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Drone Ambulance for Outdoor Sports

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ABSTRACT

The main aim of this paper is to provide basic first aid to the injured sportsmen in the outdoor sports activities. To stop the fire accident that occurred during any outdoor sport event. This is usually achieved by using a drone. Practicing sports in the outdoor is a way that improve the fitness of the body. Sports also reduces stress, strain , improve health and also can enhance the social relations, has improved inactive people to perform activities like jogging, walking, running, biking etc. .This outdoor sports activities has increased the scope to international games, professional sportsman, and also development of outdoor games. This trend of developed outdoor sport activities as also strived by new technological devices namely mobile phones (smart) with exciting apps, smart watches and few tracking systems. Usually this tracking devices measure the parameters like speed, pace, time, distance etc. And they also measure few signals namely temperature , heart rate ,calories consumed and they are able to provide the ground route(geographic location, co-ordinates)[1].During in such outdoor activities accidents, injuries can happen to the sportsman and to the professionals. And sometimes this may leads to unexpected health problems like fatigue, heart stroke, dehydration and heart attacks. During such sports meet fire accidents can also occur unknowingly which may damage the surroundings and sometimes life. The main aspect here is the emergency service is provided .So in order To provide help during such emergency as soon as possible a new technique is proposed in this paper. This can be achieved in cross-country side and even on land where transport not possible. The basic and simple logic behind this is use a drone which carries first aid kid and elide fire extinguishable balls with audio and video communication ability.

Keywords: Unmanned automated vehicle (UAV) drone, Elide fire extinguishable balls, Developing technologies in sports, Parameters measured.

1. INTRODUCTION

During the last few decades, the role of sports and physical activities has become more and more important in modern communities, conditioning sports are generally considered positive by the government because of their beneficial effect on human wellbeing. Physical exercise is the basic and the fundamental prior importance to the human being. The sports and the physical activities is usually performed to improve the health, fatigue resistance, stress, strain tolerance and also to improve good relationship with those who practice sports.

This regular physical activities improve physical and psychological states of the human being. In spite of these beneficial aspects sometimes this sports, games leads to injuries, strain to the sportsman during workout, practice if they are not executed in a proper way [3]. This may leads to unconsciousness, fatigue, dehydration. Usually in such activities huge accidents will not occur but small injuries like fracture, sprains, cramps can happen. The risk of injuries is increased ,for both acute traumas and overuse injuries, and prevention has become more important in sports .When injured mainly two main systems are affected vascular system and nervous system .About 80% of injuries during sports includes sprains, cramps, abrasions, etc. another 20 % correspond fractures and damage to internal organs[[3].The body parts usually suffer from injury I because when player does not perform proper warm up, exercise and starching before the game starts .Basically about 45.5% of injuries occur at the knee, with rate of about 9.8% at ankle and the shoulder with probably 7.7%. Among these about 53.9% involves only soft tissues. Sometimes fire accidents also may occur during the outdoor sports activities. Fires are the accidents which occur most frequently, whose causes are the most diverse and which require intervention methods and techniques adapted to the conditions and need of each incident. Depending on the type of fire, meteorological condition and the effectiveness of the intervention material damage can be limited [4].

For practical reasons it is best to refer to technical support by the fire engine before the damage happens. In order to rescue during such fire accidents drones with elide fire extinguishable balls are used to stop the fire as soon as possible. Another important aspect that should considered during practice is hydration. Hydration is the loss of water and electrolyte in the form sweating from the body. Body temperature is increased and energy expends due to the heat produced by muscle contractions. The body temperature should be maintained because if it reaches 40 C or above can cause a thermal shock or heart stroke and extremis, it can lead to death. There will be a separate team to provide rehydration to the players when they required. So in order to avoid this sportsman should have sufficient amount of water and maintain body temperature balanced and, liquid (isotonic drinks), i.e. it must stay hydrated. Therefore proper hydration methods reduce risk of injuries and fatigue and sometimes overcharging [4].

In recent years, small and compact technologies for the outdoor sports has been developed. Devices that can track the player position, ground co-ordinates and also can track few parameters like fast, duration, time, face, speed. It can also measure few signals like heart rate temperature. Few new devices which can stop fire as soon as possible called elide fire extinguishable balls. Few devices can also record the calories burnt. Apart from this there as few smart equipment, sensors, high resolution cameras and drone both unmanned automated vehicle (UAV) and also the manned vehicle. This

drone carry the basic requirements to the players in the ground during emergency.

The potential use of drones in outdoor games is enormous. Some of the application is already in use and explored like the drones ability to provide high-resolution and efficient aerial observation. But here in this idea we use drone to provide a basic first aid kit to athletes in certain competitions .The minimum geographical constraints of a drone are paramount importance for this type to use. These drones are also used to stop fire during any fire accidents that occurred in the ground.

Fig. 1. First aid kit

This paper proposes and describes an unmanned aerial assistance system (UAAS) to provide athletes support when geography or distance limits a prompt ground response. And also to stop fire in a particular geographic limit. This system deliver, by air, first aid utensils and medicines to players who suffer some kind of injury, dehydration in athletic competitions. These drone also carry Elide fire extinguisher balls to stop fire accidents.

Fig.2. Route planner (Geographic co-ordinates)

2. RELATED WORKS

Recent years there is a good demand for the robots. Robots can work which a human being can do. So as the technology increases robotics and other field of interest was rapidly developed. Among these drones have their own priority and used frequently in almost all the fields. Due to the altitude advantages, and they can move to remote places where transport cannot be provided and controlled easily. They can carry things faster during emergency. Therefore these drones are used to such applications during emergency. Multinational national companies like Google and Amazon are planning and testing them as delivery vehicles. Besides these drones can also cover situations where it would be too dangerous to send a person and to document sports scenes that cannot be captured on the ground.

A unmanned aerial vehicle used to autonomously deliver items to various destinations is described in the patent filed by Amazon Technologies, Inc. [5].The UAV receive the inventory information and the destination location within a materials handling facility, compute a route from the materials handling facility to a destination and travel to the destination to deliver the inventory. Another company called Deutsche Post DHL developed a drone application. This company developed a drone with the name called Parcel copter, for packages delivery. This company proved that small packets can be delivered through drones [6].This company uses an application to know the destination address and allow drone to reach in particular time as soon as possible.

Rakuten, another company uses drone for delivery services for general consumers .This Company is one of the world's top most Internet service company. Its first and main application is used provide intended help for golf players. This use an android application called Android Sora Raku app, using this application golf players can order snacks, beverages and other items, which are delivered by drones at a predefined pickup points.

UAV s can also be used to deliver sensitive materials like medical substances and products. So the company called Zipline had developed a drone named as Zip. Zip is a small robot airplane designed for high level safety, using many of the same approaches a commercial airliners. It can carry blood, vaccines, and medicines. This company with the partnership with government of Rwanda, will deliver medicines and blood to the Rwanda hospitals and health centers. This project has attracted interest from UPS, a company like which invested $80,000 in the project [6].With the partnership they have planned to deliver about 150 deliveries made to medical centers each day. A drone is only effective in delivering packages to remote or distant locations if the flight is autonomous and sometime man controlled. So therefore drone should be specified with guidance and automation systems which sets it apart from traditional multi-rotor which often only support remote control. Here the drone is a combination of both multi-rotor wings and fixed wings called hybrid drone.

Arducopter developed a software which is an open source that is capable of controlling all the major rotary wing airframes, including helicopters, tricopter, quadcopter, hexacopter and also ocatcopter. This software features fully autonomous waypoint based flight, with mission planning and real time telemetry via a ground station. It also illustrates the route map as shown in fig 2.

Although the firefighting balls from Elide and AFO are new on the market, their concept is probably based on the design from 1800's.Back then, there existed glass fire grenades or fir extinguishing glass balls. Usually these glass balls or grenades are that time were filled with a liquid instead of

powder like the balls are now. Some kind were for active fire suppression and could be thrown into the flames. Others were self-activating. Instead of pyrotechnic explosives, the glass balls had a spring-loaded trigger held in a place by a link that melted in high heat. The trigger shattered the ball to release the liquid the liquid. But unfortunately toxic materials like carbon tetrachloride were used in the glass fire balls, unlike the nontoxic materials in the fire extinguishing balls of today. Therefore few self-activating fire extinguishers are used now a days

3. PROPOSED SYSTEM

The unmanned aerial assistance system provided in this paper uses a drone which carries first aid kit in case of minor health issues. Drone also can carry Elide fire extinguisher balls which stops fire during any fire accidents that occurred in the ground.

Fig .3. Block diagram

This fig.4.shows the basic block diagram of what exact function that is taking place. So here each player will have a system called as encompasses electronic devices which senses the sportsman health activity, with GSM and location by GPS (Global Positioning System) which together communicate with the Ground station called central control station via GSM. This system also consists of a drone that carry first aid.

The flow chart is shown in fig.5.which gives the information about the system. Before the competition each electronic device carried by the players in registered in the ground station with unique identity. Each device is given with a specific unique identity number which is used by the control station during any emergency. Here when the player is injured he can press the button called SOS button. This can also be activated autonomously by the electronic device. Usually the device contains an ECG device which can measure the heart rate, so there will be threshold value below which player is assumed to be danger. So whenever the value reaches the threshold value the electronic device can self autonomously activated and the corresponding location is send to the ground station. When the emergency is called the ground station in turn activates the aerial assistance system i.e drone. If the drone is already flying over that particular area, it will directly go to that particular location to help the player. On the other hand id the drone is not in motion or when the drone is parked, the control station operator loads the drone with necessary items and operates it. This drone carries the first aid kit to the player who is injured, the drone should return back to the ground station as soon the first aid is delivered. This is to reload the drone with new first aid kit and recharge the battery.

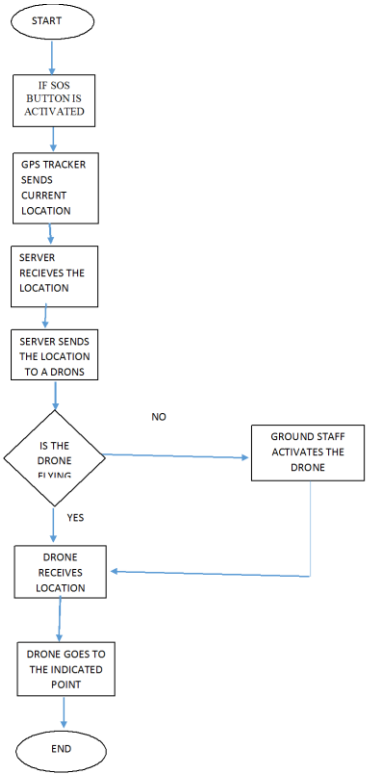

Fig.4. flow chart

Another application is to stop the fire accidents, this also uses the same concept. Whenever a fire accident occurs in the ground, thermal sensor get activated. Usually fire sensor or smoke sensors are used, sometimes we and use a camera called as thermal camera which captures the images of fire materials is detected and gets activated.

Whenever a thermal camera is activated a corresponding fire alarm is activated. Each fire alarm has a GSM module attached to that. Each GSM has a unique number which is saved in ground station. So during fire accident the fire alarm sends the current location to the ground station. Now the ground central station sends the location to the drone which carries Elide fire extinguishing balls. The drone also contains a thermal camera and differentiate the fire image and move that particular fire alarm location. Find the location were fire and throw the fire extinguisher balls and stops the fire.

4. DESCRIPTION

TECHNOLOGIES REQUIRED:

The combination all these technologies will form a combined structure, the electronic components used GSM, GPS and unmanned aerial assistance system.

A) Unmanned Aerial Vehicle (UAV):
A UAV or drone is controlled and operated by remote or sometimes is autonomous also. Unmanned Aircraft system (UAS) is designation commonly used to describe the entire system, in this case the unmanned aerial assistance system for outdoor sports activities. Therefore UAS includes the aircraft, the control station and remote transmission unit. The system diagram is shown in the figure.3.

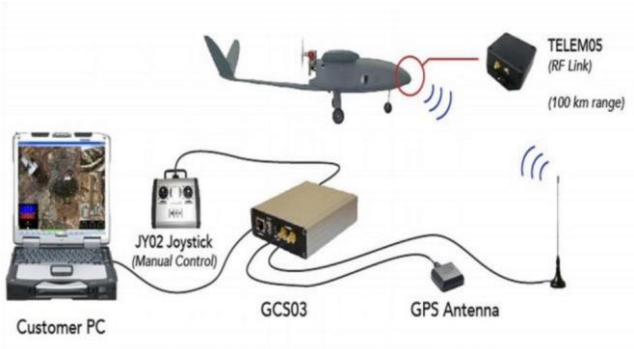

Fig.5. Unmanned Aerial System

Basically drones are of two types:The fixed wing And Multi rotary wing.Depending on the type of mission or purpose to carried out,one of these modes are used.Both these types has there own advantages and disadvantages [8].

Fixed wings is characterised comparatively with more simple structure and more efficiently aerodynamics that provide the advantage of longer flight durations at higher speed.Maximum flying time of 45 minutes with a speed of 80 Km/Hr.This makes fixed wing UAVs ideal for applications like aerial survey which requires the capture of geo-referenced imagery over large areas.A limitation of fixed wing are that they dependent upon either a aluncher or a runway to facilitate takeoff and landing.To a fixed wing lndind space required is about150m*30m.

In contrast ,rotary wing aircraft involve greater mechnical complexity which translate generally into lower speed and shorter flight ranges.Maximum flying time of around 30 minutes with the speed of 60 km/hr.The advantage however is the ability of vertical takeoff and landing(VTOL).

Therefore the combination of both rotary and fixed wings are used in a drone can be called as HYBRID wing model.so the advantages of both these types are compressed un a single vehicle.So this can have a vertical takeoff,landing with the maximum time duration,speed and also stable to carry the items.The payload is also better and can be improved.Table.1 shows the cahercteristics of fixed and rotary wings.

	FIXED WING	ROTARY WING
FLIGHT	High Altitiude	steady and stable
AUTONOMY	High	Low
ENERGY	Electrical/chemical	Electrical
PAYLOAD	Small	High
SPEED	80 Km/Hr	60 Km/Hr
DURATION	45 min	30 min
TAKE OFF	Runway	Vertical

Table.1.Comparision Between Drones

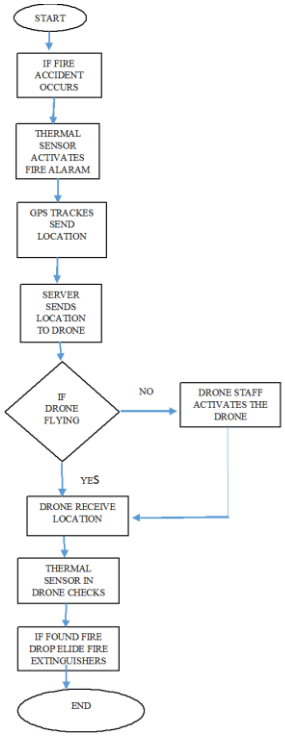

Fig.6. Flow chart 2

MAX2769	Band / frequency (MHz)	1550 to 1610
	Ref. clock frequency (MHz)	8 to 44
	IF output frequency (MHz)	2.5
	Noise figure (dB)	1.4
	Voltage supply (V)	2.7 to 3.3
	Current supply (mA)	10
	Footprint (mm X mm)	5.0 x 5.0
	Packages / pins	TQFN / 28
	Applications	GPS GLONASS Galileo

Table 2. Max2769 Performance Parameters

B. GPS technology:
The global position system,also known as NAVSTART-GPS[9],I a global navigation satellite system that comprises between 24 and 32 medium earth orbit satellites to form a constellation that sorrounds the Earth planet.The microwaves signals trasnsmitted by the satellites enables the GPS recievers to determine their speed,location,direction and time.Usually GPS reciever needs

atleast three satellite signals to know the position of the target element which compute two dimensions latitutde and longitude or atleast four satellite for three dimensional position. The drone can reach the palyer only if the location or the geographical co-ordinates are perfectly known.So GPS is important factor here and key technology for proposed system.Here MAX2769 is used as GPS reciever.The characteristics are shown in Table.2.

C. GSM technology:

The electronic devices here in this model communicate with each other using a GSM cellular network.In this system each electronic device must have GSM/GPRS modem,which requires a SIM card from a mobile operator(Subscriber service)to work.They uses a technique called circuit switching. Which provides a virtual path between two devices.First the two devices should connect to each other and only the a constant stream of digital data is trnsfered.In this model the GSM that used is chipset SIM900.The specifications is shown in table.3.This chipset is a quad-band and can communicate with controllers via AT commands.This works on the frequency 850/900/1800/1900 MHz.

Table 3. Sim 900 Characteristics.

GSM Module	Frequency band (MHz)	Quad band 850/900/1800/1900
	Transmission power (W)	2 W @ 850/900 1 W @ 800/1900
	Baud rate (bauds)	9600
	Power supply	12 V, 1 A
	Operating temperature	-40°C to 85°C

D. Ground Control Station:

The ground station is responsible for the coordination and control of all UAAS devices. This is the central control station and therefore this requires a microcomputer to process all the data and manage all the communications. So Raspberry Pi 3 board is selected as a microprocessor to implement as ground station. Raspberry Pi is used because it must be compact and portable, but with sufficient processing power. The Raspberry Pi 3 has 1.2GHz 64-bit quad core ARM v8 CPU,802.11n wireless LAN, Bluetooth Low Energy (BLE) and about 1 GB of RAM.[9].Since the storage capacity is low we can add another feature of cloud computing i.e the detais of the players is updated in the cloud and if requires it is taken.

Fig.7. Raspberry Pi 3

E. CAMERA:

The camera that here is GIMBAL camera.This camera allows the rotation of an object about a single axis.A set of two or three cameras are mounted onn th other with orthogonal pivot axes,are used to allow camera mounted on the innermost gimbal to remain independent of the rotation of its support.On the drone ,the camera typically uses gimbal camera to keep its capture image stabilized despite the drone pitching and rolling. Figure .8. shows the position of the camera and the map of the gimbal camera captured.

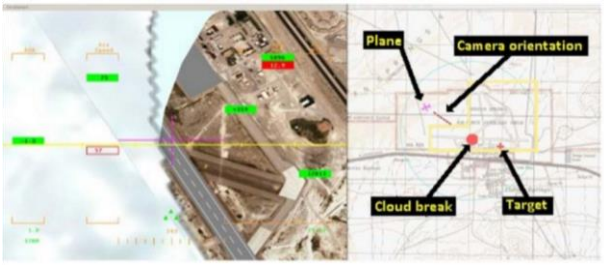

Fig. 8. Gimbal camera view

F. FIRE EXTINGUISHER BALLS:

This balls if filled with an aerosol capable of extinguish fire using nitrogen mixed with potassium. The aerosol compound contains 70% of nitrogen and 30% of oxygen. Using these two components, this method of extinguishing fire is successful in fully developed and in early stage fire. The physical characteristics of the fire extinguishing grenade is shown in the fig.9.

Fig.9. Elide fire extinguishing ball

This ball grenade has a solid material system that is filled with a minimal amount of extinguishing compound.

The compound acts directly on the flame, hence having an uninterrupted interaction with the burning surface once the chemical is released. These devices can be activated by thermal reaction, electronically or manually. This grenade ejects the potassium solid as aerosol in a 360 degrees and total deployment will be 40 seconds.

They weight about 2.87 pounds and are just a little bigger than a soft ball so people of many ages and abilities can manage them. No special training is require to use them. When they are released, they emit a loud warning siren. The non-toxic powder inside them can handle A, B and C, E type fire and come with a warranty of 5 years.

Table.4. characteristics of elide fire extinguishing balls

FEATURE	VALUE
Diameter(m)	0.145
Weight(kg)	1.5
Volume of action(m^3)	9.12
Activation time(sec)	3 to 10
Useful lifetime(years)	5
Extinguish classes	1A – 5B- C
Fire extinguishing agent	Mono Ammonium phosphate

5. CONCLUSION

This paper presents and describes an easy and affordable solution so that sport event organization can provide medical support to the athletes as soon as possible. And also to stop the fire accident as soon as possible not only in ground but also in remote and far apart locations. The drone i.e. unmanned aerial assistance vehicle carries this first aid kit and elide fire extinguishing balls during any emergency occurred. The proposed systems consists of few electronic devices that sense the sportsman health, activity and location. Also few devices to sense the temperature and alter the drone carry the required elements.

6. FUTURE SCOPE

This model in future can be used in international games where the number of sports players are more and the requirement is high. The same model can be used in the public, town or city levels also i.e whenever there is an emergency to some person in the city, relatives or surrounding people can call to the ambulance. The drone gets the location and carries the first aid to that particular location as soon as possible. There is another concept called a Swarm drones, which can be manufacture so that it can actually carry a person to nearest hospital during any emergency. The number of UAV should be increased so that even if there I multiple accidents occurred, sufficient Drones are available.

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