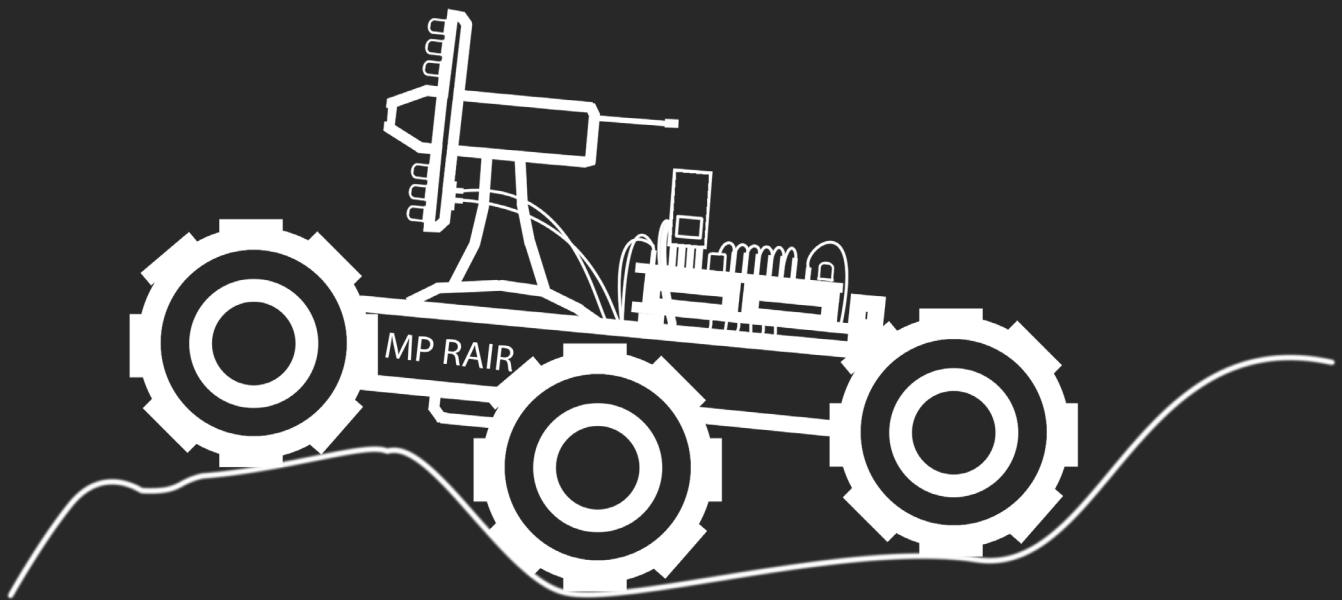




-IHSAN ISIK  
-FEHIM TRNKA



IHSAN ISIK  
FEHIM TRNKA





# ABSTRACT

---

As many of you already know mines are all around Bosnia. And obviously someone has to do something for it. While thinking about these we finally came up with an idea. An idea of a robot which would help in the area of mines. Even if it wouldn't be able to get rid of mines by itself it would at least help determine their location.

As we got our base plan set almost for certain we got ideas of improvement. These ideas changed the purpose of our project and turned it into a 'Rescue and Investigation' Robot from a simple RC mine detector.

MP RAIR is a remotely controlled Rescue and Investigation Robot with the ability to detect mines, pin down mine location on the map by means of GPS coordinates, detect temperature, stream live video to the control PC, etc...

MP RAIR is a Robot useful in many areas, from hobby to Military purposes. Hobby Metal Detectorists could make great use of it. MP RAIR could save soldiers' lives. Instead of having soldiers die while trying to clean the way up for others, they could simply use MP RAIR to detect the mines from distance then find and defuse them just like they planted them themselves...

# INTRODUCTION

---

Bosnia, a country full of mines... Go on a mountain trip and you'll see what I mean. On your way up to the mountain I'm sure you'll see the signs at the roadside telling you not to put a step into the territory because its full of mines...

Living in such a country it wasn't so hard to come up with an idea of mine detecting robot.

Mine sweeping sure is expensive and hard. Put aside the word 'hard' it is dangerous. It risks soldiers' lives. You've surely heard a soldier's death due to a mine explosion at least once.

Well, wouldn't it be nice to have a robot doing the detection job for you? A robot that you can control remotely from a distance. Let it detect the mine and tell you the location. Then the only thing left for you would be to go and defuse it.

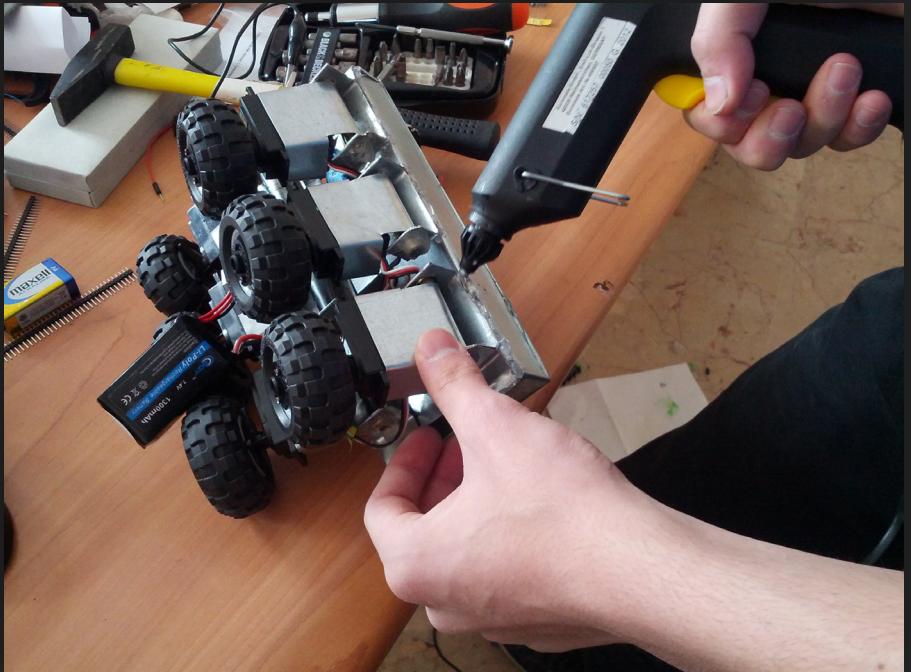
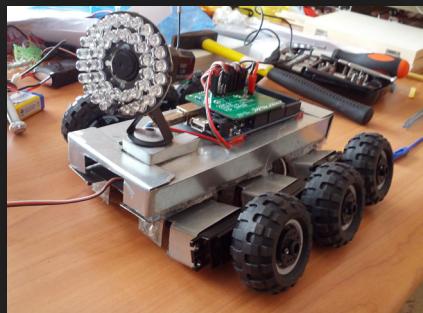
This being the initial idea of MP-RAIR we soon got to develop it into something further. We added a Wireless Camera, a microphone, temperature sensor, etc...

MP-RAIR, Multi-Purpose Rescue and Investigation Robot, an investigation robot with 6 independant wheels allowing easier and faster movement on rough terrains, a Wireless Camera for remote driving and investigation and various sensors such as GPS for location tracking and for noting down mine location and calculating vehicle speed, temperature sensor, etc...

# MATERIALS AND METHODS

## CHASIS

First of all we had to design and build a chassis for our project. For this purpose we used aluminum. For bending and getting the aluminum in shape we used the help of clamps and to stick together the pieces of aluminum we used hot glue.



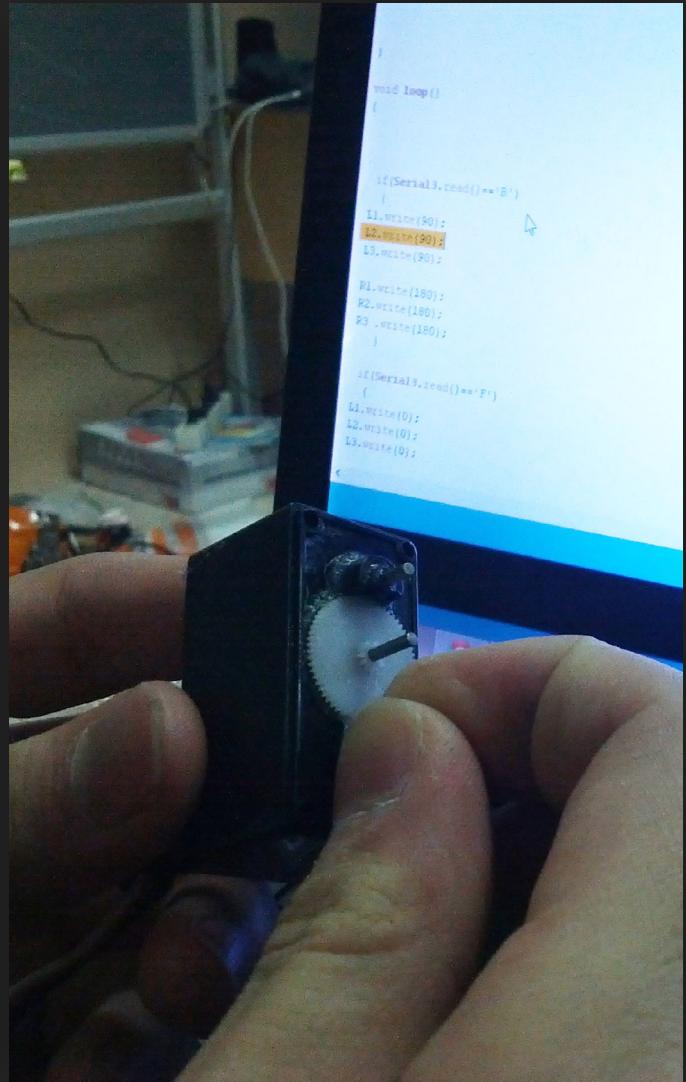
# MOTORS

We chose Servo Motors over DC Motors because of two reasons. First, Servo Motors have a higher torque. And second, they are a lot easier to use with Arduino. Both in electronics and code.

## MODIFYING SERVO MOTORS

Though they are easier to control, a standart servo motor wouldn't turn to a higher angle than 180 degrees, which makes it impossible to use as tire motors. To overcome this we had to modify them a bit to make them rotate to infinity.

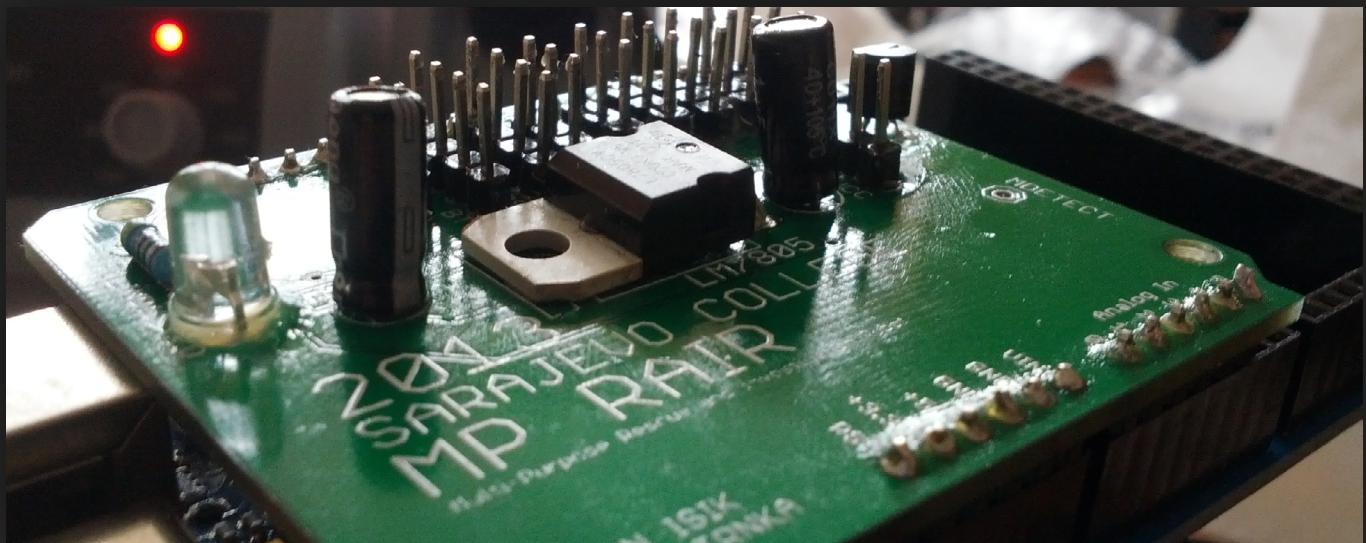
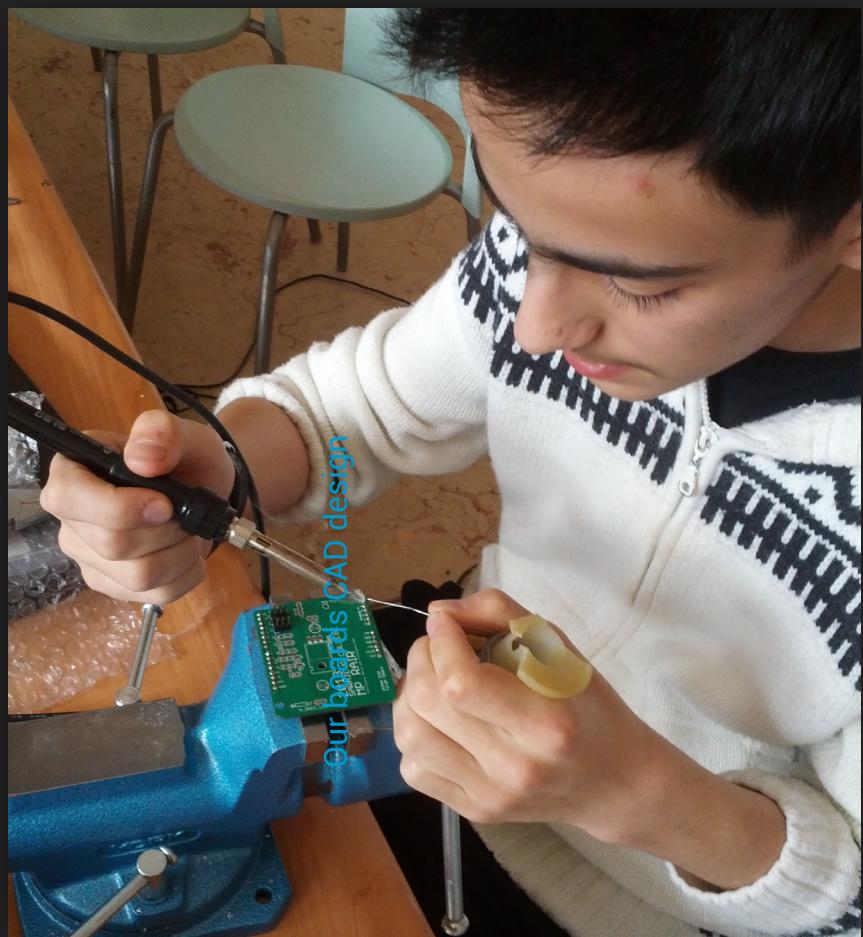
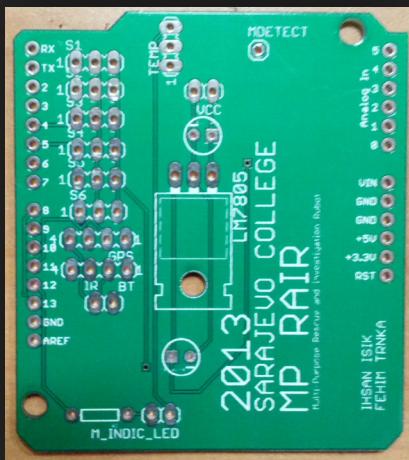
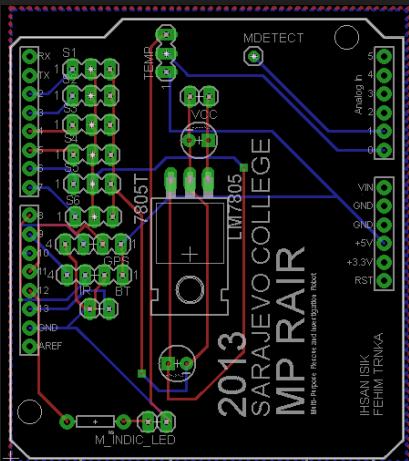
I could have written all the steps here but decided not to as I don't really think it's neccessary. All kinds of information on this can be found on the internet. Just Google "*modifying servo motors for continuous rotation*".



## PCB (Printed Circuit Board)

We designed the board using Eagle CAD\* and sent it for production to Seeedstudio\*. At first we had issues with shipping. Hong Kong Post website told us that there was a 21 day delay and we really thought we would get to produce our boards by ourselves using acid. Fortunately our PCB arrived a week before BOSEPO and we managed to include it in our project.

Our boards CAD design



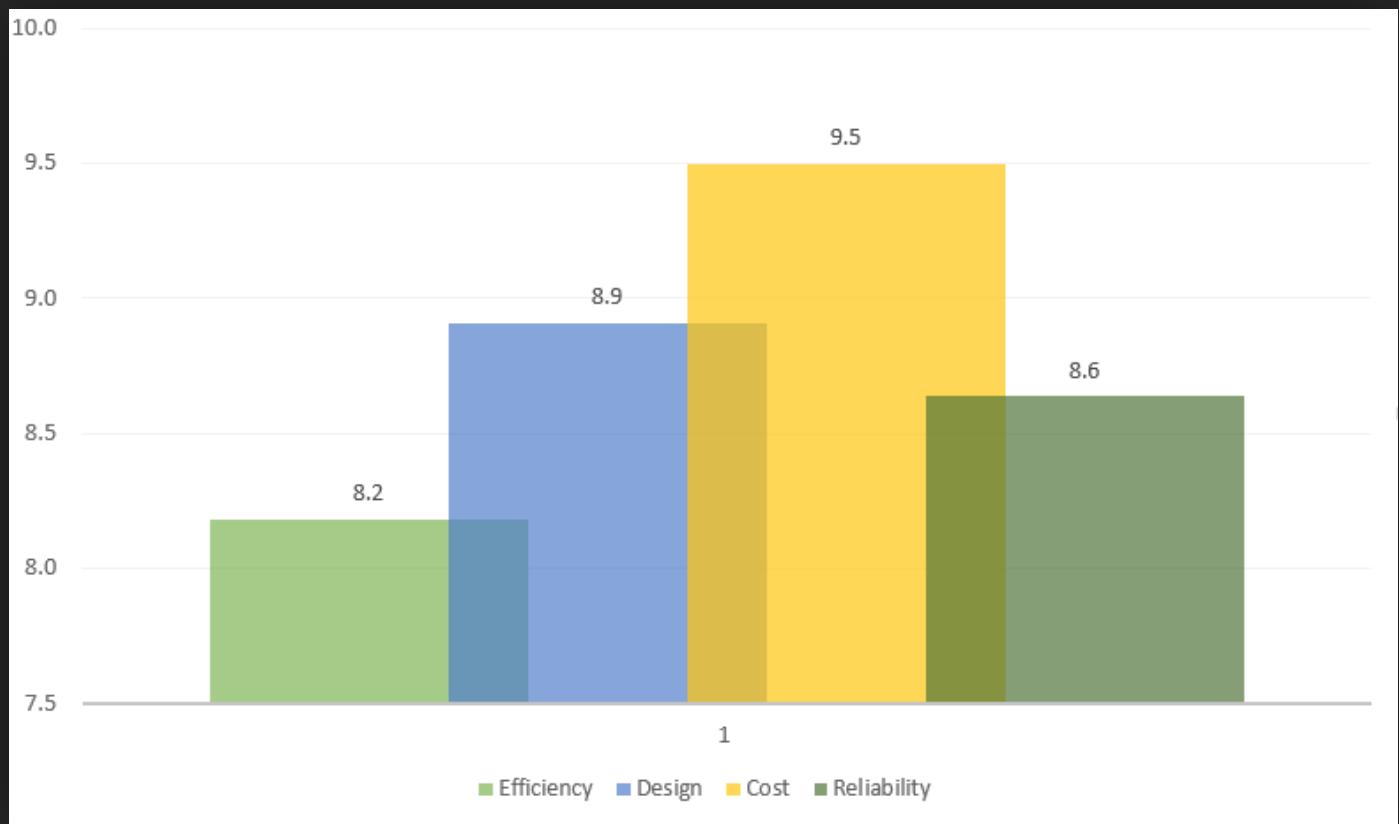
# LIST OF MATERIALS

Item Name	QTY/Size	Description
Arduino Mega ADK	1	Arduino Mega ADK microcontroller board
Futaba s3003 Servo Motor	6	For Whells
Micro Servo	1	Camera Rotation
Aluminum	1.20x0.30m	Chasis
1k Resistor	1	For onboard LED
1uF Capacitor	2	Power for servor motors
Wheels	6	
Bluetooth Module	1	Remote communication and control
GPS Module	1	Location and mine pinpointing
Wireless Camera	1	Remote control and investigation
Metal Detector	1	Detecting mines
LM7805 Voltage Regulator	3	Power for servor motors

# PCB PARTS LIST

Part	Value	Package	Library	Position (mil)	Orientation
1UF-INPUT		CPOL-RADIAL-10UF-25V	SparkFun-Passives	(1105 2401)	R0
1UF-OUTPUT		CPOL-RADIAL-10UF-25V	SparkFun-Passives	(990 1208)	R180
ARDUINO	ARDUINO_SHIELDLABEL	DUEMILANOVE_SHIELD	SparkFun-Boards	(100 700)	R0
BT		MA04-1	con-lstb	(548 1681)	R180
GPS		MA04-1	con-lstb	(540 1845)	R180
IR		1X02	pinhead	(574 1500)	R0
LM7805		T0220H	linear	(1057 1792)	R180
MDETECT		1X01	pinhead	(1400 2850)	R0
M_INDIC_LED		1X02	pinhead	(882 895)	R180
R2		AXIAL-0.3	SparkFun-Passives	(552 897)	R180
S1		MA03-1	con-lstb	(529 2781)	R0
S2		MA03-1	con-lstb	(529 2639)	R0
S3		MA03-1	con-lstb	(530 2485)	R0
S4		MA03-1	con-lstb	(535 2324)	R0
S5		MA03-1	con-lstb	(536 2167)	R0
S6		MA03-1	con-lstb	(545 1993)	R0
TEMP		MA03-1	con-lstb	(932 2867)	R90
VCC		1X02	pinhead	(1109 2635)	R180

# RESULT



# DISCUSSION

---

Of course, everything can't be perfect and this project is no difference. There may be failures at any moment.

## BLUETOOTH

First of all I should admit that using Bluetooth for such a purpose is meaningless. It has a range of at most 15 meters which simply doesn't make sense for this project. In the future the Blue-tooth module will be replaced with a Wireless Tranciever.

Bluetooth connection could be lost at any instant. In the project's current form if such a case happens it would be quite troublesome. Loosing control over the vehicle.. You'd have to go and get it back by yourself. Though this could be solved by replacing the Bluetooth Module with a Wireless Tranciever. Benefits of Wireless Tranciever would be it's long range of kilometers and it's reliability.

## SERVO MOTORS

Servo Motors could be replaced with High-Torque DC Motors.. Although Servo Motors have high torque they aren't as fast. They are also bigger in size. Using DC Motors with high torque would provide a lot of speed and would be easier to combine with the chassis. They would also take up much less space as they are smaller and barrell shaped.

## ROBOTIC HAND INSTEAD OF CAMERA

A smaller camera could be used to save space for a robotic hand. Robotic hand could help pick up things in case.

# CONCLUSION

---

As we worked on this project we gained a lot of new knowledge and experience. From programming to handcrafting as well as preparing for project competitions...

The project in it's current state satisfies our hypothesis. We achieved more than what we had initially planned. Still there are a lot of things that can be improved. They say "improvement never ends" don't they?

# ACKNOWLEDGMENTS

---

Well, firstly and most importantly I should thank my father for all his support(financial, moral and also technical).

We greatly thank and appreciate the help our instructor, Sabahudin Husic for all his teachings, his help over E-Mail for every single issue no matter how stupid my questions were, and his solutions to the problems we faced during building process.

We also want to thank our school, Sarajevo College's Administration for providing us the place, materials and tools to work with.

# REFERENCES

---

IDEA FOR CHASIS

<http://letsmakerobots.com/node/5155>



## INSTRUCTORS

---

SABAHUDIN HUSIC  
AMMAR TALIC  
METIN ISIK

**SCHRC**  
SARAJEVO COLLEGE HARDWARE AND  
ROBOTICS CLUB