INNOVATION TOUCH - UAE

Technical Documentations

JUNE 20, 2019

MATE ROV

USA - Tennessee – Kingsport

INNOVATION TOUCH

1- Sultan Salem (10th grade) CEO / lead researcher / co-pilot
2- Mohanned Adnan (10th th grade) pilot / Electrical engineer / lead software technician
3- Abdullah Mohamed (10th grade) pilot / Software technician / lead Electrical engineer
4- Hassen Yasser (10th grade) media coordinator / copilot / lead Mechanical Engineer
5- Hamed Mohamed (10th grade) CFO / Technician / Researcher
6- Sultan Seed (10th grade) tether man / Mechanical Technician
7- Mohamed Albraiki (10th grade) media coordinator / tether man / safety officer
8- khalid Abdulla (11th grade) Technician / tether man / marking

INNOVATION TOUCH (UAE)

- Our team is a governmental Emirati School that accumulated 277 hours of time working on the ROV and related work.
- Team age between (15-18)
- Distance traveled to international Competition 7566 miles

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Abstract

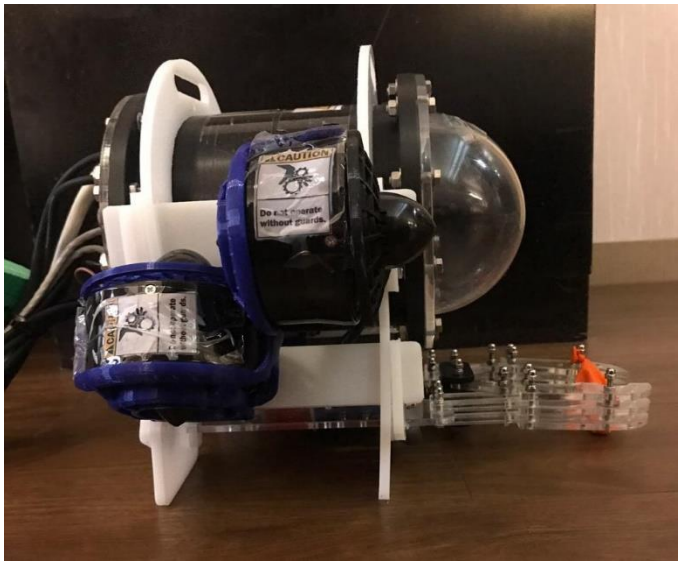
The Innovation touch company (IT), considers our highest priorities to be safety, innovation, environmental preservation. The Innovation touch crew believes that a team of high-school students innovating indefinitely will almost certainly produce the ideal Remotely Operated underwater Vehicle (ROV).

Our team consists of eight different students in skills, ranging between tenth and eleventh grade, who applied Physics laboratory at the School laboratory, detects the Dolly plug cracks located in King Sport City in state of Tennessee.

Our remotely operated vehicle (ROV) is the culmination of months of experienced innovation and troubleshooting, resulting in many professional grade features, one of those futures is that our (ROV) the checker is strain relief, also it can dive 20 meters under the water and hold out water pressure. After discussing with our team, the pilot selected the (Joystick Extreme 3D PRO) to control the (ROV).

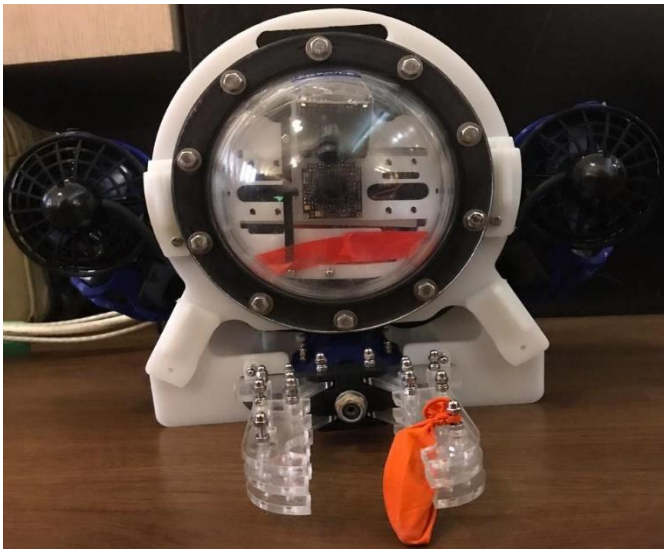
The Checker Photos: -

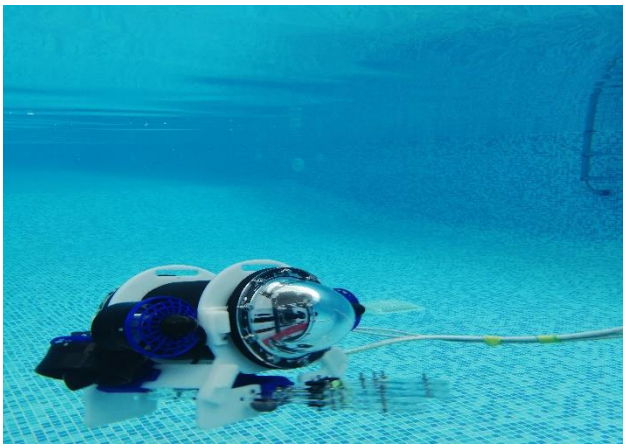
Side view



Top view

Front view

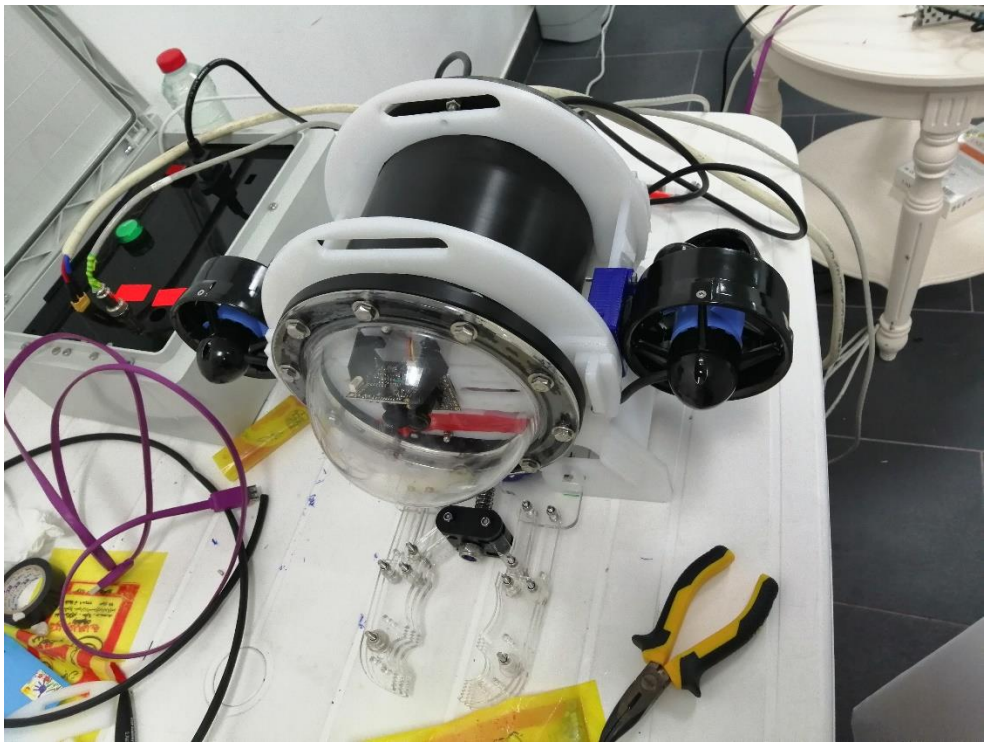




The innovation touch Company commend to make a ROV can finish all of the mission that we have to do in the completion and the ROV that we make is Fully qualified to perform all tasks entrusted to him . the completion will be in USA In Tennessee , the things that we mast do is from the hardest mission that the completion do ,we have to chick the dam because the dam is old and there are sum of cracks we have to migrate and before many years their was a surveil war in the aria so we have to clean the rear from the things that steel in the river .

we build aware ROV from Polyethylene (HDPE) because many reasons the first reasons is that the Polyethylene (HDPE) will not expand or contract under extreme temperature changes like normal plastics the other thing is the density of this material from the best material density that is work god with the water

Our team also has a team for schedule and time One of the benefits that every on now wat to do so wen every one now wat he must do the work will be more accurate and we have a mechanical that design the ROV



There are the electrical team that makes every electrical things in the ROV.

Our Whole Project Mentor

Mr. Mohamed Ragab

Our SolidWorks Mentor:

Mr. Mustafa & Mr. Wali

Team Support:

MOE

AL Ruwad School

The Engineering Design Process:

AD library

Shake Zayed library

MATE website

In order to accomplish all the tasks that come with building a ROV and preparing for competition, our team

Held weekly Sunday, Tuesday, Thursday, Friday and Saturday meetings since the beginning of December 2018. We added a tentative meeting schedule for our December meetings.

The calendar of meetings about four month

8-15/4/2019

1. Training in the school 6 hours in the week

2. Camp in Dubai every days 9 hours

3. Going to the regional national competition in Egypt

4. Return and training in the school for 6 hours

5. Training in camps in Dubai for 9 hours

We will use engineering design

For the process of improvement and

further development

Advanced and reliable ROV. We will use this

The process is the first time to guide us through each step

The project:

1- Define the Problem

2- Do Background Research

3- Specify Requirements

4- Brainstorm Solutions

5- Choose the Best Solution

6- Do Development Work

7- Build a Prototype

8- Test and Redesign

The Innovation Touch company has experienced many successful research projects and competitive achievements, but to be more successful, we challenge ourselves with new ideas and techniques. The checker is us

The vehicle is equipped to complete the required tasks, but the vehicle meets the weight standards In addition, size.

Frame design:

In the process of designing our frame, the process began with the design of the frame in the paper to get a rough sketch of the shape, Then we started developing the model in SolidWorks.

We wanted to design the ROV by Developed based on mission criteria, we chose good materials for design, We designed the frame differently so that we could catch Rove and be able to drive easily final design stage of the checker.

The frame structure was to attach the largest number of the parts needed to make ROV Playback. Our technical teacher, Mustafa, gave us support for the software technical support for 3D creation apply for ROV before cutting any materials.

TETHER

We ways to make The heaviest part of our ROV is the tether and to reduce the weight.

The requires a change in size and number of conductors that we use in the tether. We never considered changing the material the conductor was created from so we researched conductor material that had a high level of pure copper and a low level voltage drops. We decided to use Blue Robotics Shielded Fathom Tether, shorten the tether length to 20 meters, and remove some data lines from our control system to lose most of the extra weight and prevent a voltage drop along the tether.

Control System

The Raspberry Pi system accommodates us with a reliable processor control that was within our budget. The code and the Pix-Hawk converts the analog input from the joystick to the electronic speed controllers needed to input power to the T100 thrusters. Working with Q-Ground Control a drone flight software- on a surface laptop, we can use an joystick to control the thrusters and camera. This system is compact and reliable, allowing our robot to operate quickly and efficiently. Additionally, reusing our Pelican waterproof case makes our ROV transportable, durable, and easy to modify. These new controls allow our pilots to drive the ROV to full capacity and make their job easier with the simplicity of the joystick controller.

Propulsion Design

In the past, propulsion has been the one area that we spent the longest time developing because we needed thrusters that had more thrust. The conversion to the Blue Robotics T100s has solved our thrust issues but created a variety of other time consuming design problems. To use the T100 thrusters, they need ESCs (electronic speed controllers) that are not waterproof. Our first attempt to waterproof the ESC was to encase them in acrylic. This worked, but it was very messy and did not produce a professional looking solution. To create a more professional look, we upgraded to using an electronic housing enclosure in our frame that housed the ESC's, so they were all combined into one area neatly. Two of the thrusters are in the back of the frame for forward and backward motion as well as turning left and right. The other two thrusters are located on the top of the ROV between the enclosure and the edge of the frame for upward and downward motion. These four locations allow for optimum maneuverability and speed, which is critical when competing against the clock in product demonstrations. These thrusters allow our vehicle to maneuver effectively through the product demonstration landscape and achieve our goals.

Linear Measuring Device

Using our experience from previous MATE Regional Competitions where measuring was required, we created a new and improved linear measuring device. Until recently, we have struggled with measuring for many years and could never figure out an efficient way to collect data. Now, we have designed and prototyped what we believe to be our best attempt at measuring yet. The designers had tried everything from string to motors when deciding how to measure the distance but realized that they should

just go back to the basics. The designers sultan Alharbi and hassan yaser settled on taking an ordinary tape measure and attaching a curved metal rod to the first 15 centimeters, which allowed the hook to be strong and from its placement on the ROV it can be easily seen by the camera which makes the data accurate. We tested it out on our practice props to be sure it would work and found that it was successful.

Mechanical Grabber

The ROV is equipped with a reliable aluminum grabber that has 3 servos attached to it. The three servos allow the grabber to maneuver on three different axes'. The open/close, up/down, and side to side functions all work together to move the grabber in a 360-degree motion to help us complete tasks. The three servos are Lean Soul servos that are rated for 12 kg of pressure. This is especially helpful when trying to attach lift bags to the engine and debris. Rather than the entire robot moving the mechanical grabber acts like a human arm. The "joints" of the mechanical grabber allows easier access points to difficult tasks. With the three different servos, it makes it much easier to complete the mission and it makes the ROV much lighter, which will allow us to fit into the weight requirement for the extra points. Also, with our arm's dexterity, it reduces our reliance on our entire ROV to have to move in order to use the grabber. Now, with the three servos, we can reduce the time and difficulty to complete the mission.

Camera design and placement:

Our blue robotics camera is 190 degree field of view, We have two blue robotics cameras and it is placed at the front dome one is for field view and the other one is for the gripper,

that is easier for the pilot to see surround him.

Build or buy?:

The Innovation touch company focused on building a good quality and trying to save more money but there is somethings we cant build because it is difficult and it to be perfectly working like thrusters we bought four T-100 trusters from blue robotics company, other than that we did every thing like the frame we laser cut and we 3D printed the safety for the thrusters and 3D printed the cover for the DC motor for gripper we pressured the E-bod and the dome

Old or new?

In Al-Ruwad specialized robot club we have experience on robots and we have all kinds of equipment's for the robots so it is not a fault that we use old equipment for the ROV but it is not a broken or used to much so we can save more money and used for other time, but it will be more better if we put a new one or advance one.

A company called Innovation Touch aims to provide a safe and positive working and learning environment. The company members have come up with a number of rules that should be practiced by each member. One states that proper safety clothes must be worn while working with or on the ROV. The safety clothes consist of goggles, closed shoes, and long pants which should be worn, while working with dangerous tools, soldering equipment, and industrial glues. The second rule states in order to avoid unnecessary or critical injuries no company member shall work on the ROV while it is connected to power. Moreover, the last rule was put due to past experiences which lead to minor injuries due to tripping or slipping on leftover tubes which is to clean-up after yourself.

As a company we did not want to ensure a safe environment only but within the ROV its self. The vehicle incorporates two strain reliefs that prevent the tether from being ripped out. One of the strains is located located on the back of the ROV.The strain is made of carabineer clip which is attached to all the wires coming out of the enclosure preventing strain. The second strain relief is attached to the side of the control box so the tether is securely attached. There is also an in-line fuse that located 30cm from the point of power. The top thrusters and surrounded with warning tape as a visual and noticeable warning for anyone around the device. All thrusters have a 3D printed guard over them to avoid fingers entering the vicinity of the propeller. Finally, all the ROV’s edges are round to prevent any member from injuring themselves while doing their work.

Challenges

Our greatest challenge was to make the ROV completely water proof, and working around everyone's schedules in order to meet this goal of creating a better engineered ROV

All of our team members are involved in other academic activities and sports so our meetings had to take place in the evenings. Additionally, due to multiple different sports practice times, even meeting at night can make having everyone together at one time next to impossible. This makes it extremely difficult to develop and share ideas so, while we try not to miss sporting events or extracurricular activities, we often have to miss other activities in order to meet the overwhelming responsibilities and needs of engineering an ROV.

One of the most difficult electrical challenges facing the our team was to make the ROV fully water proof, the Tether needed to be made from a special conductor material that had a high level of pure copper and a low level voltage drop and water proof

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Lessons Learned

The first lesson we have learned was to be careful and gentle with the ROV, we broke the part that protect the t-100 thrusters it was made from 3D plastic, its fixed now but the lesson we learned that day is to be gentle with the ROV.

On an interpersonal level, our team learned the lesson that they need to be gentle and careful about anything in the ROV, so we bullied a box for the ROV the box have a lot of foam so it can protect the ROV from any damages.

We tried to make our ROV mostly from 3D printed parts to make it cheaper and reusing some parts like the Arduino Uno we got it from the (IT) department from our school and most of the reused stuff is from our school, our total budget is $610 dollars

category	description	Cost or value	New or reused
ROV Structures	3D printed parts	$0	new
Propulsion Electronics	4-T100 Thrusters 2-180 Wide view Camera Logitech Extreme 3D Pro Joy Stick Adriano Uno	$450 $60 $50 $0	4 new 2 new New reused
Tether	20m- Almisria alturkia for cables 2x4mm 40m-Internet cable RJ45	$2 per meter $0 per meter	New reused
Mission Tools	OBS PVC Parts	$0	reused
ROV box	Box Fome	$0 $10	Reused new