



ECE 511

GROUP-10

OFFICE BOT

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MOTIVATION

- *Inspired* from M-O, a line following bot from the movie "WALL-E"(2008)
- A grid-sensing robot used as a carrier of small memos/objects
- Builds upon the logic of a line-following robot

BLOCK DIAGRAM

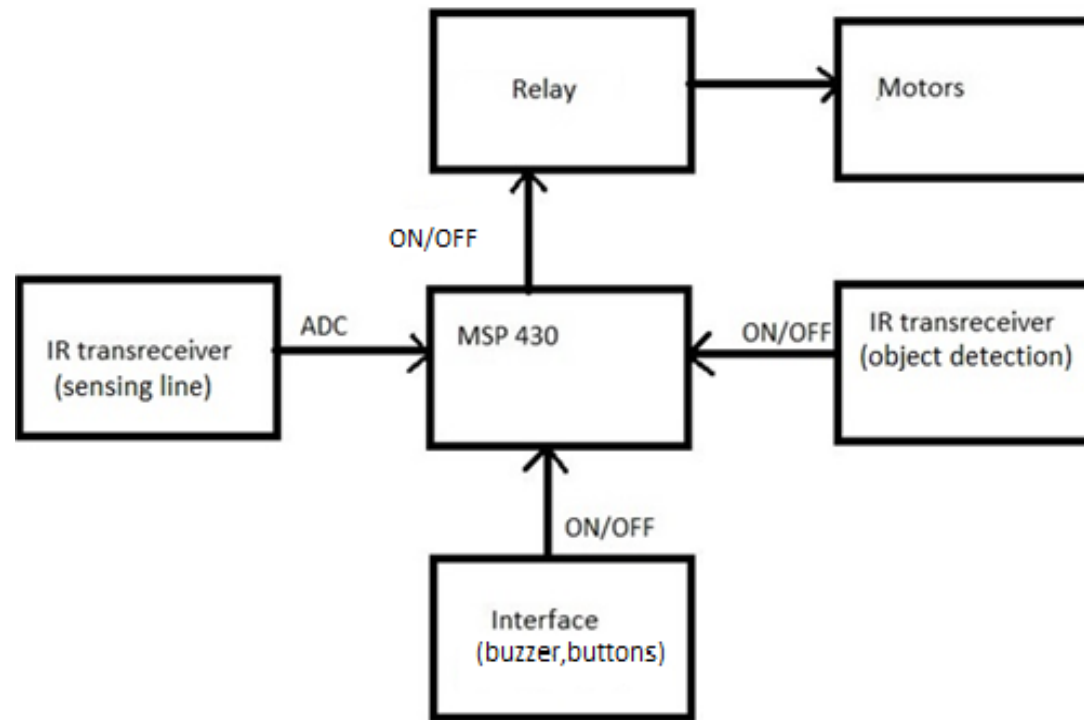
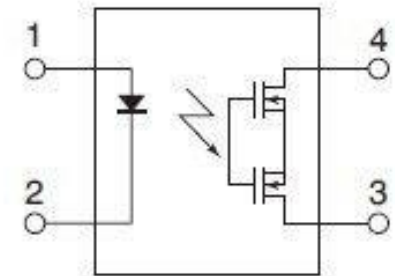


Fig.1 Block Diagram

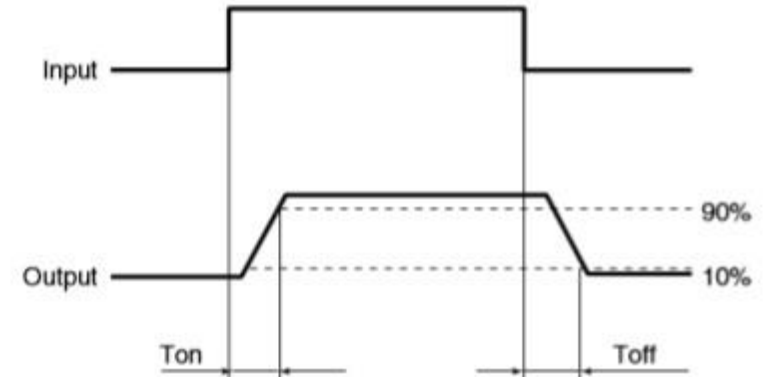
COMPONENTS & THEIR INTEGRATION

- **Panasonic AQY212GH**
 - Solid-state relay
 - Actuates motors, by means of IO pin of MSP430
 - Also used for interface of buzzer
 - Isolates high-power components from ultra-low power MSP430



COMPONENTS & THEIR INTEGRATION

- **Panasonic AQY212GH**
 - Switching device: photoMOS
 - Continuous load current: 1.1A
 - Control voltage rating: 1.5V – 5V
 - Load voltage rating: 60V
 - $T_{on}=1.3\text{ms}$
 - $T_{off}=0.1\text{ms}$



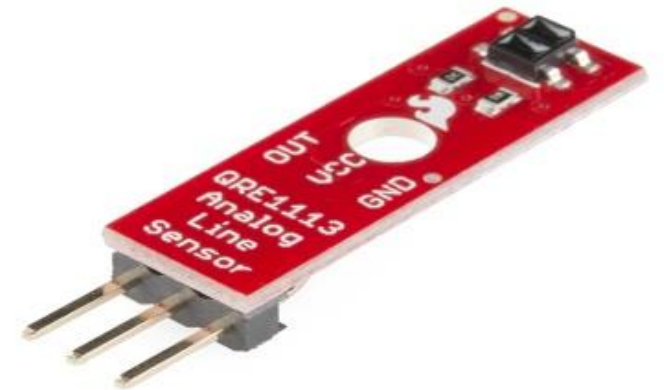
COMPONENTS & THEIR INTEGRATION

- **Piezo-electric Buzzer**
 - 2 operating modes – continuous and pulsed mode buzzing
 - Sounds when external object is detected
 - Operating voltage: 6V-28V
 - Interfaced to P2.4 via relay



COMPONENTS & THEIR INTEGRATION

- **QRE1113**
 - Line Sensor
 - The QRE1113 is a common reflectance sensor often used in robotic line followers
 - The sensor works by shining an IR LED down and seeing how much of that light bounces back using a phototransistor
 - The sensors are interfaced via the in-built 12 bit ADC



COMPONENTS & THEIR INTEGRATION

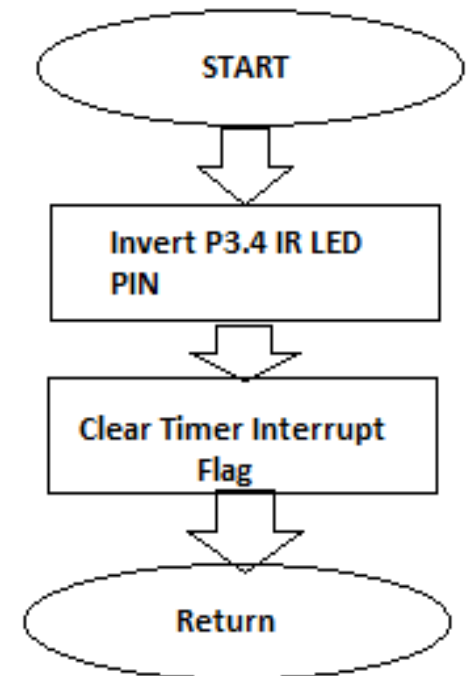
- **Line follower Logic**

- Black line value = 4096 by testing we have set the threshold to 3000.
- When black line Turn the motor OFF
- When not detected turn the motor ON.
- Sequentially Scan the ADC channel.
- Compare the ADC values to stay on the line

COMPONENTS & THEIR INTEGRATION

- **TSAL6200**

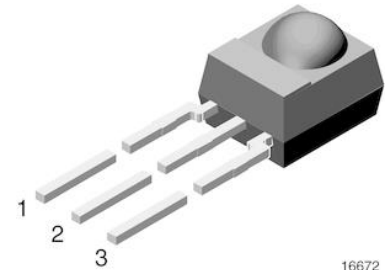
- IR LED
- interfaced with MSP 430 through pin P3.4. It transmits IR pulses with 38 KHz frequency using timer and interrupt.
- To generate pulse of 38 KHz frequency, timer A is used to produce an interrupt 26 ms with 50% duty cycle.



COMPONENTS & THEIR INTEGRATION

- **TSSP58P38**

- IR Receiver
- TSSP58P38 detects on IR pulses with 38 KHz frequency.
- Interfaced with MSP430 through pins VCC, GND, and P1.4 via a port pin interrupt.
- When object detected output goes low and enters the interrupt handler.
- Turn motors off till signal is low and at the same time turn on buzzer.



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COMPONENTS & THEIR INTEGRATION

- **On-board push-buttons**
 - One button to determine which right turn to take and the other button to start the motors
 - Order doesn't matter
 - One button interfaced via polling and the other one via port pin interrupt P1.1



RESULTS & CONCLUSIONS

- A simple and fun grid-detector robot was designed
- The robot followed a dark line on a light surface
- As per programming, robot navigated over a designated path, and reached its destination
- Multiple paths can be programmed, and the bot be made to follow any of them, based on the interrupts generated by different push-buttons
- Intelligent and flexible line-following, using simple hard-coding, yet not treading in the category of grid-solver/maze-solver bots
- **Challenges**
 - Determining a suitable threshold value to differentiate between black and white surface
 - Generating a 38kHz pulse for the IR emitter, and to make rest of the components work in tandem with the overall project
 - Recalibrating the line sensors after every couple of runs