Texas Instruments Innovation Challenge
India Design Contest 2015

PAGE 1 - SELF ASSESSMENT

"We, authors of the report entitled "**Gesture Controlled Surveillance Vehicle**", confirm that this report has not been submitted to any other forum such as another contest or conference for publication. We hereby state that we will not submit the same work for any other contest in the future. We understand that Texas Instruments has the right to use this report in its conferences/publications. We will seek TI's permission before we submit the report for publication in an external forum."

1. Comment on the originality of your idea. Did you derive inspiration from any other work? Provide the appropriate references.
    - Gesture controlled surveillance vehicle presents the idea of replacing humans with machines. These machines can be used in areas which are not easily accessible by humans. Some of the areas include military, disaster management, surveillance, accessing remote areas. The machine, controlled through gestures, collects data from any environment and from any terrain which can be obtained in real time. Also, the vehicle is designed in such a manner that it detects and recognizes obstacles and dead ends.

2. List any persons who helped you in the course of the project and explain their contribution.
    - P. J. Engineer sir
    - Dr. M. A. Zaveri sir

3. Highlight at least two technical challenges you faced and how you overcame them.
    - We faced the problem of location of location tracking using GPS module. It gives the longitude and latitude of the current location but after decimal it was not giving the exact values, After many trials, we got the exact readings of the particular locations.
    - Secondly, we faced the problem in the readings of accelerometer. The readings were very random. Due to this problem, we were not capable of controlling our robot using the gestures. But we came out with the solution that if we take the average of readings of the device, the error will be minimized and our solution worked.

4. Please highlight at least two non-technical challenges you faced and how you overcame them.
    - health issues of a team member
    - other academic involvements
    - Dates clash with ROBOCON 2015

5. Did you use WEBENCH to design power supply, filter etc in your project? If yes, share your experience of using WEBENCH
   No.

6. Explain how the experience of the TI India Analog Design Contest helped you.
    - It helped us to learn the application of robots and how it can be used for the safety and security of the humans and the environment.
    - • It developed team spirit amongst us.

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7. List two things that could have added further value to your project.
   - We could have added the camera which would have helped us to obtain the clear live pictures of the place where these vehicles are to be used.
   - Gesture control limits the area of the robot. This can be overcome with the use of internet to transfer and receive data through it as a server.

8. Please tick all aspects of your project that you believe are now complete.

Paper design of hardware	☑	Algorithm/software design	☑
Hardware implementation on breadboard	☑	System-level testing with examples	☑
Hardware implementation on PCB	☑	Benchmarking/Performance Analysis	☑
Hardware Testing	☑	Short Video on Project http://youtu.be/0Zph5xEKzr0	☑

Riken Mehta :
Milankumar Patel :
RASAT KHANDELWAL : Rajat
Vaishnavi Thakkar :

Names and signatures of student team members

P. J. Engineer

Name and signature of the mentor

Gesture Controlled Surveillance Vehicle

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***Abstract*—** Robots have been widely used to perform variety of tasks which reduces the manual work specifically in remote areas where human accessibility is unimaginable. The main applications where the robots have exhibited their excellence include surveillance, tracking targets for military purposes and also for disaster management like searching and rescuing victims. This paper deals about an evolutionary Non-humanoid robot for surveillance with intruder protection capability. This gesture controlled robot includes Tiva C Series TM4C123G Launchpad, accelerometer (MMA7361), GPS module and variety of sensors and measuring tools.

Keywords—Surveillance robot, Monitoring system, location tracking, Wireless control, gesture control.

I. INTRODUCTION

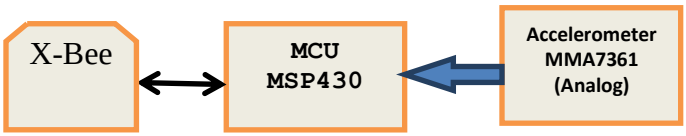
Robots are becoming more and more intelligent as technology advances in the areas of CPU speed, sensors, memories etc. And there is ever demanding applications even in defense. Humans are anxiously working on finding new ways of interacting with machines. However, a major breakthrough was observed when gestures were used for this interaction. A gesture is a form of non-verbal communication in which visible bodily actions communicate particular messages.
Robots have even replaced humans in performing various tasks that they are unable to perform due to physical disability, size limitation or extreme environments.

A. Technical Background

A Gesture Controlled robot is a kind of robot which can be controlled by hand gestures and not the old fashioned way by using buttons. The user just needs to wear a small transmitting device on his hand which includes a sensor which is an accelerometer in our case. Movement of the hand in a specific direction will transmit a command to the robot which will then move in a specific direction. Then it will be transmitted by an X-Bee Transmitter module after taking various drive command by an accelerometer. At the receiving end an X-Bee Receiver module will receive data and this data is then processed by a microcontroller and passed onto a motor driver to rotate the motors in a special configuration to make the robot move in the same direction as that of the hand. On other hand the surveillance robot measure the different sensor reading like light intensity, temperature, gas, GPS coordinate at that place and send to the monitor system.

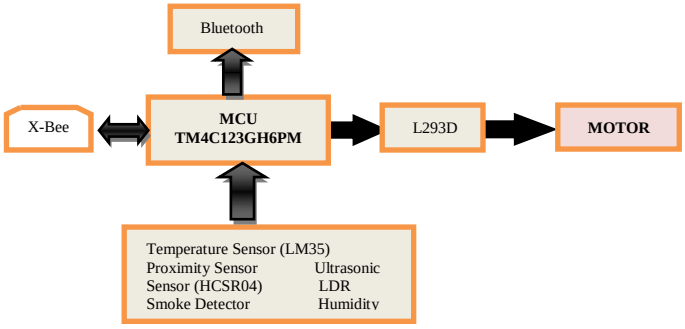
II. PROPOSED SOLUTION

- ***Gesture recognition module:***



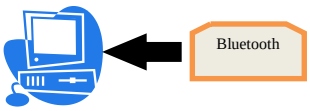
The central processing controller of this module is MSP430, which will receive analog reading from 3-axis accelerometer (MMA7361). Using internal ADC channel of MSP430, analog data will be converted to digital format. Different gestures will be recognized and MSP430 will transmit command through UART wirelessly using X-Bee module. These commands will be received by vehicle and will navigate accordingly.

- ***Differential drive Vehicle***



This module contains a transceiver which will receive command from gesture recognition module and will navigate around accordingly. It will also be sensing its environment side by side. It will automatically detect the obstacles and will avoid them. This module is loaded with the bunch of sensory tools. These sensors will continuously collect data from environment and central processing controller will transmit them to monitoring system.

GUI Application



This module consists of a central computing controller. It will receive data from surveillance vehicle by Bluetooth. This controller will communicate with computer GUI application to transmit the sensor data. The GUI application will be displaying different details of environment like temperature, humidity, smoke status, obstacle status, ambient light intensity etc.

III IMPLEMENTATION

A. Hardware Implementation

These different modules will work independently and will coordinate with each other for command and data transfer. The central vehicle will contain Tiva C Launch Pad as central computing unit. It will get commands from gesture recognition module. Gesture recognition module will contain MSP430 to convert analog reading of accelerometer to digital format. MSP430 will then recognize the gesture and will send command accordingly to the vehicle. Vehicle will navigate accordingly. Vehicle is fully featured with variety of measuring tools which will be constantly surveying the environment. These data will be sent to monitoring system. Monitoring system contains one Tiva C to communicate with vehicle and to transfer that data to display system which is a GUI application. This GUI will display all the data in a well-organized manner.

IV. RESULTS

In this manner a complete surveillance system using a gesture controlled robot has been implemented with some shortcomings and many advantages over currently working system. Such system can be implemented in real life application with much higher efficiency of the system.

V. CONCLUSIONS

Enormous amount of work has been done on wireless gesture controlling of robots. In this paper, various methodologies Have been analyzed and reviewed with their merits and demerits under various operational and functional strategies. Thus, it can be concluded that features like user friendly interface, light weight and portability of android OS based Smartphone has overtaken the sophistication of technologies like programmable glove, static cameras etc., making them Obsolete. Although recent researches in this field have made wireless gesture controlling a ubiquitous phenomenon, it Needs to acquire more focus in relevant areas of applications like home appliances, wheelchairs, artificial nurses, and table Top screens etc. in a collaborative manner.

ACKNOWLEDGMENTS

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APPENDIX B

Codes of different Controllers and GUI application:

1. Tiva C code
   - main.c
   - UART.c
   - SysTick.c
   - PLL.c
2. MSP430 Code
   - main.c
3. Monitor Window
   - monitorwindow.cpp
   - monitorwindow.h
   - main.cpp
   - Geo_map.py

APPENDIX C – BILL OF MATERIALS

	Component	Manufacturer	Cost per component	Quantity	Total cost of component	TI Supplied/ Purchased
	TivaC LaunchPad (TM4C123GH6PM)	Texas Instrument	1200 INR	1	1200 INR	TI Supplied
	MSP430 LaunchPad	Texas Instrument	1004 INR	1	1004 INR	TI Supplied
	L293D	Texas Instrument	230 INR	1	230 INR	TI Supplied
	LM35 Temperature Sensor	Texas Instrument	Sample	1	Sample	TI Supplied
	Accelerometer (MMA7361)	Freescale	500 INR	1	500 INR	Purchased
	Gas Sensor	Hacktronics,India	150 INR	1	150 INR	Purchased
	Light Dependent Resistor	Hacktronics,India	4.5 INR	1	4.5 INR	Purchased
	XBee Module	Hacktronics,India	875 INR	2	1750 INR	Purchased
	Wheels	Hacktronics,India	30 INR	2	60 INR	Purchased
	Motor	Hacktronics,India	160 INR	2	320 INR	Purchased
	Proximity Sensor	Visha Electronics	200 INR	3	600 INR	Purchased
	GPS Sensor	Hacktronics, India	1500 INR	1	1500 INR	Purchased
	Bluetooth	Hacktronics,India	350 INR	2	700 INR	Purchased
	Total Cost of the Project				8018 INR	