rate of 800 pieces per work-hour. Mechanical sortation processes 1,850 pieces per work-hour, and fully automated technology can handle 10,000 pieces per work-hour.[2] New technology reduces human labor, time, and cost, and is usually more reliable than people. However, technological change and competition are related. The Postal Service provides a traditional, industrial-age service, the delivery of messages in hard-copy form, which is being challenged by various new information-age communication alternatives. These alternatives already have eroded the Postal Service's share of the communication market, and will continue to do so and grow in the future. It is important that the Postal Service responds and adapts to the new circumstances.

While it is clear that large private firms such as United Parcel Service (UPS) and Federal Express (FedEx) are strong competition. There are also other competitors challenging the Postal Service. There is a small, private mail carrier industry that operates today, subject to the constraints of the letter-mail monopoly. These private carriers deliver

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[1] U.S.P.S., Publication 150: "Automation and Retail Equipment". Washington, D.C.: U.S.P.S. 1992.

[2] Anthony M. Frank, "Efficiency, Yes; Balkanization, No", *Free the Mail: Ending The Postal Monopoly*, ed. Peter J. Ferrara. Washington, D.C. : C.A.T.O. Institute, 1990.

un-addressed advertising mail and periodicals that may be un-addressed or addressed. The small firms that make up the private mail delivery industry have been offering a variety of services in connection with the basic delivery service, many of which are not offered by the Postal Service. For example, private carriers offer selective coverage based on various demographic characteristics, guaranteed delivery on a specific day, coordination with printers, and Sunday and holiday delivery service. These are small, friendly, mom-and-pop operations. To the extent that economies of scale and scope are important in this market, the Postal Service should best utilize advantages that are unavailable to the private carriers. The fact that private carriers can compete suggests either higher costs or mispricing on the part of the Postal Service.

The U.S. Postal Service has raised postal rates in the past few years, but its service quality has shown no significant improvement. Along with high costs, consumers still suffer poor and deteriorating service quality. Mail delivery is slow, unreliable, and unpredictable. Mail is lost, damaged, or even discarded. Sale notices arrive after the sale. The post office does not provide

Figure 1 Inconvenient Office Hours

Figure 2 Inconvenient Location

Figure 3 Unfriendly Clerk

Figure 4 Long Waiting Time & Slow Service

enough information to the customers. Some clerks are not friendly or professional, post office hours and services are not convenient, etc. Customers continuously complain that the service quality does not reach their expectation.

These are some of the issues that the Postal Service must deal with now, or the situation will only degenerate as new technologies and competitors eat into the Postal Service's markets and undermine its financial viability.

PROPOSAL

Improved customer service, reasonable rates, and increased employee commitment are all parts of the United States Postal Service Strategic Plan for the next few years.[3] Only by improving mail collection, sortation, and delivery can these goals be met. They can be achieved with full deployment of an automated mail system. This plan for the future incorporates the pledge that *"virtually all mail will be barcoded by 1995."* [4] This aggressive pursuit of increased automation is one of many actions the U.S. Postal Service is undertaking to improve the quality of services provided to the public.

This design thesis proposes a new automatic customer service system for the United States Postal Service. By using an automated and computerized system, this new customer service system will provide customers a variety of convenient postal services and products, improve the postal service quality and customer satisfaction, and be efficient and profitable to the post office as well.

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[3] USPS, Publication 150: "Automation and Retail Equipment". Washington, D.C., USPS 1992.

[4] USPS, "Postal Engineering and Technology". Washington, D.C.: USPS, Postal Service Training & Development Institute 1974.

OBJECTIVE

To achieve customers' satisfaction and improve the postal service quality, the development of this system is proposed with the following goals :

A. Streamline the process -- To simplify the work procedure, increase the speed of processing mail, and utilize and maximize the current automatic mail processing system is the first priority.

B. Diverse services -- Other than parcel service and stamps, the Postal Service can also provide other services like mailgrams, money orders, passport applications, etc. Automating these services, providing customers alternate telecommunication media and convenient services, and allowing customers to choose different ways to pay the service fee, such as cash, credit card, or debit postage card, is the second goal.

C. Improve Services -- This postal service system is for consumer use. Convenience for customers is a very important consideration. To design an user friendly system so the general public can experience it easily and comfortably is the third objective, and it includes several sub-goals:

1. Easy and friendly interactive interface -- Since this is an automated system that is being proposed, the issue of user friendliness is a particularly critical one. Instead of a human clerk, the automatic system interacts with customers by an interface. The customers do not want to spend much time and effort learning how to operate the system, so it is necessary that the interface be designed as simple and easy to use as possible.

2. More accessible and convenient locations -- Decentralization of services, for customers who are unable or unwilling to travel to a post office is the second sub-goal.

3. Twenty-four hours service -- Post office hours and business hours are the same. For most people who have to work or go to school during this period, it is very inconvenient to use the post office. Extending the service hours and allowing customers to use the postal service more flexibly and freely is another goal.

4. Information about postal services and products -- Besides the mail processing information like mail weight, postage, and postmark date, it is beneficial that people be aware of services, products, and information available from the post office, and understand how to use them. Providing all kinds of easy-to-get and easy-to-understand information about the Postal Service is the final sub-goal.

CHAPTER II
BACKGROUND INFORMATION

In order to define the design problem and start the design process, the following materials and information need to be collected and examined thoroughly.

ABOUT THE POSTAL SERVICE

Current Postal Services and Products

There is more to the U.S. Postal Service than just stamps. Before developing a new automatic system which provides postal services, we have to know what kinds of postal products and service options the Postal Service offers:

Getting Mail to You

There are many ways that an individual customer may receive mail. The type of delivery you receive from the post office is determined by several factors, primarily physical location. Some of the common delivery methods are listed below. The new system will cooperate with these traditional delivery methods and develop more convenient and efficient ways to get mail to you.[5]

• City and Rural Delivery -- providing delivery from 30,000 post offices across the nation to the mailboxes located on the right-hand side of the carrier's line of travel.

• Central Point Delivery -- providing service to several addresses at one delivery point.

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[5] See Post Master or U.S. Postal Service., Publication 201: " *A Customer's Guide to Postal Services and Products*". Washington, D.C.: U.S.P.S. 1996, for more detail.

• Curbline Delivery -- providing service to customer boxes located at the edge of streets and roads.

• General Delivery -- mail can be picked up by the addressee on request at a retail window at post office.

• Special Delivery -- providing delivery to the addressee for Express Mail or big packages.

• Mail Forwarding -- free service for transferring mail to a new address.

Post Office Box and Caller Service -- getting mail from a private box at the post office.

Sending Mail -- Getting Mail to the Postal Service

When you have a traditional hard-copy-form letter or package to mail, usually you have to go to a post office. There are more than 40,000 post offices around the country where you can deposit your mail. There are also over 292,000 regular and 26,000 Express Mail collection boxes in most communities.[6]

If you are willing to pay a small fee, the post office will make a special trip to you to pick up prepaid Express Mail and Priority Mail packages.

If you live on a rural route, you can also buy stamps from your rural carrier to place on your letters. Put the letters in your roadside box, raise the flag, and the carrier will pick them up. You can mail parcels, send registered or certified mail, insure your packages, or buy other postal products or services through the rural carrier.

If you receive curbline delivery service from a city letter carrier, you can place postage-affixed mail in your mailbox, raise the flag, and it will be collected regardless of whether there is any mail to be delivered to you. In residential areas with door

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[6] U.S. Postal Service, Publication 201: "*A Consumer's Guide to Postal Services and Products*". Washington, D.C.: USPS. 1996.

delivery, letter carriers are not required to check the mailboxes for outgoing mail if there is no mail to be delivered.

The new system will develop a new convenient method for customers sending "real" mail or digital-form mail.

Sending Mail -- Choosing the Right Class of Mail

This new system provides customers with all USPS mail classes and products designed to meet different delivery purposes and needs. Since the new system will improve the efficiency of the current mail processing system, the delivery standard of all the classes will be re-evaluated. The current mail classes the USPS offers are:

• Express Mail -- the fastest service, with next day delivery by 12 noon or 3 p.m. to most destinations, delivered 365 days a year.

• Priority Mail -- faster delivery in 2 to 3 days to most destinations at the least expensive rate in the industry.

• First-Class Mail -- for sending letters, postcards, greeting cards, personal notes, checks, and money orders. Use Priority Mail for first-class items weighing more than 11 ounces.

• Periodicals -- for authorized publishers and registered news agents to mail publications at the Periodicals rates.

• Standard Mail (A) -- used primarily by retailers, cataloguers, and other advertisers to promote their products and services. The public use single-piece rates for certain items -- books and printed matter, merchandise, and plants -- weighing less than 1 pound.

• Standard Mail (B) (Parcels) -- for mailing certain items -- books, catalogs, other printed matter, and parcels -- weighing 1 pound or more. The delivery goal for parcel delivery is 2 to 9 days, depending on distances.

• Parcels and Publications Sent to Military Bases -- mail is flown to a military mail dispatch center where it is sent on a space available basis overseas by air transportation.

• International Electronic Post (INTELPOST) -- an international facsimile message service available between the U.S. and about 50 foreign countries. A black and white image of the document is printed and delivered in the destination country.

• International Mail -- airmail (faster) and surface mail (cheaper) to almost all foreign countries in various ways :

•Express Mail International Service (EMS)	•Post Cards and Postal Cards
•International Priority Mail (IPA)	•Printed Matter
•International Surface Air Lift (ISAL)	•Matter for the Blind
•Valuepost/Canada	•Small Packets
•Bulk Letter Service to Canada	•Parcel Post
•Aerogrammes	•Direct Sacks of Printed Matter (M-Bags)
•Letters, and Letter Packages	

Special Mailing Service

In addition to standard delivery service, the U.S. Postal Service offers some other mailing services for special needs to the customers. Customer used to purchase these special services with an additional fee. With the new system, some special service will be automatically included in the process, like receipt, mailing proof, mailing record, and etc., and the other services can be purchased when sending the mail.

• Certificate of Mail -- is a receipt showing evidence of mailing.

• Certified Mail -- provides proof of delivery of mail.

• Collect on Delivery (COD) -- is used when the mailer wants to collect for merchandise and/or postage when it is delivered.

• Insurance -- the amount of insurance coverage for loss will be the actual value, less depreciation.

• Merchandise Return Service -- allows permit holders to pay the postage and fees for merchandise returned to them.

• Recorded Delivery -- is a service if you want to receive a record of mailing on international mail. and want to know that a record of delivery exists, in the event an inquiry is necessary.

• Registered Mail -- provides added protection for valuable and important mail. Registered articles are placed under tight security from the point of mailing to the point of delivery.

• Restricted Delivery -- the sender's mail is delivered only to a specific addressee or to someone authorized in writing to receive mail for the addressee.

• Return Receipt -- is the sender's proof of delivery that shows who signed for the item and the date that it was delivered.

• Return Receipt for Merchandise -- provides a mailing receipt, return receipt, and record of delivery.

• Special Delivery -- provides for daily delivery even on Sunday and holidays, as well as delivery beyond normal delivery hours.

• Special Handling -- is required for parcels whose unusual contents require additional care in transit and handling except those sent by first-class Mail.

• Special Service Endorsements -- endorsements for special service should be placed above the delivery address and to the right of the return address on all articles.

Other Benefiting Customer Services

Besides the mailing service, the U.S. Postal Service also provides some convenient post-related services to its customers. The new system will automate these services, and also design more products to promote the mail system:

•Cash Receipt

•Payment by Credit Cards, Debit Cards and Personal Checks

•International Business Reply Service(IBRS)

•Easy Stamp Services :
  Stamps at retail establishments
  Stamps by mail
  Stamps by phone
  Stamps by computer
  Self-service vending equipment

•Mailgram

•Money Orders and International Postal Money Orders

•Information on the Internet

•International Reply Coupons

•Passport Applications

•Postage Meters

•Stamp Collecting

•Boxes and Packaging Materials

Consumer Services

Just like any service business, the USPS has a customer service department which handles all the customers' problems and complaints. If you had questions about : claims, complaints and suggestions, inquiries, mail fraud / mail order problems, pornographic and undesirable mail, refunds, unsolicited merchandise, etc., you can contact your local post office in person or by phone. The new system will provide an interactive customer hot-line to communicate with people who have postal problems.

Development of Postal Automation

To develop a future automatic postal system, we have to know what the present postal automation status is. By studying the development of postal automation, we can understand the technology used in postal automation, know what kinds of equipment are needed now, and predict the future trend of postal automation.

The first postal automation was undertaken in the late 1960's. The Post Office Department began an accelerated mechanization program consisting of semi-automatic equipment such as the Multi-Position Letter Sorting Machine, the Single Position Letter Sorting Machine, and the Facer Canceler. In November 1965, the Post Office Department put an Optical Character Reader (OCR) into service in the Detroit Post Office. This first-generation machine read the city/state/ZIP Code line of typed addresses to sort letters, but each subsequent handling of the letter required that the address be read again. These mechanization efforts realized significant increases in gross productivity.

By the mid 1970's, however, the postal mechanization had reached a point of diminishing returns and it was clear that cheaper, more efficient methods and equipment were needed if the Postal Service was to offset the rising costs associated with the growing mail volume. To reduce the amount of mail piece handling, the Postal Service began to develop an expanded ZIP Code in 1978. The Postal Service management has recognized that continued productivity improvements in mail processing operations are dependent upon the deployment of up-to-date equipment. Since then, the Postal Service has been on a continuing course to update existing equipment and introduce new equipment to improve service and productivity in all facets of its mail processing and retail operations.

By the early 1980's, the Postal Service entered the age of automation by installing the first computer-driven production Single Line Optical Character Readers

and Bar Code Sorters.[7] A letter needed to be read only once at the originating office by an OCR, which printed a barcode on the envelope. At the destination office, a less expensive barcode sorter sorted the mail by reading its barcode. Following the introduction of the Zip+4 code in 1983, the first delivery phase of the new OCR channel sorters and BCSs was completed by mid 1984.[8]

Today, a new generation of equipment and the modification of existing equipment are quickly changing the way mail flows and improving productivity. Equipment such as Multiline Optical Character Readers, Wide Area Bar Code Readers, Advanced Facer Canceler System, and the Remote Bar Coding System are just a few examples. This new generation of automated letter mail processing equipment represents the latest advances in technology and has been deployed in pursuit of continued productivity improvements.

In addition to letter mail processing, the Postal Service is making great strides in automating the processing of flats, parcels, and mail forwarding system. The Postal Service also accelerates the deployment of lobby automation equipment that can better serve customers. The new systems will not only reduce a customer queuing time, but will also provide a much improved customer-oriented system. The backbone of this effort is the IRT (Integrated Retail Terminal). Retail automation is also advancing in the field of vending equipment. Much of the existing equipment is currently being replaced with state-of-the-art technology including digital displays, paper money validation, and the use of ATMs (Automated Teller Machines) for purchasing commodities. These and

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[7] U.S. Postal Service, History of the United States Postal Service 1775 - 1993. "*The Age of Automation* " Washington, D.C.: USPS. 1993.

[8] U.S. Postal Service, Publication 150: "*Automation and Retail Equipment*" Washington, D.C.: USPS. 1992.

many other developments in technology will soon be increasing the efficiency of the mail service.

Current Postal Automation and Equipment

The following tables list some of the USPS automatic equipment[9] whose technologies are currently commercially available, and would also be applied on the concept development of the New Mail Processing System or the Customers' Service Terminal.

Table 1. **Mail Preparation Equipment**

Equipment	Performance	Deployment
Advanced Facer Canceler System (AFCS)	Minimum throughput of 32,000 pieces per hour. One operator required.	622 units were deployed by spring 1994.

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[9] For more detail about these and all the other equipment, see USPS, Publication 150: "Automation and Retail Equipment" or USPS, Training & Development Department, "Automation System and Programs". Washington, D.C.: USPS, William F. Bolger Management Academy Operations Training Branch 1991

Table 2. **Letter Mail Equipment**

Equipment	Performance	Deployment
Multiline Optical Character Reader (MLOCR)	30,000 to 37,000 pieces per hour depending on the mail type. One operator and one "sweeper" required.	831 deployed by the fall of 1992.
Mail Processing Bar Code Sorter (MPBCS)	Between 32,000 and 37,000 pieces per hour depending upon the mail type. Two operators required.	Over 1,000 MPBCSs were deployed by fall 1991.
Delivery Bar Code Sorter (DBCS)	34,000 pieces per hour throughput with two operators required.	1,228 units were deployed by spring 1993. Additional 5,600 units were deployed by 1995.

Table 3. **Mail Forwarding System**

Equipment	Performance	Deployment
Computerized Forwarding System II (CFS II)	This piece of equipment is operator-paced with a target productivity of at least 900 pieces per hour.	Deployment of 224 systems consisting of 1,030 mechanized terminals and 1,225 non-mechanized terminals was completed in the fall of 1990.

Table 4. **Flat Mail Equipment**

Equipment	Performance	Deployment
Automated Flats Sorting Machine (AFSM)	Approximately 21,000 flats per hour in the bar code mode with a capability of 28,000 pieces per hour.	Deployment for the AFSM started in Postal Fiscal Year 1993.

Table 5. Parcel / Package / Sack Equipment

Equipment	Performance	Deployment
Sack Bar Code Label Scanner System	The Sack Bar Code Scanner improves the quality as well as the throughput of sack sorting in the BMCs.	The deployment of 362 scanner systems to the 21 BMCs and the Topeka Materiel Distribution Center was completed in Dec. 1990
Package Bar Code Sorting (PBCS) System	Productivity for the PBCS system is estimated to be 2,300 pieces per hour utilizing one operator per induction station.	Deployment began in the summer of 1992.

Table 6. Window Automation and Retail Vending

Equipment	Deployment
Integrated Retail Terminal (IRT)	58,800 units currently deployed nationally to the USPS's window offices.
Postage Validation Imprinter (PVI)	60,000 units to be deployed nationally between 1992 and 1993.
Integrated Terminal Network (Hardware Disk / LAN)	9,000 retail offices nationally receive IRT Network Hard Disk / LAN.
Postal Booklet and Stamp Machine (PBSM) Model PBSM-624	8,500 units were deployed nationally between 1993-1994.
Small Stamp Machine PS-53D	5,000 PS-53Ds have been deployed. Additional units will be procured as necessary.
Weighing and Rating Unit (WRU)	1,600 units were deployed between early December 1990 and late March 1991 for installation in Postal Convenience Center, formerly known as Self-Service Postal Centers (SSPCs).

Future Programs of the Postal Service

After studying the development of postal automation, we knew that the future of Postal Service automation would go well beyond bar coding the mail by 1995. All areas of the USPS should be affected and all play an important role in making the mail service more efficient and more reliable. More advanced equipment to better serve customers will continue to be integrated into the postal lobbies and self-service units. Improvements will include more user-friendly systems such as vending machines or automatic service kiosk. Equipment will be more reliable and serviceable. New systems and equipment will be linked to accumulate statistical data for ease of management. Postal commodities will be purchasable through Automated Teller Machines (ATMs) in conveniently located areas. New technology will continue to be introduced into postal equipment through programs to enhance the efficiency of these systems. Improvements to existing equipment will continue as new technology allows advancement to occur.

The Postal Service has introduced new equipment to more efficiently sort and distribute mail within mail processing centers. However, the methods employed to move mail from one operation to the next is still very labor intensive. Within the next few years much effort will be devoted to the development, integration, and deployment of flexible material staging and handling systems to transport mail throughout the postal distribution network. A fully integrated and standardized approach would reduce the increasing allied labor needed to move mail from one operation to the next. As the market for on-line service or other electronic forms of communication expand so fast, the Postal Service will respond and adapt to these new technologies and circumstances.

Customer Service Problems

Using focus groups and other means of getting customer input[11], the United States Postal Service has identified several customer service problem areas which could be solved by developing a new automatic system:

Long waiting times at post office counters -- Customers across the country identified waiting time in retail lobbies as an issue they care about. The services are not very efficient, and there are always too many customers with only few windows opened.

Inconvenient service hours -- One major reason for long waiting time in the post office is that most people use the service at only some certain time like lunch break or the afternoon because they have to work. Customers feel that they should be able to use the service at their convenience.

Poor access to postal information -- Postal customers would be surprised at how much extra money they pay because they have chosen the wrong service.

Poor service -- Even though there are just few of them, somehow it is always your luck to meet one: they are cold faces, dead voices, rude language, unfriendly attitudes, and sometimes they just don't know what they are doing!

Limited locations -- The post office may be too far; there may be too much traffic on the road; there may be no parking space, or the customers may be just being lazy; anyway, customers wish to have their "mail thing" done while they are working, banking, or shopping.

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[11] U.S. Postal Service, *U.S. Postal Service Customer Survey.* Washington, D.C.:USPS, 1993.

Ignoring the needs of business customers -- Although the volume and revenue of business mail accounts for bulk of the Postal Service's business, the U.S. Postal Service is not very responsive to different business needs and purposes.

Lack of postal safety -- In this chaotic world, customers worry about not only the safety of mail, but also the safety of the senders and the receivers from bombs, mail fraud, thievery, threats, etc.

Important Postal Automation Facts

The following postal facts[12] show the demand and trend for the new automatic postal service system.

• The USPS has committed about $4.3 billion since 1987 for equipment to automate letter mail processing and delivery point sequencing operations.

• Since 1990, more than 11,500 optical readers, delivery barcode sorters and other pieces of equipment have been installed at post facilities throughout the country.

• Total letter automation investment by the end of 1997 is expected to be about $5 billion. The goal is to automate the processing of all letter mail by 1998.

• Today's USPS delivers 115% more mail to over 50 million more customers with 33 percent more employees than it did as the Post Office Department in 1970.

• The USPS is working with other organizations to evaluate services such as electronic certification, authentication, encryption, "electronic postmarks," and other value-added services.

• Business and Courtesy Reply Card scanning is a service which will read customer information from reply cards at the originating post office. The data will be

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[12] U.S. Postal Service, *Postal Facts*. Washington, D.C.: USPS, 1997

electronically transmitted to the business, enabling information processing within hours.

• As part of Vice President Al Gore's call to "reinvent government," the USPS is working with federal, state, and local entities to develop an interactive "citizens kiosk" that provides a single point of contact for government service. The kiosks will ensure fast, easy, and universal access for all people.

• The USPS has begun the implementation of Classification Reform, the first major realignment of mail groupings since 1879. It is a market-based structure providing increased economic incentives for mailers who prepare their mail for the most efficient, automation compatible handling.

• Forecasts indicate the USPS revenue will reach $62.1 billion on a volume of 212.3 billion pieces of mail in 2001.

• With another year to go for full implementation of automated equipment, the USPS has saved an estimated $6.5 billion in automation efficiencies since 1990.

TECHNOLOGY IN TELECOMMUNICATION

There are literally dozens of telecommunications systems which could impact upon the volume of first-class mail in the future. In many cases they represent competing types of systems, but they can also be utilized in the expanding mail service business. To simplify the description of these various media, they are grouped under several generic types in terms of input and output as presented in table 7.

Table 7. Types of Telecommunication Systems

Type	Senses	Example
Voice input, voice output	Sound	Telephone
Voice input, displayed output / keyed input, voice output	Sight / Sound	TTY Telephone
Terminal-to-terminal, alphanumeric input / output	Sight, Sound	Telex Internet
Scanned input / paper copy, image output	Sight	Facsimile
Multiform input (voice, paper copy, or computer-generated) / paper copy output	Sight	Mailgram
Multimedia input (voice, video, text) / soft image output	Sight, Sound	Cable TV
Terminal-to-terminal, keyed input / displayed output	Sight	CRT Terminals
Continuously scanned input / soft image output	Sight, Sound	Videotelephone
Mixed systems	Sight, Sound	Teleprocessing

The installation and use of private-message switched networks became a very important part of the world telecommunications with the development of a large number of alphanumeric terminals. Development of these terminals, mostly personal computers, is accelerating as a result of improvements in hardware and transmission systems. Their capability of transmitting a message in a few seconds, flexibility of using multimedia, and their concomitant lower-priced transmission services and digital transmission facilities, are all contributing to the growth of this service.

The use of display terminals, mostly Cable TV, continues to expand, and a new generation of terminal products is presently being utilized. The primary characteristic of the new products is the incorporation of internal data-processing capabilities, which permit more operations to be performed on data at remote locations and allow more flexible combinations of devices to be used on the same network.

After studying the feasibility of transmitting and processing mail electronically, the U.S. Postal Service had conducted laboratory demonstrations of a prototype Electronic Message Service System (EMSS) at its research facility. Messages would be transmitted electronically from one point to another, using commercially available equipment. At the same time, postal technicians would observe the performance and compatibility of two pieces of developmental EMSS equipment: a scanner capable of reading a conventional letter, converting its contents into digital form, and replaying the data to a predetermined point for electronic transmission to its destination, and a printing and paper-handling system which can receive and reconvert digital data into printed form, fold, and insert the pages into addressed envelopes.

CHAPTER III
DESIGN   DEVELOPMENT

After studying the materials that had been collected, I established the design goals that would meet the customers' needs and expectations and the requirements of the Postal Service. Then I selected criteria to meet the design goals. I developed concepts and possible solutions through sketches and diagrams, and evaluated them based on the design criteria. I reported my progress weekly and scheduled committee meeting every three weeks to present my development.

CONCEPT DEVELOPMENT AND EVALUATION

Selecting Criteria

The goals of this project are very clear: to allow customers to use the Postal Service easily and conveniently, and to improve the postal system by utilizing the new technology. It could be cataloged into two parts: the design of the postal processing system, and the design of the interactive customers terminal. To accomplish the goals, the development of design concepts would be examined by criteria selected blow:

•Aesthetics -- Is the design stylish or objectively aesthetically pleasing? Is it a form that won't pose any unpleasant association?

•Ease of Use -- Is the system easily used by an un-experienced user? Is the interface or instruction easily understood and followed?

•Economics -- Is the concept economically feasible? Is the technology used in the concept commercially available and reliable?

•Efficient Work Process -- Does the concept reduce the work process and time? Does the work process flow smoothly and orderly?

•Environmental Orientation -- Is the product easily installed in the intended environment? Do the size, form, and color fit the surroundings?

•Environmentally Friendly -- Is the product made of recyclable materials? Does the concept raise any negative impact in the environment?

•Flexibility of Various Functions -- Does the concept provide the user with a variety of functions and means to communicate with others?

•Identifiable -- Is the appearance easily recognized as a postal equipment? Is the interface easily related to its function?

•Mechanical Performance -- Is the mechanical interface functioning well?

•Safety -- Does the concept provide both users and mail a safe environment?

•Universal Design -- Is the product easily used by most people, including children, elder people, handicapped, etc.

Concept Development and Evaluation

The new postal system is developed based on the combination of electronic network and traditional postal carrier's delivery. The concept is that the decentralized terminal will perform some functions of the post office and presort mail when the mail is put into the terminal (mail box). Through the terminal, mail can also be sent electronically, and received by the receiver's private equipment or printed out by the destination post office and then delivered.

By combining different media systems, the mail can be in many forms: written, video image, voice recording, flat image, electronic file, etc. The addressee can receive not only a hard-copy-form mail of original or printout from the post office but can also receive all different forms of mail by a variety of telecommunication equipment such as

computers, fax machines, and even Cable TVs. Users can also rent an " electronic mail box" from the Postal Service, and receive their digital-form mail from any terminals by typing their account numbers and pin numbers. The concept is to allow easy use of the service by the majority of people who don't have private machines or people who are out of town. The development of the system is shown in figure 6-10.

The customers' terminal, which performs the functions is developed from three different directions. Each concept will be examined and evaluated against the criteria. One final design will be selected to build a full-size model:

Concept A -- One machine with multiple interfaces and functions

This concept is to provide the user with a "service column" or "desk" that offers various services to several people in the same time. Therefore, when one person is writing E-mail, the other people can still process their mail or fax. (see figure 11-16)

Evaluation: shorter waiting time, partly shared resources, single function interface, lack of privacy, easily confused functions, higher cost, more space required.

Concept B -- Various single function machines

The concept is to automate the existing self-service postal lobby and provide several services through a variety of automatic equipment. People can just pick the service they need with no need to wait. (see figure 17-19)

Evaluation: shorter waiting time, no shared resources, single function interface, more privacy, high cost, big space required, lack of flexibility.

Concept C -- One interface machine with multiple functions

This concept provides the user with the most flexibility of doing postal matters on one machine. They can choose as many postal services as they need from the interface of the "ATM", and don't need to move to another machine or place. (see sketch 20-30)

Evaluation: flexibility of services, shared resources, small space required, flexibility of installation, more privacy.

Figure 6 System Concept Development (Sketch 1)   29

MAIL SERVICE

RECEIVE

SEND
- MAIL INFORMATION
  - WEIGHT, SIZE
  - VAULE
  - ADDRESS
  - RATE
- MAIL PRODUCT
- SPECIAL SERVICE

PROCESSING
- PREBARCODE
- PRE CANCELER
- POST MARK

MAIL FOREWARDING

MAILGRAM FAX SERVICE

SEND
SCAN
- COLOR
- BLACK & WHITE
- SLIDES

ADDRESSEE'S COMPUTER
ADDRESSE'S FAX
WEB TV

POST OFFICE
PRINT OUT & DELIVERY

RECEIVE
- ON SCREEN
- PRINT OUT

STAMP

ORDER & DELIVERY
- COLLECTION
- USE

POSTAGE VALIDATION

RETAIL VENDING MACHINE

ELECTRONIC MAIL ELECTRONIC IMAGE

SEND
IN PUT
- MO
- DISK
- CD
- ZIP
- ....
- TYPING

TRANSMIT
- ADDRESSEE'S COMPUTER
- WEB. CABLE TV
- PRINT OUT & DELIVERY

RECEIVE
- ON SCREEN
- PRINT OUT

NAME
ACCOUNT NO.
PIN NO.

MONEY ORDER
- CREDIT CARD
- CHECK

MAIL ORDER

INQUIRIES
- ON LINE SERVICE
- CUSTOMER HOTLINE
- PUBLICATION

GREETING CARD
- BIRTHDAY
- ANNIVERSARY
- SPECIAL OCCASION
- DELIVER ON SPECIAL DAY

PRINT
OWN DESIGN

PASSPORT APPLICATION

Figure 7 System Concept Development (Sketch 2)

COMMUNITY CENTER
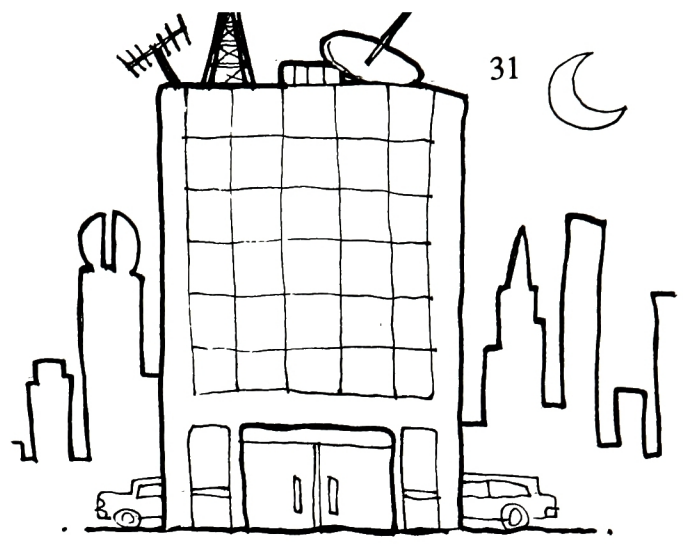
BUSINESS CENTER

DECENTRALIZATION

I came first

POST SERVICE

7-ELEVEN

ATM

CONVENIENT STORE

BUS

R.I.T

SCHOOL

MARKETPLACE
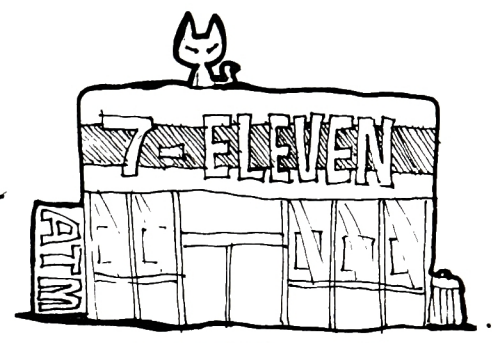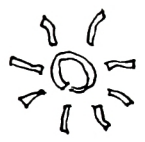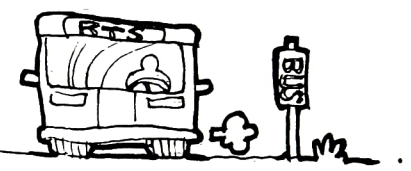
MALL & GROCERY STORE

Figure 8 System Concept Development (Sketch 3)

COMPUTER INPUT (CCD, DISK, ZIP...)

VIDEO, VOICE RECORDED TAPE

FAX MACHINE INPUT (SCAN)

TRADITIONAL MAIL INPUT

TRADITIONAL MAIL PROCESSING

POST OFFICE

PRINTED-OUT & DELIVERY

SENDING

YOU CAN RECEIVE YOUR MAIL BY COMPUTER

NETWORK, PHONE LINE.

RECEIVE FAX, OR MAIL PRINTED OUT FROM YOUR FAX MACHINE.

READ MAIL FROM THE SCREEN, OR FROM THE PRINT-OUT

POST OFFICE PRINTOUT SERVICE

USE POST-CARD TO OPEN YOUR "ELECTRONIC MAIL BOX"

YOU GOT A MAIL

RECEIVE MAIL FROM CABLE TV

Figure 9 System Concept Development (Sketch 4)
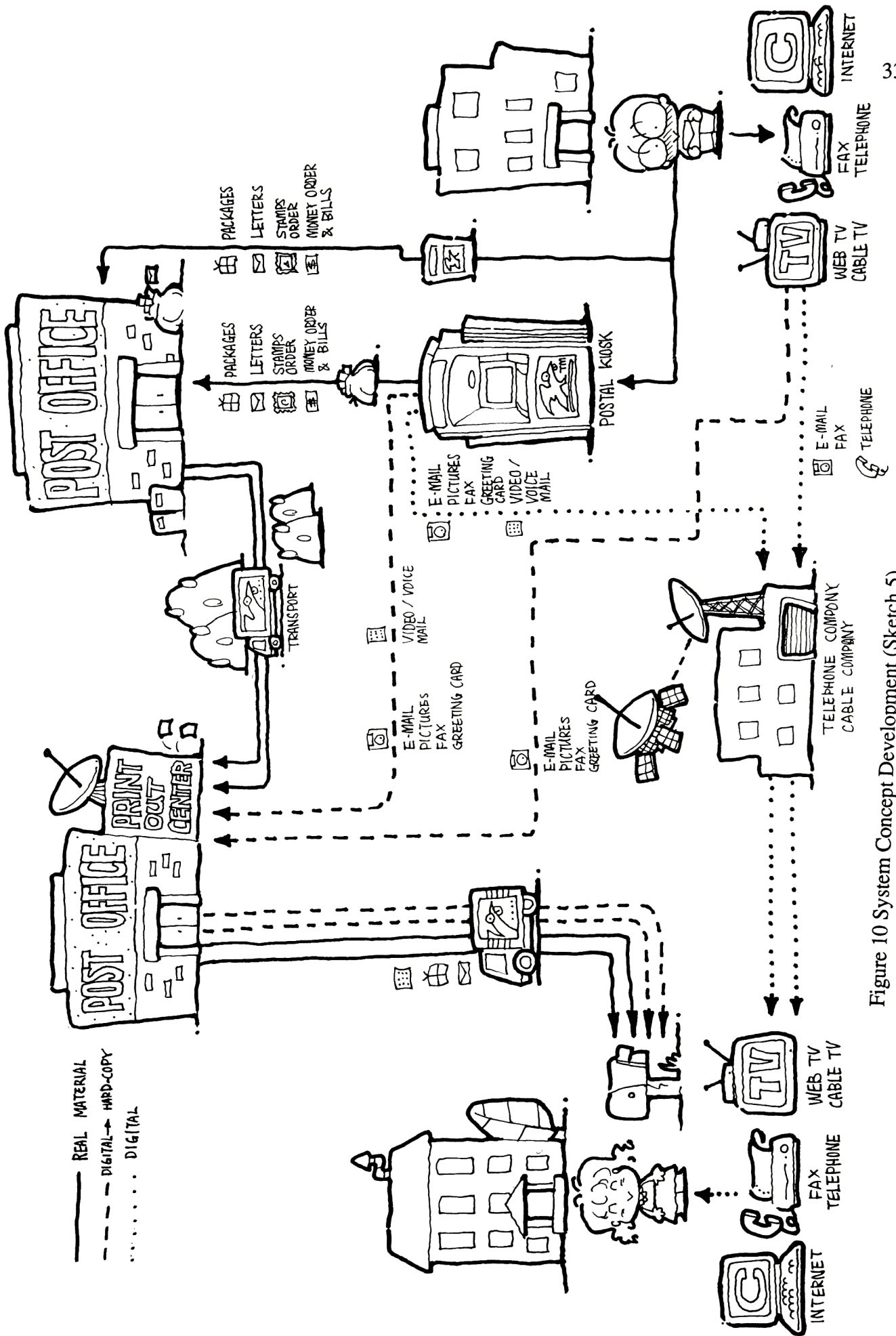
Figure 10 System Concept Development (Sketch 5)

MAIL SYSTEM TOUCH SCREEN INTERFACE

INFORMATION INTERACTIVE SCREEN

STAMPS VENDER MACHINE

CHANGES

MAIL & PACKAGE STORAGE SPACE
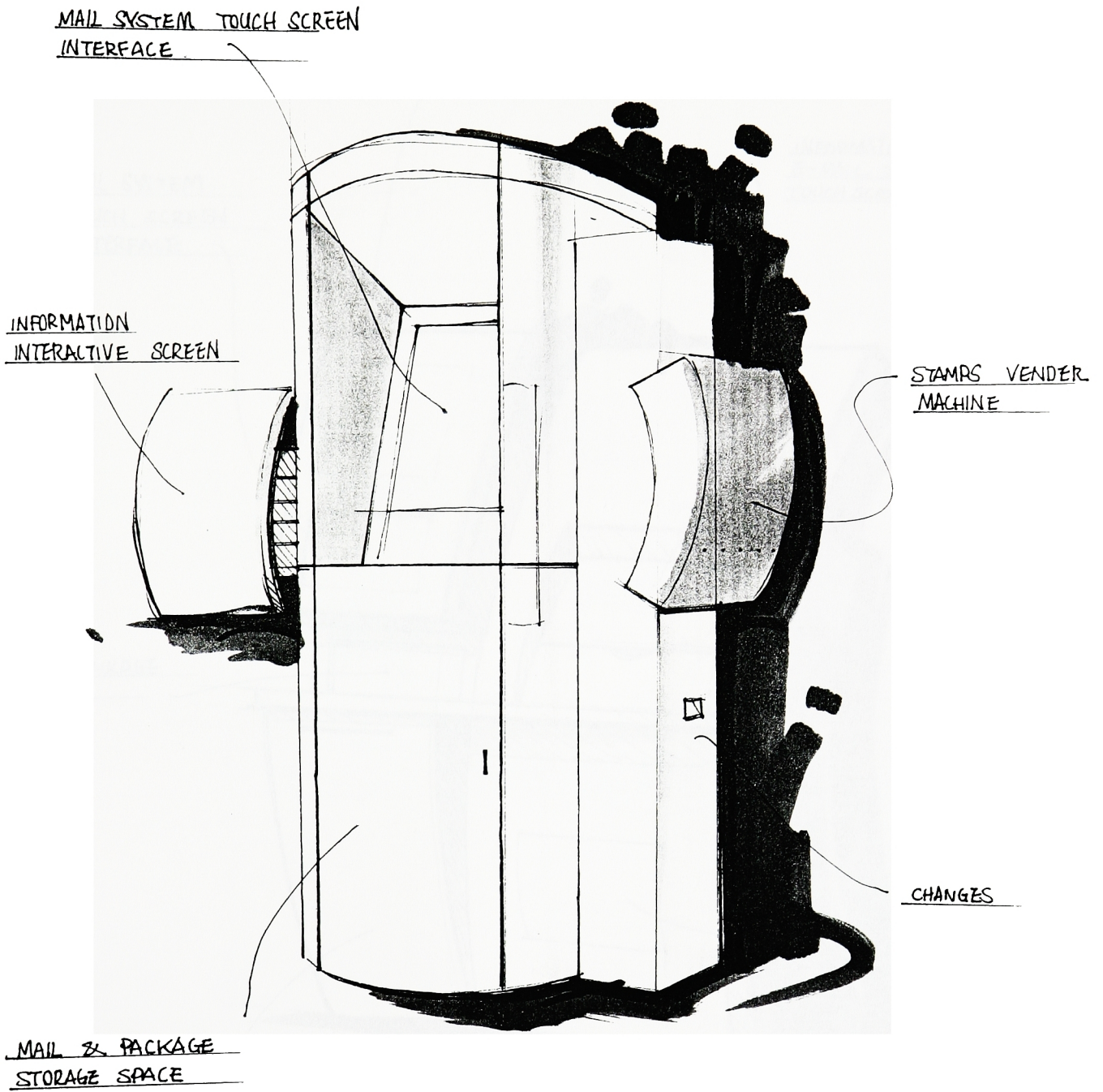
Figure 11 Terminal Development Concept A (Sketch 6)

POSTAL SERVICE ICON

MAIL SYSTEM
TOUCH SCREEN
INTERFACE

INFORMATION
E-MAIL SYSTEM
TOUCH SCREEN INTERFACE

MAIL & PACKAGE
ENTRY

POSTAL SERVICE
ICON

MAIL STORAGE SPACE
MAIL COLLECTING
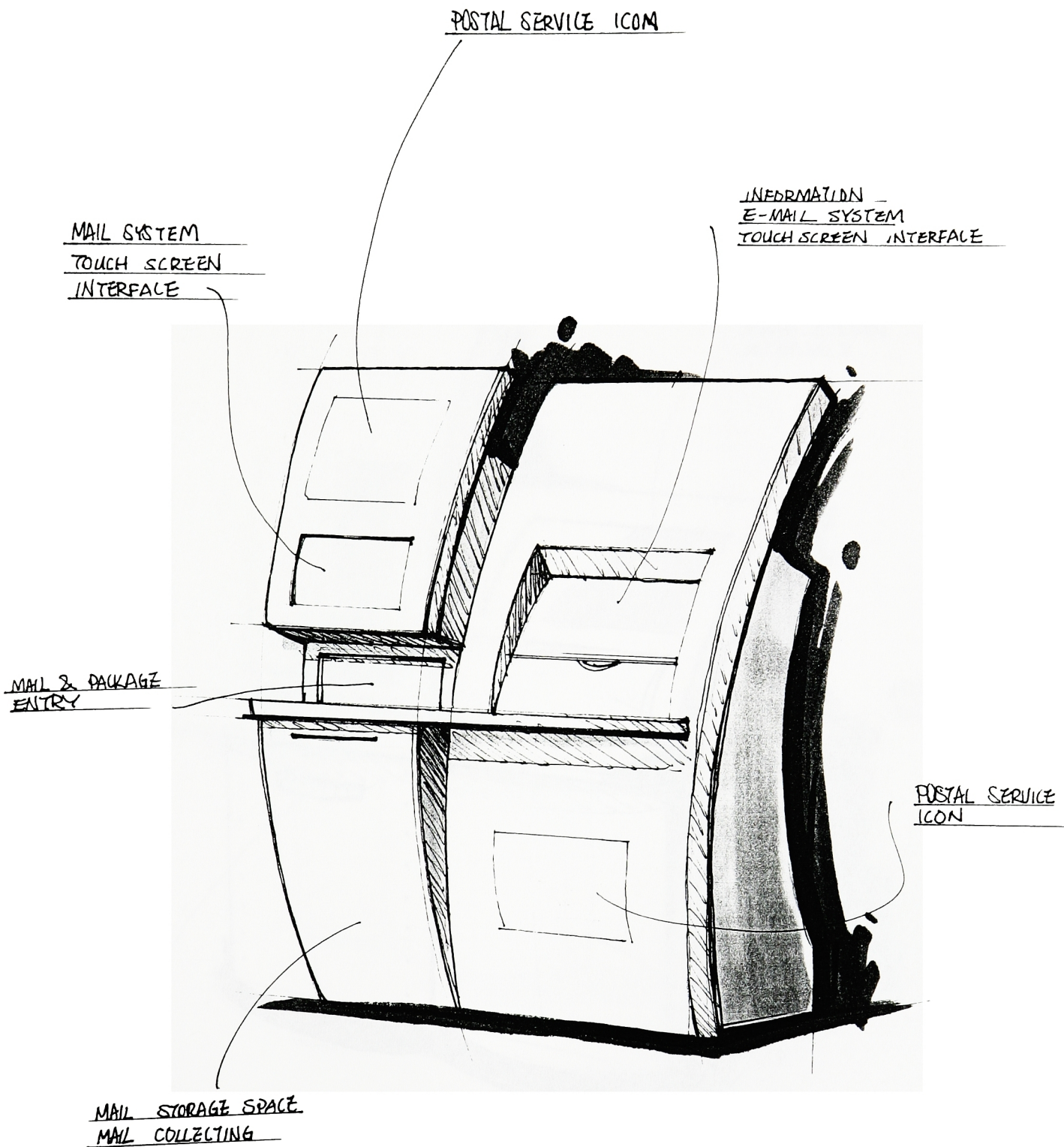
Figure 12 Terminal Development Concept A (Sketch 7)

INFORMATION
E-MAIL
VIDEO MAIL
INTERACTIVE SCREEN

POSTAL SERVICE
IDENTIFICATION

MAIL SYSTEM
TOUCH SCREEN
INTERFACE

KEYBOARD

MAIL & PACKAGE
ENTRY

PRINTOUT

MAIL & PACKAGE
STORAGE SPACE
& COLLECTING
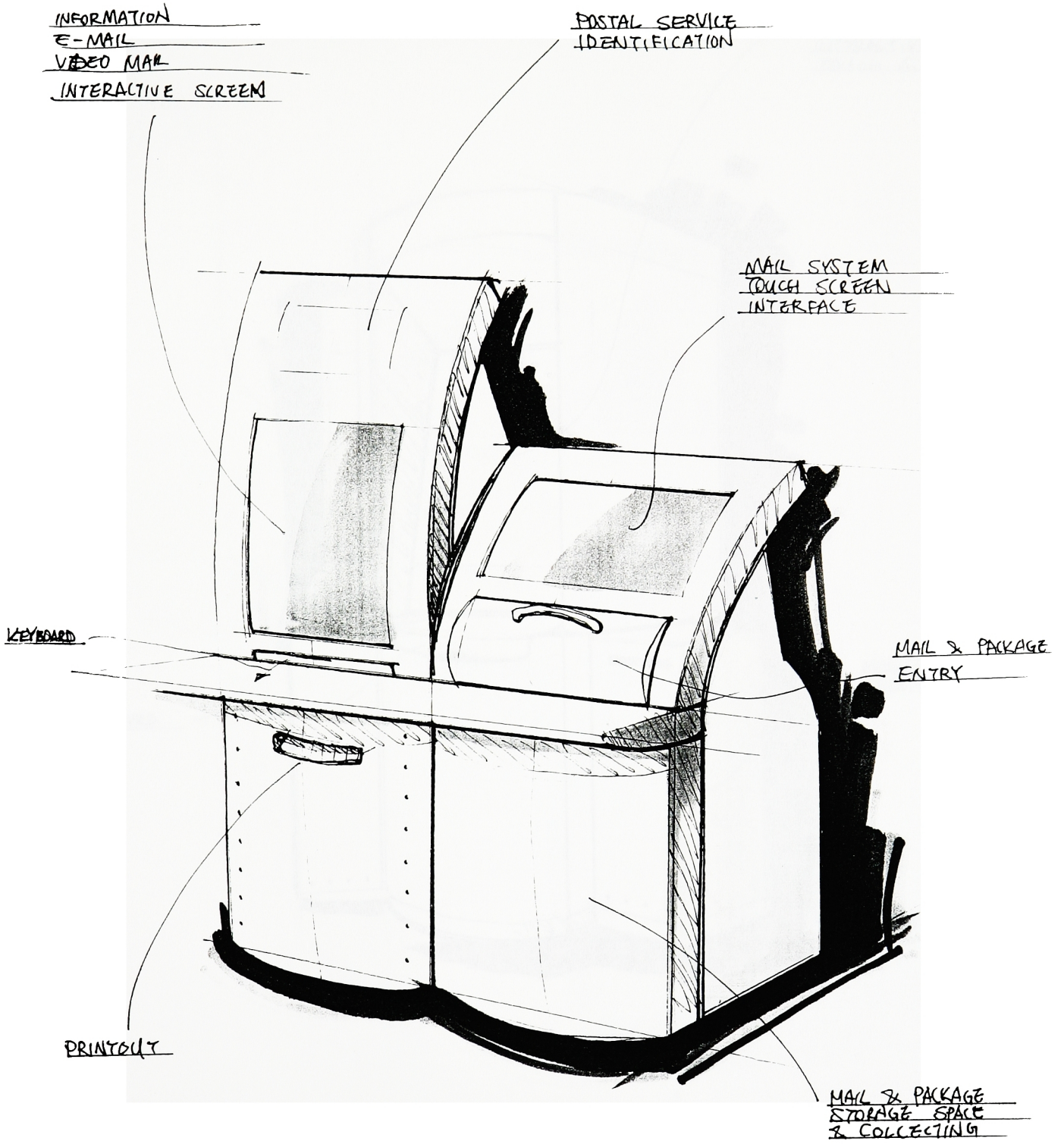
Figure 13 Terminal Development Concept A (Sketch 8)

E-MAIL , MAIL
INFORMATION
INTERACTIVE
TOUCH SCREEN

STAMS COLLECTION
VENDER
MACHINE

MAIL & PACKAGE
COLLECTING BOX

KEYBOARD
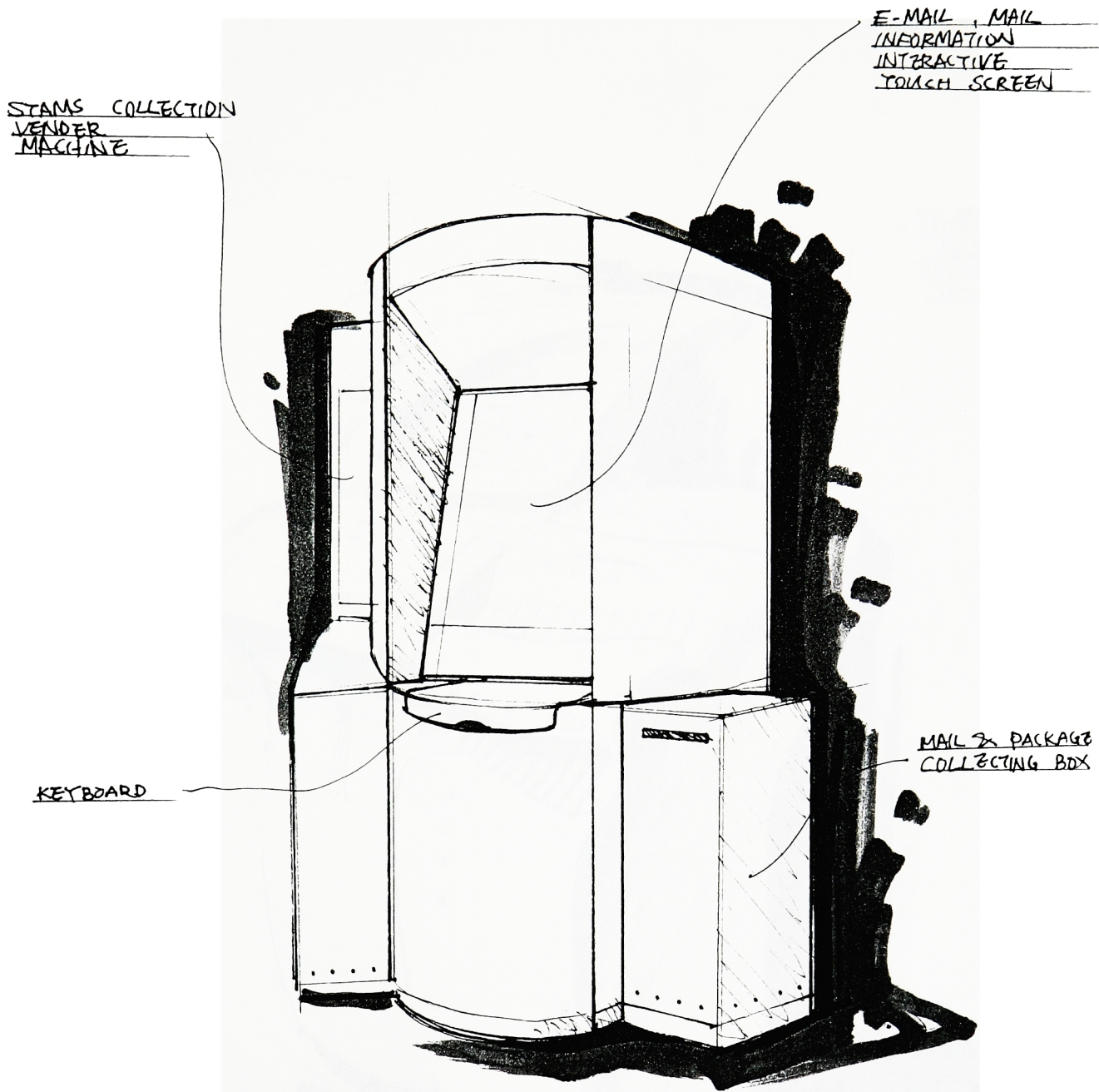
Figure 14 Terminal Development Concept A (Sketch 9)

SECURITY SYSTEM.
IMAGE TRANSMIT SYSTEM.
CAMERA.

TOUCH SCREEN
INTERFACE.

PAYMENT SYSTEM.
CREDIT CARD.
POSTAGE CARD
CASH.

MAIL & PACKAGE
SYSTEM.
·PRE - BAR CODE
- PRE· FALER CANCELER.
·SORTER SYSTEM.
-FORWARDING SYSTEM
MAIL & DELEVERY INFORMATION.

· ELECTRNIC MAIL
SYSTEM.
DISK. ZIP DRIVE
CD ROM.

FAX SYSTEM.

OPEN

Figure 15 Terminal Development Concept A(Sketch 10)

SECURITY SYSTEM
IMAGE TRANSMIT SYSTEM
CAMERA

TOUCH SCREEN
INTERFACE

ELECTRONIC MAIL SYSTEM

PAYMENT SYSTEM
CREDIT CARD, POSTAGE
CARD, CASH

LETTER & PACKAGE
SYSTEM

FAX SYSTEM
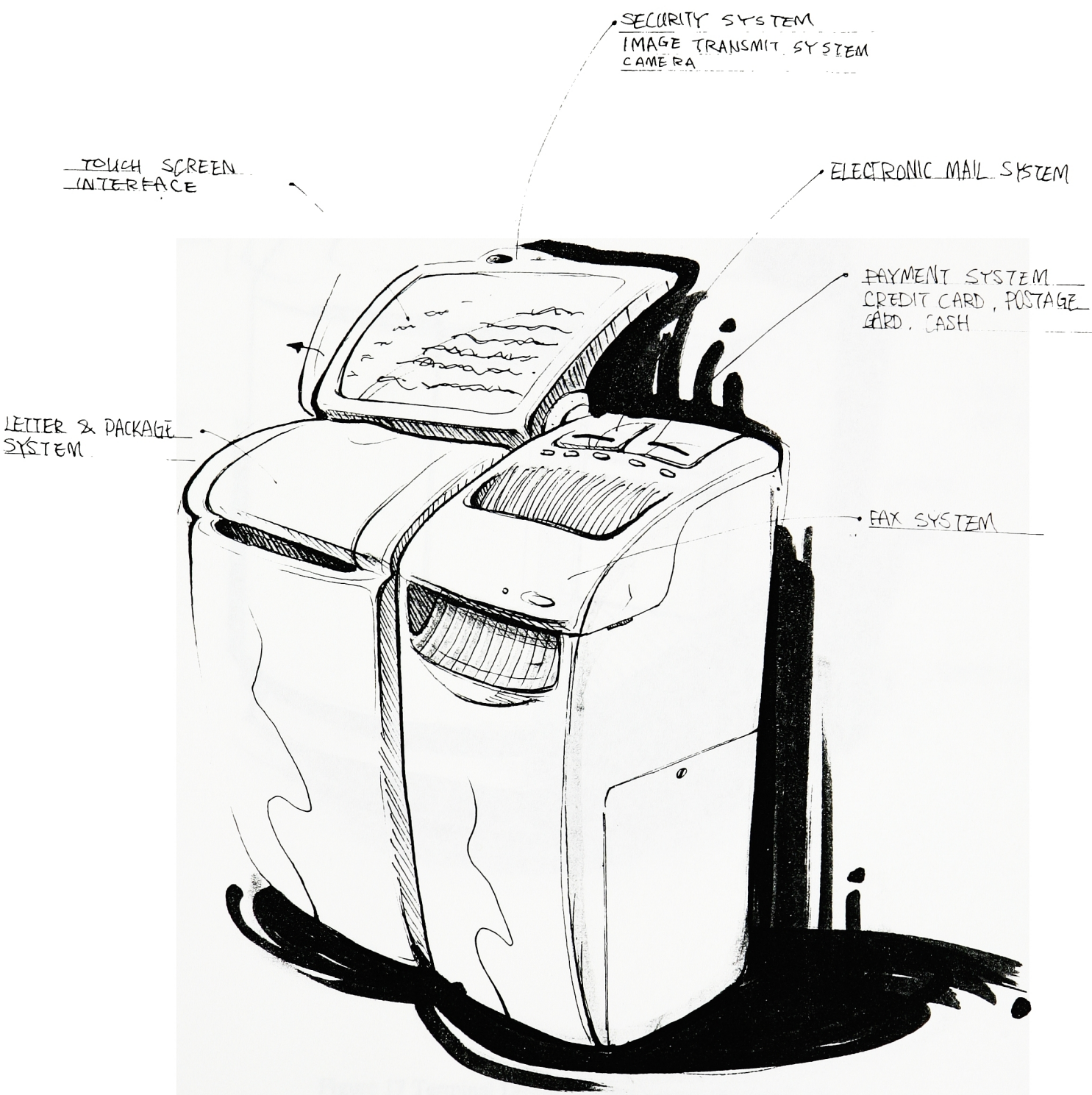
Figure 16 Terminal Development Concept A(Sketch 11)

TOUCH SCREEN INTERFACE

OPEN

POSTAL CARD ENTRY

CREDIT CARD, CASH ENTRY

CHANGE

RECEIPT

PRINTED OUT
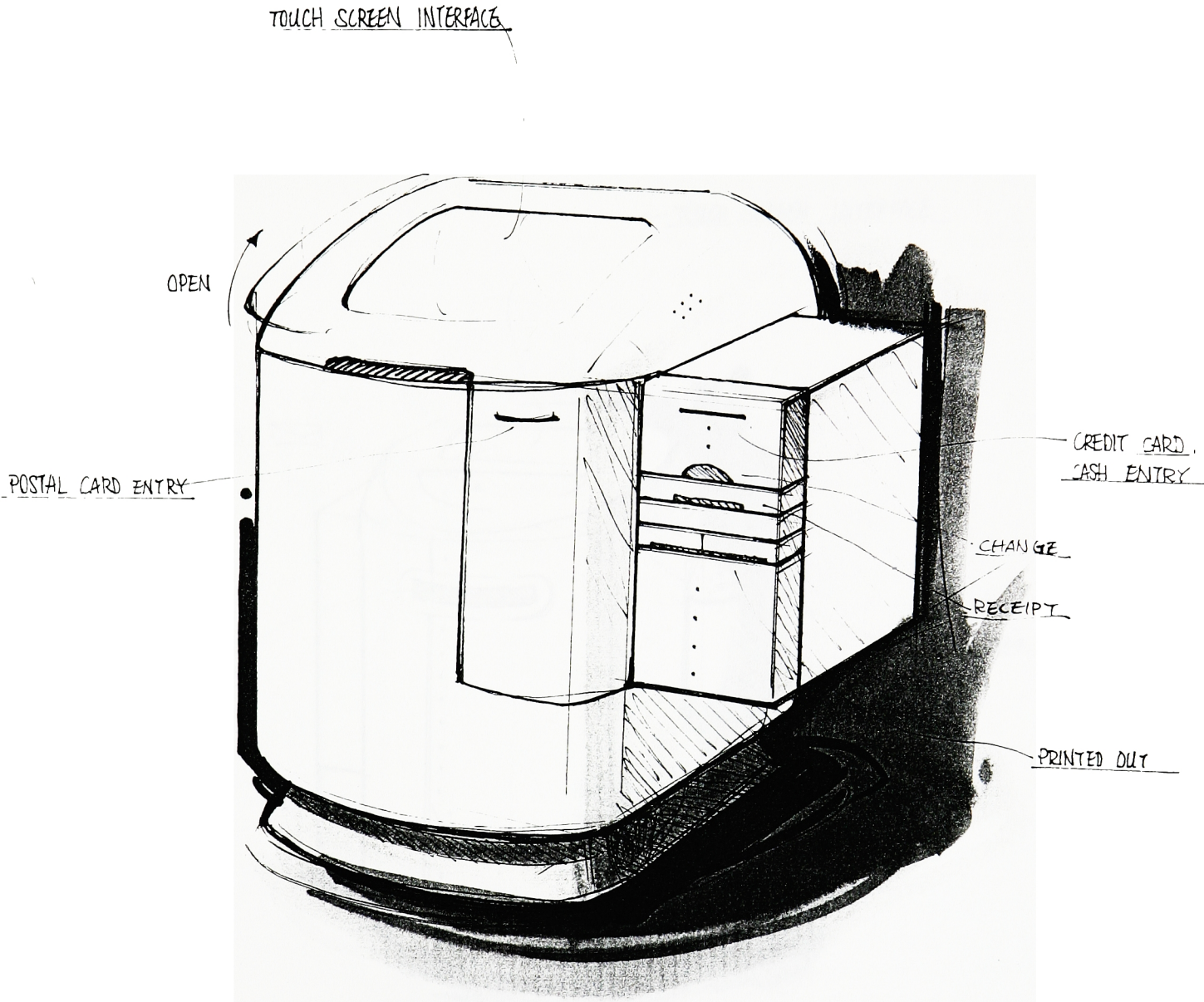
Figure 17 Terminal Development Concept B(Sketch 12)

TOUCH SCREEN INTERFACE

MAIL ENTRY

PRINTED OUTPUT

VOICE MAIL
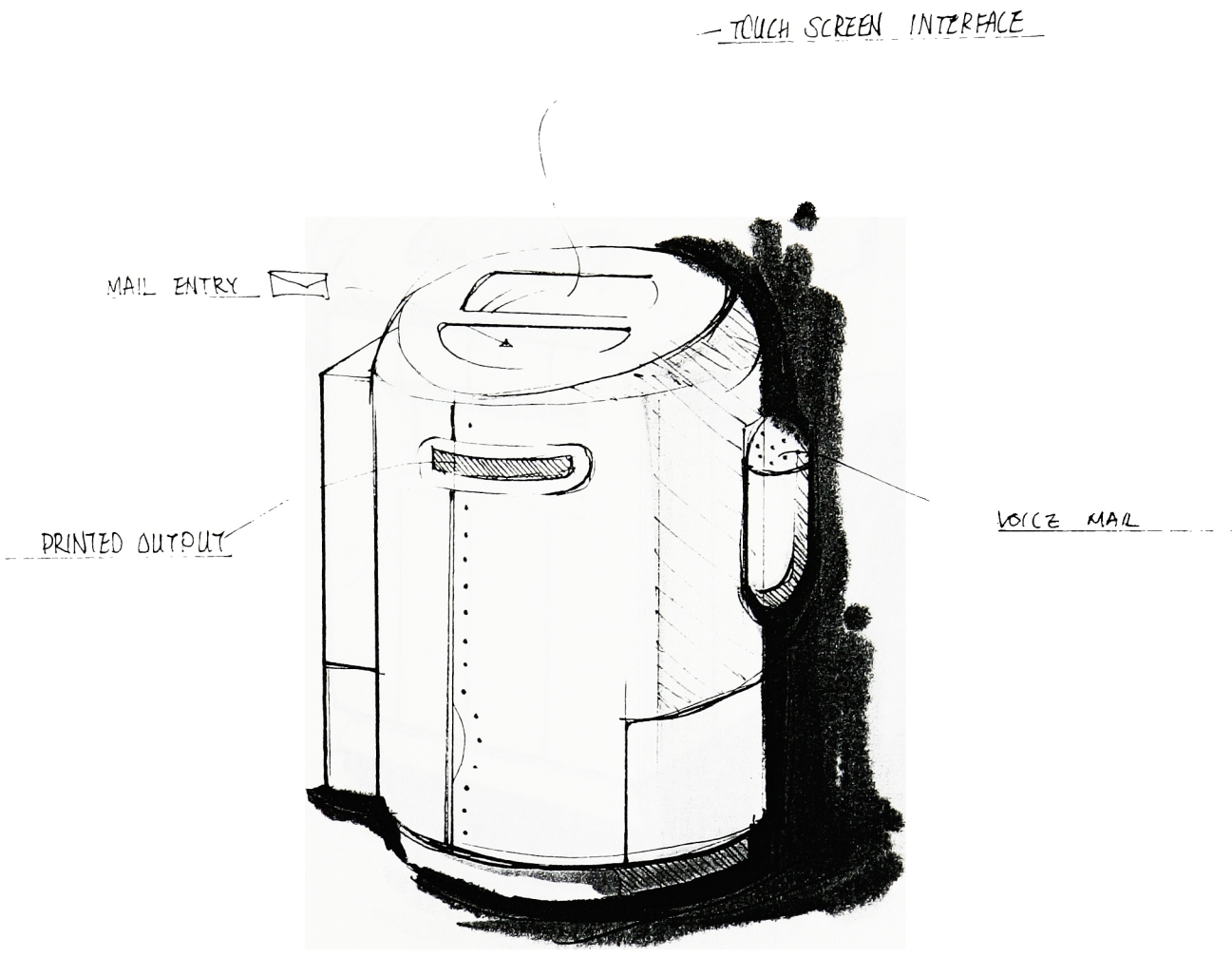
Figure 18 Terminal Development Concept B(Sketch 13)

TOUCH SCREEN INTERFACE

OPEN

MAIL ENTRY

DESK

PACKAGE ENTRY
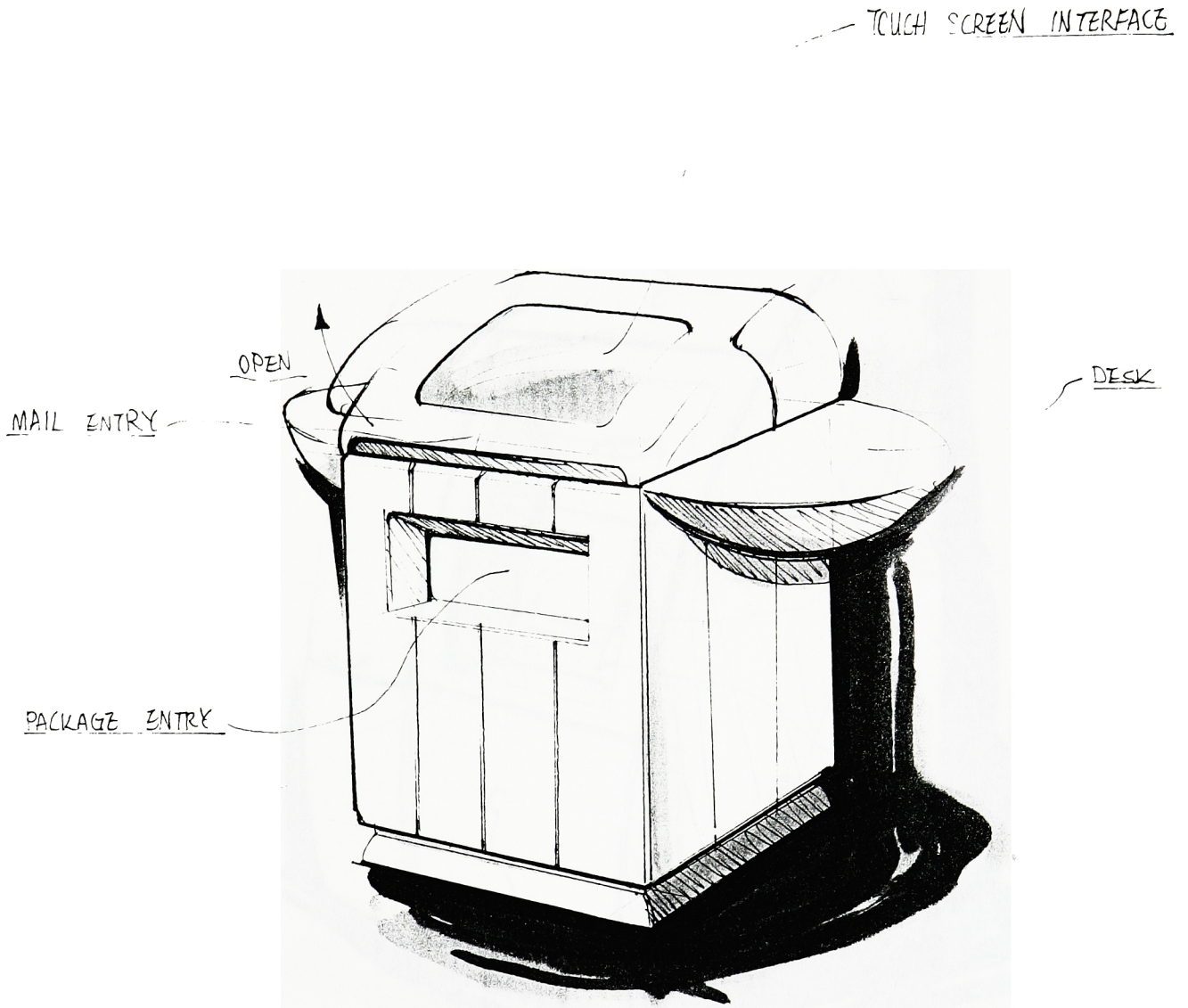
Figure 19 Terminal Development Concept B(Sketch 14)

IMAGE TRANSMIT SYSTEM
SECURITY SYSTEM CAMERA

TOUCH SCREEN INTERFACE

PACKAGE ENTRANCE

LETTER ENTRANCE

PAYMENT SYSTEM

ELECTRONIC MAIL SYSTEM

FAX SYSTEM
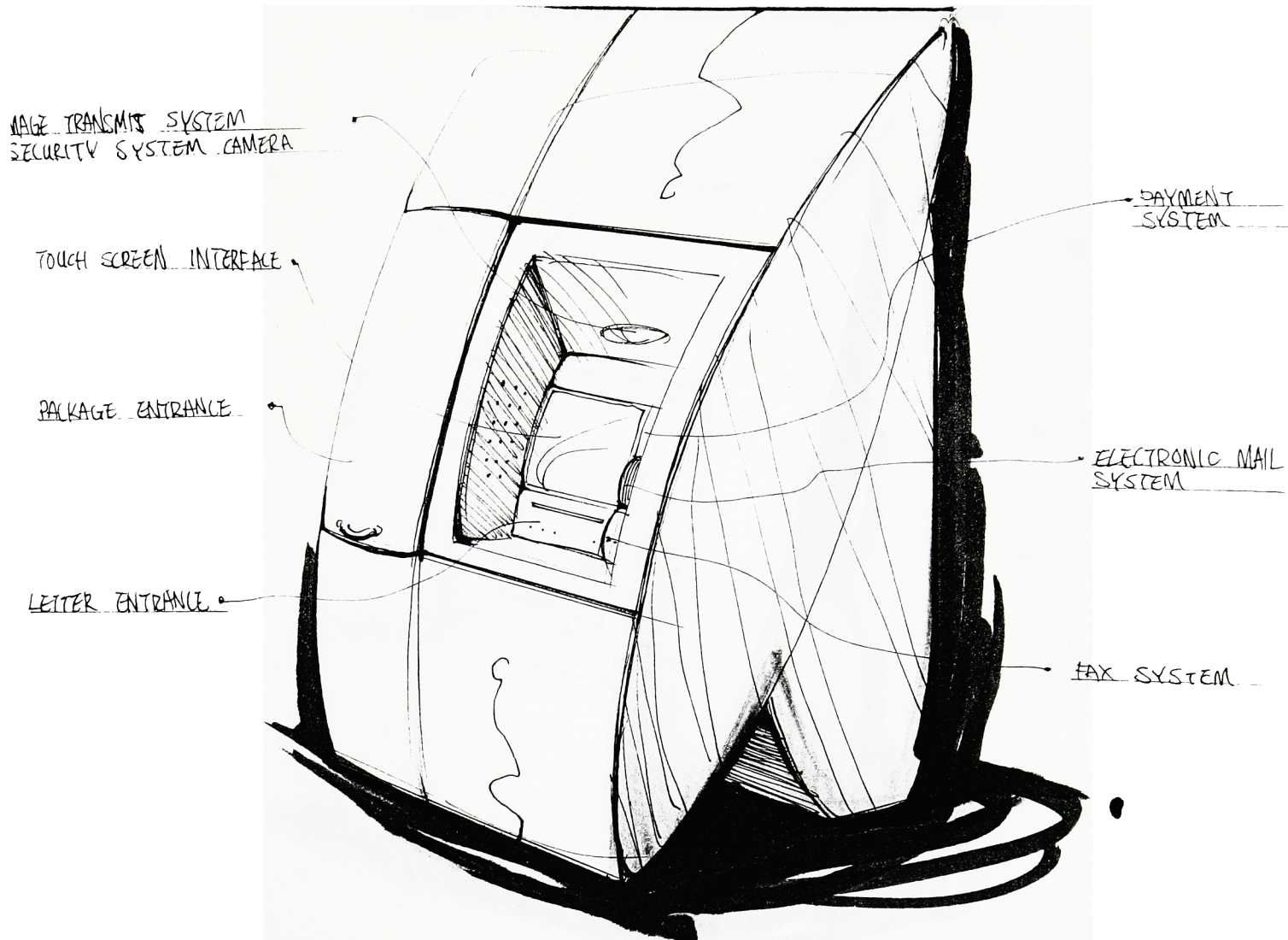
Figure 20 Terminal Development Concept C(Sketch 15)

Figure 21 Terminal Development Concept C(Sketch 16)

IMAGE TRANSMIT SYSTEM
SECURITY SYSTEM

PACKAGE ENTRANCE

TOUCH SCREEN INTERFACE

LETTER ENTRANCE

PAYMENT SYSTEM

ELECTRONIC MAIL SYSTEM

FAX SYSTEM

INTERACTIVE
TOUCH SCREEN
INTERFACE

FUNCTIONS, SERVICES
SIGN

MAIL & PACKAGE
ENTRY

MAIL & PACKAGE
STORAGE SPACE
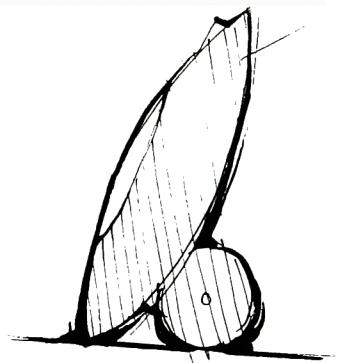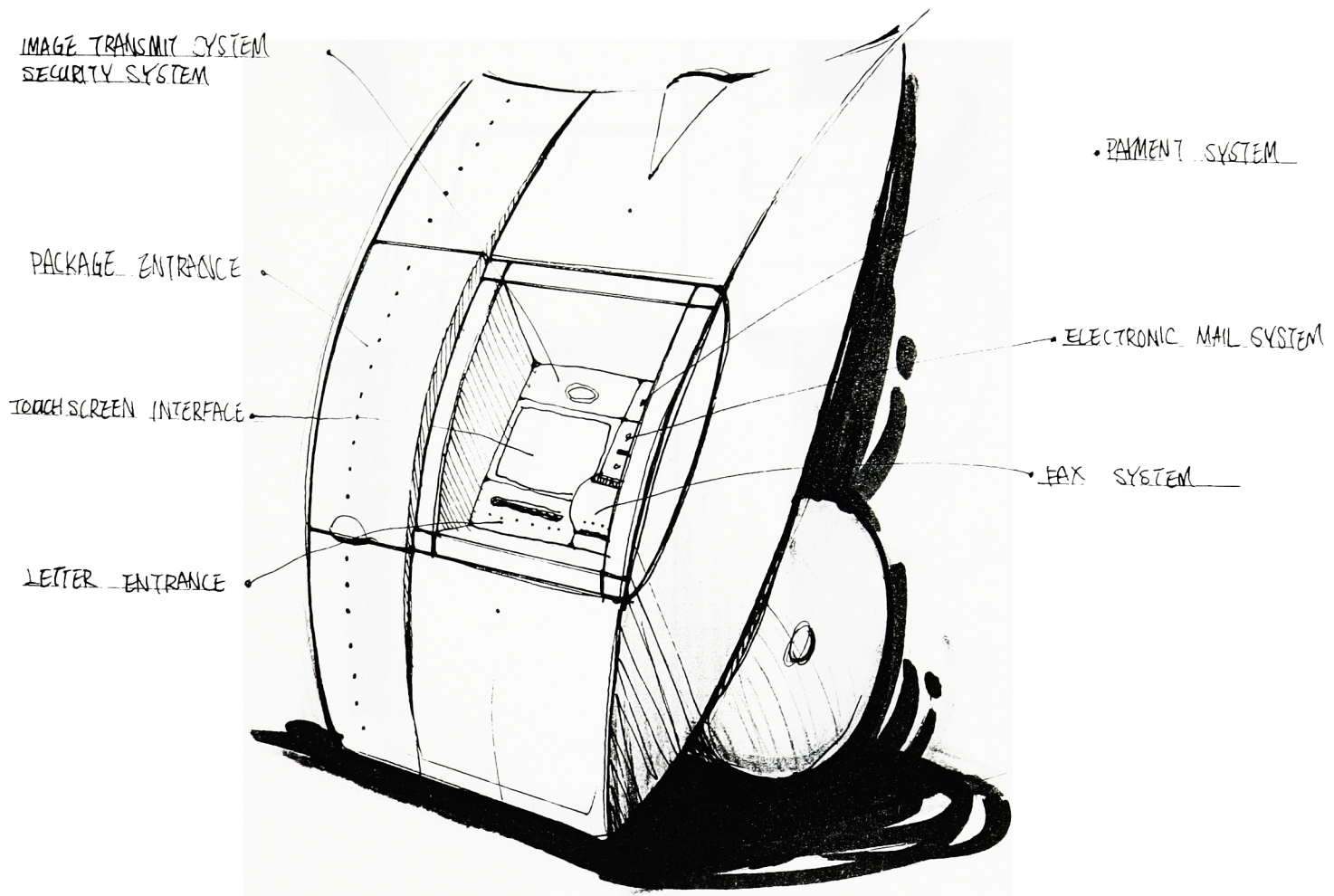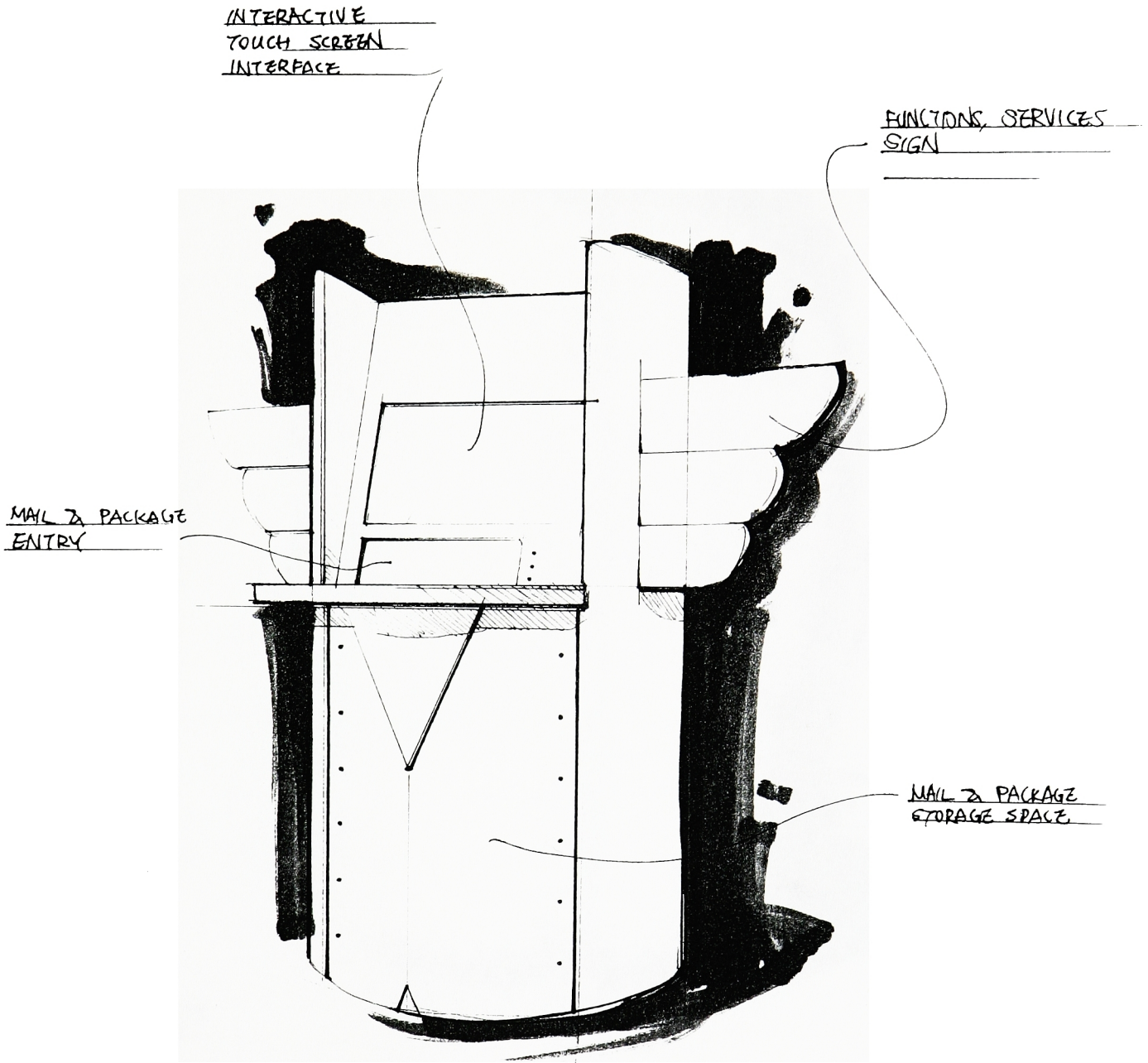
Figure 22 Terminal Development Concept C(Sketch 17)

INTERACTIVE
TOUCH SCREEN
INTERFACE

POSTAL SERVICES,
FUNCTIONS SIGN

MACHICAL
INTERFACE

MAIL & PACKAGE
STORAGE SPACE
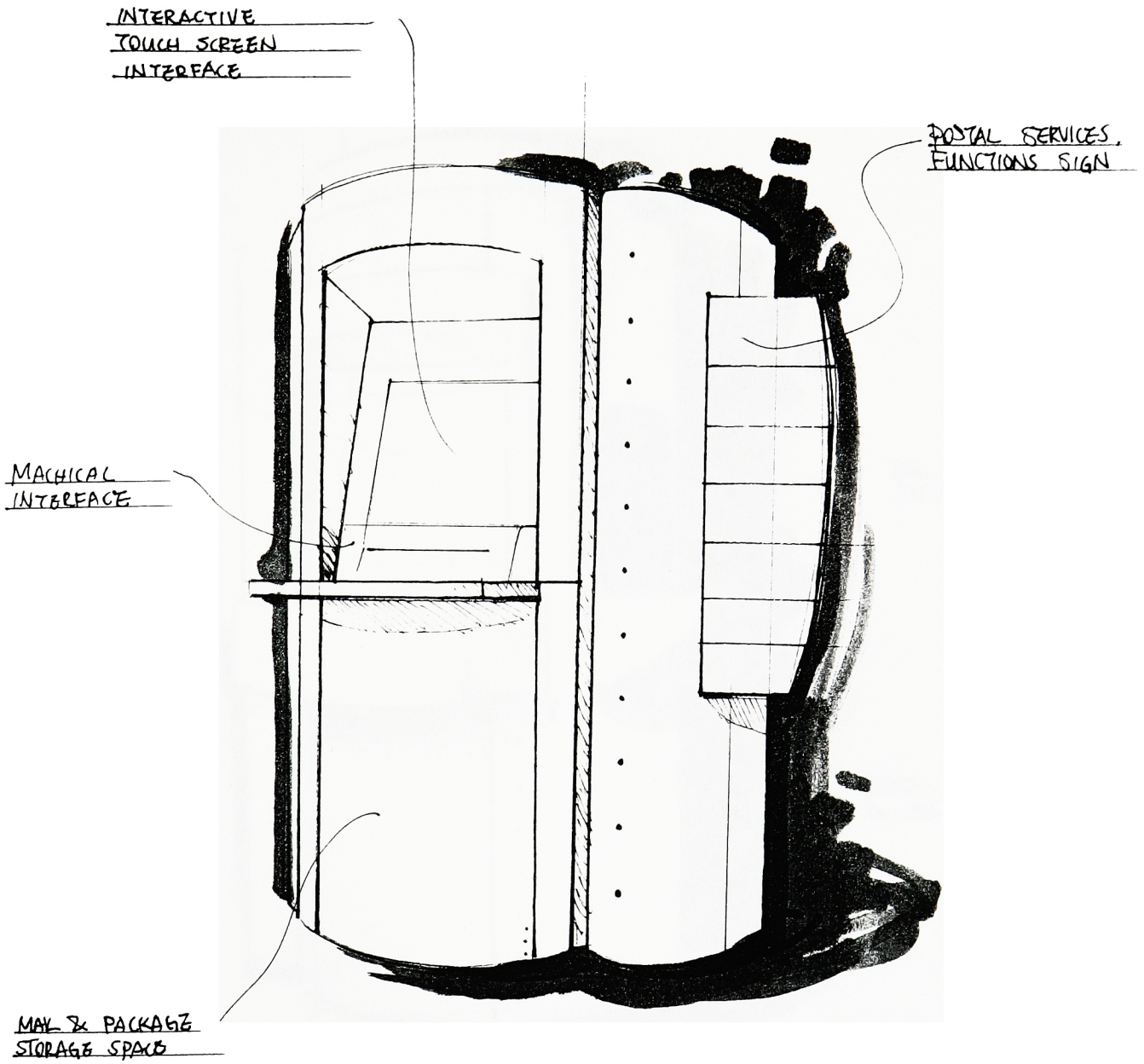
Figure 23 Terminal Development Concept C(Sketch 18)

INTERACTIVE
TOUCH SCREEN
INTERFACE

LIGHT, THE POSTAL
SERVICE IDENTIFICATION

BIG PACKAGE
ENTRENCE

WORK DESK

WORK DESK
& WEIGHT

MAIL & PACKAGE
STORAGE SPACE
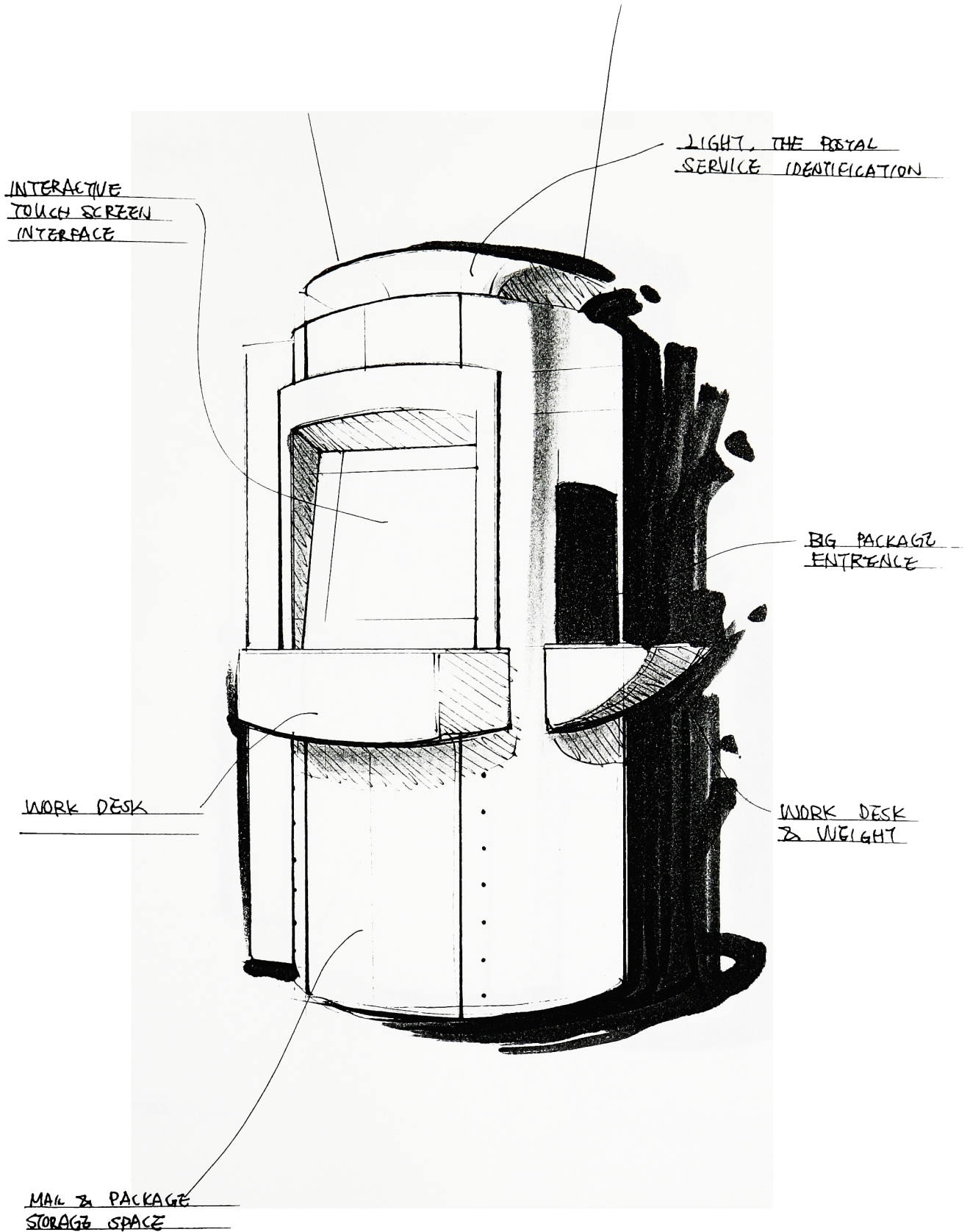
Figure 24 Terminal Development Concept C(Sketch 19)

POSTAL SERVICE ICON

SERVICES, PRODUCTS FUNCTIONS LIST

INTERFACE

WORK DESK KEYBOARD

MAIL & PACKAGE COLLECTING BOX

MAIL SYSTEM
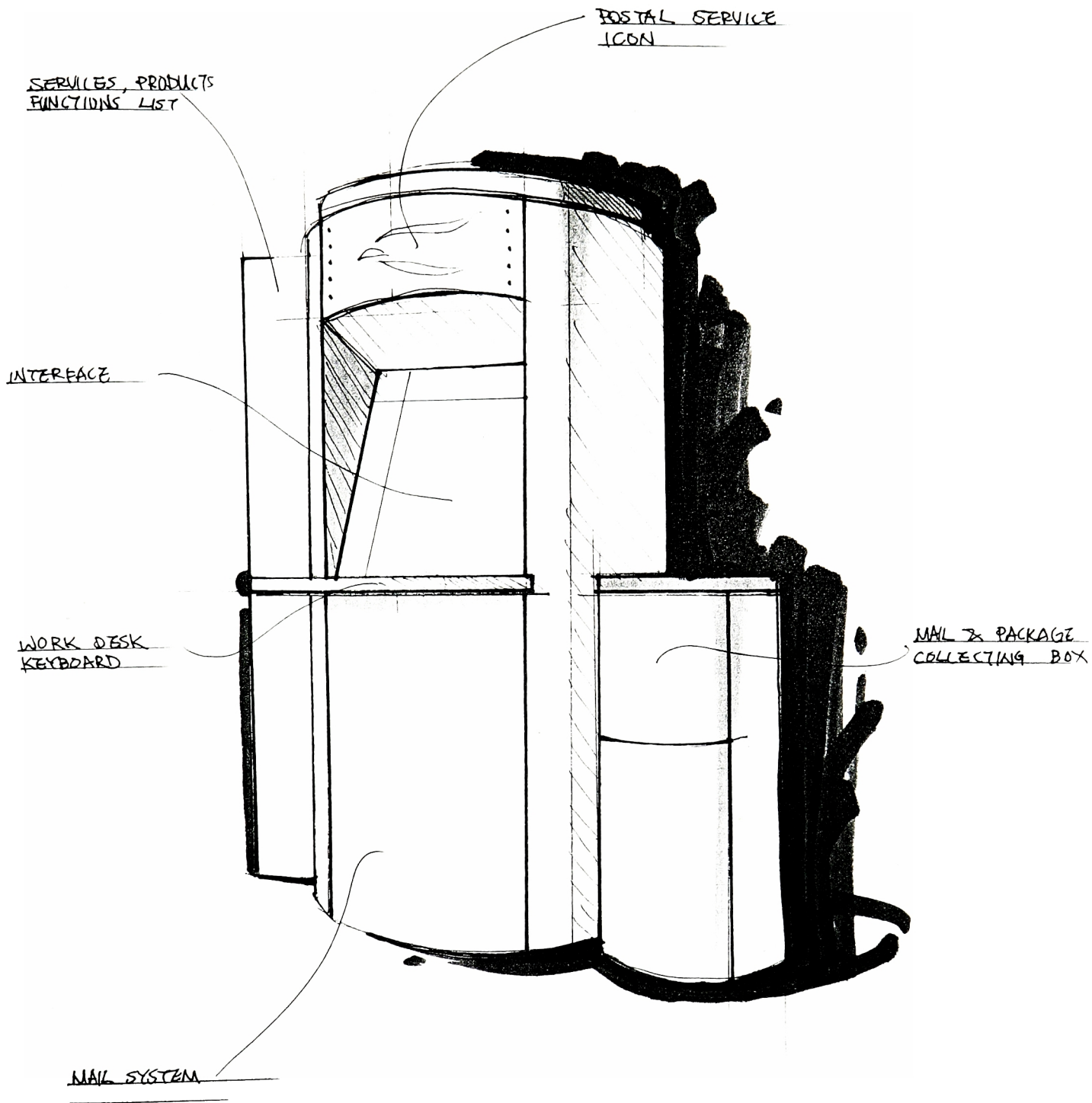
Figure 25 Terminal Development Concept C(Sketch 20)

CAROUSEL INTERFACE SYSTEM
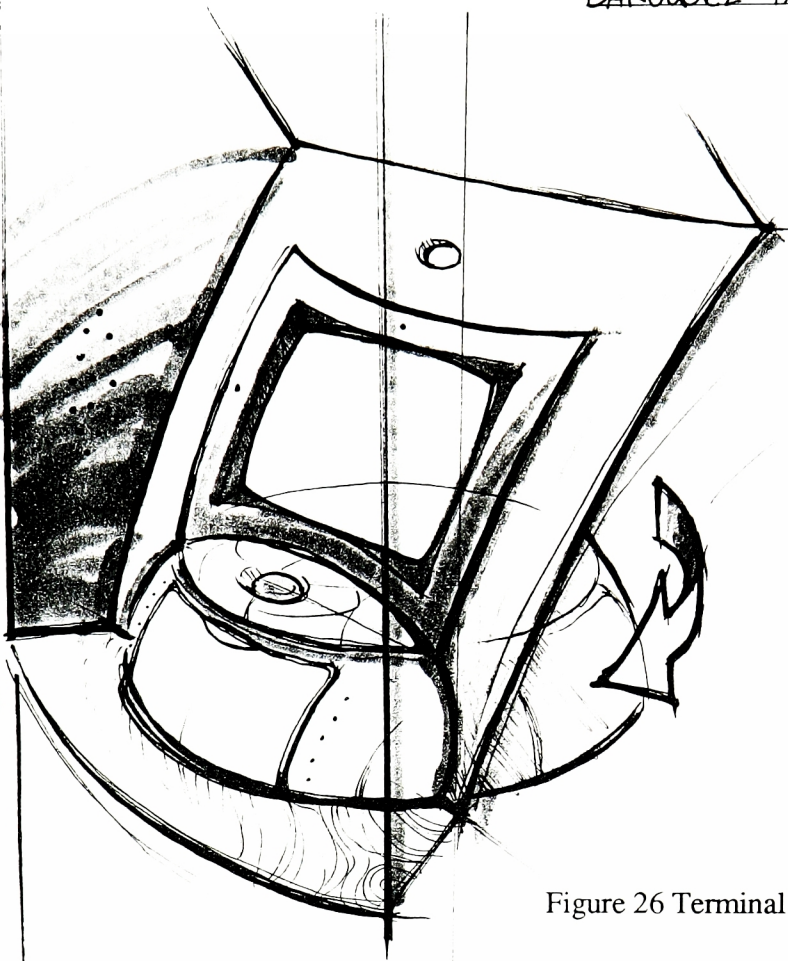
AS YOU CHOOSE THE FUNCTION.
THE INTERFACE IS ROTATED
OUT.

Figure 26 Terminal Development Concept C(Sketch 21)

ROTATING

FAX SYSTEM

ELECTRONIC IMAGE
& MAIL SYSTEM

LETTERS & PACKAGES SYSTEM
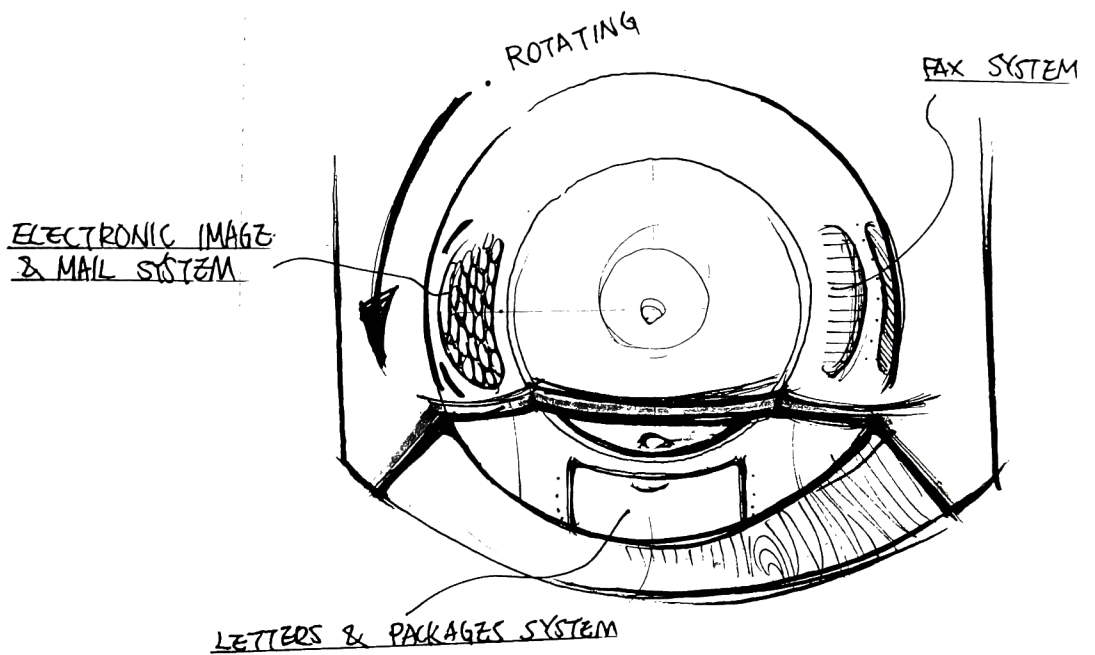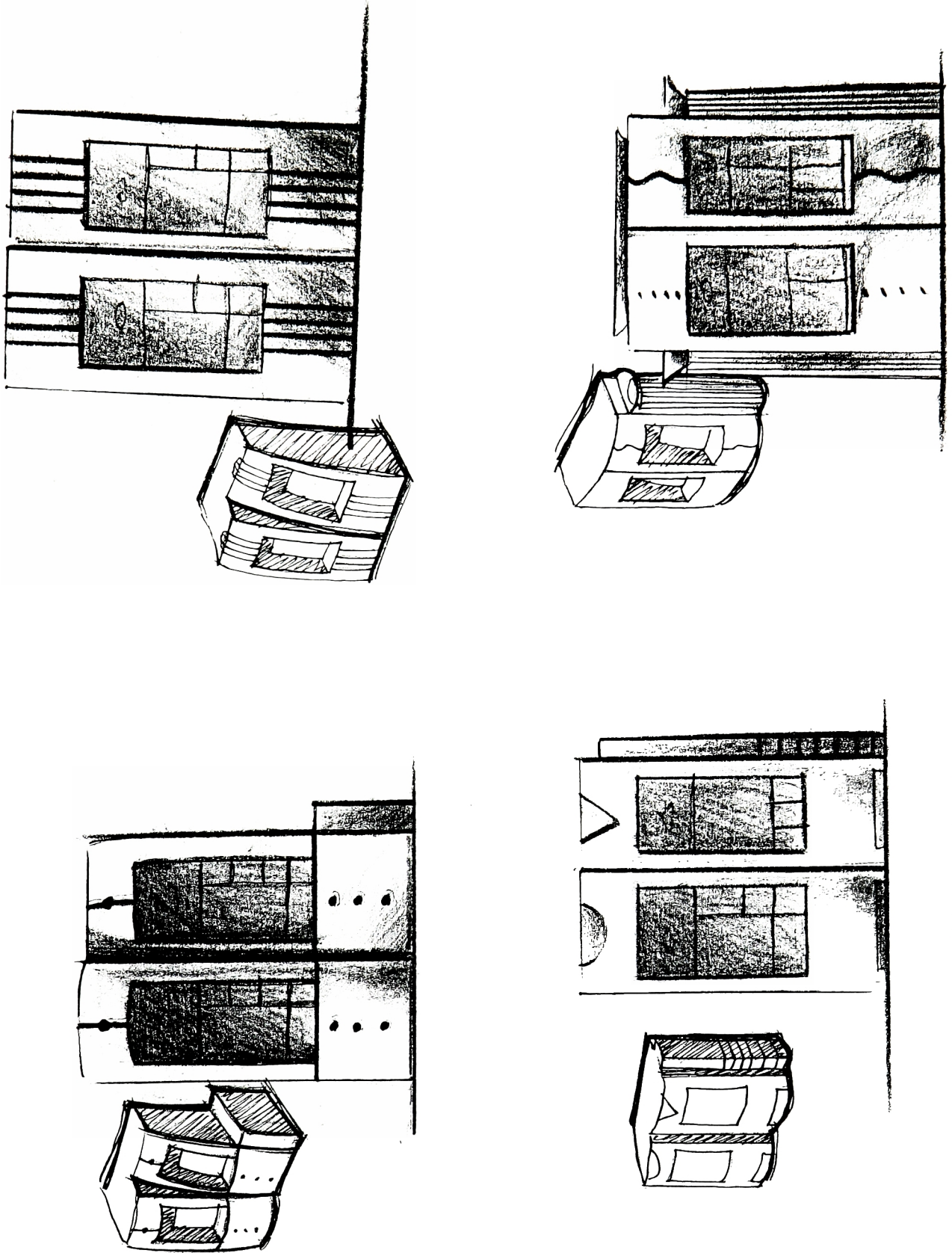
Figure 27 Terminal Development Concept C(Sketch 22)
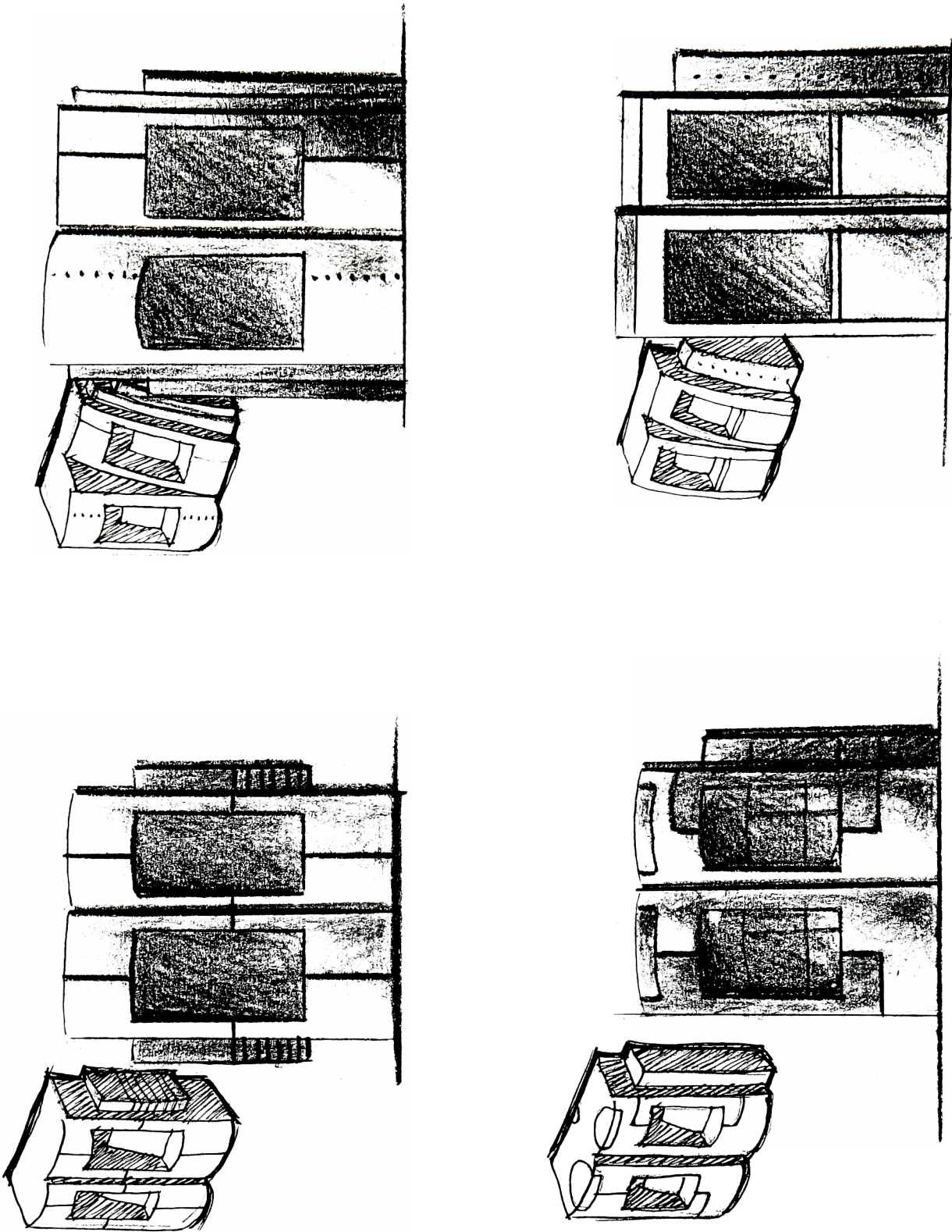
Figure 28 Terminal Development Concept C(Sketch 23)
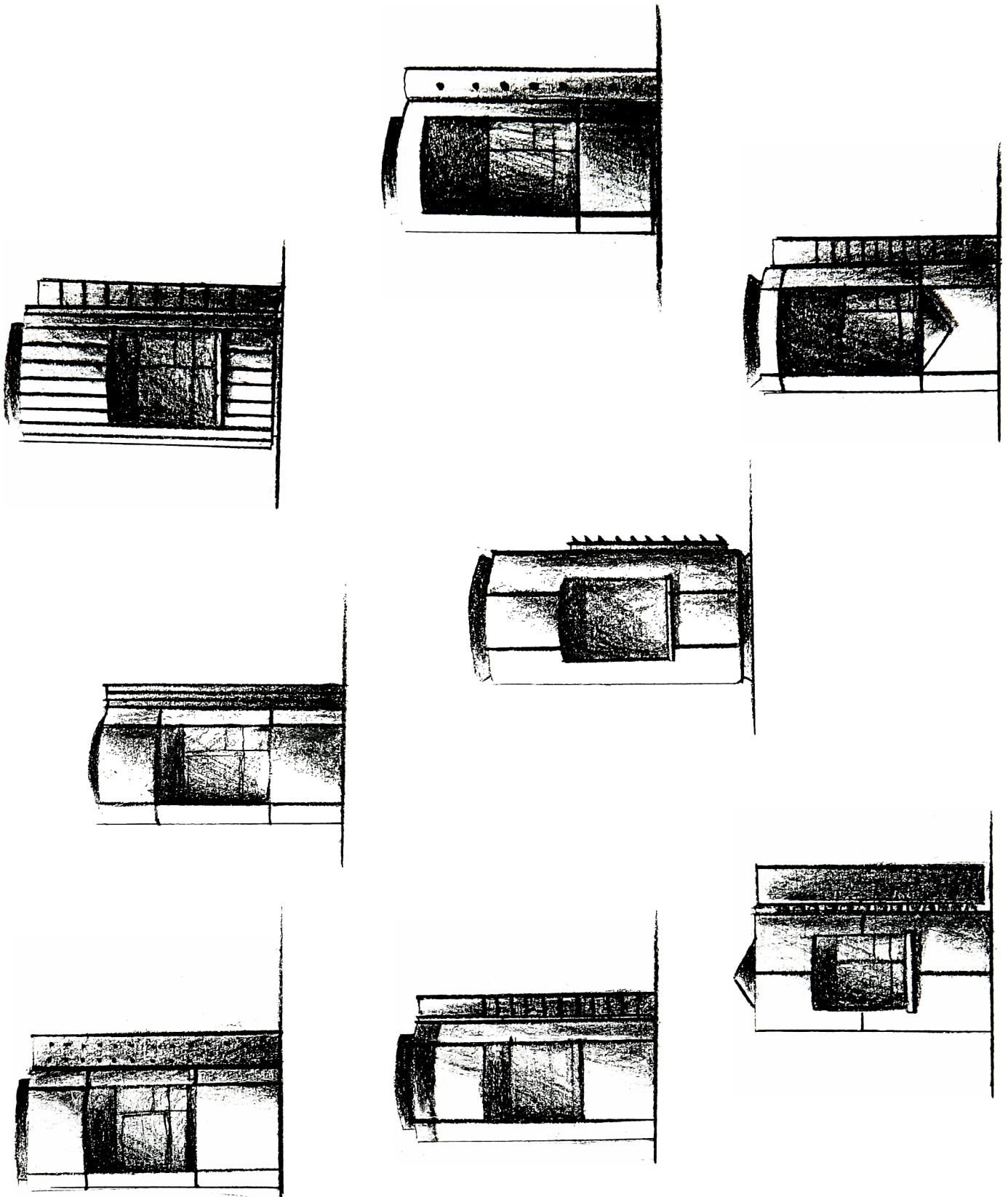
Figure 29 Terminal Development Concept C(Sketch 24)

ROOF . FOR OUTDOOR
ENVIRONMENT

POSTAL SERVICE IDENTIFICATION

INTERACTIVE
TOUCH SCREEN
INTERFACE

FUNCTIONAL
INTERFACE

WORK DESK

MAIL & PACKAGE
STORAGE
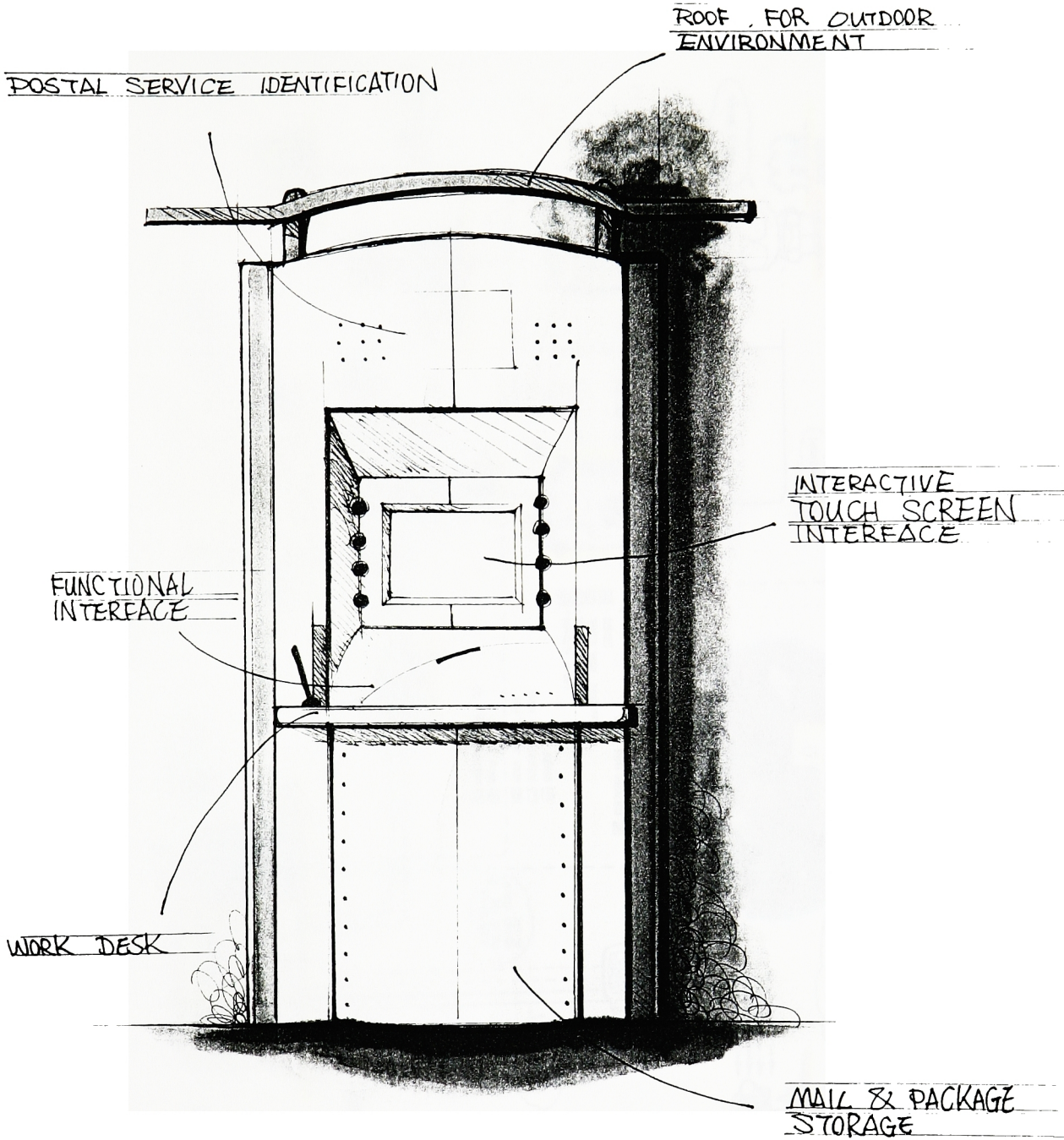
Figure 30 Terminal Development Concept C(Sketch 25)

Final Concept

Postal Processing System
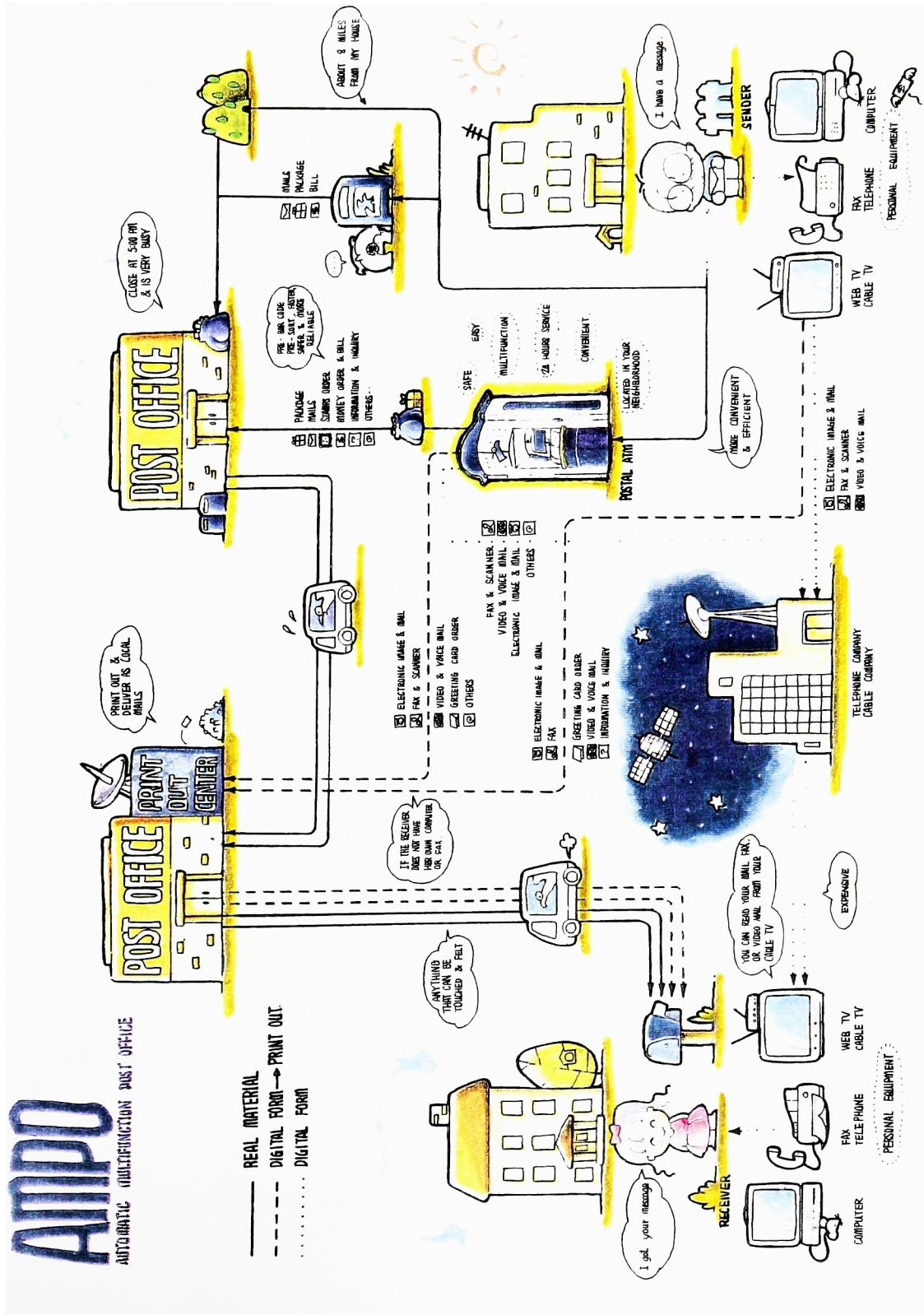
Figure 31 Final Design of Postal Processing System

Final Concept

Customers' Interactive Terminal
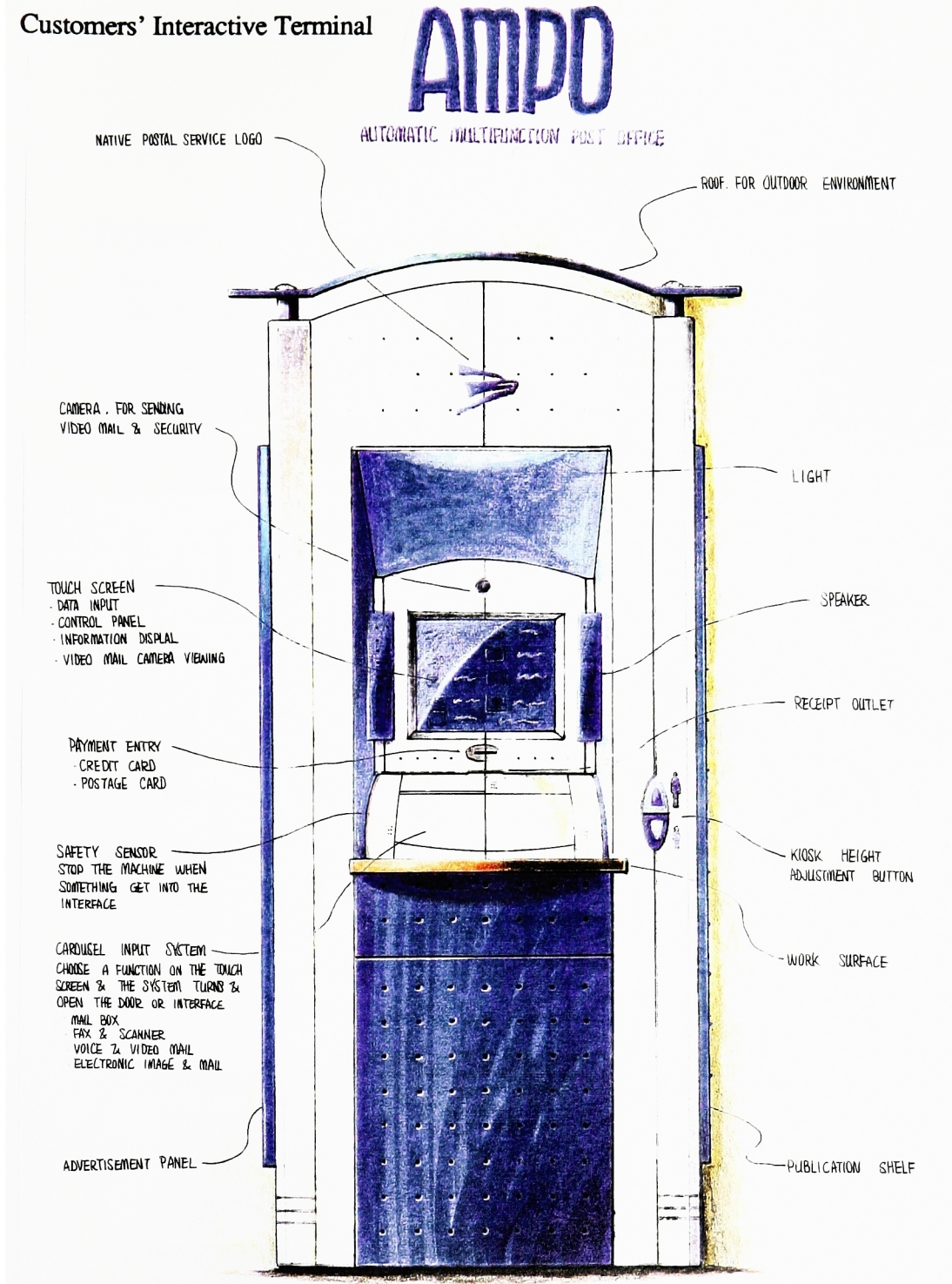
Figure 32 Final Design of Customers' Interactive Interface

Final Concept

Customers' Interactive Terminal

THERE ARE FOUR DIFFERENT MEDIA ON THE SYSTEM :

- MAIL BOX : TRADITIONAL HARD-COPY FORM LETTERS, POST CARD, AND PACKAGE. (ZIP CODE & BAR CODE TRANSLATION, PRE-SORT, ADDRESS FORWARDING SYSTEM....)

- FAX & SCANNER : TEXT DOCUMENTS, COLOR PICTURES, SLIDES.....

- ELECTRONIC IMAGE & MAIL, DIGITAL FILE IMAGE.... OR TYPING ON THE ATM.

- VIDEO & VOICE MAIL, TAPES OR TALKING TO THE CAMERA (YOU WILL SEE YOUR OWN IMAGE ON THE SCREEN, IT'S LIKE TALKING TO A MIRROR)

YOU CAN CHOOSE THE RECEIVER RECEIVING HIS FAX, E-MAIL, OR VIDEO BY PERSONAL EQUIPMENTS (COMPUTER, FAX MACHINE) CABLE TV, OR A PRINT OUT COPY FROM THE LOCAL POST OFFICE.

IF THERE IS ANYTHING IN THE WAY OF THE CAROUSEL SYSTEM, (SOMETHING LIKE YOUR FINGERS....) THE SAFETY SENSOR WILL STOP THE ROTATION

BY SELECTING AN ICON ON THE TOUCH SCREEN, THE CAROUSEL SYSTEM SLOWLY ROTATES TO CORRECT INTERFACE AND POPS OUT THE DOOR OR INTERFACE WHICH IS CONTROLLED BY THE TOUCH SCREEN.

AMPO
AUTOMATIC MULTIFUNCTION POST OFFICE

Figure 33 Final Design of Customers' Interactive Terminal

Final Concept

Mock-up
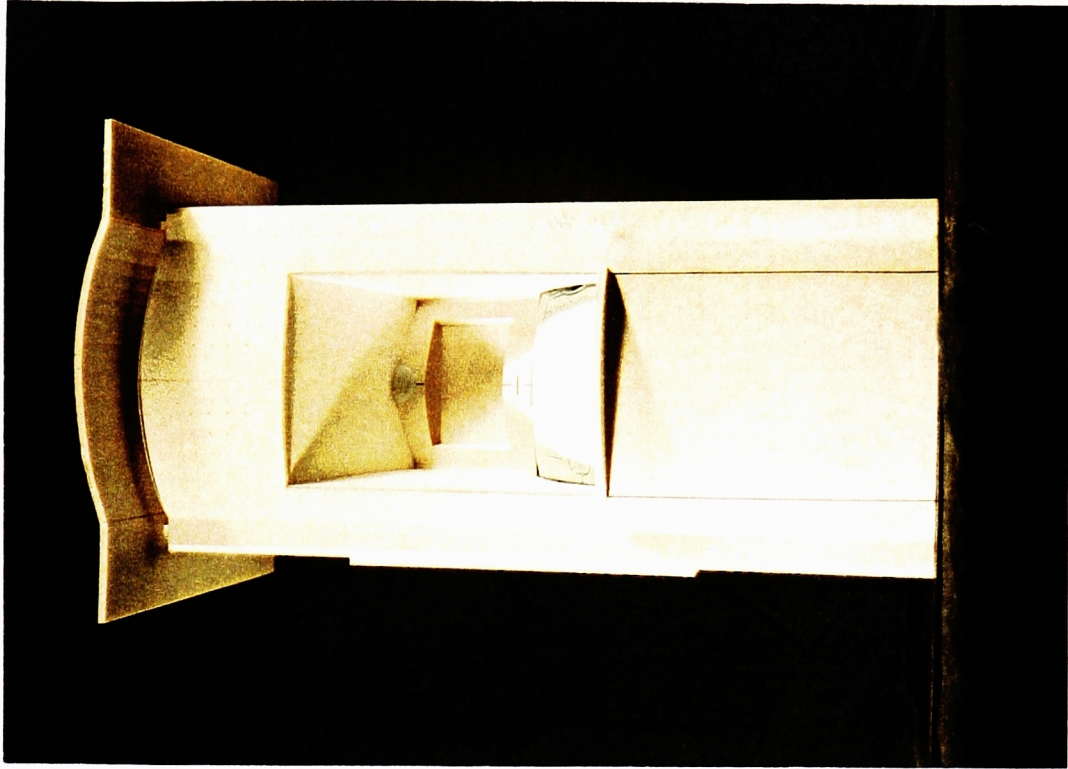
Figure 34 Mock-up
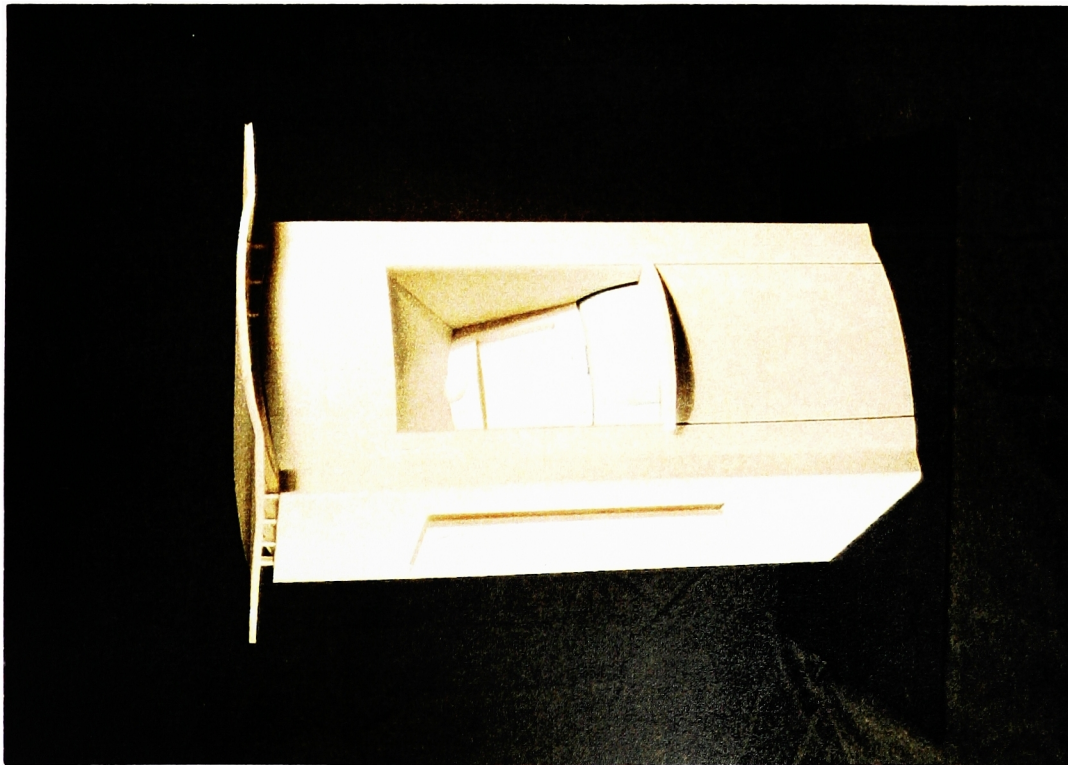
Figure 35 Mock-up

DETAIL DESIGN (CAID)
INTERFACE FORM STUDIES
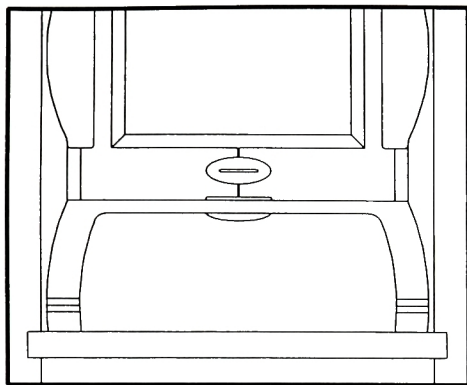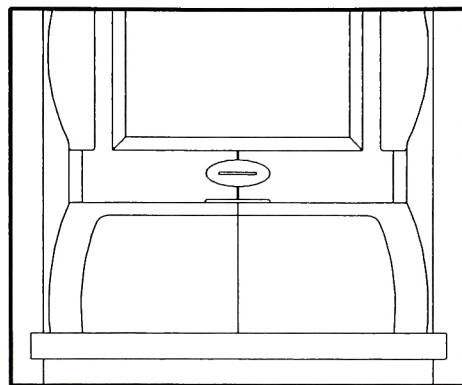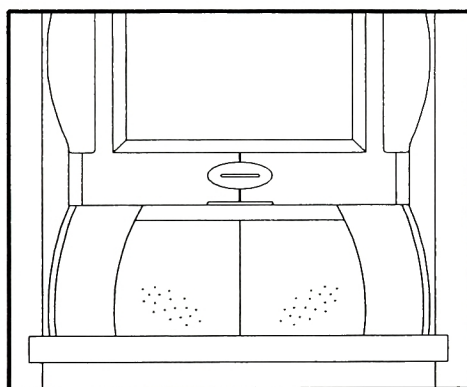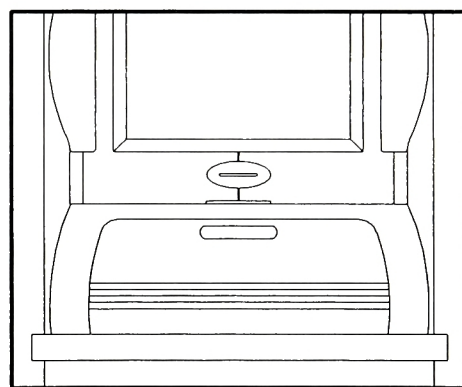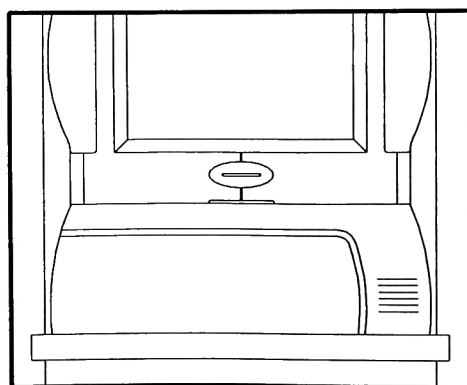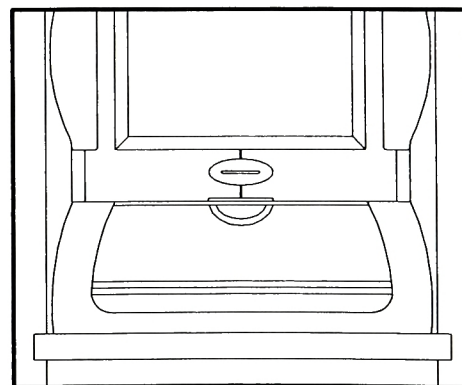
Figure 36 Interface Form Studies -- Mail System

DETAIL DESIGN (CAID)
INTERFACE FORM STUDIES
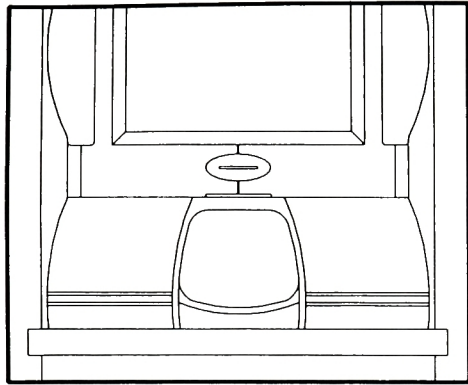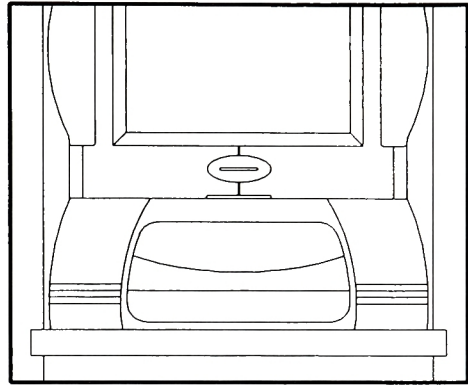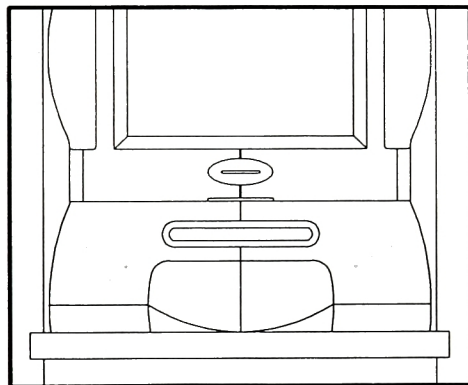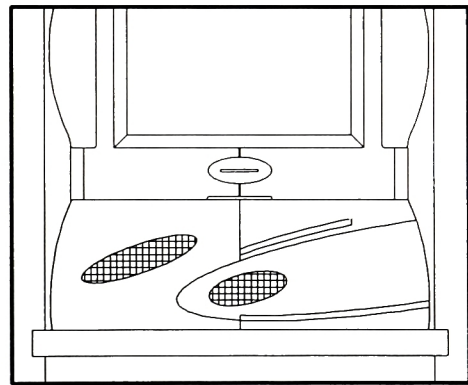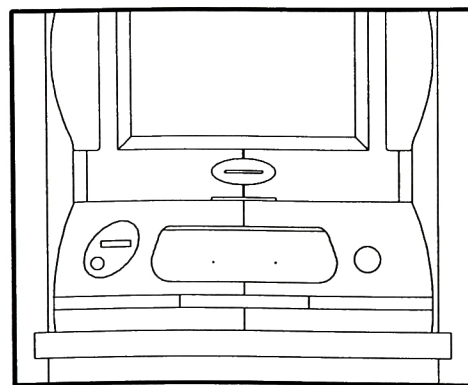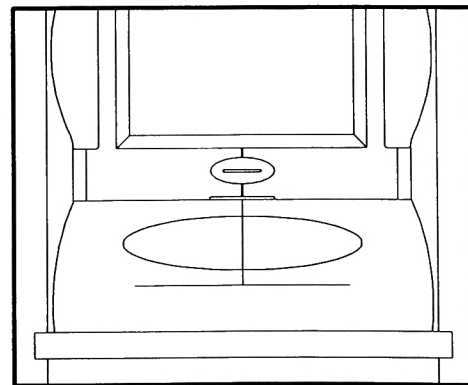
Figure 37 Interface Form Studies -- Fax System

DETAIL DESIGN (CAID)
INTERFACE FORM STUDIES
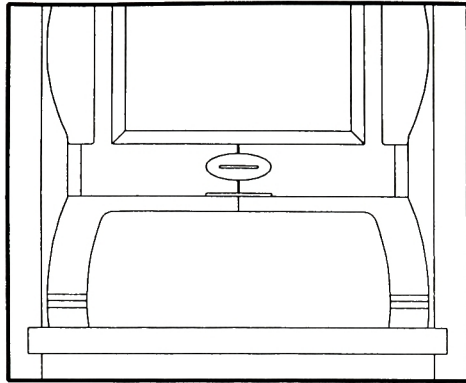
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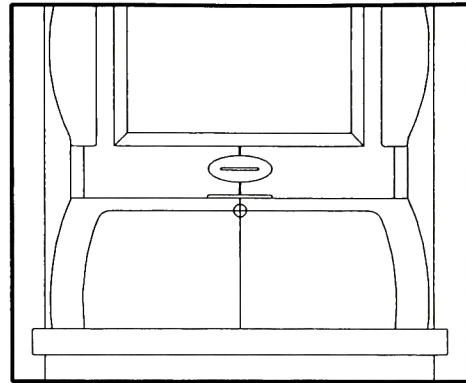
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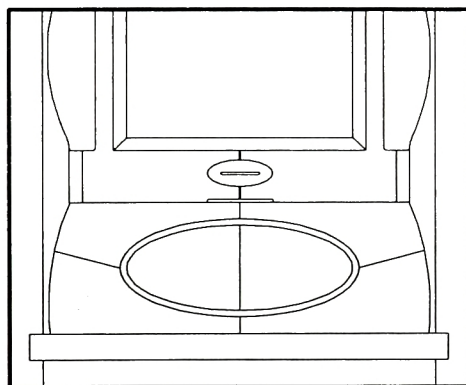
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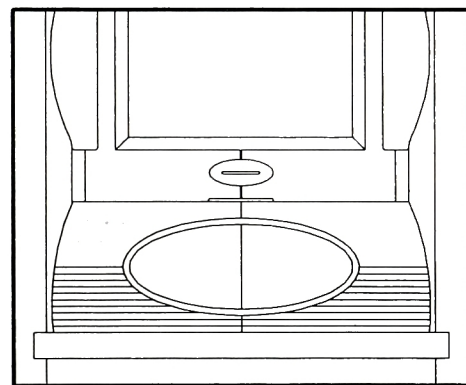
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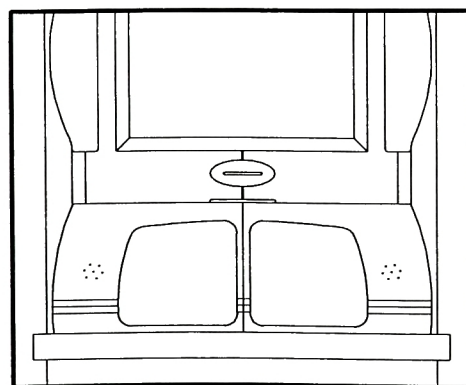
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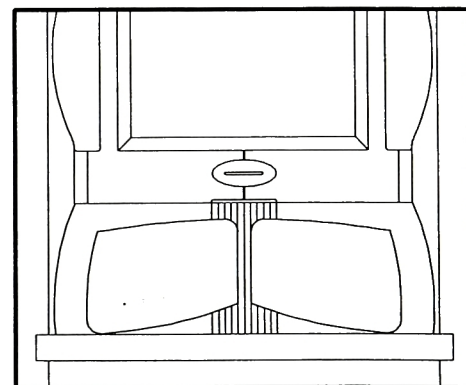
f

Figure 38 Interface Form Studies -- Electronic Mail System

DETAIL DESIGN (CAID)
INTERFACE FORM STUDIES
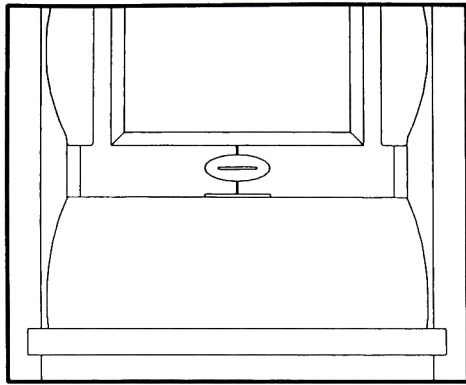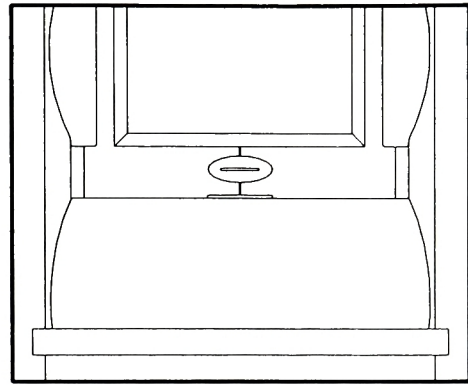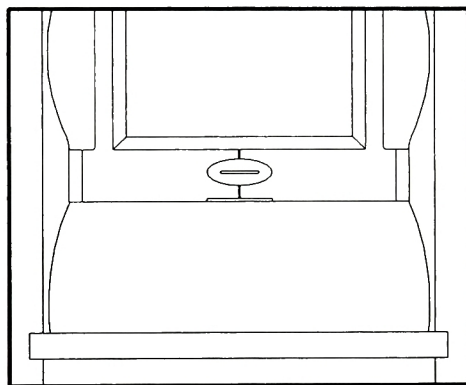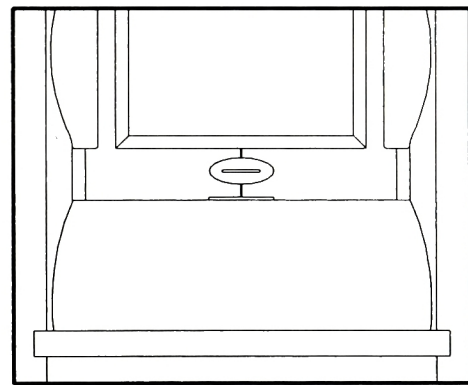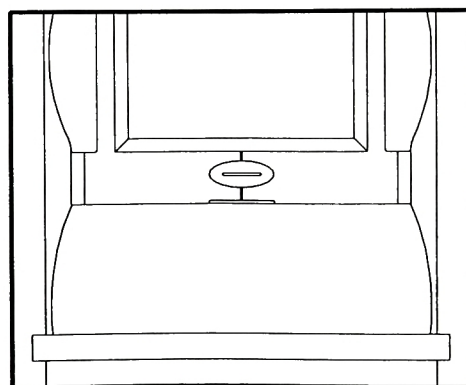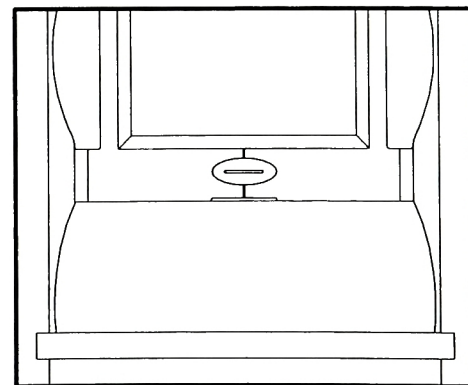
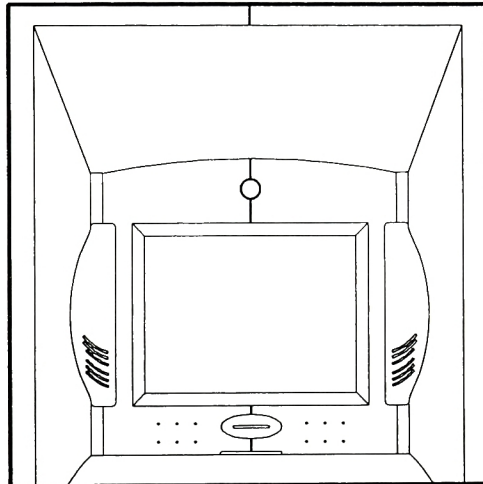

Figure 39 Interface Form Studies -- Video & Voice Mail System

Figure 40 Speaker Form Studies
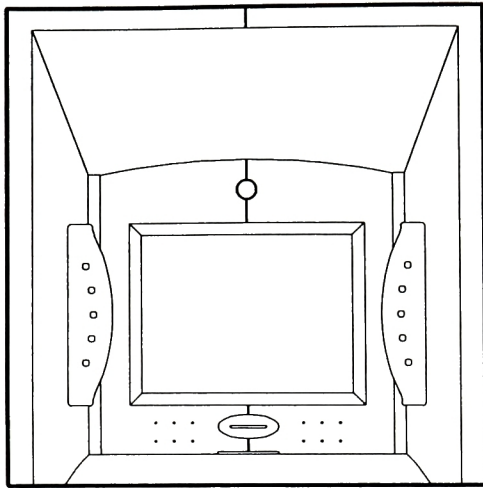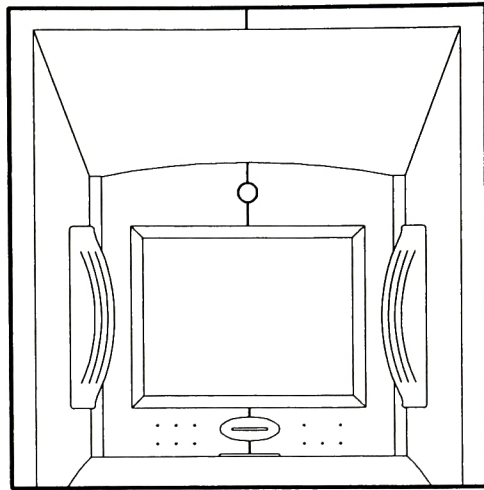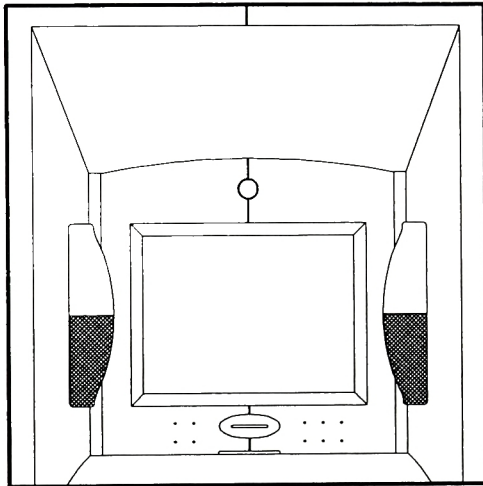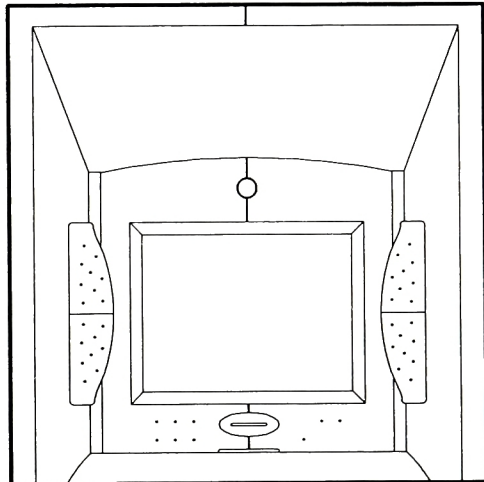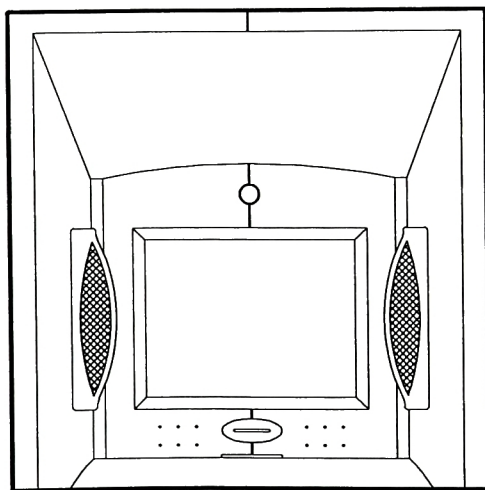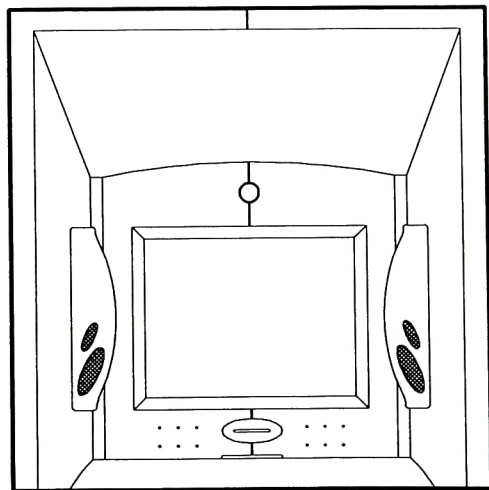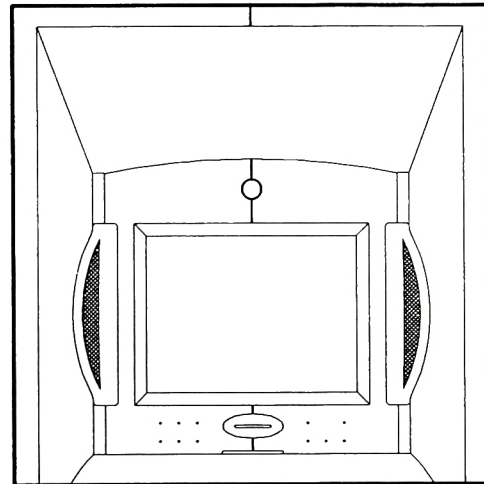
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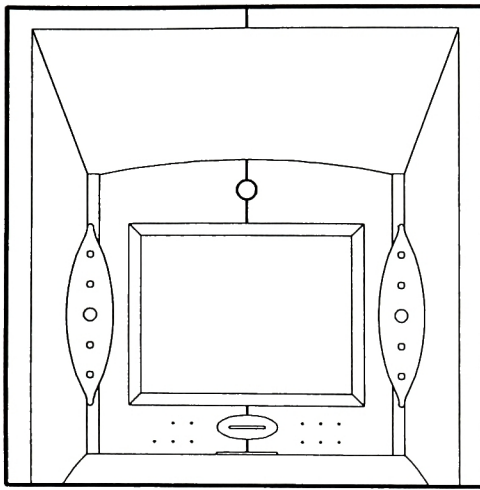
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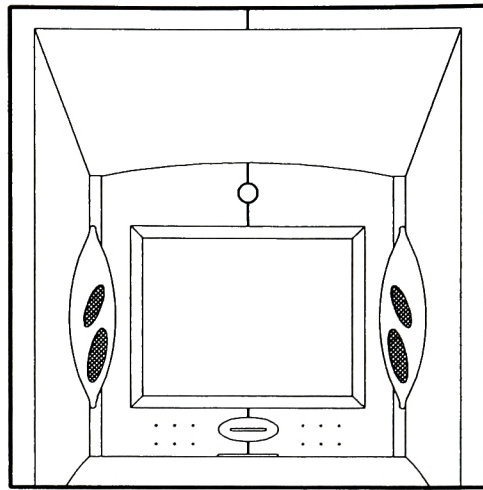
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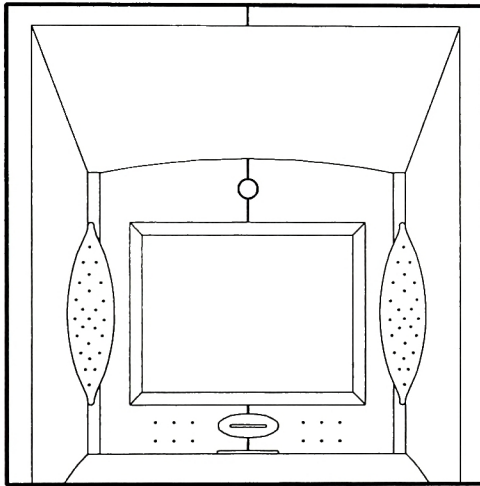
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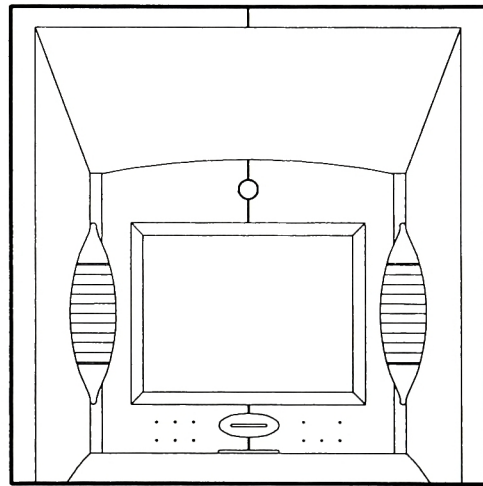
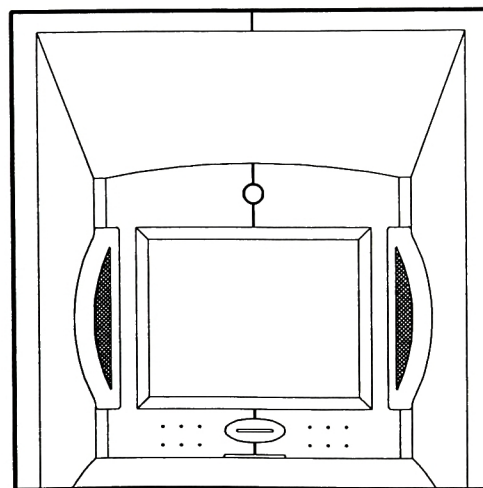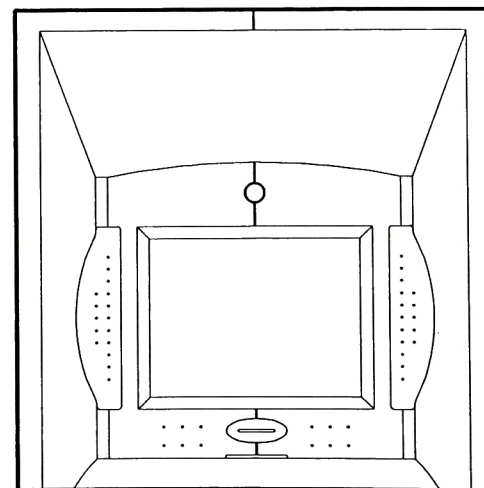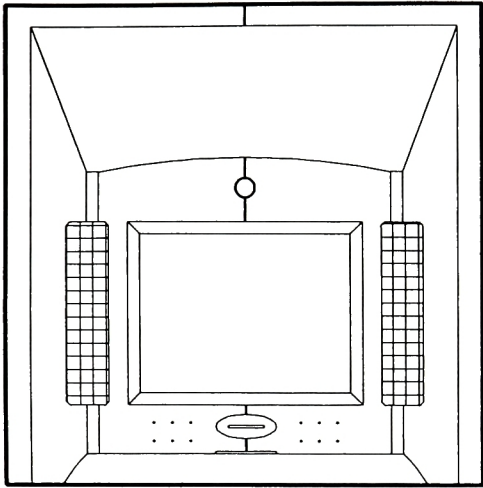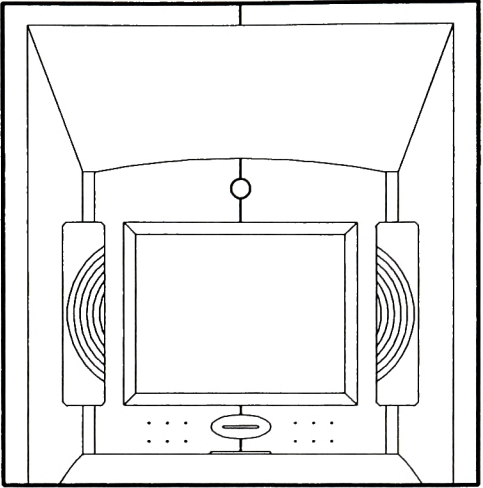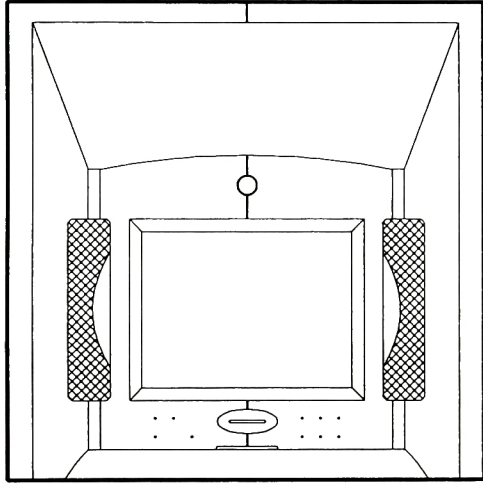d
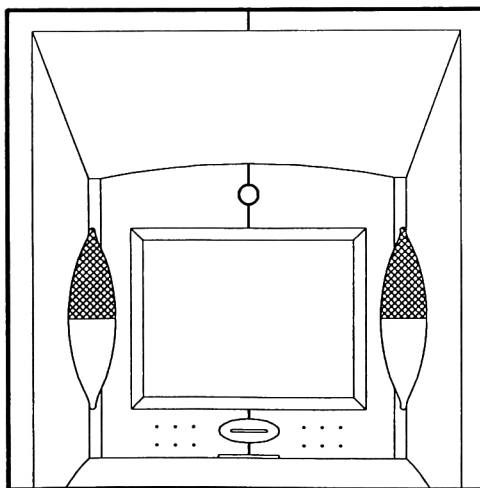
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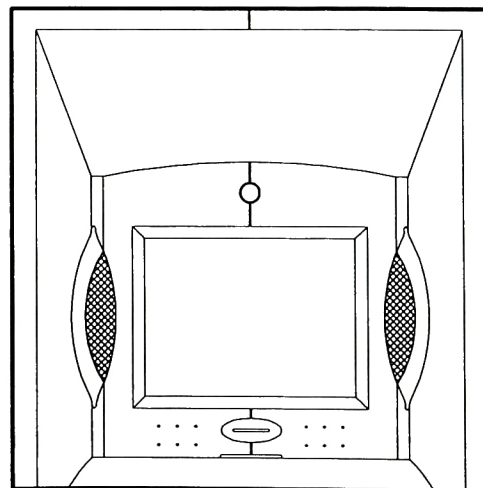
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Figure 42 Speaker Form Studies
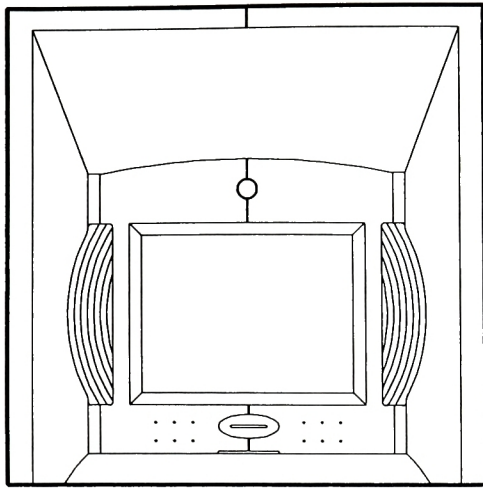
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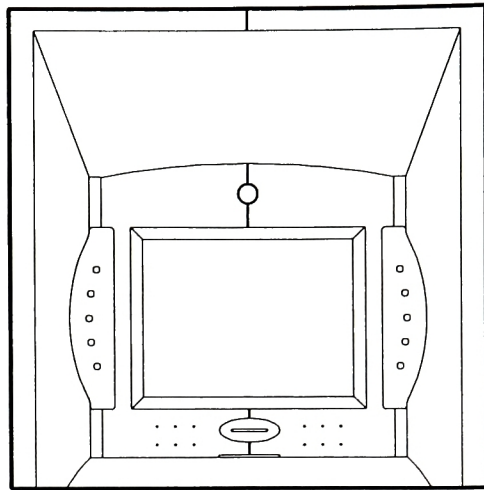
b

c

d

e

f

Figure 43 Speaker Form Studies
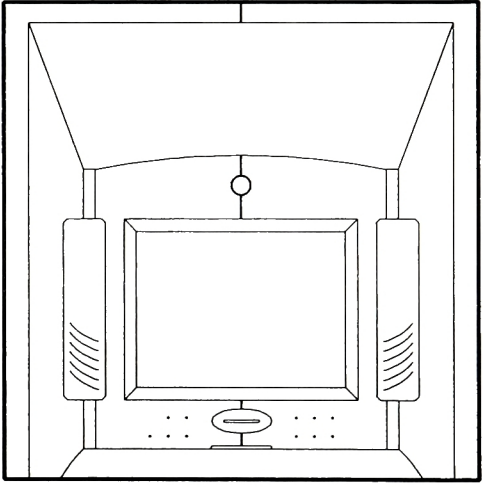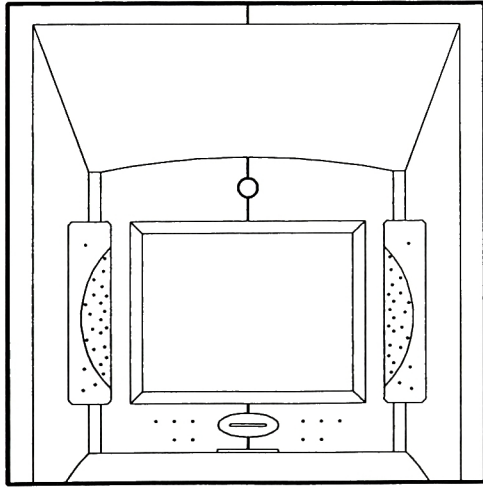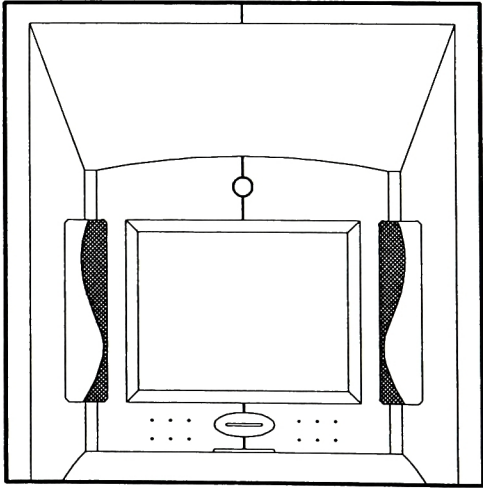
Figure 44 Speaker Form Studies

a

b

c

d

e

f

Figure 45 Color Studies

1. ROOF
2. COLUMN
3. MAIN BODY
4. SIDE
5. INTERIOR /TOP
6. INTERIOR /FACE
7. SCREEN
8. SPEAKER
9. INTERFACE
10. DESK
11. FRONT
12. BUTTON /UP
13. BUTTON /DOWN

Figure 46 Color Studies

1. ROOF
2. COLUMN
3. MAIN BODY
4. SIDE
5. INTERIOR /TOP
6. INTERIOR /FACE
7. SCREEN
8. SPEAKER
9. INTERFACE
10. DESK
11. FRONT
12. BUTTON /UP
13. BUTTON /DOWN

1. ROOF
2. COLUMN
3. MAIN BODY
4. SIDE
5. INTERIOR /TOP
6. INTERIOR /FACE
7. SCREEN
8. SPEAKER
9. INTERFACE
10. DESK
11. FRONT
12. BUTTON /UP
13. BUTTON /DOWN

Figure 47 Color Studies

1. ROOF

2. COLUMN

3. MAIN BODY

4. SIDE

5. INTERIOR /TOP

6. INTERIOR /FACE

7. SCREEN

8. SPEAKER

9. INTERFACE

10. DESK

11. FRONT

12. BUTTON /UP

13. BUTTON /DOWN

Figure 48 Color Studies

CHAPTER IV
DESIGN   RESULT

The design result of this thesis is presented by:

a computer rendering which is finished in Alias/Wavefront,

a full-size ABS plastic model,

a technical drawing,

and a disk which contains the interactive interface design.

Rendering

This is a SGI Alias/Wavefront V.8 computer rendering.

Figure 49 Computer Rendering

Model

This is a full size ABS plastic model.

Figure 50 ABS Plastic Model

Technical Drawing

This is drawn in MicroStation V.5

Figure 51 Technical Drawing

Design Features

• 24 hours service.

• Colorful and friendly interface.

• Kiosk interface height is adjustable.

• Security camera for sending packages.

• A variety of convenient postal services and products.

• Payment by credit card, postage card, or cash, no stamps needed.

• Information on screen, printout, or publication.

• Decentralizing postal services, located in spots like school, marketplace, business center, community center, ..., or any convenient locations near you.

• One touch screen interface and one mail input entrance (carousel system).

    --Sending hard-copy-form mail: pre-barcoded, list of available mail products and prices, address forwarding, pre-sorted, receipt, delivery record. Faster and more reliable.

    --Sending fax or scanned image: color or black-and-white documents or pictures, enlarge or reduce, printed-out and delivery, addressee's private fax machine, e-mail account, cable TV.

    --Sending electronic mail or image: digital text file, image file, program--charged by the size of file, or typing on the keyboard--charged by time, printed-out and delivery, addressee's computer, cable TV.

    --Sending video mail or voice mail: recorded tapes, recorded by the camera of the terminal, editing function--charged by time, see your image on the screen.

• Safety bars on the carousel interface which is control by touch screen interface.

• Multiple languages choices: English, Chinese, French, German, ..., and other major languages depending on the location.

Interface Design

The graphics of interface are drawn in Alias/Wavefront V.8, and put together in Director V.5. (see Disk for interactive interface)
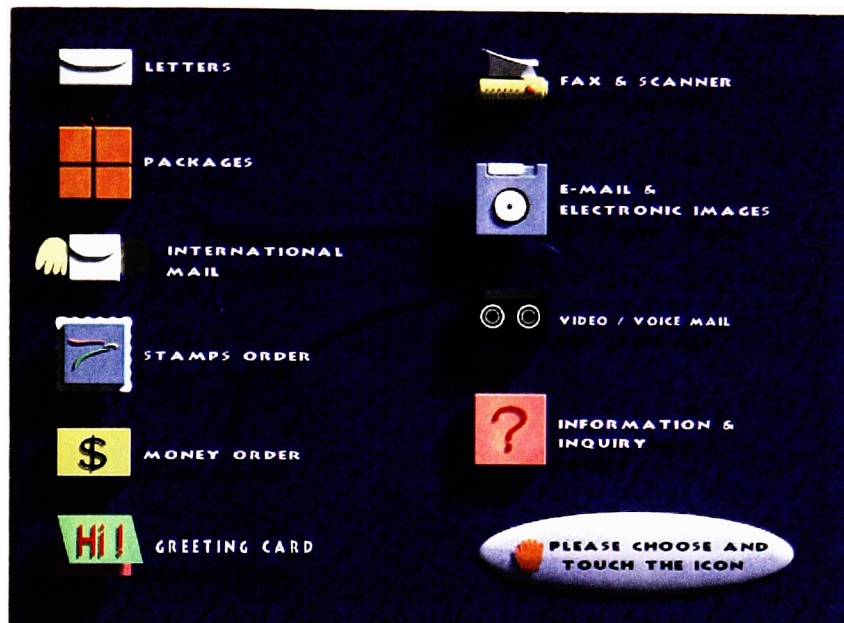

Figure 52 Interface Graphic

Figure 53 Interface Graphic

CHAPTER V
CONCLUSION

The goal of this design was to develop an automatic system to better service postal customers. In the final result shown in chapter IV, the terminal performs like a bank ATM. It can be used anytime and anywhere. Customers will be able to use the postal services more easily and conveniently. The interface is designed to look and function like a carousel, and the user would only face the interface they need. It is simple, step-by-step, and user-friendly. The system also works with various other networks such as the cable TV system, telephone system, or satellite system to provide the public a variety of communication methods and faster delivery. The Postal Service's delivery-on-time success rate is getting lower and lower. This pre-bar-coding or pre-sorting kiosk will reduce the handling processes and time, and improve the delivery efficiency. The Postal Service has no longer needs to lower the delivery standard to increase their success rate. Besides automating the existing postal services, this system can also be expanded to provide other government services.

When developing the system, I tried to use as many commercially available technologies as possible in order to make the product more marketing-feasible. Some people think this project is not realizable because the postal employees would resist it. The Postal Service now employs more than 800,000 employees, which is too many, and the labor cost takes almost 85% of its total cost. Although the Postal Service is a federal institution, it still needs to be competitive to stay in business. This technological change will reduce lots of human labor cost and increase profits. For example: in a big city such as New York City, the Postal Service could install many postal kiosks around

the city's public spaces for people's convenience instead of having several postal offices which are very expansive but not very easy to get to and not efficient either. It also allows small towns to maintain convenient postal service.

The form of the final design is simple but not boring. I repeatedly used simple vertical lines and horizontal arcs to give the impression of efficiency, reliability and friendliness. The arced roof presents the Postal Service as a connecting bridge. The outward curved desk and interface welcome people to use the kiosk. I chose wood for the desk to provide a friendly touch.

While I was doing my research, I also learned that some similar concepts had been proposed long before. However, the market was different, and the technology and network system at that time were not as popular and easily available as today.

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