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Streamlined Traffic Control System for the Urban Cities in Misamis Oriental

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Abstract:

The study of microcontroller-based traffic light system is a typical example of an electronic and industrial system. An initial structure was designed and built. Traffic light materials and devices specifications were methodically made for a comprehensive output. Existing energies of dynamic model were observed separately to generate the model of the traffic light. State – space model of traffic light was developed and microcontroller was used as a programming medium according to state-space model. Microcontroller-based system has some key parameters that are directly engaged with system performance and response. System starts with the Microcontroller which will be the main control, Integrated Circuit which is used to link the signal send by the microcontroller to the mechanical relay being energized to light the outputs which are the traffic lights. Proximity sensors are added to measure the volume of vehicles passing in order to adjust the set time of the traffic lights. Parametric studies were done and system responses were observed by variation of key parameters. Observed results from parametric studies were applied into physical model to improve the traffic light performance.

Keywords — **Microcontroller based traffic light, proximity sensor, Automated traffic control, Traffic Control, Traffic Light**

I. INTRODUCTION

Traffic light is one of the vital public facilities that play an important role to the road users. Traffic light system consists of two parts, first part is traffic light and the second part is controller unit, which is used to control traffic flows at the busy intersection (Oshevire, 2014).

The world's first electric traffic signal is put into place on the corner of Euclid Avenue and East 105th Street in Cleveland, Ohio, on this day in 1914(history.com, 2015).The UK is the latest European country to introduce 'soft' speed enforcement techniques, using existing traffic signal arrays that have been equipped to detect that an approaching vehicle is exceeding the speed limit and stop it in its tracks. The aim is to deter

With detection equipment located at safe distances – the technology it is designed to integrate with company's ADIMOT (adaptive multi-algorithmic optimization techniques) urban traffic control product. When a vehicle reaches a loop detector, the system knows how long. Once the vehicle exceeds the limit, the alerted signal flashes intermittent amber for a fixed minimum period (six seconds). If there are no following vehicles, the signal flashes three seconds of fixed amber and then returns to red, its resting state (Crawford, 2012).

These developments in Europe led the researchers to pursue a similar study to improve the traffic light system of the urban cities in the province of Misamis Oriental. Automating the traffic light systemof the city may be of greater significance to the pedestrians, drivers and the community as a whole.

II. METHOD

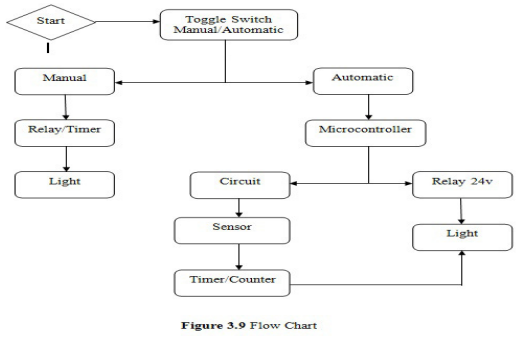

Fig. 1 Traffic Light Control Flow Diagram

The figure above shows the flow diagram of the traffic light control system. In fig. 2, the relay to timer/counter microcontroller and pin assignment is shown. Pin 0 and 1 used to communicate with other microcontroller, pin 2 to 5 sends signal to the microcontroller, pin A0 to A5 multiplexer transmits signal to the seven segment and pin 6 to 13 show the display signal from multiplexer. Therelaytomicrocontroller.Pin0and1usedto communicatewithothermicrocontrollerandpin2to9 sendssignaltoenergizeand de-energizethe relay. Microcontroller sends signal tolane1 relay 1to energize and light the go signal whilethe otherlight are stop. When the relay de-energize stop light willlight.

A. Design and Development

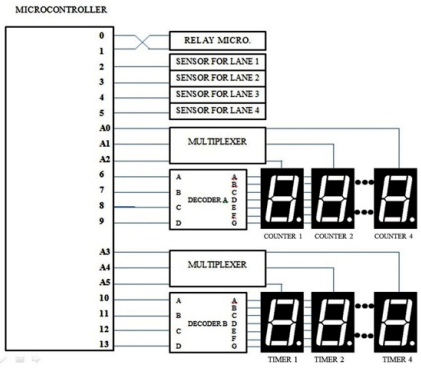

Fig. 2 MCU to relay and timer

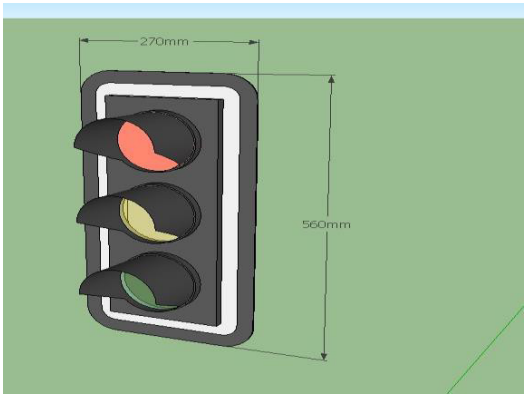

Fig. 3 Signal Pole

Fig 3 is the signal pole. It shows the signal status. The green light indicator for go, the yellow lightis indicator to proceed with caution and red lightis indicator for stop.

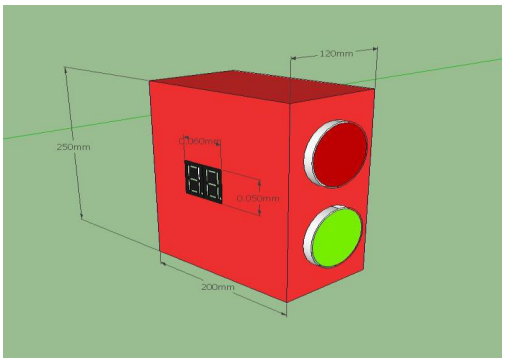

Fig. 4 Pedestrian Signal

Fig 4 showsthewalksignalandtheseven-segmentforthetimer.The redpedestrianlightsignalsthepedestriantostop.Thegreenpedestrianlightsignals to proceed across the road.

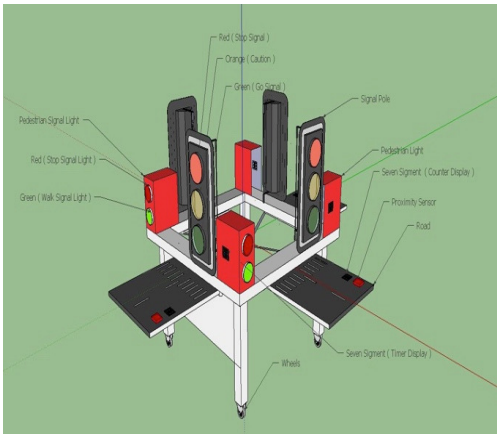

Fig. 5 Perspective View of the Traffic Light

Thenormalflowofthetrafficlightinonelaneisalways "go"iftherearenovehicles onalllanes.Ifthesensorcounted5 vehiclesorbelow,thetimeris set to5seconds.If10 vehiclesorbelow butmorethan5 vehicles,thetimeris set to 10seconds.Ifmorethan10 vehiclesthetimeris set to 15seconds.If alllaneshavethesamevolumethetimerisalways5seconds.Thedefault status of the traffic light is greenlight or GO signal and the pedestrian isSTOPthenready/pedestrianstopandlastlyred light/pedestrian go, andback to normal which isgreen lightor GO signal.

Inthisphasetheresearcherstestedeachmaterialandpartsofthesystemfor agoodqualityprototypetoimproveimplementationwithregardsandconsideration to therecommendations cited fromthe searchedstudiesandarticles.

Microcontroller isthe main control of the automation system. It interpretsthe programinstalled.Itsends signalto theintegrated circuitbased on the interpreted program.

The seven segment was used as display of the number of vehicles passing throughthe sensor, Also a display of the time thatthe traffic light has given.

Infraredproximity collision sensordetectsvehiclespassingthroughit. The numberofdetectedvehicleswillbedisplayonthesevensegmentontheupperpart of the sensor.

RESULTS AND DISCUSSION

A. Design and Development

Insteadofusing9012transistorinthecircuitforthesignalsuppliedtothe 24Vrelay,9013transistorisusedbecausethesignalfrom themicrocontrollerthat willpassthroughthesaidtransistorisconvertedtonegativeandcompletedtheloop for24Vsupplyisisolatedfromthe5Vsupplyofthemicrocontrollerbutthetwo supplies have common ground.

Ontheassemblingprocess,wiretagswereaddedsoas nottoconfuseend usersofthedifferentcomponentsincorporatedonthetrafficlights.Itwasfound outtobeavitaladdsonsincewiringthecomponentsonthemicrocontrollerisa verysensitiveactivitythatmayresultonamicrocontrollerandcomponents malfunction.

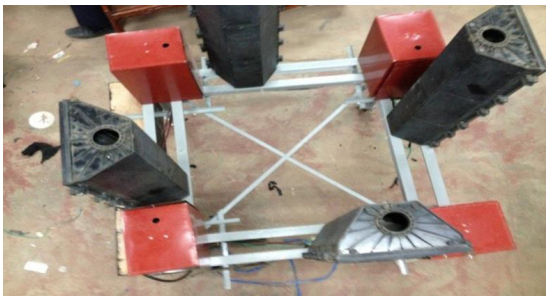

Fig. 6 Top View of the Automated Traffic Light System Prototype

Figure 6 shows the topview components of traffic light which are the following:
a.)The traffic lights, the main component of the whole system
b.)The pedestrian lights, component that also servesas output
c.)Proximity sensor, used to detect the number of vehicles passing
d.) The seven-segment is responsible of the display of the volume of the vehicles passing through the proximity sensor

Fig. 7Right SideView ofthe Traffic Light System

As shown on the fig 7 the right side view ofthe traffic light system;

a.)The traffic lights, the main component of the whole system
b.)The pedestrian lights, component that also servesas output
c.)Proximity sensor, used to detect the number of vehicles passing
d.)The seven segment, responsible for the display of volume of vehicles passing throughthe proximity sensor

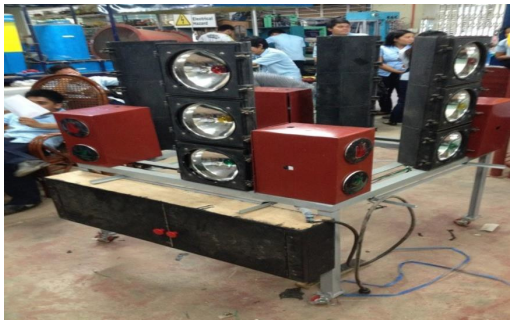

Fig. 8 Actual View ofthe Whole System

Asshownonthefigurethewholeviewofthesystem,thepositionofthe devicesandelements;
a.)The traffic lights, the main component of the whole system
b.)The pedestrian lights, component that also servesas output
c.)Proximity sensor, used to detect the number of vehicles passing
d.)The seven segment, responsible for the display of volume of vehicles passing throughthe proximity sensor

B. Implementation

Inthefinaltestingofthetrafficlightsystem,theinput programwas achieved.Theworkprocessoftheautomatictrafficlightsystemisshowninfig 9.

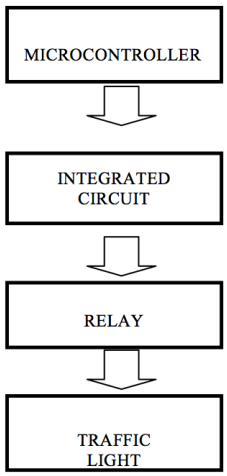

Fig. 9Work Process

The programof the system must be uploaded first to the microcontroller; it isresponsiblefortheswitchingbasedonthesensor'sfunction.Themicrocontroller willsendsignaltotheIntegratedcircuitwhichwillalsosendsignaltothe mechanicalrelay.Iftherelayistriggered,the220Vtrafficlightswillfunctionas intended.

III. CONCLUSIONS AND RECOMMENDATIONS

The test and assessment conducted on the developed automatic traffic light systemrevealthatthetrafficlightisabletodemonstrate theprogramthatisbeing downloadedinthemicrocontroller.Theunitusesmicrocontrollerasalanguagefor the programthatis

beingdownloaded.

Theevaluationofthe developedtrafficlightsystemdesignshowedthatthe unit is perceived to havegood qualities on the evaluation parameters.

Therespondentsfoundthatthetrafficlightsystemha vegoodphysical appearancewithameanof3.6.Thisvaluesuggeststhatt herespondentsfoundthe trafficlightsystem'sdesigntobepleasing.Thearrange mentandphysicaloutlook parameterswerealsogivenagoodrating,reflectingam erelysatisfactory evaluation of the way by which thewires and component layout are displayed. Themeanresponseoftherespondentswithregardstothe technical functionality,whicharegenerallyfoundtobefair,witha naveragemeanof3.4. Therespondentsfoundtheinputandoutputcomponents tobeworkinginorder, evident,andthatthe traffic light functionsas it is programmed.

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REFERENCES

1. *Ahmad, Azrulnor.2007."Development of a Traffic Light Control Systemusing ProgrammableLogic Controller". http://umpir.ump.edu.my/75/*

2. *Brown, 2011. "Green wave-style sequence of three sets". http://www.itsinternational.com/categories/enforcement/features/traffic- signals-turn-red-to-stop-speeding-drivers/*

3. *Ida S.Mdisa1 ,N.Latif A.Shaari2 , A.T.I Fayeez3, N.Azlin4 2014. "Portable Wireless Traffic Light System(PWTLS)". http://esatjournals.net/ijret/2014v03/i02/IJRET20140302041.pdf*

4. *Khalil m. Yousef, 2010. "IntelligentTraffic Light Flow Control SystemUsing Wireless Sensors Networks". http://www.iis.sinica.edu.tw/page/jise/2010/201005_02.pdf*

5. *Monderman, 2015. "Shared Space".http://www.pps.org/reference/hans-monderman/Norbert Okec. "Solar-Powered LEDTraffic Signals" 2014. http://www.africaengineeringnews.com/solar-powered-led-traffic-signals-norbert-okec/*

6. *Oshevire Patrick, 2014."Design andImplementation ofa four ways or Junction prototype crossroad traffic light control system". http://scienceq.org/Uploaded/Editorial/655118524.pdf*

7. *Rashid Hussian, SandhyaSharma,Vinita Sharma,Sandhya Sharma, 2013. "Automated Intelligent Traffic Control SystemUsing Sensors".*

8. *Crawford, 2012. "Traffic signals turn red to stopspeeding drivers". http://www.itsinternational.com/categories/enforcement/features/traffic- signals-turn-red-to-stop-speeding-drivers/*