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Development of IoT based Drone Security System for Woman Safety

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Abstract: In this project, a drone equipped with GPS technology is used. Whenever a woman is in trouble, she only has to press the panic button which is placed nearby or available in the form of a mobile application that directs the UAV to reach to victim's location at once. Once the drone reaches the exact location it will click photographs of the crime scene and send it back to the nearby police station including its current location through IoT. Now once the current location is retrieved by the policemen, they can reach the exact location and stop the crime at once. Here we use IOT for receiving transmitted images and displaying them to policemen with alert sounds.

(Index Terms- drone, unmanned aerial vehicle, women safety, aerial surveillance, sos devices, IoT)

I. INTRODUCTION

Unmanned aerial vehicles (UAV) famous with the name Drone, is basically a ying machine. When employed along with a GPS, the unmanned aerial vehicle can be remotely controlled and can y autonomously, as well as locate position accurately by pre-programmed ight plans in their embedded systems. UAV technology has already made its way in surveillance, monitoring tra c, search operation, etc, for years. However, with the advancement in IoT, Machine-learning, deep learning techniques, drones appear to be the best choice. Many Research and testing on drone delivery services are also going on, which will target the masses. Using IoT based model, and high de nition camera, we are developing the Drone for the safety of the women. Drones were being used for military purposes from the mid-1990s with the High-Altitude Endurance- UAV- Advanced Concept Technology Demonstrator(HAE UAV ACTD) program which is run by the Defense Advanced Research Projects Agency(DARPA) and Defense Airborne Reconnaissance O ce(DARO)[3]. Through our drone technology and enhancements made in it, we not only urge in providing safety and surveillance help to Policeman but also to overcome the drawbacks in the traditional method. Problems like, limitations of security cameras installed at public places, wired CCTVs with a small area of vision, security personnel is to be appointed to observe the CCTVs all the time (even many important incidents are missed to keep eye on). Our Project focuses on these areas and we are obliged to provide end-to- end security for women. We will also be making it simple and focus on its cost-e ectiveness so that our work for this noble cause can reach as far as possible.

The objective is to develop a feasible IoT based model using UAV-technology for the safety of the women. In this, we are using a drone for surveillance using GPS module and high de nition camera. This idea can help the policemen to overcome many disadvantages which are there in existing technologies such as the need for more number of CCTV camera which also requires more power consumption. The drone can cover more distance as compared to the CCTV camera placed nowadays and power consumption can also be reduced. This project provides a simple and cost-e ective end to end security solution for women's safety.

A. Objective

This monograph is developed around an unmanned ying vehicle(UAV) termed as a drone. The objective of the project is to build a control architecture that enables the drone to y and prevent criminal incidents along with acquiring relevant proofs against the culprit. We can use the UAV for observation and night patrolling for civilians. A drone with certain payloads can y straight above the citizens in danger, even at night to record video and capture geo-tagged thermal images and transmit them immediately to mobile command centers. From the experience, we have observed that cases of a nuisance at night, have been increasing. Therefore, if we monitor the a ected location with the drone, we will be able to pinpoint the location of the incident in real-time. By locating the law-enforcement authorities nearby, we can easily reach the exact place without wasting any time. This will really help in bringing down the rate of crime.

B. Issues

Doubts regarding drones can be classified in many ways like ethically, morally, and judicially. Drones are not allowed to fly openly in many nations, but few nations, which have a scientific inclination of mind, are now permitting drones for various utilities. There is a rise of a drone market in Singapore, but it has some conflict ethically.

Military drone manufacturing firms are looking to enhance civilian uses for sensing drones to expand their market for surveillance and various purposes.

Drones will enhance the state of surveillance in the state. Recognition of faces and behaviors may also be possible with the advancement of technologies.

C. Review

Many efforts have been put for the improvement of real-world aircraft for autonomous landing and in the field of positioning using GPS by many methodologies. Nikola Tesla, firstly, introduced an autonomous take-wing and docking vehicle concept in the year 1928. Advanced VTOL aircraft consists of an engine with a Global Positioning System (GPS).

The Jump Jet, Harrier is one of the most profound and reputed high stable drones which has greater efficiency in the field of positioning and return to home function. UAVs are becoming progressively conventional in the 21st century, of which the quadcopter has the VTOL capability.

We are also interested in the prerequisites of DARPA's UAV forge while considering all sorts of UAVs comparison which were considered around the time we initiated the project. The UAV forge is required basically to construct a micro-UAV that can take flight autonomously, reach the desired terminus, and scrutinize the location for about 3 hours. We know that the transportation of troops is an enormous aim in the war zone.

DARPA started a mission in the year 2010 coming out with four-people vertical take-offs and docking vehicles to meet this challenge. Lockheed Martin's Skunk Works R is a team with Piasecki Aircraft which improves the next generation of lively autonomous take-off and docking transport systems under the ARES mission. ARES VTOL flight unit works as an unmanned podium capable of supplying a diversity of cargo.

The flight unit consists of inherent digital flying controls, remote command-control interfaces, power systems, and fuel. It also rapidly reaches a high-speed travel voyage. Our project has many same features as Lockheed Martin's research and the flying procedure is partially as same as their machine.

In addition to the application in the defense sector, the evaluation of applications in the commercial as well as the public sector was a big concern. New markets will emerge strongly and efficiently if small drones are sufficiently present. Potential emerging opportunities in business and upcoming uses relate to the reviewing pipelines or actually inspecting regions full of risks like an emergency site at a nuclear power plant, harvest estimation, or disaster management where small drones could be advantageous. Although the plot of various UAVs is impressive; our focus was to be able to give a mini UAV, supporting the government for their night surveillance at several regions over a large area.

D. Project Description

In this project, a drone equipped with GPS technology is used. Whenever a woman is in trouble she only has to press the panic button which will be available in the form of a mobile application. The App will trigger our system via an 'SOS' call which will in turn signal the drone to reach the target location at once.

Once the drone reaches the exact location it will live telecast the situation at the police control room and send its current location through IoT.

Now once the current location is retrieved by the policemen they can reach the exact location and stop the crime at once. Here we use IOT for receiving transmitted images and displaying them to policemen. For future scope, we can also add hooter alarm and tear gas pellets in the drone and make it work as a self-defensive system against these issues. Thus, we put forward a fully autonomous security drone that operates tirelessly and patrols large areas on its own to secure the facility.

II. PROJECT OUTLINE

In this section, we will talk about the project outline starting from the system setup and working on the drone. Starting with a flow diagram, then we will move towards the components used in the project, then the detailed block diagram of the project, and at last the application which we are using in the project including the programming for the application and working screenshots.

A. Flow Diagram

The flow diagram will help in understanding the whole project scenario step by step from the starting of the system to the working part.

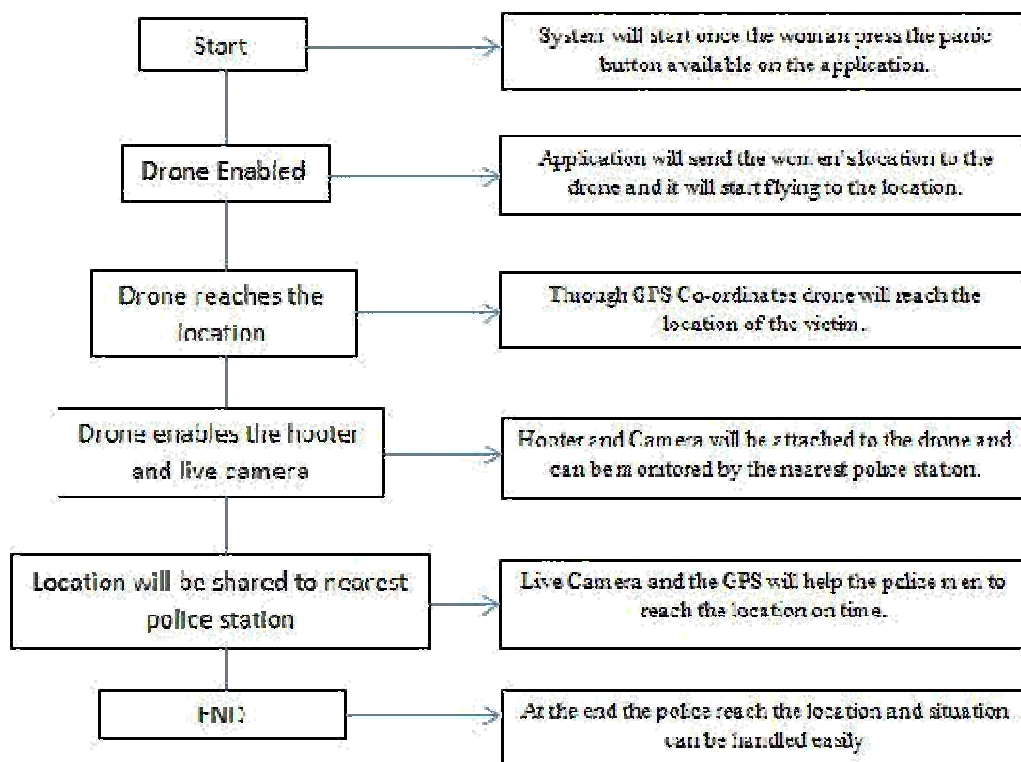


Fig:1 Flow Diagram of the Project

B. Construction and Development

For developing this project we have used APM 2.8 Flight Control Board, Radio Transmitter-Receiver(Flysky FS-i6 6-Channel 2.4GHz), Brush-less DC motors, Electronic Speed Controllers (ESC), 3300mAh Li-Po battery, GPS Module, Carbon Fiber Propellers, Propeller Guards, Lightweight Frame.

- 1) *APM-2.8 Flight Control Board*: Here we have used the APM 2.8 flight controller also known as the mind of the UAV which enables it to connect with GPS, different sensors like gyroscope, etc. It also helps in stabilizing the drone and fixing the altitude so that the autonomous function can work properly. It also gives us the platform to plan any mission for the drone in its mission planner application which enables different functions like a return to home and autonomous landing. Now the flight control board also transfers the received signal to the ATMEGA2560 processor which reads the signal and passes to the electronic speed controller for further functioning. For getting the better result we can use 'Naza' flight controller which assures very good stability and have in build GPS system which gives great efficiency and is easier to control.

Model Name	Processor	Dimensions(L*W*H)	Input Voltage
APM 2.8	ATMEGA2560 and ATMEGA32U-2	85 x 45 x 15	12-16 V.

Table:2 APM-2.8 Board Description

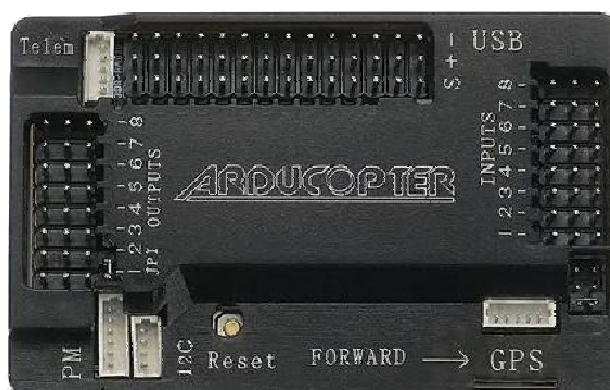


Fig:3 APM-2.8

- 2) *Brush-less DC motor:* We have used 1400KV BL2815 Brushless Outrunner Motors for our Drone, which is generally employed in sports drones of mass 700 to 1500 grams. 12*6 propellers are used which gives an upward force of 400gf per motor. Since it is a quadcopter drone, four motors will produce 1.6kgf of lifting force approximately.

Model	KV	RPM/V	Propeller	RPM	MAX Current	Thrust
BL 2815/09	1400	920	11 × 7	8360	30A	1350 gm.
			12 × 6	7000	31A	1550 gm.

Table:1 Brushless Motor Description

- 3) *Electronic Speed Controller:* Electronic Speed Controller or "ESC" is a device that is employed to control the rotating velocity of motors installed in the unmanned aerial vehicle. It also helps in controlling the direction of the UAV. Here in our project, we are using a 30A ESC which can supply the required amount of current needed by the motors to run properly.

Model Name	Size	Constant Current	Battery
ESC-30A	70*32*17mm	30A	2-4S LiPo

Table-3 ESC Description

- 4) *LiPo Battery:* As in this project, we are having four 1400kv brushless motors that require high power to operate so we are using a 3300mAh- 35C/70C battery which gives 30A(to each motor) current constantly with 11.1V voltage.

Capacity	Voltage	Weight	Dimension
3300mAh	11.1V	284g	133*42*23mm

Table-4 LiPo Battery Description

- 5) **Block Diagram:** The block diagram shown alongside will summarise the full project in front of your eyes at once. It will also provide some alternative which can be taken as future scope of the project.

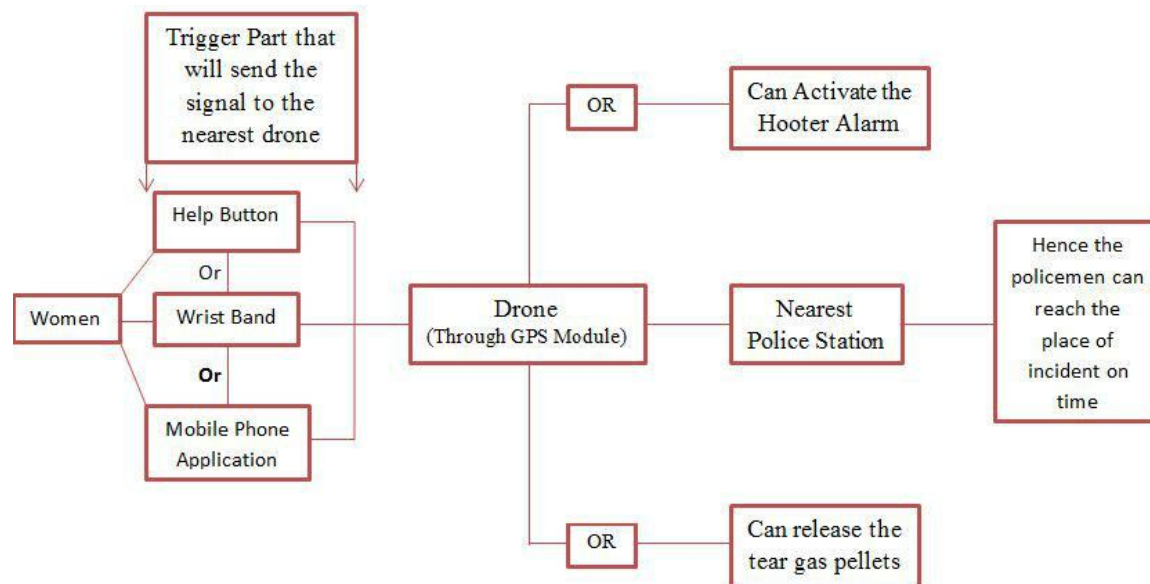


Fig:6 Block Diagram

The block diagram shows the brief working of the project which is explained below:

When any woman presses the panic button which is available in three forms as Help Button, Wrist Band, and Mobile Application, it triggers and sends the current location of the woman to the drone and the drone reaches the location at once with the hooter and the tear gas pellets.

Now while reaching the location the drone also transfers the data to the nearby police station.

After reaching the location the drone will start taking out picture and videos of the crime scene and send back to the police station.

This will help the policemen to reach the crime scene as soon as possible.

III. WOMEN SAFETY APPLICATION (ANDROID APP)

In the modern tiredness of law and order, the major emerging reason is women's security. Concerning the seriousness of the issue, the following document entitles GPS and GSM based "Women security System". It provides an amalgamation of GPS device as well as alerts and messages, encapsulating the emergency button trigger. In the fastest need of adrenaline, re-sponse to stimuli has only a fraction of second to enact. At that instance they only need is to press the "volume key." The entitling system, bene ts with a realizable and cost-e ective solution to problem prediction. Due to accelerating cases of dreadful acts such as rape by pseudo-anonymous people, whom we believe, the security of the "49%" is the top concern. The GPS part tracks the location of women which is provided to the system can be tracked by police stations on Google maps or any specialized software using the internet.

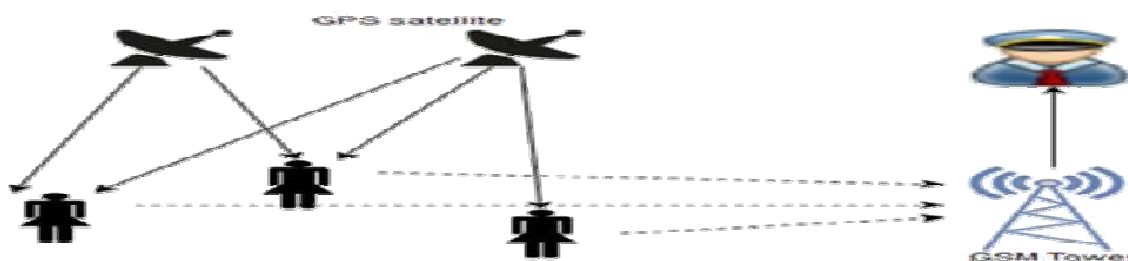


Fig:7 Application View

The hunt of IT-based companies for this security concern is still on and they demand an accurate, efficient system that evaluates the risk of women working in night shifts or traveling alone. The proposal model highlights the methods to deal with the issues, by GPS & GSM based tracking systems to reach as soon as possible before, the horrendous situation conquer the time. The 'Android Application for Women security system' ensures girls' safety during the aura of blur security. A single click and we can send the location to the family and police stations. We can also stop it using a password. These features ensure both safety and security and also it needs the engineering code of conduct, which is prima facie of the world of system and is based upon the advanced sensors, Microcontroller & GSM services. In this once the button is clicked it continuously sends updated locations mercy to all authorized people.

The app reduces the risk and brings assistance when we need it.

We can activate the feature by clicking on 'Active Service Button'.

Once the 'Active Service Button' is pressed, our system goes on alert and starts its programmed operation to save the victim.

A. System Design

The system incorporates an Android OS with Java as the processing language with Android Software Development Kit v2.2 (Froyo) or above. Front end application is performed using eXtensible Markup Language and the back end is performed using Structured Query Language(SQLite).

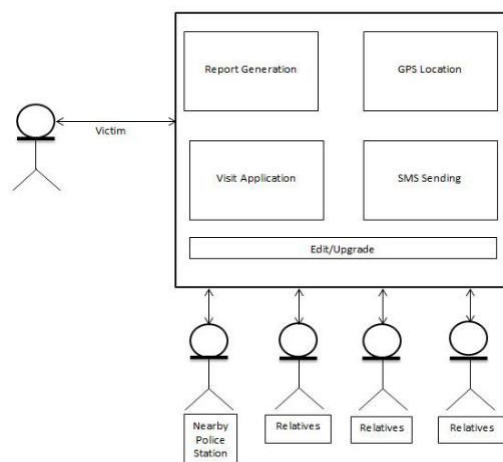


Fig:8 System Design

The above Block Diagram shows the working of our system. It shows two end-users: the Victim-End (the Girl whose safety seems compromised), and the Guardian-End (Victim's specified family members, friends, and the nearest police station).

The victim user when feels unsafe, presses the 'Active Service Button' on her mobile phone, then our system goes on alert and sends the location(Longitude and Latitude) of the victim. Now, an 'SOS message' is sent along with the location of the victim to the Guardian-End. Meanwhile, the nearest drone will also move to the location to help in preventing any crime and to take live pictures of the incident, culprit, and the site. At last, our system will generate the final report with all the acquired details, that can be used by the law enforcement bodies and the judiciary.

B. Technologies Used

1) **Java Platform:** Java is basically a high-level programming language and a platform. A platform is basically an environment on which the program is written and executed. Most of the programming language runs on the runtime environment of the operating system and the hardware components used but, java is completely different and as a result, it is used widely for the development of android apps. Java is a platform-independent programming language so it can be used on any platform. The feature which makes it platform-independent is java bytecode which is platform-independent code. To execute bytecode we just need to get installed JDK (Java Development Kit) which comprises JVM (Java Virtual Machine) which provides a platform to run the code. Besides this JVM also acts as a sandbox between the code and the operating system which increases its security of the code. Moreover, the java platform consists of Java API's (Application program interface) which is a collection of pre-built packages, libraries, classes, and that increases the efficiency of programmers many-fold.



Fig:9 Java

- 2) *Android SDK 2.2*: Android SDK 2.2 (Froyo) It is mainly a mobile OS that is formulated on the Linux Kernel and much non-proprietary software with Java API. The Android SDK is basically a toolkit that provides all the requisites for the development of android apps. Android was fully developed by Google. Android SDK comprises some sample projects with there respective source codes, an emulator, development tools, and required libraries to build. It is a less expensive more produc-tive OS that has fast background processing and supports 2-Dimensional and 3-Dimensional graphics using various embedded libraries.
- 3) *Actual Screen View of Application*



Fig:10 Application Introductory Page



Fig:11 Detail Page of Application

IV. APPLICATION OF THE DEVELOPED DRONE

The ability of our ying machine to safely and quickly gather and to access the inaccessible location of the victim in dire need and the prospective integrated network of the same that we project makes our system a versatile and multifaceted system of great utility which also extends to:

A. *Spying and Patrolling*

The drone is very compact and the sound produced by it is inconspicuous. These attributes of the drone make it suitable for carrying out activities like spying and patrolling. After further improvisation of the camera used, it can be made competent for night patrolling which would be very useful for local Police. Encouraging the use of such drone-systems instead of larger fuel consuming vehicles can cut down on expenses in Police-patrolling.

B. *Delivery of Emergency Kits*

The drone is competent enough to transport items like food packets, medicines, batteries, and ashlights. Thus, it can serve its purpose during catastrophic situations.

C. *Military Surveillance and Reconnaissance*

The drone is equipped with a camera and features like live-location tracking and a wide range of altitude levels so that it can also assist with acquiring secret information and tracking possible threats. Therefore, can also be used in military surveillance and reconnaissance operations.

D. *Inspections during Chemical Disasters*

Chemical and Biological accidents make the place vulnerable for human reach, therefore obstructing repair and regular inspections. In such hazardous conditions too, our drone system can be used to carry out an inspection in the affected location.

V. CONCLUSION

Implementation of this system can have a wide range of applications including protecting the lives of women in dreadful conditions. Our system will provide an all-round and foolproof security solution to women, using modern hardware technologies and IoT implementations.

Our proposed approach not only provides a sense of security to the women in the critical situation of rape, molestation but also the taken captured images of the culprit are used as valid proof that can be presented as a valid proof in the judicial hearing to prove the offender guilty for the crime committed.

VI. FUTURE SCOPE

In the future, we can create an autonomous drone network by increasing the number of drones to support the existing police systems to protect women and ensure their security. In order to conserve the energy of the drone, we can optimize the frame and make it light-weight so that the battery and the motors can relax a bit in working.

The application as shown above can be extended by connecting the drone to the police surveillance station and connecting hooters and tear gas pellets to reduce many more incidents without any harm to human beings. In the upcoming future, the accuracy can also be increased by upgrading the GPS module which will give more accurate positioning and pointing.

VII. LIMITATIONS

Although we tried to make an efficient model, there are some limitations in the practical world. Firstly, the issue is of flight time. Keeping in mind the cost limitations we could get a maximum flight time of 25-30 minutes with a fully charged battery which was quite decent. However, this issue can be resolved by using batteries of higher ratings and more efficient motors and circuit components. But at the same time using such expensive components will increase the manufacturing cost by 50-60 percent. Secondly, the radio controller used can have a maximum range of 1 Km so we need to have many docking stations and many drones to have the surveillance of a city.

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