Automation of post box using IoT Technology

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Abstract: The paper presents a low cost, less human effort and low power consumption implementation of smart post box system through the interaction of hardware kit with android application and web application. Whenever the sender wants to drop a letter into the post-box he can either press the open button on the post-box the disc will come out and the sender will put the letter into that disc, and presses the close button. Ultrasonic sensor will detect the letter. When the close button is pressed the letter will be put into the back compartment of the post-box and a notification will be given to the admin that a letter has been dropped in the post-box. It also tells the number of letter that has been dropped into that post-box in the entire day. Then, the postman goes to only that post-box that will be having letters. Now the postman can generate a QR code for each letter by entering sender's and receiver's information on the webpage. With the help of that QR code the letter can be traced. Here MySQL database is used to store the data. Data in sense it stores the count of the letters that are present in letter box and the address from where the letter has been received.

Keywords: Post-box, Ultrasonic sensor, MySQL database, QR code.

1. INTRODUCTION

The Department of Posts (DoP), bartering as India Post, is a government -operated postal system in India, which is a subdivision of the Ministry of communication Generally called "the Post Office" in India, it is the most widely disseminated postal system in the world. Since from 1650 the term Post office is in use shortly after the legalization of mail services in England in 1635. In India, post office are located in every villages having panchayat cities, towns and throughout geographical area in India. Post office provides various services to the public including receiving and sending letters, parcels, money orders and recently many savings services also been added like recurrence deposit(RD), PPF, postal life insurance etc.

The increase of popularity of e-commerce results in a steadily increasing number of packages sent. As the population and geographic area covered increases more number of post boxes are required to collect the posts. More man power is needed to collect and distribute letters.in the existing system post man has to visit the post boxes located in every villages, cities across the India to collect the letters sometimes the post box left empty and leads to waste of effort of post man. So to reduce effort in this paper we are designing the smart post box which will notifies the admin (post master) regarding arrival of letters into the smart post box using IOT techniques.

The 'post office automation system' eliminates time-consuming tasks such as reluctant work, automated report generation, lengthy processes, and up-to-date data. Smart letter box is the recent technology involved now a days. Smart letter boxes are largely used in post office, home mail box and in courier systems to post the letters. Automation has Smart Post box System involves three parties: admin (post-master) who controls the web application and keep the track of count of letters. The second is the postman who uses the android application and collects the letter from the post-box. The third person is the user (sender) who post the letter into the post-box.

The Indian Postal Service is the world's most widely distributed post office operation Including 155,333 post offices. Through its unrivalled network of post offices, India Post provides open and affordable service to the people of India. Mail, POSB PLI, and Parcel are the hallmarks of post offices, but in the last decade, many new services such as money transfer, EMO, and mutual fund delivery have proven to be popular. This paper proposes the development and efficiency of India's postal services, as well as potential prospects [1].

For many sections of society, especially rural households, the Indian Post Office serves as a traditional saving mode. It is a form of safe and stable savings that is risk-free and provides a consistent return on investment. The study was conducted from a sample of 140 respondents and concluded saying that despite the fact that nine different post office savings schemes exist, only two are found to be effective because they are the most common among investors. As a result, adequate promotion and publicity must be proposed in order to publicise other schemes [2].

The United States Postal Service has recently implemented hand-written address interpretation (HWAI) technology in the handling of letter mail. The HWAI technology is described, including its control structure

algorithms, recognizers, and databases [3].

The Indian government has now increased the importance of post offices and made them more meaningful. Previously, operating a post office without the help of technology was extremely difficult. A research on post office employees' experiences after digitization was conducted in Prayagraj and Lucknow, Uttar Pradesh. According to our research, young workers have a higher degree of satisfaction than older employees [4].

Introduced the smart post box application. This application is mainly responsible for identifying the presence of consignments in mail box. The solution includes hardware design consists of design of mail box and the choice of relevant products to provide the necessary control operations. Software includes parts responsible for monitoring the hardware components [5].

Presents the less time consuming, effective, low cost implementation of smart post box. Which include obstacle sensor to detect the presence of letters in the box, special device called hardware device is designed in this paper. Android application is introduced to send the notifications to the user through the internet [6].

The word automation means replacement of human by machine. This paper illustrate and demonstrate the implementation of the application which is responsible for monitoring and controlling the office appliances using IOT through internet. Additionally system also monitors the number of visitors inside the office and accordingly it controls the usage of electrical appliances to reduce electricity consumption [7].

Presents home automation and safety techniques using IOT and Arduino. This paper utilizes Arduino fundamentals and some sensor to ease the way we control our homes appliances. This is achieved by interfacing sensors like flex sensor, accelerometer sensor, magnetic sensor, flame sensor with microcontroller based system like Arduino UNO. The values from the sensor change the status of our appliances and the status of appliances can be seen on the cloud platform [8]. A clustering based packet transmission for mobile nodes discussed in [9].-

2. FRAME WORK

The smart post box is a system for identifying the presence of letters in the post box from the remote location irrespective of the distance and it consists of

- Sensors for detecting the presence of letters in box and evaluation of the contents.
- Control unit is responsible for communicating with sensor to collect the information regarding the content of the box and storing the status of the box in database. While the status being used for observing the presence of contents in the post box.
- Android application to enable the user to contact the post box control unit from the remote location to check the status of box.

2.1 Hardware devices

The hardware kit consist of an Arduino board, motor driver and Ethernet cable. The Arduino board receives the signal through Ethernet. The motor driver opens the disc. The servomotor rotates the stick and put the letter to the back of the post-box. The buttons are basically used for opening and closing of the disc. Fig 1 shows the various hardware devices used.

- **Arduino (UNO):** The Arduino UNO is an open-source microcontroller board based on the MicrochipATmega328P microcontroller the board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.
- **Motor Driver (L298):** The Motor Driver L298N is an integrated monolithic circuit in a 15- lead Multi watt and PowerSO20 packages two enable pins are provided to enable or disable the device independently of the input signals.
- **Ethernet Shield:** The Arduino Ethernet Shield (Figure3.3) allows an Arduino board to connect to the internet. It is based on the Wiznet W5100 ethernet chip (datasheet). The Wiznet W5100 provides a network (IP) stack capable of both TCP and UDP. It supports up to four simultaneous socket connections An Ethernet cable is one of the most common forms of network cable used on wired networks.
- **Servo Motor:** Servo motor (Figure3.4) works on PWM (Pulse width modulation) principle, means its angle of rotation is controlled by the duration of applied pulse to its Control PIN. Basically servo motor is made up of DC motor which is controlled by a variable resistor (potentiometer) and some gears
- **Ultrasonic Sensor:** An ultrasonic sensor is an instrument that measures the distance to an object using ultrasonic sound waves.

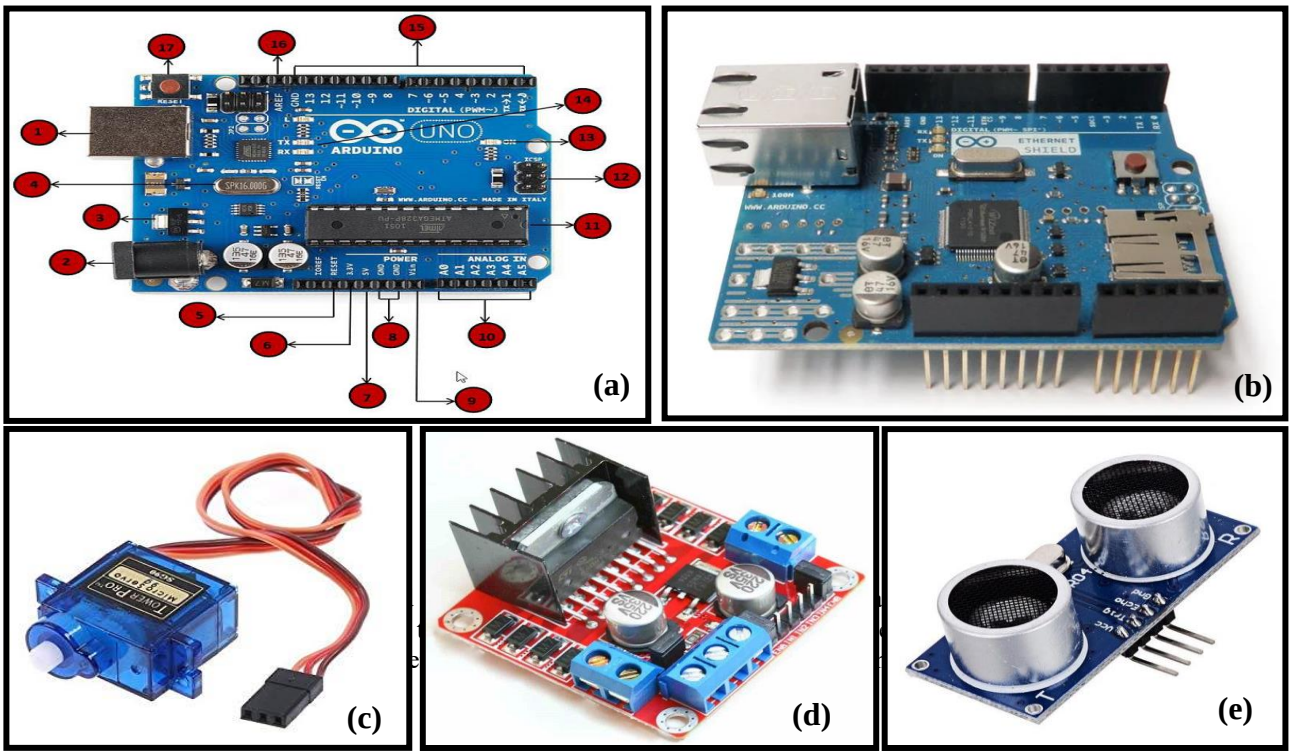

Fig 1. Hardware devices used for designing the smart post box, a) Arduino Uno, b) Ethernet shield c) Servo motor, d) Motor driver, e) Ultrasonic Sensor

insertion of the letter in the post-box.

2.3 Android application

Android application is used to create the user interface wherein the sender and the postman can access the post-box with the help of an application. The GUI will be having open, close and count buttons wherein the open and close buttons are used for the opening and closing of the post-box and the count will show the number of letters inserted into the post-box

3. METHODOLOGY

Smart Post Office System involves three parties: admin (post-master) who controls the web application and keep the track of count of letters. The second is the postman who uses the android application and collects the letter from the postbox. The third person is the user (sender) who post the letter into the postbox.

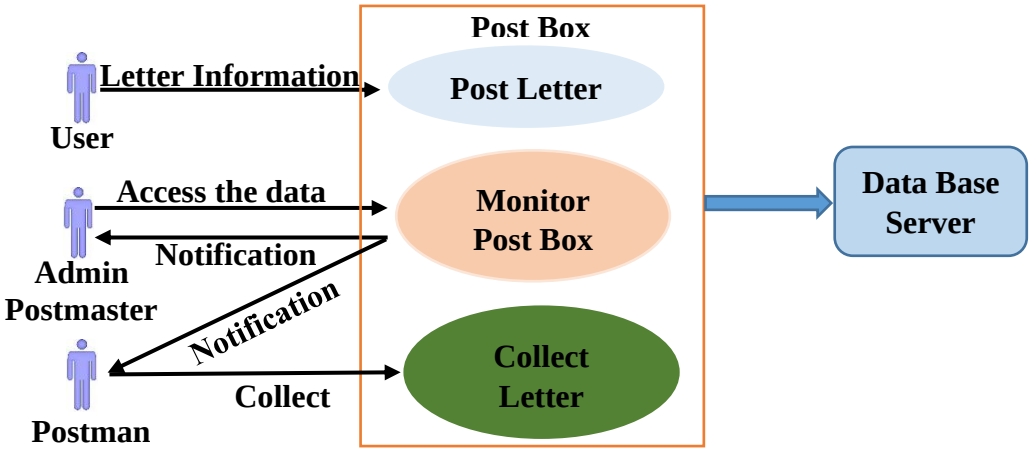

Fig 2. Use case diagram

Fig 2 shows the use case diagram of the smart post box which involves mainly three parties: first person is user who is accessing the application for inserting the letter in to box and also enters the information regarding the letter such as sender and receiver details. Second party is the admin or post master who monitors the post box frequently, the application sends the notification to the admin regarding the arrival of letters to the admin and he can access the details of letter. System involves post man as the third person who will get the notification from the admin to collect the letters, post man collects the letter from the post box and generate the QR code for the distributing the letter.

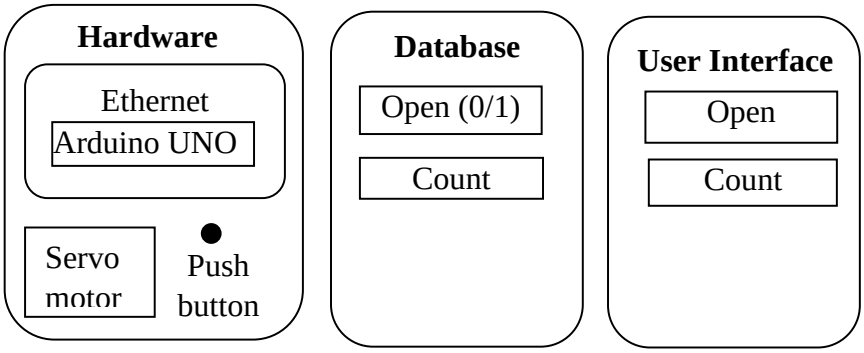

Fig 3. High level Design Architecture

Figure 3 shows the high level Design of the application which includes the appearance of user interface which contains the menu of two items open and count. Open items will allow the user to put the letter into the box. Count item will give the count of letters in box to the post man. Database is responsible for storing the count of letters arrived to the box. Hardware component shows the various hardware devices used for sensing the arrival of letters, pushing letters back to compartment and sending the notification to the admin.

3.1 Post-box

In this module we have design the post-box which is the hardware part of the project as shown in Fig 4. The post-box module consists of Arduino, a servomotor, a motor driver, Ethernet Shield and a button. When the button is pressed the disc will be opened with the help of motor driver and the letter is inserted into the disc. Button is again pressed to close the disc. Ultrasonic sensor will sense the letter that has been inserted into the disc. Once the disc is closed the servomotor comes into play and rotates thus putting the letter to the back of the postbox. Ultrasonic sensor increase the count for each letter.

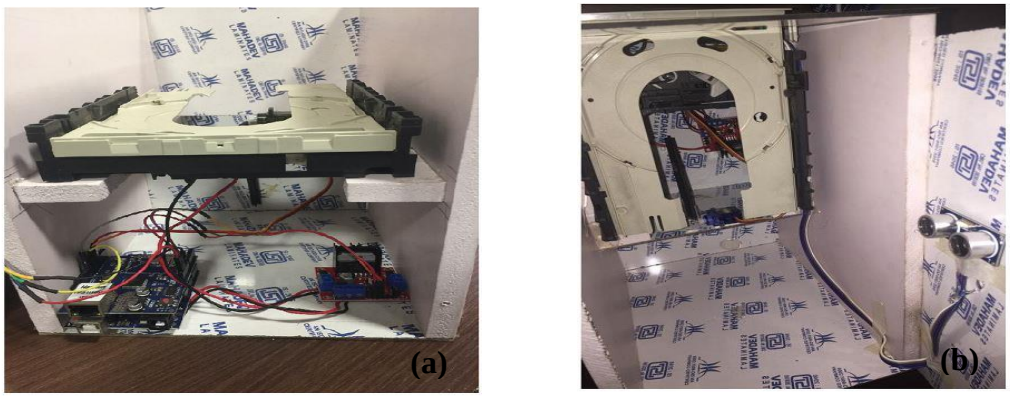

Fig 4. Smart Post Box (a) Front view, (b) Top view.

3.2 Web Application

In this module we have designed the web application with use of HTML, PHP and CSS styling as shown in Fig 5. We have designed a web application that can only be accessed by the admin. The web application tells about the number of letters being posted into the post-box. It also allows the postman to enter the sender's and receiver's information so as to generate the QR code as shown in Fig 6 and this QR code is further used to sort the letters according to their destination using pin code.

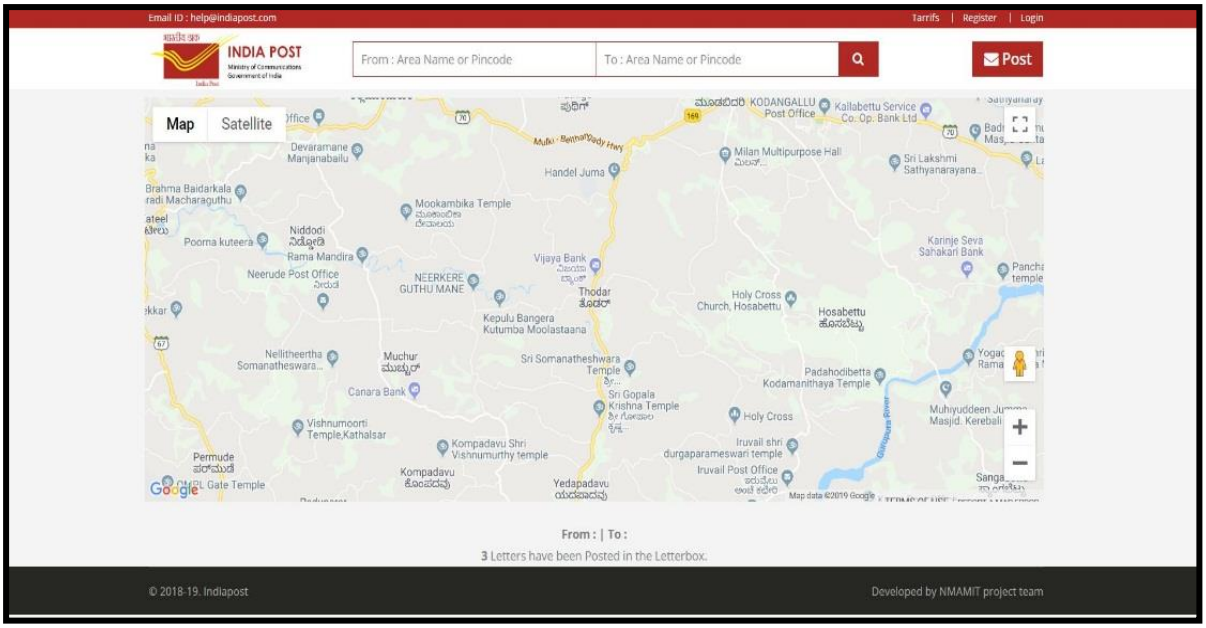

Fig 5. Front page of web site

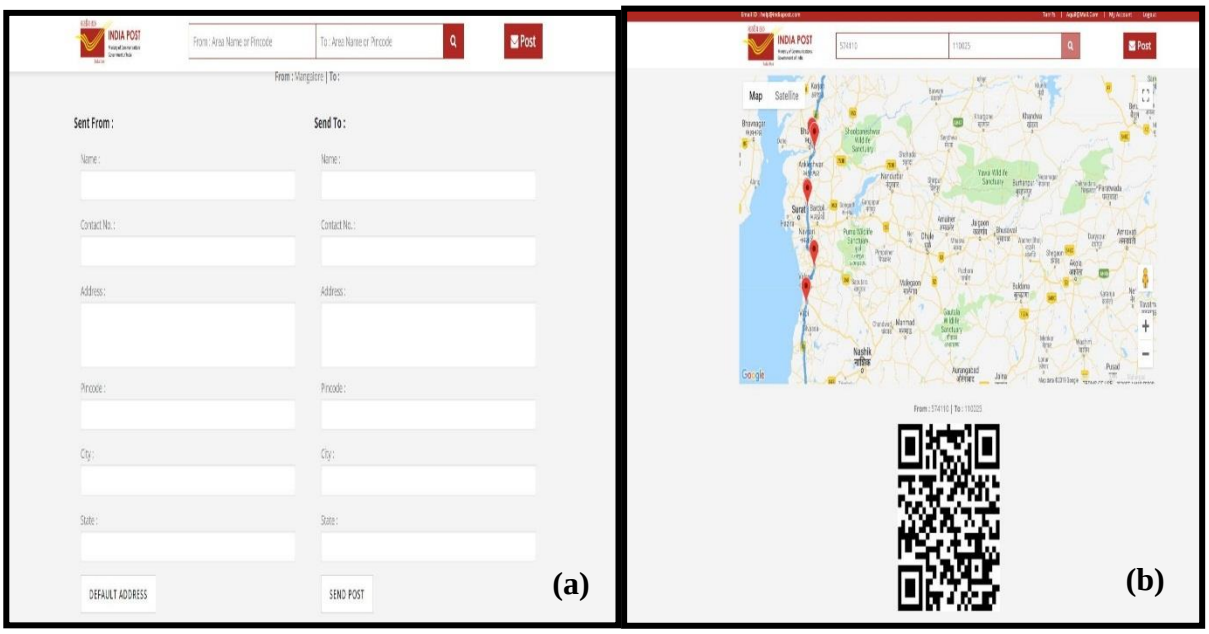

Fig 6. Smart post box website a) Detail entry of the letter, b) QR code generation

3.3 Android Application

In this module, we have designed an android application with the help of android studio which can be used by both sender as well as the postman as shown in Fig 7. The user can login to the application with the help of his phone number wherein a verification code is sent to that phone number thus verifying that phone number. Once the sender login to the application he can access the post-box to post the letter. Similarly, the postman also have to login to the application with the help his phone number and once verification is done through OTP he gets the count of letter in post box. He can also scans the QR code generated by the web application and get the information related to that specific letter.

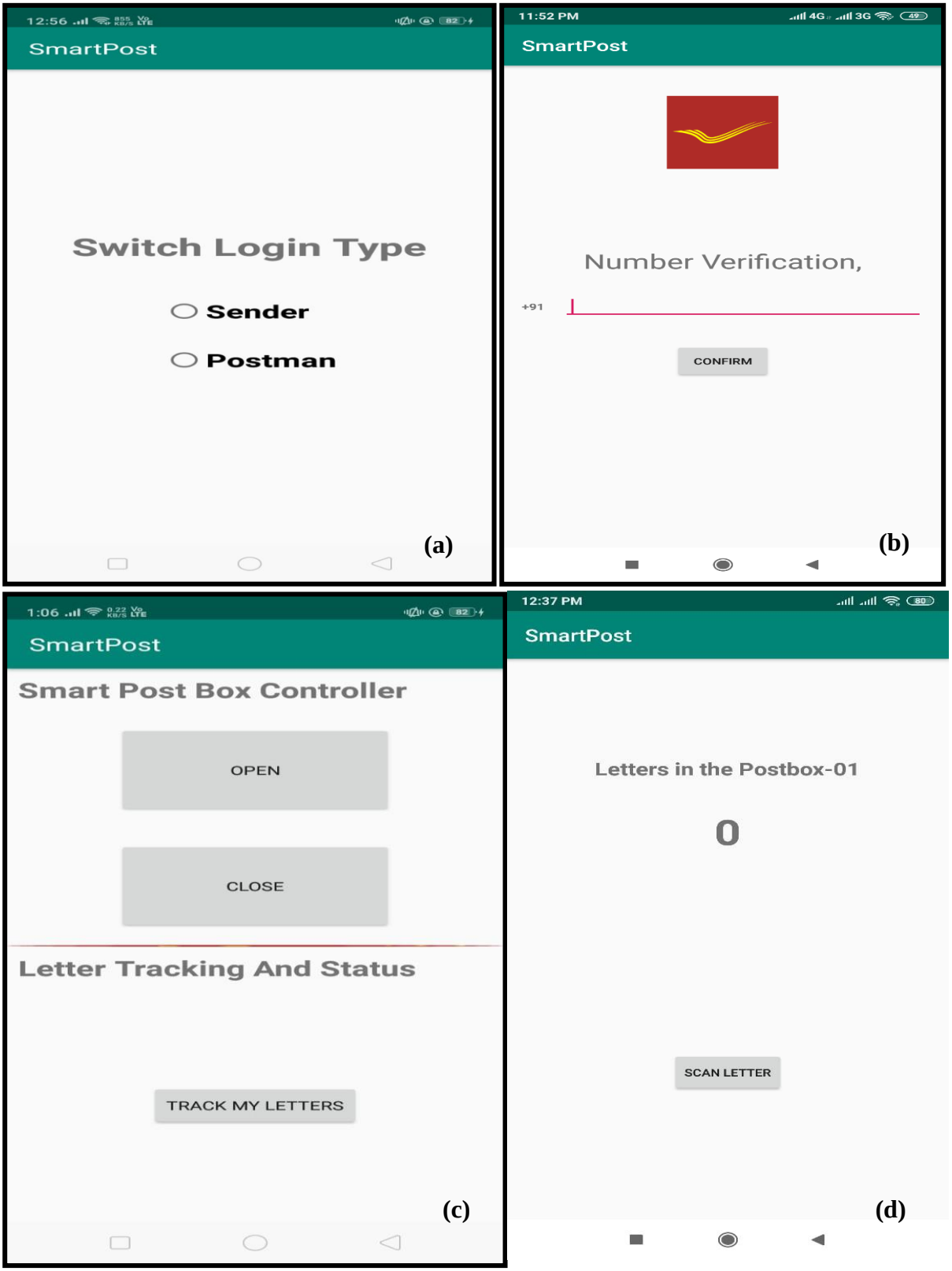

Fig 7. Smart post box android app a) Login page for user and post man, b) Mobile number verification c) User interface, d) Count of letters (post man)

4. CONCLUSION

The work is focused on the creation of smart post box application. We designed the smart post box which is

responsible for sending the notification to the post man as well as post office admin about the arrival of posts and also the count of posts in post box. The work has many benefits mainly it reduces the effort of post man. Application notifies the presence of letters in the post box so that post man can only visit such post boxes instead of all the post boxes located in the city.

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