Smart Courier Box

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Abstract: As we know, the advancements in the Radio Frequency and GSM technologies have made a platform to come up with various innovations reducing human effort. Since online shopping has become a part and parcel of common man's life, this is the right time to make use of existing technologies to simplify the procedure. The basic idea is to introduce technology into our lives for monitoring issues which demand our personal presence. By doing so we aim at providing a reliable and user friendly solution to problems incurred during online shopping. A standalone box is designed which receives and stores the intended parcel so that the customer can retrieve it as and when required.

Introduction

Most of us have encountered the problems of postal and courier services like delay in delivery, wrong address or ambiguity in delivering the right package. These problems should be addressed with the help of technology so that the solution is simpler and reliable. A device should be designed which can recognize the designated courier as well as collect and store the same so that no ambiguity is occurred. The basic idea of the system is to employ an RFID (Radio Frequency Identification) tag to the courier and send the tag number and item details to the receivers mobile. The receiver of the courier will have information about the goods and the tag with the help of which he can make sure that the correct item has been ordered. To design the entire system, we require a microcontroller which acts as a medium of communication between the RF reader and the GSM (Global System for mobile communication) modem, also the microcontroller monitors the movement of the lid. The major advantage of this system is the presence of the GSM modem enables the device to communicate with the receiver no matter wherever he was present on the globe.

Present Scenario

With surge in online market, people find it easier to buy things online but the timely delivery of right package to the right person has become long-standing issue. One of very concerned issue is that unavailability of the customer when the delivery has arrived to customer's address which results in lot of phone calls and complicated delivery procedures. Adding to that insufficient information on the package results in wrong delivery, which is unacceptable. The customers demand less involvement of one's time and money which has put delivery companies into predicament situation. Our idea is to develop a system which manages these issues and lessen the burden on both customer side and the delivery company side.

Proposed System

The system consists of a box at customer premises having a RFID reader [1] and on the other side i.e. logistics side an RFID tag [2] attached uniquely to a package with details embedded in it. Whenever the delivery address is confirmed by the customer a unique code is sent to the registered mobile or the device installed in residency of the customer which helps in identification of the package expected by the customer. Once packages are tagged, sorted and loaded into delivery vehicles correctly, it's time to deliver them to their destination. The tags contain all the information needed for sorting the packages. The design of the box is in such a way that the upper lid opens only when the correctly tagged package is to be put inside it which is realized by RFID tag and reader communication and verification via microcontroller. A predefined amount of time is given for the deliveryman to place the package and upper lid is closed thereafter. Now inside the box the received package is to be moved to safety compartment which allows further packages to be received by the box. This is implemented using motor and gear arrangement and the operation is repeated for the next package. A confirmation message is sent to both the parties which is the acknowledgement of parcel being delivered. This demands fast and reliable GSM services [3] which are not an issue these days.

Components and Block diagram

The basic components required for implementation are as listed below

1. Microcontroller (PIC 18F46K22)
2. RFID Tags and Reader
3. LDR Sensor
4. GSM Modem
5. Motors, drivers and Gears
6. Power Supply

Fig.1 represents the various components inside the box as blocks and their connections.
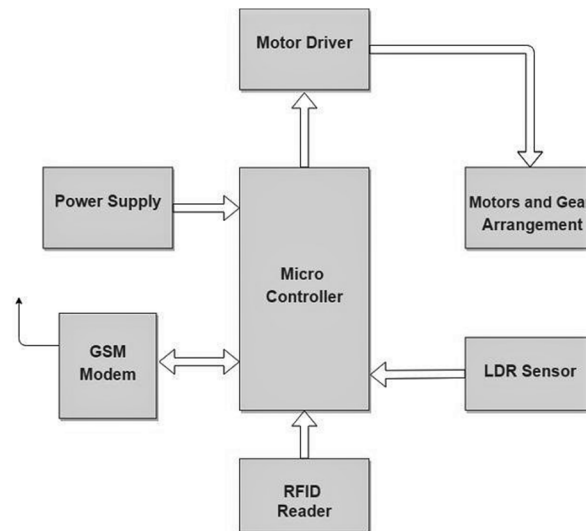

Figure1.Block Diagram indicating components inside the box

Design of box and working

The heart of the project is the design of the box in such a way that once installed it should be fully automated and error free. The box consists of two compartments namely receiving and storage compartment. The design is in such a way that it not only receives the package but also ensures the safety of the package by sprucely placing the package into safety compartment which is visible only to the customer that too after unlocking the box.

Box specification and design

The material used is acrylic which bears reasonable amount of advantages. The schematic representation of the box is shown in Fig. 2 which gives the cross-sectional view. The upper lid is for the receiving compartment and the lower one for storage compartment. Further another sliding door is provided at the bottom of the box which will be under the control of the customer so that he collects the package when required.
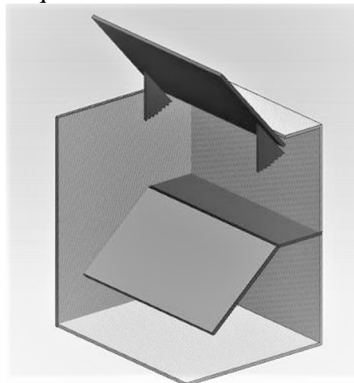

Figure.2 Cross sectional view of the box

The box size is a limiting factor. However, a standard size could be fixed by taking into considerations of different size of packages that arrive most frequently. Fig. 3 and Fig.4 are snapshots of the box designed and implemented in the project.
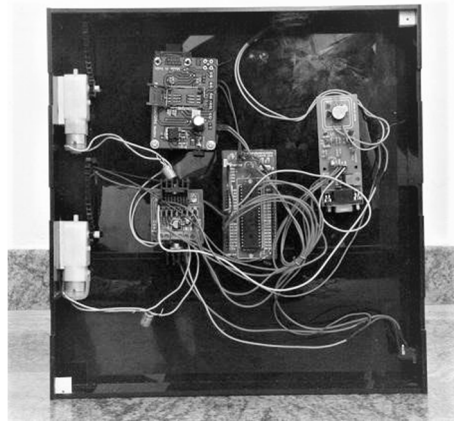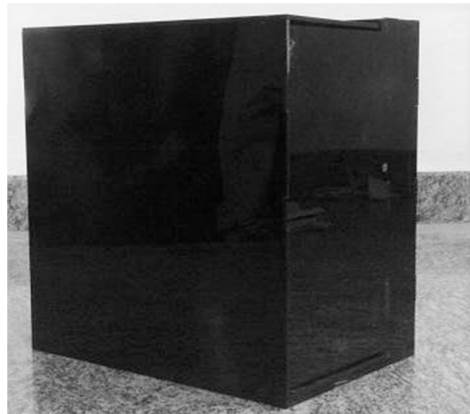

Figure.3 Components inside the box

Figure.4 Courier Box

Flow chart and working
However, the challenge lies are in synchronizing the events that occur in the box after confirmation of arrival of right package. The motor and gear arrangement placed at each compartment is responsible for movement of the lids. This is governed by the microcontroller after ensuring the right package has arrived. The flow of events is shown in Fig.5.

   The below list give the sequence of actions that take place for delivery of a package to customer premises.

- As soon as the customer's order has been verified and confirmed the company attaches an RFID tag to the package and the tag details are sent via message to the GSM modem inside the box.
- The tag number is extracted from the message received and stored for verification.
- Once the delivery man brings the package to the customer premises the RFID tag associated with the package is read by the RFID reader.
- The tag number read and tag numbers stored are compared for equality and validated if found matching.
- Further on validation the upper lid is opened and package is to be kept by the delivery person within stipulated time after which the lid is closed.
- Once the upper lid is closed another confirmation is made whether the package is placed by output of IR sensor placed inside compartment.
- After ensuring all the above events are correctly handled the package is transferred into safety compartment and the second lid is retracted.
- A confirmation message is sent to the company and now the receiving compartment is empty and ready to receive next package in the same manner.
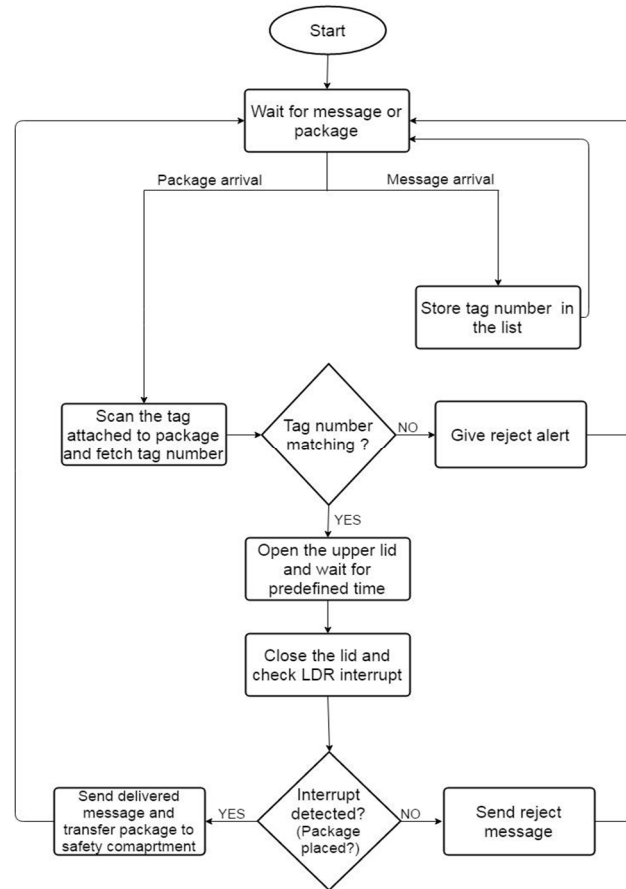
Figure.5 Flowchart

Advantages

Installing this smart box in houses and customer premises would result in,

- Providing a contactless identification and tracking
- Real-time delivery status
- Less human errors
- The tags contain all the information needed for sorting the mail and efficient delivery of the same
- Real-time up-to-date database
- RFID technology and its reliance on radio waves does not require a line-of sight for identification or a straight-line alignment between the tags and readers
- Could use passive and very cheap tags since range is not a concern
- Reusability of the tags
- Enhanced security and safety
- Less money and time spent on tracking and handling of the packages

Future Scope

With the blooming of IoT (Internet of Things) tracking of packages becomes easier. Using internet instead of GSM services also reduces the cost for communication. The status of the package could be checked just by entering the tag number without having to pay for message services. The box could be built inside the wall so that only receiving compartment lid is visible to outside world thus providing an extra security to the package and the box itself. Further improvisation could be made by adding biometric verification at the customer premises. The mechanical part of the system could be improvised for smoother handling of the package. The system requires just one time investment and easy to handle thereby making it affordable for common man.

Conclusion

The aim of engineering studies is to increase the quality of living by constant innovation and research. Introducing technology into common man's life by exploiting the advancements in GSM and RFID technology an effort has been made to simplify the delivery procedure which usually involves lot of human effort and time. Currently handling of packages, tracking and delivery is a major concern for delivery and logistics companies. This has provided a platform for us to act and resolve the problem by making the best use of technology and skill set we have developed as engineering students. An attempt has been made by realizing the vacuum that exists and a fully automated receiver system has been developed which is to be installed in customer premises.

References

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