Autonomous Obstacle Detecting Path Tracer

TEAM MEMBERS-
MEET UDESHI 14D070007
SIDDHANT GARG 14D070027
PRAKIRT RAJ JHUNJHUNWALA
140070027
NISHANT DHAMA

PROBLEM STATEMENT

The project is aimed at implementing a system which can follow a path in an arena whose shape is drawn by the user on the laptop. This path would be given as input to the bot. The bot will travel on this path avoiding any obstacle which falls in the path by generating a new path around the obstacle. Thus suiting its name-
‘Autonomous Obstacle Detecting Path Tracer’.

Additionally, we have been able to implement the path generation in an Android device rather than in a Laptop.

WHY THIS PROJECT ???

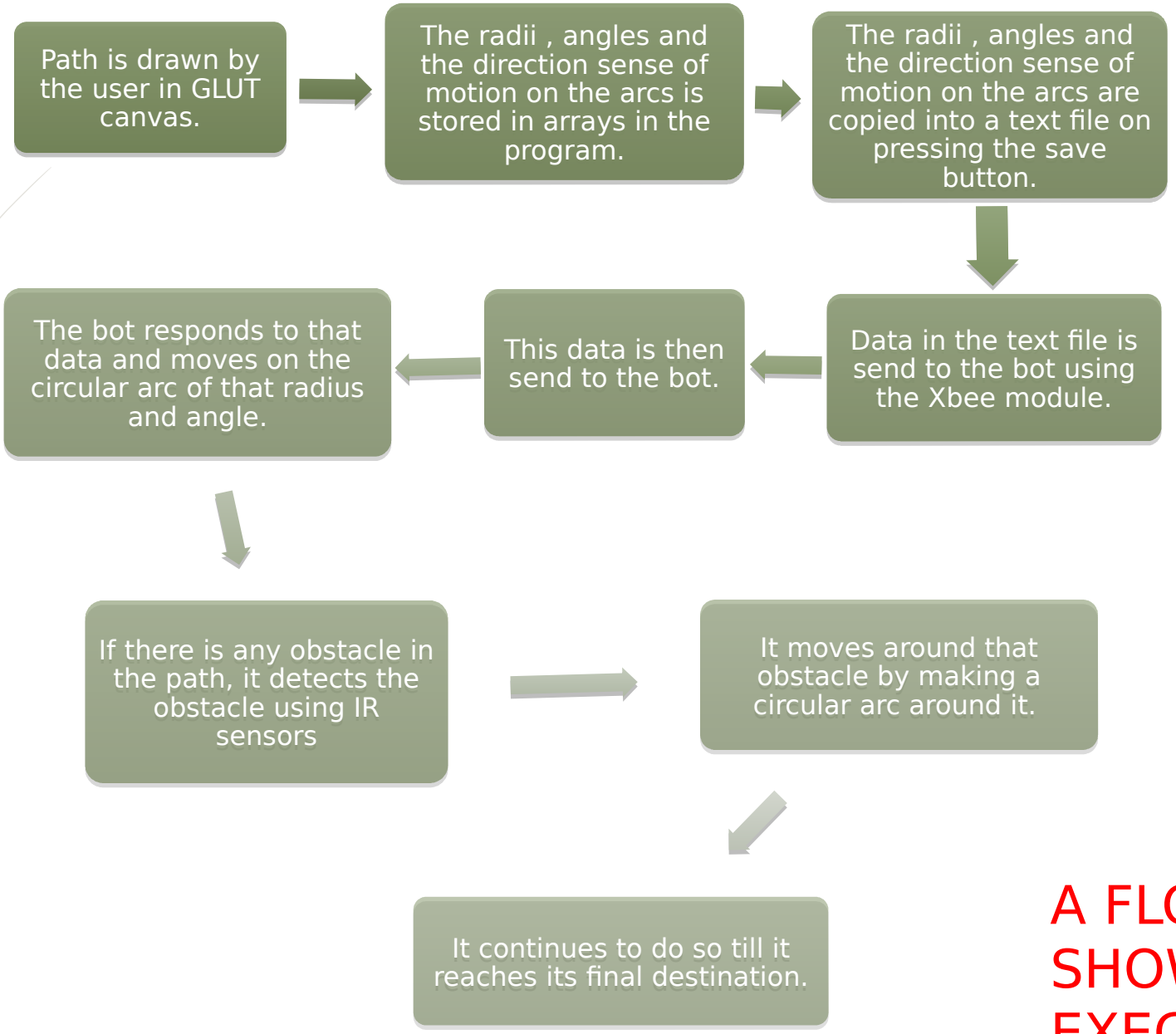
ON GETTING THE FIREBIRD V BOT , THERE WERE JUST SO MANY THINGS THAT WE COULD HAVE DONE.

WE THOUGHT OF IMPLEMENTING SOMETHING BY WHICH WE COULD LEARN TO PROGRAM AND USE THE FIREBIRD ATMEGA V AS WELL AS IMPLEMENT THE THINGS THAT WE HAVE LEARNT IN CS 101.

WE COULD ENCORPORATE THE CODE FOR OPTIMIZED PATH INPUT FROM THE USER (WHICH WOULD REQUIRE THINGS LEARNT IN THE CLASS) ALONG WITH CODING THE ATMEGA BOT FOR FOLLOWING THE PATH .

WE THOUGHT THAT THIS PROJECT HAS GREAT IMPLEMENTATION AND FUTURE SCOPE AND THUS DECIDED TO WORK ON THIS TOPIC.

(Obviously getting a good grade in CS 101 was also a motive !!!)

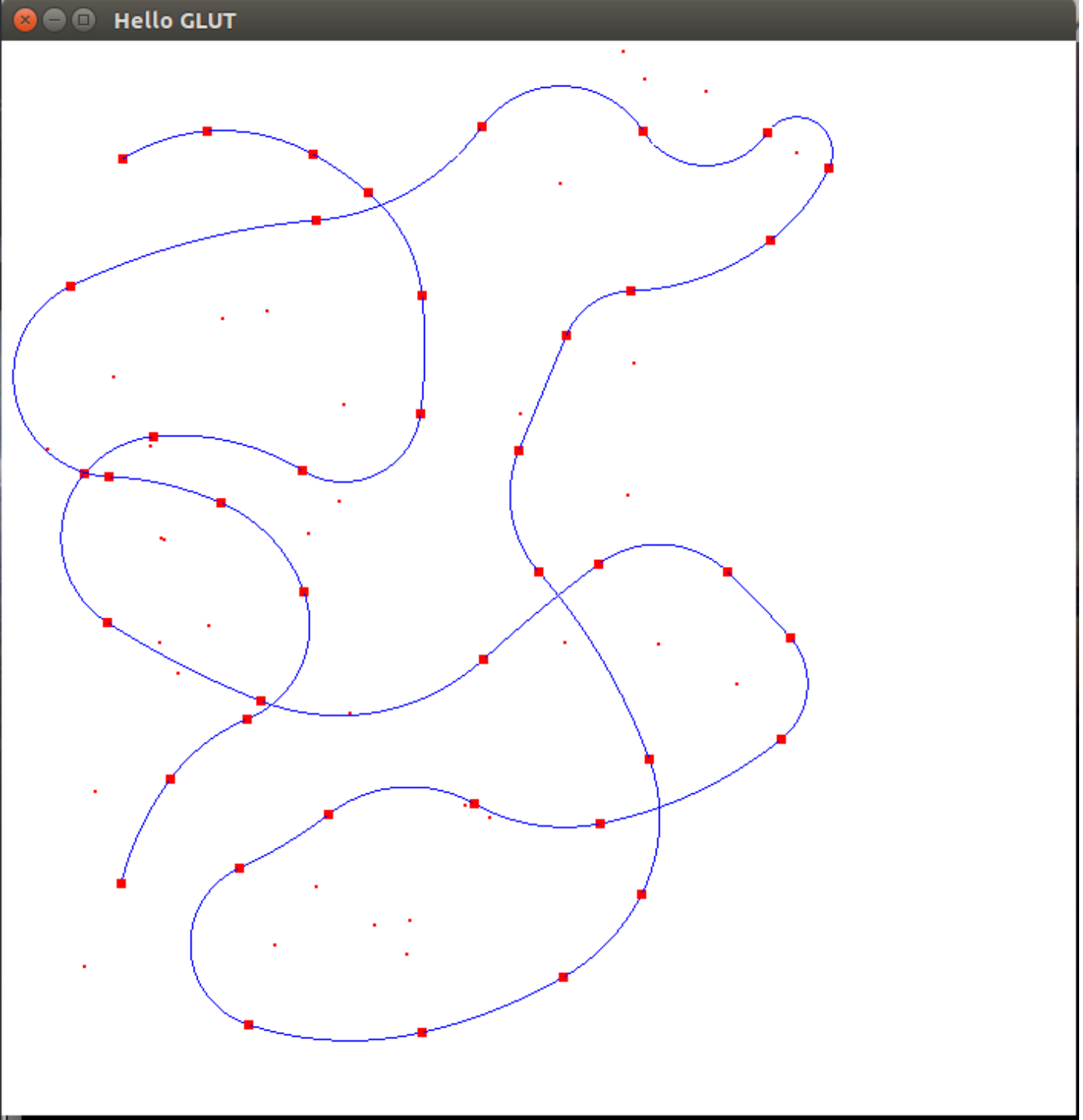


A FLOWCHART SHOWING THE EXECUTION OF THE PATH BY THE BOT.

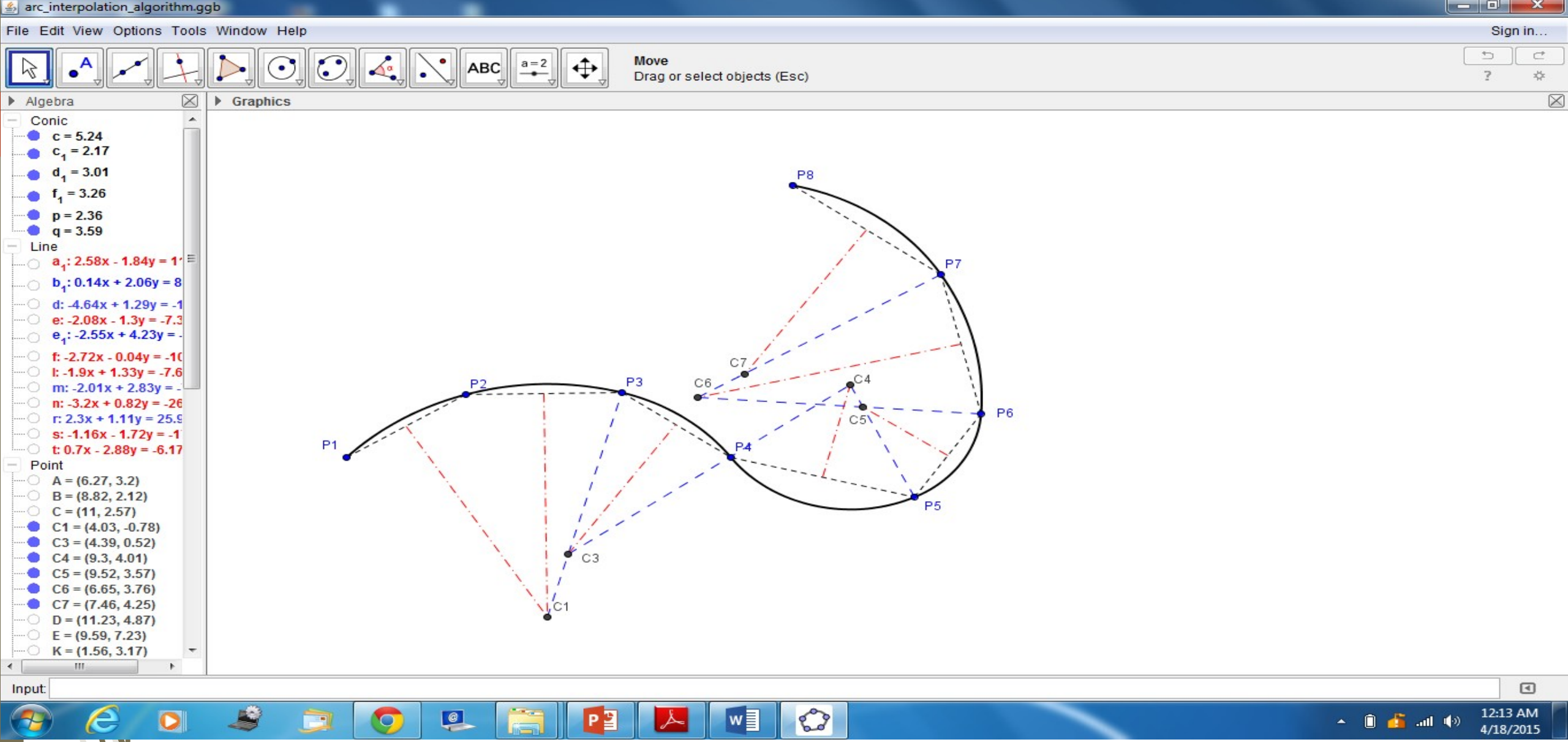
TAKING INPUT FROM THE USER

WE FIRST ENCOUNTERED THE PROBLEM OF HOW TO BREAK THE PATH INPUT FROM THE USER AND FEED IT TO THE BOT .
NOW AN EASY APPROACH WOULD HAVE BEEN TO BREAK THE PATH INTO POINTS AND JOIN THE POINTS USING STRAIGHT LINES.
HOWEVER , ON CHANGING THE PATH FROM ONE LINE TO ANOTHER , THE BOT WOULD HAVE TO ROTATE ABOUT ITS CENTER OF MASS AND ALLIGN ITSELF TO THE NEW DIRECTION AND THIS WOULD TAKE TIME.

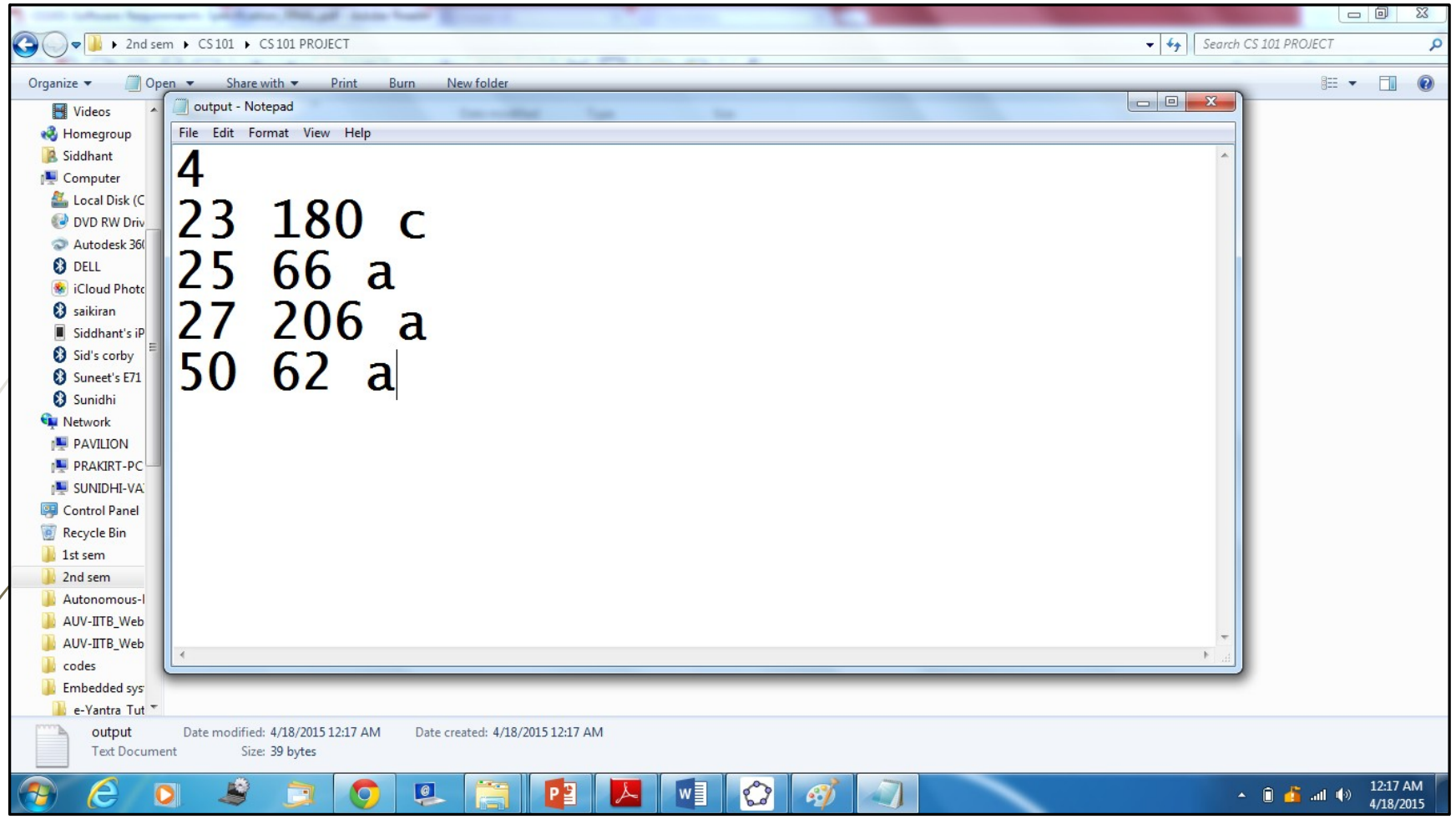
AS A SOLUTION TO THIS , WE CAME UP WITH THE IDEA OF IMPLEMENTING THE PATH AS A SERIES OF CIRCULAR ARCS WHEREIN EACH ARC IS TANGENT TO THE PREVIOUS ARC AT THE INTERSECTION POINT . USING THIS ALGORITHM , THE BOT WILL NOT HAVE TO CHANGE ITS DIRECTION AND CAN DIRECTLY CONTINUE ON THE NEW PATH.



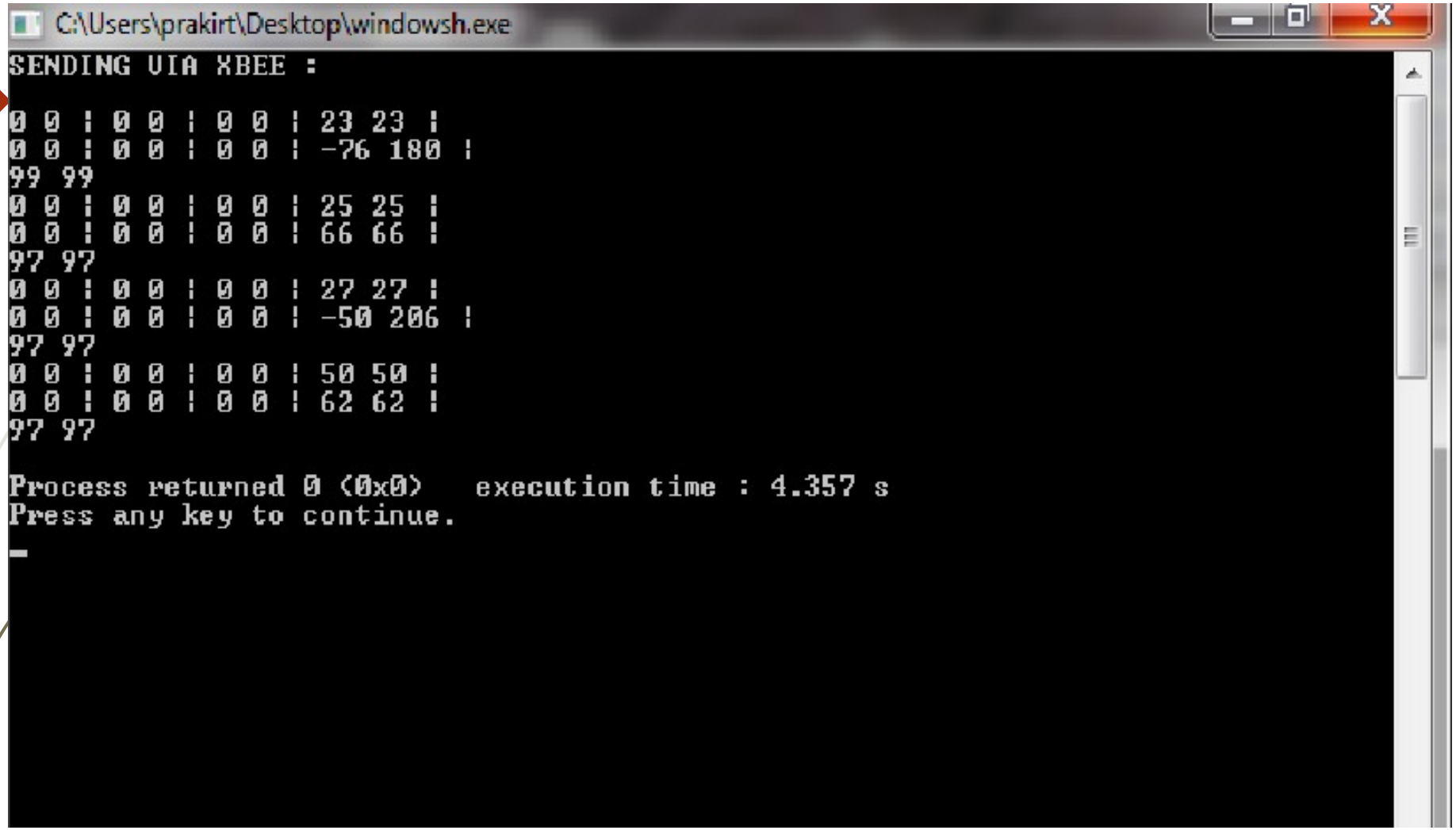
THIS IS A SCREENSHOT OF HOW THE INPUT WINDOW LOOKS LIKE . THE PATH IS CREATED IN SERIES OF CIRCULAR ARCS. EACH ARC IS TENGENTIAL TO THE PREVIOUS ARC AT THE POINT COMMON TO BOTH THE ARCS.



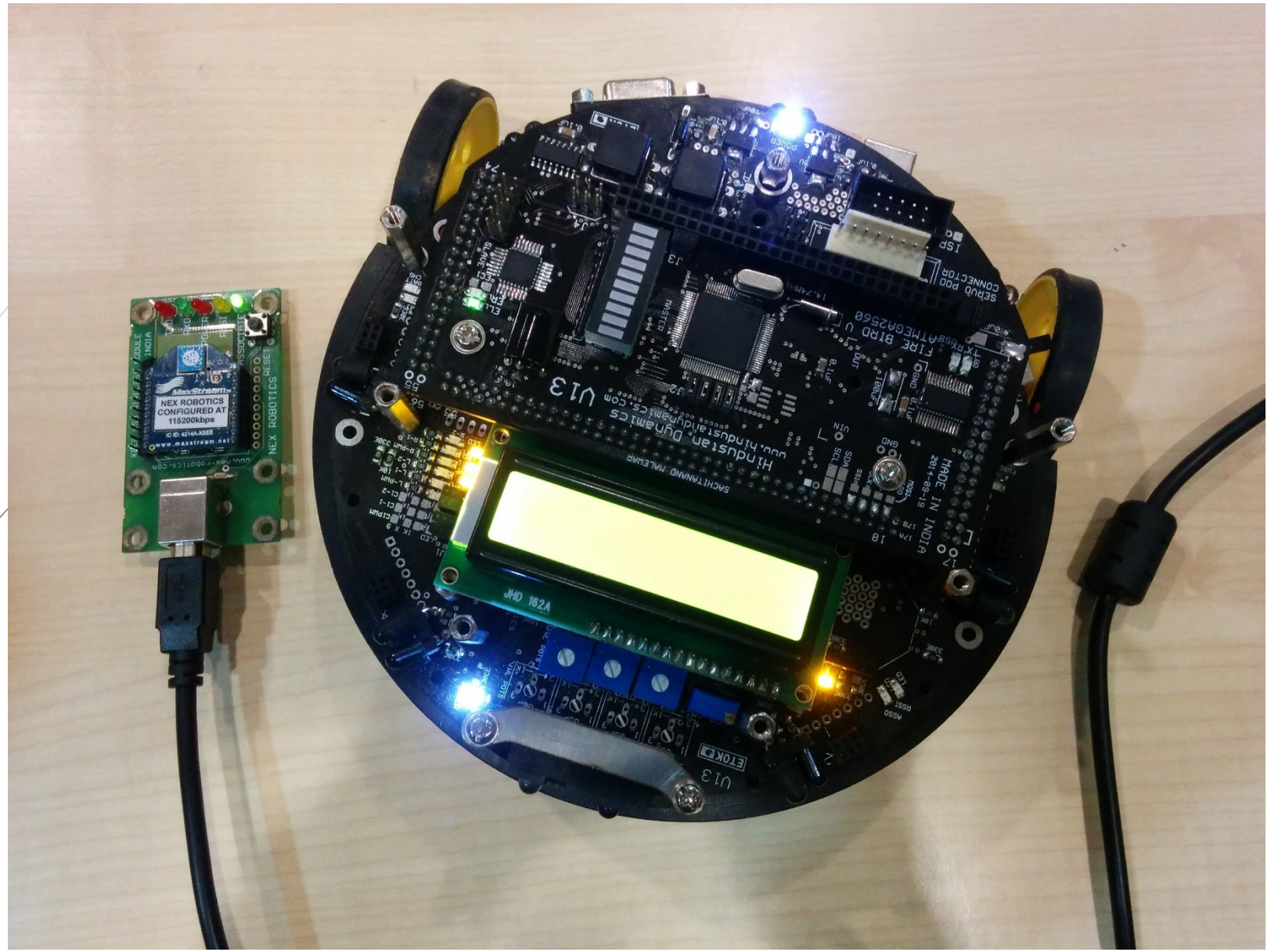
REPRESENTATION OF THE MATHEMATICAL PART OF OUR PATH GENERATION ON GEO-GEBRA SOFTWARE.



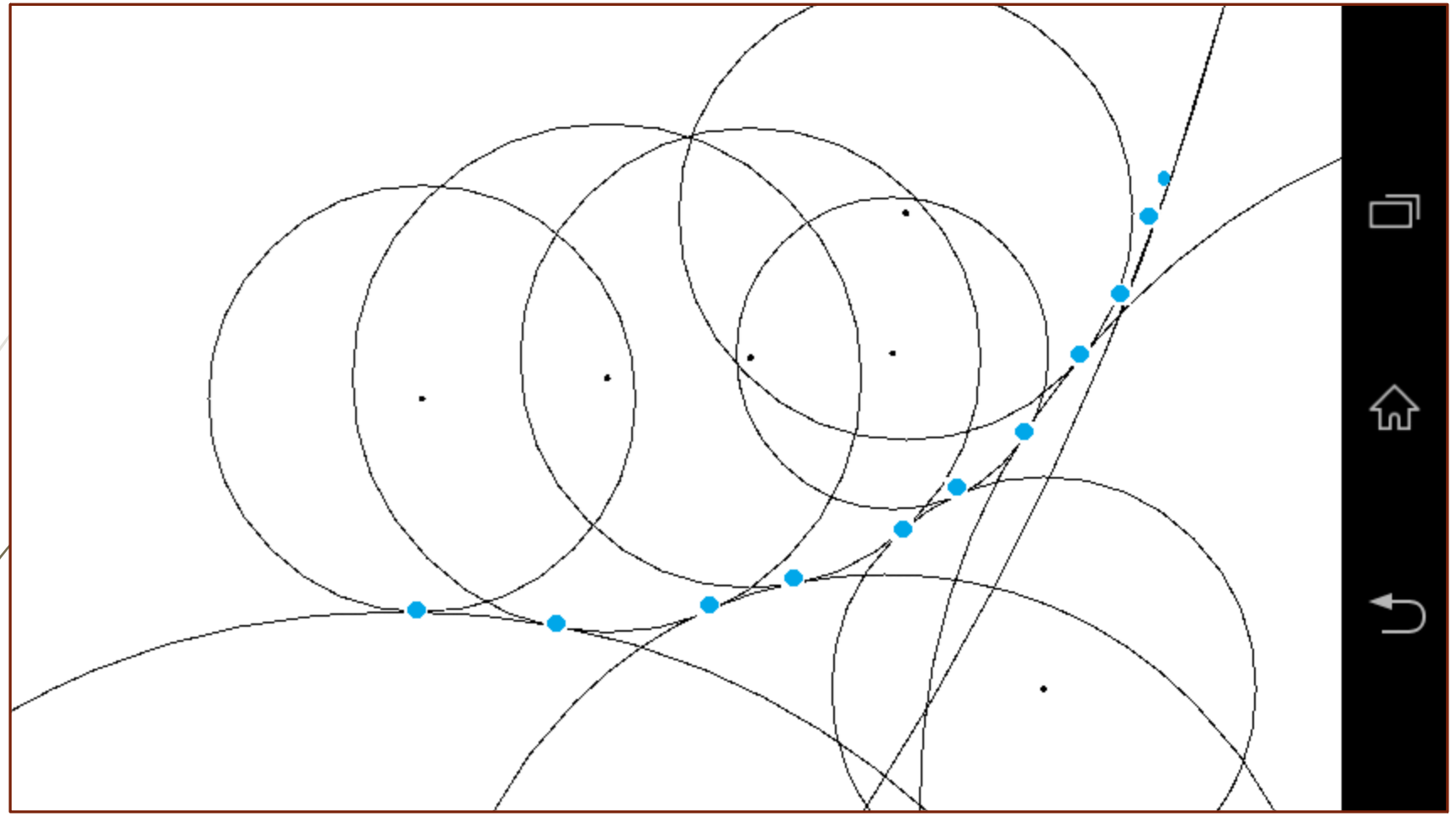
THE TEXT FILE THAT WAS CREATED FROM THE PATH GENERATION CODE ON GLUT CANVAS.



THE RADIUS , ANGLE OF THE ARC AND THE SENSE OF MOTION ON THE ARC – CLOCKWISE OR ANTICLOCKWISE IS GIVEN THROUGH THE WINDOWS.H HEADER FILE RUN IN SIMPLECPP.



THE BOT WORKING ON THE INPUT FROM THE Xbee.



THE IMPLEMENTATION OF PATH GENERATION ON AN ANDROID PHONE.

PROJECT VIDEO

CHALLENGES FACED

THE PROBLEMS WE FACED-

- DEVELOPMENT OF THE ACTUAL PATH THAT THE BOT WILL FOLLOW. (WE COULD HAVE JUST USED A SIMPLE TWO POINT STRAIGHT LINE PATH INPUT)

- WE USED OPEN GL (GLUT CANVAS) FOR PLOTTING OF THE PATH BY THE USER WHICH WORKS ON UBUNTU. HOWEVER THE ZIGBEE MODULE WAS WORKING ONLY BY INCLUSION OF THE WINDOWS.H HEADER FILE.

OUR SOLUTION TO THE PROBLEMS-

ALGORITHM FOR BREAKING THE CODE INTO SUCCESSIVE ARCS WHEREIN EACH ARC IS TANGENTIAL TO THE PREVIOUS ONE.

WE TRIED TO DOWNLOAD THE OPEN GL LIBRARIES ON WINDOWS BUT WERE NOT ABLE TO SUCCESSFULLY RUN AND COMPILE THE CODE. SO WE CREATED A .TXT FILE WITH THE INPUTS AND SENT THE FILE VIA BLUETOOTH TO A LAPTOP WORKING ON

CHALLENGES FACED

THE PROBLEMS WE FACED-	OUR SOLUTION TO THE PROBLEMS-
➢ WIRELESS COMMUNICATION THROUGH XBEE USING LIBXBEE THROUGH XCTU.	INCLUSION OF WINDOWS.H HEADER FILE TO DIRECTLY WRITE TO THE XBEE COM PORT.
➢ EXECUTION OF THE CIRCULAR ARCS ON THE GROUND BY THE BOT (DUE TO INACCURACY IN PWM- PULSE WIDTH MODULATION BASED VELOCITY CONTROL)	BREAKING EACH ARC INTO AN EQUAL NUMBER OF SEGMENTS (SAY 5) AND THEN MOVING THE BOT ON THE CHORDS RATHER THAN THE ARCS OF THE SEGMENT.

CHALLENGES FACED

THE PROBLEMS WE FACED-

- OBSTACLE DETECTION USING THE SHARP SENSOR WAS NOT WORKING ACCURATELY. WE WERE UNABLE TO EXECUTE OBSTACLE DETECTION UNDER CONDITIONS INVOLVING EXTERNAL LIGHT SUPPLY FROM WINDOWS ,ETC.

- THE POSITION ENCODING OF THE BOT IS ALSO NOT VERY ACCURATE. SOMETIMES THE WHEELS START SLIPPING ON THE GROUND AND THUS THE BOT MAY DEVIATE A LITTLE FROM THE PATH.

OUR SOLUTION TO THE PROBLEMS-

WE CARRIED OUT SEVERAL TEST CASES AND VARIED THE THRESHOLD VALUES FOR DETECTION OF OBSTACLE BY THE SENSOR UNTIL WE FOUND A SUITABLE VALUE. WE WERE NOW ABLE TO CARRY OUT OUR TESTING DURING DAY-TIME AS WELL.

WE RAN TEST CASES ON ROUGH ENOUGH SURFACES AND WE GOT AN IMPROVEMENT IN RESULTS OF OUR TEST CASES. BUT THIS IS A LIMITAION OF THE BOT AND CANNOT BE REMOVED COMPLETELY FROM OUR SIDE

FUTURE SCOPE , INNOVATIONS AND APPLICATIONS

A MAJOR FUTURE APPLICATION OF OUR PROJECT IS THE **‘DRIVERLESS CAR’.**

HOW IT CAN BE ACHIEVED?

THIS PROJECT ALSO NEEDS THE CAR TO FOLLOW THE PATH GIVEN BY THE USER AND AT THE SAME TIME DETECT OBSTACLES IN ITS PATH- HUMANS, OTHER CARS AND VEHICLES ,ETC. SO IF WE IMPLEMENT OUR PROJECT ON A LARGER SCALE WITH VERY ACCURATE PWM, POSITION ENCODING, BETTER LARGE SCALE SENSORS, ETC. WE CAN FORMULATE A DRIVERLESS CAR. ACTUAL CARS WITH RACK AND PINION MECHANISM NEED A CONTINUOUS AND DIFFERENTIABLE PATH TO MOVE WHICH IS BEING PROVIDED BY OUT ALGORITHM.

APPLICATION?

THIS WILL HAVE GREAT APPLICATION FOR THE PHYSICALLY HANDICAPPED PEOPLE AND THE BLIND PEOPLE WHO THEN WILL

FUTURE SCOPE , INNOVATIONS AND APPLICATIONS

A MAJOR FUTURE APPLICATION OF OUR PROJECT IS THE **‘WALKING AID FOR BLIND PEOPLE’.**

HOW IT CAN BE ACHIEVED?

BY ATTACHING A STICK OR A ROPE WITH THE BOT ALONG WITH ADDITIONAL SENSORS ON THE STICK (ROPE) TO DETECT ANY OBSTACLES IN THE BLIND PERSON’S PRE SPECIFIED PATH, HE/SHE CAN BE ALERTED BY AUDIO TO CHANGE HIS/HER PATH.

APPLICATION?

THIS WILL HAVE GREAT APPLICATION FOR THE BLIND PEOPLE WHO THEN WILL BE ABLE TO INDEPENDANTLY WALK AND MOVE ABOUT COMPLETELY SAFE WITHOUT BEING DEPENDANT ON OTHERS FOR HELP.

THANK YOU!!!