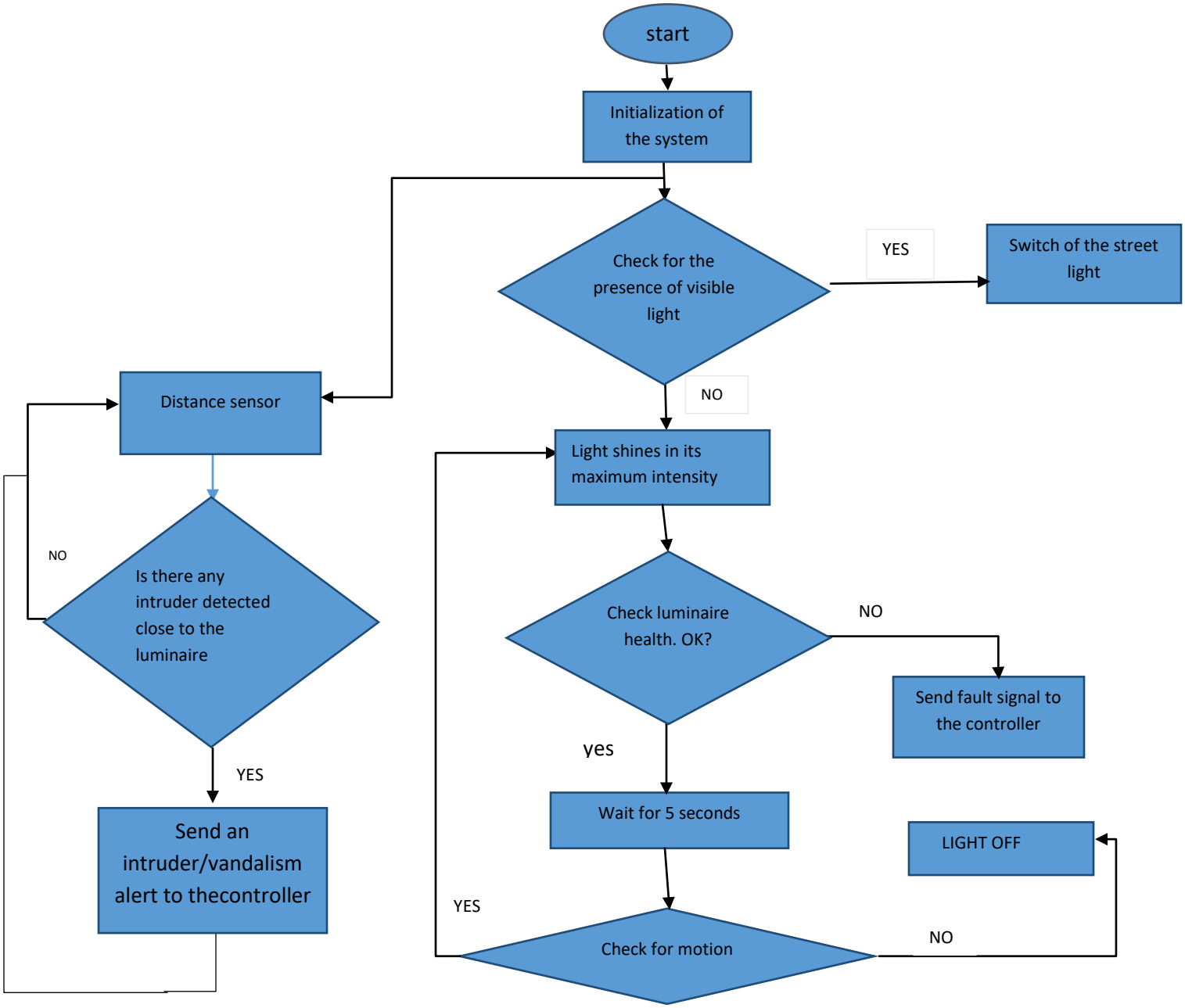
light when current drifts through it. It recombines an electron in the semiconductor with electron holes, discharging power in the mode of photons.

System flowchart



NodeMCU is programmed using C++, CSS and HTML. The compiler used is the Arduino IDE. The NodeMCU which serves as the brain of the system is programmed to;

1. To monitor the intensity of visible light on Light Dependent Resistor (LDR), sensing and measuring a distance of objects using ultrasonic sensor, measuring the current on the current sensor by applying the Hall Effect principle, to detect human/ vehicular presence or movement by detecting the heat signatures on Passive Infrared Rays.
2. Power the LED at the startup
3. Switch off the LED when no movement is detected at night
4. Take LED to a full ON state when movement is detected at night.
5. Prompts for fault detected at the Application interface.
6. Serves as the web server
7. Utilizes the WIFI system on chip features to connect other devices to the network

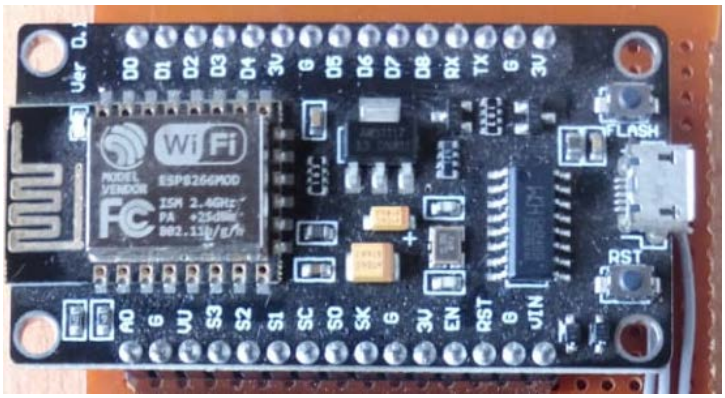


Diagram of the NodeMCU after soldering on the breadboard

Implementation of the Light Dependent Resistor (LDR).

The LDR has a resistance that varies inversely proportional to light. An example is the more light, the less resistance. The LDR was soldered to the breadboard and connected to the controller.

Implementation of the Human sensor (Passive Infrared Resistor).

The pyroelectric crystal in the sensor detects the heat signatures from living organisms and vehicles. It was soldered to the breadboard and further connected to the controller. Figure 4.18 shows the PIR soldered to the breadboard.

Diagram of PIR after soldering.

Implementation of the Current sensor.

The current sensor is used to measure the current on the load by applying the principle of Hall effects. The figure below shows the current sensor soldered to the breadboard.

Diagram of the Current sensor after soldering.

Implementation of the Ultrasonic sensor

The ultrasonic sensor HC-SRO4 has a transmitter that transmits an ultrasonic wave, this wave travels in the air and when it gets objected by any material it gets reflected toward the sensor. The figure below shows the ultrasonic sensor soldered to the breadboard

Performance/Result analysis

Module Name	Input data	Expected results	Actual results	Remarks
Testing the controller/Server	Digital Signal	Toggled LED spontaneously using the application interface	LED got switched ON and OFF at regular interval	Hardware and software correctness
Testing the light Dependent Resistor (LDR)	Outside light values	Street lights came on and off according to the visibility of light	LED powering is rightly automated according to the light visibility	Hardware correctness
Testing passive Infrared (PIR) sensors	Motion detected from the surroundings	LED glows whenever motion is detected	LED glows whenever motion is detected	Hardware correctness
Detecting faulty Lights	Faulty LED	Faulty lights detected and fault alert received	Fault alert received as designed.	Hardware correctness
Intruder Detection	The Intruder comes close to the street light	Intruder indicator alert received	Intruder indicator alert	Hardware correctness

VI. RESULTS, DISCUSSIONS, AND CONCLUSIONS.

RESULT

All units of this working prototype were properly packaged after implementation. All units worked properly as stated in the expected result.

A fault was deliberately introduced to the system for the LED not to come up, and an alert was shown on the application interface, notifying the user of the fault. Below is the picture of the complete circuitry of the main board, after all the components were soldered and working perfectly.

CONCLUSION

The current system is able to please the objective by monitoring the intensity of the visible light to switch the system, motion detection to control lights at night, fault detection and sense an intruder to the system. The current system does not need database storage but internet connectivity will be needed to help monitor the system in real time using the application interface. This work can be extended to a full-time time surveillance system with the inclusion of a camera and also should be able to send electronic mail to the operator, the amount of energy consumed over a period of time.

Diagram of the Ultrasonic sensor after soldering.

The proposed system can please the objective of the design by verifying the intensity of the visible light, fault detection, and motion detection to enable power on or off at the luminaire. When a fault is detected at the luminaire, the indicator at the application interface notifies the operator for quick action if a particular street light is not working. The current system does not need to make database storage, but internet connectivity is required to monitor energy consumed by the street light, fault detection, and an intruder to the system. This work can be extended to be a surveillance system when a camera is mounted on the streetlight and then a database for storage.

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