

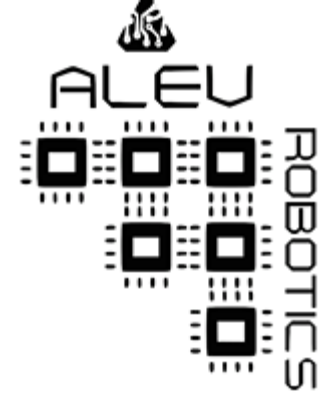
ALEV HIGHSCHOOL ROBOTICS TEAM

S.A.R.



ALEV ROBOTICS

ALEV HIGH SCHOOL
ISTANBUL, TURKEY
MATE ROV 2017



ALEV ROBOTICS TEAM

S.A.R.

From left to right:

Aziz KESKINOZ-Supervisor

Cengizcan NAKIBOĞLU – Pilot Lead Mechanical Engineer(Class of 2017)

Eren AŞKIN – CEO Lead Electrical Engineer(Class of 2017)

Can YELTEN- CFO Lead Software Engineer (Class of 2017)

Barış ÜNAL-Public Relations Officer(Class of 2017)

Ceylin ÖKMEN – Software Engineer.(Class of 2021)



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INTRODUCTION

Abstract

As our second year returning , ALEV ROBOTICS has assembled a dual-purpose remotely operated vehicle (ROV) that can operate in search and rescue tasks. This robot, known as S.A.R. (search and rescue) has been built to handle variety of different tasks and represents months of hard work and successful testing under tough safety protocols.

ALEV Robotics's newest vehicle S.A.R. is designed to operate in deep sea levels. S.A.R. comes fully equipped to demonstrate.

1. Carrying random things in the sea
2. Measuring the sea temperature
3. Measuring the depth of the sea
4. Taking images underwater

CORPORATE PROFILE

ALEV Robotics has developed an individualized approach to business management. The company is divided into two primary branches: Business and Engineering. Splitting power has helped us save time and work efficiently. It also allowed us to primarily focus on our tasks while maintaining communication between two branches.

Our business department is responsible for all financing and public relations. Public relations members operate the company's social networks and the marketing display.

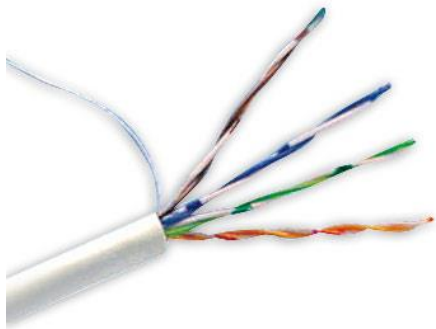
The engineering department is split into three groups: Electrical, Mechanical, and Software. The electrical department controls all the electronic hardware, the software department is responsible for the software programming, and the mechanical department creates the physical structure of working components.

Although we were divided into two groups, we have always been in communication and made our important decisions together. Alev Robotics believes that when hard-working and talented individuals come together for the same goal and put their all effort into it, the high quality and successful result is inevitable. With this belief, we were able to achieve great things, and in return, we came back stronger in our second year.



Tether

The cable contains 1 cat 5 data cable, 2x2.5 mm power cable and 1 CCTV camera cable. Data transmission between the cat5 cable and the control panel and the ROV is provided. The CCTV cable connects the monitor to the camera , and this cable and high-quality camera capture the HD image. Finally, the power cable provides electrical energy to the power supply on the ROV.



Control System/ Hardware

We have one joystick, a button for light control, one 10 inch monitor, potentiometer in robotic arm control in our control system. In order to capture a crisp and clear image in the hard box of ip67 standard used as a box in the control panel, black wood panels are cut and the system is seated on this panel. Tum cable entries are made in plug-in socket form and can be easily separated from the robot control panel when necessary.

Design Rationale

A. Physical Design Process

To streamline the design process, Alev Robotics used a multi-step approach to allow the team to envision the end result early in the design process, reducing the number of mistakes and revisions. The process began with a brainstorming session. We found multiple ideas for the materials we wanted to use. There were some factors which we had to consider such as amount cost and size of the ROV and the weight. We started to search at the internet for a light and low cost material which we could use for the frame of the ROV. We also looked for ROV designs which were done by other students before us.

B. Frames

An X shaped single piece frame was used . The frame was made from carbon fiber material and solid and aesthetic image was obtained. Thanks to the one piece main frame,lightness and a simple and elegant design is achieved.

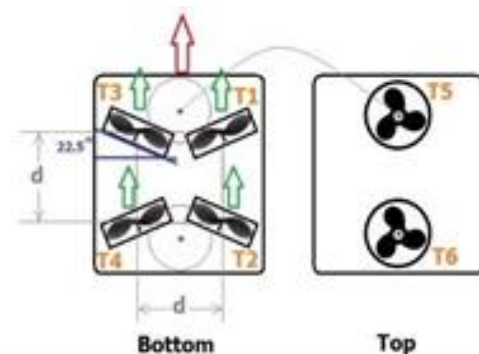


C. Thrusters

We used 6 thrusters to let our ROV move forward, move backward, rotate left, rotate right, shift left, shift right. We researched at the internet for the best available brands of thrusters in Turkey. We decided to buy 6 thrusters from the brand Blue Robotics . These thrusters had high performance and needed low energy to run at full speed. We mounted them to the frame similar to SAAB ROV settings at an ideal angle of 22.5 for major performance I the forward-backward motion and reasonable shifting motion. Each of our thrusters need 12 volts and 7 amperes of energy to run at full speed.



 Direction of Thruster Face
 ROV Forward Direction



D. Robotic Arm

. A servo motor coated with epoxy and a gripper made form hard plastic were used for robotic arm. The arm was made more functional thanks to the shoulder piece made of teflon material attached to the tip of the gripper.

E. Camera and Monitor

The modified 720p HD camera was extended with a CCTV cable and connected to a 10 inch monitor in the control box.

F. Electronic Housings

ROV un üzerinde bulunan elektronik eşyaları kuru tutmak amacıyla 29 cm boyunda 11 cm genişliğinde 5mm et kalınlığına sahip akrilik tüp ve buna uygun olarak O ringlere sahip kaplar kullanıldı. Kablo girişlerinde su yalıtımı sağlamak amacıyla yalıtkan malzeme olarak epoksi kullanıldı. Housing in iiçinde arduino boardları, güç kaynağı ve bütün rov motor ve kablo bağlantılarının devreleri bulunmakta. In order to keep the electronic items on the ROV dry, a 29 cm length 11 cm wide 5 mm Wall thickness acrylic tube and corresponding containers with those rings were used. Epoxy was used as insulation material to provide water insulation in the cable entries. Inside the housing are the circuits of arduino boards, power supply and all ROV motors an cable connections.

H. Control System

We designed our ROV to be controlled by Pilot for motion control and Co-Pilot for controlling the robotic arm and manage sensors reading. We used a Potetiometer for the robotic arm and a joystick for motion control.



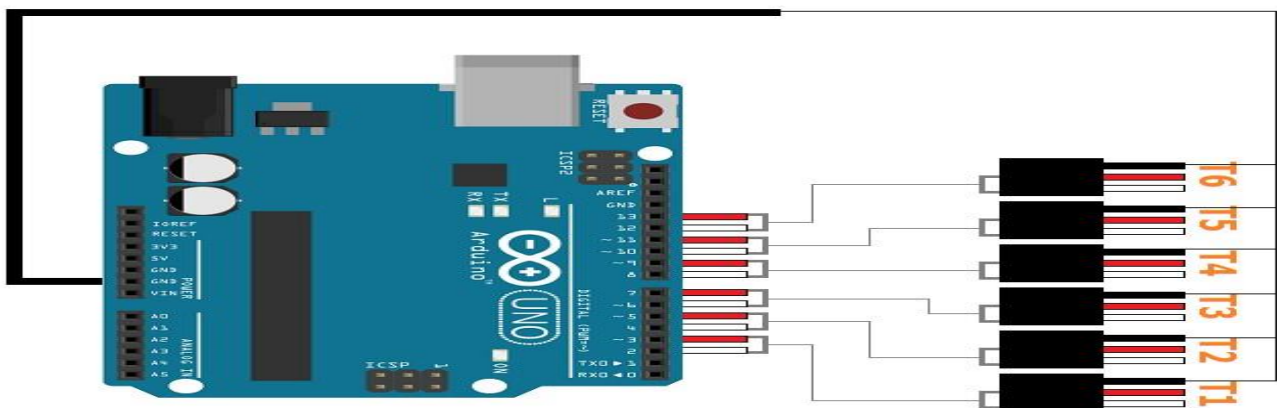
J. Electrical Systems

The power cables are connected into the housings. We also connected Cat5 network cable for the connection of the controllers. Our power supply has 2 positive and negative lines. Each one of them had 15 Amps and 12 volts of power. We connected each of our horizontal motion motors to the power lines one by one. Then we added the

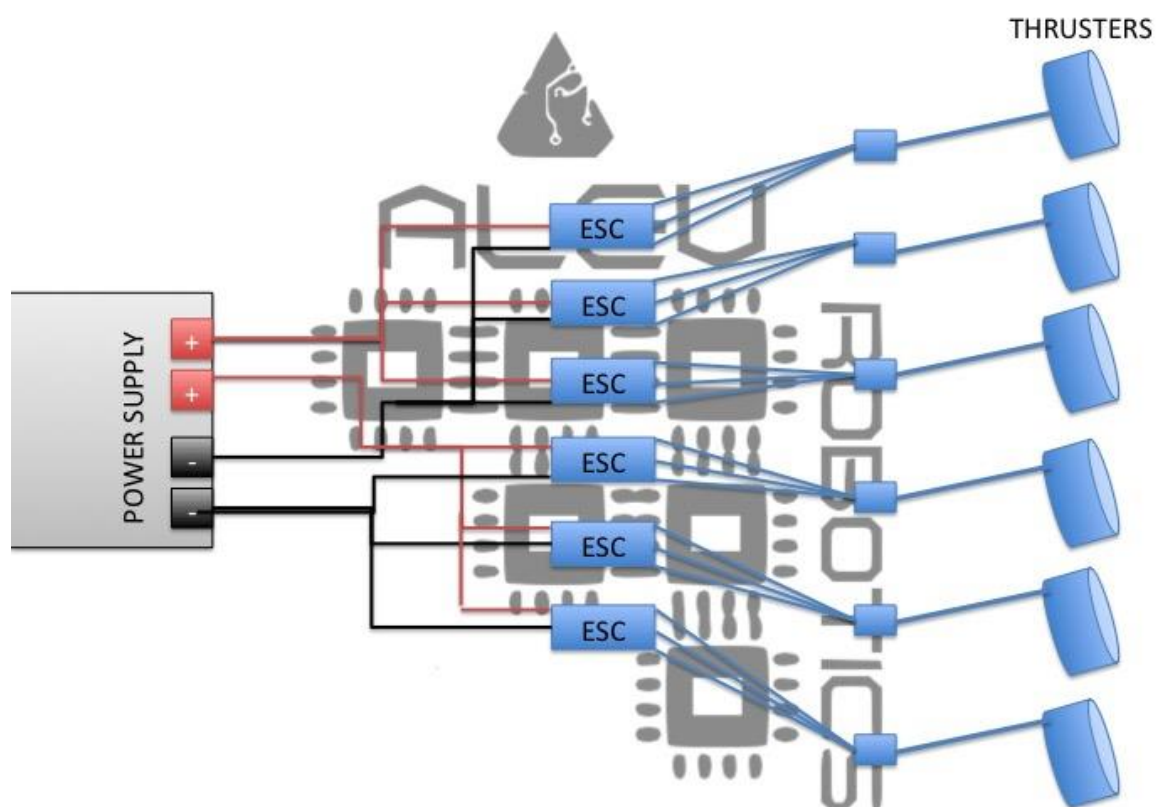
2 vertical motors to the rear horizontal thruster power lines. So we had the front horizontal thrusters working with full power and the other ones working with reduced power. There were 5 more objects to connect. We connected our cameras to the place where we connected our T1 Thruster. The robotic arm, our Arduino boards and our sensors are connected into the port where the T3 thruster was connected

K. Programming

KF-1500S is programmed with Arduino software. We used 1 Arduino-Uno boards is for ROV motion



System Interconnection Diagram



SAFETY

A. Safety Checklist

All items attached to ROV are secure

Sharp edges that have not been smoothed are marked

No exposed copper or bare wire

No exposed propellers

All wiring is securely fastened

Tether is properly secured at surface point and at ROV

All wiring and devices for surface controls are secured

All control elements are mounted inside an enclosure

On deck team is wearing safety glasses and close toe shoes

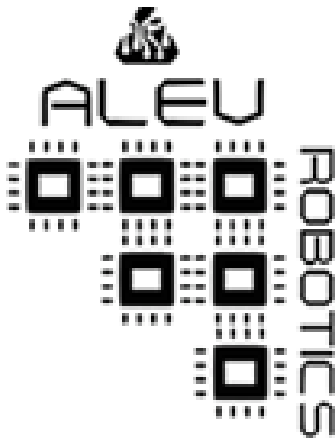
B. Company Safety Philosophy

Employee Safety is Alev Robotics core value and our company's highest priority. We believe that all of our employees have to use latex gloves and gas masks while working with chemicals. Protection eye where and thick working gloves are also provided by our company.



DESIGN THEME

Because of this year's emphasis on marketability, the team decided that a cohesive theme for the ROV and the team as a whole would be highly beneficial. The team had a brainstorming session and eventually voted on S.A.R. as the name for our ROV. Images below are our logo and our team jacket.



CONCLUSION

A. Challenges

Many technical challenges were overcome when constructing and operating S.A.R., but none as difficult as those encountered with the electrical housings. It is very important that there is no leakage. We used epoxy and fast drying hot silicone to solve this problem. We also had problem while programming the Arduino. After working for long hours we have solved all of our problems.

B. Lessons Learned and Skills Gained

We have learned everything step by step with little to none help. Our main problem was that we didn't have a real mentor who would have been with us all the time. We learned how to programme Arduino, some basic physics rules and a lot more stuff. Alev Robotics learned the hard way, through experience, about the importance of communication, or more importantly, how lack of communication affects the team. These negative effects include inefficient use of time (delays, waiting for others, missed deadlines), frustration due to wasted time and effort, and disagreements among team members. As a result of these challenges, the members of Alev Robotics learned how to work as a team, with respect and responsibility. Each member learned to be mindful of others' opinions and responsible for his or her assigned tasks. The goals and standards of the company must be communicated constantly, in order for the individuals to feel and act as part of the company. This increased awareness allows each member to realize the importance of discussion and consensus before implementation. When everyone knows the plan of action, the entire team moves forward together.

C. Future Improvements

There are a lot of improvements we want to do. We also want to improve the design of S.A.R. We will add 3D printed parts to make it look better. One of our other target is to do the electronic housing work without chemicals to have a cleaner view at the end. During the process of constructing, testing, modifying and completing S.A.R., Alev Robotics was able to work out its breakdown of communication issues by utilizing all available media to keep its members fully informed of S.A.R.'s progress and hindrances. This also increased awareness of the interdependence amongst team members and showed how one person's decisions could affect the work of many others, which was the cause for numerous arguments regarding wasted time and efforts. In line with the

problem solving and troubleshooting techniques utilized for the technical issues it faced, Alev Robotics must first identify and solve its communication issues. This valuable tool will allow technical issues to be solved promptly and efficiently. In the future, Alev Robotics will address communication breakdowns and raise the awareness of how it affects the company and each individual member. This will begin at the very first meeting, so everyone will be informed and aware of the respect and responsibility each team member must show to others and the company. There will be meetings before work begins to ensure everyone is on the same page. Meetings will also be held after work is done to plan for the next workday and to learn from events that happened that day. These meetings also serve the purpose of reminding everyone of safety techniques and occurrences before, during, and after work. Improving communication and

keeping everyone on the same page from the very beginning will increase efficiency by reducing stress, frustration, and wasted time

D. Team Reflection

Participating in the MATE competition has enabled every member of Kaimana Enterprises to grow significantly due to the countless challenges and obstacles that arose. Although each company member was able to gain a myriad of technical skills, such as troubleshooting, welding, wiring, and programming, many of them are still unsure about their future career aspirations and have many years left before going to college. As a result, the personal, non-technical accomplishments that were gained this year were more valuable to the majority of the company. At the beginning of the MATE season, some members struggled with working together and communicating effectively, not only because of the various schedules of company members, but also due to some conflicting ideas and personalities. For example, a few members had some negative experiences working together on projects in the past, leading to numerous arguments during company meetings. As the competition approached, this issue slowly resolved itself as petty differences and arguments gave way to achieving company goals through compromise.

E. Budget

School Name:		Reporting period		From: 7/1/2016			
ALEV High School		ALEV High School					
Instructor/Sponsor:		Petronet/Engtechs Ltd		To: 4/23/2017			
Funds							
Date	Type*	Category	Expense	Description	Sources/Notes	Amount	Running Balance
4.10.2017	Purchased	Hardware	Carbon Fiber	Carbon Fiber	Used for vehicle frame	\$ 172.00	\$ 172.00
5.10.2017	Purchased	Electronics	Joystick	Arduino controll Joystick	Used for control system	\$ 15.00	\$ 187.00
3.27.2017	Purchased	Electronics	Camera	underwater camera and cable	Used to see under water	\$ 41.00	\$ 228.00
3.27.2017	Purchased	Electronics	Monitor	10' monitor	Used to see under water	\$ 100.00	\$ 328.00
3.15.2017	Purchased	Electronics	Thrusters Blue Robotics	6x Blue Robotics Thrusters	Motor	\$ 804.00	\$ 1032.00
3.15.2017	Purchased	Hardware	Housing	O rings and screws	O rings and screws	\$ 9.00	\$ 1,041.00
3.25.2017	Purchased	Electronics	Power Supply	Camera connection	Used to connect the camera to the HDMI of the monitor	\$ 19.00	\$ 1,060.00
3.28.2017	Purchased	Electronics	Cable	Power Cable	Power Cable	\$ 18.00	\$ 1,078.00
3.28.2017	Purchased	Electronics	Power Supply	Power Supply	Power Supply 12V 30A	\$ 15.00	\$ 1,093.00
1.2.2017	Purchased	Hardware	Tools	Tools	Hand Tools	\$ 160.00	\$ 1,253.00
2.15.2017	Purchased	Electronics	Robotic Arm	Robotic Gripper	Robotic Arm	\$ 40.00	\$ 1,293.00
1.7.2016	Purchased	Safety Kits	Safety Kits	Gloves-eyeware-masks	Gloves-eyeware-masks	\$ 19.00	\$ 1,312.00
4.15.2017	Purchased	Hardware	Epoxy	Epoxy x 4	Waterproofing	\$ 26.00	\$ 1,338.00
2.2.2016	Purchased	Electronics	Arduino	3xArduino board/cables	Programming	\$ 23.00	\$ 1,361.00
1.7.2016	Purchased	Hardware	Tool cases	Tool Cases	x2	\$ 58.00	\$ 1,419.00
3.28.2017	Purchased	Electronics	Cable	Cat5 Cable	30m	\$ 15.00	\$ 1,434.00
3.15.2017	Purchased	Electronics	Heat Sensor	Digital Thermometer	Heat sensor with LCD	\$ 12.00	\$ 1,446.00
3.15.2017	Purchased	Hardware	Housing	Plexiglass Tubes	60cm-4mm thickness	\$ 56.00	\$ 1,502.00
3.29.2017	Purchased	Hardware	Control Box	ROV control box	ip 67 box	\$ 89.00	\$ 1,591.78
3.15.2017	Purchased	Electronics	Depth sensor	Depth sensor	To measure the depth	\$ 10.00	\$ 1,601.78
4.20.2017	Purchased	Team Kits	Poster, T-shirt and documents	Poster, T-shirt and documents	KF-1500S sheet, poster, T-shirt and roll up	\$ 230.00	\$ 1,831.78
3.15.2017	Purchased	Hardware	Tube for robotic arm	Plexi Tube	Plexi Tube	\$ 30.00	\$ 1,861.78
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							\$ 1,861.00

F. Acknowledgments

Alev Robotics would like to thank the following benefactors:

1. Alev Highschool-for all their help, for the class room they provided us
2. Avusturya Liseliler Eđitim Vakfı-for their help finding sponsors
3. Dr. Ihab Elaff-for his patience, for all of his helps
4. Mr. Ahmet Alař-for his technical support
5. Petronet Automatization for their sponsorship



ÖZEL ALEV OKULLARI