

STANLEY: A SELF-CONCEALING UGV

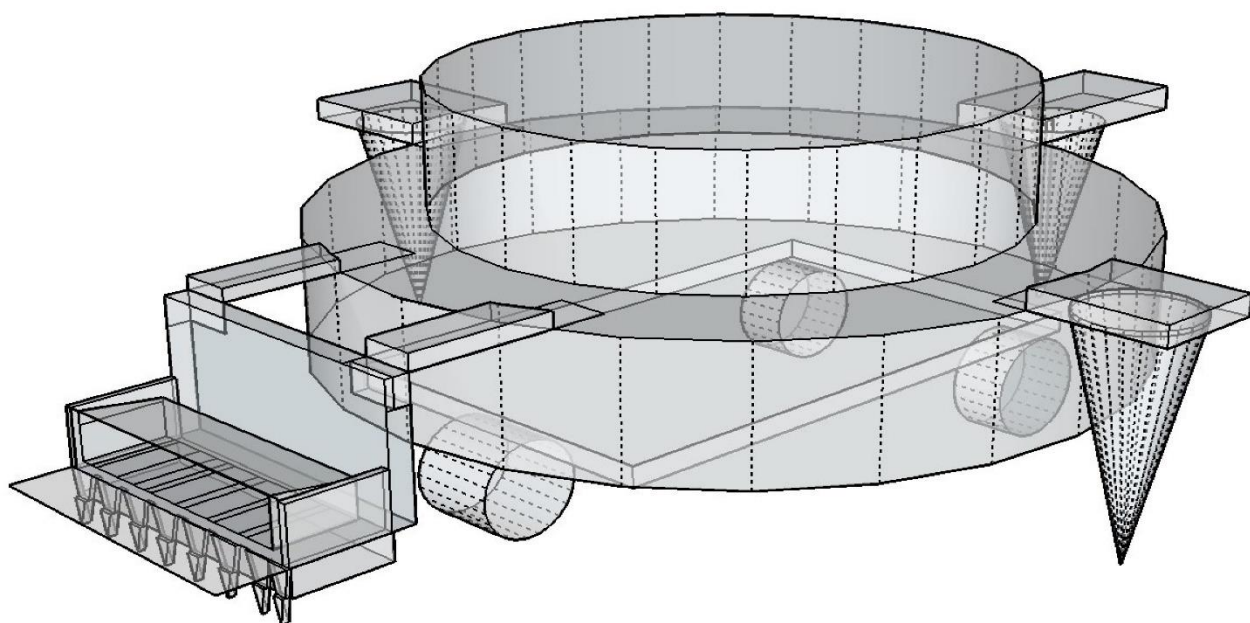
2) ABSTRACT:

Nowadays, many expenses are made in the field of defense in adopting primitive security measures to protect the border from the trespassers. Some military organizations take the help of UGV in the risk prone areas which are not that effective when done by army men. Stanley is a Self-Concealing UGV that is equipped with modern technology that enables it to conceal itself by various methods in response to a threat from the enemy. The UGV possesses camouflaging behaviour by virtue of which it changes its colour and adapts itself to the colour of the surroundings, thus deceiving the enemy. The UGV also has high power driven drillers that impart high torque to the system and make drilling easy. This results in loosening of the soil before it can be actually dug. By this way, the UGV conceals itself by digging in the soil and moving into the dug area.

3) QUESTIONNAIRE:

- Being First Year Engineering Under-Graduates, we needed a platform to showcase our innovative thought and we are highly privileged to present ourselves before the highly esteemed Defense Research and Development Organisation. The recognition from such deemed organisation is a matter of pride and this was a major source of inspiration as well.
- The team comprises of the best coders in the institution. The team has made significant progress in the field of programming in very less time. We have covered up the concepts of the language of C in computing. We are currently focussing on the Database Management Systems which is very essential to manage discrepancy and maintain transparency while recording any data. The team also has decent knowledge of Electronics and related fields. We have studied various types of Sensors (their functioning and purposes), different Gates, and other basic elements of Electronics, and is very eager to go miles ahead in this field.
- The members of the team are recognised to be the best coders in the institution on Sphere Online Judge (SPOJ) which is a global platform for coding where the premier institutes from all across the globe compete with each other. All the members of the participating team have made significant contribution in the growth of the institution. Our institute has improved from Rank 104 to Rank 50 on SPOJ which is an appreciable growth on this platform. The team leader has received an award for making a project named LED-Life Enriching Development by the Scientists of CSIR-CEERI, Pilani in the competition organised by BITS Pilani. It was a futuristic city based working model with innovative ideas. This model also received huge appreciation at the Annual Fest of the school as well as a university in Pilani.
- In this round, we have planned to exhibit our innovative ideas through a 3-D model (Software: Google Sketchup Make) and a presentation (Software: Prezi).

4) TECHNICAL PROPOSAL:



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THE SCIENCE OF TODAY IS THE
TECHNOLOGY OF TOMORROW

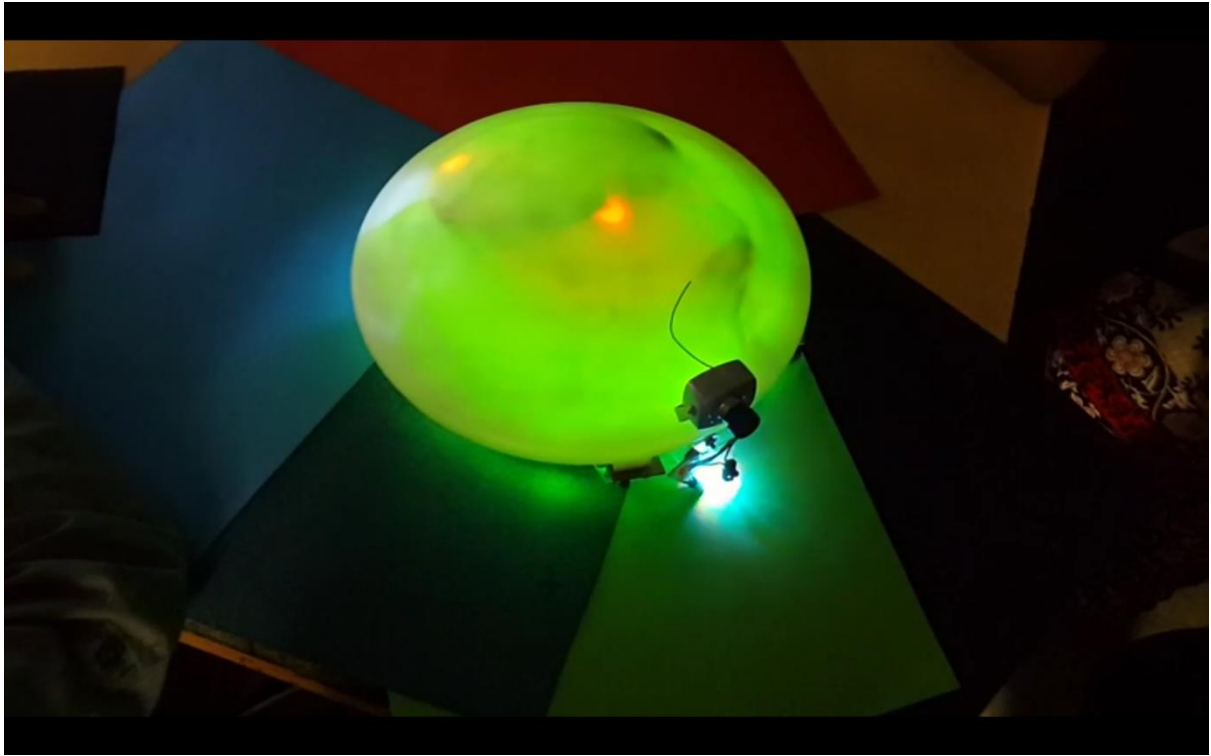
-Edward Teller

DESIGN

The UGV Stanley is designed to accomplish two tasks i.e. camouflaging and concealing with the help of digging. The upper circular cover part of the UGV is made transparent so as to depict camouflaging more effectively.

The major parts which we require to show camouflaging are:

- Micro-Controller
- PIR Sensor
- Colour Sensor
- Bluetooth Module
- LED Matrix



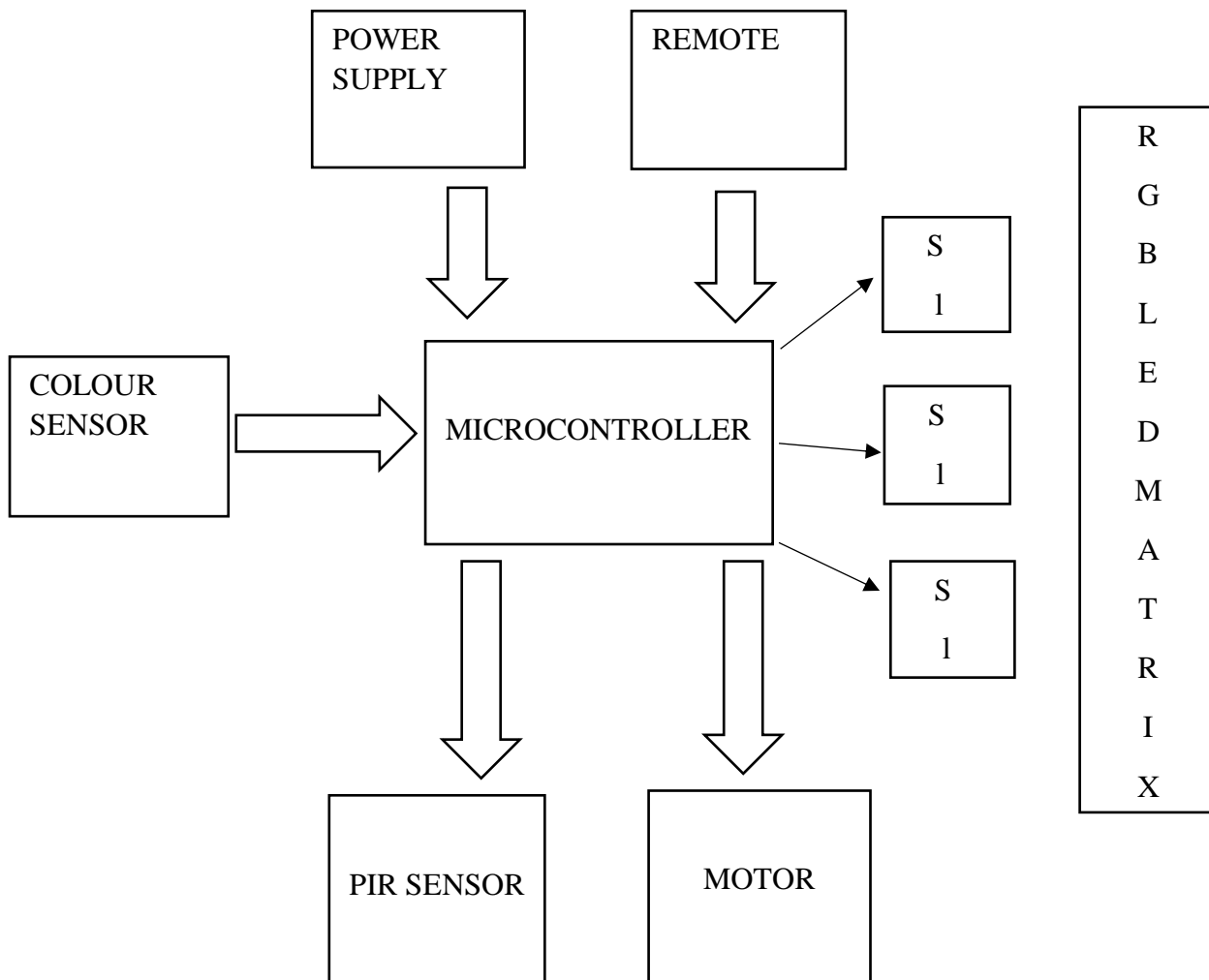
Camouflaging to Green



Camouflaging to Blue

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BLOCK DIAGRAM:



➤ MICRO-CONTROLLER

Heart of the UGV is a micro-controller. Micro-controller is used for controlling all the operation done by the devices which are interfaced to it. Micro-controller helps in transmission and reception of signals to be controlled. AT89C52 IC is used in this micro-controller for driving the UGV. The IC used in this is AT89C52 has 40 pins. This IC is a low power consumption IC having 8K byte of Flash memory and programmable memory. It also has an on chip Flash memory used for reprogramming. Micro controller is provided with the power supply of 5V through the power supply circuit. It has an additional crystal oscillator with clock frequency of 11.59MHz. This IC can be easily interfaced.

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➤ COLOUR SENSOR

To analyse the colour of its environment, colour sensor is used. The colour sensor used provides small size, low cost, easily compatible. This colour sensor is small in size and integrated on a small module making wiring easy and also emits precise information of the neutral colour lighting of pure white. The operating principle of colour sensor is simple. Photo diode is used to generate signal after reacting with the colour filter on receiving light reflected by ground. The generated signal is analysed in terms of frequencies and then gives ground colour.

➤ PIR SENSOR

The PIR (Passive Infra-Red) Sensor is used to detect the changes made in the surrounding object by measuring the infrared levels made by the movement of object. The high signal of the motion of object is detected on the I/O pin. PIR sensor is a pyro electric device. The PIR sensor is a device which generates electric charge when exposed to infrared radiation and is made of a crystalline material. An on-board amplifier is used to measure the changes in voltage generated that is obtained by the infrared on striking the object. Fresnel lens is a special kind of filter used in this sensor which is used to focus the infrared signal onto the object. The motion of the object is indicated by on board amplifier on rapid change of the ambient infrared signal. This PIR sensor has a single bit output having small size that makes it compatible to all micro-controllers of 3V & 5V operation with less than 100uA current draw.

➤ BLUETOOTH MODULE

Bluetooth module is driven by the signal given by the smart phone or remote using an Android Application. This Bluetooth Module consists of master and slave. There is one master and many slaves.

➤ LED MATRIX

To display ground colours, 8x8 RGB LED matrix's is being used. We used one matrix with one colour sensor which allows it to create a uniform colour zone. Besides, these LED matrix's have many benefits such as pins in 2*16 sets make it easier for wiring, their lightening quality (the UGV is used for the purpose of reproducing a colour rather than lightning up the environment), and a low power consumption.

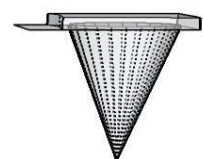
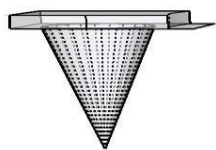
The major parts that help in digging are:

- High power driven drillers
- Blade
- Blade Lift Cylinder
- Angle/Tilt Cylinder
- Tyres
- Power Supply Circuit

The techniques which help the UGV to conceal in the soil are:

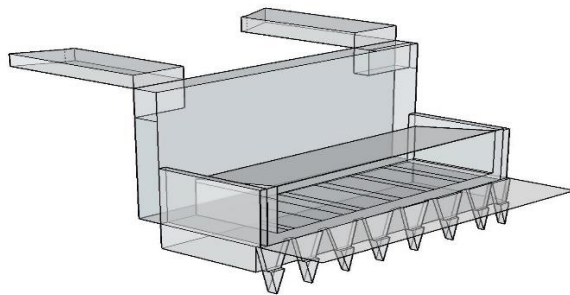
▪ **DRILLING**

Drilling is done with the help of high power driven drillers. These provide large amount of torque by taking a small amount of input power. Drilling helps in loosening of the soil before it can be dug and thus it saves time. The drillers in the UGV are symmetrically placed such that while operation the weight of the UGV stands balanced from all sides.



- **DIGGING**

The digging process in the UGV is a simple lifting process as in the case of a bulldozer. The special type of 3 movable joint makes the lifting process easier as the Blade Lift Cylinder and the Tilt Cylinder can be simultaneously moved. The soil dug is collected in the Blade and can be discarded on the sides.



- **DC MOTOR**

DC motor is used to provide locomotion to the UGV. It is driven by the power supply circuit with 12V. DC motor used is compatible with the micro-controller.
 $\text{Force} = (\text{current}) \times (\text{wire-length}) \times (\text{magnetic field})$

CONCLUSION

The main objective of our project is for Border security by using camouflage technology and has been successfully accomplished by using Bluetooth module driven by an Android App or a remote. By using PIR Sensor transmitter receiver we can detect the obstacle coming in path. The drillers and diggers help in concealing the UGV beneath the soil in minimum time. Thus in defense application it is possible to provide 24 hour security.

REFERENCES:

1. Internet
2. Basic Elements of Electronics by Boylestad

5) With regards to the 2nd round of screening, the team has planned to exhibit:

- A detailed PowerPoint presentation on our UGV and also statistically depicting the benefits in the use of our UGV
- A working model of our UGV to get a clear insight to our idea.
- A 3-D model of our UGV.

6) With regards to the 3rd round of screening, the team has planned to exhibit:

- A working model of our UGV with a focus on minimising cost and increasing efficiency.
- A more statistical and graphical PowerPoint presentation discussing the pros and cons of our UGV.
- A 3-D model of our UGV with a focus on more details.

7) IMPLEMENTATION

The idea of the UGV Stanley is based on the camouflage techniques. The aim of the project is to design, manufacture and operate via a Smart phone, used as remote control device can reproduce the colour accordingly with the ground surface where it will be moving on, hence being camouflaged to the outside world. On the one hand, in order to achieve these goals, we used a LED matrix (RGB) which can diffuse uniform colours, coupled to sensors that can precisely identify ground colours. This UGV is designed in such a way that it can reproduce the colour independently at various areas each area being able to reproduce colour with specific spots of the ground surface, which allow the UGV to mock up as a checkerboard of multiple colours – the various colours it drives over. On the other hand, we also created a system by means of which the UGV could conceal itself beneath the soil and thus remain unidentified by the enemy. The drillers and the diggers used hide the UGV from the human eye within minutes.

The UGV is being camouflaged and is controlled from afar an object. So, in the Defense sector, such a UGV would allow the vehicles having large size to be camouflaged, in fact, Camouflage is essential in the army missions. Besides, in the Intelligence sector, we could use spying robots like drones.

The link for our Prezi Presentation is given below:

<https://prezi.com/p/-qe8ydxspfuk/>