Project proposal for Texas Instruments Innovation Challenge India Design Contest 2015

Project Domain – Safety & Security, Wireless, Automation

Gesture controlled survillince vehicle

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ABSTRACT

Gesture controlled surveillance Vehicle:

With the modern world running towards the boom of automation, when machines are replacing humans, we can think of many areas where we can have machines which will be more reliable and robust than humans.

Here are some of them listed:

- Military
- Disaster management
- Safety and security purpose
- Forecast and surveillance
- Accessing remote areas

And many more…..!!

Here we come up with the idea of a **gesture controlled vehicle** using Tiva™ C Series TM4C123G LaunchPad and accelerometer (MMA7361) which can roam around in any environment and any terrain. This vehicle can be controlled remotely and we can **access data** collected by it in **real time**.

We are thinking of **controlling the vehicle through our gestures**. But along with manual control the vehicle will have its own brain to **avoid the obstacles and dead ends**.

The vehicle will be equipped **with a variety of sensing and measuring tools** like Temperature (LM35), Proximity (Photodiode-IR), Ultrasonic (HCSR04), Light (LDR), Smoke , Humidity sensor etc. that will help us in surveying the environment. There will be one wireless camera also, through which live streaming can be seen on the Monitoring System.

Market Analysis

Thousands of people die in hundreds of natural disasters taking place all over the world. This includes Fire, Earthquake, Flood, Cyclone etc. Every time such havoc happens, we need human rescue team to help the victims. Presently we don't have any automated machine system that can survey in such remote and havoc affected areas. We propose a solution to this problem by making gesture controlled surveillance vehicle.

One of the most common areas which are listed above where machines can replace humans is military purpose. Also we can have surveillance vehicle for disaster management purpose. We can have this vehicle for pre analyzing the environment in which we are sending the human support.

The most common technical system available today is human checking systems only. The result of this is, we have more human casualty. In spite of human checking or surveillance system, we have proposed a fully loaded gesture controlled vehicle, which can roam around in any environment and terrain.

The most economical surveillance systems available in market today are costs 50,000 to 70,000 INR. We are planning to build a much sophisticated and purpose specific robot. That will approximately cost 10,000 to 15,000 INR. The most beneficial part of this system is, it is controlled by gestures and the GUI side will be open source, so any one can adopt such reliable system. All the modules of this system will be easy to handle and hardware- software interfacing is plug and play type, so technical skill is not needed to handle this system.

Project Description

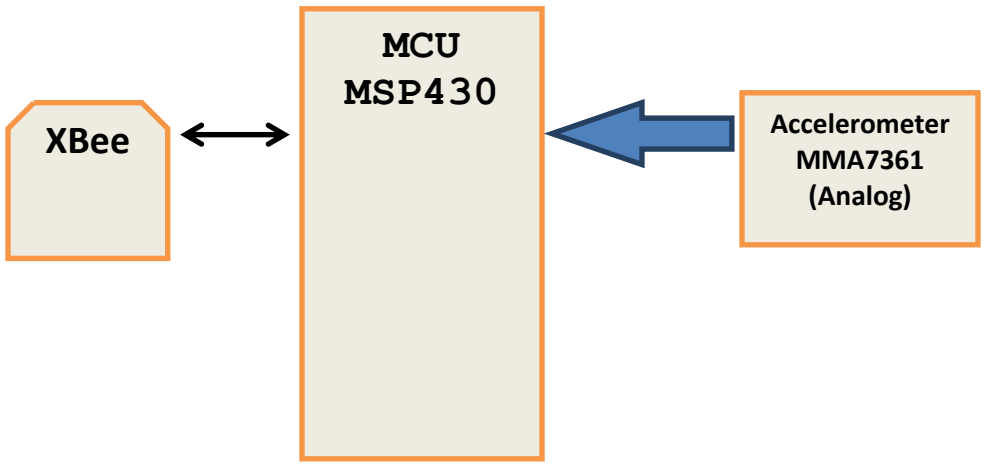
Seeing the need of automation and replacement of humans by machines in above listed areas, we got an idea of building an automated remotely operated surveillance vehicle. As gesture control is most easy, we are planning to build a gesture recognition module. We intended to build our project and divide it in different sub-modules listed below.

- Gesture recognition module
- Differential drive vehicle
  - Different sensing modules
  - Driving control module
  - Wireless camera module
  - Wireless transmission module
- Monitoring system
  - Wireless receiver module
  - Module to communicate with PC
  - GUI app to display different results

These different modules will work independently and will coordinate with each other for command and data transfer. The central vehicle will contain Tiva C LaunchPad 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.

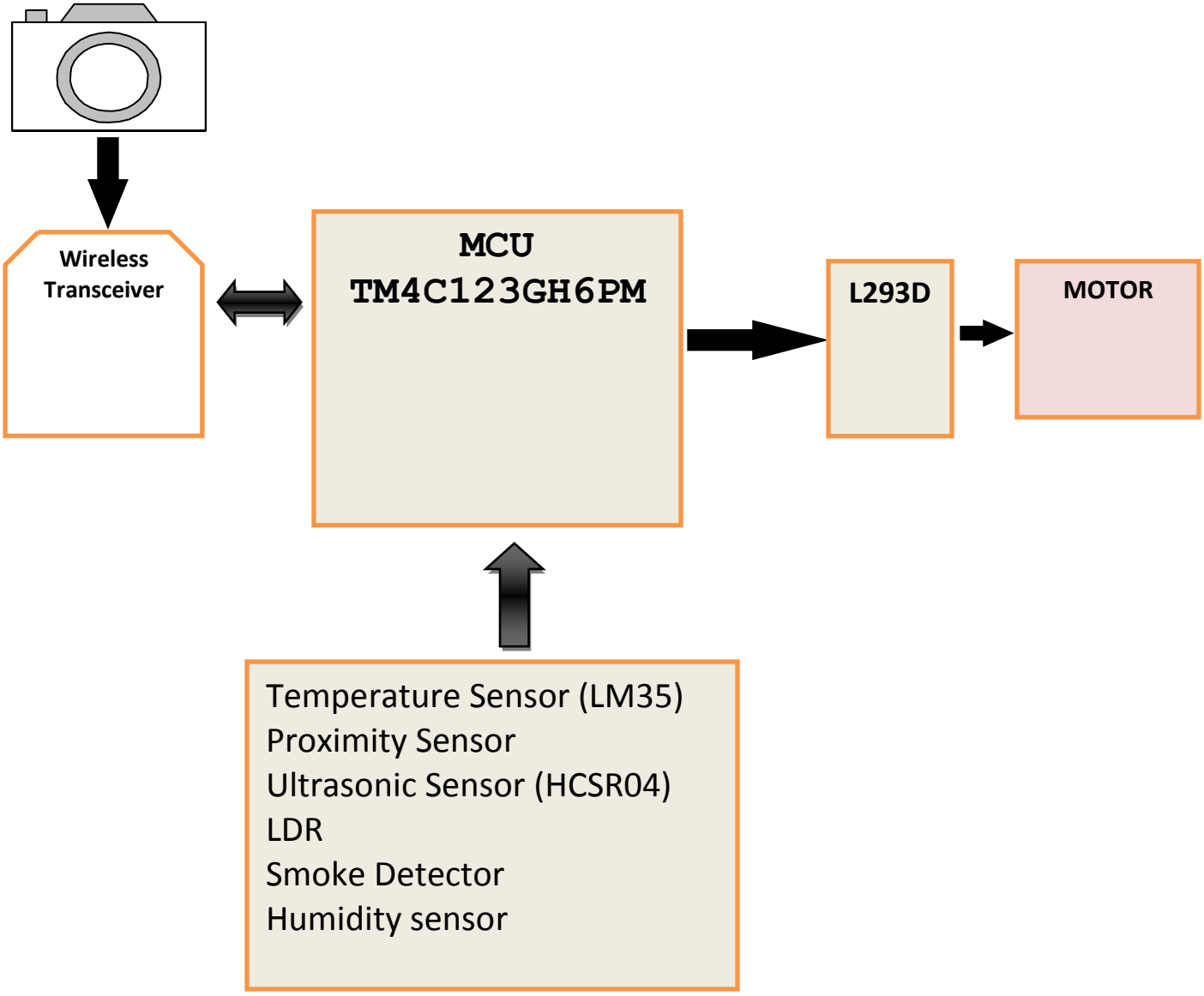
Different modules and their working:

♦ Gesture recognition module:



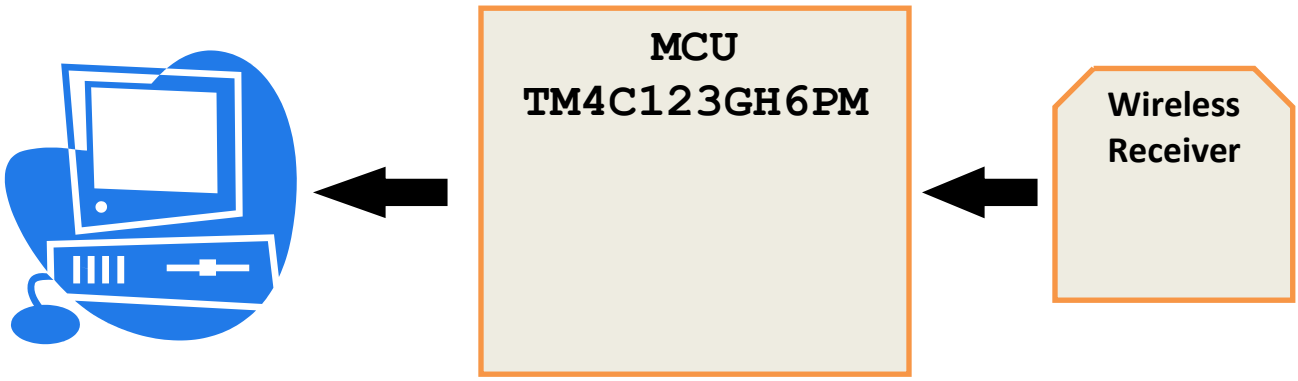
The central processing controller of this module is MSP430, which will receive analog reading from 3-axis accelerometer (MMA7361). Using internal ADC channel of MSP430, analog data will be converted to digital format. Different gestures will be recognized and MSP430 will transmit command through UART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

♦ **Monitoring System:**



GUI Application

This module consists of a central computing controller. It will receive data from surveillance vehicle. 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.

TI Content

TI Part (link all the parts to their respective product page on the TI website)	Usage/Advantage
L293D (2)	To drive the motors controlling the robotic vehicle
Tiva C LaunchPad (2)	To control the vehicle and monitoring system
MSP430 LaunchPad	To recognize gesture using accelerometer
LM35 Temperature Sensor	To sense the environment temperature

Bill of Materials

Part	Function	Estimated Quantity	Estimated cost
Accelerometer (MMA7361)	For gesture recognition	1	500 INR
Ultrasonic Sensor (HCSR04)	For obstacle detection and distance measuring	1	600 INR
Humidity Sensor (HM1500LF)	For humidity measurement	1	500 INR
Gas Sensor	For smoke detection	1	400 INR
Light dependent Resistor	For ambient light intensity detection	1	10 INR
XBee Module	For wireless transmission	3 to 4	2700 to 3500 INR
Wheels	For robot motion	4	400 INR
Motors	For robot motion	4	1000 INR
Wireless camera module	For wireless video streaming	1	1500 INR

Conclusion

The remote areas where we can't send humans without any assurance, our project can help in those areas by replacing human surveillance system by machines. The gesture controlled vehicle will be the solution of this problem.

List of References

- IMPLEMENTATION OF **GESTURE**. **CONTROLLED** ROBOT- A Research paper on IEEE
- Gestural Interaction in Vehicular Applications- IEEE Research paper
- MMA7361 Data sheet
- TM4C123GH6PM Data sheet