Intelligent Mailbox System with Automatic Delivery Notification

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Abstract— The project aims in designing an intelligent mailbox system which is capable of automatically sending information about mail to user and delivery notification to courier officials using GSM and RFID technology. The efficient use of dc motor for opening and closing of mailbox can provide security to the system.

Keywords— RFID, GSM, RFID Reader, Tag.

I. INTRODUCTION

As we know the advancements in the Radio Frequency and GSM technologies and making use of those existing technologies we can design a device which is capable of identifying the arrival of courier and forward the same to the person who need to receive the mail and also send an acknowledgement to the courier office so that they do not require the signature of the particular person for whom the courier is meant for. The basic idea of the system is to employ an RFID tag to the courier and send the identity number to the receivers mobile. The receiver of the courier will have a letter box whose opening and closing is made automatically using Geared DC motor, which has an RF reader and a dedicated GSM modem in it. As soon as the courier boy drops the letter in to the letter box it the RF reader reads the identity number of the tag and informs the same to the micro controller and compares it with the identity number send by the courier office and if both are same, then it sends message to the receiver and also to the courier office about the arrival of the courier.

To design the entire system we require a microcontroller which acts as a medium of communication between the RF reader and the GSM modem. The major advantage of this system is the presence of the GSM modem enables the device to communicate with the receiver no matter where ever he was present on the globe (GSM availability).

II. PROPOSED SYSTEM

Each courier is attached with RFID tag and sends the identity number to receivers mobile. When the courier boy arrives, the RFID tag on the courier is read by RFID reader. When the tag matches, letter box is automatically opened using geared DC motor, then it sends message to receiver about arrival of the courier.

When the receiver takes the courier from letter box, an acknowledgment is send to courier office.

Basic Block

The main blocks of this system are:
- GSM Modem
- RFID Reader
- Microcontroller (PIC16F877A)
- Motor Drive and Motor

A. GSM Modem

GSM/GPRS module is used to establish communication between a computer and a GSM-GPRS system. Global System for Mobile communication (GSM) is an architecture used for mobile communication in most of the countries. Global Packet Radio Service (GPRS) is an extension of GSM that enables higher data transmission rate. GSM/GPRS module consists of a GSM/GPRS modem assembled together with power supply circuit and communication interfaces (like RS-232, USB, etc) for computer. The MODEM is the soul of such modules.
B. RFID Reader

RFID stands for Radio Frequency Identification. RFID is one member in the family of Automatic Identification and Data Capture (AIDC) technologies and is a fast and reliable means of identifying objects. The main application of RFIDs is the identification and tracking of products using radio frequency signals for establishing communication among the tags and one or more reader. RFID tags are the devices that will be incorporated to the product that one wants to identify. There exist three different types of tags: active, passive and semi-active nodes.

C. Microcontroller (PIC16F877A)

The PIC 16F877A is a low-power, high-performance CMOS 8-bit microcomputer with 8K words of Flash Programmable and Erasable Read Only Memory (PEROM). The device is manufactured using Micronchip’s high density nonvolatile memory technology and is compatible with its RISC instruction. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the PIC 16F877A is a powerful microcomputer which provides a highly flexible and cost effective solution for many embedded control applications. This is a software controlled system and it makes use of an 8 bit microcontroller PIC16F877A.

D. Motor Drive and Motor

Opening and closing of the box is done automatically using geared dc motor. Driver is used to boost the current. The current from microcontroller is not sufficient enough to rotate the motors a current amplifier is used. L293D is used to drive the motor. L293 Device is a monolithic integrated high voltage, high current four channel driver designed to accept standard DTL or TTL logic levels and drive inductive loads. To simplify use as two bridges each pair of channels is equipped with an enable input. A separate supply input is provided for the logic, allowing operation at a lower voltage and internal clamp diodes are included. The L293D is assembled in a 16 lead plastic package which has 4 center pins connected together and used for heat sinking. The L293D is assembled in a 20 lead surface mount which has 8 center pins connected together and used for heat sinking.

III. OPERATIONAL DESCRIPTION

Each courier is attached with an RFID tag and the tag number is send to the GSM modem present in the letter box system.

This tag number is stored in the microcontroller present at the letter box system. When the courier boy arrives at the owners place, the RFID reader reads the tag number attached to the courier and this data is send to the microcontroller. The microcontroller compares this received data with the previously stored value, if there is a mismatch between these two values the system won’t allow the courier boy to place the courier. If the tag number matches the motor rotates in clockwise direction with the help of motor drive IC L293D which indicates opening of door of the letter box system. After placing the courier in the letter box, the motor rotates in anti-clockwise direction so that door is closed immediately. This ensures that the courier is delivered to the right address. After placing the courier the GSM modem send a message to the owner that a courier has been placed.

Owner has a separate RFID card for opening the letter box system. This tag number is already stored in the system. When the owner shows his card the letter box gets open and he can take the courier. Once he takes the courier from the letter box, a delivery notification is send to the courier office. Even without the physical presence of owner, the courier can be delivered with security.

IV. BENEFITS OF IMPLEMENTING RFID AND GSM BASED SYSTEM IN POSTAL SERVICES

As a conclusion we can state that tagging mail and mailboxes would result in:

- Overall reduced rate of mail delivery error
- Less human errors, more efficient working hours in sorting and deliveries
- Satisfied customers who trust the system
- Less money spent on investigating lost mail
- Real-time up-to-date database
- 100% exact mail traceability service for customers
- Less vandalism of mailboxes
- Reduced handling costs for customers, increased competitiveness
- More efficient and flexible operations, shorter delivery times
- Enhanced security and safety
- Cheaper return package costs (for online shopping)
- Highly efficient and user friendly design
- Easy to operate
- Low power consumption
- Efficient design
- Works anywhere in the world (GSM availability)
V. CONCLUSION

Intelligent mailbox system with automatic delivery notification is designed such that an automatic sending information about mail to user and delivery notification to courier officials from an intelligent courier mailbox system.

Integrating features of all the hardware components used have been developed in it. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Secondly, using highly advanced IC’s with the help of growing technology, the project has been successfully implemented. Thus the project has been successfully designed and tested.

REFERENCES


