

# Intelligent Transportation Systems with Smart Courier Box for Data Communication Using Iot

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## ABSTRACT

The proliferation of online shopping has introduced a number of problems for the customer not present in what we might call the traditional shopping experience. One of the big new problems is how to handle the receiving of a parcel when not at home. A common practice by couriers is to leave a message indicating their failed attempt to deliver your package due to a door lock or leave it in the care of the local neighbors (or not so local) post office. This then introduces a new problem of finding the time to collect your package from a place which is only open during the hours which most people work. Clearly, this is not an adequate solution. What is needed is a way to receive a package at home even when no one is there. This would mean providing a secure location in which the package can be stored until someone gets home to collect it. A standalone smart box is designed which receives and stores the intended parcel so that the customer can retrieve it as and when required. In our modern busy lifestyles, we often do not have enough time to respond to our routine activities like – answering a person at the door or for collecting a door delivery. To handle such situations we propose a solution by automating the parcel collection box. In this project, we discuss the part of IoT (WiFi) in home sophistication, the proposed approach for automating the parcel delivery collection, the working and the design of the system.

**Keywords:** Arduino Software, IoT, IR Sensor, Smart Courier Box and WiFi

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## INTRODUCTION

With the surge in the online market, people find it easier to buy things online but the timely delivery of right package to the right person has become a long-standing issue. One of the very concerning issues is the unavailability of the customer when the delivery has arrived to the customer's address which results in a 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 a predicament situation. Our idea is to develop a system that manages these issues and lessens the burden on both the customer side and the delivery company side.

In our daily life, ordering things online has greatly reduced the time and effort rather than purchasing it personally. But in such cases, the availability of the customer at the time of product delivery is always essential. The requirement of this constraint minimizes the easiness of ordering the product online. Hence automation of parcel/product receiving will certainly lead to an easy and safe fulfillment for online ordering. This is the motive behind the proposal of an approach for automation of parcel receiving.

The basic idea is to introduce technology into our lives for monitoring issues that 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 smart box is designed which receives and stores the intended parcel so that the customer can retrieve it as and when required. In our modern busy lifestyles we are often not having enough time to respond to our routine activities like – answering a person at the door or for collecting a door delivery. To handle such situations we propose a solution by automating the parcel collection unit. This project discusses about the part of IoT (WiFi) in home sophistication, the proposed approach for automating the parcel delivery collection, the working and design of the system.

## LITERATURE SURVEY

The study on similar issues in the Finland [2] provides the concept of last mile parcel being delivered to the right person. This paper specifies the issues and difficulties undergone by the customer as the parcel is being delivered, the electronic-

retailer need to provide doorstep product delivery. If in case finds unavailability of customer the delivery man needs to return the product which is totally waste of time and travelling expenses, as the result the retailer has to bear the loss. A suitable measure need to be taken to minimize the issue related in collecting the parcel. Automation of Parcel Delivery Collection Using IoT [3] presents a brief structured outline of the system framework which is implemented by using two basic devices like bar code reader in combination with weight sensor. As the delivery boy places the product inside the box on the weight sensor through the front door the customer get the notification about the product weight and the barcode reader confirms the product that is placed. Once the customer confirms the product placed inside the smart system, he will be able to collect it when returning home. This paper tells us only about the product collected that is kept inside the box with no proper measures taken to overcome the external issues faced.

The online shoppers suffer delivery problems [4] as their products are out with the confirmation for delivery. Once the product verified is taken to be given at the mentioned address, the deliveryman places product near the home or at surrounding neighbors. This results the issues faced by the receiver when he need to collect the parcel. This paper presents brief information on the problems facing by the receiver during collection of his parcel. It is analyzed that on average two out of every three person face problem related to this issue. Global Parcel Delivery Marketing [5] conditions need to be examined about the present economic situations in a totally unique kind of economy. This analysis gives the information related on how the present marketing conditions of the products are carried out. The issues presents evidence of analyzing the next future marketing conditions on exchange of products from different nation and its growth based on previous year data analysis. This helps to improve the global exchange of goods as the result of this in increasing in marketing condition of online delivered goods. Parcel locker's efficiency Analysis [6] based on the last mile delivery solution.

The system is designed to collect the product and secure it until product is collected from the system. The huge system consisting of many lockers are installed in the major interaction point in the city where the people are attracted most. The online retailer places the parcel in one of the locker and informs the receiver to collect. The receiver has to travel to the locker in order to collect the parcel which is total waste of his time and travelling expenses. All the above expressed review about the related work was sufficient and proves that more work was required in the field thinking about the interest of internet shopping at present. by someone else and perishable items can get spoiled if not delivered quickly. Similar problems related to the issue is seen in which different devices are used to develop the system which resolves the online shopping problems faced by the client and receiver. The problem may be due to the delivery related issues like delay of delivery products, damaged parcel due to external conditions, or even being stolen. As these issues are need to be solved and to be overcome, the Smart Freight Box system is proposed which mainly aims in resolving the issues and problems being faced by the receiver and client.

### **Developing a Parcel Delivery Service**

The demand of express delivery services for consumers has grown rapidly due to the increased popularity of e-commerce. For example, in J.P. Morgan's (2011, 12) annual guide, Goldman Sachs has predicted that global e-commerce sales will reach \$963 billion by 2013, growing at an annual rate of 19.4 %. DHL Express' services have originally been developed for business customers and it is, therefore, justifiable to assume that not all of the service features are suitable for consumers. The final outcome of the thesis will contain suggestion of desirable actions which the author has identified during the research process. The actions will be chosen based on the company's need to serve the consumers better and thus to meet the expectations of business customers that operate in the e-commerce field. From the author's point of view, it is interesting to gain deeper insights from the postal and courier activities industry (Statistics Finland 2008, 53) and to have the opportunity to introduce service design methods to the case company. Because the author has worked in customer service and sales departments for several years, she has a lot of experience from the support functions but less from the operational department. In order to expand her professional expertise in logistics, the author finds it important to understand both parts of the process.

The results of this study will provide important insight for the case company's operational department. The received information will help them to set targets and focus on the most critical aspects concerning the last mile of a parcel delivery service concept for consumers in away that will benefit both the consumers and the case company itself. The outcome of the research is an improved last mile of a parcel delivery service concept for consumers. The development will bring additional value for the consumers and decrease unnecessary operations from the case company's point of view. Therefore, the improved service concept will be beneficial for both of the parties.

### **RFID and GSM based Intelligent Courier Mailbox System**

An embedded system is a combination of software and hardware to perform a dedicated task. Some of the main devices used in embedded [12][15][17] products are Microprocessors and Microcontrollers. Microprocessors are commonly referred

to as general purpose processors as they simply accept the inputs, process it and give the output. In contrast, a microcontroller not only accepts the data as inputs but also manipulates it, interfaces the data with various devices, controls the data and thus finally gives the result. The RFID [16][18][21] and GSM based intelligent courier mailbox system with automatic delivery notification using PIC16F877A microcontroller is an exclusive project which is used to design an intelligent courier mailbox system which is capable of automatically sending information about mail to user and delivery notification to courier officials Page Layout.

In the earliest years of computers in the 1930–40s, computers were sometimes dedicated to a single task, but were far too large and expensive for most kinds of tasks performed by embedded computers of today. Over time however, the concept of programmable controllers evolved from traditional electromechanical sequencers, via solid state devices, to the use of computer technology.

One of the first recognizably modern embedded systems was the Apollo Guidance Computer, developed by Charles Stark Draper at the MIT Instrumentation Laboratory. At the project's inception, the Apollo guidance computer was considered the riskiest item in the Apollo project as it employed the then newly developed monolithic integrated circuits to reduce the size and weight. An 8 early mass-produced embedded system was the Automatics D-17 guidance computer for the Minuteman missile, released in 1961. It was built from transistor logic and had a hard disk for main memory. When the Minuteman II went into production in 1966, the D-17 was replaced with a new computer that was the first high-volume use of integrated circuits.

### **Development of Intelligent Transportation Systems**

In Europe, governments, companies and universities of 19 countries established the PROMETHEUS (Program for European Traffic with Efficiency and Unprecedented Safety) project. Several ITS technologies were developed in this program between 1987 and 1994. In the 80s was demonstrated the test vehicle VaMoRs at Munich [4]. In this prototype were used two forward-looking TV cameras with the purpose of an automatic lane and road following. In the 90s, a group led by Daimler-Benz developed the test vehicle VITA II [5]. This vehicle incorporated 10 cameras and 60 processors with the purpose of keeping the vehicle in the center of the lane, keeping a safe distance from the car in front, changing lanes and overtaking other cars with collision avoidance. Other projects were developed in the scope of PROMETHEUS, namely the ARGO project [6], which aimed to design, develop and test of innovative solutions for the vehicles of the future. This program was followed by DRIVE (Dedicated Road Infrastructure for Vehicle Safety in Europe) for the development and test of the communication system, for drive assistance and traffic management [7].

The public-private sector organization ERTICO (European Road Transport Telematics Implementation Coordination Organization) was set up to provide support for refining and implementing the Europe's Transport Telematics Project. In the United States, in the late 80s, the Mobility 2000 study team laid the groundwork for the formation of the IVHS America (Intelligent Vehicle Highway Systems) [29], which is a public-private forum for consolidating national ITS interests and promoting international cooperation in ITS. In 1994 the USDOT (United States Department of Transportation) changed the name from IVHS to ITS America (Intelligent Transportation Society of America). Several projects were developed at more than eighty places across the US [8]. A key project, AHS (Automated Highway System) was conducted by NAHSC (National Automated Highway System Consortium) formed by the US Department of Transportation, General Motors, University of California and other institutions [8]. Under this project various fully automated test vehicles were demonstrated on California highways. In Japan, in the 80s, some projects were carried out, namely RACS (Road Automobile Communication System) [27] by the Ministry of Construction and AMTICS (Advanced Mobile Traffic Information and Communication System) [28] by the National Police Agency.

In the 90s combining efforts with the Ministry of Posts and Telecommunications, and working on standardization projects, it was possible to combine those two projects into VICS (Vehicle Information and Communication System). A VICS terminal provides a locator for displaying the vehicle's coordinates on the map screen, and allows the communication with the ground stations to acquire traffic conditions for route planning. Examples of other developed projects are ARTS (Advanced Road Transportation Systems), by the Ministry of Construction, for the advance of road traffic through integration of roads and vehicles considering ASV (Advanced Safety Vehicle) intended for the promotion of research and development of vehicle safety technologies.

### **Smart Courier Kit using Internet of Things**

Now-a-days, we face many problems in postal and courier services like wrong package delivery, wrong address or delay in delivery, etc., These problems can be solved with the help of technologies so that the customer can no longer face the same issues in the coming days. The main aim of this paper is to design a courier box to collect and store the designated courier with no ambiguity. The system uses RFID (Radio Frequency Identification) tag to the courier and the customer will receive

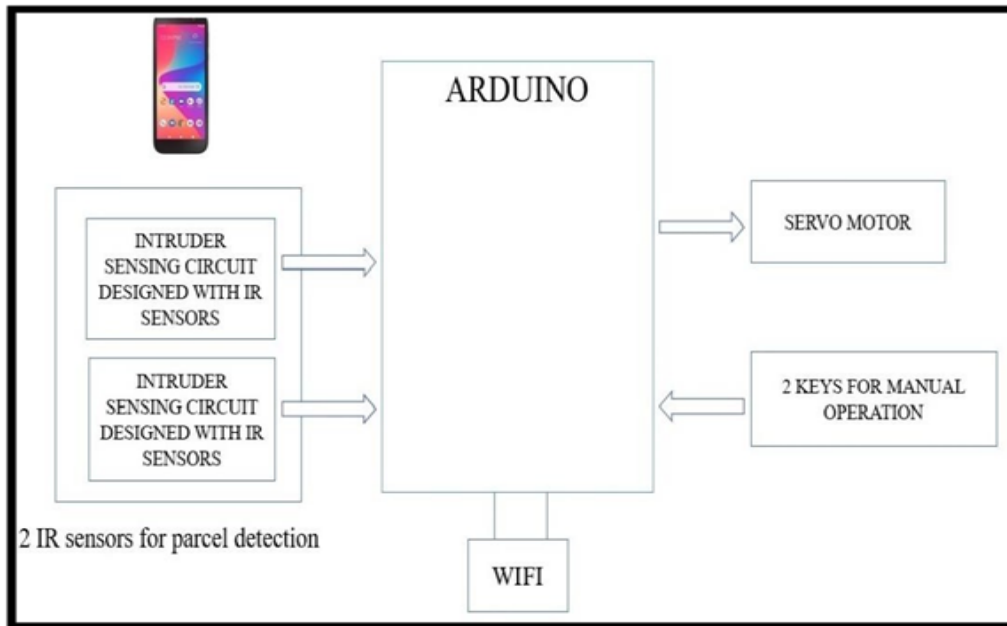
the tag number and the item details to their mobiles. The courier box is set in the receiver's house which uses Geared DC motor to open and close the courier box automatically. The courier box has the GSM[26][29][30] (Global System for Mobile Communication) modem and the RF Reader in it. When the courier is dropped into the courier box by the courier boy, the tag number is read by the RF Reader and the same tag number is sent to the Microcontroller which compares it with the tag number sent by the courier office. If tag numbers are matched, a message is sent to the customer and to the courier office about the courier. The required components to design this system are- a microcontroller which monitors the movement of the lid and is used to communicate between the RF Reader and the GSM modem. Since the GSM modem is used, the advantage is the device can communicate with the customer wherever he/she is in the globe.



Fig 2.2 Smart Courier kit

**Proposed Work**

One of the big new problems is how to handle the receiving of a parcel when not at home. A common practice by couriers is to leave a message indicating their failed attempt to deliver your package due to door lock. To handle such situations we propose a solution by automating the parcel collection unit. This project discusses about the part of IoT (WiFi) [20][31][24] in home sophistication, the proposed approach for automating the parcel delivery collection, the working and design of the system.



Block diagram of the proposed method

### Implementation

As we know, the advancements in the wireless communication technologies have made a platform to come up with various innovations reducing human effort. Now adaya's online shopping has become a part and parcel of common man's life, this 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 smart box is designed which receives and stores the intended parcel so that the customer can retrieve it as and when required. In our modern busy lifestyles we are often not having enough time to respond to our routine activities like – answering a person at the door or for collecting a door delivery. To handle such situations we propose a solution by automating the parcel collection unit. This project discusses about the part of IoT (WiFi) [22][23][28] in home sophistication, the proposed approach for automating the parcel delivery collection, the working and design of the system. This system presents a low cost, less time consuming, safe and effective implementation of Smart Box System through the wireless sensor networks. A special device, called hardware kit is realized and design for this purpose. The demo model of the smart box is designed using a door mechanism operated through a DC motor, optical sensor using IR transmitter and IR receiver, a 3X4 matrix keyboard to enter the code, WiFi module [25] interfaced to the control unit that is designed using arduino mega controller. This project is a fine combination of Android mobile technology and embedded system. An application should be installed on android mobile handset to control the smart box door. User can send commands using that application. Wireless controlling technique used in this project is WiFi technology. The WiFi device is connected to the control circuit which has a decoder. This decoder sends code for respective command sent by user through android mobile.

When the courier comes, by entering the code and sending it through its WiFi interface through the android device, the door of the smart box is opened. There is one more option that, we can set the order number of the parcel through the same android device before it is to be delivered such that the courier person can type the order number using the keyboard to open the door of the box to deliver the parcel. When the parcel is placed inside the box, it is sensed through the optical (IR) sensors and the door will be automatically closed and simultaneously a message will be sent to the android device that the parcel is put in the smart box. In addition a vibration sensor is also placed in the smart box to identify and inform to the android device [11][13][17] when any one tries to take away the smart box.

### Circuit Diagram

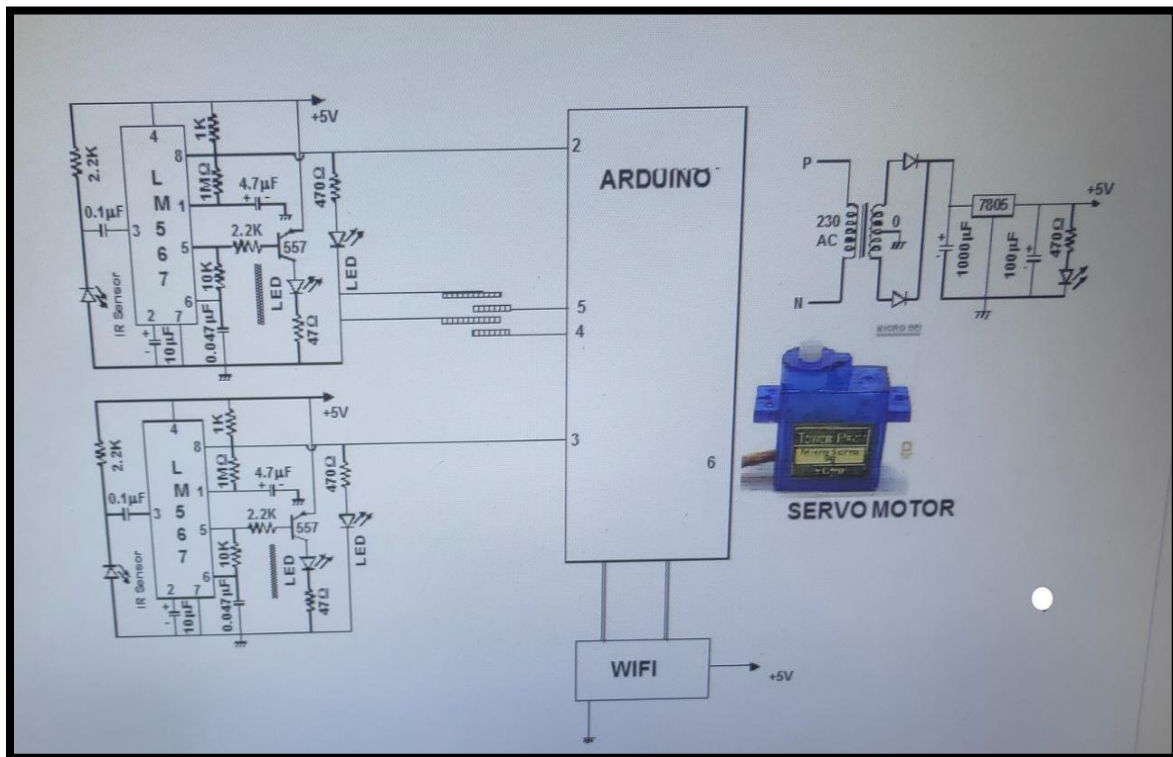


Fig 3.2 Circuit diagram

Smart Courier Box is used mainly in front of homes for collecting the package. Arduino Mega 2560 is an ideal choice for the projects requiring more memory space to use with more number of number pins on the board. Following are the main applications of the Arduino mega boards.

- ✓ Developing 3D printer
- ✓ Controlling and handling more than one motors
- ✓ Interfacing of number of sensors
- ✓ Sensing and detecting temperature
- ✓ Water level detection projects
- ✓ Home automation and security systems
- ✓ Embedded Systems
- ✓ IoT applications
- ✓ Parallel programming and Multitasking

### Experimental Settings

The IEEE 802.11 specification (ISO/IEC 8802-11) is an international standard describing the characteristics of a wireless local area network (WLAN) [19][14][17]. The name Wi-Fi (short for "Wireless Fidelity", sometimes incorrectly shortened to WiFi) corresponds to the name of the certification given by the Wi-Fi Alliance, formerly WECA (Wireless Ethernet Compatibility Alliance), the group which ensures compatibility between hardware devices that use the 802.11 standard. Today, due to misuse of the terms (and for marketing purposes), the name of the standard is often confused with the name of the certification. A Wi-Fi network, in reality, is a network that complies with the 802.11 standard. With Wi-Fi, it is possible to create high-speed wireless local area networks, provided that the computer to be connected is not too far from the access point. In practice, Wi-Fi can be used to provide high-speed connections (11 Mbps or greater) to laptop computers, desktop computers, personal digital assistants (PDAs) and any other devices located within a radius of several dozen metres indoors (in general 20m-50m away) or within several hundred metres outdoors. Wi-Fi providers are starting to blanket areas that have a high concentration of users (like train stations, airports, and hotels) with wireless networks. These access areas are called "hot spots".

### Software Description

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them. Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension .ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom righthand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor. Versions of the Arduino Software (IDE) prior to 1.0 saved sketches with the extension .pde. It is possible to open these files with version 1.0, you will be prompted to save the sketch with the .ino extension on save.

## RESULT AND DISCUSSION

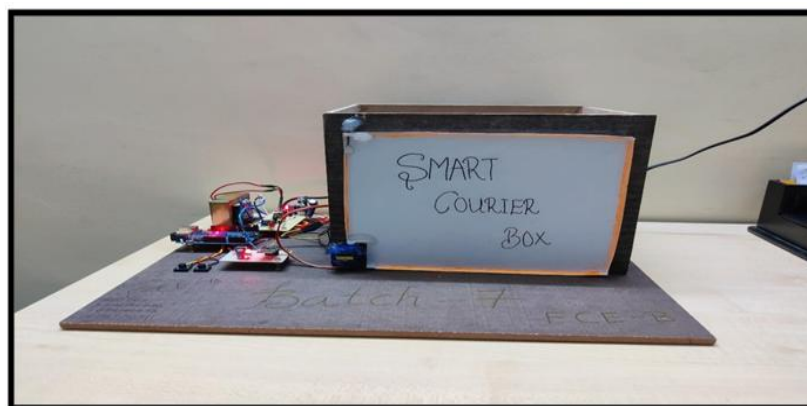


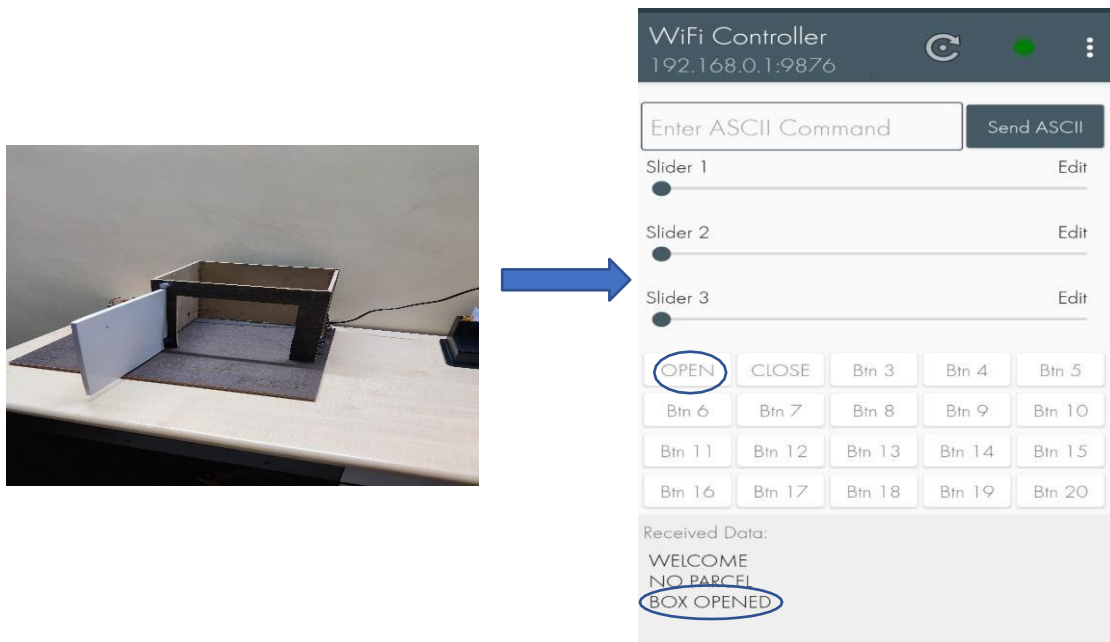
Fig 5.1 Smart Courier Box

**Step 1:** Switch on the kit and open the WIFI controller application on your mobile and make sure you turn on WIFI in your mobile before using the application.



**Fig 5.2 Step 1**

**Step 2:** Click on open button in WIFI controller application then the door of the box will be opened.



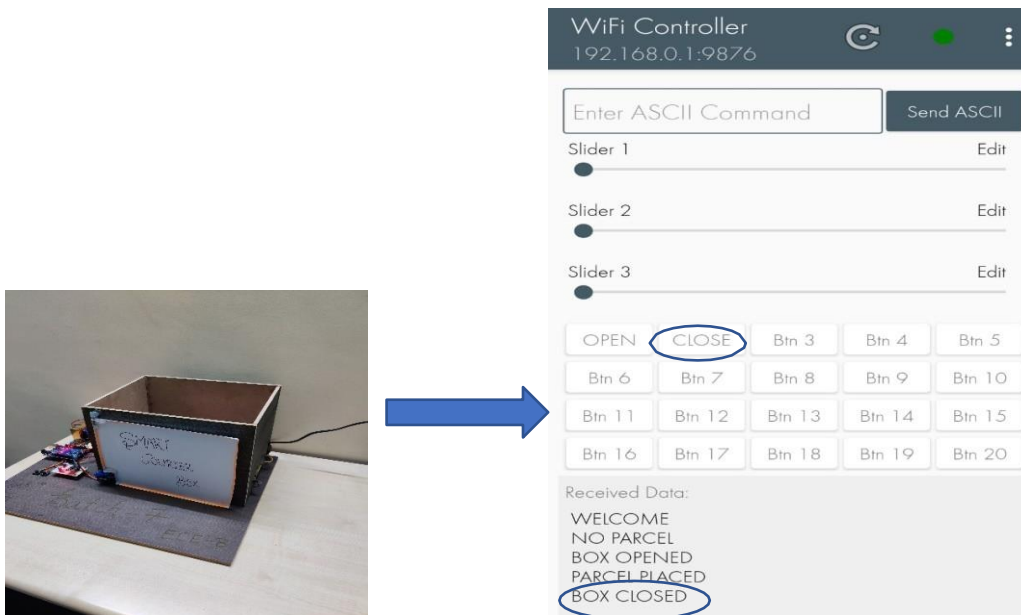
**Fig 5.3 Step 2**

**Step 3:** when the delivery boy placed the parcel, we will get notified through the phone.



**Fig 5.4 Step 3**

**Step 4:** Click on close button the box will be closed as soon as the parcel placed.



**Fig 5.5 Step 4**

### 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 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. The project work is designed and developed successfully. For the demonstration purpose, a prototype



module is constructed; and the results are found to be satisfactory. While designing and developing this proto type module, we have consulted few experts those who are having knowledge in various fields, and these professionals working at different organizations belongs to Hyderabad helped us while fabricating this project work. Since it is a prototype module, much amount is not invested. The whole machine is constructed with locally available components; some of the modifications must be carried out in design to make it as real working system. It is noted that the designed prototype will be adapted to all the areas by making some modifications and increasing the features for seeing more improvement in the designed model

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