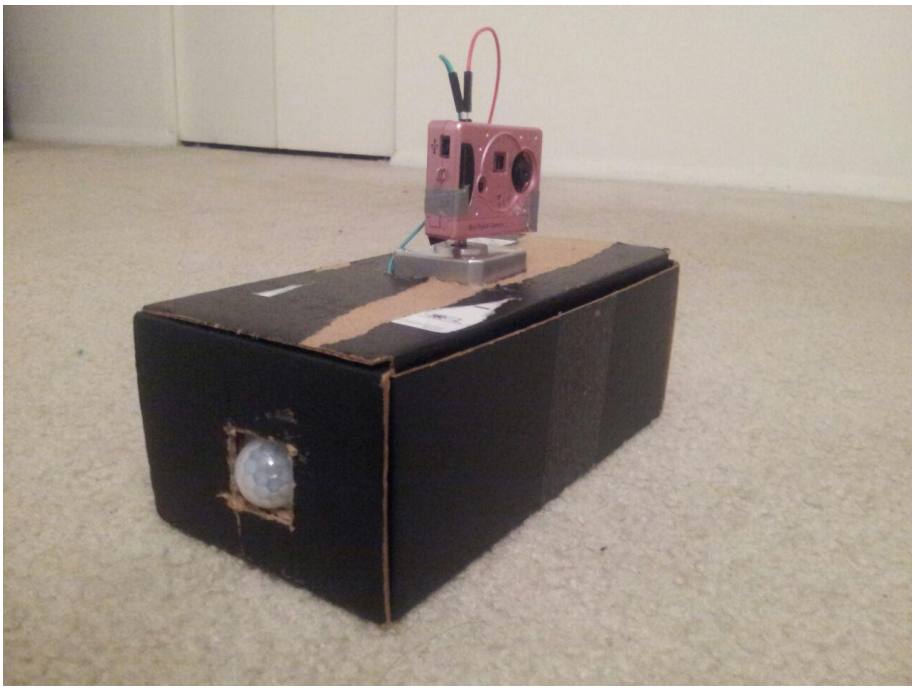
ECE511 – PROJECT REPORT

GROUP – 7

MOTION DETECTION CAMERA



TEAM MEMBERS

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Abstract

The purpose of the project was to build a motion detection camera, using simple passive infra-red (PIR) sensors, microcontroller (MSP430), H-bridge, stepper motor and camera. Functionality of the project is to capture an image or click a picture of an object or an animal in motion, sensed by the PIR sensors.

The setup of the project contains, two PIR sensors that are placed in opposite directions and are connected to the MSP430. A camera is mounted on the stepper motor. The stepper motor is connected to the MSP430 with the help of H-bridge and the trigger of camera is connected to the MSP430 using a transistor. The complete circuit is powered using batteries with the help of voltage regulators.

Whenever a motion is detected by any of the PIR sensors, that sensor sends out a signal to MSP430 indicating a motion has been detected. Now the MSP430, first, rotates the stepper motor with the help of H-bridge in the direction of the motion sensed and second, after the motor rotation is complete, it triggers the camera to capture an image of an object or an animal which moved and finally rotates the camera back to the original position. Assuming the instance that both the PIR sensors have detected motion at the same time, then PIR-1 has been given as the priority and the MSP430 rotates the camera in the direction of PIR-1 and click a picture of an object or an animal in motion.

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1. Motivation

The motivation to come up with such an idea is to know your surrounding better as you cannot keep a watch on all the events occurring around you. Events such as known and unknown visitors, can be humans, animals and may be UFO's. It helps in strengthening the security of the surrounding. This idea can be used in photography of animals which are not often seen in human presence.

By having such a device, you can keep a track of all events happening around and in your house, office, backyard, or any place all time in your absence wherever the device is kept. It might also help in photography of animals which visit a part of the forest once in a while or might also visit your backyard in the night when everyone is asleep. By keeping track of all such events might help you in understanding your surrounding much better and help you take necessary actions accordingly.

2. Block Diagram

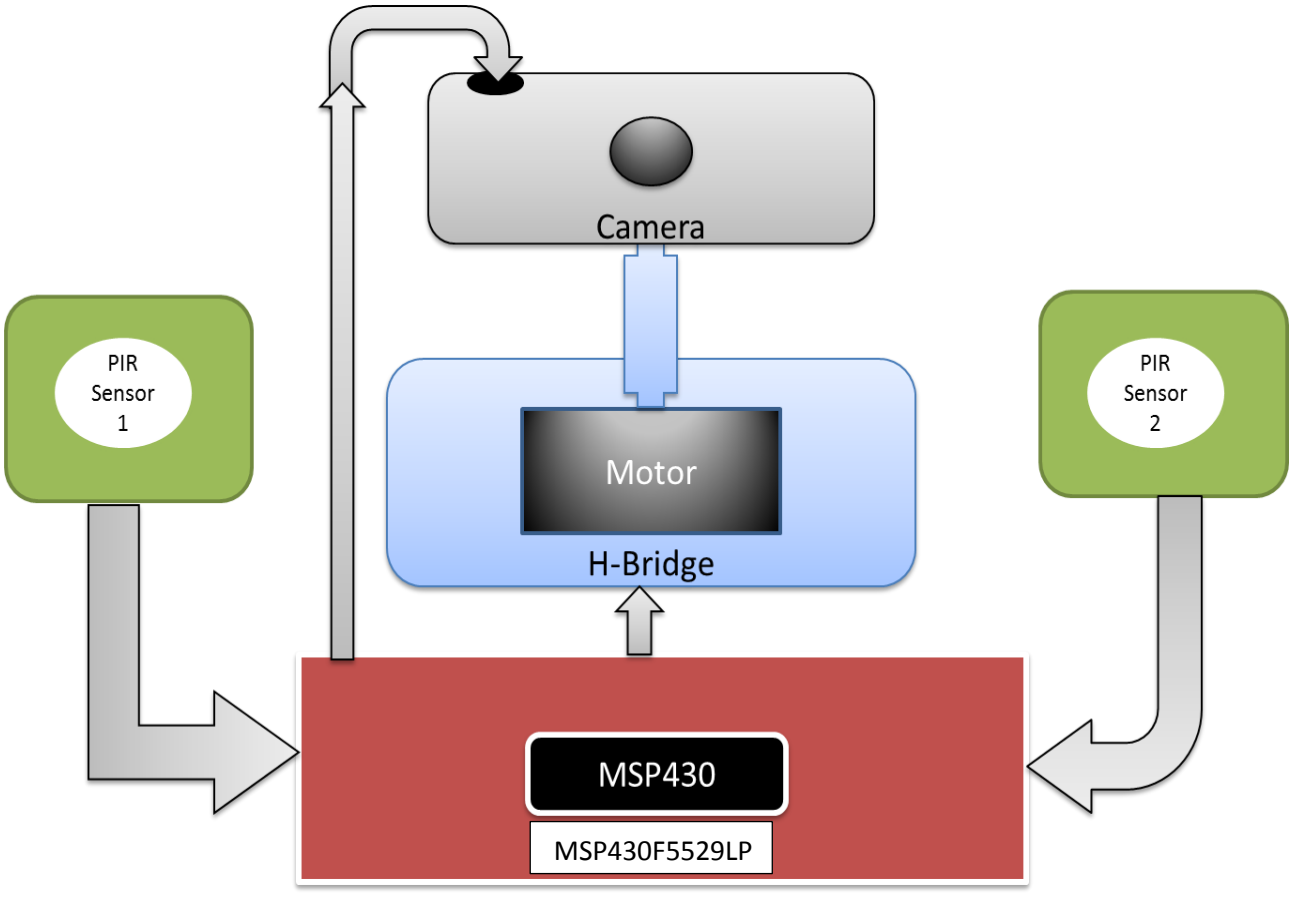


Figure 1: Block Diagram of the Device

3. Description

3.1 Passive Infrared Sensor (PIR Sensor) Interfacing:-

Figure 2: PIR Sensor

A PIR sensor is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. It has 3 pins, left most pin is GND, right most pin is Vdd and the middle pin is the output (Vout). It is powered by an input voltage of 5V. The output pin goes high when any motion of an object or an animal is detected.

Two PIR sensors are used (PIR-1 and PIR-2). They are powered by an input voltage of 5V each using a voltage regulator. The output pins are connected to pins P2.0 and P2.2 of the MSP430. The output pins are initially low. When a motion is detected by any of the sensor, the output pin goes high giving out a pulse of 3.3V as an output.

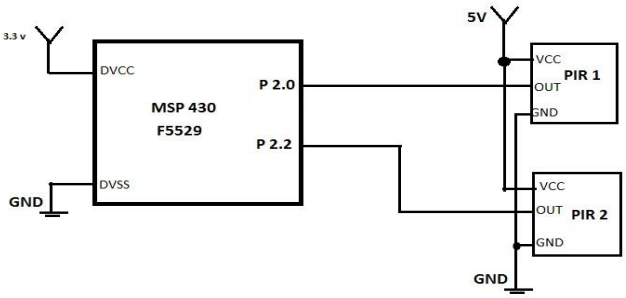


Figure 3: Connecting PIR sensors with the MSP430

3.2 H-Bridge (IC SN75441ONE):-

An H-bridge is an electronic circuit that enables a voltage to be applied across a load in either direction. The IC SN75441ONE drives the stepper motor that is being used. It is powered by a 5V supply with the help of voltage regulator and

two enables. It is used to drive the stepper motor in clockwise and anti-clockwise directions. The 4 input (IN) pins of H-bridge are connected to the pins P3.0, 3.1, 3.2 and P3.3 of the MSP430.

3.3 Stepper Motor:-

Figure 4: Stepper Motor

A stepper motor is a brushless DC electric motor that divides a full rotation into a number of equal steps. The motor's position can then be commanded to move and hold at one of these steps without any feedback sensor (an open-loop controller), as long as the motor is carefully sized to the application.

A bipolar stepper motor is used to rotate the camera. The 4 wires of the stepper motor are connected to the 4 output (OUT) pins of H-bridge. The stepper motor needs a 12 V supply which is provided through the $+V_{motor}$ pin on the H-bridge. The stepper motor is run in half step mode. The sequence of steps for the half step mode are as follows for anticlockwise.

Step	Coil 1A	Coil 1B	Coil 2A	Coil 2B
1	High	Low	low	Low
2	Low	Low	High	Low
3	Low	High	Low	Low
4	Low	Low	Low	High

Table 1: Sequence of steps for the stepper motor

If the above steps are done in reverse order the motor rotates clockwise. The angle of rotation is controlled by the number of steps.

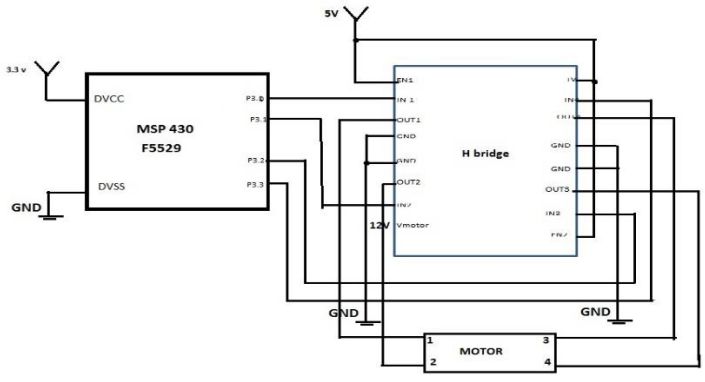


Figure 5: Connecting MSP430 to the stepper motor via H-bridge

3.4 Mini Digital Camera:-

Figure 6: Mini Digital Camera

The camera shown in figure 5 is used to click the pictures in this project. The trigger of the camera is controlled by the MSP430. It takes a picture when it receives a signal from the microcontroller. We will use a transistor (2n2222) to control the trigger mechanism of camera through MSP430.

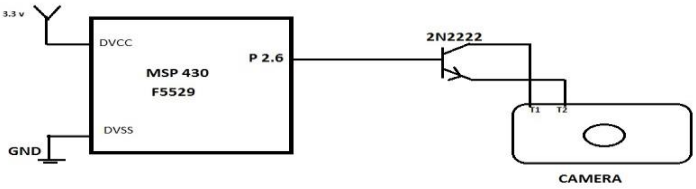


Figure 7: Connecting MSP430 with camera

3.5 Light Emitting Diode (LED):-

Figure 8: Light Emitting Diode (LED)

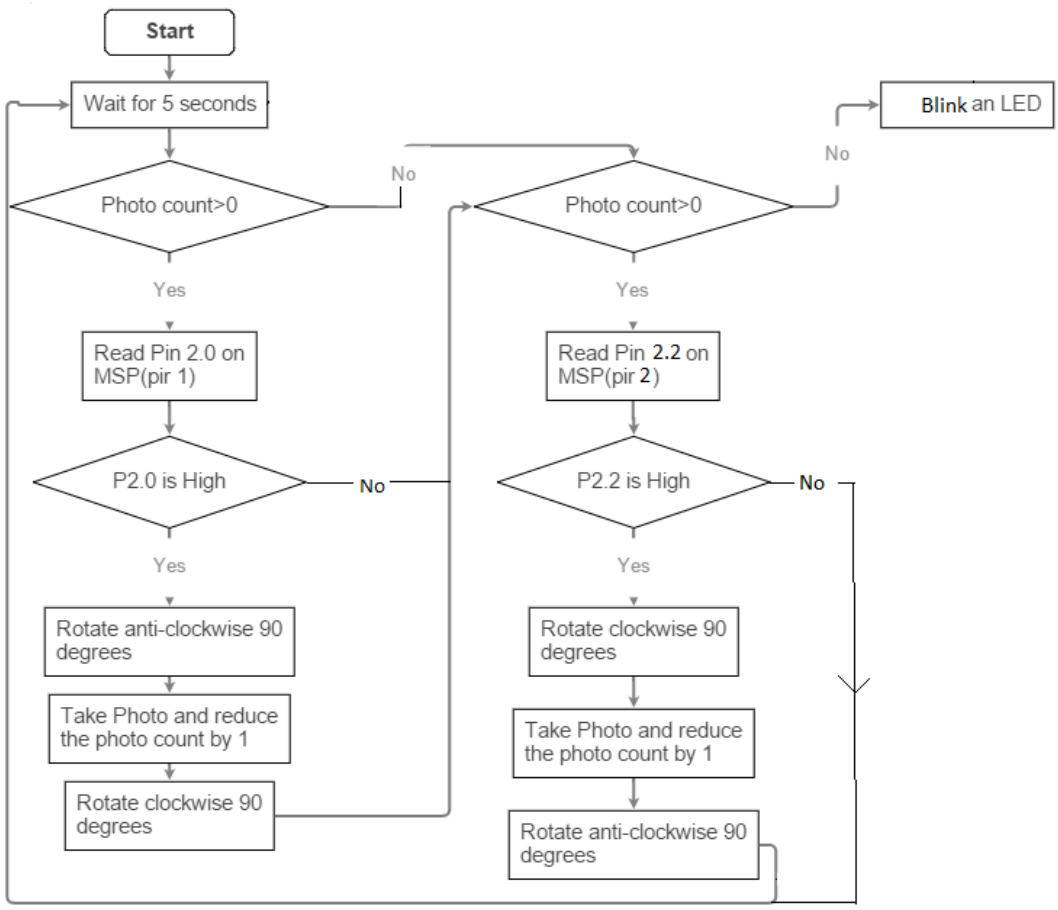
A LED is connected to P2.7 of MSP430. It glows when the camera memory is full.

3.6 Miniature Toggle Switch:-

Figure 9: Miniature Toggle Switch

A simple miniature toggle switch is used to power (ON/OFF) the circuitry.

4. Flowchart



5. Results and Conclusion

In accordance to the proposal put forward earlier we have successfully tested each component individually interfacing them to the MSP430 and have also successfully tested the complete setup by interfacing with each other using the MSP430 to control all the processes taking place. The motion detection camera is working fine according to the functionality mentioned.

Whenever a motion is detected by any of the PIR sensor, the MSP430 is notified by the respective PIR sensor that an object or animal is in motion. Then MSP430 rotates the stepper motor on which the camera is mounted, in the direction of the PIR sensor which detected a motion. After rotating the stepper motor, the MSP430 triggers the camera with the help a transistor to capture an image of an object or an animal which moved or in motion.

There were few challenges such as, giving appropriate power supply to each component, coding and debugging the errors, giving proper delays, triggering the camera click mechanism using a transistor and finally integrating (or assembling) all the individual components together and testing, connecting the circuitry without any short circuits as there are too many wires and putting everything together into a presentable package, we faced while testing and resolved them successfully to complete the project.

6. Bibliography

http://energia.nu/Tutorial_Blink.html

http://www.glacialwanderer.com/hobbyrobotics/?p=13

https://itp.nyu.edu/physcomp/labs/motors-and-transistors/lab-controlling-a-stepper-motor-with-an-h-bridge/

7. Appendix

7.1 Team Members and Task Division

Arun	→	Interfacing Motor using H Bridge
Harshad	→	Interfacing PIR sensor and Camera
Sanjay	→	System Integration
Saranya	→	Coding and Debugging

7.2 List of Components

Component	Quantity	Cost in $
MS6P430F5529	1	13.79
PIR sensor	2	15.9
Stepper motor	1	14
H-bridge	1	3
Camera	1	8.99
Connecting wires	-	5.5
LED	1	0.2
Switch	1	1
Miscellaneous	-	10
Total		72.38

7.3 Schematic