Unmanned Secured Delivery System

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***Abstract*—** Now a days customers are mostly prefer online shopping and ordering, that brought the need for the delivery man. The rapid increase in usage of online ordering has increased the requirement of manpower to deliver in multiple folds. Drone based technology is being used to meet this requirement. The present automated drone delivery system has a few drawbacks like- The drone just drops the ordered package to the location without the concern of whether the customer is available there or not. There is no facility to change the location after ordering the package. This work focuses on the unmanned secure delivery system which will address the above mentioned drawbacks. By interfacing GPS and GSM module to the drone, the intelligence of changing the location of delivery can be inherited by the user. Secondly, once the drone reaches the location if the users do not input their pass code in the drone via a keypad provided, the drone will not release the package. In this condition the drone will send an SMS to the user about the failure to deliver the package and will fly back to the vendor's control station.

Keywords- *Drone, Online ordering, pass code, secured, unmanned.*

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I. INTRODUCTION

A. BACKGROUND

Parcelcopter is an unmanned aerial vehicle (UAV), which is also known as 'delivery drone', is utilized to transport packages, food or other goods, initially the attempts of using commercials UAV's (unmanned aerial vehicle), such as tacocopter, company for food delivery, were blocked by FAA regulation in the united states.[1] In United States government forbid delivering of packages with the help of the drones, as of 2015[2]. FPS distribution completed the first commercial delivery using UAV on 13th march 2015 in Sheffield, US. The taco delivery concept, which is then used in tacocopter, is based on a smart phone app to order drone- delivered tacos in San Francisco area. Star Simpson an MIT (U.S.) graduate invented this technique which is used in tacocopter, and its website went live in July 2011 magnetizing the public and the media attention. [3][4] Many labeled it as hoax as it was reached that it didn't exist as a delivery system or app.

The remote controlled drone, dome copter, was tested by an independent British franchisee Domino's pizza to deliver pizza. Dome copter was developed by a joint venture of U.K. Drone specialist aero site, big communications and creative agencies T+ Biscuits. A short footage video was released in June 2013. [5]

B. Problem Overview and Scope of Work

On December 1, 2013, Amazon.com CEO Jeff Bezos revealed plans for Amazon Prime Air in an interview on 60 Minutes. Amazon Prime Air will use multirotor Miniature Unmanned Air Vehicle (Miniature UAV, otherwise known as drone) technology to autonomously fly individual packages to customers' doorsteps within 30 minutes of ordering.[6] To qualify for 30 minute delivery, the order must be less than five pounds (2.26 kg), must be small enough to fit in the cargo box that the craft will carry, and must have a delivery location within a ten-mile radius of a participating Amazon order fulfillment center [6]. 86% of packages sold by Amazon fit the weight qualification of the program.

The present automated drone delivery system has a few downsides like:

- The drone just drops the ordered package to the location without the concern of whether the customer is available there or not.
- There is no facility to change the location after ordering the package [2].
- What if at the landing of drone, if someone else picks up the package before the intended person comes out from inside home [3].

In this work to overcome some of such issues, GPS and GSM module is used. In this work GPS, GSM and servo motor and keypad are interfaced to Arduino board. GSM and algorithm in Arduino is used to direct the drone to the location fed in it.[7] After reaching to the location it will ask for passcode to enter which is provided at the time of order placing, by keypad entering the passcode it will verify the code. If it gets matched the drone will release the package otherwise not [8], here if the passcode gets matched the servo motor moves accordingly to open latch. This overcomes the problem of security for package. The users ordering through mobile app can have additional security in order delivery, by entering the finger print impression at time of ordering, the same biometric impression would be asked at time of order delivery. If needed the change in location, before delivering the order, can be done using GSM module. Throughout this GPS will track the location of the path covered by drone. One of the most important applications for UAVs is the area of search and secure handling of parcel operations. The Unmanned drone delivery system is faster than a delivery boy.

II. METHODOLOGY

The work of delivery of the order by drone, involves here the circuitry with Arduino MEGA, with the Arduino interfaced with GPS, GSM 900, mini servo, 4x4 membrane keypad, and SD card slot. [9] When the order is placed using the website, after entering the details like mail id, mobile number and location of delivery, a pin is generated which will be sent to the ordering person and one to the GSM which is on the drone. Arduino will fetch the pin and location and will direct command to drone to fly to the location once the parcel is ready to deliver. Once the drone starts from its location the GPS will start tracking the location of the drone and store the data in SD card, the GPS which is also interfaced to Arduino.

When the drone reaches to the location, the need to enter the pin as pass code, which was sent at time of ordering , to release the parcel. If the pin matches, the parcel will get released from some locking mechanism otherwise the drone won't release the parcel and will return back to the source location. If the location at which the drone reached is wrong, and even if the OTP entered is right it won't release the parcel.

By this delivery system the issue of security that what if someone stole it in the absence of the intended customer when the drone drop the parcel, is overcome. Also, if need to change the location can edit the location, the changed location is updated in drone through GSM. This is the additional feature provided.[10]

III. EXPERIMENTATION

Arduino mega is development board, build using ATmega1280 microcontroller, which is having a digital and analog IO pins, serial communication, data transfer buses, interrupts, memory, etc. It needs 16 MHz of clock speed. Peripheral devices such as GSM, GPS can be interfaced using its serial interrupts named as serial and serial 1-3, which is used to receive (RX) and transmit (TX) TTL serial data. SPI (serial peripheral interface) is a synchronous serial data protocol used by the microcontroller to get communicated with peripheral devices. [9]

A. Interfacing of GSM to Arduino

In this work the GSM module used is GSM 900, which is used for transmitting and receiving the data services. This GSM provides the speed of data transmission of rate 9.6kbps. Three pins of GSM module, namely TX, RX, and GND are interfaced with Arduino by GPIO hardware pins and make these pin as a software serial virtually. GSM module supports the SIM card , having a frequency of 900Mhz. GSM uses the 890-915 MHz frequency band to send data for the mobile station to the base station (uplink) and 935-960 MHz frequency band to receive data from the base station to the mobile station (downlink).[11]

As seen in fig 1, while interfacing Arduino with GSM module we used hardware serial pins on the development board. To make GSM stand alone and attached to drone base, it needs a minimum of 7v and 2amp of battery. The interface on the GSM side needs only Tx, Rx, gnd and supply pin.

B. Interfacing of GPS[VK16U6] with Arduino

As seen in fig. 1 the GPS module VK16U6 connected to Arduino via hardware serial interrupt. GPS have maximum altitude & speed at 18,000 m and 500 m / s respectively, with 50 tracking channels. [12] It provides TTL Output and built-in Antenna and it gives the resolution of 5m on average in 2D plane. The tracking sensitivity and Acquisition sensitivity are 162dBm and 146dBm respectively. It gives 1Hz-5 Hz positioning update rate. It needs power supply of 3.3V which is taken from Arduino on board 3.3v supply and UART / TTL 3.3V. It has built-in RTC crystal it provides the data rate of 9600 bps.

Interfacing GPS module with Arduino make some sense with ease because built in antenna, resolution of m and less weight. To interface GPS module with development board, just we have to deal with 4 pins of module named as vcc, gnd tx, rx, as seen in fig2(a). Tx-rx of module and tx-rx of software serial of are contradictory connected to each and programmed same too. Fetching datas by gps module is stored to rom of Arduino and further load to ram of memory card attached at sd card slot in form of CSV file. When we plot that data to google map, as seen in fig2(b) output we can find.

C. Interfacing of Servo motor with Arduino

As illustrated in fig.1 basically servo motor is used here for the lock mechanism using the important feature of angle shift. In this work the angle shift is of 90º. This angle shift work as lock and unlock mechanism of the package .Servo motor has a torque of 4.8V,25.0 Oz-in and speed of 0.12 sec/60º. The signal pulse width is 500-2400 µs. Three GPIO of Arduino is used to interface servo motor namely +,-supply and signal.[13]

D. Interfacing Of keypad with Arduino

The keypad used here is 4x4 membrane keypad for numeric data input as a passcode, which is provided at the time of ordering. The keypad has 8 pins, 4 for rows and 4 for columns. Which are connected with Arduino GPIO. In coding we assigned 8 GPIO pins of Arduino to the keypad, and have set the baud rate of 9600 for serial communication.[14]

IV. CONCLUSION

The work done here is designed with a view for delivering a parcel for online shopping but this system can be also used for

other purpose like for providing medical facility, military purpose also, especially in a country like an India where logistics face so many obstacles on the ground. Drone delivery could be better for the environment. A single, battery-powered drone traveling to bring your order versus a large emission-spewing logistic like the truck is a vast improvement when it comes to emissions and energy efficiency. The drone also wins out when comparing it to you driving your car to the store for the same items. And if many people are taking advantage of drone delivery, the delivery trucks on the road will be traveling fewer miles with less weight.

This work can further be extended by two point. First by adding security based location tracking security, which is most important. If in worst case someone fetch the drone, at that time we can get notified that location being changed by real time monitoring. Here the scope of IOT can be found. By which we can estimate data and can conclude that drone is going on right way or not. And the second thing is the 2D GPS module is used here. Which is having limitation that while apartment or building comes in the picture at that it will consider same longitude and latitude for the top floor to the bottom floor. To overcome this, 3D GPS can be used.

V. FIGURES

The following figure shows the wired connection of GSM with arduino IO pins.

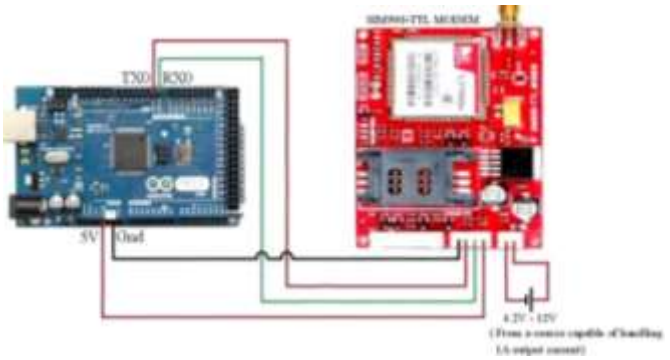

Fig.1 GSM interface with Arduino Mega board

Fig.2(a) GPS sensor

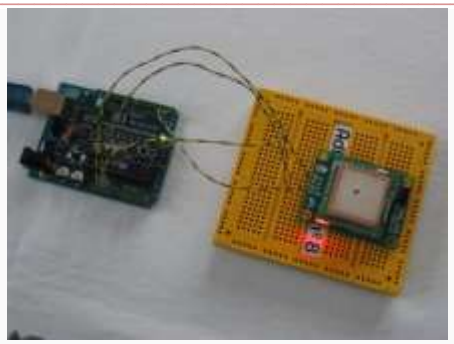

Fig.2(b) Interface GPS with arduino

The following figure shows the tracking of path stored by GPS.

Fig.2(c) GPS value on the map

Fig.3 Servo motor with Arduino

The following figure shows the wired connection of keypad with arduino IO pins.

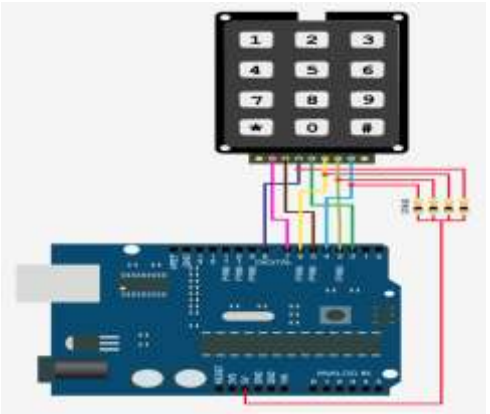

Fig.4(a) interface keypad with Arduino

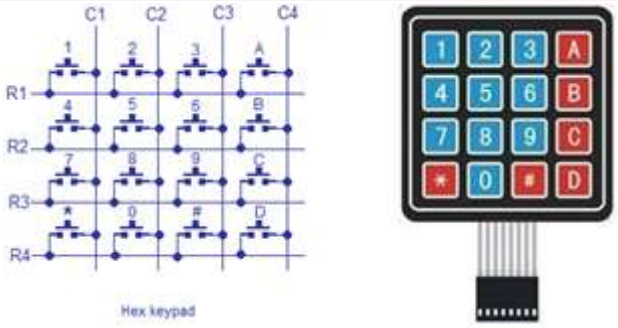

Fig.4(b) 4X4 hex membrane keypad mechanism

The following figure shows interfacing of GSM, GPS, Keypad, servo motor to Arduino board.

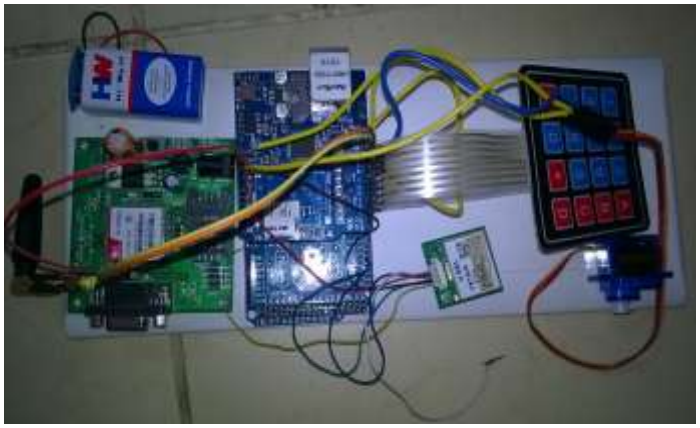

Fig.5 Arduino interfaced with GPS,GSM, keypad, servo

The following is the drone on which the complete circitry is mounted.

Fig.6 Drone is attached with securtiy module

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